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JOINT RESOLUTION authorizing the Public Printer to print reports of the United States Fish Commissioner upon new discoveries in regard to fish culture.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Public Printer be, and he hereby is, instructed to print and stereotype, from time to time, any matter furnished him by the United States Commissioner of Fish and Fisheries relative to new observations, discoveries, and applications connected with fish culture and the fisheries, to be capable of being distributed in parts, and the whole to form an annual volume or bulletin not exceeding five hundred pages. The extra edition of said work shall consist of five thousand copies, of which two thousand five hundred shall be for the use of the House of Representatives, one thousand for the use of the Senate, and one thousand five hundred for the use of the Commissioner of Fish and Fisheries.

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UNITED STATES COMMISSION OF FISH AND FISHERIES,
Washington, D. C.

For the purpose of utilizing and of promptly publishing the large amount of interesting correspondence of the Fish Commission in reference to matters pertaining to fish culture and to the apparatus, methods, and results of the fisheries, Congress, on the 14th day of February, 1881, by joint resolution (H. Res. 372), authorized the publication annually of a Bulletin, a portion of the edition to be distributed signature by signature, and the remainder in bound volumes. The present volume is the fourth of this series, and contains many announcements which are believed to be of great importance in relation to the subject in question.

CHAS. W. SMILEY, A. M., is the *Editor* of this volume.

SPENCER F. BAIRD,
Commissioner.

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BULLETIN

OF THE

UNITED STATES FISH COMMISSION.

1884.

1.—INSPECTION OF FISH AND OTHER MARINE PRODUCTS IN THE DISTRICT OF COLUMBIA, 1879 TO 1883, INCLUSIVE.

By CHAS. W. SMILEY.

For several years a careful inspection of the marine products brought into the District of Columbia has been made under the direction of the health officer of the District. Five years ago an arrangement was perfected by Prof. S. F. Baird, Commissioner of Fisheries, with Hon. Smith Townshend, M. D., health officer, whereby the daily receipts of fresh fish, oysters, &c., should be tabulated and transmitted in monthly tables to the Fish Commission. These monthly tables have all been footed and transferred to yearly tables in this office. I am able herewith to present annual tables for 1879, 1880, 1881, 1882, and 1883 (Tables I, II, III, IV, V). In Table VI may be seen the annual summaries of the different kinds of marine edible products for these five years, the total summations of which are as follows:

Products.		1879.	1880.	1881.	1882.	1883.
Miscellaneous	pounds..	1, 391, 852	2, 920, 136	2, 710, 331	1, 385, 010	1, 402, 803
Shad	number..	311, 585	320, 799	458, 368	350, 292	261, 478
Sturgeon	do	1, 200	1, 176	1, 289	1, 904	1, 673
Herring	do	3, 605, 984	6, 853, 721	9, 633, 568	6, 499, 865	4, 983, 998
Clams	do	1, 167, 000	1, 384, 950	1, 131, 000	1, 219, 850	1, 380, 000
Crabs	do	528, 400	682, 370	314, 800	527, 001	690, 372
Crawfish	do		340			
Lobsters	do	....	....	....	11	....
Oysters	bushels..	259, 356	378, 295	315, 296	411, 255	400, 564
Terrapin	number..	1, 452	3, 154	2, 574	834	1, 646
Turtles	do	454	501	117	116	95

The yield of shad and herring may be supposed to have been influenced somewhat by the artificial propagation under the direction of the United States Fish Commission, which has been carried on at the Potomac for a number of years. The run of shad and herring is also affected by the temperature, which varies somewhat for the same date in different years. This is presented in Tables VII to X, inclusive.

TABLE I.—*Monthly summary of the fresh fish, oysters, &c., inspected by the health officer of the District of Columbia during the year* 1879.

[The figures given are in pounds, unless stated to refer to other denominations.]

Description.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Alewives *a*									5,400	9,075	2,000		16,475
Bass, black						37							37
Bluefish *b*					17,193	31,190	49,152	36,100	73,850	39,860	950		248,295
Catfish	1,200	7,200			180,300	79,150	40,450	9,400	13,650	39,100	17,300	14,100	401,850
Clams (number)					369,000	356,000	254,000	180,000	8,000				1,167,000
Cod												2,000	2,000
Crabs (number)		3,100			154,800	136,800	96,300	95,500	35,800	4,200	300	1,600	528,400
Drum									165	8	67		240
Eels	175	3,735			19,120	725	107	45	314	3,650	5,800	3,310	36,981
Flounders									594	2,885	2,500	570	6,549
Fresh-water fish, small					48,900		6,425	2,075					57,400
Herring, fresh-water (number)			61,635	1,603,649	1,906,885	33,260	330			225			3,605,984
Hogfish										330			330
Mackerel						45	3,509	2,419	1,144				7,117
Mackerel, Spanish						750				75			825
Oysters (bushels)	29,138	41,982							22,086	47,730	56,660	61,760	259,356
Perch, yellow	900	8,500								2,355	4,900	8,550	25,205
Perch, white	700	10,150			*c* 16,355	8,905	8,300	*d* 6,500	37,850	76,400	88,900	18,600	272,660
Pike, yellow	50	2,645			1,190	225	315		393	1,560	4,100	3,125	13,603
Rockfish *e*	750	4,475			11,050	13,335	15,300	13,500	20,930	23,950	36,300	8,625	148,215
Scup *f*						90			1,077	5			1,172
Shad (number)			3,570	116,938	168,515	22,218	183	70	52	34	5		311,585
Shad, winter	1,700	13,150							4,725	14,950	23,100	14,600	72,225
Sheepshead					197	230	24	12	57	77			597
Smelt					31,000								31,000
Sturgeon (number)					549	283	187	95	75	3	8		1,200
Sunfish *g*									987	1,375			2,362
Terrapin (number)					115		25		51	214	457	590	1,452
Trout, salt-water *h*					6,550	3,885	4,900	2,500	13,704	11,725	*i* 2,250		45,514
Turtle, green (number)					*j* 397	36		9	8	4			454

a Bugheads, or menhaden.
b Or salt-water taylors.
c Includes some yellow perch.
d Reported as whitefish.
e Or striped bass.
f Or porgies.
g Or tobacco-box.
h Or squeteague.
i Reported as salmon-trout.
j Reported as snapping turtle.

TABLE II.—*Monthly summary of the fresh fish, oysters, &c., inspected by the health officer of the District of Columbia during the year* 1880.

[The figures given are in pounds, unless stated to refer to other denominations.]

Description.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Alewives *a*			1, 180	1, 900	7, 620				4, 700	2, 800	1, 300		19, 500
Bass, black	9												9
Bluefish *b*				1, 100	32, 735	71, 969	99, 375	82, 269	46, 065	35, 745	2, 730		371, 988
Catfish	13, 800	31, 300	97, 435	98, 740	113, 500	15, 490	11, 020	1, 635	12, 400	32, 000	36, 500	6, 000	469, 820
Clams (number)		47, 000	87, 600	162, 400	362, 000	297, 950	225, 000	175, 000	28, 000				1, 384, 950
Crabs (number)	2, 400	13, 200	71, 900	95, 170	142, 200	113, 800	112, 300	89, 100	35, 600	6, 700			682, 370
Crawfish (number)					340								340
Croakers						5, 720	4, 900	9, 470	6, 500	3, 000			29, 590
Drum								16	224	63	13		316
Eels	540	433	6, 098	15, 355	7, 035	261	155	129	400	2, 775	2, 740	335	36, 256
Flounders									700	3, 125		50	3, 875
Fresh-water fish, small		1, 257											1, 257
Gars			195	95	105	49	25						469
Herring, fresh-water (number)	50	3, 045	235, 367	2, 764, 141	3, 850, 618	500							6, 853, 721
Mackerel, Spanish					90	6, 417	3, 075	2, 296	4, 712	1, 120			17, 710
Mullet *c*	4, 915	5, 225	18, 295	3, 182	1, 390	245	635	520	2, 875	4, 050	870	90	42, 292
Oysters (bushels)	60, 720	56, 080	44, 875	20, 459	4, 174	1, 345	911	1, 866	22, 708	52, 575	65, 310	47, 272	378, 295
Perch, white	5, 975	13, 925	66, 660	335, 315	266, 500	17, 070	9, 475	9, 630	19, 500	64, 550	91, 000	10, 850	910, 450
Perch, yellow	26, 200	25, 200	58, 160	11, 910	4, 090	502	275		555	3, 500	7, 700	2, 850	140, 942
Pike, yellow	5, 335	7, 375	7, 332	1, 735	360	230	455	10		1, 125	1, 070	725	25, 752
Rockfish *d*	687	13, 682	41, 971	18, 053	8, 205	9, 170	21, 275	22, 095	34, 600	121, 900	99, 300	15, 200	406, 138
Scup *e*						540	319	80	75	14			1, 028
Shad (number)	4	28	10, 110	165, 071	139, 441	6, 145							320, 799
Shad, winter	20, 100	21, 826	36, 555	16, 285	3, 995	1, 580	4, 600	5, 826	16, 730	48, 500	31, 200	15, 600	222, 797
Sheepshead					126	424	17	181	124	669			1,.541
Spots						1, 620	2, 400	10, 430	2, 650	12, 280	100		29, 480
Sturgeon (number)			6	20	455	221	209	61	71	86	47		1, 176
Sunfish *f*	3, 775	2, 710	1, 465	10, 550	2, 500								21, 000
Taylor, fresh-water *g*			2, 435	25, 669	13, 283								41, 387
Terrapin (number)	960		327	177	138	16	7		4	668	212	645	3, 154
Trout, salmon					37, 860								37, 860
Trout *h*				13, 630		5, 201	4, 637	8, 390	19, 020	36, 625			87, 503
Turtle, green (number)					31	50	15	6	8				110
Turtle, snapping (number)					191	110	80	10					391

a Menhaden, or bugheads. *b* Or salt-water taylors. *c* Or sucker. *d* Or striped bass. *e* Or porgies. *f* Or tobacco-box. *g* Skip-jack, or hickory shad. *h* Salt-water trout, or squeteague.

TABLE III.—*Monthly summary of the fresh fish, oysters, &c., inspected by the health officer of the District of Columbia during the year* 1881.

[The figures given are in pounds, unless stated to refer to other denominations.]

Description.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Bluefish *a*					5,200	60,721	48,279	35,457	39,314	7,382			196,353
Bonito						24							24
Catfish	1,000	7,000	168,200	485,000	131,000	28,400	1,995	1,075	4,070	14,480	17,675	14,570	874,465
Chubs of North Carolina												1,800	1,800
Clams (number)			37,000	133,000	231,000	291,000	233,000	180,000	260,000				1,131,000
Crabs (number)					48,100	87,400	67,700	77,850	22,750	7,050	3,950		314,800
Drum							23		5	92	2		122
Eels			2,379	13,990	7,155	25				735	3,050	2,475	29,809
Flounders								5	38	2,680	4,255		6,978
Gars *b*			202	199	101								502
Grunters					1,200								1,200
Haddock						800							800
Herring, fresh-water (number)			221,958	3,618,796	5,712,814	80,000							9,633,568
Mackerel						5,860							5,860
Mackerel, Spanish							3,421	1,721	3,701	923			9,766
Mullet *c*		3,000	9,750	5,360	400				300	955	1,235	1,445	22,445
Oysters (bushels)	27,608	32,350	42,080	21,850	5,950	481	367	189	12,088	46,994	62,785	62,554	315,296
Perch, yellow	400	8,000	75,500	36,900	22,700	670	35	110		955	2,065	5,040	152,375
Perch, white	100	3,000	195,025	544,000	73,800	9,250	5,235	1,945	4,155	9,845	38,420	6,995	891,770
Pickerel and pike									10	195	480	1,735	2,420
Pike, yellow		700	4,370	3,020									8,090
Pollock										104			104
Rockfish *d*	100	4,000	150,700	31,500	8,950	8,540	8,910	11,510	12,265	43,130	94,805	20,960	395,370
Scup *e*						753	131	21	678	106			1,689
Shad (number)			16,074	233,716	200,723	7,855							458,368
Shad, winter *f*	200	2,000		830					755	9,150	9,055	1,875	23,865
Sheepshead						76	258	25	69	23			451
Smelt							510	1,295					1,805
Spot							1,005	2,330	1,655	369	990		6,349
Sturgeon (number)				6	261	557	69	193	153	8	42		1,289
Taylor, fresh-water *g*				36,871	1,460						800		39,131
Terrapin (number)	125	20	472								*h*408	*h*1,549	2,574
Trout, salmon									*i*1,692	17,894	226		19,812
Trout, salt-water			*j*3,212		1,380	1,227	5,645	9,105	12,705		2,225		35,499
Turtle (number)						*k*67	*l*23	*l*10	*l*17				117

a Or salt-water taylor.
b Probably silver-gars.
c Or sucker.
d Or striped bass.
e Or porgies.
f Or mud.
g Skip-jack or hickory shad.
h Reported as salt-water terrapin or diamond-backs.
i Reported as brook trout.
j Reported 45 green turtles and 22 snapping-turtles.
k Reported as sea turtle.
l Reported by number.

TABLE IV.—*Monthly summary of fresh fish, oysters, &c., inspected by the health officer of the District of Columbia during the year 1882.*

[The figures given are in pounds, unless stated to refer to other denominations.]

Description.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Blackwills							90			30			120
Bluefish *a*					305	35, 895	70, 205	64, 820	47, 920	2, 695	2, 200		224, 040
Carp		110											110
Catfish	11, 920	52, 390	44, 815	47, 520	2, 752	15, 645	8, 510	6, 610	9, 275	43, 960	19, 710	8, 490	271, 597
Chubs of North Carolina												855	855
Clams (number)					269, 000	310, 000	302, 000	274, 000	64, 850				1, 219, 850
Croakers					675		*b*3, 925						4, 600
Crabs (number)	2, 300	*e*2, 500			104, 650	82, 161	112, 040	132, 400	80, 400	10, 550			527, 001
Drum				1	3		6		30	10	96	1	147
Eels	530	435	5, 645	19, 580	8, 740	650	90	250	316	5, 025	1, 705	570	43, 536
Flounders										125			125
Herring, fresh-water (number)	9	1, 051	127, 302	2, 989, 456	3, 282, 391	99, 656							6, 499, 865
Hogfish											80		80
Lobsters (number)						11							11
Mackerel, Spanish						1, 292	3, 182	1, 845	1, 791	39			8, 149
Mullet *d*	6, 905	5, 075	5, 255	2, 630	315					1, 035	1, 795	*e*4, 365	27, 375
Oysters (bushels)	54, 500	54, 430	44, 300	17, 850	1, 466	647	403	1, 331	19, 828	70, 145	73, 200	73, 155	411, 255
Perch, yellow	9, 930	8, 855	16, 715	8, 325						33	395	6, 035	50, 288
Perch, white	980	6, 400	25, 270	39, 565	26, 710	2, 970	3, 070	5, 260	6, 275	16, 965	34, 840	10, 995	179, 270
Pike, yellow	*f*1, 905	*f*3, 400	*f*8, 235	*g*3, 555			145		*f*125	*f*1, 600	*f*5, 745	*f*6, 660	31, 370
Pompano									235				235
Rockfish *h*	860	19, 250	73, 415		6, 605	4, 325	15, 060	10, 540	15, 820	59, 860	81, 550	47, 580	334, 865
Scup *i*					68	943	204		46				1, 261
Shad (number)		14	18, 895	226, 164	101, 175	3, 989		55					350, 292
Shad, winter *j*	2, 370	2, 230	995	31, 195					2, 565	8, 755	9, 830	1, 930	59, 870
Sheepshead					145	111	46	160	107	46			615
Spot						670	1, 305	2, 705	2, 185	425	170		7, 460
Sturgeon (number)				16	357	844	281	138	203	50	15		1, 904
Taylor, fresh-water *k*			2, 192	23, 172	1, 070								26, 434
Terrapin (number)	*l* 46										*l*401	*l*387	834
Trout					22, 160	16, 505	*m*1, 203	*n*5, 210	1, 820	*n*7, 835	1, 655	470	66, 858
Trout, salmon					2, 343	1, 405				98			3, 846
Turtle (number)					*o*43	*p*58	*q*8	*q*3	*q*3		*q*1		116

a Or salt-water taylor.
b Reported as crocas.
c Given as number.
d Or sucker.
e Reported as fresh-water mullets.
f Reported as pike.
g Reported as pickerel and pike.
h Or striped bass.
i Or porgies.
j Or mud.
k Skip-jack or hickory shad.
l Reported as diamond-back.
m Reported as brook trout.
n Reported as gray trout.
o Reported as snapping, green, or sea.
p Reported as sea or snapping.
q Reported as green or sea turtle.

TABLE V.—*Summary of the fresh fish, oysters, &c., inspected by the health officer of the District of Columbia during the year* 1883.

[The figures given are in pounds, unless stated to refer to other denominations.]

Description.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Bluefish *a*					11,755	45,400	59,750	71,805	33,390	20,925			243,025
Carp		14	3	11	9								37
Catfish	3,085	44,630	35,535	35,430	18,780	10,170	6,530	4,670	7,940	20,065	15,320	12,360	214,515
Chubs of North Carolina	3,585	4,500									6,025	21,050	35,160
Clams (number)				66,200	286,000	346,000	345,000	271,000	63,100			2,700	1,380,000
Codfish	8,500												8,500
Crabs (number)				18,200	79,350	139,250	205,450	189,600	38,550	7,900			678,300
Crabs, soft (number)					7,440		3,600	1,032					12,072
Croakers						*b*2,035	12,690	5,935					20,660
Drum					9	4		12	3	14			42
Eels		250	2,345	19,810	15,690	513	905	835	1,380	3,970	4,040	465	50,203
Flounders										55	23		78
Herring, fresh-water (number)		925	67,016	2,675,134	2,227,392	8,931							4,979,398
Herring, Nova Scotia	4,600												4,600
Mackerel						463							463
Mackerel, Spanish							4,480	5,419	580	71			10,550
Mullet	2,935	12,220	10,445	5,345	780				520	1,625	2,400	2,575	38,845
Oysters (bushels)	44,750	48,853	39,000	25,814	3,900	1,449	1,722	3,134	26,237	54,835	60,970	89,900	400,564
Perch, white		16,025	27,925	34,360	21,545	380	1,590	4,115	7,165	24,810	40,570	4,885	183,370
Perch, yellow	10,945	19,525	40,285	9,735					735	3,240	5,810	11,310	101,585
Pike	2,975	10,670	12,560	5,020	1,245				590	4,355	6,070	6,700	50,185
Rockfish *c*	3,630	21,775	33,810	29,155	8,365	7,900	10,290	19,080	18,345	39,760	70,985	11,765	274,860
Scup *d*						319							319
Shad (number)		4	11,254	171,641	76,127	2,452							261,478
Shad, winter	2,885	3,145							1,085	7,640	8,045	3,000	25,800
Sheepshead					740	1,043	24	124	11	133	11		2,086
Smelt	2,400												2,400
Spot					1,200	1,610	4,415	6,175	1,865	3,690			18,955
Sturgeon (number)					346	718	127	318	151	12		1	1,673
Taylor, fresh-water		1	1,111	8,936	489								10,537
Terrapin, diamond-backed (number)	394										934	318	1,646
Trout, salmon					3,298	1,052			362				4,712
Trout, salt-water					*e*26,925	*f*37,075	*e*11,965	*e*3,995	*f*9,985	*f*13,065	*f*735		103,745
Turtle, sea (number)					3	42	12	17	17	4			95
Whitefish	498												498

a Or salt-water taylors. *b* Returned as "crocus." *c* Or striped bass. *d* Or porgies. *e* Returned simply as "trout." *f* Returned under name of "gray trout."

TABLE VI.—*Yearly summary of the fresh fish, oysters, &c., inspected by the health officer of the District of Columbia, for the years* 1879–1883, *inclusive.*

Description.	1879.	1880.	1881.	1882.	1883.
Alewives *a*	16,475	19,500	....	....	....
Bass, black	37	9	....	....	....
Blackwills	....	....	....	120	....
Bluefish *b*	248,295	371,988	196,353	224,040	243,025
Bonito	....	....	24	....	....
Carp	....	....	....	110	37
Catfish	401,850	469,820	874,465	271,597	214,515
Chubs of North Carolina *u*	....	....	1,800	855	35,160
Clams (number)	1,167,000	1,384,950	1,131,000	1,219,850	1,380,000
Cod	2,000	....	....	....	8,500
Crabs (number)	528,400	682,370	314,800	527,001	690,372
Crawfish (number)	....	340	....	....	....
Croakers	....	29,590	....	*c* 4,600	20,660
Drum	240	316	122	147	42
Eels	36,981	36,256	29,809	43,536	50,203
Flounders	6,549	3,875	6,978	125	78
Fresh-water fish, small	57,400	1,257	....	....	*v* 498
Gars *d*	....	469	502	....	....
Grunters	....	....	1,200	....	....
Haddock	....	....	800	....	....
Herring, fresh-water (number)	3,605,984	6,853,721	9,633,568	6,499,865	*w* 4,983,998
Hogfish	330	....	....	80	....
Lobsters (number)	....	....	....	11	....
Mackerel	7,117	....	5,860	....	463
Mackerel, Spanish	825	17,710	9,766	8,149	10,550
Mullet *e*	....	42,292	22,445	*f* 27,375	38,845
Oysters (bushel)	259,356	378,295	315,296	411,255	400 564
Perch, white	*g* 272,660	910,450	891,770	179,270	183,370
Perch, yellow	25,205	140,942	152,375	50,288	101,585
Pickerel and pike	....	....	2,420	....	....
Pike, yellow	13,603	25,752	8,090	*h* 31,870	50,185
Pollock	....	....	104	....	....
Pompano	....	....	....	235	....
Rockfish *i*	148,215	406,188	395,370	334,865	274,860
Scup *j*	1,172	1,028	1,689	1,261	319
Shad (number)	311,585	320,799	521,368	350,292	261,478
Shad, winter	*k* 72,225	222,797	23,865	59,870	25,800
Sheepshead	597	1,541	451	615	2,086
Smelt	31,000	....	1,805	....	2,400
Spot	....	29,480	6,349	7,460	18,955
Sturgeon (number)	1,200	1,173	1,289	1,904	1,673
Sunfish *l*	2,362	21,000	....	....	....
Taylor, fresh-water *m*	....	41,387	39,131	26,434	10,537
Terrapin (number)	1,452	3,154	*n* 2,574	*o* 834	1,646
Trout, salmon (pounds)	....	37,860	....	3,846	4,712
Trout, salmon (number)	....	....	19,812	....	....
Trout, salt-water *p*	*q* 45,514	87,503	*r* 35,499	*s* 66,858	103,745
Turtle *t* (number)	454	501	117	116	95

a Or bugheads, or menhaden.
b Or salt-water taylors.
c Of this quantity 3,925 pounds were reported as "crocas."
d Probably silver-gars.
e Or suckers.
f Of this quantity 4,365 were reported as fresh-water mullet.
g Includes a few yellow perch; also 6,500 pounds which were reported as whitefish.
h Of this quantity 27,670 pounds were reported as pike, and 3,555 as pickerel and pike.
i Or striped bass.
j Or porgies.
k Or mud shad.
l Or tobacco-boxes.
m Or skipjacks, or hickory shad.
n Of these 1,957 were reported as salt-water terrapin or diamond-backs.
o Reported as diamond-backs.
p Or squeteague or weak-fish.
q Of this quantity 2,250 pounds were reported as salmon trout, erroneously no doubt.
r Of this quantity 3,212 pounds were reported as brook trout.
s Of this quantity 13,045 pounds were reported as gray trout, and 1,203 pounds as brook trout.
t Including several kinds of turtles.
u Or big-mouthed bass.
v Reported as whitefish.
w Of this amount 4,600 pounds was Nova Scotia herring.

TABLE VII.—*A comparison of the inspection of shad in the Washington market daily during March, April, May, and June of* 1879, 1880, 1881, 1882, *and* 1883.

Month and day.	1879.	1880.	1881.	1882.	1883.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
March 1	....	4	....	8	....
2	....	39	....	39	....
3	....	15	....	....	11
4	....	8	....	5	....
5	....	66	....	....	17
6	....	4	....	126	22
7	....	....	....	3	4
8	....	38	....	159	2
9	....	94	....	193	24
10	....	20	....	102	7
11	....	....	....	195	....
12	....	28	....	....	56
13	....	100	....	64	7
14	....	....	....	....	94
15	....	190	3	815	106
16	....	295	....	358	151
17	....	1,150	7	505	11
18	....	186	150	1,312	....
19	....	205	310	....	174
20	....	340	....	1,217	309
21	....	....	11	2,075	9
22	....	558	388	1,321	361
23	....	424	381	1,206	187
24	....	439	200	1,700	54
25	325	21	1,853	214	....
26	415	741	2,029	....	263
27	400	463	....	152	616
28	730	....	881	974	681
29	1,500	873	3,765	1,514	3,250
30	....	2,199	3,294	2,012	3,220
31	200	1,610	2,802	2,626	1,609
April 1	100	3,140	1,796	5,289	....
2	1,781	3,414	1,343	....	1,261
3	1,912	3,258	....	2,612	1,037
4	....	....	2,243	9,099	2,490
5	1,800	4,000	3,565	11,158	4,472
6	....	6,303	....	12,859	2,974
7	3,050	3,191	2,145	10,769	6,156
8	4,000	2,911	1,618	8,243	....
9	3,335	8,077	1,918	....	5,036
10	1,400	9,412	....	18,582	11,362
11	2,000	....	2,152	9,686	6,017
12	1,500	2,400	14,413	8,303	9,751
13	....	6,343	12,166	9,492	8,338
14	4,000	6,282	7,789	11,035	9,206
15	7,000	7,047	6,414	9,031	....
16	3,000	6,661	14,084	....	7,097
17	2,000	8,452	....	12,632	15,865
18	3,000	15,632	4,839	10,432	6,814
	2,500	....	17,445	9,997	9,443
20	....	5,294	13,189	5,868	10,346
21	2,500	4,884	10,500	5,693	5,087
22	17,900	4,821	12,920	7,088	....
23	10,300	10,446	14,545	....	11,112
24	6,000	3,570	....	8,696	6,592
25	7,500	....	17,883	8,748	6,086
26	5,000	6,677	22,304	9,046	6,784
27	....	3,030	6,335	8,190	6,673
28	10,850	4,600	16,801	5,867	6,040
29	8,000	18,218	6,668	7,749	....
30	6,510	7,008	18,369	....	5,602
May 1	8,280	14,998	....	10,616	7,784
2	6,317	....	23,838	7,286	5,489
3	9,105	6,026	13,251	3,718	4,564
4	6,000	8,746	12,023	5,721	4,873
5	6,194	6,634	3,456	5,793	4,789
6	12,425	8,815	13,100	7,089	....
7	10,275	7,505	18,974	....	4,784

TABLE VII.—*A comparison of the inspection of shad, &c.*—Continued.

Month and day.	1879.	1880.	1881.	1882.	1883.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
May 8	7, 594	3, 617	....	6, 013	3, 288
9	8, 300	....	8, 613	4, 969	3, 866
10	4, 915	7, 656	12, 199	4, 484	3, 222
11	7, 000	6, 378	11, 508	3, 194	2, 845
12	5, 750	6, 550	3, 869	2, 047	3, 532
13	7, 060	4, 822	2, 489	2, 134	....
14	5, 090	9, 555	10, 908	....	3, 678
15	6, 000	4, 040	....	2, 469	2, 530
16	7, 000	....	12, 575	5, 171	2, 772
17	4, 000	10, 467	2, 110	3, 776	1, 649
18	4, 500	4, 947	8, 836	2, 593	1, 804
19	3, 600	....	3, 849	2, 321	1, 585
20	5, 000	5, 488	5, 049	3, 289	....
21	6, 000	4, 995	4, 094	....	2, 809
22	3, 000	1, 550	....	4, 330	1, 269
23	5, 000	....	8, 649	3, 003	1, 137
24	3, 700	5, 181	6, 456	2, 612	1, 844
25	100	2, 000	2, 467	1, 370	1, 117
26	6, 100	2, 850	4, 139	1, 649	1, 485
27	3, 500	1, 500	1, 306	1, 437	....
28	1, 800	1, 421	2, 672	....	2, 278
29	2, 000	2, 500	....	1, 845	438
30	1, 500	....	....	....	....
31	1, 500	1, 200	4, 793	2, 246	696
June 1	2, 000	1, 300	200	192	449
2	2, 000	327	1, 838	154	326
3	2, 000	800	1, 118	409	....
4	640	500	800	....	296
5	1, 000	646	....	232	388
6	2, 940	....	536	879	184
7	200	90	1, 100	532	349
8	....	88	700	771	279
9	5, 095	2, 029	572	829	81
10	1, 650	315	996	262	....
11	618	50	....	....	....
12	900	....	....	126	....
13	700	....	....	243	....
14	600	....	....	217	....
15	....	....	....	143	....
16	290	....	....	....	....
17	400	....	....	....	....
18	200	....	....	....	....
19	480	....	....	....	....
20	150	....	....	....	....
21	100	....	....	....	....
22	....	....	....	....	....
23	105	....	....	....	....
24	25	....	....	....	....
25	20	....	....	....	....
26	50	....	....	....	....
27	15	....	....	....	....
28	25	....	....	....	....
29	....	....	....	....	....
30	15	....	....	....	....
Total	311, 241	320, 767	458, 368	350, 223	261, 474

NOTE.—In 1879 shad continued to be reported after June 30 as follows: During July, 183 (eleven dates); August, 70 (three dates); September, 52 (seven dates). In 1880 28 shad were reported in February (five dates). In 1882 shad were reported: In February, 14 (four dates); August, 55 (two dates). In 1883 4 shad were reported in February (three dates).

TABLE VIII.—*A daily comparison of the inspection of herring in the Washington market during March, April, May, and June, of* 1879, 1880, 1881, 1882, *and* 1883.

Month and day.	1879.	1880.	1881.	1882.	1883.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
March 1	....	200	30	567	....
2	....	3,000	25	90	....
3	....	2,680	....	740	780
4	....	2,170	....	520	....
5	....	7,100	120	....	580
6	....	120	....	1,385	560
7	....	....	....	260	290
8	....	3,200	100	2,831	210
9	....	7,725	....	1,739	224
10	....	900	200	963	280
11	....	....	100	2,110	....
12	....	475	1,500	....	1,661
13	....	1,500	....	478	528
14	....	....	1,000	210	1,095
15	....	1,000	1,144	3,236	2,105
16	....	2,610	900	732	1,783
17	....	7,600	7,000	2,253	420
18	....	2,550	5,000	1,312	....
19	....	7,550	40,000	....	2,915
20	....	11,200	....	2,916	4,499
21	....	....	2,480	4,607	290
22	....	26,090	29,520	2,166	2,483
33	....	39,540	5,400	7,021	490
24	....	34,140	3,950	2,040	464
25	3,000	4,000	17,020	2,340	3,720
26	5,700	16,352	14,759	....	....
27	6,000	6,860	....	4,474	5,698
28	13,435	....	3,850	15,304	8,154
29	33,000	17,330	25,510	15,989	10,549
30	....	18,930	30,275	27,338	8,860
31	500	10,545	32,075	23,681	13,424
April 1	2,300	47,190	7,832	31,943	....
2	14,610	41,630	14,170	....	9,091
3	21,139	78,363	....	21,956	10,730
4	....	....	10,090	87,774	13,950
5	51,000	115,400	33,670	80,798	33,584
6	....	111,980	....	78,853	33,801
7	45,000	66,598	13,712	89,108	66,331
8	60,000	26,737	13,144	59,229	....
9	48,400	57,015	28,375	....	60,554
10	75,000	92,590	....	144,369	81,791
11	50,000	....	52,300	96,090	47,339
12	50,000	24,236	122,000	25,327	60,386
13	....	17,438	100,128	80,532	106,843
14	70,000	47,008	82,445	89,397	120,713
15	100,000	79,919	47,553	117,095	....
16	25,000	85,507	75,592	....	139,914
17	50,000	84,866	....	125,347	112,057
18	45,000	....	46,785	201,816	120,027
19	56,000	149,768	178,546	169,205	143,174
20	....	195,385	222,498	129,212	219,298
21	27,000	122,642	172,214	177,014	127,858
22	80,000	96,008	212,599	176,717	....
23	83,000	179,543	304,780	....	207,978
24	80,000	111,900	....	179,290	194,169
25	110,500	....	301,883	129,122	120,159
26	112,000	127,727	528,053	168,695	102,567
27	....	109,501	275,150	188,785	128,192
28	167,700	70,320	402,572	169,235	171,213
29	90,000	399,062	228,194	161,547	....
30	90,000	225,808	149,511	....	183,415
May 1	141,000	335,220	460,847	421,666	228,618
2	110,400	....	403,920	124,514	164,541
3	96,860	112,220	394,838	96,899	122,511
4	75,000	200,807	160,000	148,679	142,374
5	98,375	230,571	253,220	160,077	162,837
6	146,900	365,300	407,875	181,110	....
7	158,550	383,450	....	....	234,248

TABLE VIII.—*A comparison of the inspection of herring, &c.*—Continued.

Month and day.	1879.	1880.	1881.	1882.	1883.
	Number.	*Number.*	*Number.*	*Pounds.*	*Number.*
May 8	133,000	246,385	826,950	211,717	68,718
9	95,000	...	422,900	108,413	85,478
10	88,000	232,362	236,250	109,819	134,737
11	45,400	294,967	175,000	94,942	121,877
12	97,000	245,678	255,000	55,900	84,925
13	96,000	200.400	...	46,800	...
14	86,000	334,640	269,650	...	102,423
15	62,000	147,000	...	51,621	92,291
16	45,000	...	249,500	122,068	57,807
17	45,000	169,975	100,000	126,753	63,627
18	25,000	131,750	134,465	90,432	72,381
19	31,000	...	89,000	99,257	62,870
20	50,000	60,500	299,968	171,558	...
21	45,000	51,445	56,900	...	98,667
22	20,000	22,000	...	244,222	29,189
23	11,000	...	128,225	109,987	17,419
24	21,100	48,288	117,130	84,978	21,352
25	300	8,000	49,000	97,640	7,463
26	31,000	5,280	30,830	84,328	11,602
27	25,000	6,000	59,200	78,824	...
28	10,000	6,380	52,556	...	19,063
29	8,000	12,000	...	82,894	9,874
30	5,000	...	...	...	...
31	5,000	...	80,000	82,793	10,440
June 1	6,000	...	...	27,300	2,687
2	10,000	500	35,000	3,463	1,302
3	10,000	...	6,000	5,867	...
4	8,000	...	12,000	...	604
5	600	...	...	6,850	1,892
6	1,000	...	15,000	5,800	406
7	300	...	8,000	7,989	640
8	800	...	4,000	14,050	440
9	...	...	...	12,265	900
10	600	...	...	7,605	...
11	300	...	...	...	...
12	200	...	...	5,094	...
13	100	...	...	1,747	...
14	100	...	...	1,159	...
15	...	...	...	467	...
16	50	...	...	...	...
17	...	...	...	...	...
18	...	...	...	...	...
19	...	...	...	...	...
20	...	...	...	...	...
21	...	...	...	...	...
22	...	...	...	...	...
23	125	...	...	...	...
24	25	...	...	...	...
25	...	...	...	...	...
26	10	...	...	...	...
27	...	...	...	...	...
28	50	...	...	...	...
29	...	...	...	...	...
30	...	...	...	...	...
Total	3,605,429	6,850,626	9,633,568	6,487,865	4,879,473

NOTE.—In 1879 herring continued to be reported after June 30 as follows: During July, 330 (seven dates); October, 225 (three dates). In 1880 herring were reported in January, 50 (one date); February, 3,045 (seven dates). In 1882 herring were reported in January, 9 (one date); February, 1,051 (nine dates). In 1883 herring were reported in February, 925 (six dates).

TABLE IX.—*A weekly comparison of the inspections of shad in the Washington market during March, April, May, and June of* 1879, 1880, 1881, 1882, *and* 1883.

Week.	1879.	1880.	1881.	1882.	1883.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
March 1- 5	....	132	....	52	28
6-12	....	184	....	778	115
13-19	....	2, 126	470	3, 054	543
20-26	740	2, 523	4, 862	7, 733	1, 183
27-April 2	4, 711	11, 699	13, 881	12, 567	10, 646
April 3- 9	14, 097	27, 740	11, 489	54, 740	22, 165
10-16	18, 900	38, 145	57, 019	66, 129	51, 771
17-23	38, 200	49, 529	73, 439	51, 710	58, 667
24-30	43, 860	43, 103	88, 630	48, 296	37, 777
May 1- 7	58, 596	52, 724	84, 142	40, 223	32, 283
8-14	45, 619	38, 578	49, 586	22, 841	20, 431
15-21	36, 100	29, 937	36, 513	19, 619	13, 149
22-28	23, 200	14, 502	25, 689	14, 401	9, 130
29-June 4	11, 640	6, 627	8, 744	4, 846	2, 205
June 5-11	11, 503	3, 218	3, 904	2, 505	1, 381
12-18	3, 090	....	....	729	....
19-25	880	....	....	....	....
26-30	105	....	....	....	....
Total	311, 241	320, 767	458, 368	350, 223	261, 474

TABLE X.—*A weekly comparison of the inspections of herring in the Washington market during March, April, May, and June of* 1879, 1880, 1881, 1882, *and* 1883.

Week.	1879.	1880.	1881.	1882.	1883.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
March 1- 5	....	15, 150	175	1, 917	1, 310
6-12	....	12, 420	1, 900	9, 288	3, 225
13-19	....	22, 810	55, 044	8, 221	8, 841
20-26	8, 700	131, 322	73, 129	21, 090	11, 946
March 27-April 2	69, 845	142, 485	113, 712	118, 729	50, 785
April 3- 9	225, 539	456, 093	98, 991	417, 718	218, 950
10-16	370, 000	346, 698	480, 018	552, 810	556, 986
17-23	341, 000	828, 212	1, 132, 422	979, 311	990, 392
24-30	650, 200	1, 044, 318	1, 885, 363	996, 674	899, 715
May 1- 7	827, 085	1, 627, 568	2, 080, 700	1, 132, 945	1, 055, 129
8-14	640, 400	1, 554, 432	2, 185, 750	627, 591	598, 158
15-21	303, 000	560, 670	929, 923	661, 689	447, 703
22-28	118, 400	95, 948	436, 441	694, 479	107, 088
29-June 4	47, 000	12, 500	133, 000	202, 317	24, 967
June 5-11	3, 600	....	27, 000	54, 559	4, 278
12-18	450	....	....	8, 467	....
19-25	150	....	....	....	....
26-30	60	....	....	....	....
Total	3, 605, 429	6, 850, 626	9, 633, 568	6, 487, 805	4, 879, 473

TABLE XI.—*A yearly statement of the number of shad and herring inspected in the Washington market during the six years ending June* 30, 1873, 1874, 1875, 1876, 1877, *and* 1878.

Years.	Shad.	Herring.
1873	852, 900	3, 789, 800
1874	628, 637	6, 567, 240
1875	464, 215	1, 674, 465
1876	319, 079	1, 488, 950
1877	131, 199	2, 572, 124
1878	121, 785	2, 507, 500
Total	2, 517, 815	18, 600, 079

2.—REPORT UPON THE SHAD AND HERRING FISHERIES OF THE POTOMAC RIVER FOR 1883.

By GWYNN HARRIS.

Number of shad landed at Washington	257,687
Number of shad landed at Alexandria, Va	81,429
Number of shad landed at Georgetown	2,200
Number of shad shipped from Glymont	14,250
Number of shad shipped from Kinsale, Va	4,100
Number of shad shipped from Cone River	3,450
Number of shad sold on the different shores	16,700
Total number	379,816
Number of herring landed at Washington	4,914,261
Number of herring landed at Alexandria, Va	2,331,000
Number of herring landed at Georgetown	360,000
Number of herring shipped from Piney Point	78,000
Number of herring shipped from Kinsale	24,000
Number of herring shipped from Cone River	32,000
Number of herring sold on different shores and trap nets	1,250,000
Total	8,989,261

NOTE BY MARSHALL McDONALD.—The herring product is about the same as that for 1882; probably a little in excess of that year. The shad figures indicate a decrease of 70,000 as compared with last year, but I infer from Capt. Wood's report in regard to the Chesapeake, that this deficiency in the Potomac was compensated for three or four times over by the increased catch of pound-nets in the bay.

3.—OCCURRENCE OF BALISTES VETULA ON THE NEW JERSEY COAST.

By J. H. VAN MATER, M. D.

[From a letter to S. F. Baird.]

Mr. J. B. Swan, light-keeper of Conover Beacon, near this place, recently picked up on the beach a fish the like of which no one here had ever seen. I inclose a rough sketch and description of the same.*

ATLANTIC HIGHLANDS, N. J., *October* 29, 1883.

*From the description given by Dr. Van Mater, the fish has been identified by Dr. Tarleton H. Bean as *Balistes vetula*, which he says is rather rare on our coast.—C. W. S.

4.—CARP IN ENGLAND IN THE SEVENTEENTH CENTURY.

By THOMAS FULLER.

[From Worthies of England, 1662.]

It is a stately fish, but not long naturalized in England, and of all fresh-water fishes (the eel only excepted) lives longest out of his proper element. They breed (which most other fishes do not) several months in one year; though in cold ponds they take no comfort to increase. A learned writer [Sir Francis Bacon, in his History of Life and Death] observeth, they live but ten years; though others assign them a far longer life.

They are the better for their age and bigness [Gesnar and Janus Dubranius] (a rule which holds not in other fishes); and their tongues by ancient Roman palate-men were counted most delicious meat; though, to speak properly, they have either no tongues in their mouths, or all their mouths are tongues, as filled with a carneous substance, whilst their teeth are found in their throats. There is a kind of frog which is a professed foe unto them; insomuch, that of a hundred carps put into a pond, not five of them have been found therein a year after. And though some may say perchance two-legged frogs stole them away, yet the strict care of their owners in watching them disproved all suspicion thereof.

Now as this [Sussex] county is eminent for both sea and river fish, namely, an Arundel mullet, a Chichester lobster, a Shelsey cockle, and an Amerly trout; so Sussex aboundeth with more carps than any other of this nation. And though not so great as Jovius reporteth to be found in the Lurian Lake in Italy, weighing more than 50 pounds,* yet those generally of great and goodly proportion. I need not add, that physicians account the galls of carps, as also a stone in their heads, to be medicinable; only I will observe that, because Jews will not eat caviare made of sturgeon (because coming from a fish wanting scales, and therefore forbidden in the Levitical law), therefore the Italians make greater profit of the spawn of carps, whereof they make a red caviare, well pleasing the Jews both in palate and conscience.

All I will add of carps is this, that Ramus himself doth not so much redound in dichotomics as they do; seeing no one bone is to be found in their body, which is not forked or divided into two parts at the end thereof.

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*Mr. Pennant notices from Jovius, that they were sometimes taken in the Lacus Lurius, of 200 pounds weight, but of his own knowledge could speak of none that exceeded 20. Others are reported to have been taken in the Dneister that were 5 feet in length.—Nuttall.

5.—MOVEMENTS OF MACKEREL IN WINTER.

By J. W. COLLINS.

[From a letter to Prof. S. F. Baird.]

Capt. Wm. Dempsey told me last night that last January he saw heavy schools of mackerel 70 to 75 miles southeast of the southeast part of George's Bank. He was driven off the bank in a gale, and when the weather moderated the fish "showed up." He saw them in the afternoon and at night. A fisherman of Captain Dempsey's experience could scarcely be mistaken as to the kind of fish he saw; more especially as he told me they "rushed" repeatedly, a habit of mackerel, when schooling, that I think no other fish has.

GLOUCESTER, MASS., *October* 8, 1883.

6.—A LARGE SQUID.

By J. W. COLLINS.

[From a letter to Prof. S. F. Baird.]

Yesterday, while in conversation with Capt. Charles A. Keene, of this port, I obtained from him the following statement relative to one of the big squid that was found on the Grand Bank. The squid seen and secured by Captain Keene and his crew was much larger than any that I have previously heard of. But his statements are very positive and precise as to its length. The information which he furnishes seems to be of more than ordinary importance, since it enables us to form more accurate estimates of the maximum growth attained by these great "devil fish."

Captain Keene states that, in September, 1876, when fishing on the Grand Bank, in latitude 44° north, longitude 50° west (approximately), he found floating at the surface near his vessel one of the large squid, the body of which, measured as accurately as it could be from a dory, was 50 feet long, while the tentacles, all of which were intact and uninjured, were longer than the body, making the entire length more than 100 feet. The tentacles were larger around than the body of a stout man. He cut the squid up and boated aboard three dory loads, probably about 3 tons weight, and he estimates that there was at least one to two more boat-loads which he left to drift away.

I had previously heard of fishermen finding pieces of tentacles, &c., which might belong to animals nearly or quite as large as the one above mentioned, but I have never before met with any one who has had the fortune to see entire such a king of the mollusks.

GLOUCESTER, MASS., *November* 20, 1883.

7.—THE TRANSPLANTING OF ONE HUNDRED LOBSTERS FROM THE EASTERN PART OF LONG ISLAND TO CHESAPEAKE BAY.

By Lieut. W. M. WOOD, U. S. N.

[From a report of the Fish Hawk trip from Wood's Holl to Washington, October 11-30, 1883.]

Wednesday, October 24, 1883, we received at navy-yard, Brooklyn, N. Y., one hundred live lobsters for deposition in Chesapeake Bay. They were from Mr. Blackford, who had them sent especially for the purpose from Fort Pond Bay, Long Island. They were placed in the tank belonging to the ice-machine, a sheet-iron-lined box, 8 feet long, 20 inches wide, and 30 inches deep. A constant circulation of water was maintained by means of one of the pumps and suitable piping.

Friday, the 26th, the weather showing signs of clearing, we left the yard at 12.40 p. m., and put to sea, passing Scotland light-ship off Sandy Hook at 3.15 p. m., and entering the capes of the Chesapeake at 6.20 p. m. of the 27th.

The lobsters were now all taken from the box and placed in tubs preparatory to putting them in the water. Only two were dead, notwithstanding their crowded quarters, and all the rest seemed strong and healthy.

At 8 o'clock, October 27, we arrived abreast of Fort Wool (Rip Raps) and deposited them on the north side of the fort.

WASHINGTON, D. C., *October* 31, 1883.

8.—A FOUR-POUND CARP LIVES EIGHT HOURS OUT OF WATER BY BEING PACKED IN WET MOSS.

By R. T. W. DUKE.

[From a letter to C. W. Smiley.]

On Saturday evening I caught with a hook a "carp" which would weigh about 4 pounds. I put him in my bath-tub filled with water. On yesterday, about 8 o'clock a. m., I put the carp in a small box, surrounding it with wet moss, and forwarded to Lynchburg by express. It reached there about 4 p. m., and I learn this morning from my friend to whom it was sent that when taken out and placed in a tub it was as lively as could be. My family ate a small carp Sunday morning, and thought it very good.

CHARLOTTESVILLE, VA., *March* 18, 1884.

Vol. IV, No. 2. Washington, D. C. April 9, 1884.

9.—ON A NEW FORM OF FILTER OR DIAPHRAGM TO BE USED IN THE CULTURE OF OYSTERS IN PONDS.

By JOHN A. RYDER.

The unexpected success which crowned, in a measure, the attempt made by the writer, in association with Mr. H. H. Pierce and Mr. G. V. Shepard, at Stockton, Worcester County, Maryland, during the past summer, to rear the spat of the American oyster from artificially fertilized eggs in an inclosed pond connected with the open water by a trench only, into which a permeable diaphragm was fitted to give ingress and egress to the ebbing and flowing tides from without, in order to change the water in the pond, has given us experiences which will enable us to greatly improve the diaphragms to be used in the connecting trenches, and also render it possible to clean or renew the filter of sand whenever desirable or necessary; also to *increase or diminish at will the thickness of the stratum of sand used as the filter and as a barrier to prevent the escape of the embryo oysters swimming about in the pond.* Such a diaphragm the writer proposes to describe and figure in this communication, believing that for simplicity and effectiveness the apparatus in its present form cannot fail to be in a large measure the means of obtaining spat at will and also the means of preventing the escape of the swimming embryos of oysters cultivated in ponds or coves with narrow outlets.

The fertility of the oyster, as shown by the investigations of scientific men, is truly astounding; some conception of this fact may be gained when it is stated that a single female oyster, according to its size, may produce all the way from one to one hundred millions of eggs in a single season. How to save, in a measure, this vast yield of germs from wholesale destruction, has engaged the practical attention, for several years past, of such men as Professors Brooks, Rice, Lieutenant Winslow, U. S. N., and Col. M. McDonald. In Europe, with the Portuguese oyster, the greatest success in artificial culture has been attained by Bouchon-Brandely, of Paris. The viviparous *Ostrea edulis* of Europe has also been thoroughly studied by Messrs. Hoek, Hubrecht, and Horst, of Holland, with prospects of ultimate success in its artificial propagation. Science has therefore been more thoroughly awakened to the importance of studying the life-history of these three, probably the most valuable of all edible mollusks, during the last half decade than ever before, and it is not too much to say, that more real knowledge of economical value has been gained, respecting especially the American oyster, during this brief renascence than had been acquired during the previous half century. All investigators are agreed that only a small fraction of one per cent. of the total number of eggs produced by oysters under natural conditions, ever, even when those are favorable, attain a size large enough so make it an object to carry them to market. While Professor Huxley may be right in the opinion expressed in his recent address before the Royal Institution, 11th May last, that it would be difficult to prove that overdredging is accountable for the wholesale destruction of oyster beds, I cannot but believe that it has been, to some if not to a great extent, responsible for the diminished productiveness of the beds of our native species in its natural home, the Chesapeake Bay and its tributaries. If the oyster embryos survived in a uniform proportion to the number of adults existing during any and every season, then dredging and overfishing would necessarily have their effects, but we have the best of reasons for believing that the proportion of young to old oysters during different seasons is variable, so that in some years there is a much greater yield of spat than in others. Professor Huxley, while he is bound to admit that the oyster beds of Europe are less productive than formerly, however believes, after all, that there is hope for oyster consumers, and that artificial propagation may yet be successfully carried on. Here is what he said: "I for my part believe that the only hope for the oyster consumer lies first in oyster culture, and secondly in discovering a means of breeding oysters under such conditions that the spat shall be safely deposited. And I have no doubt that when those who undertake the business are provided with a proper knowledge of the conditions under which they have to work both these objects will be attained." These remarks were apparently intended to apply to the European oyster, but they apply in reality with equal force to our own species.

My own studies and experiments during four years past have borne upon the question of the artificial propagation of the oyster, and while I am aware that shell-planting is practiced on the shores of Connecticut and Long Island with gratifying and even with very profitable results, another phase of the industry remains undeveloped in the United States, namely, pond, park, or *claire* culture as practiced in Europe. It is upon the development of this branch of oyster culture in this country that I largely build my hopes regarding the future utilization of the many thousand of acres of swamp-lands or flats adjacent to waters where the oyster is already native, while I also believe that the seed or spat can be reared in these ponds in quantity sufficient to supply the needs of culture, provided diaphragms such as, or similar to, what I am about to describe are used to prevent the escape of the naturally produced embryos from the culture ponds. I look forward to the possibility of depending entirely upon the embryos produced by the natural spawning of the adults confined in the ponds and not altogether to the process of artificial fertilization, in the practice of which both the male and female parents are sacrificed. *The* question is, how can we retain the embryos in the ponds which are produced there, and what can we do to afford the embryos, developed and swimming about in such confined waters, surfaces to which they may attach themselves and become converted into fixed spat which can afterwards be transferred to other ponds or to open waters?

Our experiments at Stockton, this year, have gone far towards giving us a solution of some of these questions. They have shown that, first, it is possible to excavate ponds in salt marshes where oysters will also grow; secondly, artificially fertilized spawn may be placed in such places and live; thirdly, such spawn may fall as spat in such inclosures if surfaces for its attachment are provided; fourthly, it will grow just as rapidly as the spat which has grown under natural conditions in the open water; fifthly, the natural microscopical food is continually generated within the inclosure and consists mainly of very minute animal and vegetable organisms; sixthly, the water may be partially changed within the inclosure twice a day by the rise and fall of the tide provided a permeable diaphragm or filter composed mainly of fine sand is placed in the sluice way joining the pond to the open water of the bay or sea.

It is imperatively necessary that the water used be of the right density. If it is too saline or contains too little saline matter the oysters die. A specific gravity varying from 1.007 to 1.020 or 1.022 seem to represent about the range of density of the waters in which the American oyster will thrive. In the Chesapeake Bay the water over the great oyster beds ranges mostly from 1.012 to 1.016. In the Chincoteague the density may be as great as 1.022. At Wood's Holl, Massachusetts, I have found oysters growing in water having a density of 1.0146, 1.0172, and 1.018. The last mentioned was about the density of the water in the pond at Stockton in which we obtained spat under conditions of confinement.

DESCRIPTION OF AN IMPROVED FORM OF DIAPHRAGM FOR OYSTER PONDS.

My improved permeable diaphragm is placed horizontally within an oblong trunk or box, A, Fig. 1, of the accompanying plate. The box is made of inch planks, to which strong horizontal side pieces, *a*, Figs. 2 and 3, are secured, and to which are fastened the transverse cross-bars *b b*, of Figs. 1, 2, 3, and 4, upon which the permeable diaphragm rests. Fig. 1 represents the trunk A secured within a pair of quadrangular frames, F F, and partially in sectional elevation in place in the trench or canal leading from the pond to the open water. Fig. 2 represents the construction of the end of the trunk next the open water, and Fig. 3 that of the end next the pond, while Fig. 4 shows the trunk as viewed from above.

On the cross-bars *b b*, a single screen of galvanized wire cloth, W, Fig. 1 (galvanized after it is woven), is superimposed, having meshes say one-half inch in diameter; upon the wire screen a layer of gunny cloth, C, Fig.

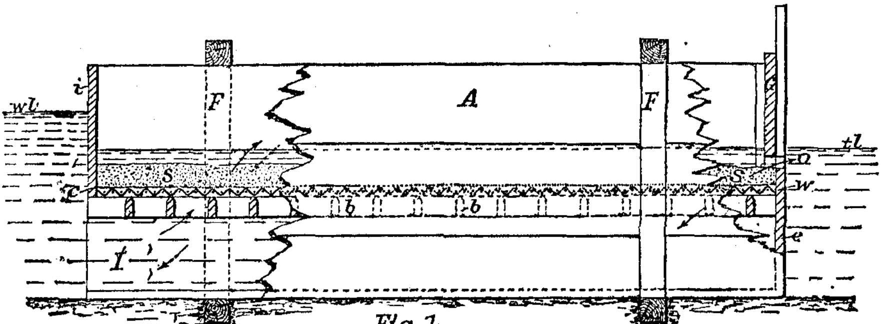

Fig. 1.

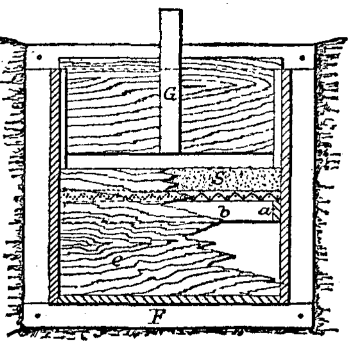

Fig. 2.

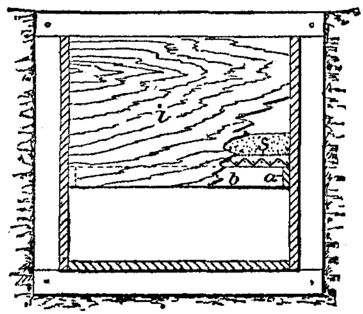

Fig. 3.

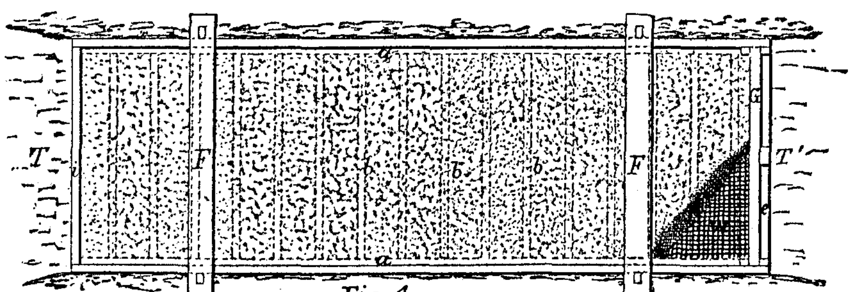

Fig. 4.

Fig 5.

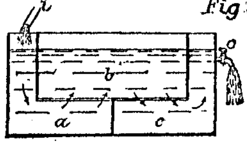

Fig. 6.

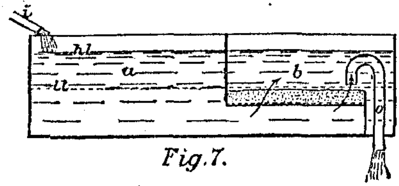

Fig. 7.

IMPROVED PERMEABLE DIAPHRAGM FOR OYSTER PONDS.

1 and 4, is laid, upon which a layer of fine, clean sand, S, is spread evenly from one end of the trunk to the other. The end board *e*, extending half way up at the outer end of the box, runs up past the level of the wire and cloth to confine the sand at that extremity, as shown in Fig. 2, while the sand is confined by the board *i* at the other end of the trunk next the pond, as shown in Fig. 3. The wire cloth and bars *b b* constitute the support for the sand as it lies upon the gunny cloth, which is supported in turn by the wire cloth or screen W. This is essentially the construction of the filtering apparatus in which the layer of sand, S, is at all times accessible, so that it can be removed if it becomes clogged with ooze carried in by successive tides under the gate G, Figs. 1, 2, and 4. This layer of sand can also be increased or diminished in thickness so as to strain the inflowing and outflowing water more or less effectually, as may be desired, or in order to more or less effectually prevent the escape of any eggs or embryos of oysters which may be developing within the pond and wafted to and fro by the ebbing and flowing currents which are carried in and out of the pond through the diaphragm by tidal action. The gunny cloth C, Fig. 4, may possibly be replaced by, first, a layer of coarse gravel, then a layer of finer gravel superimposed upon that, which would prevent the fine sand from sifting through the supporting wire screen W. Gravel would be more durable than gunny cloth or sacking, which, like all other textile fabrics, will rot if immersed in salt water for a few weeks. In practice, however, a mode of getting over all such difficulties would soon be devised; a coarse sacking to be used for the purpose might be saturated with a drying oil or with tar diluted with oil of turpentine, which when dry would act as a preservative of the material, but not cause it to become impervious.

In the old style of diaphragm used in the experiment at Stockton, it was difficult to renew or clean the sand, inasmuch as the apparatus consisted essentially of a box open at the top, and as wide and as high as the trench connecting the pond with the open water. Its depth was three feet, its width two feet, and its total thickness about four inches. The sides forming its greatest depth and width were perforated with numerous auger holes. On the inside, this narrow, deep box, of the above dimensions, was lined with gunny sacking and the intervening space filled with fine sand. This diaphragm was placed vertically in the trench, and it will be readily understood that the filtering surface was limited by the depth of the water in the ditch, while its free action was also to some extent impeded by the small amount of ingress and egress offered to the ebbing and flowing tide, in passing in and out of the pond through the auger holes, in the sides of the box, on either side of the vertical stratum of sand. It will also be readily understood that it would be impossible to remove the sand, from the box to repair or renew the filter without destroying its effectiveness for the time being.

The diaphragm, of which I am about to describe the working, obviates all of these objections, while it is possible to augment the extent of the filtering surface to any desired extent, by simply widening and lengthening the horizontal stratum of sand which does duty as the filter of the sea water and acts as a barrier to prevent the escape of the embryos. A description of the working of the apparatus will make it much better understood.

When the trunk A is put in place (which should be done before the water is let into a freshly excavated pond, and also before the water is let into the trench from the sea-end), it should be securely placed in position and the earth tightly rammed in along the sides so as to prevent any sea water from finding its way into the pond, except such as passes through the filtering diaphragm. It is also unnecessary to insist that the trunk be constructed in such a way that it will be practically water tight, and not liable to leak between the planks or at the corners. The wire-cloth, sacking or gravel, and sand having been got into place, and when complete forming a stratum having a total thickness of five or six inches, the operator is ready to cut away the barrier at the sea-end of the trench to let in the water.

If then the trunk A has been let down into the trench deep enough, the sea level at low tide ought to be somewhat above the upper edge of the board *e*. The water will then, as the tide rises, flow back over the sand as far as the board *i*, and will percolate through the diaphragm into the space I, under the latter, and so find its way into the pond. After a day or so the pond will be filled with sea water, which has practically been filtered, and filtered more or less effectually in proportion to the thickness of the stratum of sand constituting the diaphragm. After the pond has once been filled, with the rise and fall of the tide in the open water, the level of the latter and that in the pond will be constantly changing; in other words, when the tide is ebbing the water level in the pond will be higher than that of the water outside, as in fact represented at *wl* and *tl* in Fig. 1. Under these circumstances there will be a supply of water flowing out, through the under division I of the trunk A, up through the sand and out over its surface, through the outlet O under the gate G. After the ebb tide is over and flood tide begins these levels will be reversed and *wl* in the pond will be lower than *tl* in the open water, and under those circumstances there will be an inflow of sea water into the pond through the diaphragm instead of an outflow, as in the condition of the water levels during ebb tide. Under such conditions there will be four alternating periods during every twenty-four hours of inflow and outflow, lasting we will say four hours each, not reckoning the nearly stationary intervals between tides or during slack water. This almost constant partial renewal of the water will unquestionably maintain the water inclosed in the pond or ponds, by means of diaphragms, in a condition fitted to support oysters colonized therein, provided its density is not too great or too slight, and if there is also some microscopic vegetation present.

It will be readily understood from the preceding description how it is intended that the apparatus is to be operated. The figures also give a very good idea of how the diaphragm and trunk are to be constructed; the first four figures being drawn to a common scale of one inch to three feet.

THE POND.

In Fig. 5 I have represented a pond in vertical section to which a diaphragm D, of the form above described, has been adapted and fitted into the connecting trench T leading to the open water B. This pond P, it is supposed, has been dug out of a salt-marsh of the type so common adjacent to waters well adapted to the cultivation of oysters along the shores of the shallow bays and sounds of the Eastern United States. The French are in the habit in some places of walling up or facing the sides of the rearing ponds with cement or tough clay, or even building the sides of stone. That breeding ponds should in some way have their sides made firmer when dug out of a mere salt-marsh, would hardly be doubted by any one, because such an arrangement is an important safeguard against the bad effects of rains and frost in causing the sides of the pond to crumble and wash down into the bottom as mud and sediment, thus tending to cover and smother the oysters at the bottom. It cannot be questioned either that in case the pond is excavated on salt-marsh lands, which are often merely large accumulations of sedimentary deposits consisting of ooze or mud which has been piled up along the shore by the waves during ages, the bottom should be covered with at least a coating of loam or clay, to, in a measure, intercept the poisonous marsh gases coming up from below. To render such an artificial bottom firmer, old oyster shells scattered thickly over the bottom would render the loam or clayey sand firmer and less liable to give way under the soft and yielding bottom, which is really in a viscous, yielding condition at a depth of a few feet, so much so that when a horse or other heavy animal walks over the surface the thick turf usually vibrates up and down perceptibly on the soft stratum below. In such situations it is therefore plain that a preparation of the bottom of the pond excavated would be necessary. In other situations, such as, for example, in the vicinity of Point Lookout at the mouth of the Potomac River, where there is a firm clay bottom near the surface, oyster ponds might be excavated and a bottom found which would need no preparation, and at a level which would require no more digging to get below tide-level than in the salt-marshes adjacent to Chincoteague Bay.

The deposition of sediment which is held in suspension by the ebbing and flowing tides on the bottom of ponds has been very troublesome to the French in the conduct of pond-culture, and it will be one of the difficulties to be overcome in this country, as a very cursory glance at a few facts will readily show. Here, as well as there, ooze is very rapidly deposited on the bottom of oyster coves or confined natural areas, which in this country represent rudely, in some cases, the "claires" in which oysters are grown in Europe. I now call to mind the extensive deposits of ooze on the bottom of a cove at Saint Jerome's Creek, where deposition over a limited area has been going on for many years until in some places the ooze is 9 feet deep and utterly unfit as a bottom upon which to plant oysters, because they would inevitably sink into the mud and be smothered. In the moat around Fortress Monroe, which is in communication with the Chesapeake Bay, there is also a very considerable sedimentary deposit, few oysters being able to exist on the bottom, but large numbers are attached as "natural growths" to the clean surfaces of the walls on either side of the moat, to which the spat has at one time and another affixed itself in such numbers, and there grown so rapidly as to nearly cover the vertical and inclined surfaces of the massive boundary walls. Ooze or sedimentary deposits of more than a very few inches in thickness are therefore hurtful to growing adult oysters, while a very thin film of a similar kind is fatal to the young oyster in its extreme infancy or embryonic state immediately after fixation. Getting rid of or preventing such deposits is therefore of the very greatest importance in the work of practical oyster culture.

Many oystermen are ready to affirm that some mud is a necessity in the work of oyster culture; they in fact make bold to say that the animal needs a certain proportion of mud to feed upon. The origin of this mistaken doctrine is probably to be sought in the fact that a few of the more intelligent culturists have possibly noticed that the nearly black fæcal matters of the animal consist almost wholly of a material which, without critical examination, would be taken for mud molded into the form of the internal cavity of the intestine. A little investigation will serve to convince the most skeptical, however, of the utter absurdity and irrationality of the hypothesis that oysters feed upon mud. In the first place mud is not in any sense food, either vegetable or animal, and whatever of ooze or sediment is found in the alimentary tract of the oyster, or any other mollusk, was carried there accidentally together with what was truly food in the form of minute animal or vegetable organisms, upon which it is also known that the oyster exclusively feeds. It is well known to naturalists, moreover, that when one wishes to find such minute living organisms for study with the microscope, they are not to be found buried in the mud, where they would as inevitably be smothered and killed as the oyster itself, and from the same causes, namely, interruption of respiration on account of the absence of oxygen, and the exhalation from the ooze of poisonous, asphyxiating gases. Here is what a very eminent authority has said about the habits of certain minute organisms living in water: "The favorite habitation of many kinds of Rhizopods is the light superficial ooze at the bottom of still waters, where they live in association with Diatoms, Desmids, and other minute Algæ, which form the chief food of most of these little creatures. They never penetrate into the deeper and usually black mud, which, indeed, is almost universally devoid of life of any kind."* This remark, which was meant to apply to small organisms found in fresh water, applies with equal force to those found in brackish or sea water, because the fresh-water and marine faunæ and floræ of microscopic forms really blend together or overlap. It is therefore evident that ooze or mud on the bottoms of oyster-beds or ponds in excess is invariably to be regarded as injurious both to the oysters themselves and to the minute organisms upon which they feed.

To prevent in a measure the accumulation of sediment on the bottom of oyster ponds and coves the introduction of sand filters will be found effective in proportion to the practical skill and knowledge brought to bear in their construction and management. I do not mean to affirm that the form of diaphragm here described will be found to be the most suitable means of attaining our object after prolonged experience has been had in the work. It may be found in using a single diaphragm, through which the water may flow in either direction alternately, that when the flow is reversed a certain amount of sediment will be washed out of the sand filter, and that when this occurs during the inflow into the pond a certain quantity of sediment would be carried in and deposited. If this should be found to be the case it would be an easy matter to arrange two separate diaphragms in a trunk divided by a longitudinal vertical partition alongside of each other. One of these might be arranged, as shown in Fig. 1, to filter only the inflowing water and the one alongside of it to filter the outflow. They could be made to operate automatically if wooden valves were provided at the inlet and outlet of either, so arranged as to close and open when the pressure of the tide was least or greatest as the latter rose and fell, but such complications in the construction of filters or diaphragms would only make them more difficult to operate and less suited to be left to the management of the ordinary laborer. If it is possible, therefore, to keep out the sediment with the simple form here described, it would be much better to stick to that without additional complications. The confinement of the brood or fry either thrown off from old oysters living in the pond or of such as has been artificially introduced into the inclosure, as was done at Stockton, would be well enough accomplished, in all probability, by a simple diaphragm such as that here described.

The freedom of the flow through the diaphragm will depend mainly upon the area of the latter and the fineness of the sand composing the filtering stratum. And it would therefore be possible to construct a filter of a capacity great enough to filter enormous volumes of water, or enough for the very largest operations, by simply increasing the area of the filtering surface. The obstruction or clogging of the filter by deposits of fine and coarse materials on the top of the stratum of sand might be obviated to a large extent by the use of wire screens placed

* Fresh-water Rhizopods of North America. By Joseph Leidy, M. D. Rep. U. S. Geol. Surv. Terr., vol. xii, 1879, pp. 8 and 9.

in the trench beyond the diaphragm to intercept such coarser materials, along with which a good deal of pretty fine sediment would be caught and prevented from clogging the diaphragm. If one diaphragm failed to accomplish the desired result, two placed in the same trench in succession could not fail to answer, and it would then doubtless be possible to completely arrest all sedimentary materials as well as effectually prevent the escape of any brood in the outflow which it was desirable to confine in the inclosure.

Such in the main are the conditions to be fulfilled in the construction of artificial oyster ponds. In Fig. 5 the conditions are essentially those obtaining at Stockton. The shell collectors consisted of perforated oyster shells strung upon wire and hung upon the stakes *s s s s s*, as shown in the figure. Shells were also strewn upon the bottom, but in practice these ponds ought also to be available for the culture of adult oysters both for market and breeding purposes, and if the pond is prepared with the proper bottom, supplied with water of the right density and temperature and with the proper amount of oxygen in solution, there is no reason why success should not reward the experimenters. In Europe the claires are often constructed so as to have their bottoms at about low-tide level, so that they may be drained and cleaned. This would hardly be practicable along the eastern seaboard of the United States because the rise and fall of the tide is, as a rule, not great enough. But this need not be any obstacle in the way of success, for in the Report of the United States Fish Commissioner for 1880 there is a translation of a Norwegian notice, by Prof. H. H. Rasch, of a natural basin near Stavanger, Norway, in which oysters are indigenous. This lake, strange to say, "lies a few feet higher than the open sea close outside of it, which could convey salt water into the lake only during severe southwest storms combined with spring tides. The lake receives through a brook the surplus fresh water from two lakes situated higher:" it has a percentage of saline matter ranging from 0.02 to 3.90 per cent.—the former at a depth of 2 feet, the latter at 27 feet. The oysters thrive best in it at a depth ranging from 3 to 15 feet; in this so-called oyster belt swarms of young oysters appear to congregate during at least nine months of the year. In 1879, 65,000 young oysters of the European species were taken from the lake, scarcely five acres in area, a quantity which would be equivalent to about 430 bushels of the American species. These young ones were transplanted to fattening grounds.

This lake is protected by cliffs around three sides 300 to 400 feet high, which defend it from the cold winds of this inhospitable northern region. Algæ grow in the lake, and, with its relatively uniform high temperature in its protected situation, affords probably amongst the very best conditions for the growth of oysters.

We know very well that it is quite out of the question to attempt to control the character of very large bodies of water so as to adapt them to the purposes of the oyster culturist, but if nature has in a few instances, as in the example just cited, brought together the very best conditions on a small scale, there is no reason why man should not imitate them successfully, and in such a way as to make it exceedingly profitable. While it is not possible in one year to settle upon all the conditions necessary for success in the work of artificial oyster culture, I believe that the business will in time be successfully pursued and will engage the attention of an industrial and producing seaboard population in the eastern United States which for numbers will surpass anything of the kind the world has yet seen. In order to imitate nature where she has been unusually successful in producing results profitable or advantageous to man, we must go to work to study her methods by scientific means, and when we have discovered her combinations of conditions favorable to her ends we shall have discovered those which may be approximately imitated by man and applied by him to his own purposes of gain.

The successes of Brooks, McDonald, M. Brandely, and myself during the past four years with the unisexual species of oysters has proved that we are nearing a solution of the question of their artificial culture—in fact that we are translating the language of Nature into terms intelligible to man, and rendering her methods to some extent available industrially. The first steps in this work are necessarily to some extent empirical, but the results so far achieved have shown how utterly impossible it would have been for the merely practical and avowedly unscientific man to have gained possession of all the information now in our hands.

The writer took up the subject in 1880, and then supposed that a box constructed as shown in Fig. 6, in section, would answer to confine and rear oyster spawn. The permeable bottom of the compartment *b* rested upon a partition along its middle, which divided the space at the ends and below *b* into the spaces *a* and *c*. The water was let into *a*, from which it would filter up through the half of the bottom of *b* and down and out again through the other half into *c* and off by the faucet *o*. While this arrangement it was found would retain the fertilized eggs in the compartment *b*, the filter on the bottom, made of filtering paper, backed on either side by strong canvas, was found would soon clog and stop the passage of the water. Then it was attempted to force water through an apparatus of the same kind; this too was a failure. A large flannel pen was then tried; this too failed. In 1881 a tidal box was constructed similar in principle to what is shown in longitudinal plan and section in Fig. 7. In this the spawn was confined in the chamber *a*, into which the water was allowed to run slowly through the pipe *i*. The filter was horizontal and formed the bottom of most of the compartment *b*, into which the water would rise until it reached the level *h l* in both boxes, when it would be run off rapidly through the wide siphon *o* till it reached the level *l l*, when it would again fill to the level *h l*, to be again partially emptied. This was also a failure as well as the Wolff's-bottles apparatus devised in 1882 by Colonel McDonald. We got the young oysters so far along as to have them adhere to the sides of the vessels and to old oyster shells, but beyond that point our results were not satisfactory. Somewhat similar results were obtained during the same year by Messrs. Brooks and Winslow. That same season M. Brandely conceived the idea of using sand as a barrier for the embryos of *Ostrea angulata*, the Portuguese oyster, and succeeded in confining them in a pond fed partly by salt water by the tide and partially by water from another pond used as a reservoir, and from which the water passed through a sponge filter to the breeding pond. The Stockton experiment was even simpler than that of M. Brandely, which has already been described in the translation of his paper, addressed to the minister of marine of the French Government, having been published in Volume II of this Bulletin. It will also be seen that his method does not differ essentially from the method used in 1881 by the writer, on a small scale, at Cherrystone, and shown in sectional plan in Fig. 7.

In 1882 the writer also tested the method of blowing air upon the surface of the water contained in the hatching receptacles, which, like the cotton-wool diaphragms used during the same season for the purpose of retaining the fertilized eggs of the American oyster, was also a failure as far as valuable practical results were concerned. Various devices were also used for the same purpose by Dr. Brooks, Lieut. Francis Winslow, and Henry J. Rice, and I believe all of these three last named experimenters, like ourselves, had reared the young oysters to the condition of fixation, so that it is not absolutely true that M. Brandely was the first to successfully rear oysters to the condition of fixation; but he seems to have been the first to obtain spat from artificially fertilized eggs.

These historical details are introduced to show that the results so far obtained are not the fruits of the efforts of any one person, but that a number have been actively engaged in the work, and that probably had it not been for the success of the American investigators, who attacked the problem of the development of our native oyster in 1879, the Europeans, who now again took up the subject after twenty years of inactivity, would not have been stimulated to undertake the investigations which led to such successful results, at the hands of the secretary of the College of France.

The essentials for the artificial culture of oysters, we very well know, have not yet all been determined, though some of the conditions required have been successfully supplied. What seems now to be required seems to be further experiment to determine finally and quite satisfactorily the following points:

1. Can sediment be effectually prevented from finding access to oyster ponds, and how can the embryos naturally or artificially bred there be confined in such inclosures?

2. What are the best means of preparing the sides and bottoms of

the ponds and the communicating trenches, so as to make them durable and easily cared for where there is a muddy or clayey bottom?

3. What simple and effective devices will best serve the purpose of diaphragms or filters to be placed in the sluiceways of oyster ponds as filters?

4. To what extent will it be profitable to prepare an extensive system of connected breeding-ponds or claires in which to rear the American oyster for market?

5. What is the most economical and successful mode of using collectors for the purpose of rearing spat for seed or for stocking barren or uncultivated waters?

6. How thickly can oysters be planted upon a given area, say per square yard, rod, or acre; and is it best to spread the planted oysters evenly or irregularly over the bottom?

7. Do embryo oysters stick to the under surfaces of collectors because they are freer from mud or sediment? (This is the experience of observers both in Europe and America.)

8. What is the length of the spawning period of the American oyster, and in what month does spat first appear, and when does it cease to fall or set in the autumn?

9. What is the minimum of time in which an oyster is matured, counting from the time it was spawned until it is of marketable size?

10. Do oysters vary very greatly in the rapidity of their growth in different localities?

11. What is the cause of the variation in the quality or flavor of oysters from different localities?

12. What forms of microscopical organisms are the most frequently met with in the stomachs of oysters, and therefore the most valuable food of the animal?

13. What is the average density of the water in which oysters will always thrive best?

14. What temperatures are most favorable to their growth?

15. What temperatures are most hurtful, and under what circumstances?

16. What means of oxygenating the water in oyster ponds are the most satisfactory?

17. What parasites and enemies of the oyster are most hurtful, and in what way?

Some of these queries we have, in different publications issued during the past two years, sought to answer approximately, but it will be seen that many of them would require an elaborate series of investigations to be carried out before it would be possible to give entirely satisfactory replies. It is much easier to ask questions than to answer them, but there is no easier way to find out how little we really know than to ask a series of questions such as the above. It will doubtless require many years of observation before most of them will have received completely satisfactory replies; but it none the less behooves the practical men who are interested in the oyster industry to experiment and observe till they are in a measure answered, because until then we shall have made no very solid progress in the pond-culture of the oyster.

Whether policing and districting the Chesapeake will be of as much use as intelligent efforts at culture even in a very primitive way, I gravely doubt. The average oysterman is very conservative; the great majority could not even be induced to sow shells, often being quite ignorant that such a means was ever resorted to for the purpose of giving the beds a chance to spread and cover more territory; the thought of the possibility of the fixation of some of the millions of embryos which are emitted from the oysters on the old beds, and wafted hither and thither by the tides, never seems to enter their minds. They plant oysters, it is true, but this means simply, among the Southern oystermen at least, that poor or undersized oysters are brought from some other place and laid down for a season or two to grow, when they are again taken up, sorted, and marketed; those which have not grown large enough, together with such spat as in some cases may have been produced on the beds, are thrown back and replanted, and not usually in a very thorough or systematic way. There is to-day very little effort being put forth by the planters, so-called, of Maryland and Virginia to really cultivate the oyster. The old system of simply shipping the poorly grown or two-yearlings from some other old bed to a new one, is what is called planting and cultivation. The time has come when these "planters" will have to awaken from their indifference to this subject, and take hold of the industry in an intelligent and scientific manner.

It may be urged that pond culture will be expensive, and involve large outlays for digging and preparing the ponds, but it should also be borne in mind that ponds once prepared can, with slight annual repairs, be kept in condition for the business for many years, besides which the work is condensed and becomes more accessible and easily managed. The oysters are planted thickly, about 100 per square yard, in the claires or ponds of Europe. At this rate one acre of cultivated oyster bottom, worked on the pond or basin system, ought to accommodate 480,000 single oysters, or 3,200 bushels, reckoning 150 oysters to the bushel. This is a yield which ought to satisfy the most extravagant expectations. Though this is not actually the produce per acre, which is found over the limited areas known as natural beds or "oyster rocks," where an average of 270 single oysters will sometimes be found to the single square yard, giving a total of 1,296,000 single oysters to the acre, aggregating the almost fabulous yield of 8,740 bushels, a result which must of course be regarded as the growth of at least three years, as I have known "oyster rocks" to be formed within that time, through the agency of man, where piles of old oyster shells had been thrown overboard, and left heaped up on the bottom, to which a large set of spat had caught and grown so as to produce the above result.

The average depth of the pond should, of course, be at least 3 feet, and and probably a depth of 4 feet would be better in practice, as this would pretty effectually prevent frost from reaching the oysters on the bottom in winter, while the water would not be heated in summer as much as in shallower ponds. The culturists abroad are said to occasionally suffer losses from the water becoming too warm in their "claires" or ponds, many of which get no water except once in every fourteen days or during spring tides. From this cause also it is evident that considerable loss must be experienced from evaporation, while of course the warmth and quiescence of the water would tend to cause the microscopical vegetable organisms in the water to multiply rapidly and give off oxygen to the water, and in turn consume the carbonic acid gas given off by the oysters during respiration. In this connection I must not forget to mention the fact that I have known the water along some parts of the shores of the Chesapeake to rise to a temperature of 101° F. to 105° F., after exposure to the sun during the middle of the day, where the bottom was composed of dark or black mud, which would of course absorb the heat from the burning rays of the sun and again radiate it into the overlying stratum of water at night.

WASHINGTON, D. C., *November* 24, 1883.

10.—NOTES ON THE ACCLIMATIZATION OF FISH IN VICTORIA, AUSTRALIA.

By W. P. WHITCOMBE.

[From a letter to Prof. S. F. Baird.]

We have had a small fish acclimatization society here for some years. We have stocked our waters with English trout (*S. Fario*), with English perch, tench, and carp. Kindred societies on the seaboard have tried (with what success remains to be proved) to introduce some of the migratory *Salmonidæ*. We have not attempted this as our streams are not suitable. Indeed, I may say we are very badly off for permanent streams in this district, most of them becoming a mere chain of water-holes during the summer without any flow through them, and should the fall happen to be dry it is not uncommon for the streams not to run until the winter is well passed. Such dry seasons are not unfrequent. We have in this neighborhood some small lakes which we should like to stock with as good fish as we can. In some of them there are already English perch and trout, and in one a fish known here as the "Murray Cod" (*Oligorus Macquarientis* Gunther). This fish is a native of the Murray or Macquarrykion, is non-migratory, and is a good table fish, but not good as a sporting fish. The lake into which it has been introduced is fed by small streams which run only during wet weather, and as it lowers through evaporation in summer becomes somewhat brackish—too much so for man to drink of it. The average depth of water in this lake may be about 12 feet, its circumference some 35 miles. Fish of the above kind taken in it are much better eating than those in the river of which they are natives. We have put some trout in this more than ten years ago, but there do not seem to be any in it now. At any rate none have been taken or seen. We have an elevation above sea-level of some 1,500 feet, and consequently the climate is cool, well fitted for any of the *Salmonidæ*. *S. Fario* grows to a great size. I have seen it 16 pounds weight, and frequently 7 and 8 pounds in the lakes; not the lake above described, but other smaller ones. In the streams it seldom exceeds 2 pounds. Now, my object in thus describing our waters is to find out whether they would be fit for Schoodic salmon, black bass, or shad. The two latter, if I mistake not, are migratory, so would be useless here, but your land-locked salmon (is it *S. namaycush* of Gunther?), I think, would do well enough provided it can propagate in still water. Streams are not to be relied on here, at least those which run into any of our lakes.

If your interest in pisciculture will lead you to give me the above information I shall be much obliged. I would also like to know when your Schoodic spawns. How long after spawning does it hatch? I think there would be no difficulty in getting a box of spawn put in the ice-house on one of the California mail steamers which would bring it here from San Francisco in less than thirty days.

BALLARAT, VICTORIA, AUSTRALIA, *September* 17, 1883.

ABSTRACT OF REPLY BY PROFESSOR BAIRD.

It is impossible to send the American shad to Victoria, as we have not learned how to transfer them over a much shorter trip to Europe. There would be no difficulty in supplying you with eggs of the land-locked salmon or lake trout. We have transmitted with entire success eggs of both the California salmon and of our white-fish (*Coregonus*) to Australia. The lake trout spawns on reefs in the Great Lakes, and does not need to ascend into running water. One of the best fish that could be introduced in your fresh waters would be the American cat-fish. It is very hardy, grows rapidly, is a capital article for food, and is measurably secure against the attacks of other fishes. It is not belligerent and interferes very little with its associates. I am about sending a stock of catfish to Belgium, and possibly I might be able to do the same to Australia.

Please designate some colonial or other agent in San Francisco to receive the consignment and carefully house them in the steamer.

I am somewhat disinclined to recommend the black bass. It is very pugnacious and voracious, and might disturb the balance of life in your waters, quite as much as have the rabbit and other old world species, life on the land.

WASHINGTON, D. C., *November* 5, 1883

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11.—THE SELECTION OF SITES AND THE CONSTRUCTION OF CARP PONDS.

By S. G. WORTH.

[From the Monthly Bulletin of the North Carolina Department of Agriculture, August, 1883.]

The cultivation of carp or other fish in ponds is attended with success only after requisite preparation in the first place, followed up by a reasonable amount of care and watchfulness.

I very greatly fear that the majority of fish-ponds are improperly located or improperly built. Upon the water and soil depend the ratio of growth.

SITES FOR CARP PONDS.—This is one of the best watered sections in the world, possessing small and large streams in every quarter. The extensive flat alluvial or made lands which lie along the creeks are the places for the best-paying ponds, such places as make the best corn, but there are very few persons in North Carolina who are justified in going into pond-building on a large scale this year. They have no means of stocking such large ponds until the fish first distributed have spawned.

A large number of ponds which will be built during the next twelve months will be small, and used ultimately for breeding or hatching purposes, and I take this occasion to call attention to the various localities which offer advantages for these and larger ponds. The most valuable ponds for growing carp will be on creeks, but these are the most costly and the most difficult to maintain.

Casting about for the most advantageous point to construct a pond, it will be observed that there are five classes naturally presented. With these in mind, I believe there are many persons who, having despaired of finding a proper place on their lands, will, after further search, discover all necessary conditions for making as good ponds as they wish.

I. NEAR THE SOURCE OF SPRINGS.—Ponds of this class will always be in favor. The advantages are, slight liability to overflow and close proximity to dwellings. They are more often visited, the fish are more easily protected against birds and snakes and can be domesticated more quickly; but the coldness of the water produces a comparatively slow growth. Such ponds are useful for hatching purposes, but the area is generally too small for the extended growing of fish, except when high dams are built, and these are risky. Besides, there is generally but a small area of rich soil at spring heads, and consequently a scarcity of insect life. Hill-side ditches, made chiefly with the plow, will sufficiently protect them from overflow, but it is advantageous to allow a safe amount of washing to pass into them.

II. ON THE BEDS OF BRANCHES OR CREEKS.—Ponds made on the beds of branches and creeks will constitute a larger number than any other class. They will prove most valuable for growing carp, but will require much care in the construction of the dam and the overflow. They will not attain to the highest value unless the inflow and outflow of water is screened. Every one who has tried can estimate to some degree the trouble this involves. Whenever it rains the volume is so increased that it is nearly impossible to strain it through screens.

The only way to control it absolutely is to go above the head of the pond and cut a wide, shallow ditch around the side of the pond and turn the freshets. This will be impracticable in many ponds, but in some cases where plows can be used it can be done with a moderate outlay.

III. ON MEADOW-FLATS.—Ponds built on meadow-flats by the side of branches or creeks can be made entirely safe from freshets. I greatly favor this as well as the following class: On many streams where it would be impossible to build manageable ponds of Class II, large areas of comparatively level land are found which would make excellent ponds. Ponds of this kind would have a dam or dike running down the side of the stream and, turning at right angles from it, run to the hill-side. Now, to get water into this pond, you have to go up the stream until you get 4 or 5 feet of fall. When this point is found, obstruct the run with a log or some piling and cut a ditch along the hill-side with very slight fall (1 inch to 20 feet), running the water nearly level. By the time you get down to the head of the pond you are some distance up on the hill-side, away from the old run. If the stream is flat and the fall insufficient to answer this purpose, it may be practicable to make the obstruction above a tumbling dam, 2 or 3 feet high, by using more logs and piling. The sand filling in behind will make no difference, as the dam is put there for the sole purpose of giving you that much more fall to supply the pond below. With a pond of this kind (and they may often be made) there is no danger of overflow at any time. The supply ditch, made chiefly with a plow, will only convey a given amount of water to the pond, and the rest will fall over your log obstruction or tumbling dam and pass down the creek. The long dam extending alongside the stream should not be built too close to the old run, as craw-fish will work under it and high water may cut it away. It should be quickly set in cane or Bermuda grass.

IV. BY THE SIDE OF MILL-RACES.—By the side (on the lower side) of mill-races, frequently occur sites well adapted to the construction of fish-ponds. Such races are quite common in the middle and western counties, and they often reach a long distance. On the lower side, between the race and the old bed of the stream, level or comparatively level tracts of land from one to four acres in extent are often found.

Dams thrown up here are safe from overflow, and water can be let in from the race and the supply governed with precision. Both in this and the preceding class, the dams need not generally be very high, since they receive no freshets.

V. BELOW MILL-DAMS.—I have frequently observed level tracts of land on which good fish-ponds could be made. Generally, in such places, it will be necessary to run a dam parallel with the creek as far down as the pond is to extend, and then turn at right angles to the hill-side with another section of a dam, as in Class III. Dams of this class need not be very high, and the water supply can be taken through the dam of the mill-pond above. In the three classes last named, the area of land covered by the water will be alluvial as a rule, and suited exactly to the requirements of the fish. The advantage of requiring moderately low dams is a great item, because it is the vertical height of water that causes the majority of dams to break. As stated before, they will not overflow, and the amount of water received into them can be regulated and strained as it goes in and wastes out.

Most persons have a leading idea that all ponds must be made by throwing dams across streams. This is a great mistake, for many large ponds can be made on the three plans last named.

But the value of such ponds as are made by the side of streams, below canals and mill-dams, is apparent for other reasons than those just mentioned. The land covered by these being naturally dry beforehand, gives a firmer bottom to walk upon when the fish are being picked up, and in the course of three or four years, when a quantity of soft mud accumulates, destroying the productiveness of the pond, the water may be turned out, when the mud will dry enough to produce a crop of rice, German millet, or corn. One crop made on this soil will reconvert its latent properties into fish-producing substances, and render it as valuable as in the commencement.

It is important to have the drainage of the pond very deep. The draw-gate should be below the bottom of the pond proper, allowing, when desired, complete drying of the soil, which will then produce crops from the rich mud soil. With two feet fall a ditch may be cut from the upper end of the drainage box, and allow all the water to leach from the soil.

Being beyond the possibility of overflow, the dam need not reach more than 8 or 10 inches above the surface of the water. A dam which rises but slightly above the pond surface is less liable to attacks from musk-rats, for although these animals penetrate the face of dams beneath the water-level, they incline the passages upward, and enlarge them in the dam above the water as it stands in the pond. Besides, dams look better when built but a few inches above the water, though they can never be safe unless the inflow is controlled. Another economic point lies in the fact that you avoid large wasteways and extensive and costly screens.

CONSTRUCTION OF PONDS.—Many persons who depend upon a limited amount of water for a supply fail through poorly constructed dams to hold enough to keep the pond full. Others, who have an abundant supply, usually receive into the ponds entirely too much when the rain-fall is great. The ponds which are in danger are those which receive the floods.

To secure the desired result, the food products of the water must be given up exclusively to the carp as the properties of the soil are given to the cotton plant. Therefore, when it is intended to construct a pond, there are several questions which should be determined beforehand.

EVAPORATION.—If the supply of water is small, too large a pond will expose so much surface in dry weather that the level of the water will be lowered by evaporation, and by filtration through the porous soil forming the basin. It is difficult to estimate this loss, but I do not believe that it would be safe to regard it as less than ¼ of an inch per day in dry, hot weather in shallow ponds. At this rate an acre pond would lose at such times 6,783 gallons per day, or 282.6 gallons per hour. In other words, if the loss by evaporation is approximately ¼ of an inch of the surface a day, it will require a constant supply of spring water, amounting to 282.6 gallons per hour, or 4.7 gallons per minute, to keep the pond full. Ponds half the size would lose but half as much. Rain-water must not be depended upon to supply fish-ponds.

MANAGEMENT OF OVERFLOW.—A carp pond to be of value must be arranged in a manner that all the water coming in and going out can be passed through screens. Labor and money invested in any attempt to pass the *floods from heavy rains* through screens may be regarded as thrown away. A volume of water a foot in diameter, running with the usual velocity of streams after rains, contains enough floating and suspended matter to fill several yards of screen in a few hours, and oftener in a few minutes. The earlier this is realized the better. If it is the purpose to build a large pond by building a dam across the stream, it will be best to cut a canal around the dam at the outset, through which the floods may pass without entering the pond at all. Such a canal should begin a few yards above the head of the pond. By using a level you can stand at the site of the dam and determine the upper beginning point before the dam is built. But it may also be determined after the water is raised, since the surface will indicate the line along the side of the pond above which the canal must extend. The fall in it should not exceed 1 inch in 20 feet, and if it passes close along the pond side, its bottom should not be lower than the water surface of the pond. To determine its required dimensions necessary to waste the floods, you must ascertain as nearly as possible the acreage of land which sheds rain-water into the basin or valley above. A rain-fall of 1 inch amounts to 3,628 cubic feet, or 27,138 gallons, to each acre. Ascertain the rain-fall of your region, in order to serve as a guide for making wasteways on dams and for regulating the size of canals around them. Note the extremes in the rain-fall, for it is the heavy rains that test the construction of ponds. The canal should be two or four times wider than deep. The soil removed should be plowed up and shoveled to the lower or pond side. When the question of getting rid of the floods is disposed of, the dam may be built.

WASTEWAYS.—Many persons will not attempt to turn the floods around the dams by making canals, and therefore I would recommend that the wasteways to their dams should be cut around the end through the natural soil of the hill-side. This form of wasteway is merely a wide ditch, cut without fall, and extending far enough below the lower side of the dam to prevent the waste water from cutting that side of the dam away. Two or more rows of piling to arrest the cutting out may be required to be driven across this outlet, the upper ends being even with the bottom of the ditch. A row of narrow strips of boards may be driven in the mud close together in the pond above the mouth of this ditch to serve as a screen. If this screen or fence is located in 4 or 5 feet of water, and the two ends drawn in to the shore, it will be twice as valuable as if built immediately at the ditch mouth, for more surface would be exposed. The strips or stakes should be driven a foot into the soil below, and their upper ends on a level with the top of the dam. No dam, however small, should be built without a box in the bottom, provided with a gate, for drawing the water. Such a box should be made 6 or 10 inches square, of 2-inch plank, and reach entirely through the dam, and much pains must be observed to make it long enough. It should be well nailed together and be placed into the bottom of the dam at the lowest point. It should be placed upon one or more pieces of scantling laid in the soil at the base of the dam, and be nailed to these to prevent the water flowing under. The earth can be packed above and on the sides, the timbers being necessary only underneath. A gate should be put into the upper or pond end.

No dam should be made until a ditch has been cut along the line which it will occupy, and the light soil thrown out. Fresh earth put back into the ditch, well rammed, will prevent blowing out if the ditch is dug 2 or more feet. Ponds for raising the carp should be shallow, not more than from 2 to 4 feet deep, except at the dam, where there may be a depth of 5 or 6 feet.

12.—ON A SKIN PARASITE OF THE CUNNER (CTENOLABRUS ADSPERSUS).

By JOHN A. RYDER.

Shortly after my return from Wood's Holl, Mass., an interesting specimen of the common Cunner, Chogset, or Blue Perch, was sent on from that place by Vinal N. Edwards, to Washington, on account of the peculiar spotted and rough appearance presented by the skin. At first one might have supposed that the peculiar whitish spots, with a dark halo of pigment around each of them, were points where some minute fungus was vegetating and infesting the skin of the fish. Microscopic examination, however, soon showed that what was at first sight suspected to be a fungus was really an animal parasite which had bored its way from without into the skin of its host.

Upon consulting Dr. T. H. Bean, the obliging Curator of the Department of Fishes in the National Museum, he informed me that he thought there were in the collection a lot of specimens from farther north, of the same species, infested in a similar way. Dr. Bean kindly obtained two jars of these specimens for me, and also supplied a copy of the Museum record pretaining to them as follows:

N. M. No. 32354. Arichat, Cape Breton, 1882. W. A. Stearns.
N. M. No. 32355. Arichat, Cape Breton, 1882. W. A. Stearns.

Examination revealed the fact that these specimens were infested in precisely the same way as the one from Wood's Holl. Every part of the surface of the skin was found to be raised into small rounded papules or prominences of a blackish blue color, which it was found were caused by thick-walled cysts embedded in the skin, into the vicinity of which pigment cells had migrated or developed *de novo*. In all of the specimens the cornea was more or less infested by these cysts, which were imbedded in its substance, and, as in other parts of the skin, surrounded by opaque pigment cells, which in this situation would, of course, seriously impair vision, the cysts encircled with pigment cells, to the number of four or five, often having lodged immediately over the pupil or line of sight.

Upon removing the thin corneal membrane from the eye, and placing it in glycerine for a while, in order to render it transparent, the relations of the cysts were easily made out under the microscope. They were found to have very thick walls, which were also laminated. The thickness of the walls of the cysts varied considerably; and, as observed in some, was nearly twice as thick as in others. This difference in the thickness of the walls of the cysts is doubtless related to the length of time since the parasite bored its way into the skin. The oldest cysts doubtless having the thickest, the youngest ones having the thinnest walls.

The entire cyst proper measured about one one hundredth of an inch in diameter, while the halo of surrounding pigment according to its amount would increase this dimension to from one seventy-fifth to one-fiftieth of an inch, which was the size of the papules or swellings caused by the presence of the cysts when the skin was viewed superficially.

In the most badly infested specimens as many as 480 cysts were counted within an area of a single square inch of skin on the sides of the body. Here they seemed to be usually associated in groups numbering from one to fifteen to a single scale, and imbedded in the thin skin covering the scales. They were least numerous on the chin and under side of the jaws, but very numerously embedded in the skin which covered the fins. From this cause the pectorals, ventrals, anal, dorsal, and caudal fins presented a peculiar densely mottled appearance, due to the aggregation of pigment cells in the vicinity of the cysts. The velar flaps within the anterior portion of the mouth were also infested, as well as the floor and roof of the mouth below the tongue, the inner surface of the opercles, and the anterior faces of the gill arches. The cysts were, on the whole, most numerous on the fins, embedded in the interradial membranes.

From the fact of our finding the parasite encysted it is evident that it is not an adult form, but that it is part of the life-cycle of some species which infests in great numbers one or two other hosts, in which it undergoes its complete development and metamorphosis. It is also in the highest degree probable that it is in fact a Platyelminth or Flat worm, belonging to the group *Trematoda*, which are almost all truly parasitic, presenting a remarkable life-history and exhibiting a true alternation of generations in the course of its migrations from host to host. The animal becomes sexually mature in the intestine of some vertebrate host, where it discharges its eggs into the fæcal matters of the intestine. These ova are then expelled with the fæcal matters, and, finding their way into the water, there hatch out as a ciliated larva, after which it loses its cilia; soon afterwards it enters the body of a snail or other mollusk, where it grows into a sexless individual, in the hollow sac-like interior of which a second generation of asexual individuals quite different from the first are developed from the walls of the sac, provided with tails for the purpose of propulsion. The sac or "nurse" in which these tailed forms develope then ruptures, and the tadpole-like forms escape which are known as *Cercaria*. These then swim about in the water until they find a proper host, into the skin of which they bore, at the same time losing their tails and becoming encysted, as we have observed to be the case with the creature infesting the skin of the Cunner. The next step in their development is the adult sexual state; this develops directly from the tailless larvæ inclosed in the cysts, such as are found in the specimens before us. If another fish should swallow the infested Cunners, the embryos of the parasites would leave their cysts in the skin of the latter and develop into fluke-like parasites, which would very probably find their way into the vessels of the digestive apparatus and liver of their new host, where they would finally become mature or capable of producing eggs. If infested Cunners were imperfectly cooked and eaten by man, he would become the final host in which the worm would reach maturity. After a more or less prolonged stay in the final host, the adult parasites are expelled, and are as a rule within the limits of this group of a flattened or depressed form with a naked soft skin and provided with a mouth, the intestine branched and ending in numerous cæcal diverticula, with ventral suckers, sometimes armed with rings of hook-like chitinous organs. In the mature condition they are hermaphroditic.

Gyrodactylus is a genus of Trematodes which often infests gold-fish in aquaria, and I have met with it in great numbers on the skin of these fishes in the adult state over the whole body of the fish and looking like very minute leeches. They are said to especially attack the gills of Cyprinoids, such as *Cyprinus*, *Carassius*, *Phoxinus*, and *Acerina* in Europe. Here in the United States I have seen thousands on a single gold-fish creeping over every part of the body, and they cannot therefore fail to be very injurious. This type is said to be viviparous, and to reproduce itself by internal gemmation parthenogenetically; a second generation appears within the first and even a third within the second before the *Gyrodactylus* is born. It is very small; has a large terminal sucking disk bearing a circlet of powerful hooks, with two long curved median spines more developed than any of the other parts of the armature of the sucking disk. These parasites are doubtless often transported from one part of the country to another with gold-fish for ornamental purposes, and in this way uninfested fish probably often become infested by being brought into contact with others which harbor the parasite.

Another genus of these parasites, *Bucephalus*, is said to infest the European oyster, *Ostrea edulis*, and passes into the encysted state in a fish which serves as food for a larger fish, *Belone vulgaris*, in the intestine of which the adult of the same worm, a species of *Gastrostomum* occurs. The American oyster, *Ostrea virginica*, is said to be infested by *Bucephalus cuculus*, Macrady. This should deter epicures from indulging too freely in raw oysters, in the ovaries of which it is said to occur, though it is probably a rare parasite, since in examining the soft parts of great numbers of oysters, it has never been my good fortune to meet with it.

The foregoing data supply us with the means of accounting for the manner in which the cysts found their way into the skin of the Cunners. It is probable that some mollusks inhabiting the waters in great numbers where the fish were taken were badly infested with the agamic nurses from which the tadpole-like larvæ escaped in great numbers, which then bored into the skin of the Cunners. But in order that the latter could be as badly infested as are the Wood's Holl and Cape Breton specimens, the free-swimming, Cercaria-stage of the parasite must have literally swarmed in the surrounding waters, if each of the thousands of cysts found on a single Cunner represents a *Cercaria*, as must be the case. I have before me sixteen specimens of infested Cunners from Cape Breton, the smallest 3½ inches, the largest 7 inches long, while the single specimen from Wood's Holl measures nearly 11 inches in length. Even the smallest of these specimens harbor not far short of a thousand encysted parasites, and some of the largest would probably by actual count be found to have five times as many imbedded in the skin. From this circumstance it is fair to infer that the surrounding water at the time the fish became infested must have been swarming full or literally alive with free-swimming *Cercariæ*, which bored into every exposed part of the skin of the fish, as our examination of the specimens has shown.

It is, of course, not possible with the material at present in my hands to identify the species, nor can we do more than indulge in surmises as to what must be the hosts in which the *Redia* or nurse stage of the parasite resides. That probably is some mollusk abounding near where the infested Cunners were taken. To make out the complete life-history of the parasite which we are now dealing with would probably take several years, and would involve the necessity of a prolonged residence in the localities where the infested fish were taken in order to be able to trace the parasite from one host to another. All that we can now be assured of is that the cysts contain a *Cercaria* in the encysted or pupal stage, and that the parasite is one of many similar forms known to infest fishes of the family of *Cyprinidæ*, especially where the encysted state also occasionally produces papules on the skin.

The accompanying pathological effects produced by means of physiological processes are of the greatest interest to the writer, and are significant in connection with known facts relating to the movements of pigment or color-bearing cells. These, as is well known, are specialized differentiations of ordinary cells charged with black, brown, red, or yellow granules. Why the presence of the cysts should attract pigment cells or cause them to be developed in places normally devoid of them is the question raised by what we have learned from a study of the tissue adjacent to the cysts. Normally, and for a very obvious reason, the cornea of fishes is quite transparent, but the infested corneas of the Cunners before us have pigment cells developed around the cysts, and they thus partially intercept the light passing into the eye, as already noticed. Where the cysts are numerous and adjacent, or nearly in contact in the corneal tissue, the crowded masses of pigment cells produce an opaque reticulum, in the meshes of which the cysts are lodged. But aside from these the less densely aggregated pigment cells in the vicinity are of the greatest interest, especially when studied in relation to the structure of the cornea, the principal tissue of which is known to be laminated and to contain cellular nucleated bodies, known as corneal corpuscles of a flattened or depressed form, with long protoplasmic processes extending out into capilliary spaces between the laminæ, and thus in stained preparations producing the appearance of a close network of fine fibers when a prepared cornea is viewed flatwise by transmitted light. The protoplasmic processes of the superimposed corpuscles existing between layers of a slightly different depth have a tendency to run at right angles to each other, and the stained filaments of corpuscles of different laminæ therefore tend to divide the transparent interspaces of the corneal substance into quadrangles. This is precisely what happens in some cases with the pigment cells, which have accumulated in the infested cornea of the Cunner. The color-bearing plasma of the pigment cells seems, therefore, either to have wandered into the corneal lacunæ previously occupied by the corneal corpuscles, and to have displaced them, or the corneal corpuscles themselves, owing to the irritation produced by the intruding parasite, have developed pigment granules in their interiors, and become like pigment cells in optical character. Specimens of the cornea cleared in glycerine show this criss-cross arrangement of pigmented plasma, embedded somewhat like the warp and woof of a loosely woven kind of cloth in the clear corneal substance. More usually, however, the pigment cells are unmodified chromatophores, especially where they lie superficially and do not fall under the influence of the corneal lacunæ normally inhabited by the corneal corpuscles, where they of course would have their shapes modified to correspond with the form of the bodies which they have replaced.

I have for a long time known that the chromatophores or pigment cells of fishes have a certain power of movement among the cells of the skin, especially of embryos, and that they not only slowly change their form but also their positions by means of what cannot be regarded as other than a special kind of independent amœboid migratory movement. In this way their modes of aggregation are slowly altered, while an actual growth and extreme flattening occurs in the course of development, during which they seem to cover more space than at first, and I am very doubtful as to whether they have multiplied, especially in certain cases, so as to cover a greater area, as might at first be supposed. This power of movement of the pigment cells, I believe, explains quite readily the aggregation of these bodies in the vicinity of the parasitic cysts found in the skin of the Cunner. That the distribution of the coloring tissue has been modified in the specimens before us no one can deny, and I am loth to believe that the color-bearing cells have been multiplied in consequence of the irritation caused by the parasites. On the fins, for example, wherever there is a cyst present, there the pigment is sure to have accumulated, and in the light of our present knowledge I see no more satisfactory explanation of the fact than that here given.

What stimulus other than irritation would be adequate to produce the physiological impulse leading to the migration of the color-bearing cells, I am quite unable to conceive. Can it be that the physiological function of pigment cells is in this case defensive or reparative? It is possible, in consequence of their nearness to the irritating cause, that they are among the first amoeboid bodies on hand to attempt to assume some protective function. That such is their function here I have also no doubt whatever. If they are generated in consequence of the irritation produced by the parasite, which is very doubtful, then is there all the more reason to suppose that they have a reparative or protective function. Of one thing we may be sure, that they have some share either directly or indirectly in carrying on some salutary metabolic process, else we should not find them in the vicinity of the cysts, no matter whether they are developed there *de novo* or have migrated into their new positions from adjacent groups of pigment cells which are, as is well known already, very abundant in the skin of the Cunner.

WASHINGTON, *November* 7, 1883.

13.—JOURNAL OF OPERATIONS ON THE GROUNDS OF THE EASTERN SHORE OYSTER COMPANY, ON CHINCOTEAGUE BAY, NEAR STOCKTON, MD., DURING THE SUMMER OF 1883.*

Compiled by JOHN A. RYDER.

[From records kept by J. A. Ryder, George V. Shepard, and H. H. Pierce.]

§ 1. (MOSTLY MR. SHEPARD'S RECORD.)

June 27.—Mr. Ryder arrived at Mr. Shepard's in company with Mr. Pierce.

June 28.—Went to Cedar Island oyster-beds; discovered no catch of spat on shells planted June, nor on those planted on more sandy bottoms about the 10th.

June 30.—Messrs. Pierce and Ryder left in the afternoon for Snow Hill, to settle upon some plans for experiment.

July 2.—Messrs. Pierce and Ryder returned to the Shepard House.

July 5 to 7.—Were employed in getting the pond excavated and prepared for our experiment.

July 7, 11.30 a. m.—Opened about two dozen oysters, about one-third male and two-thirds female. Placed the eggs and milt at once in a pail of water taken from the creek near the claire. Changed the water in this pail at 1.30 p. m. At 4 p. m. contents of the pail were poured into the claire. Eleven stakes, with shells strung on wire attached, placed in the pond.

July 8, 10.45 a. m.—Opened two dozen oysters, about two-fifths male and three-fifths female. These oysters seemed to be in better spawning condition than those of yesterday. Temperature of water in claire, 85° F.; in creek the same at 10 a. m. Temperature of air, 91° F. Specific gravity in creek at oyster house, 1.0175, United States Standard Coast Survey hydrometer scale, to 1.015; in claire or pond, 1.018; in Chincoteague Bay, 1.020; at head of creek, 1.010.

July 9, 11 a. m.—Opened two dozen spawning oysters, "natural growth." Poured this spawn into pond at 4 p. m. Temperature much lower than yesterday. Specific gravity in creek, 1.018; claire, 1.018. Tide very full. (Spring tide.) Mr. Ryder returned to Washington this a. m.

* This journal gives a daily record of the work at Stockton, the results of which have already been published in Bulletin U. S. Fish Commission, vol. III, pp. 281-294, in a paper by the editor of this journal, entitled, "Rearing oysters from artificially fertilized eggs, together with notes on pond-culture, &c." Messrs. Shepard and Pierce, I have elsewhere neglected to say, bore the expense of excavating the pond used in the experiment, and also had the gate or diaphragm made which was placed in the trench leading from the pond to the bay in order to confine the spawn poured into the inclosure. A letter from Mr. Pierce has also been incorporated, which will be interesting as affording further confirmation of the results claimed in my first paper, the title of which has been cited above.

July 10.—Put out five more stakes, with date marked on them, with shell collectors attached; 12 m. opened two dozen oysters (Potomac plants); 4 p. m. poured fry into the pond.

July 12.—Put out the spawn from one dozen oysters at 3 p. m. Temperature of air, 80° F. Put out four stakes with shells attached.

July 13, 12 m.—Opened two dozen oysters, natural growth, well filled with eggs and milt; 4.30 p. m. poured the contents of the pail into the pond. Temperature of water, 82° F.; of the air, 83° F. Before putting out fry a violent thunder and hail storm occurred.

July 15.—The most violent thunder storm of the summer at 9 p. m.

July 16, 1 p. m.—Opened two dozen oysters; most of those opened had but few eggs and milt; 3.30 p. m. poured the spawn into the pond. Temperature of water, 84° F.; of air, 85° F.

July 17, 12 m.—Opened two dozen oysters well filled with spawn. Poured spawn into pond at 4 p. m. Put out three stakes with collectors attached.

July 18, 3 p. m.—Opened one dozen oysters not well filled with ripe spawn; poured into pond at 9 p. m. Temperature of air, 69° F.; that of water not observed. Discovered spat on shells put out in Cedar Island Channel June 1; none on those put out later.

July 20, 10.45 a. m.—Opened two dozen oysters well filled with spawn. At 3 p. m. poured contents of pail into the pond. Put out six more stakes with shells attached.

§ 2. (Mr. Pierce's Record.)

July 23.—At 10.30 a. m. the spawn of twelve female oysters was mixed with the milt of three males; added water three times, and after occasional agitation, carefully poured the same into the pond at 1.30 p. m. Put out six new collectors marked with the date.

July 25.—Opened about thirty oysters and took spawn from eighteen, and emptied into the claire at 3.30 p. m., after standing in pail about four hours. Put out six new collectors. Last evening a very severe thunder storm; wind, almost a hurricane, passed over the claire. Trees nearly blown down.

July 28.—Opened about three dozen oysters taken yesterday from Cedar Island Channel, and found spawn in about two dozen abundant, and a good proportion of males. Put out five collectors and poured the spawn into the pond at 2.45 p. m., after having stood in the pail two and a half to three hours. Temperature of water in clair, 81° F.; temperature of air in claire, 77° F.; temperature of water in pail, 76° F.; in bay, 79° F.; in creek, 79° F. Day cloudy, and a strong southerly wind. Heavy rain, with some thunder and lightning in the early evening.

July 30.—Put spawn from about two dozen oysters into the pond after it had stood about three hours. The adults from which this spawn was taken were fresh from the off-shore beds (Cedar Island Channel), and seemed to be in fine condition.

August 1.—Took spawn from eighteen oysters taken from the float at oyster house and brought from Cedar Island Channel three days ago. Spawn seemed poor, coming from very watery oysters. Spawn stood in the pail about three and a half hours and was put into the claire at 3.30 p. m. Temperature of water in claire at 3.30 p. m., 84° F.; temperature of air in sun, strong south breeze, 88° F.; in shade, 80° F.; temperature of water in pail emptied into pond, 76° F.

August 3.—No spawn to be got from inshore oysters.

August 4.—No spawn to be got from oysters taken from Cedar Island Channel.

August 5.—Found plenty of spawning oysters on the float (at oyster house), and put that taken from about one and a half dozen into claire at 6.30 p. m. Temperature of air in the sun at the pond, 83° F.; temperature of water in the pond, 81° F.; in the creek, 83° F.

August 6.—Took spawn from about two dozen oysters taken from the float. These oysters, two days ago, had apparently little or no spawn in them. Found a good proportion of males. Spawn emptied into claire about 10 o'clock. Put out five new collectors. Temperature of air in sun over claire, 92° F.; of water in claire, 79° F.; in bay, 80° F.

Wednesday, *August* 22.—Had Sharply, a laborer, examine pond. He reports the discovery of several young oysters of considerable size.

Thursday, *August* 23.—Went to the claire or pond in person and made a more thorough examination, and found quite a numerous set of spat on collectors put in place July 7 to 12; some as large as a 10-cent piece; could not discover any on collectors of a later date with the naked eye; sent several shells by mail to Mr. J. A. Ryder, at Wood's Holl, Mass.

August 31.—Examined pond and found a set of spat on collectors, put down as late as the 20th August, but could see none on collectors of a later date with the naked eye. The slimy deposit on the shells is great and is apparently increasing.

§ 3. (MEMORANDUM BY MR. RYDER.)

Summarizing the foregoing data, the following facts may be especially noticed. Seventeen lots of spawn were put into the pond from July 7 to August 6, inclusive. An average of 22 adult oysters were sacrificed each time a fresh lot of spawn was obtained. The entire number of adult oysters sacrificed was 378, of which probably not more than half actually yielded spawn.

Nine lots of shell collectors were placed in position altogether, from July 7 to August 6, inclusive. From eleven to as few as three were placed in position in one day in the pond. The whole number of collectors, consisting of stakes supporting garlands of oyster shells strung on galvanized wire, was 51.

§ 4. (EXTRACT FROM A LETTER FROM MR. PIERCE TO MR. RYDER, WITH COMMENTS BY THE LATTER.)

SNOW HILL, WORCESTER COUNTY, MARYLAND,
October 10, 1883.

MY DEAR MR. RYDER: * * * Before writing you I wanted to again visit the claire and the oyster beds, which I did yesterday. I was not able to discover that the "brood" (spat) in the claire had increased either in size or numbers. We placed some of the shells in the open bay and then took away the diaphragm, so that now the claire is open to the bay. It seems to me probable that the great amount of sediment [deposited] upon the shells [in the course of the experiment] prevented a large part of the catch which we ought to have had from fixing itself to the collectors. Perhaps you can suggest next season some way by which that difficulty can be overcome.

I found yesterday some very small oysters on the shells in the claire, and in the open bay; on the shells put out into the latter in June there is every indication that the catch there extends from soon after the shells were put out up to within a very few days. Some of the young oysters [*taken from the bay, this season's spat*] measured about 2 inches long, some were so small as to be not easily seen by the eye, except upon very close examination. * * *

Most sincerely, yours,

H. H. PIERCE.

P. S.—It may be interesting to you to know that yesterday Mr. Shepard, in opening some oysters out in the bay, found one with spawn enough in it to plainly show, in fact he took the spawn from it.

From Mr. Pierce's question as to the cessation of the growth of the spat in the claire, I am reminded that apparently but little growth of the shell, either of the adult or young oyster, occurs after cool weather sets in. There is, in fact, a marked cessation of growth about the end of October, as is shown by specimens of young oysters twenty-three months old now before me. In one specimen of that age the spat had grown during the first season to be 1⅝ inches in diameter, after which there is a sharp offset where the growth had ceased in the autumn. This was the growth accomplished in about four months; during the next succeeding nineteen months a growth of only 2 inches had been made, so that the total length of the shell was now 3⅝ inches measured from the beak to the free edges of the valves. In other specimens measuring 2¼ inches, but of the same age as the preceding, there is a similar sharp offset where the layers of calcic carbonate forming the spat shell cease, and where the first year's growth suffered temporary cessation.

The fact that the young oyster should stop growing appreciably during the autumn and winter is therefore not surprising, and this fact may possibly be connected with another of some significance, namely, the great development or augmentation of the volume of the connective tissue of the animal during the winter months, when oysters are said to be fat or in good condition. This increase of the connective tissue mass in bulk and consistency may probably be regarded as a winter storage of reserve material, which upon the approach of warmer weather is gradually converted into germs. Such an opinion is supported by a large number of facts, derived from a study of the minute structure or the histology of the oyster.

Another fact of considerable importance is what Mr. Pierce notes regarding the late spawning of the oyster, which is in accord with my more exact observations made in 1880. I then found that spawning or spatting occurred during the period intervening from about July 1 to late in October, or that spat fell and fixed itself for a period extending over at least three and a half, if not for even as much as four months. This would indicate that in the case of the American species it is probably possible for the culturist to avail himself of the chance of collecting spat on collecting apparatus put out at intervals during the whole of this prolonged period of the reproductive activity of the animal.

WASHINGTON, D. C., *November* 19, 1883.

14.—NOTES ON THE MENHADEN FISHING OF 1883.

By OSCAR O. FRIEDLAENDER.

[From letters to Prof. S. F. Baird.]

The result as far as dollars and cents are concerned was very unsatisfactory this year on account of the poor yield of oil. We had a large catch from our own boats—about 50 per cent. more than last year—26,053,250 fish. There was a yield of 49,900½ gallons of oil. The average price was 39.6 cents. The above quantity included 2,614,800 fish purchased from outsiders.

Last year we had 23,996,650 fish, including 9,766,700 bought from outsiders. These yielded 121,553 gallons of oil. The average price was 39 cents.

This year's price would have been much higher had it not been for the very heavy import of Japanese fish oil—something entirely new here. The fish were much better in October and November, and, although the weather was very favorable, only small bodies of big sea menhaden were caught here. The catch on the east end of Long Island and Rhode Island was better than here, and the fish yielded about double the quantity of oil. The Church firm caught with four steamers over 60,000,000 fish. I sent some of the last caught fish to Mr. E. G. Blackford, as they were full of spawn. The spring and summer fish were bare of spawn.

NEW YORK, *November* 29, 1883.

John Doyle, who is now chief engineer on the New York and Jamaica steamship, and who was three years an engineer with us, reports a solid body of Menhaden about the 1st of last month, 30 miles off Cape Hatteras. This steamer passed through this immense body for fourteen hours; they were apparently bound for the Gulf Stream and were full of sharks. The presence of the latter on our coast this year may account for the scarcity of bluefish.

Never before were our fishermen so much troubled by sharks as this year, and our catch of sharks was unprecedented.

NEW YORK, *December* 3, 1883.

15.—METHOD OF CATCHING CRABS.

By McMENAMIN & CO.,

[Packers of hermetically sealed goods, such as crabs, oysters, clams, &c.]

Our crab catch has been greatly lessened this season by the high winds that have almost constantly prevailed along the coast. We catch now with trot lines, one man in a small row-boat attending each line. It has occurred to us that if we could use sloops or schooners with dip or other suitable nets, we would be able to work regardless of the general winds.

Your familiarity with the habits of the crab, and your knowledge of the methods of taking fish both in this country and abroad, suggests that you might know of some net that would answer our purpose better than the trot-line.

HAMPTON, VA., *October* 8, 1883.

REPLY BY PROFESSOR BAIRD.

I am inclined to doubt very much whether it would be possible to use nets in the capture of crabs, especially such as would have to remain for any length of time under water, or where a considerable number of crabs were collected together. You would, I think, find that those meshed would be immediately devoured by their more fortunate fellow or by accompanying fish.

There are various forms of traps which might be used for catching fish by baiting; but you are, of course, familiar with all of these.

WASHINGTON, D. C., *October* 12, 1883.

Vol. IV, No. 4. Washington, D. C. April 15, 1884.

16.—A SEARCH FOR MACKEREL OFF BLOCK ISLAND, MONTAUK, AND SANDY HOOK, IN NOVEMBER, 1883.

By J. W. COLLINS.

[From a letter to Prof. S. F. Baird.]

The following facts which I have obtained from Capt. Adoniram J. Burnham relative to a cruise he made last month in search of mackerel in the waters off Block Island, Montauk, and Sandy Hook, may prove of some interest to you; therefore I take the liberty of submitting them to your consideration.

Captain Burnham left Provincetown on November 1 in the schooner Hereward, of Gloucester. The vessel was fitted for purse-seining, having one seine boat and two seines. Besides this, she carried a good supply of the best menhaden bait for tolling up mackerel, and plenty of jigs and lines.

The wind blew strong from the westward on the day that the Hereward left Provincetown; therefore she anchored that night at Hyannis. On the following morning she got under way and beat over to Tarpaulin Cove, where she lay until the next day. Leaving Tarpaulin Cove early on the morning of November 3, with a moderate northwest wind Captain Burnham stood out of Vineyard Sound, from whence he steered off to the southward of Block Island. When about 8 miles southwest of Block Island he hove to and "tried" for mackerel, throwing out ground menhaden toll-bait. He "raised" a school of tinkers and caught 50 or 60 fish, which averaged about 10 inches in length. These mackerel seemed disinclined to take the hook, though they were quite plenty alongside the vessel; not, however, sufficiently abundant to warrant setting a seine around them. Another trial was made about 7 to 8 miles farther south, with the same result as before, small mackerel being tolled up and about 60 of them caught.

"It was a beautiful evening," says Captain Burnham, "and probably we should have seen some schools if mackerel had been plenty."

That night the wind blew up fresh from the southwest, and the Hereward ran into New London, where she lay over Sunday, November 4. Monday morning, November 5, the wind having moderated, the schooner got under way, and passing Block Island and Montauk—the latter in the afternoon—stood off on a south-southeast course, the wind being southwest by south. The morning of November 6, the Hereward hove to and "tried" for mackerel 70 miles south-southeast from Montauk, her position being latitude 39° 56′ north, longtitude 71° 03′ west. No mackerel were tolled up. Two other attempts were made during the day to "raise" fish, but without success. After making the morning trial the schooner stood 27 miles west by south, and hove to in latitude 39° 49′ north, longtitude 71° 37′ west. The last trial for the day was made 20 miles west of the locality last given, in latitude 39° 47′ north, longtitude 72° 04′ west.

During the day Captain Burnham saw flocks of sea geese (*Phalaropes*); gulls were fairly abundant, and occasionally a gannet was noticed. Shoals of porpoises were also seen, but no whales. While the birds and porpoises are considered as indications of the presence of mackerel, Captain Burnham looks upon the absence of whales as quite significant, since, he says, "in this locality, in spring, whales are almost always seen where there are large bodies of mackerel."

After making the last trial for the day, the Hereward headed in for Fire Island, and between 3 and 4 o'clock on the morning of the 7th, when some 18 to 20 miles from the land, the vessel ran through 5 or 6 schools of small fish which Captain Burnham thought were tinker mackerel of the size usually called "spikes." At that time the wind was blowing strong from northwest, and the Hereward stood in under the land, and finally worked over to Sandy Hook lightship, which was reached about 3 p. m. About sunset of the same day the wind moderated, and during the night the schooner ran off southeast from the Hook. On the morning of the 8th she hove to about 30 miles southeast from the highlands of Neversink, where small mackerel—8 to 9 inches in length—were tolled up, and about a half barrel caught on hook and line. No large or medium-sized mackerel were noticed, even in the water.

There was a moderate to brisk breeze from southwest to south-southwest during the day. After the morning trial mentioned above, Captain Burnham stood off shore on a southeast course until the vessel was 88 miles from the land. Attempts were made to "raise" mackerel at intervals of 10 or 15 miles during the day, but without success. About 60 to 70 miles from the land, sea birds were the most abundant, but beyond that limit few were seen.

After making the last "trial" for fish for the day the Hereward ran 16 miles north-northeast, and hove to until the moon set, which was about midnight; after which she ran for Sandy Hook, a bright lookout being kept for fish. When she was about 60 miles off the land, saw scattering small fish, which were thought to be "spikes." This was not far from the locality where we saw small fish darting about on the morning of November 5, when we were running for the Gulf Stream in the Albatross.

Though the Hereward ran through these fish for nearly an hour, they were not seen in sufficient abundance to set the seine, even had they been of larger size. As it was, they were too small to be of any use.

Captain Burnham spoke a New York pilot-boat, part of the crew of which went on board the Hereward. In answer to inquiries, the pilots said that they had never seen mackerel in the water off New York, except in the spring, when the fish were moving north.

The Hereward stood in to the land, and went into Sandy Hook, where she lay until November 13, the weather in the mean time being too rough for the prosecution of further researches. Leaving the Hook on the 13th, she ran down the south side of Long Island, at a distance from the land of 3 to 5 miles. The wind was blowing strong from the westward at the time, and no fish were seen; indeed, there would have been little probability of seeing any in such weather, if mackerel had been plenty in the locality. No further attempt was made to find fish, for Captain Burnham came directly home to Gloucester, and gave up mackerel fishing for the season.

GLOUCESTER, MASS., *December* 11, 1883.

17.—DEPLETION OF FISH IN PANGUITCH AND BEAR LAKES, UTAH.

By ANDREW L. SILER.

[From a letter to Prof. S. F. Baird.]

I intend devoting the most of my time to fish-growing, as it is only a question of time, and that, at the present rate of depletion, a very short time, when the food-fishes inhabiting our waters will become so scarce that they will not be found in our markets. In Panguitch Lake, near this place, the fish are being rapidly exhausted, although the fishermen that fish that body of water say that the fish are as plenty as they were ten years ago; but at present the average weight of the fish caught out of that lake is 1 pound, while the fish caught eight or ten years ago averaged 3 pounds.

The time is very near at hand when, if we have fish from Panguitch Lake, we will have to restock it with Schoodic (or land-locked) salmon or white-fish, or both.

I add an extract from the Deseret News in regard to the fish of Bear Lake. The same thing that has taken place there will certainly take place in the lakes of Utah unless our Territorial legislature takes steps to restock our waters.

"The famed Bear Lake covers some 150 square miles, and washes on three sides the rolling hills. It used to be full of finny beauties, splendid speckled trout. Some weighing nearly 20 pounds have come from there; but, alas, through unlawful methods and at unseasonable as well as seasonable times, is now only a pleasant memory of the past. Mullet and suckers roam the unfathomed depths and glide in the tributaries and outlet of the lake."

HILLSDALE, UTAH, *January* 21, 1884.

18.—NOTE ON THE USE OF THE MALE SALMON HOOK AND THE RUN OF 1883.

By WILLIAM NEY A. HABERSHAM.

[From a letter to Prof. S. F. Baird.]

Lying down on my stomach, on a rock in a pool where I sat and killed many salmon with a fly, I observed in July and August the male use his hook on the female, pressing her neck in his mouth, just as he does in spawning time, showing the use of it long before that period.

The run of salmon this year was very fair, and the fish more plump than I ever saw them before. When I had the pool to myself, I killed about half a ton a week. I remark this because, for several years back, there have been all kinds of predictions that the supply was disappearing, the Canadian often ascribing it to breeding houses, whereas it is well known to all the intelligent old Indians that their appearance and disappearance used to be the same in spearing time. Salmon flocked in crowds for two and three years consecutively and then disappeared in a similar way. This year the supply on the Restigouche main River was great, and very small on its branches, the Matapedia and Upsalquitch.

SAVANNAH, GA., *November* 27, 1883.

19.—AMERICAN LAKE TROUT AND WHITEFISH IN FRANCE.

By MONSIEUR BANMEYER.

[Extract from letter to the Society of Acclimatization.*]

I have just visited the piscicultural establishments of Virelles and Chaulieu, and I have had the pleasure of ascertaining that the eggs of the omble-chevalier (*Salmo salvelinus*), which you had the kindness to send me, are all hatched. It is the same way with the *Coregonus albus* and with the *Salmo namaycush*, which came out equally well, and the young alevins are full of life. In regard to the eggs of trout from the lake of Garde sent recently, we are expecting them to hatch every day. We have lost scarcely 3 per cent. of these eggs. The most assiduous attention is given to these different species, and I am happy to communicate its good results. Everything leads to the expectation that the period of alevinage will be as prosperous as that of incubation.

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*Bulletin Mensuel de la Société Nationale d'Acclimatation de France. Mars, 1883. pp. 173, 174.

20.—THE FISHERIES OF NEW ZEALAND.

By JAMES HECTOR, M. D.

[From Handbook of New Zealand, 1883.]

New Zealand is the chief center of the southern whale fisheries, and at certain seasons the less frequented harbors are visited by whalers for the purpose of refitting and carrying on shore fishing and barreling their oil. These are generally American ships, but Otago and Auckland whaling ships are also equipped by New Zealand owners. The sperm whale abounds in the region of the ocean lying to the northeast of New Zealand, but stragglers are found all round the coast. In the open sea and to the south the most prized whale next to the sperm is the black whale or tohoro (*Eubalæna australis*), which is like the right whale of the North Sea, but with baleen of less value. Along the shores the chief whales captured are the hump-back (*Megaptera*) and rorqual (*Sibbaldius*), which become very abundant when not disturbed for a few years.

VALUE OF WHALE OIL.

In 1875, 20,845 gallons of black oil were exported, valued at £4,100, and 7,775 gallons of sperm, valued at £2,894. In 1877, 15,047 gallons of sperm-whale oil were exported, valued at £4,032. In 1881, 20,686 gallons of sperm-whale oil were exported, valued at £5,059.

SEAL FUR.

The sea-bear or fur seal (*Arctocephalus cinereus*) is found on the remote parts of the coasts, about a thousand skins being taken every year by boating parties. In 1875 there were exported 2,767 seal-skins, valued at £4,050; and in 1877 there were exported 1,503 seal-skins, valued at £1,652. In 1881, 1,259 seal-skins were exported, valued at £1,717.

The fishes which we find in the New Zealand seas on the whole represent the characteristic forms of the southern or Lusitanian provinces of European coasts. In other words, our New Zealand fishes resemble those which are found on the coast between Madeira and the Bay of Biscay more than they do those which are caught about the north of Scotland. Of 33 sea fishes that are used as food in New Zealand, we have among the constant residents of all parts of our coast the Hapuku, Tarakihi, Trevally, Moki, Aua, Rock Cod, Wrasse, and Patiki; and while the Snapper, Mullet, and Gurnet are only met with in the north, the Trumpeter, Butterfish, and Red Cod are confined to the south. But, with the exception of Patiki, or Flounder, and the Red Cod, none of these are representatives of fishes that are common even in the south of Britain, while from the more northern seas similar fishes are altogether absent.

In addition to those which remain throughout the year, a very large number of the fishes of the New Zealand coast, owing to its geographical position, are pelagic in their habits, and roam over a wide range of ocean, visiting our shores only irregularly in pursuit of food. Of the edible fishes of this class, by far the largest number are visitors from warmer latitudes, such as the Frostfish, Barracouta, Horse-mackerel, King-fish, Dory, Warehou, Mackerel, and Gar-fish, while only the Ling, Hake, Haddock, and a few other fishes, which are rare, and worthless as food, are among those of more southern types which reach the New Zealand coast in their migrations.

There is, however, no reason to complain of any want of useful variety in the New Zealand fishes as compared with Britain, for we find that out of 208 species of fishes enumerated as occurring in the British seas, including many which are extremely rare or only occasional visitors, only 40 are considered to have a marketable value. In New Zealand, notwithstanding our very imperfect knowledge (especially with regard to the gregarious tribes, which there is reason to believe inhabit shoals at some distance from land), out of 192 sea fishes, some of which are only known from single specimens, we have nearly as many varieties used for food as are brought to market in the British Islands.

Of 140 species of fish enumerated as found in New Zealand, 67 species are, so far as we know, peculiar to New Zealand; 75 are common to the coasts of Australia or Tasmania; while 10 species are found in New Zealand and other places, but not in the Australian seas. New Zealand ichthyology thus presents a very distinct character, the thorough deciphering of which affords a wide field for future observation and scientific investigation.

The following is a list of the fishes which are chiefly met with in the market:

Hapuku	Oligorus gigas.
Kahawai	Arripis salar.
Red Snapper	Anthias richardsoni.
Snapper	Pagrus unicolor.
Tarakihi	Chilodactylus macropterus.
Trumpeter	Latris hecateia.
Moki	Latris ciliaris.
Frostfish	Lepidopus caudatus.
Barracouta	Thyrsites atun.
Horse-mackerel	Trachurus trachurus.
Trevally	Caranx georgianus.
King-fish	Seriola lalandii.
John Dory	Zeus faber.
Boar-fish	Cyttus australis.
Warehou	Neptomenus brama.
Mackerel	Scomber australasicus.
Rock Cod	Percis colias.

Gurnard	Trigla kumu.
Mullet	Mugil perusii.
Sea-mullet	Agonostoma forsteri.
Spotty	Labrichthys bothryocosmus.
Butter-fish	Coridodax pullus.
Haddock	Gadus australis.
Red Cod	Lotella bacchus.
Whiting	Pseudophycis breviusculus.
Ling	Genypterus blacodes.
Turbot	Ammotretis guntheri.
Brill	Pseudorhombus scaphus.
Flounder or Patiki	Rhombosolea monopus.
Sole	Peltorhamphus novæzealandiæ.
Gar-fish	Hemirhamphus intermedius.
Grayling	Prototroctes oxyrhynchus.
Smelt	Retropinna richardsoni.
Kokopu	Galaxias fasciatus.
Minnow	Galaxias attenuatus.
Sand-eel	Gonorhynchus greyi.
Anchovy	Engraulis encrasicholus.
Pilchard or Sardine	Clupea sagax.
Sprat	Clupea sprattus.
Eel (tuna)	Anguilla aucklandii.
Black Eel	Anguilla australis.
Conger Eel	Conger vulgaris.
Silver Eel	Congromuræna habenata.
Leatherjacket	Monacanthus convexirostris.
Smooth-hound	Mustelus antarcticus.
Sting-ray	Trygon thalassia.
Skate	Raja nasuta.

21.—A MARINE MONSTER.

By RICHARD A. PROCTOR.

[From the Newcastle Weekly Chronicle.]

The discovery of a strange sea creature near St. Elmo illustrates the truth of what I had remarked a few days earlier as to the smallness of our knowledge of the denizens of the mighty deep. The case is interesting not only in its bearing on the accounts of sea monsters of species as yet unknown, but also because it seems as though in the present case evidence of the existence of a tolerably numerous race of creatures had been obtained.

To begin with, the account is not characterized by any evidence of an attempt to excite wonder by untruths. The animal seen, though unlike any known, would not be in itself very marvelous. Omitting details of no importance, the account runs thus:

While the boats of Captain Seymour's bark *Hope On* were on the watch for whales off the Pearl Islands (between 40 and 50 miles from Panama) the water broke a short distance away, and Captain Seymour made ready for a whale. But a head like that of a horse rose from the water and then dived. The creature was seen by all the boat's crew. Captain Seymour describes the animal as almost 20 feet in length, with a handsome horse-like head, with two unicorn-shaped horns protruding from it. The creature had four legs or double-jointed fins, a brownish hide, profusely speckled with large black spots, and a tail which appeared to be divided into parts. The creature was seen on two different days, and if whales had not been about at the time, an effort would have been made to catch it. Captain Seymour and his officers agree in considering that the creature is peculiar to the locality, and that it could easily be killed with lances and guns. It is important to notice that officers of the Pacific Mail Company state they have seen the animal on several occasions, but not so closely as did the officers and men of the Hope On.

The nearest account of any strange animal akin to that seen by Captain Seymour and his men is the account of a marine creature, supposed to be a sea serpent, seen in 1817 near Cape Ann, Massachusetts. Eleven witnesses of good reputation gave an oath before magistrates (one of whom had himself seen what they had) a description of a creature like a serpent, dark brown in color (some said mottled), with white under the head and neck. The head of this creature was as large as a horse's, but shaped like a serpent's, and the animal was estimated as exceeding 50 feet in length. Colonel Perkins noticed an appearance in the front of the head like a single horn, but other observers thought this was the monster's tongue.

The evidence now obtained confirms the theory which was advanced in 1848, and has since been maintained by Gosse and others, that a race of marine animals exists, including probably several varieties, which is characterized by a serpentine neck, a head small compared with the body but large compared with the thickness of the neck, an air-breather, and deriving its propulsive power from paddles; in other words, a modern representative of the long-necked Plesiosaurians of the great secondary or Mesozoic era. Creatures of this class have been aptly compared to what would be formed by drawing a serpent through the body of a sea-turtle.

LONDON, ENGLAND, 1884.

22.—RETURN TO GLOUCESTER HARBOR OF THE YOUNG CODFISH HATCHED BY THE U. S. FISH COMMISSION.

By R. S. TARR.

[From a letter to Prof. S. F. Baird.]

While in Gloucester recently I made some inquiries in regard to the report that small cod of the species *Gadus morrhua* were very abundant in the harbor. Although I was there in the wrong season, still I think that I ascertained enough information to establish beyond a doubt that small cod, some as large as 14 inches in length, belonging to *G. morrhua*, are extremely abundant at Gloucester; and as these belong to the species which is at present almost entirely deep sea, it seems evident that we must look to some other causes than natural ones to explain the appearance of such great numbers in so small an area, for as far as I can find out only one other school has been seen along the New England coast in shallow water. I talked with several fishermen, and they all reported the abundance of the "silver gray cod," which could not be distinguished by them from the deep-sea cod. The most intelligent and observing of all with whom I spoke was Mr. Edwin F. Parsons, of East Gloucester, who expressed a willingness to correspond with you upon the subject, and also to make preparations of specimens, under your direction, if you desired it.

He told me that in the spring and summer for the two past seasons, while fishing for bait for his lobster traps, he took great numbers just outside of Ten-Pound Island. Their abundance dwindled down until in February they were least abundant. Last spring the largest fish weighed 4 or 5 pounds, and often in a day 100 pounds would be the result of his catch. He did not fish especially for these, but simply for bait for his traps. The cod he would sell, while the other fish would serve his purpose. He thinks that he can see three generations, the largest weighing 5 pounds and the others considerably smaller. Although he has been fishing for seven or eight years, never before 1882 did he find deep-sea cod in any numbers inside of Gloucester Harbor. Taking into account this fact, Mr. Parsons feels confident that they can be no other than the fish put into the harbor in 1879; and he wished me to say that he feels thankful for the money he had made and the chowders he has had, as he expressed it, at the expense of the Fish Commission. Considerable enthusiasm is expressed among the fishermen in regard to this matter, and they feel anxious that the work started in 1878 shall be continued. Not only are these fish caught in the outer harbor, but even in the innermost docks of the inner harbor, boys, while fishing for flounders, frequently land gray cod. This is extremely remarkable—that such cod should be found in the very impure water of the docks. But still this is asserted by many. My cousin, Mr. Spinney, who for many years was a practical fisherman and a good observer, and now the head of a firm which handles thousands of cod every month, has examined them critically and compared them with deep-sea cod, and said positively that they were the same. The specimen sent by Mr. Wonson is *G. morrhua*. If you wish specimens in alcohol Mr. Spinney will obtain any that you want upon receiving directions from you. Mr. Spinney sees nearly all the cod which enter Gloucester, and upon being asked if the gray cod was found at other points along the coast he said that the only instance that he knew of was the case of a vessel which had just landed 15 barrels of cod taken in shallow water near Mount Desert. I went to the wharf and found the fish, which proved to be *morrhua*, 14 inches long. I obtained two specimens for the National Museum. They seemed to run about the same size, varying about 1 inch in length, and correspond in size almost exactly with the specimens taken at Gloucester. These may be a portion of the cod from Gloucester emigrating from their original home. As this was the only case which I could find of the *G. morrhua* being found in shallow water, outside of Gloucester, I am inclined to the opinion that they are but an offshoot of the Gloucester cod.

Another recognized good caused by the Fish Commission while at Gloucester is in regard to the reddening of fish. I was informed by several fish-dealers who have adopted your suggestion to use Trepani salt instead of Cadiz, that not a single instance of reddening has occurred during the past summer. The butts used for pickling the fish exhibited a tendency to turn red only when they had previously been saturated with Cadiz salt.

WASHINGTON, D. C., *November* 12, 1883.

23.—SOME OBSERVATIONS ON THE COD GILL-NET FISHERIES AND ON PRESERVATIVES FOR NETS.

By J. W. COLLINS.

[From a letter to Prof. S. F. Baird.]

In course of a conversation last evening with two young men who have been engaged in the gill-net cod fishery this winter, I gathered the following items of information:

They stated that since the fishery closed in Massachusetts Bay, some time in the early part of the winter, and the vessels had resorted to Ipswich Bay, nearly all the fish caught in the latter locality had been netted on a small area that did not exceed three-fourths of a mile in diameter. This piece of ground, which seems to be swarming with fish while the adjacent bottom appears quite barren, is somewhat irregular in outline, judging by where the fish are caught; but, so far as anything can be told of its physical conformation, does not differ at all from the rest of the sandy slope immediately surrounding it. The fishermen have a theory that there are fresh-water springs in this particular spot around which the cod love to gather, for they can assign no other reason, since there appears to be no more food than elsewhere and no special feature in the bottom to attract the fish. So persistent are the cod in clinging to this locality that it invariably follows that nets set within its limits come up "well fished," while those a dozen or twenty fathoms outside get very few if any cod. The fishermen confess that they are puzzled to know how the fish get there and escape the walls of netting which surround this "spot" in every direction. Not believing it possible that enough cod could be there at once to fill the nets night after night, for months, they arrive at the conclusion that the fish reach the place during the day, when they rise above and swim over the nets that bar their progress, and which they can see by daylight.

It is a common thing on the Grand Bank to find schools of codfish staying for weeks, possibly even months, on a small piece of bottom, the outlines of which, so far as catching fish is concerned, are as sharply defined as one could possibly imagine. In these cases it is generally supposed that this peculiarity which the fish exhibit is due to the fact that the bottom they stick to is better feeding-ground than that which surrounds it. So far as my observation extends, I believe this theory is correct in the main.

But to return to the cod gill-netters. It follows, as a matter of course, that when the fish are found in such a limited area there is much crowding, and it is said that the nets are literally piled on top of each other, crosswise and every way, each vessel's crew that comes along dumping over their gear regardless of everything except to get it on the "spot." The result is that the underneath nets are often sunk flat on the bottom and catch no fish; and it naturally follows that much gear is torn and otherwise injured, while far fewer fish are caught than if some better method was observed in setting the apparatus.

One of the young men above referred to has been using a net that had been treated with Horner and Hyde's preservative, and he says that it shows no signs of decay yet, though it has been in use about two months. He also stated very positively that this net caught *one-third more* fish than those prepared in the ordinary way, and which were always set with it *in the same string*. This is an extraordinary fact, and is one which is substantiated by the testimony of others. The advantages of fishing for cod with gill-nets are fully appreciated by the fishermen, who, among other things, say that "it don't cost anything to try a new piece of ground, for no bait is needed."

GLOUCESTER, MASS., *March* 3, 1884.

24.—NOTES ON THE SCOTCH HERRING FISHERIES.

By T. F. ROBERTSON CARR.

[From a letter to Capt. J. W. Collins.]

Christopher Borthwick, fisherman, Eyemouth, says: One day this season, in the month of August, when hauling in the nets at sunrise in the boat Harriet Miller, we perceived that the herring had "masked" (*i. e.*, meshed). We had hauled 35 nets and had other 15 to haul. In 5 yards' length of net by 7 fathoms deep we got 5½ crans of herring; all the nets before and after this space were blank. The force with which the fish struck the net dragged the boat astern, although it had a "little way on her." The crew were so struck with the novel occurrence that they made a note of the affair and measured the space and fish.

A Coldingham boat fishing with the metallic buoys had so great a catch of herrings as to sink nets, buoys, and everything; the nets were fished up afterwards and the buoys were found to be flattened out like a griddle cake, by the weight of the water on the top of them. The same party states that bladder buoys will stand any weight of water on top of them.

EDINBURGH, SCOTLAND, *September* 26, 1883.

25.—AMERICAN FISH INTRODUCED IN ENGLISH WATERS.

By J. J. MANLEY.

[From Journal of the Society of Arts, November 23, 1883.]

The great lake trout of Switzerland has been successfully introduced into some of our waters, and so has the *Salmo fontinalis*, or American "brook trout." The black bass (*Grystes nigricans*) from the northern districts of America, and that from the southern and western, known by the name of *Grystes salmoides*, have also been found likely to suit our waters. The Marquis of Exeter has been very successful in the acclimatization of some species of black bass at Burleigh House, and it is a fish which would probably thrive well in some of the waters of the East Anglian broads and rivers, as suggested by Mr. S. Wilmot, the Canadian commissioner at South Kensington, on the occasion of a visit some few weeks ago to the Norfolk broads by gentlemen connected with the Fisheries Exhibition. The black bass is a fine sporting fish, and gastronomically to be commended. To these we may add, as suitable to some of our waters, the whitefish (*Coregonus albus*) of America, which is very prolific, and most excellent eating.

LONDON, ENGLAND, *November* 23, 1883.

26.—HABITS OF THE SHAD AND HERRING, AS THEY APPEAR IN THE POTOMAC RIVER TO ONE WHO HAS WATCHED THEM FOR FIFTY YEARS.*

By PEARSON CHAPMAN, Sr.

The Glut shad make their appearance in the river, say at Mathias Point, about the 10th of March, and would increase in numbers until the 1st of April if not disturbed. During or about the last of the month of April they commence depositing their spawn, always, as I believe, on hard gravelly beds, rocks, logs, and even anchors when at the bottom for a few hours. I have never hauled mud up with spawn in it. After spawning each individual returns to salt water.

In the month of May another species of shad, commonly called the May shad, makes its appearance. It is very short, thick, and stout, remarkable for the smallness of its body just before it branches off into a tail, fat and well flavored. This species of shad is nearly extinct, owing to the gill-nets. In the month of June, in addition to the above, we have a very large and stout shad, the flesh remarkably white when split open and soaked in clean water. It looks somewhat as if saturated with milk, but is so soft, mushy, and tasteless that one would hardly want to eat it.

What shad feed on in the Potomac I cannot say. When I reflect on the immense numbers that visited our waters fifty years ago, I almost venture the assertion that they do not eat at all, for there could not have been food enough for half the number. Yet when their stomachs are examined we find a substance not unlike black mud. In the month of September the young fry are in great numbers playing along the shores on their way down. Immense numbers are caught up in gauze seines for bait. They are then about the length of a man's finger, and from that down to the smallest minnow. I am fully persuaded that they come back to where they were spawned, but when I cannot say, though I believe immediately after the third year. I have often seen young shad not more than 9 or 10 inches long caught in a seine. What they were doing among their elders I know not.

The Branch or Blear-eyed herring is so called from its peculiar eye, which looks as if it had been seriously injured a month or so ago and was just healing. Some might doubt whether these can see at all. These make their appearance about the same time the first shad do. They go into the creeks and thence up in the branches (hence the name), and sometimes as far up as they can flutter over the gravels in order to deposit the spawn.

The Hickory jack (Hickory shad or Taylor) go there also, and about the same time and for the same purpose. May not the immense size of

* Read before the Maryland Academy of Sciences December 22, 1875.

the Branch herring, as compared to the Glut herring, and the bad flavor arise from the mixing of the spawn? They taste as much like a Hickory jack as a Glut herring, and from the above facts I strongly suspect a cross. They do not diminish in numbers on account of the war made on the herring by man as other herrings do. May not that arise from the fact that their spawn in the branches is not disturbed by gill-nets and otherwise as is that of the Glut herring in the river?

The Glut herring is but little more than half the size of a full grown Branch herring and is far superior in flavor. It has a small, round, black eye, and never ascends the branches. Fifty years ago we had five distinct gluts or varieties of herring. First, the Branch herring. Second, the common Glut herring, early in April, afterwards later in April, and for the last three years (1875) not at all in April. Third, the Poplar-back, named from the fact that their backs were the color of yellow poplar. There are none to be seen now. Fourth, the Dun-bellies, so called from the fact that their sides have a yellowish appearance as if gold dust had been sprinkled over them and then rubbed in. A few of those remain yet. Fifth, in the latter part of the season, which formerly began the 10th or 15th of May, we were regularly visited with a small, fat, and delicious herring called the "May Flipper," owing to the fact that they jumped and flipped the water higher than any of the rest. That fish no longer appears in gluts. I occasionally see a few with other kinds. I have always thought this due to the young herring coming on a year sooner than they now do, for they were exactly like them.

Our fisheries for the last fifty years have been gradually growing later. Then the shad and herring fisheries commenced about the 15th to the 25th of March and ended about the 1st of May. Now they commence a month later and end about the 25th of May. For the last thirty years there has been a gradual decrease of fish in the Potomac, owing, as I believe, to two causes—first, the immense quantity taken out, principally by the gill-nets; secondly, by the dragging of seines and gill-nets over the bottom, destroying the spawn. A giller will tell you that his net does not reach to the bottom, but a few figures will disprove that assertion. In the first place they have to sink their nets some 15 feet below the surface, letting them down with cords and cork, in order to allow the large coal vessels to pass over without hanging the nets. Then the seines are at least 20 feet deep, and the average depth of the Potomac is about 25 to 30 feet. At Fort Foote, Fort Washington, the White House, and just above Indian Head, the river spreads out very wide, and becomes shallow from Indian Head downwards. It is equally as certain that the lead-line of a seine destroys all the spawn that it comes in contact with. There are now 24 seines in all. Now, let us suppose that they will average 100 acres each, and destroy every spawn deposited thereon. There are 2,400 acres upon which the spawn is entirely destroyed. The estimate is that there are 500 gill-nets, one-half of which are fine. These all drift about five miles up the river and five miles down, dragging on the bottom with from 5 to 10 feet of net all the while, and of course disturbing the spawn all the way. Now which is the most destructive, the seine drifting about a mile and the gill-net five, 24 of the one and 500 of the other, the seine fishing lasting five weeks and the gill-nets three months? The seine catches an immense number of cat-fish, eels, and mullets, which follow the fish to prey on the spawn. The gill-nets only aid them in exterminating the shad and herring. The best evidence of the destructiveness of the gill-net is the fact that in all the rivers to the north of us where they were introduced years ago they have first destroyed the seines and then exterminated the fish.

All our fish have decreased perceptibly within the last half century except the perch. That has held its own. May not that arise, first, from its pluck and courage in battle, and, secondly, from its spawning habits? The male clears out a spot about the size of a barrel-head; he removes everything offensive, and by some means causes the sand to look bright, clear, and as if gold dust had been sprinkled over it. Then he goes off in search of a female, and drives, coaxes, or persuades her to his parlor. Then you can see them going around in a circle, and woe to the fish that comes too near. I think the place selected is always in shallow water, and out of the way of all enemies. It occurs in June after the seines have all stopped.

The flounder has become nearly or quite extinct here. It has no enemy that I know of except the war loon and kindred ducks—the goggler, for instance, which frequently kills itself by attempting to swallow a flounder backwards, for such is his greediness that I have found as many as seven flounders in the throat of one dead goggler, the first one having been swallowed backward or tail first. The goggler is smaller than the war loon, and has a tuft of bristles on the top of its head, and can dive a great ways.

The Virginia or winter shad I never see in our waters or hear of now, thanks to our winter fishermen. I think it is a very indifferent fish, and would not be eaten if we could get a better at that time.

The gar is nearly extinct. I was talking with "a down-river giller" this summer (1875) on the subject, and he informed me that gars were exceedingly troublesome by hanging in their nets, and that they killed the gars by thousands. Formerly they threw them overboard after killing them, but it was soon found that they gave a troublesome hang to their nets, and now they uniformly keep them in their boats until they go ashore. Sometimes their boats get so overloaded that they have to quit their nets and go ashore to get clear of them.

The sturgeon also is becoming very scarce. A man has been fishing for them opposite me all the summer, and three a week is about the measure of his success. Forty or fifty years ago, with such a net as he has, he could have loaded a small boat in three hours. But the greatest decrease of all, as I have said, is in the shad and herring. At the time named above it was not uncommon to take at a single haul fish estimated at from *two to three hundred thousand.* Of course they were not counted, for they were unmanageable. Now from ten to twenty thousand is considered a great haul.

DECEMBER 22, 1875.

27.—EFFORTS IN TROUT-CULTURE.

By B. F. DOWELL.

For nearly two years I have been experimenting in trout-culture a little near Portland, Oreg., and I have great hopes of making the business profitable after a while. I have a large spring within 4 miles of Portland, that offers 54 inches of water under a 6-inch pressure. The water is 49° F. at the springs and 52° in the ponds at the hottest time in August.

I have the Silver and Rainbow trout, and I am mixing them, and I would be glad to get some of the German saiblings.

JACKSONVILLE, OREG., *November* 7, 1883.

28.—NOTES ON THE SCOTCH FISHERIES.

By T. F. ROBERTSON CARR.

[From a letter to Capt. J. W. Collins.]

A 6-foot Greenland shark was caught last week on an Eyemouth line. The species *Heamargus borealis* rarely travels into these latitudes. A gentleman cruising at the mouth of the Tay counted over 90 seals on a bank there. This, also, is an unusual sight. A haddock 30 inches in length, 18 inches girth, and weighing 10 pounds, was landed by a Stonehaven boat. Haddock of this size were, some years ago, plentiful, but are now rarely to be seen. Both trawlers and line fishermen have had heavy catches of cod, ling, haddock, and flat fish. Both as to size and quality, all are agreed that this season's fish are rarely surpassed.*

EDINBURGH, SCOTLAND, *February* 12, 1884.

* The last paragraph is all the more interesting at this time when so much testimony has been given by Scottish fishermen to the Royal Commission to show that trawling is destroying all kinds of fish and breaking up the fisheries.—J. W. C.

Vol. IV, No. 5. Washington, D. C. April 15, 1884.

29.—WHAT FISH CULTURE HAS FIRST TO ACCOMPLISH.*

By CHAS. W. SMILEY.

An impression sometimes prevails that fish culture proposes to immediately fill all our streams with fish, to such an extent that the supply will be practically inexhaustible. In order to show that this is an extravagant expectation, attention is called to the following facts.

Any tract of country needs to be but sparsely populated in order that its inhabitants may soon exhaust it of desirable food-fishes. The native powers of the fish for reproduction and growth are not sufficient to withstand the inroads of man, when added, to any considerable extent, to the natural enemies with which they are surrounded. Very early in the history of the United States, its leading rivers were mostly depopulated of the best fish. A hundred years ago nearly all the streams of New York which emptied into the Great Lakes were visited annually by salmon in such enormous quantities that their numbers seem to us incredible. There are most authentic accounts which point to the water being fairly alive with them in many places, when seeking the upper waters of these streams for the purpose of spawning. It is well know, also, that the Connecticut, Hudson, and Susquehanna Rivers were at that early time visited by vast schools of shad, and the former, at least, by considerable quantities of salmon. Such a population as the Atlantic States contained seventy-five years ago was sufficient to exhaust these rivers of the more valuable food-fishes, and before artificial fish culture was undertaken many streams had remained in this exhausted condition for a considerable length of time.

The first and great task of fish culture, therefore, is not so much to increase the number of edible fishes in any given stream as to withstand the enormous forces which are at work to produce their entire annihilation. As illustrative of this the presence of shad in the Potomac River may be cited. For some years prior to the war of 1861–'65 the shad fisheries of the Potomac had been practically exhausted. They had reached so low a limit that it was very unprofitable to fish the stream, and its barrenness helped to deter men from fishing; but the occupation of the banks of the river by hostile forces for the period of nearly four years made fishing practically impossible and gave nature an opportunity to restore the fisheries. As a consequence, at the close of the war it was found that the river had been restocked to such an extent that the yield for a few years was very large indeed. The presence of large

*A paper read before the Biological Society of Washington D. C., March 8, 1884.

numbers of fish, however, called out the fishermen, and there was a steady decline annually in the yield, and had it not been for artificial propagation there would not be shad enough remaining in the river at present to warrant any fisherman in using a hundred-fathom seine. Fish culture, however, was brought in as a restorative. Each year since 1873 the United States Fish Commission has hatched and deposited from one million to ten million, the numbers increasing annually. The principal result, however, has been to prevent annihilation rather than to cause considerable increase in the fisheries. The number of shad received at the Washington market annually for the past five years was as follows:

1879	311,585
1880	320,799
1881	521,368
1882	350,292
1883	261,474

In spite of the best efforts possible during these years the catch has declined. That for 1883 is smaller than might reasonably have been expected, because the temperature of the river happened to be unusually low during the spawning season, and there is good reason to believe that many fish were diverted to other tributaries of the Chesapeake which would legitimately have come into the Potomac as a fruit of fish-culture on that river.

The fish of our rivers have not only to contend with enemies within the water, such as a great variety of carnivorous fishes, the destruction of their eggs by numerous forms of aquatic animals, the injuries of abnormal temperature and sudden changes thereof, and the damage produced by sawdust, sewage, and other filth introduced into the rivers, but the aggressive character of our citizens has told against the food-fishes in increasing ratio annually. The increase of population produces a corresponding increase in the demand for these fishes, but the numerous facilities which modern inventions have brought to the aid of the fishermen in the way of wholesale appliances for capturing this kind of food, complicate the question exceedingly. If fishing with rude appliances a hundred years ago was sufficient to exhaust a river of shad, what may be said of the ingenious traps and the miles of netting operated by horse-power with which fish are met to-day? To successfully run the gantlet of a series of nets, but a few rods or miles apart, upon a considerable portion of the length of the river, and to elude the fishermen even on a flood tide at midnight, has become practically impossible. Fish culture thus has all the natural disadvantages of a hundred years ago to contend with, and has the accumulated ingenuity of nineteen centuries to circumvent, in order even to maintain a decent supply of food-fishes.

A striking example of the task of fish culture may be found at the

Great Lakes. He would indeed be rash who would call upon the half-developed science of fish culture under existing circumstances to materially increase the supply of food-fishes in the Great Lakes. Its mission is rather to try and keep the supply up to three-fourths, two-thirds, or even one-half of what these lakes formerly yielded. In 1871 there were 281 pound-nets being used in Lake Michigan, and 481 gill-nets. These appliances were sufficient to cause a continual decrease in the number of fish contained in these enormous bodies of water, and, fish culture aside, were sufficient to practically exterminate the fish in forty years. But in 1879 the 281 pound-nets had been replaced by 476 pound-nets and the 450 gill-nets by 24,599 gill-nets. Steam-tugs devoted to fishing, scarcely used in 1871, numbered 30 in that lake in 1879. Furthermore, the larger fish of the lake having been caught, it became necessary to decrease the size of mesh of the nets, and to lengthen the nets. So that, without doubt, there have been for several years nets enough in use on Lake Michigan to reach entirely around the lake. Fish culture aside, and without any additional efficiency in apparatus, it is only a question of some ten years when the whitefish and trout fisheries will be entirely exhausted.

Fish culture is practically a science of the past fifteen years. It has not yet reached a stage of efficiency which can cope with any such state of affairs as present themselves on these great lakes. Even if $5,000,000 and fifty men are placed at the service of the State fish commissioners in the interest of fish culture, what are these in the contest with 50,000,000 of people demanding food, and millions upon millions of capital naturally drawn upon to supply their need. The fruits of fish culture, like bread thrown upon the water, must return after many days. It must wait the coming of the young fish to maturity before results are apparent. The fishermen, however, reap the fruit of their labors on the same day, if at all, and thus know the degree of success they are attaining at any hour. With them it is largely a question of muscle; they put down their nets and haul up their fish. With fish culture it is a serious question of scientific knowledge. It has not professed to yet know many of the needed facts with reference to the embryonic life of fishes, suitable temperatures of water, how to secure proper forms and kinds of food, &c. These are questions which must be solved by careful and continued study; and, while the past ten years have been well spent in this respect, there yet remains an enormous deal to be learned. It is as if all agricultural implements, all knowledge in regard to seeds, soils, climate, and treatment of vegetables were blotted out of existence, and we had in ten or fifteen years to bring the science of agriculture from nothingness up to where it could supply the wants of 50,000,000, while but fifty or a hundred people were engaged in the effort, and all the remainder of the 50,000,000 were arranged practically in hostility to their efforts.

As illustrative of what present apparatus worked by skilled fishermen at the instance of very thickly settled regions will do, I will cite the Farmington River, in Connecticut. Artificial hatching was carried on there for several years previous to 1879. That year it was discontinued. The catch was affected as follows:

Catch of shad:

1881	11,505
1882	3,800
1883	1,155

Bearing in mind that three years are required for shad to mature, the effect will be observable. In 1879 the Connecticut commissioners prophesied just what has occurred there. In 1881 hatching was resumed, and a consequent increase for 1884 is predicted.

The salmon propagation in California affords one of the most remarkable of the successes thus far attained. The salmon canneries of the Sacramento River annually increased in number until, by 1870, the entire run of salmon was being caught and utilized. The greatest natural capacity of the river under these circumstances may be considered to have been reached in 1875, when the yield to the canneries was 5,098,781 pounds. The first possible fruits of fish culture were in 1876, when the young of 1873 may be supposed to have returned. The United States hatchery was established in the latter year at Baird, Shasta County, California, and a half a million young released in 1873, and again in 1874. In 1875 the number was increased to 850,000, in 1876 to 1,500,000, and during each of the years 1877, 1878, 1879, 1880, 1881, 2,000,000 young fry were placed in this river. From an annual catch of 5,000,000 pounds the river has come up to the annual catch of over 9,500,000 pounds, which figure has been maintained during the past four years. The figures were:

	Pounds.
1880	10,837,000
1881	9,600,000
1882	9,605,000
1883	9,586,000

Allowing the three years which it takes for salmon to come to maturity and enter the rivers for spawning purposes, the increase in yield to the canneries for ten years has been almost exactly proportionate to the increase in the deposition of fry. Taking into consideration the cost of hatching 2,000,000 of salmon annually, and the value of the increase of 4,500,000 pounds, it will be seen that there is a very large per cent. of profit in artificial fish culture when conducted under circumstances as favorable as these.

UNITED STATES FISH COMMISSION, *February* 7, 1884.

30.—PISCICULTURE IN ENGLAND.

By J. J. MANLEY, M. A.

[From Journal of the Society of Arts, November 23, 1883.]

Pisciculture, as applied to both salt and fresh water fish, was well illustrated at the recent Fisheries Exhibition; and it is expected that an impetus will be given to its pursuit in this country, which has hitherto been somewhat backward in this matter, except as regards the artificial propagation of the *Salmonidæ* family. The culture and acclimatization of salt-water fish has made little progress among us, and foreign countries have left us far behind. The Romans, in the time of the empire, paid great attention to salt-water fish farming, rich men having extensive and elaborate vivaria for amusement sake and gastronomic pleasure, while others cultivated fish for profit. Arrangements were made for the fish to run into the vivaria from the sea and deposit their ova in them, and spawn was collected in the sea itself and brought into the vivaria to hatch. Exotic fish, also, were brought from long distances. But the artificial propagation of fish does not appear to have been practiced till the fifteenth century, and in this country not till within the last fifty years; and we are still without any recognized establishment or enterprise for the culture of sea fish. The United States Government is thus far ahead of our own, and the shad has been artificially disseminated in many districts, to say nothing of the success in other branches of pisciculture. Other Governments are following the example of the United States; and in England it is hoped that the establishment of a marine biological station, or stations, will lead before long to an extensive system of marine pisciculture and the acclimatization of foreign fish. The recent news from America, that the spat of the oyster has been successfully impregnated by artificial means, will give a further impetus to marine pisciculture.

In the matter of pisciculture in fresh water, other countries, notably France with its famous Huningue establishment, and Germany, are also in advance of us, notwithstanding many admirable private enterprises, such as those at Stormontfield, on the Tay, and of Sir J. Gibson Maitland, at Howietown. But there is no fear now that the culture of salmon and trout and their allies will not make continued progress, and it is already an established and remunerative industry. The culture of other and commoner kinds of fresh-water fish is another matter, and this, too, has, directly and indirectly, had fresh attention called to it by the Fisheries Exhibition; and it is to this branch of pisciculture the following remarks are directed.

The question seems to present three chief heads for consideration; the first, whether pisciculture applied to fresh water could be so carried out in this country as to supply an amount of food which would be a sensible addition to our resources; the second, whether the fish food thus produced would be acceptable to our tastes; the third, whether pisciculture would pay commercially. As to the first point, there can be little doubt but that the supply of fresh-water fish of the ordinary kinds might be immensely increased by proper culture. By ordinary kinds are meant jack, carp, tench, roach, dace, perch, chub, gudgeon, bream, and eels; but the culture of the *Salmonidæ* family is not included, as it forms a distinct branch of this question, and may be considered as an established and remunerative industry. Pisciculture, as applied to the common fresh-water fish of different countries, is a very ancient art. It was successfully practiced by the Greeks and Romans, and probably by the Egyptians before them. It has been a branch of public industry among the Chinese for many centuries, and at the present time fresh-water fish form the cheapest and most plentiful food in that country. This is the case also to a very great extent in Japan, where, by the way, it is said that most fish are preferred in a raw to a cooked state. For many centuries the abbeys and monasteries in this country procured a large supply of fish food from their ponds and stews; and during the church fasts, which were many, and often of long duration, a large proportion of the population lived mainly on a diet of fresh-water fish. The monks, and country gentlemen too, in those days, must have had tolerably good ideas of pisciculture, as the different old books on the formation and management of fish ponds indicate, and it is certain that fish formed a very considerable portion of the food supply of the kingdom. With our improved knowledge of natural history, and especially of the method of expressing the ova from fish and artificially hatching them, whereby the increase of production is extended a thousand-fold, we could, doubtless, raise a very large stock of fish in our ponds and rivers. But considering the great increase in the population, it is more than doubtful whether the supply thus obtained would be any very appreciable addition to our food resources.

But though the supply of "coarse" or common fresh-water fish could be greatly increased, the acceptability of such fish as food to the mass of the population is very uncertain; indeed, the popular verdict seems decidedly against them, with few exceptions. They have all, more or less, a palpably muddy taste, and where this is not predominant they have but little more flavor than stewed blotting paper. Even trout, from many streams that could be named, are either insipid or partake to a great extent of the characteristic flavor of other fresh-water fish. Persons may be found, indeed, who will go into raptures over jack stuffed with the appropriate "pudding," or over carp and tench stewed *secundum artem*. Even roach, dace, barbel, and bream find advocates; but in this matter the *vox populi* is probably right, and it is more often the sauce or the stuffing which gains admirers than the fish themselves. It may be admitted that there is a vast difference in fresh-water fish, and much depends on the way of cooking them. Thames fish have a decided superiority over most others, and the wives of Thames puntsmen and cooks at Thames-side hostelries seem to excel in the art of serving up the fish from their river. The secret chiefly lies in cleaning the fish as soon as possible after they are caught, and thoroughly drying them, when split open, in the sun and wind before cooking. Thames gudgeon, when properly cooked, are by no means bad eating, and are fairly entitled to the name of "fresh-water smelt." Thames perch, also, and jack, are certainly eatable; and a Thames trout is undeniably excellent, but he is a *rarissima avis*. Thames fish are, however, an exception. Those from other rivers are mostly inferior, while it is no exaggeration to say that fish from stagnant water, or from ponds and lakes which have only a slight stream running through them, can hardly be considered as coming within the category of acceptable food. Even enthusiastic anglers can hardly dare to advocate the culinary merits of fish from the Norfolk Broads. As a rule, the poor will not eat fresh-water fish, even when they can get them for nothing, or when *paterfamilias* brings home a basket of "coarse" fish of his own catching, pretends to like them himself, and his family eat them out of compliment to the catcher. When a pond or river is dragged, the owner, as a rule, can hardly find persons to carry away the carp, tench, and other such fish captured. As an instance of this, I once saw large heaps of fine roach, which had been netted out of the trout water round Wilton, lying on the banks and no one caring to come for them, though a general invitation to help themselves had been given to all the country side. There is little or no market for coarse fish in London, except at particular seasons, when the Jews will buy them, following some "tradition of the elders." But this is a poor testimony to their goodness, when we find that barbel is the most favorite fish among the Jews, whereas most Christians would agree that this fish is the most unpalatable one our waters produce.

It may be said that this popular estimate of fresh-water fish is all prejudice. Perhaps it is, to some slight extent. We know how prejudice militates against the use of Australian tinned meat. We know that a true Celt will not taste an eel, or a true Englishman a snail or a French edible frog. It would take many years of "raniculture" to make the latter an acceptable article of food. But it is not all prejudice in the matter of fresh-water fish. With the exception of trout, to which may be added gudgeon and perch from the Thames and some other rivers, and eels, which, like salmon, almost stand apart by themselves in this question, fresh-water fish have either a muddy or unpleasant flavor, or are simply tasteless; add to which, the abundance of large and small bones throughout them renders them still more unacceptable. Again, it might be alleged as a proof of present prejudice, that our forefathers, not only of the lower but the higher classes, ate and appreciated these fish. True, but this was partly because of the cheapness of this poor food, and the scarcity of better, and partly owing to their want of good taste. This is not begging the question. The tastes of a nation travel forwards, so to speak, not backwards, and food which previous generations accepted is refused by those that follow them. This is a fact, however much as in certain respects it may be a subject of regret. Jack and carp can hardly be considered as generous dishes at modern, civic, or regal banquets, as they were of old, though I believe the latter fish is still served at Windsor Castle. But the Virginia water carp do not appear at the royal table till they have spent a considerable time in clear, sharply running water, arranged for the purpose in which they, to some extent, are freed of their muddy flavor. And, after all, this serving of the old Elizabethan stew must be more a matter of form and of keeping up old traditions, than based on any real appreciation it meets with. Of course, scientific pisciculture might improve the quality of our pond and river fish; and proper feeding, due cleansing of the ponds, a proper regulation of the number of fish in any given space, and a cleansing of those about to be used as food in stews of swiftly running water, according to the old custom, might do much to make the fish more palatable; but I cannot imagine that the time will ever recur when the old saying recorded by Izaak Walton, "He that hath bream in his pond hath always a welcome for his guest," will be true either in reference to the poor-eating fish named, or to the other ordinary inhabitants of our waters. We cannot expect by scientific culture to improve their breed as we have that of our flocks and herds. The salmon family and eels seem to be the only products of our fresh waters really worth cultivating from a food-supply point of view, or as ministering to the pleasures of gastronomists.

If pisciculture is destined to supply us with any appreciable increase of palatable fresh-water fish-food, it must be by the introduction of new species from other countries, and their acclimatization in our waters. Several such have been proposed as most suitable, and some have actually been introduced by way of experiment. For instance, the *Silurus glanis*, or "sheat-fish" of Central Europe, is thought by some as a very likely kind to thrive in our waters. It is excellent food, and grows rapidly, and to a great size. It was in reference to the enormous weight which this fish attains that a humorous contemporary suggested that, if naturalized in our rivers, it would show excellent sport when played with a chain cable attached to a crane, which should move on a tramway along the river's bank. The great lake trout of Switzerland has been successfully introduced into some of our waters, as so has the *Salmo fontinalis*, or American "brook trout." The black bass (*Grystes nigricans*) from the northern districts of America, and that from the southern and western, known by the name of *Gristes salmoides*, have also been found likely to suit our waters. The Marquis of Exeter has been very successful in the acclimatization of some species of black bass at Burleigh-house, and it is a fish which would probably thrive well in some of the waters of the East Anglian broads and rivers, as suggested by Mr. Wilmot, the Canadian commissioner to the Fisheries Exhibition at South Kensington, on the occasion of a visit some few weeks ago to the Norfolk broads. The black bass is a fine sporting fish, and gastronomically to be commended. To these we may add, as suitable to some of our waters, the white-fish (*Coregonus albus*) of Canada, which is very prolific, and most excellent eating.

The third point for consideration is—would pisciculture pay? Even if our ordinary fresh-water fish were acceptable to consumers, it is doubtful whether the culture of them would commercially be successful. Under no circumstances could it be expected that they would be able to compete with salt-water fish in cheapness. The cost of cultivation would, probably, be greater than the advocates of pisciculture anticipate. Letting the water off ponds in succession, and cropping them with corn or vegetables, as proposed by the late Mr. Frank Buckland, and after the removal of the soil, would involve great labor and expense. Fish are but slowly growing creatures, unless supplied with abundance of food, and this represents a further outlay. During the summer months, Mr. Buckland suggested that putrefying flesh hung over the ponds would supply maggots, and that lob-worms might be gathered in the meadows after dark. But suitable flesh is not always obtainaable, and for weeks in a drought not a lob-worm will show itself. The latter are often worth from a shilling to half-a-crown a quart for fish, in dry weather, along the Thames side; and are actually imported by thousands from Nottingham, where "vermiculture," or rather worm-gathering, is a recognized industry. The difficulty and expense of feeding the fish in the winter would be still greater. It certainly would not pay to supply them, as Mr. Buckland did his small fry of various kinds at South Kensington, with "chopped beef-steak and biscuits." Whether the quicker growth of foreign fish proposed for naturalization would cover the expenses attached to their culture, is a matter on which it is almost impossible to give an opinion. It would be satisfactory to think that careful calculations as to the whole matter would give good grounds for expecting that any system of pisciculture in fresh water would answer the expectations formed of it by its advocates. At all events they will be benefactors who can make two fish to live where only one lived before, and will, by the introduction of new species, develop the capacities of our now generally ill-stocked waters. As an encouragement to such, it may be noted that in Germany the scientific culture of carp in ponds is found to be remunerative, as in that country, and in some other districts on the continent, this fish is still specially popular as an article of food.

Perhaps the recent establishment of the National Fish-culture Association of Great Britain and Ireland, the honorary secretaries of which are Mr. R. B. Marston and Mr. W. Oldham Chambers, will do much toward the solution of the question. It is certainly one which may fairly be taken up by scientific and philanthropic members of the community; and perhaps many of the general, and especially the angling, public will supply funds for the acquisition of some suitable water or waters for experiments in the way of pisciculture, not so much in the hopes of receiving a pecuniary return, at least for the present, as for the purpose of practically testing the possibility of improving our own fresh-water fish supply by cultivating the species already in our rivers, ponds, and lakes, or naturalizing new ones. Such an attempt would have the sympathy of a considerable public interested in the subject, and could not fail to elicit valuable information. It is hoped that the remarks here made will not be considered as discouraging to such an inquiry. Even apart from the question of fresh-water fish as contributing to our food supply, their multiplication for the sport of the angling fraternity is a matter well worth attention, as the facilities for rational and wholesome recreation are no mean elements towards the well being of a nation, and especially of its poorer classes.

31.—COMPOSITION OF SOME OF THE FOOD-FISHES.

By E. T. KENSINGTON, F. C. S.

[From a book entitled "Composition of foods, waters, minerals, manures, and miscellaneous substances, compiled by E. T. Kensington, F. C. S." London, 1877.]

I.—ROE OF SALMON (p. 24).

Lecithin	7.5
Cholesterin	2.2
Fat	4.5
Albumen	10.3
Nuclein*	48.7
Protamine	28.8

II.—COMPOSITION OF CARP, TROUT, &c. (p. 24).

Constituents.	Carp.	Trout.
Water	80.00	80.5
Muscular fiber	12.00	11.1
Albumen and hœmatoglobulin	5.20	4.4
Alcohol extract	1.00	1.6
Water extract	1.70	0.2
Phosphate of lime, &c	....	2.2

Fish.	Fibrin.	Oil.
Skate	97	8
Haddock	92	8
Herring	92	8
Salmon	78	22
Eels	44	56

*All albuminoid substance rich in phosphorus.

III.—Composition of Whitefish, Salmon, Eels, Oysters, Mussels, Spawn, and Lobsters (p. 302).

Constituents.	Whitefish.	Salmon.	Eels.	Oysters.
Nitrogenous matter	18.1	16.1	9.9	14.016
Fat	2.9	5.5	13.8	1.515
Mineral matters	1.0	1.4	1.3	2.695
Non-nitrogenous matters	....	....	....	1.395
Water	78.0	77.0	75.0	80.385
	100.0	100.0	100.0	100.000

Constituents.	Mussels.	Spawn.	Lobster.	
			Flesh.	Soft.
Nitrogenous matter	11.72	21.892	19.170	12.140
Fat	2.42	8.234	1.170	1.444
Salts	2.73	1.998	1.823	1.749
Non-nitrogenous	7.39	4.893	1.219	.354
Water	75.78	62.983	76.618	84.313
	100.00	100.000	100.000	100.00

32.—A GREAT CARP.

By ALFRED MACKRILL.

[From the Fishing Gazette, February 23, 1884.]

I went on Monday last to Walton-on-Thames, to have a day's fishing with my fisherman, old George Hone. On my arrival he greeted me with, "Well, sir, I have got another big carp to show you, but it is not so big as the one you caught." He opened the well of his punt, and there was a splendid female carp which he had caught in his landing net.

The water rose very rapidly about a fortnight back, and at the end of last week fell very rapidly. On these occasions old George is always on the lookout for stranded fish, so that he may assist them back to their homes.

In the backwater at Walton, in a shallow pool, George saw the carp, and very cleverly put the landing net under the fish, and placed it in the well of his punt for my inspection. We weighed the fish, which was full of spawn, and found it turned the scales at 9½ pounds. After weighing it we returned it to the river again, close to the bough where I took the great carp in 1882, weighing 12½ pounds.

TENBY LODGE, KINGSTON HILL, SURREY.

33.—AMERICAN LAND-LOCKED SALMON AND LAKE TROUT IN FRANCE.

[Extract from Proceedings of the Society of Acclimatization.*]

Prof. Spencer F. Baird announces his intention of making a shipment to the society soon of 15,000 land-locked salmon eggs (*Salmo salar* var. *Sebago*). Mr. Raveret-Wattel recalls in this connection that the land-locked salmon of North America, which is not a migratory fish, and the conditions of whose existence thus resemble those of the trout, would be a very interesting species to acquire for our fresh waters, considering the excellent quality of its flesh and the rapidity of its growth.

The president of the Linnæan Society of the North of France sends a report on the results yielded by the eggs of lake trout and of *Salmo namaycush* sent to that society.

PARIS, FRANCE, *March*, 1883.

34.—NUMBER OF EGGS IN THE GADIDÆ.

By MATTHIAS DUNN.

[From the Zoologist for March, 1884.]

Last week I was fortunate to get hold of two of the *Gadidæ* heavy with roe. The first was *Gadus pollachius*, or the whiting pollack of Couch, of about 12 pounds weight, the roe of which was 15 ounces. On weighing a half grain, and counting them and computing the number, I found it contained 4,200,000 eggs. My next fish was the *Gadus virens*, or the coal-fish of Couch, and 21 pounds weight the roe being 33 ounces. Here I again weighed and counted a half grain, and on working out the result I found it to contain 8,260,000 ova. There was not the least difficulty at getting at these results. After allowing the eggs to remain in boiling water a few minutes they readily separated, and a magnifying glass and needle soon told the story. From these figures I think we may reasonably expect that whiting pollacks of 20 pounds weight may be expected to give about 7,000,000 eggs, and coal-fish of 30 pounds weight full 12,000,000 of eggs.†

MEVAGISSEY, CORNWALL, *January* 22, 1884.

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* Bulletin Mensuel de la Société Nationale d'Acclimatation de France. Mars, 1883. p. 173.

† Some further estimates of the number of eggs in the Gadidæ will be found in Report U. S. F. C. 1878, pp. 733–4. Mr. R. E. Earll there reports a 23½ lb. pollack or coal-fish (*G. virens*) to have contained 4,029,200 eggs; and a 70 lb. cod (*G. macrocephalus* Gunther) to have contained over 9,000,000 eggs.—C. W. S.

35.—THE FISHES OF FLORIDA KEYS.

By DAVID S. JORDAN.

I spent three weeks in active work on the island of Key West, using the seine daily through the forenoon, and availing myself of the important help of the many hook-and-line fishermen for information in regard to the fishes of the deeper waters. My list numbers one hundred and seventy-five species. The great majority of these are forms more or less common in the West Indies, but rare or absent even so far north as Pensacola and Cedar Keys. A few Northern species, as the Sheepshead, occur at Key West, and do not cross the channel to Havana, but the number of such is very small. One remarkable species, the "Hardhead" (*Chriodorus atherinoides* Goode and Bean), is very abundant about Key West, but has never been noticed elsewhere. I have also found about fifteen species of small fishes which seem to be new to science. Most of these will doubtless be found in the West Indies when the seaweed fauna of that region is better known.

All the market fishing at Key West is done with hook and line. The great supply comes from the bottom-fishing, but some kinds, as the King-fish (*Scomberomorus cavalla*), and frequently the Dolphin (*Coryphæna hippurus*), the Barracuda (*Sphyræna picuda*), the Amber-jack (*Seriola lalandi*), the "Albicore" (*Seriola dumérili*), the Jack (*Caranx*), and the "Bonito" (*Euthynnus alliteratus*), are taken in the winter in large numbers by trolling. With these are occasionally found the Spike-fish (*Histiophorus*) and the Wahoo (*Acanthocybium solandri*). From the 1st of December to April is the "King-fish" season, and then that large and handsome Mackerel is brought every day to the market, and is generally preferred to the "bottom-fish."

The "bottom-fish" are those taken with hook and line, at moderate depths, from the vessel while at anchor in the channels. Of these, the most abundant species, doubtless exceeding in quantity all other species combined, is the common Grunt or "Ronco Grande" (*Hæmulon plumieri*). Next to this comes the Red Grouper (*Epinephelus morio*), and then in varying number come the different snappers (*Lutjanus*), groupers (*Epinephelus*), porgies (*Calamus*), and grunts (*Hæmulon*), there being some eight or ten species more or less common in each of these groups.

The common Snappers are the following, arranged in order of abundance: *L. caballerote*, the Gray Snapper or Mangrove Snapper; *L. chrysurus*, the Yellow-tail; *L. synagris*, the Lane Snapper; *L. analis*, the Mutton-fish; *L. caxis*, the Schoolmaster, and *L. jocú*, the Dog Snapper. Of the groupers, besides the Red Grouper (*Epinephelus morio*), we have the Nassau Grouper (*E. striatus*); the Gag (*E. microlepis*); the Black Grouper or Bonaci (*E. bonací*; the Scamp (*E. falcatus*); the Rock-hind (*E. ascensionis*), and the Coney (*Epinephelus guttatus*). The common "Porgies" are the Jolt-head Porgy (*Calamus bajonado*); the Little-head Porgy (*C. pennatula*); the Saucer-eye (*C. calamus*); the Little-mouth Porgy (*C. penna*); and the Shad or Grass Porgy (*C. arctifrons*.)

Among the Grunts, besides the common *Hæmulon plumieri*, we find the Sailors' Choice or *Ronco prieto* (*Hæmulon parræ*); the Yellow Grunt or Ronco Amarillo (*H. scinrus*); the Tom-tate (*H. aurolineatum*), and the French Grunt or Open-Mouth Grunt (*H. flavolineatum*). The little Striped Grunt (*H. tæniatum*), although common enough, is not brought into the market. The Hog-fish (*Lachnolæmus suillus*), the Pork-fish (*Pomadasys virginicus*), the Turbot (*Balistes carolinensis*), the Jack (*Caranx hippos*), the Horse-eye Jack (*Caranx latus*,) and the Runner (*Caranx chrysos*), are also rarely wanting from the market.

Other "bottom-fish" less abundant, but still frequently seen in the markets, are the Pudding Wife (*Platyglossus radiatus*); the Spanish Hogfish (*Bodianus rufus*); the Tangs (*Acanthurus chirurgus tractus* and *cæruleus*); the Black Angel (*Pomacanthus aureus*); the Yellow Angel, (*Holacanthus ciliaris*); the Goat-fishes (*Upeneus balteatus* and *U. maculatus*); the Breams (*Diplodus unimaculatus* and *D. rhomboides*); the Sheepshead (*Diplodus probatocephalus*); the Whiting (*Pomadasys chrysopterus*); the Blue-fish (*Pomatomus saltatrix*); the Old-wife (*Trachynotus glaucus*); the Pompano (*Trachynotus carolinus*); the Pampa or Permit (*T. rhodopus*); the Round Pompano or Palometa (*T. rhomboides*); the Sun-fish (*Caranx crinitus*); the Moon-fish (*Selene vomer*); the Robalo ("Ravallia") or Snooks (*Centropomus undecimalis*); the Sand-fish (*Serranus formosus*); the Cavia (*Elacate canada*); the Spanish Mackerel or Pintadilla (*Scomberomorus regalis* and *S. maculatus*); the Silver fish (*Trichiurus lepturus*); the Hound fish (*Tylosurus crassus*); the Moray (*Sidera moringa*), and the Ten-Pounder (*Elops saurus*).

All these fishes are brought to the market alive in the wells of the smacks. When a bargain is made, the fish is taken out with a scoop-net and killed with a blow on the head, or by an iron spike being driven into the brain. It is then strung on a strip of palmetto leaf and delivered to the purchaser. Fish are very cheap at Key West; three grunts usually sell for a dime, and it takes a fish of considerable size to be worth ten cents. King-fish, worth $1.50 to $2 at the beginning of the run, fall to one-tenth that sum before the end of the season.

In deeper water the larger smacks make a somewhat different catch and, these large fishes are usually taken alive to Havana instead of being sold at Key West. With these vessels the Red Grouper (*Cherna americana*) is the leading fish. Next in importance comes the Red Snapper (*Lutjanus campechianus*), the Black Grouper (*Epinephelus bonaci*), the "Gag" (*Epinephelus microlepis*), the Margate-fish (*Hæmulon gibbosum*), the Rock-fish (*Epinephelus venenosus*), and the Gigantic Jew-fish or Guasa (*Epinephelus itaiara*).

No seining is done at Key West, not a seine being owned on the island. Some fishing with cast-nets is done during the time of the mullet runs, the following species being mainly taken: The Callifaver Mullet (*Mugil albula*); the Blue-back Mullet (*Mugil brasiliensis*); the Fan-tail Mullet (*Mugil liza?*); the Bone-fish (*Albula vulpes*); the Broad Shad (*Gerres cinereus*); the Balao (*Hemirhamphus balao*), and occasionally some Grunts and Gars. Cast-nets are used also for securing bait; the species mostly taken being the "Pilchard" (*Clupea pensacolæ*), and the "Sardines" (*Stolephorus browni* and *Atherina stipes*). King-fish flesh is considered good bait.

Among the fishes frequently taken, but for one reason or another not considered food-fishes, may be mentioned the following: The Swelling-fish (*Tetrodon nephelus*); the Shell-fish (*Ostracium trigonum*); the Cow-fish (*O. tricorne*); the Leather-fish (*Monacanthus hispidus*, and *M. ociliatus*); the Parrot-fishes (*Scarus cœruleus*, *S. guacamaia*, *S. croicensis*, and others); the common Shad (*Gerres gula*); the Slippery Dick (*Platyglossus bivittatus*); the Toad-fishes (*Batrachus tau*, *Scorpæna grandicornis*, *S. stearnsi*, and *S. plumieri*); the Squirrel (*Holocentrum*); the Leather-jacket (*Oligoplites saurus*); the Hard-head (*Chriodorus*); the Gar-fish (*Tylosurus notatus*); the Balaós ("Ballahóo") (*Hemirhamphus balao* and *unifasciatus*); the Green Moray (*Sidera funebris*); the Tarpum (*Megalops atlanticus*); the Miller's Thumb (*Synodus cubanus*); the Catfish (*Arius felis*); and several kinds of Sharks and Rays. Sharks swarm about the wharves, feeding on refuse fishes, every fish which dies in the wells being thrown overboard by the fishermen. Especially abundant are *Carcharias lamia*, *C. brevirostris*, *C. punctatus* (*terræ-novæ*), and *Sphyrna tiburo*.

The names applied to the different species have at Key West a fixity of meaning which is not usual along the American coast. Generally each name used is applied to a single species and to no more, and most of these names have a high antiquity. They are now used for the same species in the Bahamas (whence most of the Key West fishermen have come), and the same names were in use there more than one hundred and fifty years ago at the time of the visit there of Mark Catesby. The Hogfish, the Margate-fish, the Tang, the Shad, the Pilchard, the Bone-fish, the Lane Snapper, the Mutton-fish, the Mangrove Snapper, the Pudding Wife, are still commonly known here by the names given by Catesby, although these names are seldom applied to the same fishes elsewhere along the coast of the United States. From the catalogue of the fishes of the Bermudas, by Professor Goode, it appears that the same general nomenclature of the species is current in the Bermudas. From this, the common origin of the fishermen of the Bahamas, Bermudas, and Florida Keys is naturally to be inferred.

There are but few Cuban fishermen in Key West, but as fully half of the customers at the wharf are Cubans, a Spanish nomenclature is also current. As this agrees fully with that given by Professor Poey, as in use at Havana, I need say little in regard to it, except that it, too, runs back far into the last century, the names given to the plates of Parra being still current. A few names, not given by Professor Poey, may be noticed. The "Scamp" (*Epinephelus falcatus*) is here "Bacalao" instead of "Abadejo," both words meaning codfish. The Sheepshead, not mentioned in Cuban lists, although certainly sometimes sent from here to the Havana market, is "Sargo Raiado." The Red Snapper here, as with the Spanish fishermen on the Texas coast, is "Pargo Colorado." The name, "Sailor's Choice," is one having a singular variety of meanings. Northward along our coast it is sometimes applied to the fish here known as Bream (*Diplodus rhomboides*). At Jacksonville, Fla., the Sailor's Choice is *Pomadasys chrysopterus*, known at Key West as "Whiting," while at Cedar Key the choice of the sailor falls on *Diplodus holbrooki*. In Key West the Sailor's Choice is a kind of Grunt (*Hæmulon parræ*).

KEY WEST, FLA., *December* 20, 1883.

36.—FOOD QUALITIES OF TARPUM (MEGALOPS).

By C. J. KENWORTHY.

[From a letter to Prof. S. F. Baird.]

I would respectfully suggest the propriety of your directing the attention of fishermen and fish dealers to the edible qualities of the Tarpum. As a food-fish it is excelled by but few; and as it exists in great numbers it should be utilized.

JACKSONVILLE, FLA., *December* 25, 1883.

37.—OCCURRENCE OF MULLET IN FRESH WATER.

By WALTER HOXIE.

[From a letter to Prof. S. F. Baird.]

I was hunting on Edding's Island a few days since, and found Mullet in large quantities in a fresh-water pond. This pond was flooded with salt water about three years ago, and the Mullet must have been there ever since; but now it is perfectly fresh, and does not taste in the least brackish. I have never seen this fish living in fresh water before, so I communicate the fact to you, thinking it may be of interest. If they will breed in fresh-water ponds they would, it seems to me, be a valuable fish for stocking purposes.

FROGMORE, BEAUFORT COUNTY, S. C.,
January 18, 1884.

Vol. IV, No. 6. Washington, D. C. April 15, 1884.

38.—INAUGURATION OF THE FROZEN-HERRING TRADE.

By J. W. COLLINS.

The following brief account of the first attempt to establish the frozen-herring trade is given as it was told the writer by Capt. Henry O. Smith, of Gloucester, Mass., who was the pioneer in this business.

The inauguration of the frozen-herring trade was one of those instances of combining the result of accident and enterprise which so frequently influences the welfare of mankind. Captain Smith was engaged in fishing for halibut along the west coast of Newfoundland and elsewhere during the summer of 1853, and learned, while in Port au Port, that in the winter season halibut were generally very abundant at Harbor Le Coue, on the west coast of Newfoundland. He was told by a resident of that place that the halibut followed in after the school-herring, which generally arrived on the coast during December, and that for the remainder of the winter there was always an opportunity for catching as many of these fish as might be required. Accordingly, in the latter part of 1853, Captain Smith, then in command of the schooner Flying Cloud, determined to make a voyage to Newfoundland in pursuit of halibut, with the intention of freezing his fish and bringing them into the markets of the United States.

He started about the 20th of December. On the last of that month he was caught in a terrific northwest gale near the western part of Newfoundland. After lying-to under a close-reefed foresail throughout the gale, the wind finally moderated on the morning of January 1. The weather cleared up and the snow-clad hills of Newfoundland were visible in the distance. Captain Smith judged his vessel to be near the port for which he was bound. As soon as practicable reefed sails were set, and the schooner headed for the land. As she approached the shore, to which the crew were entire strangers, no indication of a harbor could be made out. Knowing the abrupt character of the coast, however, and the general freedom from outlying dangers, Captain Smith stood fearlessly on in his ice-covered vessel, approaching the towering snow-laden mountains. At last an opening was seen, which he thought might be Harbor Le Coue, and into this he sailed, passing the headlands and coves, one after another, until he finally came to the head of the harbor, dropped anchor, and furled his sails. As soon as the vessel was moored she was boarded by residents of the place, who expressed great surprise that he had successfully entered that port under such circumstances. In reply to the inquiries of Captain Smith, the local fishermen stated that halibut, contrary to their usual custom, had failed to strike in during that winter, but reported herring and cod abundant. It is enough to say here, that halibut failed to make their apperance during the winter, and that while the Flying Cloud was in Harbor Le Coue, she was able to procure only 4,600 pounds of these fish.

Captain Smith, finding that there was no hope of obtaining a cargo of frozen halibut, decided to do the next best thing, and to secure as many fresh codfish as he could, freeze and pack them away in the hold. The chances for obtaining a full load of cod were favorable, but the thought occurred to him that he might do well to take home part of a cargo of frozen herring to be used as bait by the George's cod fishermen. He was induced to take this step by an incident which had occurred in his previous experience, of which the following is an account: While in command of the schooner Columbia, in 1846, and engaged in the winter George's cod-fishery, he had taken a good catch of herring in nets on George's bank; and when he started for home he had 450 of them which had not been used. After leaving the bank the weather was extremely cold, and the herring which had been left on deck during night were frozen as "stiff as sticks." It occurred to Captain Smith to save these fish for another trip, and accordingly he packed them away carefully in the hold, so that the frost might be retained in them. On his succeeding cruise he found the bait which he had thus saved was of great service to him; and the consequence was that he obtained a full fare of fish in a much shorter time than the other vessels which were sailing in company. Here, then, was the starting-point, so to speak, of the frozen-herring trade. Captain Smith succeeded in procuring a fare at Harbor Le Coue of 64,000 pounds of frozen cod, 4,600 pounds of frozen halibut, and 80,000 frozen herring. For the herring he paid $1 per barrel, which would be about 20 cents per 100. Arriving in Gloucester, he found the George's fleet about ready to start on their first trip to the bank, and offered his herring for sale to them at $1.50 per 100 in number. Unfortunately a large portion of the George's fleet was frozen in, so that they could not easily get out; but, nevertheless, this was so great an innovation in the fishery that few of the skippers could be found among those ready to sail who would venture to take a supply of frozen herring for bait. Three of the captains, however, decided to make the trial. One of them was Capt. Theodore Parsons, who bought 1,000 herring, half of which he sold to another vessel before sailing; while the third vessel took 500 herring. Finding that there was little probability of selling his herring in Gloucester to the Georgesmen, Captain Smith went to Boston, where he sold them as food at from 75 cents to $1 per 100.* In the mean time the three vessels which had taken bait from him, notwithstanding the small

* Before going to Boston he sold 20,000 of the herring to a stable-keeper, at Gloucester, by the name of Floyd, who took the fish on teams to the east side of Cape Ann, where the most of them were sold for bait to the boat fishermen, the remainder being hauled to Swampscot and sold there for a similar purpose.

amounts, had been very successful, and brought in fares ranging from 80,000 to 90,000 pounds of codfish. As soon as they arrived at Gloucester and reported how much the voyages had been benefited by the use of frozen herring, the owners at once sent an order to Captain Smith, who was in Boston, for 30,000 herring; but at this time all of the fish had been disposed of for food, and consequently the Georgesmen could not obtain them. Nevertheless, the seed had been sown from which the frozen-herring trade has grown to its present proportions, exerting an almost incalculable influence on the fisheries as well as providing the masses with a large amount of cheap and wholesome food.

39.—MINUTE UPON THE DEATH OF OREN M. CHASE, GEORGE W. ARMSTRONG, AND CHARLES H. BROWNELL.

By THE MICHIGAN BOARD OF FISH COMMISSIONERS.

The Michigan State Board of Fish Commissioners directs this minute to be spread upon its records in respectful and affectionate remembrance of a friend, as well as in sincere sorrow for the loss of their most efficient and helpful officer, Oren M. Chase, superintendent of fisheries for the State of Michigan, and in memory of two of his most trusted and respected assistants, George W. Armstrong and Charles H. Brownell, the overseer and assistant of the Petoskey Station.

In the fateful storm which swept over the Great Lakes on the 11th day of November, 1883, which will long be remembered throughout this State by reason of the loss of life occasioned, Oren M. Chase, George W. Armstrong, and Charles H. Brownell, while engaged upon the work of this commission, were drowned in Little Traverse Bay, opposite the village of Petoskey.

No man who knew either of them doubts that they each met death as bravely and quietly as they met the duties and responsibilities of life, nor do we doubt that they made as brave a struggle for life as ever men made when overwhelmed by cruel seas and bitter cold which no mortal strength or skill could overcome or long resist. For each possessed the best things that made life dear and worth a manful struggle to retain, as sterling characters, health, and a hopeful future of honorable usefulness in their chosen work, and, more potent still, homes where their loss can never be repaired.

Oren M. Chase was born at Rochester, in the State of New York, in the year 1840, where he spent his childhood, and at the age of about twenty years removed to Michigan, beginning life as a farmer near Dimondale. By his own efforts he cleared a farm of about 40 acres, upon which he remained for a number of years, and then returned to Rochester to reside. After his returnhe was employed by the New York Central Railroad as baggage-master at Rochester. While connected with the railroad, Mr. Chase became acquainted with the pioneer fish culturist, Mr. Seth Green, who, recognizing his many sterling qualities, induced him to enter the employment of the New York Fish Commission. Mr. Chase took up the duties with that energy and singleness of purpose which were characteristic of the man, and made rapid advancement in the principles and practical detail of the work.

In the summer of 1875, Mr. George H. Jerome, then superintendent of fisheries, applied to Mr. Seth Green for assistance in securing a competent person to undertake Whitefish work at Detroit, expressing at the same time a preference for Mr. Chase. Mr. Green consented, and Mr. Chase came here for the season to inaugurate that work. But little time was required to satisfy the commissioners of Mr. Chase's entire competency, and he was given full charge of the operations, which were so successfully conducted by him that he was permanently employed.

Mr. Chase remained in charge of the Detroit hatchery until September, 1882, when he was appointed State superintendent of fisheries. He entered upon the work at Detriot with the crude apparatus then used, in the face of many discouragements, and achieved most honorable success. To his unfailing energy, consummate skill, and thoughtful, intelligent application to his duties, we owe all that is permanently useful in this department. He has perfected and simplified the apparatus for hatching by his invention of the automatic jar; and by his thoughtful experiments and keen observation rendered safe and comparatively easy the methods of gathering the ova, and thus made it possible for the commission to meet the urgent necessity for operations that can be increased almost without limit.

In addition to the skill and industry that made him a competent overseer of a single work, he had also the business capacity, good judgment, address, and promptness of decision that made him an invaluable superintendent. He was just and considerate to those under him; loyal and most helpful to those under whom he worked. He never spared himself or was afraid of work that promised to avert disaster or give results of value. He was progressive, ready to learn, and never content to rest upon moderate results or partial successes.

But admirable and valuable as Mr. Chase's official and technical work has been, he was more than a good officer in the force, or at the head, he was an honest, courteous, manly man. At this board we shall sorely miss his practical counsel, and his ready sympathy with every suggestion that looked to extended usefulness of the work in which his heart was so earnestly enlisted.

Mr. Brownell had been employed for a number of years at the Pokagon hatchery, where he won the confidence and respect of all by his intelligent devotion to his work, and his manly bearing. Upon the recommendation of the Michigan commission he was appointed superintendent of the Nebraska commission. That post he relinquished on account of a prolonged sickness in the winter of 1883, and upon his recovery this commission was very glad to welcome him back and secure his valuable services.

Mr. Armstrong, while not a regular employé until September, 1883, had yet served for several seasons in gathering whitefish ova. He had gained the reputation of being one of the most skillful and capable among experts. He was also well known for his industrious habits, honorable dealing, and good judgment. When the increased appropriation, granted by the legislature, made possible extended operations by this commission, Mr. Armstrong was the first man engaged.

They were three manly fellows that any commission might well have been proud of, as we were. They were three fast friends, who were always loyal to each other and themselves, their families, and their friends.

And this minute is the saddest that shall ever be made upon these records.

40.—POACHERS OR DESTRUCTIVE VISITORS OF FISH-PONDS.

By JAMES ANNIN, Jr.

[Abstract, by Chas. W. Smiley, of a paper in the Transactions of the American Fish Cultural Association for 1881.]

I. KINGFISHERS.—The notes of this bird are heard from early spring until cold weather, and even before the spring season is opened, as if impatient for it to come. He is never satisfied, being on the lookout from daylight till dark, and is ever ready for the plunge. He can take as many fish as the average sportsman.

The best way to destroy him is by a small, round, steel trap, the kind without the shank or tail piece. Fasten it to the top of a 10 or 15 foot pole, near a fishing ground, where the bird may think it a splendid spot for observations, and he will drop both feet squarely into the trap. Occasionally it will take hawks and owls, but very few robbins or small birds.

II. DUCKS.—The domestic duck is very destructive, not only to fish and fish eggs, but to the food of fish. I have seen the tame duck devour a trout 6 inches long. I have been annoyed by the wild ducks called saw-bills or shell-drakes, and I was not able to exterminate them by shooting. Red flannel flags I found to have the effect of scaring them away.

III. OWLS.—The common hoot or screech owl will cause some trouble. One day I found an owl in a muskrat trap, some 4 inches under water. He was after the fish food of the stream, such as the fresh-water lobster, caddis worm, shrimp, &c. They can be caught in the kingfisher traps.

IV. HERONS.—The blue heron deals death with his long, heavy, sharp bill to everything in the fish line. He poaches mostly in the early morning and after dark, coming into shallow water, even within a rod of the house. He stands in the water perfectly motionless, and as the fishes approach he strikes them. I have sometimes heard a great flopping and disturbance in the water at night time, and upon going to the place in the morning found heron tracks and a trout from half a pound to one pound in weight with a hole in his back or side into which you could put your finger. I suppose this fish to have been too strong for the heron that had mortally wounded it.

To capture them, set steel traps in shallow water, taking careful precaution to secure them, or the heron will fly away with them. When you find him in the trap quiet him with a long club or a charge of shot, lest the savage bird inflict a bad wound upon you.

V. BITTERNS.—These birds are similar to the herons, though smaller, and do some damage. I always shoot them.

VI. MUSKRATS.—This animal feeds upon the caddis worm and other fish food, undermines the banks, and eats off the screen slats. I have seen a peck of empty caddis-worm cases in one pile on the bank at the water's edge, which had been left by the muskrats. These should be trapped in the winter and spring, when their fur will sell readily. I usually sell from $10 to $15 worth in a year.

VII. MINKS.—The mink is the greatest of our enemies. If he gets the notion of coming to your ponds he will annihilate the fish before you know it. He usually enters at the same place. Set your trap just under the water where he may slide into it as he is sliding into the pond. I have seen a mink slide down the bank of a stream under the water and come up with a fish time and again, with scarcely a failure. One mink is good for a hundred dollars' worth of fish in a short time.

VIII. SNAKES.—I have seen a 30-inch water-adder catch a 5 ounce trout, and have found three trout at a time in the stomach of the same variety. A gentleman told me this spring that last summer he was passing near a pond which contained brook trout, and he saw a snake glide down the bank into the water, and as the water was clear he watched it. It went into some moss that was on the bottom of the pond. Entering the moss from below, soon he saw its head appear in the top of the bunch of moss, and then, for the first time, noticed a small trout about 4 inches long that was almost over the snake's head. After slowly drawing its head out a little, it made a dart for the fish and caught him; then the snake came out on the bank. The only method I have found for dealing with them is to kill them whenever they come in your path. In the months of May and June they may be found along the banks of streams or ponds sunning themselves, when a charge of No. 6 or 8 shot will put them on the retired list.

UNITED STATES FISH COMMISSION, *February* 8, 1884.

41.—SUCCESS IN RAISING LAND-LOCKED SALMON.

By Dr. C. H. BARBER.

[From letter to Prof. S. F. Baird.]

I was very successful with the land-locked salmon eggs which I formerly received from you. Some of the fish have now been caught that weigh $6\frac{1}{4}$ pounds, one party taking 23 in a single day.

RUTLAND, VT., *December* 12, 1883.

42.—PLANTING IRISH SHELLS—HELIX ASPERSA MÜLLER—AT WOOD'S HOLL, MASS.

By B. F. KOONS.

[From a letter to Prof. S. F. Baird.]

According to your request, I give you the facts concerning the Irish shells, *Helix aspersa* Müller, planted in connection with our work at Wood's Holl, Mass., August 31, 1883.

About the last of July, as Mr. E. A. Andrews, a former member of the Fish Commission party, returned from Germany, his steamer stopped at Queenstown for the mails, and while waiting there he went ashore and gathered a few shells from walls along the sides of the streets of the city. He said they did not seem to be active at the time but rather dormant, simply sticking to the stones in the walls. He brought seven to Wood's Holl, and gave them to me with a request to plant them at some place about the shores, remarking that the climate of Wood's Holl resembled that of Queenstown very much, and he thought they would do well there.

Wishing to have a witness as to the place, &c., I requested Prof. E. Linton to accompany me, and on August 31, 1883, we took the shells to Bush Island, at the end of Long Neck, and placed them upon a large rock under a small bushy oak tree, the largest upon the island. It stands 12 or 15 feet above the water and about the middle of the crescent-shaped north side.

In Binney's "Land and fresh-water shells of North America," he describes those from Charleston, S. C., as introduced European species. He also states that they have been found at New Orleans, Portland, Me., Nova Scotia, and at at Santa Barbara, Cal. If they have flourished elsewhere upon the continent in widely different climates, we may reasonably expect to establish a colony at Wood's Holl.

MANSFIELD, CONN., *February* 23, 1884.

43.—A CHINESE METHOD OF FISH-CULTURE.

By SMART, GOLDSMITH, AND JOHNSON.

[Extract from The World Displayed; or, A Curious Collection of Voyages and Travels, selected and compiled from the Writers of all Nations: By Smart, Goldsmith, and Johnson. First American Edition, Vol. VI, Philadelphia, 1796.]

We cannot conclude our account of this species of animals and of China in general, without mentioning a singular method by which all kinds of fish are dispersed into different provinces even before they have life. About the month of May the Chinese draw mats across the great river Yang-tse-Kiang in order to stop the spawn, which they know how to distinguish at first sight, though the water is scarce altered by it; with this water mixed with spawn they fill many vessels, which they sell to the merchants, who go thither at that season in great numbers to buy it, and transport it into different provinces. This they sell by measure to those who have fish-ponds belonging to their houses. In a few days the young fry begin to appear in little shoals; but the different kinds of fish cannot be soon distinguished.

44.—SHAD IN OREGON WATERS—A NEW SALMON HATCHERY.

By CHAS. I. FINÉLY.

[From a letter to Prof. S. F. Baird.]

Last fall I caught a lot of shad, or what we took to be shad. They were certainly of the herring family, and had what we call a saw under the belly. I believe a lot of young shad were released in Upper Rouge River. This is the second year only that any of that species has ever been seen here.

Mr. R. D. Hume, who owns the cannery at this place, and for whom I have been foreman the past four years, has built a hatchery for salmon. He had one here before, but run it only one year. This he intends to be permanent. I am running it and have so far, considering the circumstances, been very successful. I only had eight female spawners and the corresponding males, for the hatcheries were hardly ready. I have so far lost a little over 4,000 eggs in four weeks, the principal cause being from diffused light, which I have overcome by battening up the creek. I have splendid water, a ditch 3 miles long, a big reservoir 20 by 20 feet, 6-inch iron pipes, and two big flumes to feed through. Where the screens are in the water it is splendidly clear. I will report further progress.

ELLENSBURG, OREG., *December* 14, 1883.

45.—NOTES ON THE FISHERIES OF GLOUCESTER, MASS.

By S. J. MARTIN.

[From letters to Prof. S. F. Baird.]

MACKEREL.—During the past week there have been 42 arrivals with salt mackerel. They landed 8,000 barrels mostly No. 4 mackerel. They average about 1,500 to the barrel. There were a few large ones. Last week small ones were plenty from Thatcher's Island to Cape Cod. Vessels coming from the eastward report plenty of small mackerel as far as Matinicus. Four vessels from the bay of St. Lawrence brought 1,390 barrels, and reported mackerel plenty October 5 and 6. They caught as many as they could take care of. I think there will be three vessels from Gloucester go down to the Nova Scotia coast after mackerel. The prospect for large mackerel is poor.

The mackerel from the Bay of St. Lawrence were of good quality and sold for $14 a barrel without being culled. Large No. 1 mackerel have sold for $23 a barrel; No. 2 for $14 a barrel; No. 3 for $10 a barrel; and there is no sale for No. 4.

GLOUCESTER, MASS., *October* 14, 1883.

Pollock and cod have been scarce this fall. Forty sail of small craft which were out two days on the pollock grounds, came in with 2,000 pounds. There are no sperling this fall, so that most of the boats will use nets.

GLOUCESTER, MASS., *October* 28, 1883.

MACKEREL.—The mackerel-catchers are all at Provincetown. There are plenty of small mackerel in Barnstable Bay. Vessels make good hauls when there is a chance to get out. The weather has been bad for seining the last fortnight—wind northeast, with thick weather. Small mackerel were seen schooling on Middle Bank last night. We have got 13 sail of mackerel-catchers in the Bay of St. Lawrence, and 15 sail have gone down to Cape Breton Island after mackerel. There were plenty of mackerel schooling off Sydney, C. B., last Tuesday. Some vessels made good hauls. Schooner Edward Webster, Capt. Solomon Jacobs, and schooner Warren I. Crosby, Captain Carroll, went through Canso last Thursday, bound for the Bay of St. Lawrence, after mackerel.

GLOUCESTER, MASS., *October* 28, 1883.

GEORGE'S COD FISHERY.—The vessels that go to George's after codfish have done well. There have been three arrivals this week, with 40,000, 45,000, and 54,000 pounds of codfish, respectively. The time gone was fourteen days. They used squid for bait.

SQUID.—Squid are plenty on George's, on Cashe's, and in the Bay of Fundy. They are plenty on the whole coast from Grand Manan, Bay of Fundy, to Middle Bank. Vessels that have come in from Le Have Bank and Brown's Bank say there are plenty of squid on all the fishing banks of the Nova Scotia shore. A few have been caught off the mouth of the harbor.

HALIBUT FISHERY.—The vessels that go after fresh halibut have done well. There have been three arrivals this week from the southwest part of Grand Banks, with 65,000, 55,000, and 68,000 pounds of fresh halibut, caught in 140 fathoms of water.

GLOUCESTER, MASS., *October* 28, 1883.

MOVEMENTS OF MACKEREL.—When the mackerel came on the coasts of Massachusetts and Maine the large mackerel came first, and passed to the eastward. Then came the small ones, which also passed to the eastward. The latter came up inshore this fall. Boston Bay was full of them all the time during the month of October. The large mackerel were farther off shore. They came across Cashe's. A few of them were caught at Chatham. Some of the vessels which have come in during the last two days saw mackerel on the northeast part of George's. Those mackerel came out of the Bay of St. Lawrence. They come up the Cape shore as far as Cape Sable, then strike across to the northeast part of George's, and work southwest the whole length of the bank; how much farther I don't know. When they went to the eastward they went down the whole length of George's Bank, went across to Cape Sable, and followed down the whole length of the Cape shore. Some of them went through the Straits of Canso. Some of them went down as far as Scatary Island, and then took a westerly course in the Bay of St. Lawrence. Some of the large mackerel went up by the island of Saint Paul and were not seen afterwards. Some vessels which were on the Labrador coast after herring saw large mackerel there. According to the last reports from the Nova Scotia shore there are plenty of mackerel there working westward.

GLOUCESTER, MASS., *October* 31, 1883.

MONTHLY SUMMARY.—The amount of fish landed at Gloucester during the month of October was as follows: Shore mackerel 24,091 barrels; mackeral from the Bay of St. Lawrence, 4,343 barrels; herring, 5,335 barrels; cod from George's Bank, 956,000 pounds; halibut from George's Bank, 11,900 pounds; cod from Western Bank, 1,403,000 pounds; halibut from Western Bank, 9,400 pounds; cod from Grand Banks, 2,133,000 pounds; salt halibut from Grand Bank 13,400 pounds; fresh halibut, 696,000 pounds; Greenland halibut, 90,000 pounds; pollock, 588,000 pounds; hake, 36,000 pounds; cusk, 22,000 pounds; haddock, 23,000 pounds; fresh cod, 12,500 pounds; mixed dried fish by freight from Maine, 10,550 quintals; pogy slivers, 170 barrels; cod oil sold here, 95 barrels; cod imported from Nova Scotia, 700 quintals.

GLOUCESTER, MASS., *November* 4, 1883.

MACKEREL FISHERY.—The shore mackerel fleet all hauled up. There has been a large falling off in the catch of mackerel from last year. There have been 218,000 barrels taken this year against 378,000 barrels last year. There are 13,000 barrels on the wharf to-day; last year at this time there were 45,000 barrels. There are fifteen sail of vessels on the Cape shore after mackerel. A dispatch came last night from the schooner Charles C. Warren stating that they caught 270 barrels of large mackerel last week in Margaret's Bay, 35 miles to the westward of Halifax; also one from schooner Warren J. Crosby stating that she caught 300 barrels of large mackerel last week at Sydney. There is no news from the rest of the fleet. They are catching mackerel in nets all along the Nova Scotia shore.

GLOUCESTER, MASS., *November* 11, 1883.

A REMARKABLE HAUL OF MENHADEN.—A dispatch to the Boston Herald under date of November 9, 1883, says:

"The menhaden steamers George Curtis and Vista of the George W. Miles Company brought in over 1,000,000 fish last night. Value, $5,000. This news is enough to fire the heart of every menhaden fisherman with joy. It is a most remarkably large haul, particularly for this time of the year. The fish now are fat and unusually fertile in desirable material."

GLOUCESTER, MASS., *November* 11, 1883.

VESSEL STATISTICS FOR 1883.—The following are the numbers of vessels and of men engaged in different branches of the Gloucester fisheries during the year 1883:

Mackerel fishery, 122 vessels, manned by 1,708 men.

Grand and Western Banks fishery, 111 vessels, manned by 1,333 men.

George's Bank cod fishery, 75 vessels, manned by 825 men.

Fresh halibut fishery, 22 vessels, manned by 318 men.

Shore fisheries, 56 vessels, manned by 448 men.

Greenland halibut fishery, 5 vessels, manned by 70 men.

There are, in addition, 25 small boats, with one man to a boat.

GLOUCESTER, MASS., *November* 11, 1883.

GALE ON GEORGE'S BANK.—They have had a hard time on George's. November 12 and 13 it blew a hurricane. Vessels arrived to-day with decks swept, sails torn, bulwarks gone, and cables and anchors lost. I think the worst is to come. Some of the haddock vessels arrived with the loss of dories and other damage.

MACKEREL FISHERY.—Two vessels arrived last night from the Bay of St. Lawrence; schooner Fannie Belle, with 425 barrels of salt mackerel; and schooner S. R. Lane, with 200 barrels of salt mackerel. There are five more to come from the Bay of St. Lawrence, and there are eight still on the Cape shore.

GLOUCESTER, MASS., *November* 18, 1883.

MACKEREL.—Four vessels from the Bay of St. Lawrence brought 1,180 barrels of salt mackerel. On the 9th of November the schooner Charles C. Warren caught 250 barrels of mackerel at one haul of the seine in Margaret's Bay, Nova Scotia. There are three more vessels coming from the Bay of St. Lawrence with 300 barrels of mackerel each. That will end the mackerel fishing for this year.

GALE.—Fears are entertained for the safety of four haddock catchers which were on George's Bank in the gale of November 12–13. Haddock are plenty on George's Bank, but there has been no sale for them for the last three days. There are five vessels here with haddock to sell to the slitters at three-quarters of a cent a pound.

GLOUCESTER, MASS., *November* 25, 1883.

SUMMARY.—I send you the amount of fish landed at Gloucester during the month of November. Shore mackerel, 6,572 barrels; mackerel from the Bay of St. Lawrence 3,787 barrels; mackerel caught on the Nova Scotian shore, 551 barrels; George's cod, 1,168,000 pounds; George's halibut, 34,400 pounds; Western Bank codfish, 211,000 pounds; Western Bank halibut, 7,900 pounds. Fish caught in cod gill-nets, 1,330,000 pounds codfish, 174,000 pounds pollock. Haddock caught on George's landed at Gloucester 495,000 pounds; shorefish, 21,300 pounds; hake and cusk, 3,000 pounds; haddock, 4,000 pounds; codfish, 18,000 pounds; pollock, 49,000 pounds. Codfish caught in Bay of Fundy, 51,000 pounds.

Fish on freight from Maine, 5,450 quintals hake, 500 quintals codfish, 40 barrels of herring. Fish imported from Nova Scotia, 667 quintals codfish, 10 barrels of mackerel. Fish caught in cod gill-nets landed at Rockport and Portsmouth during the month of November, 183,000 pounds.

GLOUCESTER, MASS., *December* 3, 1883.

COD AND HALIBUT.—The vessels from George's Bank all brought in good fares of cod. They found plenty of squid on the bank all the fall and until last week, when the squid disappeared. None of the halibut fishers returned last week and the price of halibut was high. All that the George's vessels brought in sold at 20 cents a pound.

GLOUCESTER, MASS., *December* 16, 1883.

MONTHLY SUMMARY.—I send you the amount of fish landed at Gloucester during the month of December. George's codfish, 610,000 pounds; George's halibut, 22,000 pounds; fish caught in the cod gill-nets, 1,120,000 pounds; fresh halibut, 230,000 pounds; mackerel, 140 barrels; haddock, 230,000 pounds; cusk, 15,000 pounds; pollock, 3,000 pounds. Fish imported form Nova Scotia: 472 quintals of cod, 100 quintals of pollock, 50 quintals of hake, 22 barrels of oil, 600 quintals of hake on freight from Maine. Smoked herring from Eastport, 5,000 boxes; frozen herring from Grand Manan, 300 barrels. Fish caught in cod gill-nets landed at other ports during the month of December 300,000 pounds.

GLOUCESTER, MASS, *January* 1, 1884.

HERRING.—There were three arrivals from Grand Manan with frozen herring. Herring are selling at $1.50 per hundred.

There have been three arrivals from the banks with 20,000 pounds of fresh halibut the last three days. They sold for 2 cents a pound by the cargo. The George's vessels find fish scarce. Five vessels are bound home from Newfoundland with a full supply of frozen herring.

VESSELS.—Gloucester will have 50 sail on George's after codfish. There will be 5 vessels more engaged in fresh-halibut fishing this year than there were last year. Four new ones will be added to the fleet which goes south after mackerel.

GLOUCESTER, MASS., *January* 15, 1884.

HERRING.—Four cargoes of frozen herring arrived this week from Grand Manan. The herring are very plenty at Fortune Bay. The whole fleet of 32 vessels is coming home with full cargoes.

HALIBUT.—There have three vessels arrived from the banks this week with 90 pounds of fresh halibut, which sold at 8 cents a pound by the cargo.

GLOUCESTER, MASS., *January* 20, 1884.

MONTHLY SUMMARY.—The amount of fish landed at Gloucester during the month of January, 1884, was as follows: Salt cod, brought from George's Bank (48 arrivals), 817,000 pounds; fresh halibut from George's Bank, 150,300 pounds; shore fisheries with cod gill-nets, 843,000 pounds; fresh halibut from Banks, 177,700 pounds; herring from Grand Manan, 2,620,000 by count; herring from Newfoundland, 3,714,000 by count; salt herring from Newfoundland, 420 barrels; haddock from George's Bank, 93,000 pounds; salt mackerel from Canso, Nova Scotia, 500 barrels.

GLOUCESTER, MASS., *February* 1, 1884.

HALIBUT.—The vessels fishing on the eastern part of the George's Bank are doing well. They catch from 3,000 to 6,000 pounds of halibut on a trip. The halibut bring a good price. The average result of a trip to George's Bank is 18,000 pounds of cod and 3,000 pounds of halibut.

HERRING.—From St. John to Eastport in the Bay of Fundy, herring are plentiful. The inhabitants of Newfoundland say they have never seen this fish so abundant. The thirty-six sail of vessels at Newfoundland are coming home with full cargoes of frozen herring, each of which averages 650 barrels. Twenty-eight cargoes of frozen herring brought from Grand Manan average 350 barrels each. Fifteen vessels more are at Grand Manan loading. Herring sell at 75 cents per hundred here.

The catchers find plenty of haddock on the George's Banks. They caught 40,000 pounds in one day last week. Halibut are scarce.

GLOUCESTER, MASS., *February* 3, 1884.

SUMMARY.—During the past week the amount of fish landed here has been as follows: Fourteen arrivals from the Banks, with 290,000 pounds of fresh halibut; nine arrivals from George's Bank, landing 140,000 pounds of salt fish and 45,000 pounds of halibut; 305,000 pounds of codfish brought in by the vessels using cod gill-nets; six arrivals from Newfoundland with 2,930,000 frozen herring; one arrival from Grand Manan with 250,000 frozen herring. There were 75,000 pounds of haddock landed last week; 400 barrels of salt herring were brought in from Newfoundland. The weather is bad for frozen herring. The wind has been to the eastward for the last eighteen days, with fog and rain. Some of the vessels will lose one-quarter of their cargo by wet weather.

HADDOCK.—Haddock are very plenty on George's and full of spawn. The haddock catchers in five days made trips averaging 50,000 pounds to a vessel. The netters are doing well; they land the most of their fish at Portsmouth and Rockport.

PRICES.—All kinds of fish were low. Haddock sold for 1 cent a pound, halibut for 6 cents, fresh cod for 2½ cents, and frozen herring for 60 cents a hundred.

GLOUCESTER, MASS., *February* 18, 1884.

WEEKLY SUMMARY.—During last week there were 15 arrivals from George's Bank, landing 379,000 pound of salt cod and 34,500 pounds of fresh halibut. Vessels using cod gill-nets landed 340,000 pounds of large cod at Rockport and Portsmouth. There were 2 arrivals from the Grand Banks with 70,000 pounds of fresh halibut. There was one arrival from the Western Banks with 4,000 pounds of salt cod, and 16,000 pounds of fresh halibut. There was one arrival from Newfoundland with 375,000 frozen herring; also one arrival from Grand Manan with 220,000 frozen herring. Schooner David A. Story made a trip to Newfoundland in twenty-one days, the quickest time on record. Nine vessels are due from Grand Manan with frozen herring. Some of the vessels using cod gill-nets have hauled up for the winter, three of them having used up their nets. Haddock are reported very plenty on the western part of George's Bank. There has been so much haddock in the Boston market that it sold for 1 cent a pound all last week.

GLOUCESTER, MASS., *February* 24, 1884.

MONTHLY SUMMARY.—The summary of fish landed in Gloucester during the month of February is as follows: Fifty-two arrivals from George's Bank aggregated 1,131,000 pounds of codfish and 169,000 pounds of fresh halibut. There were four arrivals from the Western Bank aggregating 75,000 pounds of salt cod and 54,000 pounds of fresh halibut. There were 183,000 pounds of cod taken by the gill-nets in

Ipswich Bay. These were eighteen arrivals from Grand Banks with 471,000 pounds of fresh halibut. There were also nine arrivals from Newfoundland bringing 3,615,000 frozen herring and 400 barrels of salt herring. There were two arrivals from Grand Manan with 570,000 frozen herring and one arrival from Halifax with 120,000 frozen herring. There were two arrivals from George's Bank with 110,000 pounds of haddock.

VESSELS.—There were 48 boats engaged in the cod gill-net fishery, most of which landed their catch at Portsmouth and Rockport. The gill-net fishing will continue in Ipswich Bay during this month. The cod caught on George's Bank are small and come from the western end of the Bank. They are full of spawn.

PRICE.—The price of fresh fish this week has been high. Fresh cod sold for 4 cents a pound, fresh haddock for 3 cents a pound, and fresh halibut sold for 21 cents a pound. The price of salt fish remains the same as last week. Frozen herring sold at 60 cents per hundred.

GLOUCESTER, MASS., *March* 3, 1884.

VESSELS.—During the coming week there will be about 20 vessels starting south after mackerel and 15 of the Grand Bank fleet will start this week. Last week 45 vessels arrived from George's Bank with good fares. There was a heavy gale there February 28 and 29. The wind blew a hurricane from the northwest. All the vessels that have arrived are more or less damaged, and fears are entertained for the safety of the rest.

Last week there were 3 arrivals with frozen herring from Grand Manan. Six more are on the way, which will close the herring business for this winter.

The cod gill-netters have not done much this week on account of the rough weather.

The vessels fishing on George's Bank caught their fish on the western edge in 28 and 30 fathoms of water; some of them had to cut their cables to avoid collision. Some had their decks swept of bulwarks, dories, and all. Two men were washed overboard. Haddock are plenty on the western edge of George's Bank. Four vessels arrived in Boston with 75,000 pounds each, which sold at 2¾ cents a pound, and was the result of two days' fishing.

GLOUCESTER, MASS., *March* 11, 1884.

COD.—During the past forty-eight hours 13 vessels have arrived from George's Bank with an average of 30,000 pounds of cod to a vessel. These were caught on the western edge in water from 20 to 30 fathoms deep. The fish weigh about 12 pounds each. Two vessels from George's brought 60,000 pounds each while 2 vessels from Western Bank report no fish.

The mackerelers are getting ready to go south; 2 sailed last Saturday and 6 to-day. By this week Saturday 25 vessels will have gone south. Haddock continue plenty on George's Bank. There are 25 cargoes i-

Boston averaging 45,000 pounds to a vessel. The price is low, only 1 cent a pound to-day.

GLOUCESTER, MASS., *March* 17, 1884.

COD.—The vessels from George's Bank brought in good fares last week, aggregating 1,142,000 pounds. Most of these fish were caught in shoal water from 15 to 18 fathoms deep. The fish are of medium size, and full of spawn. Vessels that went to the Western Bank report the water very rough and fish scarce.

PRICES.—There were no fresh halibut landed last week. The price was 20 cents a pound. On Thursday fresh halibut sold for 22½ cents per pound. The codfish from gill-nets sold for 1½ cents per pound, and haddock for three-fourths of a cent per pound.

SOUTHERN MACKEREL.—During the week 35 mackerel-catchers sailed for the south, and 10 more will sail next week. There will be 75 vessels in this fishery this spring. Two more vessels have been lost on George's Bank, one fishing for haddock and one for cod. The loss occurred in the gale of February 28–29. The George's vessels find some squid in the stomach of the cod, and also small mackerel 7 inches in length.

GLOUCESTER, MASS., *March* 23, 1884.

SUMMARY.—During the past week there have been 25 arrivals from George's with good fares. There has been no fresh halibut landed for 14 days, though some of the vessels have been gone 7 weeks.

HERRING.—There have been 6 arrivals from Western Bank mostly with slim fares. There has also been 5 arrivals from Grand Manan with frozen herring, the last being the schooner Margie Smith, which arrived March 27. That closed the frozen-herring trade.

There are now 54 vessels in the south after mackerel. Last night we had a hurricane which drove some vessels ashore. The snow in some places is a foot deep, and the thermometer went down to 30° F.

GLOUCESTER, MASS., *March* 30, 1884.

MONTHLY SUMMARY.—The total amount of fish landed at Gloucester during the month of March was as follows: Codfish from George's Bank, 3,468,000 pounds; halibut from George's Bank, 69,370 pounds; cod from Western Bank, 286,000 pounds; halibut from the Western Bank, 48,900 pounds; fresh halibut from the Banks, 70,000 pounds; haddock from George's Bank, sold to be split on the wharf, 365,000 pounds; frozen herring from Grand Manan, 2,263,000 by count. There was also received by freight from Maine 600 quintals of dried mixed fish. The schooner Reaper also brought from Maine 1,600 boxes of smoked herring. The cod gill-nets have taken in March 1,137,000 pounds of cod. The boats, 18 in number, engaged in this fishery are doing well. Those that have used up their nets are fitting out for the spring fishing. There will probably be good fishing in Ipswich Bay all this month.

GLOUCESTER, MASS., *April* 3, 1884.

Vol. IV, No. 7. Washington, D. C. April 17, 1884.

46.—REPORT ON THE CONDITION OF OYSTER-CULTURE IN FRANCE IN 1881.

By DR. P. BROCCHI.

The following explanatory remarks were prefaced to the copy of Dr. Brocchi's report printed in the *Journal Officiel:* *

"In response to a request long since made by the oyster-culturists of the Bretagne region, and to the wish expressed by the senatorial commission on the replenishing of the waters, the minister of agriculture and commerce, following out a decision dated the 30th of June last, has established a course in oyster and fish culture, in the laboratory founded by Coste at Concarneau (Finistère). This course, which was intrusted to M. Brocchi, lecturer on zoology at the National Institute of Theoretic Agriculture (*Institute National Agronomique*), began September 5, and has continued a month.

"Independently of the oral instruction, M. Brocchi is charged with the making of researches throwing light upon the important questions treated of in his course. He now addresses to the minister of agriculture and commerce his first report upon his observations regarding the present state of oyster-culture."

The preparation of the course of lectures on oyster-culture has led me to visit the principal oyster-cultural centers of France. It seems highly proper to render an account of what it has been given me to observe during this exploration and to present the actual state of oyster-culture in our country.

ORIGIN OF OYSTER-CULTURE IN FRANCE.

This industry, so new and so essentially French, has made rapid progress. It is not here necessary to give the history of oyster-culture. Its origin, however, is of recent date. Indeed, it was only after the publications and the efforts of M. Coste (1856–1858) that the attention of the inhabitants of our coasts was drawn to the possibility of raising oysters artificially. These experiments, to which the state had dedicated considerable sums, led to many others. M. Coste, with an enthusiasm which was perhaps excessive, but which, after all, produced happy results, then declared that this industry would become a new source of wealth to France. The attempts made simultaneously in the ocean and in the Mediterranean for the most part failed. However, and it has been too much forgotten, the experiment tried in Arcachon Bay was crowned with success. From that time the start was given and the oyster-cultural industry made rapid progress.

*Journal Officiel de la République Française, Novembre 8, 1881, pp. 6181–6186.

BRANCHES OF OYSTER-CULTURE.

Oyster-culture comprehends two very distinct branches; on the one hand, production; on the other, raising and fattening.

The production is the gathering of the embryos of the oysters, and the saving thus of a great number, the loss of which would be inevitable without the intervention of man.

Every one knows that at the time when it is born the young oyster is furnished with locomotive apparatus by which it is enabled to swim in the bosom of the sea. After having wandered a certain time the animal fixes itself on some extraneous body, loses forever its organs of locomotion, and becomes the mollusk well-known to all. But these embryos cannot fix themselves indifferently upon any substance which comes within their reach. It is necessary for the latter to be sufficiently smooth and clean. So it happens, in the natural condition of things, that a great quantity of these little beings, this *naissain*,* find no objects to which they can adhere, fall on the bottom of the sea, and soon perish. At last, those which have been able to fix themselves under favorable conditions find themselves exposed for a long time to many dangers. It is to obviate these perils that oyster-culturists place in the vicinity of natural beds various objects, designated under the name of collectors, destined to gather and preserve the spat. When the latter has attained a sufficient development, it is detached and delivered to the raiser.

The raising consists in supplying to the spat the conditions best calculated to promote its rapid growth, and, at the same time, sheltering it as much as possible from the attacks of its natural enemies.

Next, they proceed to the fattening; that is to say, they exert themselves to give to the animal that physical condition which makes it sought after by the epicures.

CENTERS OF PRODUCTION.—It remains for me to consider successively the most important centers of production and raising. The two points in France where production is carried on upon a large scale are, first, Arcachon; second, the Morbihan.

ARCACHON BAY.

In 1853 the oyster-cultural industry did not exist in Arcachon Bay. At that period, in fact, one of our most distinguished pisciculturists, M. Chabot Karlen, published a report on this part of France, in which one may read that the production of oysters was then absolutely neg-

* The term *naissain* applied to oysters during all the earlier stages of their existence is of frequent occurrence in French oyster-cultural literature, and is used many times in the course of the present article. When the mollusks are referred to in their pelagic or free condition *naissain* will be found to have been translated "fry" or "spawn," while in those instances in which they are spoken of after fixation, the word has been uniformly rendered into "spat," familiar words in the American oyster-dialect, and less ambiguous than any others.—TRANSLATOR.

lected in the bay. It is just to add that M. Chabot foresaw then the possibility of raising oysters upon the tide-flats.*

Oysters had once existed in a natural state in Arcachon Bay, but there, as everywhere, ignorance and improvidence had produced sad results. The natural beds were choked up with mud, and the oysters were disappearing rapidly. It was under these circumstances that, in 1860, M. Coste resolved to establish in this region some model parks. Three places in the bay were chosen, and in all the success was complete. As a result, one of the new parks, that of Lahillon, with an area of four hectares (9.88 acres), furnished, in 1866, more than 5,000,000 oysters. Now, at the time when the work commenced at that point there was nothing there but mud. After having cleaned the earth they placed there 400,000 oysters (1865), and, as I have just said, in the following year the product surpassed 5,000,000. Such examples were well calculated to impress the coast population. Applications for concessions immediately became numerous, and, as I will shortly show, are continually increasing in numbers. Some years later the Government, finding its example no longer necessary, conceded its model parks to the *Société central des naufragés*, only reserving a certain extent of oyster-beds which serve to supply the environing concessions with spawn. The reserved beds occupy an area of 200 hectares. No fishing is allowed in them except about once in three years, and after a committee, in which the fishermen and the owners of parks are both represented, has given its consent. The maritime administration is very careful of this reserve. Every year 240 cubic meters of little shells are thrown on the surface of the parks, and so form natural collectors. At the time it was last fished (1879) the reserve furnished 25,000,000 oysters, representing a value of about 250,000 francs [$50,000]. In the month of April, 1881, when I was able to visit it, the beds were covered with beautiful oysters, and appeared to me in excellent condition.

The collectors employed at Arcachon consist almost exclusively of tiles, previously limed, and arranged in hives. Ten million tiles are put out each year. The most favorable season for placing the collectors seems to be, in this region, from the 12th to the 15th of June. The hives remain in place until the month of October; some oyster-culturists, however, allow the collectors to remain the whole winter in the basin. The latter is a dangerous practice, the spat being liable in that case to be destroyed by the frosts. However that may be, the young oysters are placed either in claires or in nursing-boxes. The claires of Arcachon have been so often described† that it does not seem to me

* In the original the author quotes the words of M. Chabot, "*dans la grande eau sur les Crassats*"; *crassats* being a local term for certain portions of the Arcachon Bay, which are laid bare at each tide. These *crassats*, upon which numerous parcs are now located, are separated from each other by channels formed by the currents which cross the bay in every direction.—TRANSLATOR.

† See Report of Commissioner for 1880, pp. 939, and *post*, pp. 957.

necessary to return to them here. I will, however, recall the fact that their depth varies, according as they are designed to receive the spat already detached or the tiles yet charged with young oysters. Indeed, a certain number of park owners leave the spat to develop for quite a while on the tiles themselves. The use of nursing-boxes [*caisses*] is general at Arcachon; but, as they are very expensive, some oyster-culturists have been obliged, in the interests of economy, to dispense with them. In return, some establishments possess a considerable number of them. Thus, in the month of April last, 4,000 boxes might be seen in a single park.

It does not seem to me, however, Mr. Minister, that this is the place to enter into the details of the industry. I desire only to put before you the proof of the importance of oyster-culture in this part of France. The following figures, which I owe to the courtesy of M. Lhopital, naval commissary, have an interest, from this point of view, of the first order:

Statistics of the oyster-cultural industry in Arcachon Bay.

Years.	Number of parks.		Number of oysters exported.	Value.	Mean prices per thousand.
	Conceded.	Existing.			
				Francs.	*Francs.*
1865	297	297	10, 584, 550	338, 705	40
1866	4	301	7, 052, 000	282, 070	40
1867	39	340	4, 921, 210	191, 175	16
1868	94	434	8, 599, 675	319, 186	37
1869	30	464	10, 145, 687	419. 784	45
1870	21	485	6, 541, 140	352, 666	58
1871	276	761	4, 897, 500	268, 332	55
1872	371	1, 132	10, 796, 740	537, 515	50
1873	106	1, 238	25, 711, 750	1, 159, 397	41
1874	1, 175	2, 413	42, 542. 650	1, 745, 050	45
1875	626	3, 039	112, 715, 233	2, 817, 630	25
1876	306	3, 345	196, 885, 450	3, 941, 309	20
1877	301	3, 646	202, 392, 225	4, 456, 288	22
1878	285	3, 931	176. 500, 225	4, 426, 500	25
1879	184	4, 115	160, 197, 275	3, 944, 249	25
1880	144	4, 259	195, 477, 357	4, 254, 466	25

It may be seen by an examination of the figures, *first*, that the number of parcs, which in 1865 was only 297, was 4,259 in 1880; *second*, that, during the same period, the number of oysters exported has risen from 10,584,000 to 195,477,375, representing a value of 4,254,465 francs; *third*, that the total number of oysters exported from 1870 to 1880 has exceeded 1,000,000,000, and it must be noted that no oysters can be sold outside of the country until they have obtained a minimum diameter of five centimeters.

THE PORTUGUESE OYSTER IN ARCACHON BAY.

It can also be seen that the mean price per thousand has very much diminished of late years. This results from the great quantity of Portuguese oysters which have been introduced. And, in this connection, Mr. Minister, I cannot pass in silence the excitement which was felt in the oyster-cultural world following the introduction in our waters of the

Portuguese mollusk. Some distinguished oyster-culturists have, in fact, held that the Portuguese oyster is liable to cross with the *Ostrea edulis*, thus impairing the purity and diminishing the value of our indigenous oyster. These persons even announced that they had observed unequivocal traces of this hybridization in the oysters coming from Arcachon. This statement caused so much interest among the oyster-culturists of Arcachon that one of the fishing inspectors in England urged his countrymen to buy no more oysters coming from the Arcachon Bay.

Allow me, Mr. Minister, to lay before you the result of my observations on this point. The mollusk known under the name of the Portuguese oyster does not belong to the same genus as our indigenous oyster. While the latter ranks among the mullusks belonging to the genus *Ostrea*, the Portuguese oyster takes place among those which compose the genus *Gryphée*, the species called *Gryphée anguleuse* (*Gryphæa angulata*, Lamarck). In other words, the Portuguese oyster is not an oyster from a zoological point of view. To give any basis for the theory of hybridization between the two mollusks, it would be first necessary to prove that the zoologists have made a mistake in creating these two genera, and that Lamarck was wrong in separating the gryphæas from the oysters properly so called. Really, in the present state of science, it is impossible to admit the crossing of two species belonging to different genera. On the contrary, all that we know is opposed to the possibility of such a hybridization. So that, I repeat, until it is demonstrated that the genera *Gryphæa* should be struck out from our classifications, the fact of cross-breeding between the mollusk of the Tagus and our edible oyster cannot be admitted. Even admitting the generic identity of the two mollusks, the characters appealed to by those who believe in their hybridization do not seem to have any great scientific value. These characters, in fact, only relate to the coloring of the shell, and no one is ignorant what a variation of color there may be in animals belonging, incontestably, to the same species. Finally, to pass nothing in silence, I will add that from experiments made by MM. de Montaugé and Bouchon-Brandely (experiments which do not appear to me to have been conducted with enough scientific precision) it would seem that the spermatozoa of the Portuguese oyster cannot fertilize the eggs of *O. edulis*.

I can affirm, for my part, that during my stay at Arcachon I have not noticed anything which can make me believe in the deterioration of the oyster coming from that region.

To recapitulate, I do not believe in the crossing of the two mollusks; but I hasten to add that the introduction of the Portuguese oyster into our waters does not seem to me without danger. We know that when two species are placed side by side in a limited space there takes place between them what an illustrious naturalist has named the struggle for existence. This struggle must sooner or later terminate in the defeat, the disappearance, of the weaker species. Under these conditions, the

Gryphæa and the ordinary oyster finding themselves face to face, the latter must inevitably succumb. The Portuguese mollusk is incontestably more hardy, more resisting, and also, it seems to me, more prolific. The facility with which it propagates itself is, in fact, very remarkable. It is known in what manner the Portuguese oyster took possession of a part of our coast. Some hundreds of these mollusks, accidentally introduced at the mouth of the Gironde, soon formed considerable beds. I have this present year seen the collectors placed on the shores of the island of Oléron covered almost exclusively with Portuguese spat. I think then, Mr. Minister, that in most cases the culture of the *Gryphæa* practiced in the vicinity of parks of common oysters may be accompanied with grave disadvantages.

And yet, I must repeat, I have no evidence at Arcachon of the encroachment of the Portuguese oyster. Here is, moreover, the entirely disinterested testimony of M. Lhopital, naval commissary, to whom I communicated my fears upon seeing the introduction of the Portuguese oyster in Arcachon Bay daily increasing. M. Lhopital wrote to me lately:

"Before the question of hybridization arose, this question of the invasion of collectors by the Portuguese oysters had already agitated the maritime population of Arcachon Bay. Some park-owners had even asked that the introduction of this oyster into our waters be strictly prohibited, and at the beginning of 1878 the minister caused an inquiry to be made upon the subject. It is now recognized that the danger pointed out was not serious. For more than twenty years there have been continuously introduced great quantities of Portuguese oysters, coming either directly from the mouth of the Tagus, from the bay of La Corogne, from England, or from the mouth of the Gironde. Well, excepting perhaps one or two years, the reproduction of Portuguese oysters in the bay has been noticed to be very slight. The collectors that have been taken up this year contained none of them, so to speak, and I have had much difficulty in finding any specimens of Portuguese oysters on the reserved beds."

M. Lhopital attributes this lack of reproduction on the part of the Portuguese oyster in Arcachon Bay to the purity of the water and to the absence of mud. I am much disposed to accept the explanation of the naval commissary. It is, indeed, remarkable that wherever one sees the Portuguese oyster propagate itself rapidly one can aver also the presence of mud in suspension in the water. However, it appears to me, Mr. Minister, that the oyster-culturists of Arcachon should take some precautions and watch attentively what takes place in their parks. Only a slight change in the currents would be sufficient to cause the water to become charged with mud and the Portuguese fry to invade the collectors. I do not think, however, that the state needs to interfere in this matter otherwise than by its advice.

Such is, at the present hour, the condition of the oyster-cultural industry in Arcachon Bay, a condition certainly remarkable and worthy of careful attention.

MORBIHAN.

Another important center for the production of the oyster exists on our Breton coast. It is known under the name of the oyster-cultural basin of Auray. The cultivation of the oyster in this region is of recent date. Collectors were first placed in the rivers of the Morbihan about fifteen or sixteen years ago. The center of the business is in the rivers and inlets which open into Quibéron Bay. The oyster-cultural establishments occupy successively, in going from east to west, the creek of Pô, the river of La Trinité, St. Philibert Creek, and Auray River. In most of these rivers natural beds exist. The most important are those of Auray River, which are about 22 kilometers long, and those of La Trinité River and of St. Philibert, which have a length of about 15 kilometers. Unhappily these beds are in bad condition. They have this present year been carefully explored, with the aid of scaphanders, and the results obtained are far from being satisfactory. Here is, moreover, a table showing the result of the oyster fishery in the Auray region from 1876 to 1881:

Statistics of the oyster fishery in the Auray region, 1876 *to* 1881.

Locality.	Years.	Number of persons engaged.		Number of boats.	Duration of the dredging.	Number of oysters taken.	Average price per thousand.	Total product of sales.
		Male.	Female.					
					hrs. m.		*Francs.*	*Francs.*
Auray River and its tributaries.	1876	1,782	....	594	20 30	19,974,000	21.65	432,341
	1877	1,664	832	623	13 00	13,343,000	19.75	263,652
	1878	1,852	448	694	15 45	27,145,000	15.75	427,841
	1879	2,183	447	782	8 45	11,173,000	16.70	186,670
	1880	2,379	491	809	9 30	8,283,000	20.40	175,263
	1881	2,516	445	882	15 00	11,061,000	13.70	157,644
La Trinité River	1876	429	....	133	10 30	2,042,000	17.00	34,722
	1877	273	....	115	11 40	2,558,000	22.20	50,232
	1878	400	108	154	7 40	2,206,000	22.50	49,591
	1879	418	101	135	6 20	1,058,000	22.00	23,330
	1880	198	79	88	4 15	257,000	34.50	8,737
	1881	167	112	83	4 50	601,000	24.50	14,670

If we bring these figures to a single unit of measure, the number of oysters fished per hour by each person [*dragueur*,] the following results are obtained:

AURAY RIVER.

[1876.—Each person took per hour 546 oysters.]
1877.—Each person took per hour 411 oysters.
1878.—Each person took per hour 747 oysters.
1879.—Each person took per hour 485 oysters.
1880.—Each person took per hour 315 oysters.
1881.—Each person took per hour 262 oysters.

TRINITY RIVER.

1876.—Each person took per hour 453 oysters.
1877.—Each person took per hour 453 oysters.
1878.—Each person took per hour 712 oysters.
1879.—Each person took per hour 566 oysters.
1880.—Each person took per hour 322 oysters.
1881.—Each person took per hour 444 oysters.

We see then, clearly, that the beds are in a state of decadence. It is true that in the Trinity River the average rose somewhat in 1881, but when one reasons from such slender figures (the total number of oysters dredged in 1881 was only 601,000) averages become less reliable. Some part of the bed, perhaps, which had remained unexplored during the preceding years, was then fished, and gave a great number of oysters which rapidly raised the average.

Notwithstanding this bad condition the production of the rivers of Auray is not unimportant, as the following figures show:

Season.	Number of marketable oysters exported.	Number of fry.
1876–'77	7, 260, 000	46, 056, 000
1877–'78	8, 094, 000	46, 004, 000
1878–'79	7, 684, 000	40, 526, 000
1879–'80	10, 599, 000	37, 618, 000
1880–'81	33, 325, 000	155, 418, 000

Some observations are necessary at this point. It must be remarked that these figures are unavoidably below the reality. We are obliged to depend for them upon the statements of the oyster-culturists, who, continually fearing an increase of the license tax, are always inclined to conceal the amount of their business. The number of oysters exported, both from Bretagne and from other oyster-cultural centers, is evidently greater than that indicated by the interested parties. It should also be noticed that the spawn is furnished, not only by the natural beds, but also by the important reserves of oysters which are possessed by several oyster-culturists. This explains the fact that, notwithstanding the precarious state of the natural beds, the crop of young oysters does not cease to be abundant. Consequently, one can see from the figures which I have the honor to lay before you the marked increase of oyster production in the basin of Auray. In the season of 1876–'77, the number of oysters exported was only 7,260,000. In 1880–'81, it reached 33,325,000.

The oyster-culturists of this region have to struggle against a natural obstacle, the mud which abounds in the rivers and inlets of the Morbihan. Owing to the ingenious arrangement of the collecting tiles, they have succeeded in triumphing over this difficulty. The collectors arranged in hives rapidly become choked with mud, so this arrangement has been discarded in favor of that which is known under the name of *bouquet* or *champignon* mushroom. A dozen or fourteen tiles pierced at each extremity are fastened together by means of iron wires. These are attached firmly to the top of a stake from 1 to 1½ meters long, which can be easily fixed in the ground.* This system, the first idea of which is due to M. Leroux, has the double advantage of preventing the collectors from being choked with mud and of rendering the setting of these implements more easy and rapid. The time which appears to be most favorable for setting the tiles, in Bretagne, is from the 1st to the 20th of July. This date is a month later than that at which the setting takes place in Arcachon Bay. The discrepancy is easily explained by the difference in temperature which exists between these two parts of our coast.

The use of nursing-boxes is not so frequent in Bretagne as in the Bay of Arcachon. There are several reasons for this circumstance; the one of the most importance is that, while the oyster-culturists at Arcachon cannot export their oysters until they have attained the size of five centimeters, the Bretons have the right to sell them outside the country in the condition of spat, and need not occupy themselves with raising them.

The question of the cost, also, plays a great part, so much the more as the oyster-cultural industry is yet in its infancy in this region. Finally, a number of Breton oyster-culturists replace to a certain extent the use of boxes by the method which they call *l'huitre à tessons* (the oyster on potsherds). This is what should be understood by that expression: The young oysters are left on the tiles for a certain time; then, in place of taking them off, they break into fragments the collector itself. Each oyster is then adhering to one of these pieces—to one of these *tessons*. This system, invented by one of our most distinguished oyster-culturists, Dr. Greppy, offers the advantage of placing the oyster in the best condition to resist the attacks of its natural enemies, the crabs, for example. Other oyster-culturists leave the oysters fixed to the collectors two years. They place the tiles, charged with their harvest, into submersible basins or simply into claires. The loss which always follows the gathering of the tiles is thus greatly lessened, but, on the other hand, some oysters are arrested in their development on account of being too closely pressed against the others.

RAISING AND FATTENING CENTERS.

I will not here enter into further details, but will now apply myself to the raising and fattening centers, the most important of which are Marennes and La Tremblade.

MARENNES.—Marennes has been known for many years for the production of green oysters; but for some time this locality has been fur-

* For an illustration and further description of the bouquet collector see Report of Commissioner for 1880, pp. 959–962.—TRANSLATOR.

nishing to commerce great quantities of oysters from other parts of France, which are brought here to be raised and fattened.

The following figures, which I owe to the courtesy of M. Senné-Desjardins, show the importance of the Marennes trade for the years 1880–'81.

The number of oysters introduced at Marennes was one hundred and ninety million, of which one hundred and thirty million were placed in the live-boxes and depots, and sixty million were placed in the claires. Of the one hundred and thirty million in the rivers about forty million were Portuguese, and about ninety million French. The exportation of oysters from this place amounted to one hundred and fifty-one million. Of this number fifty-four million Portuguese and forty-seven million French came from the depots and rivers, and fifty million came from the claires.

So, then, Marennes has sent off this year one hundred and fifty-one million oysters, representing a value of 5,900,000 francs [$1,138,700]. For the reasons which I have already indicated, these figures should be increased rather than diminished. Marennes, outside of the oysters raised in its claires, has an important trade in these mollusks. Of the one hundred and ninety million imported in 1880–'81, only sixty million entered the claires. It is also impossible not to remark how much development the Portuguese oyster business has taken. The one hundred and fifty-one million oysters sold this year are estimated to include fifty-four million of the Portuguese species.

I must now dwell for an instant on the care taken of their claires by the oyster-culturists of this region. Not that I wish to repeat facts here which have been known for a long time, but because it appears to me that the management of the claires of Marennes could be imitated with advantage in other oyster-cultural centers.

The claires are located on the two banks of the Seudre. They are not, like those of Arcachon, submerged at every tide, but only at the height of the spring tides. Some are even quite a distance from the river banks. They are parceled out in such a manner that some are being prepared while the others are in operation. The preparation of the ground takes place generally in the month of March. It comprehends two operations, *gralage* and moistening. The *gralage* has for its object the purification of the soil by evaporation; it lasts about six weeks or two months. The claires are cut, that is to say, the retention of water is prevented, and they are no more visited by the sea except at the spring tides. They dry up in the sun, crack, and grale. When the claire is graled, in other words, covered with a very dry layer, fifteen days are spent in moistening it. A small quantity of water is caused to enter and remain. The dry crust splits (*sedélite*—breaks in the grain) in the water; it produces a sort of effervescence, and the final result is a uniform deposit on the claire of a creamy layer called humor. The oysters can then be put in place, and commence to become green at the end of a fortnight. This operation should be gone through every year. The oysters are placed on the bottom of the claire and spaced with the hand. About five thousand are spread on a surface of thirty-three acres.

Until the present time the industry of Marennes has consisted exclusively in raising and fattening. We may hope shortly to see production introduced into this locality. In fact, the marine commissary of this district, M. Senné-Desjardins, is applying himself actively to this question. Having lived a long time at Auray, M. Senné-Desjardins is abreast of all the questions connected with oyster-culture. His intelligence, and the interest which he carries into his labors, give ground for the hope that this new undertaking will be successful.

COURSEULLES.—ADVANTAGE OF FRESH WATER.—On many other points of our shore the raising of oysters is carried on. I do not think that I ought to pass here in review all the localities where this industry is prosecuted. I will, however, ask your permission, Mr. Minister, to say a few words to you regarding one of these oyster-cultural centers which appears to me to possess a peculiar interest.

I wish to speak of the parks which have for a long time existed at Courseulles. These parks are situated in the neighborhood of the Seulles, a little water-course which empties into the sea in this part of our Norman coast. The canals, through which the oyster basins communicate with the sea, are so disposed that when the sea rises it cannot, during the neap tides, pass over their flood-gates. Consequently the water is not renewed during this period. During the spring tides the salt water can enter the canals, but only after mixing itself with the fresh water of the Seulle. Undiluted sea-water never penetrates into the parks.

Now it has been long noticed that the oysters placed in the basins of Courseulles fatten rapidly and become of a particularly delicate taste. I repeat these facts because it seems to me to result from all that I have learned of others, and from all that I have been able to observe by myself, that the mixture of fresh water with that of the sea is a condition which, if not indispensable, is at least most advantageous for the fattening of the oyster. At the same time, the currents incontestably exert a favorable influence on the raising, the growth, of these mollusks. French oysters transported to the mouth of the Thames, in water nearly fresh, speedily acquire qualities which make them sought for by epicures. A great quantity of mollusks sold under the name of Ostend oysters have no other origin. It has also been remarked that the oysters gathered in the Chesapeake Bay are much fatter than those fished on other portions of the American coast. It is quite probable that this favorable condition is due to the numerous streams of fresh water which empty into this bay. I think then that the fattening of the oyster should be recommended on all parts of our coast where the natural conditions are such that a mixture of fresh and salt water can be obtained. At Lorient several establishments, where this desideratum is realized, are on the broad road to prosperity. These examples could easily be multiplied. They have endeavored, for some time, to practice raising and fattening in the basin of Auray. The oyster-culturists have here to struggle against the obstacle arising from the small degree of firmness which the soil presents. They succeed in triumphing over these bad conditions by macadamizing the mud. For that they cover the ground with sand and stones which end by forming a bed sufficiently resisting. I think that the Breton oyster-culturists will be able to thus raise oysters, but I very much fear that the fattening will not give good results in this region. In fact, except at a few privileged points, the want of fresh water will be a serious obstacle to perfect success.

MEDITERRANEAN COAST.

While oyster culture is comparatively flourishing on our ocean shores, it is not represented on our Mediterranean coast. All the attempts made in former times by M. Coste were without the desired results. I think that it is useless to dwell upon those unfortunate experiments, but there is some interest in examining whether the oyster industry should be finally abandoned in this part of France. Several species of oysters at present live in the Mediterranean. These species are the following:

I. The *Ostrea edulis* and its varieties. This oyster seems to live only with difficulty in the Mediterranean, at least in the part of it which washes our coast, and it never forms beds. Some individuals are found on a muddy bottom, at the depth of thirty to sixty meters, off the mouth of the Rhone.

II. The *O. cyrnusii.* This oyster very much resembles the *edulis.* It is principally distinguished by the greater length of the hinge-groove. It lives in the briny pools on the eastern coast of Corsica.

III. The *O. cochlear.* I cite this species simply for the sake of mentioning it. It is, indeed, a very small and rare mollusk, inhabiting great depths (100 to 140 meters). It possesses no interest from a gastronomic point of view.

IV. The *O. stantina.*—This is a small species, rather abundant at Toulon, more rare on the rest of our coast. It seems to prefer to inhabit impure waters.

Among these species only two are interesting from an oyster-cultural point of view, the *O. edulis* and the *O. cyrnusii.* All the attempts which have been made up to this time have related to the *O. edulis.* Thus M. Coste used for his experiments oysters coming from the coast of Bretagne. Now, as we have just said, this species of oyster seems to propagate itself with difficulty on the Mediterranean coast. Many zoölogists attribute this circumstance to the fact that the sea-water here is too salt. However that may be, it appears to me that new attempts should be made, directed this time to the oyster of the Corsican coast, the *O. cyrnusii.* I am led to think that this species would give good results if it was introduced into the lagoons which are so numerous along our southern coast, and to which I have already had the honor of directing your attention.

CONDITION OF OYSTER CULTURE AND DANGERS THREATENING IT.

Not only does the new industry place a great quantity of mollusks on the home market, but it also exports a considerable number. Thus, in the last year, the French oyster-culturists sent to London twenty-eight millions of oysters. Belgium, likewise, receives several million annually. However, I am convinced that oyster-culture could attain a much greater development if it could be protected from certain dangers that menace it, some of which, at least, are really grave. Permit me then to show you these dangers and the means which, in my opinion, should be put in operation to combat them. I have already had occasion to describe to you the rapid decadence of the natural beds. That is, without contradiction, the most formidable danger which threatens the oyster-cultural industry. It is important, then, to search for the causes to which should be attributed this state of decay.

Two principal facts can be appealed to. It is necessary first to cite the pillage of the beds, which is carried on incessantly. The thefts are committed in open day. The plunderers not only attack the reserved beds, but have even been seen to install themselves on parks belonging to particular persons, break the nursing boxes [*caisses, i. e., caisses ostréophiles*—nursing boxes, or cages], and carry off the contents. The employés of the navy, notwithstanding their good will and devotion, are not in a condition to oppose the depredations of these hardy robbers. In fact, the means which the maritime authorities have at their disposal do not permit them, under most circumstances, to follow and apprehend the robbers. Pirates of this kind, provided with rapid boats, knowing admirably the ground on which they operate, and always taking advantage of foul weather, are usually very difficult to arrest. Coast-guards cannot work with effectiveness except when they can have steam launches at their disposal. This means, already recommended by Mr. Senator Robin, appears to me the only one which can assure a serious surveillance. But this is not all. When, by a happy circumstance, the robber has been captured, the punishment which awaits him is really ludicrous. One may see a man who in a few hours has stolen oysters worth 200 or 300 francs, condemned to pay a fine of five francs!

Another quite important cause of the decrease of the natural beds is their too frequent dredging. We know that to arrive at marketable size the oyster needs a time which may be estimated at two or three years. On certain portions of our coast, and notably in the rivers of Auray, the dredging takes place every year. The fishermen are recommended, it is true, to throw back into the sea the oysters which are too small; but who cannot see that this recommendation has no effect? Necessarily, then, dredging should not be allowed on the same bed more than once in two or three years. Such is the practice adopted at Arcachon, and I have had occasion to say that its results are excellent.

Another cause which opposes the development of oyster-culture, in

Bretagne at least, is the too high rent, as I believe, which is exacted from the concessionaires of lands. In fact, while the rent at Arcachon is from thirty to forty-five francs per hectare, according to the position of the parcs, the Breton oyster-culturists pay not less than one hundred francs for the same extent of land. Now these lands are not adapted to any other use; they are absolutely valueless mud-sloughs (*vasères*). The charge of 100 francs per hectare is, then, much rather that of a leasing than that of a concession. This is really a considerable tax, which lights on a new industry that merits, in every respect, to be protected and encouraged. In fact, outside of the interest which it possesses in itself, it should not be forgotten that oyster-culture gives occupation every year to a great number of persons, women and children, who would not be able, without that circumstance, to engage in any work, ever so little remunerative.

GOVERNMENT ACTION REQUIRED.

I think it would be desirable for the Government, I. To place at the command of the coast-guards a number of steam launches, the only boats which can pursue with success the pillagers of our natural beds. II. To regulate the dredging of these beds in such a manner that none of them can be fished except once in three years. III. To recommend to the competent authorities a greater severity in the punishment of thefts committed to the prejudice of the oyster-culturists. IV. To diminish the rent required from the concessionaires of parks in the Breton region, so that the amount of this tax will not surpass that asked from those of Arcachon Bay.

ADVICE TO OYSTER-CULTURISTS.

In regard to the advice to be given to the oyster-culturists, such advice will naturally find its place in the course which you have seen fit to institute. The persons who are engaged in this industry can, moreover, do much by themselves. In this order of ideas I will point out the foundation of oyster-cultural societies. The oyster-culturists of Auray have had the idea of grouping themselves together thus. Their reunion, which has taken the name of the Ostreacultural Society of the Bassin d'Auray, has already furnished excellent results. This society publishes a monthly bulletin, and, moreover, has founded an oyster-cultural museum of great interest to all those who concern themselves with questions pertaining to the cultivation of oysters. This example should be followed in all the oyster-cultural centers.

ACKNOWLEDGMENTS.

Such are the facts, Mr. Minister, to which I would desire to direct your kind attention. In concluding, permit me to tell you how much I have been aided in my researches by the agents of the maritime admin-

istration. M. Broquet, lieutenant commanding the man-of-war *Moustique*, MM. the naval commissaries Senné-Desjardines, Lhopital, Gestain, and Castelin, have procured for me valuable information. If I have been able to record in this report some facts possessing interest, I certainly owe it to the kind complaisance which I have met with from the persons whose names I have just mentioned.

PARIS, *October* 30, 1881.

47.—A NOTE ON THE CUBAN EEL.

By SETH E. MEEK.

In Poey's Synopsis Piscium Cubensium and Enumeratio Piscium Cubensium is recorded a species of the genus *Anguilla*, *Anguilla cubana* Kaup. With a view of testing the characters assumed to distinguish this from our species of the same genus. I have carefully compared specimens collected by Professor Jordan in Cuba with specimens from Wood's Holl and one specimen from Chewalla Creek, Alabama, and am unable to find any constant difference. I have also compared these specimens with a number brought from Venice by Professor Jordan last summer. They present the same difference found to exist in specimens from both sides of the Atlantic examined by me last May (Bull. U. S. Fish Comm. 1883, 430). In my opinion *Anguilla cubana* cannot be considered as a distinct species, but as strictly identical with the *Anguilla rostrata*. Below is given a table of eleven specimens, two from Cuba, three from Wood's Holl, one from Eufaula, Ga., and five from Venice. The proportions are given in hundredths of the length to end of last vertebra. All the specimens mentioned are in the museum of Indiana University. I am indebted to Professor Jordan for valuable aid.

Dimensions.	Locality.											Average of Cuban specimens.	Average of Venice specimens.	Average of Wood's Holl specimens.
	Havana.	Havana.	Wood's Holl.	Wood's Holl.	Wood's Holl.	Eufala, Ga.	Venice.	Venice.	Venice.	Venice.	Venice.			
Length of head	13	13¾	13½	14½	13	12½	11½	11¾	12½	12	12½	13⅜	12 1/20	13⅞
Distance from end of snout to front of dorsal	34½	35½	35¼	34¾	34	31	27	30	28	30½	29	35	28½	34⅞
Distance from end of snout to front of anal	44½	45	45¼	46	44	42½	42	44	42	43½	43½	44¾	42⅘	45⅙
Distance from front of dorsal to front of anal	10	9½	9½	11¼	10	11½	15	14	14	13½	14½	9¾	14⅕	10¼
Length of mandible	5¾	6	6	6⅛	5¼	5	4½	4¾	5	5¼	5¾	5⅞	5 1/20	6¾
Length of pectoral	4¼	4	4	4¼	4	4	3¾	3¾	4	4	4	4⅛	3 9/10	4 1/12
Depth of body at front of anal	6	6	6	6	5½	5½	5¾	5¾	5½	6¼	6¼	6	5 9/10	5⅝
Distance from gills to vent	31½	30	30½	31¼	30½	29	30½	31	29½	31½	31½	30¾	30⅘	30¾
Length of specimen in inches	18.1	16.2	13.1	21.7	4.45	7	11.8	11.5	9.6	22.4	21.1	....	...	....

48.—WHITEFISH, LAKE-TROUT, AND BROOK-TROUT IN FRANCE.

[Extract from Proceedings of the Society of Acclimatization.*]

The manager of the piscicultural establishment of Bouzey writes to the agent-general: "I have the satisfaction to announce to you that the *Salmo namaycush* are magnificent and very vigorous. We have had no losses up to the present time, though the absorption of the yelk-sac will be complete in eight days. The eggs of *Coregonus albus* have turned out finely, and there are nearly as many alevins as there were eggs. Five thousand of them have been put in the lake of Girardins, 10,000 in the Bouzey reservoir, 4,000 in a special piscicultural basin well adapted to them, and 1,000 remain on the tables, which we will try to raise if it is possible. The eggs of *Salmo fontinalis* are beginning to hatch and promise a fine result."

Mr. Leon d'Halloy writes to the recording secretary: "I have received the eggs of *Salmo namaycush* and of *Coregonus* forwarded by the society. The *Coregonus* eggs have been hatched in the German apparatus which you caused to be sent to me. This apparatus has given excellent results; the eggs remain always very bright, and clean themselves very readily, as you told me would be the case. The alevins have been set free. Be particular to recommend to put the young of this species in deep water (of at least three meters), otherwise they will be lost at the age of six months; before that age they may be raised in water 50 centimeters deep. The *Salmo namaycush* are coming out well and the alevins are very vigorous.

"All my fish are doing finely. Some of my *Salmo fontinalis* (those which you saw) reproduced this year. The alevins are more vigorous than those from the eggs which I have received during the year from New York. I am satisfied with the Loch Levin trout. What made me judge ill of this species the first was that, as with the *Salmo fontinalis*, the journey of the eggs in ice causes the embryos produced to be less vigorous."

49.—CARP IN AN INSTALLMENT OF SHAD FROM JAMES RIVER.

By E. G. BLACKFORD.

[From a letter to Prof. S. F. Baird.]

A barrel of shad arrived to-day in our market that were caught in the James River, Virginia. Among them was one German carp, weighing $3\frac{1}{2}$ pounds.

NEW YORK, *April* 4, 1884.

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* *Bulletin Mensuel de la Société Nationale d'Acclimatation de France, Mars,* 1883, pp. 186, 187.

Vol. IV, No. 8. Washington, D. C. April 23, 1884.

50.—INSTRUCTIONS FOR TAKING WHITE-FISH EGGS.

By SEYMOUR BOWER.

Employés engaged in collecting white-fish eggs for United States Fish Hatchery at Alpena, Mich., are desired to observe the following instructions:

Care should be taken to use live, ripe fish only. The spawners are ripe when they discharge their eggs freely, in a liquid stream, when pressed along the belly towards the vent. The males are ripe when they yield the male principle or milt promptly by stripping with the thumb and fingers just forward of the vent. The ripe females can quite easily be distinguished from those that are not ripe, simply by touching the belly, the former being very soft and the latter more or less hard. In cases of doubt, however, it is well to take up the fish and try to start the eggs by crowding; if ripe, the eggs will flow freely with a moderate pressure; if unripe, they come away, if at all, in bunches. Fish from which the eggs are running when taken from the net are in perfect spawning condition (if alive) and may be manipulated at once.

White-fish from trap-nets usually live twenty to thirty minutes after lifting, sometimes much longer, according to the weather; but the males are too far gone for use whenever the milt is clotted or too thick to mix freely with the eggs. Whenever there is a scarcity of male fish good milters may be laid aside a few moments and then used a second time. Milt mixed with blood should not be used.

To hold a fish securely, place its head between the left arm and side, and grasp it firmly with the left hand just forward of the tail; this leaves the right hand and arm free to press out the eggs and milt. Hold the vent of the female close to the bottom of the pan, so that the eggs will not be injured in dropping; then, with the whole hand adapting itself to the natural curve of the belly, press or crowd slowly forward towards the vent, repeating the movement until the eggs are all discharged, or cease to flow freely. Then add the milt from two or more males as soon as possible, and mix thoroughly, but carefully, with a feather or the tail of a fish. Another spawner may now be stripped into the same pan, and milted as before, if there is one near at hand so that it can be done without delay; then set the pan aside and continue to take eggs as before, in another pan, and so on. Allow each pan of milted eggs to stand not less than two nor more than five minutes; then add water until the pan is about two-thirds full. In very cold weather, however, it is sometimes necessary to add the water to the eggs immediately after milting, to prevent freezing. About fifteen minutes after the first water has been added, pour it off, rinse the eggs through one or two waters, and transfer them to a pail filled with water. Fill the pails not more than half, or at the most two-thirds full of eggs, and dip or pour off the water and refill with fresh as often as once in half an hour, until the eggs are transferred to the shipping crates or floating boxes, or are delivered at the hatchery.

Eggs must remain in pails or vessels, with frequent changes of water, at least four hours before being placed in the shipping crates; but where floating boxes are provided, they may be transferred thereto at once, on arrival at shore.

When ready to fill the crates, wet the flannel trays thoroughly in cold water; dip up the eggs with a perforated dipper, allowing them to drain, and with a feather spread them uniformly on the trays, three or four layers deep; then drain still further by tilting the tray and inserting a knife blade between the flannel and frame to allow the drainage to escape. It is important that the eggs should be moist, *but not dripping.*

Place the filled crates in a cool place, out of the sun. The temperature should not be above 50°, nor must the eggs be allowed to freeze. In all cases forward to the hatchery as soon as possible. Make every effort to handle every spawning fish; and once obtained, the eggs must not be lost through carelessness or negligence. Employés remain at their stations until ordered elsewhere or to discontinue, and accompany the boat to which they are assigned on every trip to the nets.

ALPENA, MICH., *November* 1, 1883.

51.—EXCHANGE OF LAND-LOCKED SALMON EGGS FROM MAINE FOR LOCH LEVEN TROUT OVA FROM SCOTLAND.

By Sir JAMES G. MAITLAND.

[From a letter to Prof. S. F. Baird.]

I am happy to say the 5,000 land-locked salmon ova you so kindly forwarded me through Mr. F. Mather arrived in first-class condition on the morning of March 19. The eggs are not quite so large as salmon ova from this (the Forth) district, but are larger than those of salmon from the Tweed this spring. The effect of the epidemic with which that river has for the last several years been affected having been (by killing out the old fish) materially to reduce the size of the ova.

I would like to send you some of our Scotch Loch Leven trout ova which I have successfully introduced into New Zealand. If you will kindly let me know how the cases should be addressed, I will forward them from here the week beginning Monday, November 24. Our best ova in this country always hatches out in December, while the ova from younger fish is frequently not spawned till February.

STIRLING, SCOTLAND, *March* 21, 1884.

52.—SUCCESS OF FISH-CULTURE.

By MAX VON DEM BORNE.

[Translated by Charles G. Atkins from the circular of the German Fishery Union.]

It cannot be often enough repeated that not every kind of fish thrives in every water, and that we can expect success in fish-culture only when we put the right fish into the right water. If fish fry are to be planted in lakes or rivers, such places should be chosen for the deposit of the fry as the fish themselves would select. Where failure is complained of, it is commonly the case that a species of fish has been planted in uncongenial waters, or it has been forgotten that the limited amount of fish food afforded in the water can only sustain a correspondingly limited weight of fish.

When they undertake to stock the Havel at Potsdam with one or two year old salmon, bought anywhere, failure is to my mind certain. The lake trout lives in lakes and resorts to rapid brooks to spawn on stony ground; therefore I hold it to have been wrong to plant the fry of this fish in lakes and carp ponds as soon as they had absorbed the yolk-sack. The same is true of the brook trout introduced from North America, whose fry were planted in lakes, while they naturally inhabit stony brooks. Vain I consider the turning out of salmon fry at the mouths of the streams, and the planting of young German char in brooks, for the former is at home in brooks, the latter in lakes. The grayling is not so widely distributed as the trout, and it is difficult to determine, in case of a river not already inhabited by this fish, whether it is suitable for grayling or not. In some instances the planting of grayling continued for several years has been unsuccessful; probably these waters are not adapted to the species.

Where, however, the appropriate conditions of existence are afforded the fish, and there is no lack of sustenance, success is not wanting. The transplanting of our brook trout to Australia, of our carp to America, of the California salmon and the brook char to Europe, are facts that admit of no doubt.

The successes of fish-culture are, of course, more readily observable when small bodies of water, brooks or lakes, are stocked than in case of large river systems; they are easier recognized in the culture of local fishes than of the migratory kinds that run to the sea and spend most of their lives there.

SUCCESS OF SALMON AND SEA TROUT CULTURE.

The Rhine.—Von Winterstein reports from the Mosel district that the increase of salmon in the Prims is yearly more evident. In the Sauer the yield is extraordinarily abundant, as well as at the junction of the

Sauer and Mosel. In the Lower Mosel the salmon catch is satisfactory. Baron von Dücker, at Menden, says that there are a good many salmon in the Ruhr as far as they could ascend in the long-continued low stage of the water over the almost impassable dams on the Ruhr (with a favorable stage of water they used to ascend as far as Herdecke), so that the Westphalian fish-culturists may have the satisfaction of asserting that they have accomplished something. At Werden, for instance, salmon of all sizes can be seen morning and evening continually leaping. It is an interesting circumstance that at Witten, in September, Mr. Carl Lohmann took a 5½-pound salmon in the Ruhr with an artificial fly, a red palmer 20 millimeters long. At Hattingen many salmon have been taken—in the Schleuse, as the reporter says. We hope that the capture is not accomplished in the same way as it used to be in the now abolished trap at Mühlheim. In the Main salmon appear more plentiful than formerly (report from Hammelburg). The greater part of the Rhine salmon are caught in Holland, and the most of them come to the market of Kralings-veer. Since 1870, when the fish-breeding establishment at Hüningen came into German possession, a great number of salmon fry have been turned out in the Rhine Valley. The following table shows that since that time the salmon fishery has improved, though, to be sure, it cannot be shown how much fish-culture has contributed to it, since the final result is the product of sundry factors in part unknown.

CONDENSED STATEMENT OF RECEIPTS OF SALMON AT KRALINGS-VEER.

1870	21,687
1871	23,209
1872	32,228
1873	58,384
1874	77,080
1875	56,436
1876	42,293
1877	44,580
1878	49,691
1879	38,914
1880	41,736
1881	44,376
1882	55,079
1883	79,008

For the months of October, November, and December, 1883, it is assumed that the catch will average as in the thirteen years preceding. It will be seen that 1883 is the best year since 1870, even exceeding 1874.

From the Ems district Von der Wengen reports that in July of this year, in the Werse, at Munster, the run of salmon was very good. The

Weser, according to G. Seelig, in Cassel, is now richer in salmon than formerly.

The Elbe.—Prof. A. Fric, of Prague, communicates the information that so many salmon were caught in the valley of the Elbe in Bohemia that the price sank to one mark (24 cents), and in June to half a mark per pound. Formerly it was more than double these figures. Between Leitmeritz and Kolin, according to the testimony of H. Podhorsky (fisherman), more than 1,000 salmon have been cuaght this year, a number hitherto unheard of. The most of them weighed 8 or 9 pounds. Schools of young salmon were also observed in the Moldau and Elbe, on their way to the sea.

The Saale, though barred by difficult dams, was visited by salmon, and several were taken in the Upper Saale. Count Rantzau, at Breitenburg, in Holstein, reports that in the Stör the salmon were more abundant than formerly.

The Oder.—According to High Forester Ahlborn, of Schönthal, the increase of salmon in the Küddow for the past four years has been remarkable; especially have many more small and medium-sized salmon been observed.

At Borkendorf many salmon were caught at the spawning time, but no eggs fecundated. More efficient supervision is desirable there. According to a report of the Fishery Union for East and West Prussia, small salmon of the size of Swedish anchovies (Strömling) were observed in great numbers the past summer in the Drage. The fishermen of Driesen had, as I am informed by Justice Prietz himself, a good catch of salmon. There were caught 64 salmon, of 14 to 35 pounds weight, that brought 1.1. marks per pound, so that the fishermen received 1,400 marks for them. This autumn the net fishery is still better. At Driesen, up to the middle of September, 148 fish of 16 to 35 pounds had been caught, and as the fishing season lasts till mid-October, the total catch must be reckoned at twice that number at least. In the Drage the catch at Steinbusch is reported likewise good, and the fishermen of Usez, at the mouth of the Küddow, are said to have taken 8 salmon in a single night.

Mecklenburg rivers.—Councilor Brussow traveled in the spring with an official of the land district of Doberan along a part of the Baltic coast to inquire into the results of the planting of salmon fry, and which he found to have been very considerable. Formerly in the district of Doberan on a stretch of coast 2½ miles long lived three sea fishermen, of whom two followed the fishery only as a secondary occupation, and obtained but a scanty subsistence. Since 1880 the salmon fishery has become more important, and now in the same district there are eight fishermen subsisting exclusively and with comparatively ample earnings upon the sea fishery. Their catch consists mainly of salmon, sea trout, and herring, with a few flatfish and cusk. The magistrate of Wismar reports that the salmon fishery has much improved, and that in consequence a certain Captain Bade has established himself in the neighborhood of the city and engaged in the sea-fishery exclusively. At the mouth of the Warne many hundreds of salmon are now yearly caught. In consequence the magistrate has petitioned Herr Brussow to have 30,000 to 50,000 salmon eggs hatched for him and the fry planted in the Warnow basin. On the whole coast of Mecklenburg the salmon fishing has experienced a remarkable improvement. I am sorry to say that undersized salmon are also caught and secretly sold.

Schleswig-Holstein.—Von Stemann, at Rendsburg, writes that the Rhine salmon was extinct in these waters, but that now it is caught more plentifully than the sea trout. In the fall of last year fine specimens were sold at 50 pfenings (12 cents) per pound. Up to October 5, in the Treene, between Eggebeck and Tarb, 64 salmon were caught. To get salmon spawn several large inclosures were constructed to hold the fish until ripe. Since the fishermen catch plenty of sea trout, brook trout, and the hitherto unknown Rhine salmon, the repute of the Fishery Union grows year by year. The salmon have now reached a weight of 8 pounds each. In 1881 9 males of 3 to 4½ pounds were taken, and in 1882 the first mature females of 6¾ pounds were caught, and 5,000 eggs fecundated. The Luhnau and Wehrau have got a very good stock of trout and sea trout, through the planting of fry. The results of fry-planting always consist in increase. Between Flensburg and Alsen-langballig many salmon and sea trout were taken this winter, which were in great demand, and brought the fishermen from 1.50 to 1.70 marks per pound. But a short time ago, in the neighborhood of Flensburg, at one haul 50 pounds of sea trout were taken, which brought the fishermen 80 marks. At Owschlag about 500 pounds of salmon and sea trout are caught in the winter. The Eider, below Rendsburg, yields many Rhine salmon and sea trout weighing from 3 to 7 pounds apiece. The catch of salmon and sea trout at the village of Brammer, which is very considerable for so small a stream as the Jevenau, gives striking proof of the increase of these fishes through the planting of fry. B. Elsner, fish-breeder at Alt-Muhlendorf, reports that since the founding of the fish-breeding establishment, from a comparatively small number of planted fry, noteworthy good results have followed. Of the fry of sea trout liberated in 1881, according to the statement of fishermen, great quantities (basketsful) of the size of medium herring were caught at Eckernfoerde in 1882, in the basket-nets that stand in the bay of Eckernfoerde. In the spring of 1882 sea-trout fry were turned out at Neustadt, and now, as the fishermen say, in the bay of Neustadt, small sea trout are taken at every haul of the seine. Since great success has been experienced in other parts of the province also, the fishermen, otherwise hard to convince, take a lively interest in the matter.

The German Fischerei Zeitung, No. 24, reports from London, under date of August 15, that the salmon fishery in Scotland has been extraordinarily productive the past month, so that the price fell to 6*d.* per pound. The rigidly enforced close season of the salmon rivers, the prohibition of fixed instruments of capture at the river mouths, as well as the protection of the young salmon and the spawning places in connection with the vigorous employment of artificial salmon culture are generally regarded as the most important causes of the improvement in the salmon fishery.

North America.—In the report of the Commissioner of Fisheries for 1879 (published in Washington in 1882), page 698, Livingston Stone makes the statement that since artificial fish-culture has been carried on in California the salmon have increased immensely in the Sacramento, so much so that, although the canneries have increased and the sea-lions and the fishermen also, the salmon have nevertheless made a steady gain in numbers, or, in other words, the fishery commission has, with the aid of artificial hatching, beaten the sea-lions, the canneries, and the fishermen combined.

SUCCESS OF THE CULTURE OF BROOK TROUT.*

THE DANUBE.—The Fishery Union of Waldmünchen has since 1879 yearly deposited several thousand trout fry in the brooks tributary to the Regen. In consequence the catch of trout has considerably increased.

THE RHINE.—Every fishery lessee is required to turn out yearly in the leased waters 100 trout fry for every cubic meter of water supply, and the trout-fishing is thereby remarkably improved.

Würzburg.—The "Fish Brook" was fishless; it was stocked with 5,000 trout fry per year for three years past, and now it swarms with fish, of which the largest weigh a pound.

Bibelhausen near Saarburg.—The mountain brooks flowing into the Lower Mosel are now well stocked with game fish, and fishing is very remunerative.

Birkenfield.—Since 1878, 5,000 young trout have been yearly turned out in the Traun Brook Valley. Now trout occur there in plenty; even in the vicinity where formerly trout belonged to the rarities, edible trout are now again caught. The net result of artificial fish-culture is here gratifying.

Montabaur.—The Gelb Brook yields notably more eatable trout since it has been regularly stocked with trout fry.

Deutz, on the Sieg.—Franz Goebel turned out trout fry below Deutz eight years since. The fish ascend at high water as far as Deutz, and many trout now occur there, as was not the case before.

Barmen.—Burdet Chevalier stocked the brooks that he had bought and rented with trout fry, and now has far more edible trout in them than before.

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* Each item in the following paragraphs, relative to brook trout, sea trout, char, grayling, whitefish, carp, and eels, is accompanied by a reference to individual authority for the statement. The names being mostly unknown to American readers, they are omitted by the translator.

Füchten, near Neheim.—In consequence of artificial fish-culture, the Ruhr and its tributaries in the neighborhood of Füchten are now better stocked with trout than formerly.

Menden.—Baron von Duecker caught, May 23, with a gray artificial fly, between 4 and 6 o'clock, forty-four trout and one grayling, a consequence of the planting of trout fry in the Hönne; also on the Upper Ruhr he had a good catch, especially on the spots where, in the spring, trout fry had been planted.

THE WESER. *Lauterberg.*—The improvement in the stock of trout through the planting out of fry is very noteworthy, 1½ to 2 pound trout being taken much oftener than formerly.

THE ELBE.—C. Arens, of Cleysingen, near Ellrich, in the Hartz, several years ago placed several thousand trout fry in the canal that feeds his mill, which before had no trout; these were re-enforced by some small fish that had escaped from a rearing pond. On September 21, of this year, the water was drawn off to cleanse the mill canal, and on that occasion 48 pounds of the finest trout were taken under the causeway bridge, besides small trout and fry in quantity. The millers of the neighborhood also find to their astonishment beautiful trout in their water-wheels, as has not in a single instance occurred before for a decade. From which may be seen the use of planting fry, and that it is not advisable to catch too small fish. The mill canal has a gentle current, muddy bottom, a smooth shore, a maximum temperature of 77° Fahr., and is rich in insect life. The water is better for trout than spring water. Although they cannot spawn in it, they grow better than in a swift, stony brook. The water is often much roiled by rains, yet the trout stay in it and do well. The fish turned over to the cook, even those weighing 1½ pounds, had white flesh, fat and toothsome.

Königsbruck in Saxony.—Through artificial culture trout are established in wild brooks where they did not before occur.

THE ODER. *Sprottau.*—The town turned out trout fry four years ago, and in consequence trout are now often taken at Sprottau.

THE WEICHSEL.—Miller A. Ohlert, of Somers-in-on-the-Brahe, catches fine trout for the table, the product of the planting of fry.

Christburg.—A brook, utilized for trout culture, affords an abundance of table trout for private use and for sale.

Mecklenburg-Schwerin.—The northern outlet of the great Schwerin lake had formerly no trout, but brook trout of 6 pounds weight are now caught there—a result of fish culture.

Allow me to add a single instance from England. As I was fishing this spring at Walton, above London, I was informed by my friend, T. R. Sachs, and other members of the Thames Angling Preservation Society, that the trout fishery has wonderfully improved in consequence of the planting of trout fry. Mr. M. Cooper Morris writes me, that besides the Thames trout, lake trout and American brook trout were also taken. Certainly the catch is ten times as great as a few years ago. Formerly it was understood that a Thames angler needed three years for the capture of a single specimen of the giant trout living in the river. Last year one gentleman took 80 good trout. Next to the late Mr. Frank Buckland, unquestionably Mr. James Forbes has obtained the greatest return. He has a small but very prettily arranged fish-breeding establishment near Chertsey bridge, and in ten years has set free in the Thames a total of 120,000 to 150,000 trout fry. At Sunbury, also, has artificial breeding been effective in improving the trout fishery of the Thames. At the annual dinner of the Thames Preservation Society, a list was submitted of trout taken with the hook in a single week in May, 1883, between Chertsey dam and Kingston. It embraces 18 trout, weighing in the aggregate 109 pounds 14 ounces, thus averaging 6 pounds each. There was universal satisfaction over the success, and not a doubt has come to my ears that artificial culture deserves the credit.

Mr. R. B. Marston, reports in the London Field, of October 30, that Mr. S. Wilmot has in the International Fishery Exhibition in London an 11-pound New Zealand trout that was sent to him by the Otago Acclimatization Society; it was caught with the hook, and larger specimens are often killed. About twenty years ago trout eggs were sent from England to New Zealand, and from those has it resulted that the rivers of that region are now stocked with noble trout. Dr. Francis Day received from New Zealand two beautiful trout in ice; they reached London in good condition, and are undoubtedly *Salmo fario*.

LAKE TROUT AND CHAR.

Oekonomierath Brüssow, of Schwerin, Mecklenburg, caught last winter in his lake, with the coarse net, several 3-pound trout.

Zwätzen, near Jena.—The char flourishes very well in several ponds in Thuringia. According to Oberbürgermeister Schuster, of Freiburg, the success of the planting of char in the Lake of Constance is beyond doubt.

GRAYLING.

(Reports are given from seven different localities, showing in each case an increase of grayling resulting from the planting of fry.)

WHITEFISH.

In the Schleier Lake in the Bavarian Alps, in the autumn of 1882, the first ripe whitefish were taken. There were *Coregonus maræna*, the well-known fish of the Madui Lake, which have been introduced to the former locality since 1878 by the German Fishery Union.

Success has likewise attended the introduction of *Coregonus Wartmanni*, the "blaufelchen" of Lake Constance, into North German lakes. A spent male was taken February 24, in the Talter Lake, a part of Spirding Lake. According to Professor Benecke, it was 34 centimeters long, 7.5 centimeters high, 4 centimeters thick, and weighed 305 grams.

On both sides were visible, on seven rows of scales, the remains of the excrescences of the spawning season. In the same lake among smelts there was taken, April 6, a second specimen of "blaufelchen," which was identified by Professor Benecke, and which measured 32 centimeters in length, 7 centimeters in height, 3.5 centimeters in thickness, and weighed 284 grams.

Mr. Ohlert, of Somersin, in West Prussia, reports that Mr. Caspari took 60 blaufelchen with the coarse net in winter in the Summin Lake, where formerly only small maræuæ occurred; three years ago fry of *Madu marœna* and blaufelchen were introduced. Professor Benecke identified a spent male 22 centimeters long, 6.5 high, 2.7 thick, and weighing 220 grams. The same fish was sent to Dr. Gemmiger, of Munich, and by this gentleman also was recognized as a blaufelchen.

(Five other instances are given of successful breeding of the white-fish in German lakes.)

CARP CULTURE.

Sprottau.—A few years since, two-year old carp were placed in the Sprottau, and fine large specimens were taken this summer.

Potsdam, July 15, 1883.—The planting of carp in the waters of Potsdam district has been attended by evident success.

Berneuchen (Max von dem Borne).—Since the lakes of Berneuchen and the Mietzel have been regularly stocked with yearling carp, these waters have been wonderfully productive of beautiful, great table carp. The same is true of the Bötzen Lake of Dölzig, but there it was not possible to catch great numbers of carp until, last winter, the net was enlarged so that the whole lake could be swept at a single draught under the ice.

The success was complete. The net contained all the fish it could hold, mainly carp. The largest of these, about 4,000 pounds weight, were taken out, and the greater part turned back to allow the carp to grow larger.

EEL CULTURE.

Years ago Director Haack, of Hüningen, got a great quantity of eel fry from French rivers, and in the spring sent them by mail to all parts of Germany. From the planting of these fry in the lakes and rivers very good results have followed, in several cases within my own knowledge. This fall a spring pool, unconnected with any other water, and without outlet, was fished. Four eels were taken; they were one and three-fourths years old, and the poorest weighed one and one-quarter pounds. In the spring of 1882 a few specimens of eel fry had been placed here to observe the growth.

On the profitableness of eel culture, Mr. Nehrkorn-Riddagshausen (Braunschweig) says that a short time ago he had a small pond fished out that he had a few years before stocked with 500 young eels, and hat about 250 young eels were found, ranging from one-fourths to one kilogram (.55 to 2.20 pounds), some specimens weighing even one and one-half kilograms (3.3 pounds). The cost of the above 500 eels, post paid, amounted to 6 marks ($1.92); the proceeds of the sale of 200 eels was 200 marks ($64); some 50 partly-grown eels transferred to another pond had, besides, a value of 20 marks ($6.40). Such success should induce owners of stagnant fish waters to make a trial of eel culture.

Of special interest is the attempt to introduce the eels to the waters of the Danube, where, as is well known, this fish does not occur. As the Bavarian Fischerei Zeitung, No. 13, reports at Grossomehring, near Ingolstadt, about the middle of June, in the old bed of the Danube, there was taken an eel 60 centimeters (23.7 inches) long, weighing 500 grams (18 ounces), which was very lively and well fed.

53.—NOTES ON COD, SHRIMP, ETC., AT COLD SPRING HARBOR.

By FRED MATHER.

[From a letter to Prof. S. F. Baird.]

At high tide the tom-cod (*microgadus*) run up to the hatchery and eat the fresh-water shrimp, *gammarus* (?). I have a fyke-net set, and took ten of them to-day, and all had their stomachs crowded with this food. At high tide the water near the hatchery is only of a density of 1.02 to 1.05, and I have there taken menhaden, bluefish, tom-cod, *Murænoides gunnellus* (L.) Gill, and a species of *Pleuronectes* which I have not worked out. I see that the *M. gunnellus*, tom-cod, and the flat fish will soon spawn. Have only taken one *gunnellus;* kept it a week in a jar of salt water, and it died to-day. Its eggs were large and within a few days of ripening. It had only one ovary.

COLD SPRING HARBOR, N. Y., *October* 14, 1883.

54.—CARP CAUGHT IN OGEECHEE RIVER.

By GEORGE A. HUDSON.

[From a letter to Prof. S. F. Baird.]

I sent to the National Museum to-day some small fish which were caught in the fresh water of the Ogeechee River, in a trap which had been set for herring, rockfish, &c. Being the first of the kind ever seen in this section, they are sent to you for identification.

SAVANNAH, GA., *April* 14, 1884.

NOTE.—The fish sent by Mr. Hudson arrived April 16, 1884 (N. M. Acc., No. 14280), and proved to be five carp of about one pound weight.—C. W. S.

55.—CARP APPEAR FEBRUARY 7, TAKE THE HOOK, AND ARE EXCELLENT EATING.

By B. D. PALMER.

Being under the impression that, in this latitude, carp spent the entire winter in the mud in a state of torpor, I was greatly surprised by seeing one spring out of the water in my pond last Thursday, February 7, within thirty-six hours of the disappearance of the ice which had covered the pond for six weeks preceding. I tried my hook and line and caught five. Every day since, they have come to the surface for bread, although one day the mercury was as low as 38°. To-day they took the hook as freely as in summer; and I caught 30—ranging from 5 to 13 inches in length. Nearly all were scale-carp. They were particularly good, being firm and delicate; much better than those caught in the summer. This size are much better as pan-fish than the very large fish.

SANDY SPRING, MD., *February* 13, 1884.

56.—COMISION DE PISCICULTURA DE LA REPUBLICA MEXICANA.

By ALFRED V. LA MOTTE,

[Comisionado General.]

With regard to the foundation of the Mexican Fish Commission, I would state that last year the Government of Mexico opened communication with me relative to the feasibility of restocking its waters with good fish. This culminated in my going to Mexico and making an examination of the principal waters of the central portion of the republic in connection with other investigations which they wished made. On the receipt and acceptance of the reports, the Government tendered to me the honor of commissioner of fisheries for the republic, which I accepted. I proceeded to locate a national hatchery at the springs of Chimealapan, in the State of Mexico, and carp-breeding ponds in the park of Chapultepec, as I believe this latter fish will thrive well in most of the small lakes. On my return to Mexico, a Board of State Commissioners will be appointed for each State, and will proceed as rapidly as circumstances will permit toward stocking the rivers and inland waters. After completing my inspection of the rivers and lakes this year, I can form a more correct idea of my future movements, but so far as my present knowledge goes, I can see no reason why fish should not abound in the waters of Mexico.

GLEN ELLEN, CAL., *April* 8, 1884.

57.—NOTES ON FISHING PRODUCTS EXPORTED FROM SAN FRANCISCO, CAL., DURING THE YEAR 1883.*

By W. H. DALL.

The following notes and tables give the result of a laborious search through the detailed exportations cited in the Market Review of San Francisco, upon which the accuracy of the figures depends, except cept in the case of exports by rail, which in the railroad tables are given in pounds of freight without valuation, so that the value has been arrived at by assigning an assumed value derived from the average value of similar material exported by sea. This may be a little too high, as the weight of cases, &c., are probably included in the returns, but there is no doubt that the valuation of the shipments by sea (except in the matter of a few standard articles like canned salmon) is greatly underestimated.

These notes and tables give information which has a certain value, even if merely approximate in precision, and which cannot be found elsewhere. It was thought, therefore, it might be acceptable for the Fish Commission Bulletin.

Table 1 shows the exportation by sea and rail of invertebrate products. No absolute form being required for exports the classification is confused, but is given just as furnished by shippers.

The dry shrimp meats are prepared by the Chinese in California, winnowed of their shells (which go to China as a valuable fertilizer), and are sent not only to China but wherever large numbers of Chinese are found—as Australia, British Columbia, Hawaiian Islands, and Peru. The value of this apparently almost worthless fishery carried on by a few miserable but industrious barbarians is certainly surprising.

The column "Haliotis" includes not only the shells which alone are shipped to England, but the dried meats of *Haliotis rufescens*, which are prepared by fermenting under a bed of horse manure and then desiccated in the sun. These last form the bulk of the exports to China and Chinese colonists in other countries. Under the head of "pearl shell" are included only the shells of the "pearl oyster" fished in the Gulf of California and brought thence to San Francisco for transportation to Europe. The column of "shells unspecified" includes both Haliotis and pearl-oyster products as well as a small proportion of shells used for "shell work" or scientific purposes. There is unfortunately no means of classifying the different sorts of exported shell.

The shipments by the Southern Pacific Railway include chiefly goods en route for Europe via New Orleans. Those by the Central Pacific probably go to Europe via New York, excepting the small quantity

*Read before the Biological Society of Washington, April 5, 1884.

used by manufacturers in the United States. Good quality of pearl shell, especially of the selected Haliotis, is now cited at over a dollar a pound for fine buttons and pearl jewelry. Only the Haliotis shell is the product of our own shores, the others being from Mexican waters.

TABLE 1.—*Invertebrate products shipped by sea and rail from San Francisco, Cal., in* 1883.

Shipped to—	Dry shrimps.	Shrimp shells.	Haliotis.	Pearl shell.	Shells unspecified.	Value.
Australia	$2,829		$18			$2,847
British Columbia	168					168
China	73,785	$26,288	18,780	$9,885	$3,665	122,518
England			6,462		63,255	79,602
France					1,260	1,260
Hawaii	4,799		845			5,644
New York					1,818	1,818
New Zealand					200	200
Panama	79					79
Peru	1,231					1,231
Central Pacific Railroad					76,700	76,700
Southern Pacific Railroad					278,187	278,187
Total values	82,891	26,288	26,105	9,885	425,085	570,254

Table 2 shows the exports of certain sorts of fishery products by rail and sea, and the above notes in regard to destination of railway freight apply also to this table. The same difficulties of classification also appear here.

Fish unspecified, canned fish, and dry fish are chiefly cod products; canned salmon seems to be always so specified. "Fish bones" go to China for manure. "Fish wings" are the lateral expansions of the skate, which make a gelatinous soup; "fish sinews" are a kind of isinglass; "Chinese goods" are the male organs of the sea-lion, dried, used as an aphrodisiac; the galls are used in cleaning silk; all these are exclusively prepared and shipped by and for the Chinese.

Much of the oil shipped was unspecified; the amount of "fish oil" given is only that specified to be such; the total was perhaps twice as much more. Of walrus ivory 31,120 pounds were received in 1883. It is now extremely high, quoted at $4 and $4.50 in New York, though the valuation of the shipping list is only $1 per pound. Two hundred and eighty barrels of walrus oil were taken.

Of whale products not included in the table there were 1,208 barrels of sperm oil, 11,917 barrels of whale oil, and 162,244 pounds of whalebone obtained by the fleet of 1883. Oil works for refining the catch have been recently established in San Francisco, and but little of the oil will hereafter come east.

The canned salmon statistics represent the movement at the port but not the total catch, much being shipped from the Columbia River and Victoria. Of 155,000 cases of Alaska salmon canned in 1883 only 36,000 were shipped from San Francisco. The movement in canned salmon will be largely decreased hereafter, as the Northern Pacific Railway will now ship and control the movement of all salmon bound east by rail from the Columbia, leaving to San Francisco and the two other roads only the catch of the Sacramento River and a few small streams of the California coast. The mackerel of the table is all Eastern mackerel; most of the herring is Eastern. The sardines are mostly American, which are rapidly driving out the imported article, of which only about 10,000 cases reached California from all sources in 1883 against over 13,530 cases reported in 1882.

TABLE 2.—*Goods shipped by sea and rail from San Francisco, Cal., in 1883.*

Goods manifested for.	Asia.	Australasia.	British America.	Central America.	China.	England.
Fish, unspecified ....pkgs..	26	1,321	319	1,257	143	....
Fish, canned ....cases..	156	1,123	836	126	216	....
Codfish ....pkgs..	2	1,195	336	125	513	....
Dry fish, general ....do ..	18	....	198	....	2,548	....
Fish bones ....do...	....	....	....	....	99	....
Fish wings ....do...	....	....	....	....	4	....
Fish sinews ....do...	....	....	....	12	2	....
Herring, dry or wet .... do...	23	2,500	....	6	18	....
Mackerel ....kits..	14	....	27	13	18	....
Sardines....................cases..	....	30	145	237	....	....
Salmon:						
Canned..................do...	4,035	74,070	....	1,003	1,530	65,059
Pickled..................bbls..	....	3,083	....	....	....	....
Smoked..................pkgs..	....	3	....	....	....	....
Fish oil......................bbls..	....	1,425	....	....	....	....
Chinese goods ....pkgs..	....	....	....	....	75	....
Sea lion galls................do...	....	....	....	....	1	....
Walrus ivory............pounds ..	....	....	....	....	1,250	....
Sealskins ....casks..	....	....	....	....	.....	9
Total packages or pounds ..	4,274	84,750	1,361	2,779	5,168	65,068
Total values exported	$22,181	396,641	5,599	47,378	49,994	286,966

Goods manifested for.	Hawaii.	Oceanica.	New York.	Central Pacific Railroad.	Southern Pacific Railroad.	Values.
				Pounds.	*Pounds.*	
Fish, unspecified ....pkgs..	2,361	288	....	20,390	1,140	$60,864
Fish.......... ....cases..	....	242	....	....	....	11,278
Codfish .... pkgs ..	1,654	61	....	....	....	10,690
Dry fish, general .... do ..	179	....	....	....	....	36,717
Fish bones .... do...	....	....	....	....	....	3,838
Fish wings ....do...	....	....	....	....	....	350
Fish sinews ....do ..	....	....	....	....	....	277
Herring, dry or wet......... do ..	169	....	....	....	....	8,753
Mackerel .... kits..	....	13	....	....	....	343
Sardines...................cases..	....	93	....	....	....	4,017
Salmon:						
Canned..................do ..	1,125	4,327	2	10,024,840	13,267,375	2,320,624
Pickled..................bbls..	....	1,062	....	1,933,640	176,190	76,431
Smoked..................pkgs..	....	....	....	....	....	50
Fish oil .... bbls..	250	....	....	....	....	1,792
Chinese goods ....pkgs..	....	....	....	....	....	409
Sea lion galls ....do ..	....	....	....	....	....	77
Walrus ivory............pounds..	....	....	2,960	....	....	4,210
Sealskins ....casks..	....	....	....	430,540	659,480	802,846
Total packages or pounds ..	5,738	6,086	....	12,409,410	14,104,185	....
Total values exported	$31,154	34,445	2,974	1,060,530	1,405,804	3,343,666

Over 100,000 fur-seal skins from American and Russian waters were shipped by rail in casks, all of them intended for Europe. Excluding whale products, the exportation of fishery products from San Francisco in 1883 amounted to not less than $4,000,000, the foremost items being salmon, fur-seal skins, pearl shell of various sorts, cod, and shrimp products, in the order of their value.

In the table Asia includes Eastern Siberia, Japan, Batavia, and Manila. Australasia includes Australia and New Zealand; Central America includes also Panama, Mexico, and some small shipments to Peru and Brazil. Oceanica embraces Apia, Bonham Islands, Borabora, Fiji, and Tahiti.

There was hardly any specified movement in shell-fish, most of the excellent canned products being consumed at home or as ship stores. A single shipment of six cases oysters to Mexico is noted.

The total exports of the port of San Francisco by sea in 1883 were $47,649,172; the total exports of fishery products not including whale products were about $4,000,000, or nearly 9 per cent. of the total. It is probable that no other port of the United States can show a greater relative value of exported products due to the fishing industries.

WASHINGTON, D. C., *March* 5, 1884.

58.—IN REGARD TO THE "SEA-SERPENT" OF LITERATURE.

By Prof. SAMUEL GARMAN.

[From a letter to Prof. S. F. Baird.]

I have no idea that we shall ever find a huge unknown lung-breathing Saurian as a foundation for the stories. The existence of types of extinct Sauria of various geological periods is possible but improbable. The geological record is very incomplete. In the main it is the shoal water or shore and surface forms of the sea, and the land forms, that have been recorded by geology. And this record has become indistinct or entirely obliterated by changes in the rocks in the early formation. The earliest forms were marine and the depths were the original centers of divergence. The earliest forms of animals in regard to solidity were like those now living in great depths, *i. e.*, they were gelatinous, flabby, or loose in structure, and not bony and hard or such as would be preserved in the rocks. In consequence, it seems as if our hopes of solutions of problems of origin and divergence, of knowledge of the beginning itself were best placed on the results of the study of animals in conditions most similar to those of the beginning, on the results of deep-sea researches. Within a few years our imperfect apparatus has secured from great depths a host of strange creatures, but none of the largest or strongest. In fact, we have had scarcely more than mere suggestions of what may exist, and, in view of them, should not be surprised at anything that may come up. If there is a "sea-serpent" yet unknown to scientists, it is likely to prove a deep-sea fish or Selachian.

CAMBRIDGE, MASS., *January*, 22, 1884.

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59.—NOTES ON THE COD GILL-NET FISHERIES OF GLOUCESTER, MASS., 1883-'84.

By S. J. MARTIN.

[From letters to Prof. S. F. Baird.]

Captain Gill, of the boat Gracie, had four cod-nets given him that were worn out in catching codfish last winter. He set them, together with two new ones, and the first night he caught 5,500 pounds of pollock and 400 pounds of large codfish. The pollock averaged 21½ pounds apiece, while those caught on hand-lines average 13 pounds apiece. The pollock caught in nets are all female fish full of spawn. There are three boats which have nets set. They catch three times as much pollock and three times as much codfish as they do on hand-lines. Pollock and cod have been scarce this fall. Forty sail of small craft which were out two days on the pollock grounds came in with 2,000 pounds. There will be more cod gill-nets used this winter than there have been before since they began to be used. There are no sperling this fall, so that most of the boats will use nets.

GLOUCESTER, MASS., *October* 28, 1883.

There are five boats fishing with the cod gill-nets. They are doing first rate in catching pollock and cod.

The schooner S. W. Craig, of Portland, one of the high-line pollock catchers, was in here last Wednesday. I went aboard to see the skipper and gain what information I could concerning the pollock fishery. The conversation ran thus: "How do you find the pollock, captain?" "Pollock! there ain't none. I have been out two days with 12 men and got 2,000 pounds; that is bad enough." I said: "They are catching a good many pollock in nets. Do you see that small boat coming? That is Horace Wiley's; he caught 3,000 pounds night before last, and caught as many last night. He has got three nets." "Where does he catch them?" "Off on a spot of rocks called Brown's." The captain said: "I will get some spirling to-night, and go off where they have got their nets set. We will give them fits, if we can get some new spirling." I answered: "Cap., it is of no use to go where they have got their nets set. If you do you will get no fish." "That be hanged for a yarn. I think that you can catch fish with spirling as well as you can with nets." I said: "No, sir; you can't do it."

The next day he went out with some new spirling to where Wiley was hauling his nets. (The latter had picked out a dory full of cod and pollock.) He let go his anchor close to the nets. He ordered, "All hands over lines," and was going to give them fits. He lay there two hours and did not catch a fish.

I was aboard yesterday again. I said, "Captain, how did they bite where the nets were?" "That beats all," he replied; "we never felt a bite. I am going to Boston to order 25 nets."

GLOUCESTER, MASS., *October* 31, 1883.

A month ago there was one boat using the cod gill-nets; to-day 8 boats have them. The boat Gracie started four weeks ago to-morrow. Her three men made $145 apiece. The rest of this week there will be 16 boats using cod gill-nets. They have each got 15 nets 50 fathoms long and 2½ fathoms deep, with a 9½-inch mesh. There is a prospect of a good winter's work with nets. The first boat that started has landed 15,000 pounds of large cod and 30,000 pounds of large pollock. Some of the hand-line fishermen have not caught as much as 10,000 pounds in the same time. There is but one boat which has nets set in Ipswich Bay. She caught 6,000 pounds with five nets. All the shore fishing will be done with nets this winter, as the sperling are scarce. The prospect is good for a large school of fish this winter.

GLOUCESTER, MASS., *November* 11, 1883.

There have been landed this week 120,000 pounds of large cod, and 80,000 pounds of large pollock; 35,000 pounds have been landed at Rockport by two boats. Six weeks ago there was one boat using nets; to-day there are 26 boats, with an average of 15 nets each; that is, 390 nets in all, or 19,500 fathoms of netting. All that is set to-night in Boston Bay. There are two in Ipswich Bay. The schooner Onward went out to-day with 35 nets to set in Ipswich Bay. The schooner Morrill Boy hauled her nets for the first time last Sunday. She has landed 43,000 pounds of cod and pollock since then, and stocked $1,066.75. There were seven men in the crew, and they made $124 each, which is not a bad sum to take in one week. Two days out of the week they could not haul their nets, as there was too much wind. Last Wednesday they made $50 to a man. The hand-line fishermen are not doing anything, bait is so scarce.

GLOUCESTER, MASS., *November* 18, 1883.

During the past six nights 487,000 pounds of fish have been caught in Boston Bay with cod gill-nets and landed in Gloucester. Four boats fishing in Ipswich Bay landed 55,000 pounds during the same period. There are 35 vessels now using cod gill-nets, which number, I think, will increase to 40 by the 10th of December. Boats fishing with hand-lines catch only a few small fish. Bait is high; spirling brings 50 cents a bucket. About all the fish caught in-shore is by nets. If they could be knit fast enough the whole fleet would have nets. Fishermen buy twine and the women knit the nets. Everybody is at work. Some boats have been waiting four days for the glass floats. A great winter's work is anticipated.

GLOUCESTER, MASS., *November* 25, 1883.

The amount of fish landed during the month of November was as follows: Fish caught in cod gill-nets, 1,330,000 pounds codfish, 174,000 pounds pollock. Fish caught in cod gill-nets landed at Rockport and Portsmouth during the month of November, 183,000 pounds. Cod nets take the cake.

GLOUCESTER, MASS., *December* 3, 1883.

Last week the cod gill-nets landed at Gloucester 590,000 pounds of fish. There was also landed at Portsmouth and Rockport 84,000 pounds which had been caught in Ipswich Bay by 5 boats. The fish landed in Gloucester were caught in Boston Bay by 33 boats. The gill-nets catch not only cod but pollock, puffers, monkfish, and dogfish. The three puffers caught last week all contained young. The codfish average 25 pounds apiece and are mostly sold to split at 1¾ cents a pound. The cod gill-nets cost $12 apiece last winter, and this winter $14.25 apiece. We much need something to keep the nets from rotting. Some boats having used their nets about five weeks now have to get new ones; the nets are 50 fathoms only. If the nets rot as fast all the winter as they do now, each man will require three nets before April 1. These will cost $43 without the floats. The floats cost 22 cents apiece, which is too much. The catch of fish varies very much. In three cases boats caught 2,000 pounds of fish in one night, and on the next night caught 8,000 pounds in the same place. Most of the cod are full of ripe spawn.

GLOUCESTER, MASS., *December* 9, 1883.

During the past week there have been landed at Gloucester 430,000 pounds of fish, at Rockport and Portsmouth 81,000 pounds, and at Swampscot 48,000 pounds. These fish were all taken with the cod gill-nets. On one day it was impossible to haul their nets. All the nets have been in use five weeks, and are so rotten that new ones have been ordered. Forty-eight vessels are using nets this week. There are five boats from Swampscot using nets, having failed to do anything with hand lines. The business of the glass-blowers and the net-makers is good.

GLOUCESTER, MASS., *December* 16, 1883.

During the past week there have been landed at Gloucester 186,000 pounds of codfish, at Rockport 48,000 pounds, and at Swampscot 34,000 pounds, all taken in the cod gill-nets. During three nights of the week the men were unable to haul their nets. On Thursday morning when they hauled their nets some boats found they had taken 4,000 pounds of fish. On Friday morning not one fish was caught, although the nets were set in the same place. Some of the boats then shifted their nets

3 miles off shore upon a soft bottom. Here they caught from 3,000 to 4,000 pounds. Most of the large boats will go to Ipswich Bay next week. There are 54 boats using cod gill-nets. There are 5 dories with 3 gill-nets each from Salisbury. The weather has been very bad for cod gill-netting during the week.

GLOUCESTER, MASS., *December* 23, 1883.

The amount of fish landed at Gloucester during the month of December was as follows: Fish caught in the cod gill-nets, 1,120,000 pounds. Fish caught in cod gill-nets landed at other ports during the month of December, 300,000 pounds.

GLOUCESTER, MASS., *January* 1, 1884.

All the vessels using the cod gill-nets are in Ipswich Bay. During the last ten days the weather has not been favorable for fishing. Sixty thousand pounds were landed at Portsmouth last week. In Ipswich Bay the fish are in one place. Four hundred nets are set in a place one-half mile wide by one-half mile long. The nets are across one another. The vessels have set their nets all over the bay, but find only a few scattering fish except in that one spot. There they get good hauls every morning, when there is a chance to haul the nets. The three vessels that have been fishing on the Georges have set their nets in Ipswich Bay. One vessel has 40 nets. Six boats have taken up their nets. The boats are too small to fish in Ipswich Bay, and they have put their nets on larger vessels. I think we shall have a good report next week. The fishermen think strangely of the fish being in one place. They can find nothing on the bottom to keep them alive.

GLOUCESTER, MASS., *January* 7, 1884.

In the gale of January 4, the vessels using the cod gill-nets met with a great loss. They lost 35 nets and had a great many badly torn. No fish were caught for four days after the storm. The last three days the nets have done well. They have landed 150,000 pounds. There are 7 boats home preparing their nets. Fifty-two sails are using the cod gill-nets. The fish caught in the nets sell for 4½ cents per pound. I think the nets will be used till the 1st of April. The fish are large, averaging 20 pounds. They are half spawning fish.

GLOUCESTER, MASS., *January* 15, 1884.

Vessels using cod gill-nets have done well the past week, except two days when the nets could not be hauled on account of driving snowstorm. During the week 409,000 pounds were landed. The price has been high, 4½ cents a pound the whole week. The netters never get any fish the day before storms and have learned to prophesy their coming.

GLOUCESTER, MASS., *January* 20, 1884.

Fish landed at Gloucester during the month of January: Shore fisheries, with cod gill-nets, 843,000 pounds.

GLOUCESTER, MASS., *February* 1, 1884.

Vessels using cod gill-nets have not done as well the past week as previously. In Ipswich Bay there was a different school of fish. Their average weight was 10 pounds. The vessels are catching them on trawls. The netters are preparing for the February school. They have done a good winter's work and still have two months in which to use their nets. Fifty-two vessels are using the cod gill-nets, and I think 80 sail of vessels will use them next winter. Quite a number of the George's Bank fleet will also use nets next winter.

GLOUCESTER, MASS., *February* 3, 1884.

There were 305,000 pounds of codfish brought in by the vessels using cod gill-nets during the past week.

GLOUCESTER, MASS., *February* 18, 1884.

During the past week vessels using the cod gill-nets landed 340,000 pounds of large cod at Rockport and Portsmouth. Some of the vessels using cod gill-nets have hauled up for the winter, three of them having used up their nets.

GLOUCESTER, MASS., *February* 24, 1884.

There were 1,803,000 pounds of cod taken by the gill-nets in Ipswich Bay during the month of February. There were 48 boats engaged in the cod gill-net fishery, most of which landed their catch at Portsmouth and Rockport. The gill-net fishing will continue in Ipswich Bay during this month.

GLOUCESTER, MASS., *March* 3, 1884.

The cod gill-netters have not done much this week on account of the rough weather.

GLOUCESTER, MASS., *March* 11, 1884.

The men fishing with cod gill-nets in Ipswich Bay have caught nothing to speak of for ten days. The boats, 42 in number, often catch as few as 30,000 pounds in one night. March 13 they caught 75,000 pounds; March 14, the same. The price is low, 1½ cents a pound, to-day.

GLOUCESTER, MASS., *March* 17, 1884.

The vessels using cod gill-nets did well last week, having landed 520,000 pounds. The schooner Morrill Boy took 7,000 pounds in two nights in Ipswich Bay. These were mixed fish, some very large and some medium size. These were half male and half female.

GLOUCESTER, MASS., *March* 23, 1884.

The cod gill-net fishermen have also done well. Since last Monday they have landed 483,000 pounds of large cod. It has been a good winter for the cod gill-netters. At one time there were 52 vessels using nets. At present there are but 18.

GLOUCESTER, MASS., *March* 30, 1884.

The total amount of fish landed from the gill-nets thus far this season has been as follows:

	Pounds.
In November, 1883	1,987,000
In December, 1883	1,120,000
In January, 1884	843,000
In February, 1884	1,803,000
In March, 1884	1,137,000
Total	6,890,000

GLOUCESTER, MASS., *April* 3, 1884.

60.—STATEMENT OF THE CATCH OF THE SEVERAL COMPANIES ENGAGED IN THE SALMON FISHERIES IN KADIAK DISTRICT, ALASKA TERRITORY, DURING THE YEAR 1883.

By WM. J. FISHER.

KARLUK FISHING AND PACKING COMPANY AT KARLUK.

RED SALMON.—3,250 barrels, and 13,500 cases of 48 pounds each. Vessels and men employed: Schooner Marion, 235 tons and 8 men; schooner Callistoga, 29 tons and 4 men; natives, 50; Chinese, 60; whites, 16.

ALASKA COMMERCIAL COMPANY.

Kenai Station.

KING SALMON.—250 barrels. 1 white and 8 natives.

Aohiok Station.

RED SALMON.—252 barrels. Schooner Olga, 20 tons; 3 whites and 12 natives.

Seal Bay Station.

RED SALMON.—300 barrels. Schooner Three Brothers, 20 tons; 4 whites and 4 natives.

Alexandrowski Station.

RED SALMON.—500 barrels; herring, 50 barrels; schooner Mary, 10 tons, 10 men.

CUTTING & CO.

Kassilor Cannery.

SALMON.—14,862 cases of 48 pounds and fifty barrels. Bark Courier, 800 tons; schooner Manitee, 35 tons; 26 whites, 25 natives, 60 Chinese.

SAINT PAUL, KADIAK ISLAND, ALASKA, *December* 10, 1883.

61.—SOME NOTES ON THE MULLET FISHERIES.

By BARNET PHILLIPS.

MULLET FISHING ON THE WEST COAST OF FLORIDA, AT CEDAR KEYS.

The season for mullet fishing in the neighborhood of Cedar Keys begins about the last of November and continues until the first ten days of February, the best months being December and January.

The fish will weigh from 2 to 3 pounds; occasionally a fish of 7 pounds has been taken. The gill-net, seine-net, and cast-net are all used. The gill-net is 150 yards long, 8 to 10 feet deep, with a mesh of $1\frac{5}{8}$ inches, and is worked by one man in a boat. One thousand fish is considered a good day's work. The seine is from 60 to 90 fathoms long, 22 feet deep, size of mesh $1\frac{5}{8}$ inches, and it is worked with 8 men in a boat; a good day's take is 10,000 fish, although often as many as 22,000 are taken. The cast-net, a circular net, held in the mouth and thrown out by a movement of the arm, will take 100 fish a day, though 500 fish are not uncommon.

The fish are all shipped to Cedar Keys. The gangs working seines are established along the coast, as far down as Tampa Bay, and small schooners of from 10 to 16 tons carry the mullet from the fishing camps.

At Cedar Keys the fresh fish find a ready market, and are shipped through Florida to Georgia, and to South Carolina, in ice. A great many fish are salted, and the roes are cured. The method of preparing the roe is as follows: The roes are taken out carefully, and a peck of salt is used to the half-barrel of roe, and mixed with it. The salt and roe remain together for 6 hours. They are then taken out, strained, and placed on planks, and put in the sun to dry. The roes are frequently turned. When dried, so as to be still somewhat soft, another plank is put on top of them, and they are pressed a little, so as to be flat. Care has to be taken that they do not become too hard.* They find a ready market all over the country.

The fish are split, cleansed, and dry Liverpool salt is put on them; they are then piled up or "banked" for 12 hours. A pickle is made, strong enough to float a potato, which is then put on the fish, and they are shipped in barrels of 200 pounds.

Fresh fish are worth $2\frac{1}{2}$ cents each. Roes alone without the fish 1 cent.

The seines cost $125. When net and boat are furnished, the owner gets one third of the gross sales of fish.

Clear Water seems to be the limit of the mullet fisheries, from Cedar Keys. The hands are principally white, one-eighth being colored, but

* In Greece, where mullet are caught, the roes are preserved by the same process, only that when dried they are dipped in melted beeswax.

there are more of the latter coming into the business. Mullet fishing is largely on the increase.

In shipping the fish from the fishing station, ice is used, which is taken from Cedar Keys.

OFF CHARLOTTE HARBOR, FLORIDA, *January* 29, 1884.

MULLET FISHERY AT LA COSTA IN CHARLOTTE HARBOR.

This fishing station consists of 23 men, mostly Spaniards, who came from Key West. Their catch goes to Cuba. The outfit is made up at Key West. The seine is 90 fathoms long and 20 feet deep. The fisheries commence in August, and close about the first week in February. The mullet are split down the belly, the eyes cut out, and rough-salted, and are shipped in this condition to Havana. The roes are prepared as at Cedar Keys. Last year the yield at this place was 1,500 quintals, but for this season the catch has been very small, the fishermen believing that the unusual cold weather has kept back the fish. The men work on shares, the owner of boat and net taking one-third. The fish are worth in Cuba $3 a quintal and the roes $6. The fish begin spawning in December.

There is another fishing ranch for mullet on the same island, and one at Punta Rassa. All of them have done a poor business this seasea. The general outfit for boats, nets, stores, &c., cost $3,000.

CHARLOTTE HARBOR, *January* 30, 1884.

HABITS OF THE MULLET, CHARLOTTE HARBOR, FLORIDA.

Mullet are found all the year round, but the season for catching begins in August. Then they are very fat, but roes not yet well developed. At the close of November and during December they are the fullest with roe. There are mullet which remain in Charlotte Harbor all the year round; they are small, and will average from three-quarters of a pound to one pound. What are called ocean mullet come in November and December. Generally the wind is from the southwest when they enter the harbor, or just before a norther is coming. The fish then will average from 1½ to 2 pounds, with occasional fish of from 3 to 5 pounds. Small or young mullet are not found in Charlotte Harbor—so says Mr. T. A. Gibney. My informant, however, has found exceedingly small mullet, evidently the young fish, at Saint Joseph's Bay, Calhoun County, Florida. They were so small that many hundreds of them could be taken out of the water with the hands. It is generally the opinion of the fishermen that the farther south the mullet is caught the larger it is, and that off Cape Romano the biggest fish are taken.

CHARLOTTE HARBOR, OFF JOSEPHA KEY, *January* 31, 1884.

MULLET FISHING IN MONROE COUNTY, FLORIDA, AT PUNTA RASSA, AND SANIBEL ISLAND.

Punta Rassa is the southern extremity of Charlotte Harbor. There is a mullet fishery here, and one on the island opposite, Sanibel Island. The gangs, called fishing ranches, consist of 13 men each, mostly Spaniards, with two boats for each company. Nets are used. The time of catching is about the same as at other points in Charlotte Harbor, though the fish are plentiful rather later, and remain somewhat longer. This business was commenced in this portion of Florida in 1873 by some New England fishermen, but the Spanish fishermen have taken their place. At present the postmaster, Mr. G. R. Shultz, believes fish have diminished in quantity, although there does not seem to be any certainty about this. The fish are prepared as at other points in Charlotte Harbor, rough-salted, and shipped to Cuba. The business seems to have been unprofitable for this season, not because fish were scarce, but on account of low prices. One of the gangs will return here about the 15th of February for what they call deep fish, such as sheepshead, redfish (*Liostomus philadelphicus*), drum, and snook; this is the crevalle (*Carangus hippos*). These fish are rough-salted and sent to Cuba. Outfits come from Key West.

PUNTA RASSA, *February* 1, 1884.

MULLET FISHERIES AT CLEAR WATER, HILLSBOROUGH COUNTY, FLORIDA.

This fishery is a fairly important one, being the nearest to Cedar Keys, the catch being forwarded to Georgia, South Carolina, and distributed in the surrounding country. In 1883–'84 there were five gangs composed of some 46 men. They used for the most part seines, and occasionally gill-nets. They begin fishing about the last of September, and their work ends on the 1st of February. The gangs are entirely composed of natives. They employ some eight small vessels of from 10 to 28 tons, which carry their catch to Cedar Keys. The fish are kept on ice during transportation. The 10-ton smacks will carry some 12,000 mullet, and the smack of 28 tons 50,000 fish. The men work on shares. The outfit comes from Cedar Keys. The business has been carried on with good success for about four years. At Cedar Keys the fish bring 2½ cents each, the average weight being 1½ pounds. Some small business is done in smoking the mullet at Point Pinales. There has been no diminution in the catch for the last five years. With an idea of finding out how much oil these fish would produce, I was informed that 15 mullet would give about one quart of oil. The method of bringing the fish on ice to Cedar Keys seemed to be a very careless one, proper precaution not being taken to preserve the ice. At Cedar Keys there is an ice-house, the ice coming from Maine.

CEDAR KEYS, *February* 17, 1884.

62.—ACCLIMATIZATION OF SALMO QUINNAT IN FRANCE.

By Prof. VALERY-MAYOT.

[From a letter to Raveret-Wattel, secretary of the National Acclimatization Society.]

I deem it proper to bring to your knowledge some details regarding the results of the acclimatization of the California salmon which you had intrusted to my care during the three years, 1879, 1880, and 1881.

As you will remember, I planted the first and third hatch of salmon in our little river Lez, near its source, whilst the second hatch was planted in the river Hérault, near the city of Ganges, in the heart of the Cevennes Mountains.

The catch of which I have already informed you comprised fish one and two years old, of normal size, some of which were caught in the neighborhood of Ganges, some kilometers above the city and above all the weirs, and others near Montpellier, below the last great weir of the river Lez. As far as I know, no fish were caught in 1883, neither in the Lez nor in the Hérault; but I must state the interesting fact, that at three different times there were caught in the river Aude, whose mouth is near Narbonne, salmon measuring 25 to 30 centimeters in length.

It is, therefore, probable that the salmon from the Lez and the Hérault, finding it very difficult to clear the numerous weirs which cross these rivers, to a certain number ascended the river Aude, half of whose course lies in the mountainous region of Corbières, and which has not so many weirs.

Do you not think it would be useful to make new attempts to acclimatize salmon higher up the river Aude—at Quillan, for instance? I am entirely at your service, if you desire that some such experiment should be made.

NATIONAL SCHOOL OF AGRICULTURE,
Montpellier, November 11, 1883.

63.—DEPREDATIONS TO OYSTER BEDS BY STAR-FISH.

[From the Evening Register.]

It was reported yesterday that between November 1, 1883, and the close of navigation in December, there were caught on oyster-beds adjoining the Bridgeport public beds about 15,000 bushels of star-fish. Since October 1 they have destroyed over 900 acres. From six to ten steamers have been catching star-fish during the past six months, at an expense of $5,000.

NEW HAVEN, CONN., *April* 5, 1884.

64.—HOW TO COOK CARP AND TENCH.

[From Chambers' Journal.]

Carp, after being kept a few days alive in water free from the vegetable substances upon which they feed, become a luscious and nutritious dish even cooked *au naturel;* but with sorrell sauce or a squeeze of lemon, are converted into a *recherché entrée.* The false tongue of the carp has a European reputation as a delicacy. There are special recipes for dressing carp, which from their expensive character are not appropriate here. With the economical Germans, however, they are peculiar favorites, and from them we have the following method of making three excellent dishes—a soup, a stew, and a fry, with a single carp of about 3 or 4 pounds weight, of each of which we can speak highly from personal experience.

SOUP.—They take a live carp, either hard or soft roed, and killing it by a blow on the head, bleed it in a stew-pan, then scale it well, taking out and carefully preserving the entrails without breaking the gall, which, with the parts adjoining, must be immediately separated from the rest, and thrown aside, as its slightest contact with the rest of the dish would injuriously flavor the whole. Every other part of the carp is convertible into excellent food. Having opened the maw, and thoroughly cleaned it, the roe is cut into pieces, and put in with all the rest of the entrails for the soup of the first dish. This soup is either made with the addition of gravy or strong meat broth, accompanied by herbs and spices, well seasoned, and thickened with flour; or, when intended as a meager dish, with that of a strong broth of any other kind passed through the sieve, a bundle of sweet herbs, and a seasoning of fine spices, salt, &c.

STEW.—For the second dish, or stew, having slit up the carp on one side of the backbone, through the head, and quite down to the tail, cut off the head with a good shoulder to it; take the largest half of the body, containing the backbone, and divide it into three pieces, which, with its portion of the head, are to be put with the blood in the stew-pan, where they are dressed in any of the numerous ways of stewing fish, by putting in three or four glasses of ale in lieu of wine, and a little grated gingerbread, and sometimes only a small quantity of vinegar, adding sweet herbs, spices, and seasoning to palate. When serving up this dish, it is not unusual to add a little lemon or lime juice.

FRIED.—For the fry, or third dish, the remaining portion of the fish, divided as for a stew, is well dredged with flour, and fried brown and crisp in oil or clarified butter. Thus, particularly if a few savory forcemeat balls, composed in the usual manner with the fish which makes the broth or gravy, be boiled in the soup, there is a dish not far removed from the richest turtle soup; a second dish in the stew may easily be made equally aspiring, on a small scale; and, lastly, a most delicate third dish, in the fine fry, which completes this curious division and subdivision of a single carp. It may be well to note that carp should never be boiled.

THE TENCH.—The tench, although ever associated with the carp, differs widely in its habits, as while the one is most capricious in its feeding, the other is to be taken without any great amount of skill by the rod full nine months in the year; and generally through mild winters, when the carp is proof against every temptation and is said only to bite while the broad-bean is in blossom. The flesh of the tench is very firm and admirably adapted for stewing, its skin being pronounced by epicures to possess a savor comparable in its excellence to nothing else. The simple secret of how to prevent the breaking of the tender skin of the tench is known to very few cooks. It is, however, merely by placing the fish in boiling fat and just turning it in the pan; and if for boiling, then taking it out, laying it in a cloth in boiling water until it is done sufficiently. Served with a sauce made of the young leaves of the field sorrel, it is a most appetizing dish.

65.—REPORT OF AN EXAMINATION OF THE SHAD FISHERIES IN GEORGETOWN, S. C.

By Lieut. W. M. WOOD, U. S. N.

After leaving Fernandina, Fla., I proceeded in this vessel to Georgetown, S. C., to investigate the shad fisheries there, and have the honor to submit the following report:

We arrived there on the afternoon of the 5th instant. The shad season was found to be about over, and most of the fishermen had quit.

I was fortunate enough to find Mr. E. Barnes still in town. Mr. Barnes is the largest owner of nets, and buys and ships all the fish caught in the vicinity. Accompanied by him, I took the launch and went up the Waccamaw and Pedee Rivers. I also went up the Black River, a tributary of the Pedee, but only on the two former rivers and Winyah Bay, into which they empty, is any fishing done.

On account of the character of the bottom and banks no seine-hauling is carried on, and the fishing is entirely by gill-nets. This year about thirty nets were fished, averaging 150 fathoms long, $5\frac{1}{8}$ to $5\frac{1}{4}$ inch mesh, and 16 to 18 feet deep. They are not allowed to reach the bottom on account of snags. The average catch this year was about 800 shad per net.

Many of the gillers live in flat-boats moored at convenient localities. Mr. Barnes's flat is at the junction of Jericho Creek and the Waccamaw. He fishes three nets, employing 9 men, viz, a superintendent, two men for each net, a cook and a marketman, who carries the fish in a small boat to town, 10 miles below.

Mr. Barnes says they catch very few ripe fish of either sex, but take a good many "down-runners," or spent fish. He believes all the fish go long distances above the highest fisheries, which are only a short distance from salt water, to spawn.

On the headwaters of these rivers, owing to the natural difficulties and the absence of market facilities, the only shad caught are taken with bow-nets and short pieces of gill-nets, as on the Saint Mary's, and only used for home consumption.

A great many shad are taken in Winyah Bay before they leave salt water. The best of the season here is February and March. On the day of my visit to Mr. Barnes's flat, the 7th instant, his total catch was 3 shad, and he quit fishing that day. He was paying 30 cents each, at first hand, for the fish he bought, and I see by the quotations in the Star of the 8th instant that they are being sold in Washington at $25 to $32 per hundred.

It is possible that some little work might be done here before the opening of the season farther north. There would certainly be more chance of success than in Florida, so far as my experience goes. I do not think much can be done where the catch of shad is taken by gill-nets, especially as fished in Southern rivers. As a rule, comparatively few shad are taken at a drift, and of these the proportion of males and females is rarely equally divided. Still more rarely are the two sexes in the proper condition for spawning. Especially is this true when by force of circumstances these nets are only fished in the long, deep reaches of the river, and never allowed to fish *near the bottom.* Consequently it seems to me most of the fish taken are those running up or down from the spawning-beds near the headwaters, where they cannot be caught, except in limited numbers, by the bow-net, &c.

We left Georgetown on the evening of the 7th instant, arrived off the Chesapeake early on the morning of the 9th, touched at Norfolk for a couple of hours, and then proceeded to Washington, D. C., arriving on the evening of this date at 6.20.

WASHINGTON, D. C., *April* 10, 1884.

66.—PROPOSED INTRODUCTION OF HAWAIIAN MULLET INTO THE UNITED STATES.

By Hon. JOHN F. MILLER, U. S. S.

[From a letter to Prof. S. F. Baird.]

The Hawaiian mullet is a very good food fish, not equal to our black bass, shad, Spanish mackerel, pompano, and any other American fishes of the best sorts, but a fairly good fish, which grows rapidly to perhaps a pound in weight and is comparatively free from objectionable bones. It inhabits the salt water in the harbor of Honolulu, and is propagated and reared in artificial ponds which have been made in the salt marsh lands near that city. There are many of these ponds, and large numbers of these fishes are produced therefrom for the Honolulu market. The inhabitants there rate the mullet as next to the red-fish, which is taken in rather deep water and is not so abundant. I was informed that the mullet was a very hardy fish, easily cared for, and in the opinion of gentlemen of experience in such matters no difficulty would be found in transporting the small fish by steamer from Honolulu to San Francisco. The climate of Honolulu is warm and mild even in winter, and it is possible that the mullet would not thrive in our cold regions, but no one at Honolulu seemed to doubt that it would do well in California. Mr. C. R. Bishop, a banker of Honolulu, owns a number of ponds containing mullet, situate on his place at Waikiki, a suburb of Honolulu. He will give you full information in respect of these fishes. The United States Consul, Mr. David McKinley, is also quite familiar with the facts relating to the propagation of the mullet. Mr. Bishop, I have no doubt, would take pleasure in giving you assistance should you desire to obtain a number of the fish for the use of the United States Commission.

I am quite sure that the Hawaiian mullet would prove a valuable addition to the food fishes of the United States.

During my recent visit to Honolulu I made many inquiries in respect to this and other fishes, saw many specimens, inspected the ponds, and enjoyed the mullet* (very much indeed) cooked in many styles, in all of which I found them good.

WASHINGTON, D. C., *November* 13, 1883.

67.—THE INCIPIENCY OF NIGHT-SEINING FOR MACKEREL.

By GEORGE MERCHANT, Jr.

[From the Cape Ann Bulletin.]

As early as 1864, seining operations were conducted in the night-time for pogies, as many of the old pogie fishermen (of whom I am one) can testify. Up to 1874, no mackerel of any account had been caught in this manner, although there had been a few exceptional lots. In 1874, and up to 1877, a larger quantity was taken. Since the latter date, it has been the general custom of the fishermen in the latter part of the summer and fall to expect to capture the greater part of their trip in this manner.

GLOUCESTER, MASS., *November* 9, 1881.

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* This is said to be *Mugil Chaptalii* Eyd. & Soul. voy. Bonite, Zool. I, p. 171, pl. 4, fig. 1. I suppose that like other species of Mugil it is migratory, and that it feeds on organic substances found in mud and sand. Of its propagation I have not yet been able to learn anything. Jordan and Gilbert do not mention it in their Fishes of the Pacific coast. I am preparing a description.—T. H. BEAN.

68.—WATERPROOFING FOR HERRING-NETS.

By WILLIAM HEARDER.

[From the Fishing Gazette, March 29, 1884.]

I am pleased to be able at any time to give any information to my brother fishermen, although some in our trade fancy that all recipes should be kept as trade secrets. I must beg to differ from the general run, for I am never happier than when I am showing an amateur how to tie a fly or repair a broken rod.

We waterproof our herring-nets in different ways. One plan is to soak them in boiled linseed oil for a few hours, and then spread them out in the open air to dry; this will take some three or four days, or sometimes more, according to the state of the weather. Another plan is to soak them in Stockholm or gas tar diluted with turpentine, and dry also in the open air. These two plans are open to objections, for they make the nets hard and wiry, and fish do not get meshed so easily in a stiff net as they do in a soft one. The plan I like best is that I use for my lines. We make a solution by taking one-half pound of catechu (which can be obtained from any ironmonger or druggist) to every gallon of water, boil it until all the catechu is dissolved, then put in your nets or lines, and let them stay all night, taking care not to have any heat or fire underneath the vessel while the nets and lines are in. I generally add sulphate of copper in the proportion of one-half ounce to the gallon (this acts as a "fixer" for the tan). When the things are taken out they can be washed in clean water and hung up to dry. By this last method the nets will be found very much softer; and I have proved from experience that nets preserved with oil or tar do not last as long as nets preserved with the ordinary tan or catechu. Some firms put a small quantity of size with the catechu; this I disapprove of; it may look better, but after the first once or twice using, it is not only washed out of the twines, but takes a proportion of the tanning with it.

PLYMOUTH, ENGLAND, 1884.

69.—TRANSFER OF SOFT-SHELL TERRAPIN FROM THE OHIO TO THE POTOMAC RIVER.

By J. P. DUKEHART.

I put in the Potomac River, below the dam at Cumberland, on August 25, 1883, eighteen soft-shell terrapins, from the Ohio River, near Moundsville, W. Va.

I will put in more of them this season at Woodmont, near Club House. I hope they may in time stock the Potomac.

BALTIMORE, MD., *April* 6, 1884.

70—ACCLIMATIZATION OF SALMO QUINNAT IN FRANCE.

By Dr. MASLIEURAT-LAGÉMARD.

[From a letter to Raveret-Wattel, Secretary of the National Acclimatization Society.]

In the month of November, 1879, you sent me a box containing eggs of the *Salmo quinnat*. One hundred of the fry, well formed, after having remained five or six weeks under the ice, owing to continued frosts, were, in favorable weather, placed in the river Gartempe. Did these little fish survive, and would they find their way up here? I am happy to say that I can answer both these questions in the affirmative.

Yesterday I caught one of these salmon, which was three years old last spring. Its lean condition showed plainly that it had spawned in the river; and it must be presumed that it was not the only one. It weighs 1 kilogram. In summer, when it had its full weight, it must have weighed 3 or 4 pounds. I have no doubt that it was one of those which we had placed in the river in 1880. These salmon, which are exceedingly valuable on account of their fecundity and their rapid growth, have therefore been acclimatized in our rivers; and this result ought to encourage the efforts of your society.

GRAND BOURG, *December* 17, 1883.

71.—NOTES OF A TRIP IN THE GULF OF MEXICO.

By BARNET PHILLIPS.

[From a letter to Prof. S. F. Baird.]

Further south we found swarms of mullet (cf. p. 135), and on several occasions killed enough for table use by shooting a charge of fine shot into the schools. I have some idea that mullet oil might be a useful product if proper plants were put up. I left an order to have some smoked mullet sent me; such roes as I ate on the coast were badly put up and hardly edible. In a fishery sense, the west coast of Florida is not developed at all.

What struck me as remarkable was to see the shoals of porpoises sailing in very shallow water, just enough to float them, and feeding on the fish which swarm there. The feature of all the bays and creeks is that they are shallow. The struggle for life must be continuous. In some of the fresh water creeks, as those on the Caloosahatchee, we took a number of large water-turtles, the biggest about 12 pounds. What was strange about them was that fully 75 per cent. of them had lost a foot or a leg, evidently taken off by a gar or an alligator. I wrote something about the sheeps-head being considered unwholesome at certain seasons, but this would require further investigation. At Punta Rassa a 6-pound sheeps-head is used to bait a hook for shark.

TIMES OFFICE, NEW YORK, *February* 21, 1884.

Vol. IV, No. 10. Washington, D. C. April 30, 1884.

72.—REPORT ON THE WORKING OF THE BOILERS AND ENGINE OF THE UNITED STATES FISH COMMISSION STEAMER ALBATROSS.

By Passed Assistant Engineer G. W. BAIRD, U. S. N.

[From his report for the quarter ending June 30, 1883.]

Though the ship has been in commission about seven months there has been no opportunity to make a continuous voyage of any considerable length with the vessel at or near her load draft of water, under conditions of weather which would not influence the speed. The voyage from New York to Washington, just after the vessel had been docked, cleaned, and painted, offered a tolerably good opportunity, as the sea was smooth, but the wind, which was light, was ahead. The coal used was the anthracite supplied to the Navy, and it contained a considerable quantity of ash, clinker, and slate. The boilers, which have never been tight, leaked less than ever before, which permitted us to carry more pressure. The quality of the oil used was bad, and the warming of the journals prevented us from urging the engines. The voyage was a fair average one, on the whole, in point of speed, as it is our object to make economical rather than speedy voyages.

The following results must not, therefore, be considered as for the maximum performance of the vessel, but for the conditions of ordinary cruising. This, however, does not impair the deductions for scientific purposes:

Duration of voyage	42 hours 9 minutes
Total distance, in geographical miles, of 6,086 feet	423
Mean number of geographical miles per hour	10.03
Total number of revolutions, starboard engine	200,197
Total number of revolutions, port engine	200,411
Mean number of revolutions per minute, starboard engine	79.05
Mean number of revolutions per minute, port engine	79.06
Slip of the starboard screw in per cent. of its speed	14.74
Slip of the port screw in per cent. of its speed	14.75
Mean steam pressure in boilers, in pounds, above the atmosphere	60.05
Mean pressure in starboard receiver above zero	25.53
Mean pressure in port receiver above zero	23.78
Mean position of (both) throttle valves, in eighths	7.20
Mean vacuum in condenser in inches of mercury	24.46
Mean height of barometer in inches of mercury	30.09
Mean point of cutting off in starboard high pressure cylinder ... inches	26.333
Mean point of cutting off in starboard low pressure cylinder ... inches	14.032
Mean point of cutting off in port high pressure cylinder ... inches	19.780
Mean point of cutting off in port low pressure cylinder ... inches	17.831
Total number of pounds of anthracite coal consumed	42,865
Total number of pounds of ashes, clinker, &c	8,353

Total number of pounds of combustible	34,512
Mean number of pounds of coal per hour	1,016.97
Mean number of pounds of combustible per hour	818.79
Percentage of refuse in coal	19.40
Mean number of pounds of coal per hour per square foot of grate surface	10.667
Mean number of pounds of coal consumed per hour per square foot of heating surface	0.4103
Mean number of pounds of combustible per hour per square foot of grate surface	8.589
Mean number of pounds of combustible consumed per hour per square foot of heating surface	0.3303
Mean number of strokes per minute of circulating pump	80
Temperature of the air on deck	73.73
Temperature of the injection water	65.73
Temperature of the discharge water	93.78
Temperature of the feed water	76.39
Temperature of the engine-room	119.10

HORSES-POWER.

Indicated horses-power developed in the starboard H. P. cylinder	93.460
Indicated horses-power developed in the starboard L. P. cylinder	122.240
Indicated horses-power developed in the port H. P. cylinder	110.224
Indicated horses-power developed in the port L. P. cylinder	131.602
Aggregate indicated horses-power developed in the starboard engine	215.700
Aggregate indicated horses-power developed in the port engine	241.826
Horses-power required to work the starboard engine	22.116
Horses-power required to work the port engine	22.118
Net horses-power applied to the starboard shaft	193.584
Net horses-power applied to the port shaft	219.708
Horses-power absorbed in friction of the load on the starboard engine	14.5188
Horses-power absorbed in friction of the load on the port engine	16.4781
Horses-power expended in the slip of the starboard screw	23.278
Horses-power expended in the slip of the port screw	26.838
Horses-power expended in friction of the starboard screw-blades and shaft on the water	21.278
Horses-power expended in friction of the port screw-blades and shaft on the water	21.279
Net horses-power applied to the propulsion of the hull	289.642

DISTRIBUTION OF THE POWER.

Percentage of the net power applied to the shaft absorbed in friction of the load	7.500
Percentage of the net power applied to the shaft absorbed in friction of the screw-blades, hubs, and shafts on the water	10.297
Percentage of the net power applied to the shafts absorbed in the slip of the screws	12.122
Percentage of the net power applied to the shafts utilized in the propulsion of the hull	70.081

ECONOMIC RESULTS.

Pounds of coal consumed per indicated horses-power per hour	2.222
Pounds of coal consumed per net horse-power per hour	3.246
Pounds of combustible consumed per indicated horse-power per hour	1.789
Pounds of combustible consumed per net horse-power per hour	2.613
Pounds of coal consumed per mile	101.336
Pounds of combustible consumed per mile	81.588

THRUST OF THE SCREWS.

The net power applied to the propulsion of the hull by the two propellers being 289.642 horses is equal to ($289.642 \times 33{,}000 =$) 9,558,186 foot pounds of work per minute, and the speed being 10.03 knots per hour is equal to $\left(\frac{10.03 \times 6086}{60} =\right)$ 1017.376 feet per minute; therefore the resistance of the hull and the equivalent thrust of the screws at that speeed was $\left(\frac{9558186}{1017.376} =\right)$ 9395 pounds. The thrust per indicated horse-power at that speed was $\left(\frac{9395}{457.526} =\right)$ 20.31 pounds, and per pound of coal per hour it was $\left(\frac{9395}{1016.97} =\right)$ 9.23 pounds.

POWER ABSORBED BY THE FRICTION OF THE WETTED SURFACE OF THE HULL AGAINST THE WATER.

Taking the resistance of the water to a square foot of smoothly painted iron of the surfaces of the hull moving at a velocity of 10 feet per second to be 0.45 of a pound, and (according to the method of Chief Engineer Isherwood, United States Navy) deducing from the speed of the vessel the mean speed of its immersed surfaces due to the inclination of the water lines there results a speed of 16.35076 feet per second, and a consequent surface resistance of ($10^2 : 0.45 :: 16.35076^2 :$) 1.203063 pounds per square foot at that velocity. The aggregate wetted surface during the above-mentioned voyage was 7,350.44 square feet, and the power expended in this resistance was $\left(\frac{7350.44 \times 1.203063 \times 16.35070 \times 60}{33.000} =\right)$ 262.893 horses; consequently of the 289.642 horses power required to propel the hull $\left(\frac{262.893 \times 100}{289.642} =\right)$ 90.73 per cent. was expended in overcoming the friction of the hull on the water, and the remaining 9.27 per cent was expended in displacing the water and overcoming the pressure of the wind against the upper part of the hull, the spars, and the rigging.

THE CHANGE IN THE CRANK-ANGLE.

The cranks, as originally arranged, at 145 degrees, diminished, to a small extent, the friction on the center main bearings by the almost opposite position, and almost opposite crank effort. The indicator diagrams taken from the high-pressure cylinders bear a very near resemblance to each other, with the cranks at either angle, but in the low-pressure diagrams the difference is marked.

Fig. 6 is from the starboard low-pressure cylinder with the cranks at 145 degrees.

Fig. 5 is from the same cylinder, with the cranks at 90 degrees, but with the receiver enlarged from $1\frac{6}{10}$ to $2\frac{6}{10}$, the volume swept by the high-pressure piston.

TORSIAN DIAGRAMS.

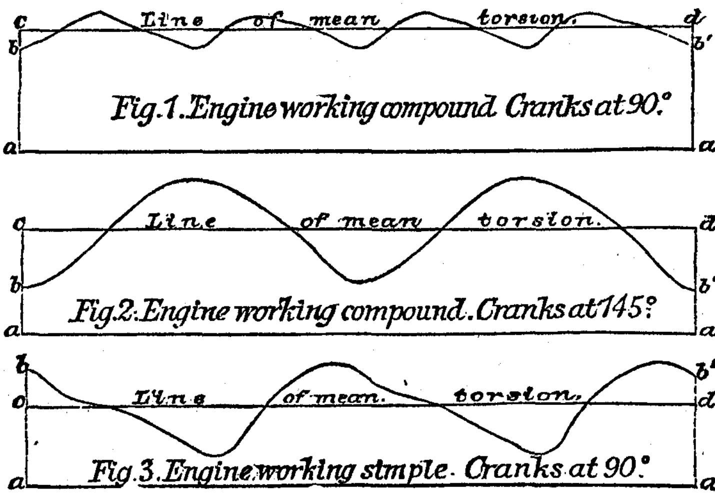


Fig. 1. Engine working compound. Cranks at 90°.

Fig. 2. Engine working compound. Cranks at 145°.

Fig. 3. Engine working simple. Cranks at 90°.

INDICATOR DIAGRAMS.

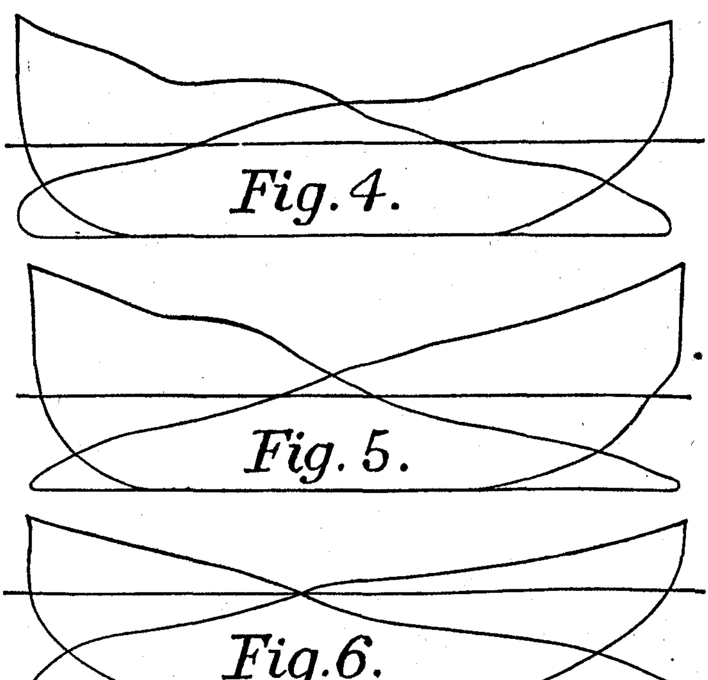


Fig. 4.

Fig. 5.

Fig. 6.

Fig. 4 is a diagram from the same cylinder with the cranks at 90 degrees, but with the original volume of receiver, namely, $1\frac{6}{10}$, the volume swept by the high-pressure piston.

The relative contours of these diagrams and their variance from the hypothetically perfect diagram is marked, and if an engineer is willing to accept them as the *ultima thule* he will doubtless decide in favor of that produced by the engines as originally arranged, namely, at 145 degrees crank angle.

The indicator is the stethoscope of the steam cylinder only; it fails to give any indication of the work, either utilized or wasted, beyond the steam cylinder.

It is manifest that a crank turned by a uniform moment is revolved with less labor and less injury to its journals than if turned by an intermittent force; by blows for example. Uniformity of torsion on the shaft is one of the great objects sought. This torsion may be demonstrated, graphically, by constructing diagrams whose abscissa is referred to the length of the path of the turning force, and the ordinates to the moments of torsion. In Figs. 1, 2, and 3, the ordinates are calculated for the combined moments of the two cranks, the same units being used for each. The lines *c d*, in these figures, refer to the path described by the combined effort of the two cranks, and the ordinates, commencing with *a b*, and ending with *a' b'*, represent the moments of torsion. The curved lines represent the variation in the torsion, and the superiority of these torsion curves is in their nearer approach to the straight line *c d*.

This graphic method might be pursued still further by applying a dynamometer to the screw shaft, which would indicate the thrust of the screw, wherein every increment or diminution in that force would correspond with those in the torsion diagram, but would be greatly reduced in extent owing to the weight and consequent inertia of the heavy working parts.

In changing the crank angle from 145 to 90 degrees the eccentrics were not disturbed; the cushioning, lead, and release are the same in both cases; the same boiler-pressure and mean back-pressures are maintained, and the same number of expansions are employed; consequently there can be no physical advantage in the original over the present crank angle. The mechanical saving in the minute amount of friction eliminated in a single journal of each engine is much more than compensated for by the saving of friction on the screw blades alone, by their more uniform velocity.

The Katzenstein packing on the piston rods has worked so well that I feel it merits a special mention. I respectfully recommend it be placed on the H. P. valve stems. The Baird distilling apparatus has produced 5,883 gallons of water during the quarter, steam being used from the main boilers, the ship being at sea under steam, and cylinder oil (a compound of petroleum) being used in the cylinders; the water was good. The anemometer used in measuring the air currents in our ventilating tubes broke down, but the makers replaced it with a new one, since which time I have been recording air velocities, and hope, at the end of the next quarter, to be able to report on the ventilation of the ship.

The electrical apparatus continues to give satisfaction; the dynamo has been in operation three hundred and twenty-three hours and nine minutes during the last quarter. Four 3-light safety plugs have been melted out, and one key socket broken, all of which I promptly replaced. I tapped the engine-room circuit and placed a lamp over the circulating pump, which was very much needed.

Advantage was taken of the ship being docked, at New York, to overhaul the sea valves, screw propellers, shafts, and stuffing boxes. We found it necessary to entirely replace the packing of our stern bearings. There was some corrosion in the shafts near the brass jackets, all of which were carefully scraped and painted.

The steam windlass, never having given any trouble, nor requiring any repairs, merits special mention.

The steam winch and feeling engine have given scarcely any trouble, and have done their work admirably.

The smithing of the ship has been satisfactorily done by one of our first-class firemen.

The speaking tube has been overhauled, and many joints, hitherto leaking, have been repaired and telephonic communication re-established between the engine-room and pilot-house.

The Dividson Pump Company voluntarily, and without compensation, supplied new stud bolts for the circulating pump, to diminish the lift of the valves and relieve the thump.

The "Little Wonder" injectors work very well, one at a time; if both are placed in circuit it is a little wonder if either will continue. They deliver the feed water hot, and are an acquisition when the main engine is not in operation.

The receivers were ordered to be enlarged—by the engineer who designed the ship—when the crank angle was changed from 145° to 90°. This was effected by placing a large convex bonnet on each low-pressure valve-chest. This increased the receivers from $1\frac{6}{10}$ to $2\frac{6}{10}$ times the volume swept by the H. P. pistons. Seeing an excellent opportunity for a valuable experiment I took the responsibility of putting only one of the new bonnets on, and selected the starboard engine for that purpose, so that for all the steaming recorded in this log-book, the port engine had the small receiver, and the starboard engine the large receiver. The results show no essential difference in the performance; what little difference does appear is in favor of the engine with the small receiver. I therefore reduced the starboard receiver by restoring the original valve-chest bonnet.

I would respectfully call attention to the high temperature of the engine-room, which I fear will become so great in hot climates as to seriously injure the men.

The steam heaters have been overhauled, six new angle valves put in place of six broken ones. Two new heaters have been bought for the cabin (one being for the office); they have much greater surface than the old ones and will, consequently, keep the cabin more comfortable in cold weather.

The springs on the drum of the reeling engine, found to be too weak, were replaced and doubled at the Washington yard. An additional drain cock has been put on the engine of Sigsbee sounder, part of the steam lead taken off, and a wooden cover put over the cylinder to prevent burning the gutta percha belts. The bolt sheared off the arm of the *circulating pump* for want of oil. A Detroit oil cup has been bought and put in place, and this, being a *sight feeder*, can be observed from the working platform. The counters, which were hitherto unsatisfactory, have been put in order by the Crosby Valve Company. The ½-inch valve stems of the main reversing engines being too light (they bent), have been replaced by ¾-inch stems. The boilers, having been recalked at the leaky corners by the Pusey & Jones Company, by the Washington yard and Norfolk yard, continued to leak; at the New York yard soft patches were put on and then they leaked; our force on board has remade the joints under these three patches, and are encouraged to find one is tight. A split elbow in the steam-whistle pipe was replaced at Norfolk, the bell wires were overhauled, and additional bolts put in donkey check-valves at the same place.

We have succeeded in adjusting one of the Svedberg governors, which works well, and when opportunity offers the other will be adjusted. Its position, however, is against it, as it is on the H. P. chest, where it is very hot, and I fear the mercury evaporates.

One piston rod was discovered to have a transverse flaw. Though the flaw does not appear to increase, it has been considered necessary to order a new rod; this is now being made at the Washington yard.

STEAMER ALBATROSS, *July*, 1883.

73.—HOW TO COOK CARP.

By C. GERBER, Jr.

I append a few receipts translated from a German cook-book. As a general rule the pond carp is not considered good to eat during the summer months, May, June, July, August (during and after spawning), but at all other times it is a most excellent table fish.

RECEIPT No. 1.—Clean a carp of about five pounds well, and split and cut it into convenient pieces. Take three table-spoonfuls salt, half a dozen kernels black pepper, same of allspice and cloves, a few cardamoms, four laurel leaves, a medium-sized onion, some celery and a sliced carrot, and a quart of water (or enough to cover the carp); let these boil together fifteen minutes, put in the carp, scale side down, head pieces first, middle pieces next, tail pieces on top, and let boil fifteen minutes longer; add one-half pound butter in small pieces, and a gill of red wine, or in place of wine pour one-half gill warm vinegar over the pieces of carp before putting them into the pot, and add it to the boiling. Boil fifteen minutes longer; take out the pieces and serve with browned butter and slices of lemon.

RECEIPT No. 2.—Clean and split a five-pound carp and rub two table-spoonfuls salt well into both sides, and let stand two hours in a covered dish. Take some spices and herbs as in No. 1, and boil thoroughly with one pint water, one pint red wine, one-half pint beer, one-half pint vinegar, some lemon peel, bread crust, and one ounce sugar. After this has well boiled, cut the carp in convenient pieces, put into the pot and boil till only about half the sauce is left; serve as before.

RECEIPT No. 3.—Clean a good-sized carp carefully by opening it as little as possible, cut off fins and tail; make a number of crosscuts on one side, rub the fish well with two table-spoonfuls salt, let it stand covered for some hours, then dry it with a towel. Make a filling of four ounces tallow or fresh fat pork, four yolks of eggs, some wheat bread slightly softened with water, three sardels, some capers, mace, salt, pepper, lemon peel, onion, and the liver of the carp (but be sure that the gall is first carefully removed), all chopped very fine; fill the carp and sew up the opening. Put it into a baking-dish with the cut side up with one pint wine, one-half pint vinegar, one-quarter pound butter, spices and herbs as in No. 1, and a few slices of lemon; bake quickly for three-quarters of an hour and baste frequently. Don't turn the fish while baking.

RECEIPT No. 4.—Take carp of one to two pounds, scale and clean well, rub inside and out with plenty of salt, let stand an hour or two, wipe dry with a towel, roll in well-beaten eggs and bread crumbs or meal, and bake in plenty of butter till nicely brown.

RECEIPT No. 5.—Boil carp as in No. 1, place the pieces in a bowl with a few slices of lemon, add to the sauce one-half pint vinegar and boil same till only enough left to cover the carp in the bowl. Pour the sauce over the carp through a sieve and let it cool thoroughly.

I tried receipt No. 1 on bass and found them excellent.

WEBSTER, MASS., *December* 10, 1883.

74.—CARP DO EAT YOUNG FISHES.

By J. A. RYDER.

[From a letter to Prof. S. F. Baird.]

A carp examined to-day was found to contain ripe milt with active spermatozoa. About a dozen small fish were taken from the intestine, each one about an inch to one and a half inches long when they were alive. They seem to be young percoids or some small fresh-water Acanthopterygians. I have saved the remains for further study and identification.

WASHINGTON, D. C., *November* 27, 1883.

75.—ANNUAL REPORT ON THE ELECTRIC LIGHTING OF THE UNITED STATES STEAMER ALBATROSS, DECEMBER 31, 1883.

By Passed Assistant Engineer G. W. BAIRD, U. S. N.

[Résumé of the quarterly reports.]

The steadiness and uniformity of brightness of the lamps depend largely (almost entirely), on the engine driving the dynamo, and the success of the system lies more in the attention paid to the engine, where the plant is correctly installed, than anything else. Uniformity of speed is the great object sought, and to secure this Mr. Edison has adopted a high-speed engine, with a sensitive governor, represented in Fig. 1.

This engine has a single steam-cylinder, $8\frac{1}{2}$ inches in diameter of bore, and a stroke of piston of 10 inches; it runs 300 revolutions per minute

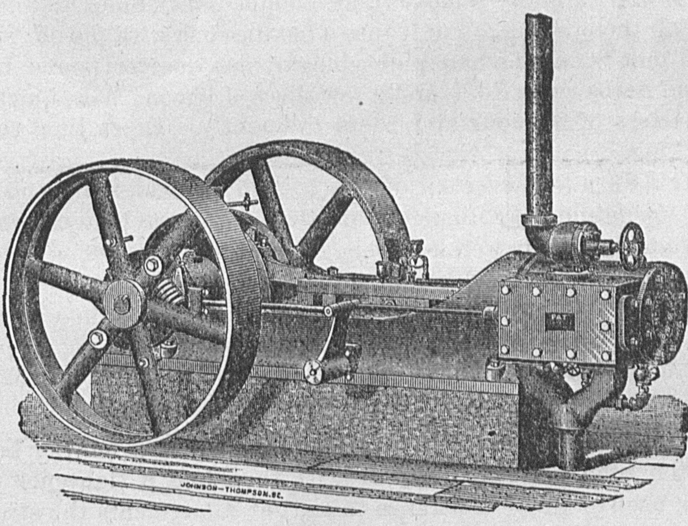


FIG. 1.

very uniformly, the automatic cut-off regulating the quantity of steam admitted to the load on the engine. This particular engine is larger than should be employed for this plant, as the short cut-off at high pressures and light loads causes great cylinder condensation, not only diminishing the economy of the engine, but causing such incessant hammering in the cylinder that I have been obliged to introduce a pressure-regulating valve (Fig. 2), which limits the pressure to what is desired. Previous to introducing this valve, two cross-head keys had been sheared off and one cross-head broken, by water in the steam-cylinder.

Had the smaller size of engine ($6\frac{1}{2}$ by 8) been used, as I recommended, this difficulty would have been avoided, but the Engineer of the Edison Company, fearing a possibility of our permitting the pressure to fall below 20 pounds, and the engine consequently failing to develop the required power, preferred to give us this large engine, even at a greater cost to his Company. The Edison Company furnished drawings for the setting of the engine and its foundation, which design I followed implicitly. The plant is so installed as to bring the driving side of the belt on top, so that the slack falls from the pulleys. This results in slipping, particularly as the belt stretches, and when the arc lamps are thrown in circuit the belt slips and the dynamo often slows down from

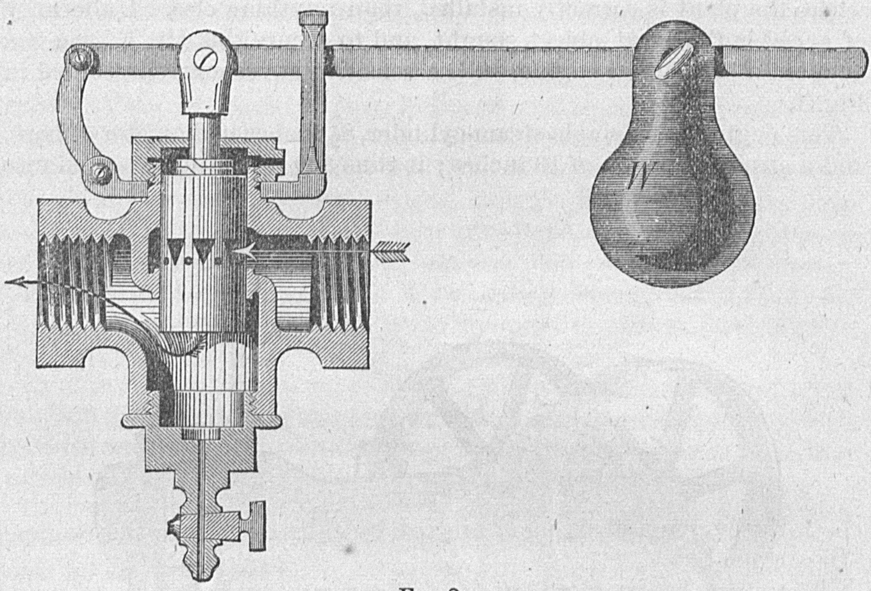


FIG. 2.

1,200 to 1,000 revolutions per minute. I procured a heavier belt, but the stretch soon permitted slipping. I then had a tightener put in. This has been of great assistance to us, but it augments the stretching of the belts very much. I have resorted to doubling the belts, *i. e.*, running one belt on top of the other; this has diminished the slipping, but the belts tend to separate and run off in opposite directions; to prevent this we have improvised guides. During the year the main valve of the dynamo engine broke—probably from water in the chest—and deprived us of the use of the plant about five days. With this exception the plant has been in operation every night when there was steam in the boilers.

The dynamo (Fig. 3) has given but little trouble. The armature has worn somewhat, and six brushes have been worn away during the year. A spare armature has been purchased and is ready for use in event of any accident to the original one. Except occasionally adjusting the brushes, the running of the dynamo requires but little attention, and

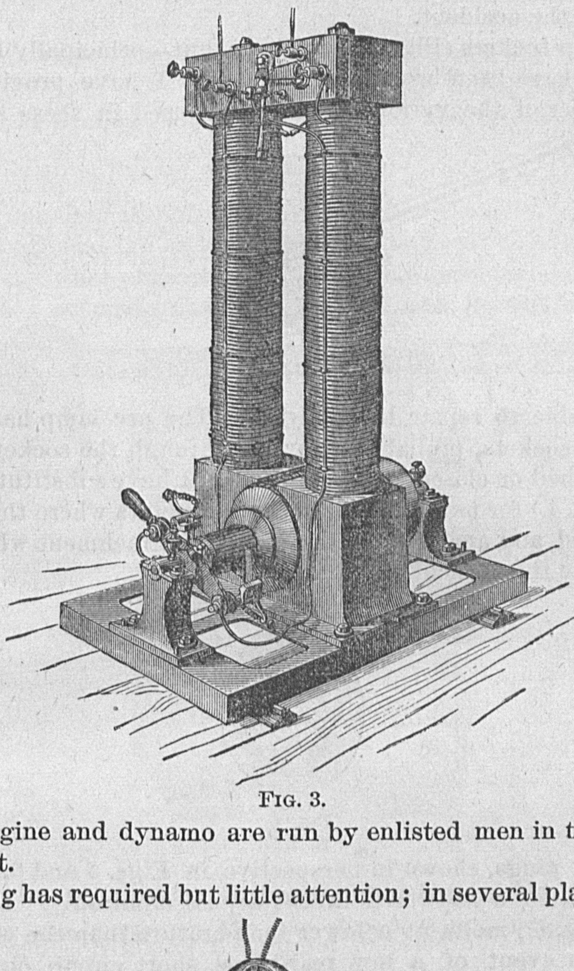


FIG. 3.

both the engine and dynamo are run by enlisted men in the Engineer Department.

The wiring has required but little attention; in several places the deck

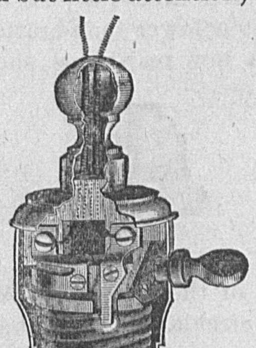


FIG. 4.

leaked and the salt water short-circuited but there have been no serious mishaps. The trouble from this cause, however, has resulted in the destruction of the nearest cut-out plug, thus preventing damage to the wire; in such cases I have added insulation to the wires to prevent a repetition of the accident.

A few lamp sockets (Fig. 4.) have burnt out—principally from arcing—and a few have been broken by accident. I have provided myself with a number of the various-sized screws used in these sockets and

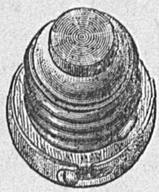


FIG. 5.

have been able to repair them myself. The arc lamp has destroyed two of these sockets, probably by arcing through the socket as the circuit was opened or closed. For this reason I have substituted two key sockets (Fig. 4.) for two ordinary sockets at points where the arc lamps were attached, and am now making a special attachment which I think will eliminate this difficulty.

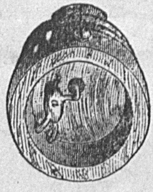


FIG. 6.

The safety plugs, shown in perspective in Figs. 5 and 6, and in section in Fig. 7, have answered their purpose admirably. The piece of solder (*a*, Fig. 6.) melts at a lower temperature than the wires, and is destroyed in event of a low resistance short circuit on the wires.

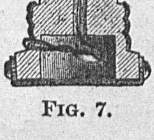


FIG. 7.

I have never known one of them to fail. When one of these safety plugs melts it breaks the circuit, and the lamps on that section are immediately extinguished. After discovering and repairing the damage, the circuit is restored by substituting a new plug in the cut-out block. Fig. 8.

By indicating the engine I find the economy to be practically uniform.

When using 45 lamps we get 7.77 per indicated horse-power; when using 50, we get 8.5 per indicated horse-power; and when using 70, we get 10.11. We have not, to my knowledge, ever used more than 70 lamps at one time, though there are 140 in the plant. The average number of lamps in daily use is about 47,* for which purpose we consume about 21 pounds of coal per hour, and use, on an average, two-thirds of a gill of oil. Since November we have been using a light oil manufactured by the Vacuum Oil Company of New York, and find that we can run our light machinery with a smaller quantity. As this oil is used on the exhaust fan as well as the dynamo and its engine, it is impossible to say what proportion each machine receives; but from short experiments I conclude that the dynamo and its engine (when the

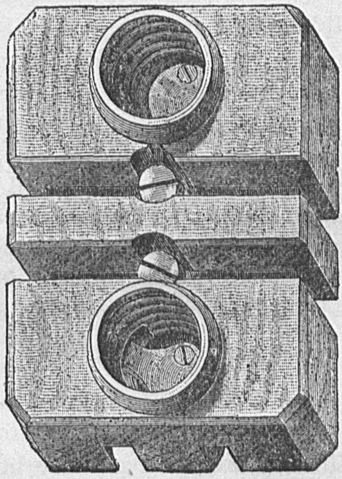


FIG. 8.

journals are in good order) will use about one-half a gill per hour. Assuming this to be correct, the cost of running the lights for the year has been as follows:

The dynamo was in operation 1,592 hours and 45 minutes, during which time the consumption of coal for this purpose was 14 tons 2,082 pounds, at a total cost of $68.67.

The oil used during the same period and for the same purpose is estimated to be 67 gallons, the mean cost of which was 72½ cents per gallon, making the total cost for oil $48.57.

The cost for repairs, preservation, and restoration has been as follows:

2 K brushes, at $2.50	$5 00
4 Z brushes, at $1	4 00
2 cut-out blocks, at 32 cents	64

*As lamps are so frequently turned on and off in different parts of the ship, at all hours, it would be impossible to keep an accurate record.

34 3-light safety plugs, at 8 cents	$1 92
6 6-light safety plugs, at 8 cents	48
4 20-light safety plugs, at 8 cents	32
2 40-light safety plugs, at 8 cents	16
5 key sockets, at 92 cents	4 60
1 wire shade-holder, at 10 cents	10
1 pound insulation compound, at 12 cents	12
2 deep-sea lamps, at $1	2 00
2 attachment plugs, at 40 cents	80
3 pounds No. 14 insulated wire, at 40 cents	1 20
1 pound No. 20 insulated wire, at 40 cents	40
6 cigar-lighter plugs, at 55 cents	3 30
1 new valve	5 00
1 pressure regulating valve	55 00
1 new cross-head	25 00
Shortening the belt	3 95
Amounting in the aggregate to	231 23

This does not include the cost of lamps and shades, which do not come in my department. Deducting the cost of the piston valve, pressure regulator, and cross-head [incident to an original error], and also the cost of the deep-sea lamps, cigar-lighter plugs, and attachment plugs, which do not form part of the ship's illumination, leaves the cost of the light, in candle-power, per hour $\left(\frac{14013}{1592.75 \times 47 \times 8} = \right)$ 0.0234 cents. This is less by about 40 per cent. than the bare cost of an equivalent amount of gas-light in Washington City.

The steadiness, brilliancy, and convenience of the light is all that can be desired, while its hygienic advantages over gas or oil-lamps is very great. When it is remembered that an ordinary gas-jet consumes about as much air as six men, and that the breathing-room *per capita* on board ship is so contracted, there ceases to be any comparison between our incandescent electric light and all other means of illumination viewed from a hygienic point. The convenience of being able to light a lamp without fire is great, and the safety of the system, especially at sea, makes it very valuable. The cheerful appearance of the interior of the ship when thus illuminated, as compared with the interior of other ships lighted with oil-lamps, marks a most agreeable contrast and goes far towards lightening the burden and easing the yoke of a life at sea.

Our sub-marine lamps have been useful in attracting amphipods, squid, young blue-fish, silver-sides, &c., into the nets, when used near the surface.

76.—PLANTS FOR CARP PONDS.

By JOHN H. BRAKELEY.

The favorite in my ponds is the water-purslane, the *Ludwigia palustris* of the botanists, a plant which abounds there, but which I have not seen named in any published list of plants suitable for a carp pond. Of this the carp tear up vast quantities, which float about in large masses, throwing out roots and continuing its growth in the water.

For plants to furnish food for the carp, procure some roots of the common water-lily (*Nymphæa odorata*), and the more common yellow pond-lily (*Nuphar advena*), and any other water-plants accessible, except pond-weed (*Potamogeton*), and water-shield (*Brasena peltata*). These latter are liable to take possession of too large a portion of the pond, to the exclusion of more desirable plants. Procure, also, the seeds of the Tuscarora rice (*Zizania aquatica*), the common reed of our tide-water marshes, on which the reed-bird grows so fat.

The American lotus (*Nelumbium luteum*) is indigenous to our own State, and I have it growing luxuriantly in one of my ponds. "There is a strange grandeur and an exquisite beauty about this plant which excite the admiration of all romantic lovers of flowers; a sweet loveliness about them which creates a desire to possess and cultivate some of them. All water-lilies are lovely, but this one is gorgeous. The flowers are a light canary color, often five inches in diameter, and exquisitely fragrant. The seed receptacle, like the flowers, standing out of the water, is a flat, circular surface, and constitutes the base of an inverted cone, which is perforated with holes for the accommodation of the nuts. These are the water chinquepins."

A person who has seen this plant growing in its native waters in southern New Jersey thus refers to it: "I have visited the Kew Gardens near London and the great botanical grounds at Paris and Cologne, and assert without hesitation that if all the flowers in the three were put together, they would not equal, as a spectacle, the lily plantation in this pond." No stinted praise, certainly, of our beautiful *Nelumbium*. Yet, beautiful as it is, it does not compare in stately grandeur with its congener, the Egyptian lotus. Its delicate rosy tints, on a ground of pure white, changing daily, its graceful petals expanding more than 10 inches when fully blown, entitle it, I think, to the rank of queen of the floral kingdom. Though a native of India, China, and Japan, being the sacred bean of the Hindoos, and, in their estimation, possessed of certain wonderful mystic powers, it is perfectly hardy in our climate. Mr. E. D. Sturtevant, of Bordentown, informs me that he has grown it in the open air for the last six years with complete success, and that he has furnished it, with other choice lilies, to Prof. S. F. Baird for the carp ponds at Washington, where it does well. Though not planted in my pond till late in June, it flowered beautifully all the latter part of the summer. To these add the Florida yellow water-lily (*Nymphæa flava*) and our own lovely water-nymph, intermixed with groups of the stately and graceful Tuscarora rice, and you have a water garden at comparatively small expense, such as no combination of the rarest and most costly land plants can rival. And if you wish to go to a little more trouble and expense, you can add other species of *Nymphæa* which are perfectly gorgeous, but which require protection during the winter. Even the queenly *Victoria regia* has been flowered by Mr. Sturdevant in the open air with the aid of a little artificial heat. And this, too, may be made to adorn the carp pond. Most of our native water-lilies are "born to blush unseen and waste their sweetness on the" unsightly marsh. Carp culture is destined to bring them into the prominence to which their beauty and delicate odor entitle them; and as the rhizomas, tubers, leaf stalks, and seeds abound in farinaceous matter, they both feed the carp and render attractive the country home.

I append a list of the plants which do well in my ponds, and which seem adapted to this latitude, and for the sake of accuracy and the scientific names:

White water-crowfoot—*Ranunculus aquatilis.*
American lotus—*Nelumbium luteum.*
Egyptian lotus—*Nelumbium speciosum.*
White water-lily—*Nymphæa odorata.*
Yellow water-lily—*Nymphæa flava.*
Yellow pond-lily—*Nuphar advena.*
Water-cress—*Nasturtium officinale.*
Water-milfoil—*Myriophyllum*, several species.
Water-purslane—*Ludwigia palustris.*
Cardinal flower—*Lobelia cardinalis.*
Water-chestnut—*Trapa natans.*
Bladder-wort—*Utricularia gibba.*
Hornwort—*Ceratophyllum demersum.*
Water-starwort—*Callitriche heterophylla.*
Cat-tail flag—*Typha latifolia.*
Bur-reed—*Sparganium eurycarpum.*
Arrow-head—*Sagittaria variabilis.*
Blue flag—*Iris versicolor.*
Pickerel-weed—*Pontederia cordata.*
Mud plantain—*Heteranthera reniformis.*
Common rush—*Juncus effusus.*
Rice cutgrass—*Leersia oryzoides.*
Tuscarora rice—*Zizania aquatica.*
Rattlesnake grass—*Glyceria canadensis.*
Manna grass—*Glyceria fluitans.*
Manna grass—*Glyceria obtusa.*

BORDENTOWN, N. J., 1883.

Vol. IV, No. 11. Washington, D. C. July 31, 1884.

77.—REPORT ON THE SHAD WORK IN SOUTH CAROLINA IN 1883—TRANSPORTATION OF SHAD EGGS ON TRAYS.

By C. J. HUSKE,

Superintendent of Fish and Fisheries.

According to the best information we have, there are about 52,000 shad taken annually in the waters of South Carolina. This constitutes the source to which we may look for our annual supply of eggs to propagate fry for restocking our rivers artificially. From fifteen to twenty thousand of this number are taken on Edisto River, within a distance along the river of about eight miles; the remaining number are taken in the waters of Winyah Bay and along Waccamaw River for a distance of twenty or thirty miles, while a few are taken from Santee River, and some, in small numbers, in most of the rivers from tide-water to the shoals of the up-country.

As has been previously reported, we have established a station, at small cost, on Edisto River, the operations of which for the past season will hereafter be reported; and it now remains for us to develop a station at Georgetown, and utilize, if possible, all ripe fish taken in the waters thereabouts. The fishing here is scattered over a wide area, and any work accomplished must, of necessity, be accompanied by many difficulties, and, at best, we can only hope for a limited number of eggs. To ascertain, if possible, some definite idea of the extent of the fisheries here, and the possibility of utilizing this point as a station, I visited, in June last, Mr. W. StJ. Mazyck, who lives on Waccamaw River, with whom I had had some correspondence on this subject, and made a partial inspection of the fisheries, with a view of locating a station during the present season. I found that fishing on the Waccamaw above Georgetown was done by drift-nets, at such distances apart as to render it impossible to attend all the boats with anything like a reasonable force, or with a reasonable hope of collecting sufficient spawn to justify the outlay it would have required to have carried on the work, as the fishing was all done in daylight, at which time we can obtain but few ripe fish. Besides these nets, there are some fish in Winyah Bay, and during the latter part of the season a number of the fishermen go up Sampit River, where they find shadding remunerative. At this season the fish here are in an advanced state, and a majority of those taken are ripe or in the proper condition to yield eggs. Mr. Mazyck, writing in May of the present year, informs me that one of the fishermen reported twenty-five ripe shad taken on the 5th of April from one net. This would be, averaging 20,000 eggs to a fish, 500,000 eggs.

This would indicate success if we can organize a force of spawntakers and establish a collecting station at Georgetown. To have a force of men regularly paid to take spawn, as is usually the case, would be too expensive to think of where the fishing is so scattered. I therefore propose, after instructing the fishermen in the art of stripping a shad, to furnish them with necessary pans, buckets, &c., and pay them so much a quart for all the eggs impregnated and brought to me in good condition delivered at Georgetown. This can be done, as there is daily communication between this place and points along the river.

TRANSPORTING EGGS ON TRAYS.

It has been ascertained by the United States Fish Commissioner, from repeated experiments, that the shad eggs can be kept for a number of hours on damp cloth spread on wire trays, and afterwards hatched successfully. This has been done for several years past by the Government, and is now the common mode of transporting the eggs from the fishing-grounds on Potomac River to the hatching-stations in Washington. To Mr. S. G. Worth, Commissioner of North Carolina, is due the credit of having shipped the first shad eggs in this way to any considerable distance. He reports success with several shipments last spring as follows:

"From Avoca, in Bertie County, I sent to Raleigh at various times during April and May a number of the eggs of the shad on trays of Canton flannel. The two points are distant about 220 miles, and the time they were on trays was thirty-one hours. The transfer was highly successful, and over 300,000 fry were hatched at the carp ponds near Raleigh and released into Neuse River, near by. The trays used were simple frames made of strips an inch square, with the fabric put on with tacks. When the eggs were ready for transfer, a number of cloths were wet and a layer of ova placed on each, either with a dipper or large spoon. About sixty-four occupy the space of a square inch, and when spread on the trays they slightly compress each other, the appearance being in shape like the cells of honey-comb, while the entire mass is nearly as clear and transparent as an equal bulk of rain-drops. A number of trays supplied with eggs were placed one upon another to the height of 10 or 12 inches and the whole number put into a box large and deep enough to allow 4 to 8 inches of moss to be introduced between the trays and box. The long moss of the coast was mixed with finely-broken ice, and a complete cushion of it packed on all sides and beneath. The moss formed an easy spring to prevent sudden jars, and at the same time arrest any undue rise in temperature. Boxed in this manner, eggs were sent to Raleigh by express without an attending messenger. * * * I wrote to Professor Baird, the United States Fish Commissioner, and told him of the shipment of eggs made to Raleigh, and begged him to aid me in pressing the experiment further. With his usual courtesy, he promptly responded by sending three lots consisting of 400,000 eggs; the first in charge of a special messenger, and the two latter by express. The first underwent a loss of 97 per cent, but the two latter, packed in accordance with my suggestions, suffered a loss of only 3½ per cent."

It will be seen from this experiment here given in detail that the old and tedious method of transporting shad fry, which are delicate in the extreme and very difficult to transport, must soon give way to the transportation of the eggs instead, which will prove in every respect more satisfactory, as smaller loss will be incurred and the cost in money and labor much reduced. If we can succeed in collecting eggs at Georgetown, as above proposed, they can be easily shipped to Columbia, where a central station will be located, and from which point all the principal rivers in the State are in easy access.

We planted from the hatchery on Edisto River 725,000 shad in that river; 300,000 obtained from the United States Fish Commissioner, and shipped by myself from Washington, were planted in the Catawba River at the Charlotte, Columbia, and Augusta Railroad crossing; and 350,000, obtained from the same source, were shipped in the Government car and planted in Congaree River at Columbia, besides other shipments made by the United States Fish Commission to the headwaters of Savannah River.

HATCHERY ON EDISTO RIVER.

Although the number of eggs taken at this point is small, never before having exceeded the take of this year, which was a little more than one million, this is probably the most available location in the State for a shad station. The water is clear, and in nearly every bend of the river there are sand-bars which are natural spawning-grounds for all fish coming to maturity before having passed this point in the river; and could we have the advantages of haul-seines along the river in the several seining-holes, used in former times, we would, I am confident, catch many more fish in ripe or mature condition than it is possible to do with the gill-nets. The mature fish tarry around their favorite spawning-places and are not captured with the immature ones which travel with the tide as soon as it begins to flood, at which time the nets are set. This season we have taken more eggs than in any previous year, owing, in part, to more favorable weather, and partly to the fact of our having a larger corps of faithful assistants. We were enabled to attend every net fished on the river whenever fished, regardless of cold, rain, midnight hours, and many other disadvantages under which we labored. The fishing was all done after dark, and at nightfall the men all left camp, some going 2 or 3 miles up the river, and others a like distance in the opposite direction, and others at their posts at intermediate points, all subjected more or less to hardships, and some remaining all night in open boats on the river, subjected often to rough and disagreeable weather.

I began work with five assistants, only one of the number having ever seen a shad egg taken before; but after a short time, in which I explained the *modus operandi* of shad-stripping, by going through the process with a ripe shad in the presence of those who had no knowledge of the work, they became familiar with the method and lost no eggs that came in their reach.

While I was aware of the small number of fish released in comparison with our necessities and the work accomplished by other States, yet, in view of all the surroundings and the amount of money expended, the season's work was highly gratifying; and a reasonable hope may be entertained that we will be able in a few years to increase the capacity of this station, so that the Edisto may be abundantly stocked and shipments made to other rivers. A few fishermen make their appearance on the river the latter part of January, and by the 15th of February they are all at their accustomed localities and the season is in full blast, and continues till the first week in April, when the shad become scarce and the gar-fish so numerous and destructive to the nets that the fishermen are compelled to abandon further operations and surrender the river to them. Their work of destruction is so sure and well-known that it has become a custom among the fishermen to raise a white flag over their camps when these fish appear—which is a signal of surrender—and in a few days' time they are abandoned. I opened the hatching-house here about the first of March and ordered the "McDonald automatic glass hatching jar"; but, owing to delays at the manufacturer's, I did not receive them till late in the season, and so had to use the tin cans that were on hand.

After the receipt of the jars the percentage of eggs hatched was much better, and had I begun the season with them the number of fish released would have been greater. We are indebted to Colonel McDonald, of Virginia, the inventor, for this jar, which far surpasses any other apparatus for shad-hatching that fish-culturists have yet known.

78.—REPORT ON CALIFORNIA TROUT DISTRIBUTION IN SOUTH CAROLINA IN 1883.

By C. J. HUSKE,

Superintendent of Fish and Fisheries.

On application to Professor Baird for a supply of California trout eggs, he sent me 5,000 eggs from the trout hatchery on McCloud River, California. I had previously prepared two temporary hatching-troughs in the department building at Columbia for their reception. They came to hand on the 8th of March, and, being engaged at the shad station, I was compelled to intrust them to the care of a novice, after having carefully unpacked and planted them in the troughs and devoting two days to his instruction as to the care of the eggs. He was devoted and faithful in his attention, and although never having seen an egg hatched before, and laboring under many disadvantages—high temperature of water, &c.—he succeeded in saving 1,700 fish, which number, the second week in April, I placed in the pond of Dr. Fahnestock, near Walhalla, who had kindly tendered me the use of it until the necessary ponds can be constructed to keep them in. From these fish I hope to obtain a stock from which we will be able to supply the streams of the mountain section of our State, which are well adapted to the requirements of the California trout (*Salmo irideus*). In addition to this lot, in May I obtained 9,000 of the same trout from the Government, which were turned over to me by the United States messenger at Seneca, from which point I transported them in person a distance of 25 miles over the mountains by private conveyance, and planted them in fine condition (with the exception of 1,000 lost *en route* from Washington) in the Chatooga River, on the South Carolina and Georgia line.

79.—SHAD FISHING ON THE EDISTO RIVER.

By C. J. HUSKE,

Superintendent of Fish and Fisheries of South Carolina.

[From a letter to Prof. S. F. Baird.]

I have finished the season's work on Edisto River, having taken a total of 440,000 eggs, from which I released 334,000 fry, all in fine condition. This is less than one-half of last year's product; but still with the small plants I am able to make the fishermen say they are now taking fish that were planted by us. At least 1,000,000 eggs were lost by a deficiency of buck fish, which deficiency was caused by the large size mesh used by the gillers. There is one seine beach on the river, which if I can fish myself, I am satisfied I can increase the take of eggs to 2,000,000 a season. This in a few years should make Edisto River a good station. This is my only hope. The cost of the season's work at present is about $300.

In view of the small number of eggs that we can get in the State, we are compelled to fall back on the generosity of the Government Commission for our supply for other rivers. Will it be practicable for you to furnish me with the eggs, sent by express to Columbia, instead of the fry that South Carolina usually received? I see that you made successful shipments of shad eggs to North Carolina last season. If you can send me three or four hundred thousand a week, I can hatch them out here and plant them in Congaree River.

COLUMBIA, S. C., *April* 8, 1884.

80.—CULTURE OF EDIBLE SNAILS.

By RUD. HESSEL.

[From a letter to Prof. S. F. Baird.]

Regarding the cultivation of the *Helix pomatia* and the *H. adspersa*, I have to report that if you intend a trial with either of these next year steps will have to be taken to get some of them during the next two months, as this is the season when they can be shipped best and can be found in the finest condition. I think we can get the *H. pomatia* in Bavaria or Wurtemberg, and two other kinds, the *H. adspersa* and the *H. nauticoides*—which latter I consider to be the best in taste of all—in Italy and Southern France (Genoa, Marseilles, and Bordeaux). In each of the countries the mediation of a consular agent might be requested. The prices are not very high yet in Germany, perhaps five or six marks [about $1.30] per hundred for selected ones. It may be that the *H. adspersa* and the *H. nauticoides* could be obtained for the same price.

The Romans, as you know, raised these animals in their *cochlearia* about 2,000 years ago, and they introduced their cultivation into Germany and France. In Germany the practice was reintroduced by the monks of the eighth century in their convent gardens. They sometimes adopted the better plan of collecting them in the field and keeping them in garden-beds to fatten. The method which I desire to introduce is a different one from that used by either the Romans or the German monks: I raise them from the egg.

The cultivation of these species is very interesting; and in a rich country like America there is no doubt but that they will bring good prices in the market, notwithstanding the excellent oysters, clams, &c., which we have. I hope that you will decide in favor of this enterprise.

WASHINGTON, D. C., *November* 17, 1883.

81.—AMERICAN BLACK BASS PLACED IN THE RIVER NENE, ENGLAND.

By JOHN T. HENSMAN.

[Abstract from the Fishing Gazette, December 1, 1883.]

Of 1,200 black bass brought from the United States by Mr. W. T. Silk, 140 were placed in the river Nene. They were from 4 to 7 inches in length. The river has a number of small backwaters with swift currents and gravelly bottoms, and also deep, quiet holes. Fishing will be prohibited for some years until the fish are well established. I think the Nene and the Welland are the only rivers in England where the bass have been put; but they are in several lakes.

82.—THE "KURREN" AND "KEITEL" (FISHING-VESSELS) OF THE COURLAND HAFF.

BY ERNST ANCHER.

The principal need of our fishing-vessels is that they should draw very little water; for the fishing-ports and landing-places along the entire coast of Lithuania are exceedingly shallow, the water often being only one foot deep, and in the northern part of the Haff there are many banks which, under certain circumstances, cannot be avoided. This makes it impossible to have fish-tanks in our vessels, as these would cause them to draw more water and render them useless in many places along our coast. Our seine-fisheries are dependent on various local circumstances, which are unfortunately of such a nature as to yield almost exclusively dead fish.

The main object of all fishing-vessels is that they should be suitable for cruising and for casting the net in a fresh and heavy breeze and in short waves, and these conditions determine the method of building our vessels.

The bottom is not even, but rises from the mainmast to the prow (one-third of the entire length) about 5 inches in a straight line. A stronger rise would make sailing easier, as well as cruising in calm water or long waves, but in the short waves of the Haff it would prove an impediment. Towards the stern the rise is very inconsiderable. Thereby the vessel drags in the water and moves a little heavier than would otherwise be the case, but as it draws but little water this proves no serious difficulty, the steady movement of the vessel remedying the evil. Moreover, the yawing to which all vessels which draw little water are subject is avoided. Crosswise the bottom also slants a little towards the center and also towards the sides. This, of course, is not favorable to sailing with a fresh breeze, but it increases the strength of the vessel in a strong wind. The bottom should be as broad as possible and obtuse at both the stern and the prow, so as to make the vessel float in the water with ease.

The sides of the vessel are not straight; the lowest plank bulges out considerably, the second is somewhat straighter, and the third rises almost perpendicularly. Thereby the side of the vessel assumes the shape of a curve, on which the vessel rests when leaning over, and is enabled to withstand the rolling of the waves. Towards the prow the sides must be straight, so as not to cut the waves, but allow these to lift the vessel easily. A vessel constructed in this manner may cruise with perfect security even in the shortest waves. The vessel needs no ballast, but will be safest without any. The bottom is 3 to 3½ inches thick, and made of pine wood. The lower planks of the sides, made of oak wood, are about $2\frac{1}{2}$ inches thick, and gradually diminish in thickness towards the top, the upper plank being only $1\frac{1}{4}$ inches thick.

Of the sails, which are manufactured here, sprit-sails are the best in wind; the two small foresails also render better service than a large stay-sail, and are therefore preferred by the fishermen. In reefing the mainsail, the small foremast is taken down entirely, and the sprit-sail remains spread. The mainsail is reefed from the top. It is somewhat narrower at the top than at the bottom, and by reefing it from the top there is no danger of rolling the sail too tight and of tearing it. The reef-line is simply tied at the top of the sprit, and in reefing it is made loose and tied lower down.

The great advantage of these vessels is their strength, as they can withstand almost any storm. I own a cutter built in the United States. In moderate wind I can always outsail our vessels, and even in a tolerably stiff breeze I can cruise as well as they; but if a strong wind springs up I can no longer cruise, but must think of my own safety, while our vessels keep on in their course.

RUSS, EAST PRUSSIA, *July* 1, 1880.

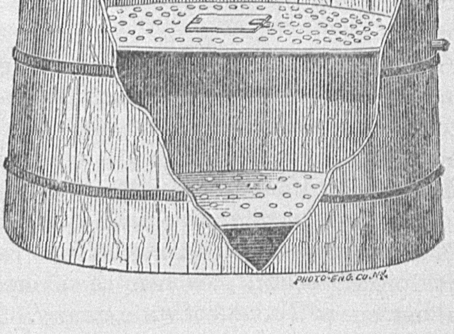
83.—WOODEN TANK FOR THE TRANSPORTATION OF LIVING FISH.

By MAX VON DEM BORNE.

The tank has a double bottom, in order that dirt may be separated from the fish. If water is poured into the tank, it will flow out by the pipe from below the upper bottom, and take the dirt out of the tank.

There should be three inches of air below the cover. On warm days some ice may be placed on the cover.

BERNEUCHEN, *February* 29, 1884.



84.—PENNING OF SALMON IN ORDER TO SECURE THEIR EGGS.

By C. J. BOTTEMANNE, M. D.

[From a letter to Prof. S. F. Baird.]

In the Dutch "Economist" of 1874 I gave a description of the fish-breeding establishment of the State of New York, and therein I mentioned the United States salmon-breeding establishment on the Penobscot, principally for the penning of the salmon from June till breeding time. As you are likely aware, the Dutch Government pays yearly $4,800 to salmon breeders for young salmon delivered in spring, at the rate of 10 cents for yearlings, and not quite (4/5) one dollar per hundred for those that are about rid of the umbilical sac, and ready to shift for themselves. For the latter they receive payment only if there is money left after delivering the yearlings.

The breeders get their eggs from Germany from Schuster in Freiburg, and from Gloser in Basel; but complain always that the eggs are from too young individuals, that there is always too much loss in transportation, that the eggs are so weak that after the fish have come out there is great mortality in the fry, &c.

In this month's "Economist" I published the results on the Penobscot, and figured out that if breeders here set to work in the same style they would get at least four eggs to one, at the same price, and be independent.

We have an association here for promoting the fresh-water fisheries, of which the principal salmon fishermen are members, and also several gentlemen not in the business, including myself. In the December meeting I told them all I knew about the Penobscot; and one breeder got a credit for $200 for getting ripe salmon and keeping them in a scow till he had what he wanted, and he has succeeded pretty well. Still this is only on a limited scale. I want to put up larger pens and in the style of the Penobscot. In order to do this I must know exactly what is done on the Penobscot and how.

What is the size of the pen, how large area, how deep? Is it above tidal water? (This I take for granted.) What is the situation of the pond compared with the river? What kind of failures were there, and the probable reasons therefor? In short, I would like a complete description of the place, with the history of it. I hope you will excuse my drawing on you for such an amount, but as the United States is the authority in practical fish-breeding, we are obliged to come to you.

I am sorry to say that I cannot report the catch of any *S. quinnat*, yet three fish have been sent in for the premium we held out for the first fifteen caught, but they proved not to be *quinnat*. Lately I heard that there were so many salmon caught in the Ourthe, near Liege, Belgium (the Ourthe is one of the feeders of the Maas), which was an astonishing fact, as salmon are seldom taken there.

BERGEN OP ZOOM, NETHERLANDS, *January* 12, 1884.

85.—MEMORANDA RELATIVE TO INCLOSURES FOR THE CONFINEMENT OF SALMON, DRAWN FROM EXPERIENCE AT BUCKSPORT, PENOBSCOT RIVER, MAINE.

By CHARLES G. ATKINS.

[In response to request of Dr. C. J. Bottemanne.]

The Penobscot salmon-breeding establishment was founded in 1872, at Bucksport, in the State of Maine, near the mouth of the Penobscot River. The location was primarily determined by the necessity of being near a supply of living adult salmon, to be used for breeders. After an exploration of the headwaters of the Penobscot, which lie mostly in an uninhabited wilderness, the conclusion was reached that the chances of securing a sufficient stock of breeders were much greater at the mouth of the river, where the principal salmon fisheries are located; but to avail ourselves of the supply here afforded we must take the salmon at the ordinary fishing season, May, June, and July, and keep them in confinement until the spawning season, which is here the last of October and first of November. As the salmon naturally pass this period of their lives in the upper parts of the rivers, it was thought essential to confine our captives in fresh water. Later experiments in Canada indicate that they will do as well in salt water, but the construction and maintenance of inclosures is much easier when they are located above the reach of the tide, to say nothing of the proximity of suitable fresh water for the treatment of the eggs. In the precise location of the inclosures several changes have been made, but they have always been in fresh water, and within convenient distance (5 to 10 miles) of the place where the salmon were captured.

In our experiments and routine work we have made use of four inclosures, which I will now describe.

No. 1.—In Craig's Pond Brook, a very pure and transparent stream, an artificial pond 40 square rods in area and 7 feet in extreme depth, was formed by the erection of a dam. The bottom of this pond was mainly a grassy sod newly flooded. About half the water came from springs in the immediate vicinity, and the rest from a very pure lake half a mile distant. The water derived from the lake was thoroughly aerated by its passage over a steep rocky bed. The transparency of the water in the pond was so great that a pin could be seen at the depth of 6 feet. This inclosure was a complete failure. The salmon placed therein were after a day or two attacked by a parasitic fungoid growth on the skin, and in a few days died. Out of 59 impounded not one escaped the disease and only those speedily removed to other waters recovered. Several, removed in a very sickly condition to the lake supplying the brook, recovered completely, from which it is safe to infer that the cause of the trouble did not lie in the lake water. Of the spring water I have some suspicions, and should not dare to inclose salmon in it again.

No. 2.—After the failure of the above experiment an inclosure was made in the edge of an ordinary lake by stretching a stout net on stakes. This water was brown in color, and objects 4 feet beneath the surface were invisible. The bottom was gravelly and devoid of vegetation. The depth was 7½ feet in early summer, and about 4 feet after the drought of August and September. The area inclosed was about 25 square rods in June, and perhaps half as much at the end of summer. This inclosure was entirely successful, very few salmon dying in it except those that had been attacked by disease before their introduction, and all the survivors were found to be in first-rate condition in November. This site was not afterwards occupied, because it was inconviently located, and was exposed to the full force of violent winds sweeping across the lake, and therefore unsafe.

No. 3.—The inclosure in use for the confinement of the stock of breeding fish for the four years from 1872 to 1875, inclusive, was made by running a barrier across a narrow arm of a small lake (mentioned in official reports as "Spofford's Pond") near Bucksport village. This body of water, about 60 acres in area in the summer, receives the drainage of not more than 5 square miles of territory through several small brooks, that are reduced to dry beds by an ordinary drought. About a quarter of the shores are marshy and the rest stony. The water is highly colored by peaty matters in solution, and all objects are invisible at a depth of 2 feet. The bottom is composed mostly of a fine brown peaty mud of unknown depth. Aquatic vegetation of the genera *Nuphar*, *Nymphœa*, *Bragenia*, *Potamogeton*, &c., is abundant. The water is nowhere more than 16 feet deep in the spring, and 11 feet in midsummer. The portion inclosed is 2 feet shoaler. The inclosure occupied sometimes 8 or 10 acres, and sometimes less. The barrier was from 400 to 600 feet long, and was formed the first year of brush; the second and third years of stake-nets, weighted down at the bottom with chains; and the fourth year of wooden racks, 4 feet wide and long enough to reach the bottom, which were pushed down side by side. The brush was unsatisfactory. There were holes in it by which the fish escaped. A single net would not retain its strength through a whole season, the bottom rotting away and letting the fish out, unless before the autumn was far advanced its position were reversed, the stronger part that had been above water being placed now at the bottom. This method was therefore rather expensive and not perfectly secure. The wooden racks were costly and heavy to handle, but quite secure.

The salmon placed in this inclosure had to be carted in tanks of water overland about a mile in addition to transportation in floating cars from 3 to 5 miles; they were transferred suddenly from the salt water of the river (about two-thirds as salt as common sea-water) into the entirely fresh water of the lake. To all the supposed unfavorable circumstances must be added the high summer temperature of the water. During August the mean was generally above 70° Fahrenheit at the bottom and several degrees warmer at the surface. Occasionally there was observed a midday temperature of 74° F. and once 76° F. at the bottom. Yet this proved an excellent place for our purpose, a satisfactory percentage of the salmon remaining in perfect health from June to November.

No. 4.—The inclosure in use since 1879 at Dead Brook, Bucksport. It is located in a gently running stream bordered by marshy ground, with a bottom in part of gravel but mostly of mud, crowded with aquatic vegetation. The water, supplied by two small lakes among the hills, is cleaner than the average of Maine rivers, but does not in that respect approach the water of inclosure No. 1. The greatest depth is about 8 feet, but in the greater part of the inclosure it is from 3 to 5 feet. The width of the stream is from 2 to 4 rods, and the portion inclosed is 2,200 feet long. The barriers to retain the fish are in the form of wooden gratings, with facilities for speedily clearing them of débris brought down by the stream.

Better results were expected from this inclosure than from No. 3, but have not been realized. The percentage of salmon dying in confinement has been greater, amounting commonly to about 25 per cent of those introduced, and this notwithstanding the salmon are conveyed to the inclosure by water carriage the entire distance (7 miles) instead of being carted in tanks. The cause of the trouble has not yet been discovered, but there is good reason for thinking that it lies in some of the circumstances attending the transfer of the fish from the place of capture, and that the inclosure itself is perfectly suited to its purpose. This view is supported by the fact that nearly all the losses occur within a few weeks after the introduction of the salmon and almost wholly cease by the end of July. If the cause of disease was located in the inclosure, we should expect it to be more fatal after a long than a short duration of the exposure of the fish to its action, and that with the smaller volume and higher temperature of August it would be more active than in June and July.

The above description will, I think, give Dr. Bottemanne a sufficiently correct idea of the character of the inclosures we have tried. There are, however, several other points to be touched upon to put him in possession of the practical results of our experience.

The facilities for the recapture of the salmon when the spawning season approaches must be considered. In the lake at Bucksport village (No. 3) we hoped at first that their desire to reach a suitable spawning ground would induce them all to enter the small brook that forms the outlet, which was within the limits of the inclosure. In this matter our expectations were but partially realized. Many of the fish refused to leave the lake through the narrow opening that was afforded them, and were only obtained by pound-nets, seines, and gill-nets, all of which involved a considerable expenditure of labor and material. The drawing of a seine in a large body of fresh water is likely to be a serious undertaking unless the bottom has been previously cleared of snags. In this respect the long and narrow inclosure at Dead Brook possesses great advantages, since it can be swept with a comparatively short seine. However, the influx and efflux of a considerable volume of water is of great advantage in enticing the gravid fish into traps that can readily be contrived for them by any ingenious fisherman.

The existence of a gravelly bottom in the inclosure must be considered a positive disadvantage, inasmuch as it affords the fish a ground on which they may lay their eggs before they can be caught; but the danger of such an occurrence is less as the bounds of the inclosure are more contracted and the facilities for capturing the fish are better.

As to the number of fish to a given area, I think we have never approached the maximum. I should have no hesitation in putting 1,000 salmon in the inclosure at Dead Brook, which covers an area of less than 3 acres. Of course the renewal of the water supply, or its aeration by winds, is of importance here.

The capture and transport of the fish in June involves methods requiring some explanation. The salmon fisheries about the mouth of the Penobscot River are pursued by means of a sort of trap termed a "weir." It is constructed of fine-meshed nets hung upon stakes, arranged so as to entrap and detain the fish without insnaring them in the meshes. They swim about in the narrow "pound" of the weir until the retreating tide leaves them upon a broad floor. Just before the floor is laid bare, the salmon destined for the breeding works are dipped out carefully with a cloth bag or a very fine bag-net and placed in transporting cars or boats, rigged specially for the purpose, sunk deep in the water, which fills them, passing in at two grated openings above, and passing out at two others astern, and covered with a net to prevent escape. In a boat 13 or 14 feet long (on the bottom) we put 10 or 15 salmon, to be towed a distance of 7 miles. If the water is cool, twice as many can go safely, but there must be no delay. It is very important that this car be smooth inside, with no projections for the salmon to chafe on, and the gratings must be so close that they cannot get their heads in between the bars.

If conveyance overland is necessary, a wooden tank 3 feet long, 2 feet wide, and 2 feet deep, with a sliding cover, will take six salmon at a time for a mile and perhaps farther, and they may be jolted along over a rough road in comparative safety.

It has been our uniform experience that all the salmon that survived till autumn were in normal condition as to their reproductive functions, and yielded healthy spawn and milt. On two occasions we suffered serious losses of eggs. In neither instance could the loss be attributed to any defect in the inclosure, but on one occasion the conclusion was reached that the water which was well suited to the maintenance of the fish was injurious to the eggs, rendering the shell so soft that they could not be transported safely.

With the exception of the disasters enumerated above, there has been but one that I can recall, and that was caused by the bursting of our barriers at Dead Brook under the pressure of a flood.

BUCKSPORT, ME., *April* 7, 1884.

86.—FURTHER REPORT OF R. D. HUME'S SALMON HATCHERY, OREGON.*

By CHARLES I. FINÉLY.

[From a letter to Prof. S. F. Baird.]

I have carefully liberated about 12,000 salmon fry in a little stream called Indian Creek, a tributary of Rogue River, Oregon.

Nearly all the eggs that I lost were from non-impregnation. I had to spawn the salmon too early, but I did it then for fear of losing them altogether, on account of a freshet. We had them in two boxes afloat in the water. These boxes are made of slats 24 by 10 by 6 feet. Between the 25th and 28th of August last I put into these boxes 100 salmon (50 in each box). Those that lived I left there until the 22d of November. In towing the boxes down the river one of them ran aground and a slat tore off, so that we lost 50 fish thereby. Of the other lot about half died. I think this was due chiefly to their being confined in too small a space. They got a good deal bruised before the middle of September. Mr. Hume intends to do away with the boxes and to build a large reservoir at the outlet of the hatching-house.

I spawned in all only nine females; lost two from their getting away, and let one go for want of a male. I estimated only about 30,000 eggs, and from actual count the loss of eggs was 7,000. The loss of minnows and fry was about 1,000.

The first eggs were put in the trays on the 22d of November; the first embryo was discovered on the 26th of December; and the first fish was free the 27th of January, or in sixty-six days. The last salmon hatched February 17th, or eighty-seven days from spawning. On the 10th of March we commenced fishing, and on the 7th of April let them go, all large and healthy fry. As far as I could find, I had only ten cripples, and some of these lived to become fry. I waited for Mr. Hume to come from San Francisco before turning them out. Under the circumstances, I feel much encouraged with my success.

Mr. Hume intends to make the hatchery a permanent fixture here, and to have the river stocked to its full capacity during the coming winter. We have a capacity for about 1,000,000 eggs.

ELLENSBURG, OREG., *April* 27, 1884.

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* See previous report on page 88 of this volume.—C. W. S.

87.—WHAT CODFISH SOMETIMES SWALLOW.*

By CAPT. J. W. COLLINS.

[From a letter to Prof. S. F. Baird.]

I send by to-day's express a knife, apparently of the kind known as a "haddock ripper," which was taken from the stomach of a large codfish on Le Have Bank. The knife was presented by Captain Henry McEachern, of the schooner A. F. Gifford, of this port, through Capt. Benjamin F. Blatchford. Captain McEachern stated to me that the knife was found in the stomach of a 45-pound cod which was caught this winter on a trawl-line, in about 55 to 60 fathoms of water, latitude 43° 08′ north, longitude 64° 11′ west. As Captain McEachern is considered very reliable, there is no reason for doubting the correctness of his statement, though it does seem strange that a fish should swallow such an implement.

GLOUCESTER, MASS., *January* 26, 1884.

88.—LEECH CULTURE.

By RUD. HESSEL.

[From a letter to Prof. S. F. Baird.]

The *Hirudo medicinalis* and the *H. officinalis* begin to propagate when three or four years old, at which age they are from three to five inches in length and from half an inch to an inch in diameter.

They are raised extensively in France, especially on the moss-lands in the environs of Bordeaux, where the culturists call the adult worm by the unscientific name of *Sangsue vache*, "cow-leech." I have seen all the different kinds of ponds in use there, as well as in other parts of France, and in the Danube province of Austria-Hungary.

I once laid out some ponds on my place especially adapted to the habits of the leeches, and to protecting them from their enemies. I then bought 10,000, including both species, one of which I got from Bordeaux and the other from Hungary. Two years afterwards, when my establishment was washed away by a freshet, I had about 100,000, about 60,000 of which were of marketable size.

For the trial which you are intending to make, from 150 to 250 would

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*There is in the National Museum a package of 15 or 20 cards of the usual size of playing-cards ($2\frac{1}{4}$ by 4 inches) which were taken from the stomach of a codfish. The corners are well rounded off, but the colors are in quite a good state of preservation. The cards were exhibited at the London Fishery Exhibition, and the fact that they came from the stomach of a cod is well authenticated.—C. W. S.

be enough to begin with. You might then have from 2,000 to 3,000 a year for distribution to the hospitals, &c.

The propagable leeches sell for higher prices than the common-sized ones. I think that I paid 20 francs [$4] per hundred for the best of mine. They may be cheaper than that. I suppose the best thing to do is to get the price-lists from the different Bordeaux establishments, through the mediation of the United States consular agency at that place, so that we can see what kinds of leeches they sell, as well as their prices. The Becharde Brothers, rue Fondadège, Bordeaux, from whom I got my "*vaches*," gave me entire satisfaction, both in regard to the quality of the leeches furnished and their healthiness.

WASHINGTON, D. C., *November* 17, 1883.

89.—EDIBLE QUALITIES OF CARP.

By EDWARD THOMPSON.

[From a letter to Prof. S. F. Baird.]

I enjoyed reading the different opinions of men on the eating qualities of the carp.* I would venture to say it would be the same with beef, pork, or any other fish, no matter where it came from. It would be an utter impossibility to take any fish out of a muddy hole and expect it to taste like a fish out of a pond with pure, clear water, such as you could stoop down and drink out of. One fact which cannot be got over is that different food and water will make either animal, fowl, or fish taste differently, no matter where they come from or what their names are. I once sent Mr. Eugene G. Blackford two brook trout, about one-half pound each, and asked him his opinion as to flavor, and he pronounced them as good, if not better, than any he had ever eaten. Why? Because they were fed on the natural food for trout. Again, I have eaten trout that tasted very distinctively of liver. Why? Because they were fed on liver, &c. It is the food and water which makes the carp have so many different tastes. I might ask one more question. Can you find two even in one family to whom things taste alike? It is not so in mine.

The carp is the best fish I know of for workingmen and mechanics, who rarely lack an appetite, and who will always consider the fish good when they can get it. My personal opinion is that it is a very superior fish, and I will even go so far as to say that I prefer it to trout.

ST. JOHNLAND, SUFFOLK CO., N. Y., *February* 15, 1884.

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* Notes on the edible qualities of carp, &c., by Chas. W. Smiley. Bull. F. C., 1883, p. 305.

Vol. IV, No. 12. Washington, D. C. July 31, 1884.

90.—ON THE SPECIMENS RECEIVED BY THE SMITHSONIAN INSTITUTION FROM THE UNITED STATES LIFE-SAVING SERVICE.

By Prof. S. F. BAIRD.

The arrangement made by the Superintendent of the Life-Saving Service, early in the year, for the telegraphic announcement to the Smithsonian Institution of the stranding of marine animals has already been productive of important results. The series of specimens thus far received is in every way remarkable, and should the system continue to be so productive it is impossible to say what good may not result to zoology. The first specimen received was that of a shark (*Pseudotriacis microdon*) from Station No. 10, Amagansett, N. Y., Mr. Joshua B. Edwards, keeper. This species had hitherto been captured only off the coast of Portugal, and its discovery in our waters was a matter of great interest to American ichthyologists. The only specimen known to be preserved besides this one is the type of the species.

Shortly after this shark was received, a still more remarkable animal was announced from Station No. 8, at Spring Lake, N. J., Mr. Henry S. Howland, keeper. This was a pigmy sperm whale, which was entirely new to the North Atlantic, and apparently new to science as well. It has been provisionally named *Kogia goodei*. Few specimens of this genus have ever been collected, and these from the most remote parts of the globe, some from New Zealand, and one from Mazatlan at the entrance of the Gulf of California. These animals resemble the great sperm whale, to which they are closely related, but do not seem to attain a length of more than 9 or 10 feet, and are truly the pigmies of their race. The New Jersey specimen was peculiarly interesting in that it was a female with young. In dissecting the animal a a fetus fully 3 feet long was found, which is probably the first ever seen.

The enthusiasm aroused by the arrival of this specimen had scarcely abated when the stranding of another cetacean was announced from Station No. 17, at Barnegat City, N. J., Mr. J. H. Ridgway, keeper. This remarkable animal floated in upon the tide and was secured by Mr. Ridgway and his crew after considerable exertion. The curator of mammals and an assistant were dispatched from the National Museum and a cast of the exterior was made and the skeleton prepared for shipment to Washington. As the huge animal lay upon the sand the question of its identity proved quite a puzzling one to the zoologist who viewed it; but when the skull was cut out, it was at once apparent that the animal belonged to the whales known as the Ziphioids, and probably to the species *Ziphius cavirostris*, an animal for which no common name exists, but which may be termed a bottle-nose whale. It is probably the second specimen ever taken on the coast of the United States.

Ziphioid whales have a most interesting history. In ages past they were very abundant, perhaps as much so as the common porpoise of today, but at present only stragglers are found in remote quarters of the globe. It would seem as if they were but the surviving relics of a great race, which sprung into existence, reached the maximum of its abundance, and declined long ages before man appeared on the earth.

From Station No. 20, at Fire Island, N. Y., Mr. Daniel S. Hubbard, keeper, and Station No. 37, at Turtle Gut, N. J., Mr. Uriah Gresse, keeper, came two specimens of a porpoise, which, unlike the cetaceans which have been already referred to, is of common occurrence on our Atlantic coast, and is probably also represented in European waters. The casts, however, which the National Museum was enabled to make, are probably the first of the species in any museum in the country, and with the skeletons which were preserved form an excellent basis for comparison with other forms. The animal is commonly known as the bottle-nose dolphin, and is identical with or closely allied to the species *Tursiops truncatus*.

In addition to the shark previously mentioned several peculiar and interesting fishes have been received. Among these is a fish known as the "star-gazer" (*Astroscopus anolophus*) from Station No. 6, at Deal's Island, N. C., Mr. Malachi Corbel, keeper. The "star-gazer" is a southern species which occasionally strays northward as far as Cape Cod, but it is very rare in museums. A very closely allied species (*Anolophus* V. *græcum*) is said to possess electrical powers in life. From Station No. 2, at Point Judith, R. I., Mr. Herbert M. Knowles, keeper, was received a specimen of the "lumpfish." The "lumpfish" (*Cyclopterus lumpus*) as a rule is an inhabitant of colder waters than that in which it was found. The "flute mouth" (*Fistularia serrata*) from the same station is a very rare species on our coast. The "angel fish" (*Pomacanthus arcuatus*) taken at Barnegat City, N. J., has not hitherto been known north of Florida.

WASHINGTON, D. C., *January* 25, 1884.

91.—WEIGHTS OF SALMON TAKEN AT McCLOUD RIVER STATION IN 1880.

By LIVINGSTON STONE.

The following table showing the weight of female salmon after spawning, was accidentally omitted from the report for that year of the operations at McCloud River station. The average weight of those taken August 31 was $9\frac{3}{8}$ pounds; of those taken September 9, $8\frac{4}{5}$ pounds; of the entire lot, $9\frac{7}{30}$ pounds.

Salmon taken August 31.

No.	Weight.	No.	Weight.	No.	Weight.	No.	Weight.	No.	Weight.
	Pounds.		*Pounds.*		*Pounds.*		*Pounds.*		*Pounds.*
1	19	9	7	17	18	25	12	33	13
2	9	10	14	18	14	26	5	34	7
3	11	11	5	19	7	27	7	35	5
4	7	12	7	20	8	28	14	36	7
5	16	13	11	21	8	29	8	37	6
6	8	14	10	22	12	30	7	38	9
7	8	15	8	23	6	31	12		
8	14	16	5	24	16	32	7	Total	367

Salmon taken September 9.

No.	Weight.	No.	Weight.	No.	Weight.	No.	Weight.	No.	Weight.
	Pounds.		*Pounds.*		*Pounds.*		*Pounds.*		*Pounds.*
1	11.5	25	11	49	8	73	11	97	9
2	12	26	12	50	10	74	12	98	7
3	5	27	8	51	7	75	8	99	5
4	3.5	28	12	52	6.5	76	8	100	12
5	14	29	6.5	53	11	77	9	101	8
6	6.5	30	8	54	7	78	8	102	8
7	15	31	6	55	6	79	7	103	14
8	8	32	12	56	6	80	8	104	6
9	8	33	6	57	16	81	16	105	7
10	6	34	7	58	14	82	8	106	7.5
11	9	35	6	59	10	83	8	107	7.5
12	5	36	7	60	10	84	13	108	7
13	7	37	10	61	14	85	7	109	9
14	9	38	8	62	9	86	9	110	8
15	8	39	8	63	9	87	8	111	7
16	15	40	6	64	9	88	6	112	8
17	13	41	8	65	7	89	8	113	10
18	10	42	7.5	66	6	90	7	114	8
19	6	43	8	67	7	91	10	115	12.5
20	7	44	7	68	8	92	11		
21	7	45	11	69	8	93	11	Total	1,014.5
22	7	46	8.5	70	9	94	13.5		
23	8	47	10	71	9	95	9		
24	6	48	16	72	9	96	7		

92.—VITALITY OF GERMAN CARP AND RESTORATION OF SOME APPARENTLY DEAD.

By CHARLES W. SCUDDER.

Wishing to examine some scale carp anatomically, on January 2d I visited the Central Hatching Station of the United States Fish Commission in the Armory building, and called for dead carp, as they would answer my purpose as well as live ones. Mr. J. E. Brown handed me seven or eight, which were from 1 to 3 inches in length, and which had been thrown out of the tanks as dead. These I at once put into an envelope and carried home in my pocket.

At least an hour later I removed them from the envelope and put them in a wash-bowl of water for cleansing them. I soon noticed that two of them were floating on their sides and occasionally gasping. A half hour after this, for the purpose of discovering how much vitality there might be in the two in which I had observed signs of life, I placed in the mouth of each one a drop of brandy diluted with an equal quantity of water. These I returned to the bowl, and paid no further attention to them until six hours afterwards. I then noticed that the two which had received the tonic showed a marked improvement, and were swimming on their sides nearly at the top of the water. I then changed the water and administered the same amount of brandy as before. On the following morning, thirteen hours after the first administration of brandy and seven hours after the second dose, the two fish in question were apparently fully restored, and were swimming naturally and actively about the bowl. The restoration proved to be complete.

UNITED STATES FISH COMMISSION,
Washington, D. C., January 4, 1884.

93.—LOSS OF LIFE AND PROPERTY IN THE GLOUCESTER FISHERIES.

By Capt. J. W. COLLINS.

I beg to submit the following statement of the losses, from Gloucester, of life and property in the New England fisheries during the past ten years, first saying that there is no available source from which to obtain similar facts relative to the fishing fleets of other New England coast towns. The period covered by the statistics I give is from 1874 to 1883, inclusive, during which time Gloucester has had a fleet of, approximately, 400 fishing vessels, carrying about 4,300 to 4,800 men. About one-half to possibly three-fourths of this fleet has been engaged in some branch of the winter fisheries, the rest of the vessels being hauled up for about five months of the year.

In the ten years mentioned the total loss of vessels has been 147, of which number 82 have foundered at sea, 7 of the latter having been abandoned in a sinking condition. The total value of these vessels was $735,126. The total loss of life has been 1,233 men, 895 of whom went down in their vessels, which foundered at sea. It is a little difficult to get at the exact number of bereaved families which lost their natural protectors, since for one or two years of the period under consideration accurate record was not kept of the widows and fatherless children left by these disasters at sea, and even if it had been it would not show how many almost helpless parents have been deprived of their only means of support. As near as I can get at it—making what I believe to be an underestimate for the years of which I can obtain no statistics of the widows and children left—322 women have been made widows, and 658 children left fatherless by the disasters to the Gloucester fleet alone. Many of these families have been left in utter destitution.

There can be but little doubt that upwards of 75 per cent of the vessels lost at sea meet with an untimely fate simply because they are too shallow; the consequence being that when caught in a gale they are liable to be thrown on their beam ends, and, not being able to right because of their shallowness, fill and sink. In a single gale, that of December 9 and 10, 1876, no less than five Gloucester schooners were knocked down and barely escaped sinking. Three of them were dismasted, two of which were abandoned, one went into Liverpool, Nova Scotia, under a jury-rig, while the others were not so badly damaged. The inference is that other vessels which foundered in the same gale, and those that have been lost at sea on other occasions, were knocked down in a similar manner, and, failing to right again, soon sunk. Of course, with a deeper body to the vessels, and the ballast placed lower, there would be far less probability of such a mishap occurring, and even should it happen the chances would be a hundred to one that the vessel would right again.

It is, therefore, altogether probable that the introduction of deeper fishing vessels in New England would save for Gloucester alone somewhere about $30,000 to $50,000 per year, besides a large number of lives.

As an instance showing how terrible the loss is sometimes, I will say that from the 29th of August to the last of December, 1883, 16 vessels from Gloucester foundered at sea, carrying down with them 205 men, while the loss of property was little less than $100,000.

GLOUCESTER, MASS., *February* 21, 1884.

94.—LOSS OF LIFE AND PROPERTY IN THE FISHERIES.

By R. B. FORBES.

I have perused with great interest the statements on the subject of the loss of life among the fishermen of Gloucester. The loss of 447 vessels and 2,600 lives in fifty-four years ending in 1884 is fearful to contemplate. In 22 years ending this year the number of men lost was 2,140. There must be some cause for this large increase. It may be presumed that the increase of the number of vessels in the business accounts for the increased loss of lives in a great degree. Another cause must be the fact that the vessels are more crowded. Another prominent cause must be the fact that trawl-fishing in dories necessarily exposes the men to greater danger than hand-fishing. I have before me a long list of men who have been separated from their vessels; many of these have been lost, while some have been rescued in a starving condition. No regular rule has been established for furnishing dories with condensed food and means for cooking. This should be done. Mr. D. W. Low, of Gloucester, has contrived means not only to feed persons, but to enable them to right their dories and to cling to them when capsized. If the owners of fishing craft do not feel interest enough to encourage the use of these means, there should be a law to compel them to do so; and if a law cannot be passed to compel attention to the safety of the men, public opinion must be invoked to organize relief associations for the mitigation of the existing evils. It would, perhaps, be considered out of place for me, who have had no experience in bank fishing, to give an opinion adverse to what is said by one brought up in the business (Capt. J. W. Collins), who attributes the loss of many of the vessels to capsizing, owing in a great degree to the long masts and shallow hulls. A shallow craft is certainly more liable to be capsized than a deep one, but the spars of a schooner cannot contribute largely toward capsizing. Captain Collins is said to be in favor of putting out a drag rather than riding at anchor in stormy weather. No small craft should be without one, but I doubt if it would conduce to prevent collisions in the event of a fleet of vessels trying to keep head to the wind by it. The canvas-bag drag is an excellent thing to ride by in the open sea, where a single craft or a few craft may be exposed, and where there is plenty of room to drift; but in a crowd it would not tend to prevent vessels fouling with each other, as compared to riding at anchor with a long scope of cable. The drag is an excellent thing to assist in changing position, by reversing it with the tripping line and catching hold again.

There are more fishing vessels run down by steamers than we hear of. The remedy for this class of losses lies in steam lines adopting regular courses (or lanes, as Maury called them), whereby the fishing-grounds most frequented should be avoided by the steamers, and the steam-routes where they cross banks should be avoided by the fishermen. Fog-horns should be made to work by compressed-air power on board of fishermen, and every boat leaving the vessel should carry a good fog-horn as well as some means to show a powerful light. As to the compass, I should class that as a luxury which might be dispensed with much better than a supply of food; any intelligent seaman can tell near enough how he is heading by night or in a fog, but none can exist long without food and drink. As to comparing the safety of the yacht-like craft with the old-style fishing craft, I would make use of the same argument as I have used for steamers in fogs, namely, "go ahead in fogs and shorten the time at sea." The old banker may be a safer model in a gale; but she is so long in making her trips that she encounters more dangers in the aggregate than the sharp modern craft. The subject of oil to smooth the rough water is one that should be studied by fishermen. I feel sure that it would in many cases be found useful, especially when cast over from a vessel drifting fast, but its utility to vessels at anchor may be doubted; still if a crowd of vessels should all spread oil on the rough seas, those to leeward might possibly be benefited. I submit these remarks in the hope of calling more attention to the risks incurred by fishermen; and I close with the single remark that if more native boys of Gloucester should be used and fewer foreigners, we should hear much less of loss of life and something more in regard to preventing it than we now do.

Boston, Mass., *May* 29, 1884.

95.—RESUSCITATION OF APPARENTLY DEAD CARP.

By MILTON P. PEIRCE.

[From a letter to Prof. S. F. Baird.]

From a lot of 1,200 carp one of my assistants threw out 110 which he supposed to be dead. I do not think they were dead, but only torpid, for one was left floating in the tank when it was replaced in the store. A small boy called who was going on the street-cars to a distant part of the city [Philadelphia]. The mechanics gave him the supposed dead carp, which he wrapped in a piece of paper and placed in his pocket to show to his chum. After reaching his destination and playing awhile, the two boys passed into a room where the goldfish tank stood when he thought of his carp. The boys thought they would give the lady of the house a surprise, and so placed the carp in the tank. An hour or two later the lady discovered a strange fish swimming in her aquarium in an erratic manner, and upon inquiry, learned from the boys the almost incredible facts. Two weeks later she called and related them to me, saying that the carp was well, lively, eating readily, and growing rapidly.

WENONAH, N. J., *March* 31, 1882.

96.—REMARKABLE RESUSCITATION OF FROZEN CARP.

By CHAS. W. SMILEY.

On the morning of January 4, 1884, 2,100 German carp were forwarded from Washington by express to Birmingham, Ala. Mr. F. L. Donnelly, a messenger of the Commission, proceeded by the same train to watch them on their passage and to take charge of them upon their arrival at Birmingham. The fish had been placed in the usual four-quart tin pails, and packed in crates of 16 pails each. Each pail contained 15 carp.

Mr. Donnelly and the carp arrived at Birmingham at 1.30 a. m., January 6. The packages were left in the office of the Southern Express Company through the remainder of that night, but placed within 10 feet of the stove in order to prevent the water freezing. The thermometer indicated +4° F. at the time of arrival. At 8 o'clock on the morning of the 6th, Mr. Donnelly examined the condition of the fish, and, in his official report dated January 14, says:

"I was greatly surprised to find every drop of water in the buckets frozen into solid ice, and all the fish apparently dead; but upon close examination of their eyes, I thought perhaps a great many of them were still alive though frozen solid in the ice."

Mr. Donnelly thereupon courageously undertook to see if any of the fish could be saved. He procured the necessary laborers, four large tubs, and a supply of water. He then broke the ice from the small pails, transferring such as contained carp to the water. He states that "in this manner a great number of fish were soon freed from their confinement, and by constant working with them during the entire day we were able to save 1,300 fish." Although the thermometer continued to remain in the vicinity of zero, by careful management he succeeded in keeping the 1,300 fish alive until the 8th and 9th, when they were distributed to the applicants throughout the State.

The saving of 1,300 carp out of a lot of 2,100, under such circumstances, may be considered a very remarkable achievement.

Having prepared the foregoing statement from Mr. Donnelly's report, I sent a copy of it to Mr. L. H. Black, route agent, Southern Express Company, Montgomery, Ala., asking how far he knew the statements to be true. Under date of January 25, 1884, he wrote me in reply as follows: "As route agent of the Southern Express Company, my duties call me to Birmingham. I saw the carp first on the morning after their arrival at Birmingham and frequently during the day while Mr. Donnelly was at work with them. My opinion is that this statement is correct in every particular. I give it from what I saw myself and from information Mr. Donnelly gave me during the day, while he was working with the fish."

WASHINGTON, D. C., *January* 30, 1884.

97.—DESTRUCTION OF SMALL FISH IN WEIRS.

By SETH NICKERSON.

[From a letter to Prof. S. F. Baird.]

I desire to call your attention to the great destruction of small fish along our shores by means of deep-water weirs. These engines of destruction are set in water from 4 to 10 fathoms deep. Oftentimes last year, from many boat loads of codfish, hake, haddock, and other kinds of ground fish, together with mackerel and herring taken, only one barrel of fish large enough for market use would be saved. There were sometimes 25 barrels of fish thrown away, leaving the bottom of the sea covered with dead carcasses. If this destruction of spawn and young is not prevented we shall soon have no fresh fish from Provincetown. Formerly hundreds of tons of cod and haddock were caught here with hook and line and sent to Boston; whereas, during the past year, we had to depend upon Boston for our own supply of fresh fish. Seining is bad enough, but deep-water weirs are the worst engines of destruction I ever saw.

PROVINCETOWN, MASS., *April* 28, 1884.

98.—CONCERNING THE SALMON FISHERIES OF BRETAGNE, FRANCE, AND THE NEED OF FISH-WAYS AND RESTRICTIVE LEGISLATION.

The crawfish is not the only thing threatened with extermination. Our last article on the truly blameworthy tolerance of the administration in regard to poaching in our waters has brought us a letter from a resident of Finistère. We give his exact words, so as not to lessen the appearance of truth with which our correspondent has described that which passes under his eyes. He writes us:

"Affairs in this country have reached their limits. Salmon and trout are threatened with absolute destruction. Notice what takes place: Salmon ascend the river to spawn; at the mouth nearly all the fish are stopped by the nets of the fishermen of the maritime inscription, whose right to fish with seines extends in the river as far up as the tide ascends. There pass, then, only a few salmon, which the nets of the residents along the river will harass all summer. You see what is likely to survive for reproduction.

"Nor is this all. At the time when these unfortunate fish choose a spawning-place, and when they are easy of capture by any one with a grappling-iron, with a basket even, great numbers are caught; and they can be seen carried to market with their eggs flowing from their bodies like the water of a spring. Also, one now sees but few young salmon; and, as it is acknowledged that after their sojourn in the sea these young salmon return to the streams where they were born, you can judge of the final issue: our rivers after a short time will contain no salmon.

"The advantage of the fish-culturists lies in protecting the different species, and in aiding the processes of propagation. The English understand this and profit by it. Last year I saw in Aberdeen, a large city of Scotland, sea-trout weighing from three to four pounds sold at the rate of twelve cents apiece. Can any one pretend that our people would not be fortunate in sparing this wholesome and agreeable food for a like good market? On the other side of the department of Manche the mouths of the streams are allowed to be fished only every other day by the fishermen, including the fishermen of the coast as well as those of the streams; why should it not be the same with us? The salmon fishery should close on September 1 instead of October 15; but to make amends, it could open on January 1. Thus reproduction under normal circumstances would be assured; but on the condition, of course, of ascertaining by a strict inspection the manner in which the law is obeyed by those living along the streams.

"Fish-ways are unknown in our rivers of Bretagne. It requires, therefore, considerable water passing over the dams or slopes for the fish to be able to surmount these obstacles and continue their ascent.

Now each in emulation of the other obstructs its end of the river, in order to push into a kind of close passage the migrating salmon, which, of course, never go out except to die. Millers also need a word. They make of their mill-wheels the most deadly means of destruction. When young salmon were there, they would take them by basketfuls in one night, salt down these young fish scarcely as large as sardines, and in case of superabundance would give them to their hogs. See where we are! Almost nothing is found in all our river-basins. It is true that England, Scotland, Ireland, and Norway are willing to forward to us all the trout and all the salmon preserved in ice which the market of Paris calls for; but of course it is on the condition that we return them good French money, and this last commodity begins to become so scarce here that perhaps it would be better if we were keeping it for ourselves."

As we have the utmost confidence in our correspondent, we conclude that affairs in Bretagne are going exactly as they are in our streams of Central France, where, when the "prohibited" nets become too fatiguing to manage and insufficiently productive, they never hesitate to call in the aid of lime, of poison-berries (*Cocculus indicus*), and at present, above all, of dynamite. Sluggish species of fish and migratory species are alike quickly passing away, since nothing is done to stop it.

It will be with this plague—for it is one—exactly as it was with the phylloxera. In 1865, when the American plant-louse began its ravages among the rich vineyards of the Rhone, several hundred thousand francs were considered sufficient, following the example of Switzerland and Germany, to stop the career of the destructive insect.

The indifference with which it was treated costs the Government annually millions of francs, and causes a loss to agriculture of something like a billion of francs every year. Even so in ten or twenty years there will arise a statesman of genius who will discover that our rivers are depopulated, and that this depopulation constitutes a crime of high treason against the nation, because it deprives the people of an economical kind of food, growing without labor, and one which our hundreds of thousands of acres of water ought to furnish us at as low a price as it is furnished in Scotland and China. In his patriotic indignation this statesman will call all the fish-culturists to his aid; they will multiply breeding-basins; they will establish costly stations; they will restock the waters, rivers, streams, &c., with the prodigality in such matters which should characterize the acts of every Government; they will expend a hundred millions of francs to obtain with difficulty a result which should be reached immediately and almost "free of cost," requiring merely some employés to execute the laws which are now little more regarded than scarecrows. Is to allow such a thing as this an act of good government? In spite of our desire, which we share with all poor wretches, to be agreeable to the authorities, it is impossible for us with sincerity to answer yes.

LA PETITE FRANCE, *April* 25, 1884.

99.—AN ACT TO PROHIBIT FISHING BY STEAM VESSELS WITH SHIRRED OR PURSE SEINES IN ANY OF THE WATERS WITHIN THE JURISDICTION OF THE STATE OF NEW JERSEY.

Introduced by Mr. W. B. MILLER.

[Passed April 8, 1884, without the signature of the governor.]

1. *Be it enacted by the Senate and General Assembly of the State of New Jersey*, That it shall not be lawful for any person with steam vessels to take with purse or shirred nets any menhaden, porgies, herring, or other fish, in any waters within the jurisdiction of this State, including the waters of the Atlantic Ocean within three nautical miles of the coast-line of said State, either on his own account and benefit or on account and benefit of his employer; and every person who shall offend herein shall forfeit and pay two hundred dollars, to be recovered and applied in the manner hereinafter directed by section four of this act; and the said steam vessel used and employed in the commission of such offense, with all the fish, tackle, furniture, and apparel, shall be forfeited, and the same seized, secured, and disposed of in the manner hereinafter prescribed.

2. *And be it enacted*, That no steam vessel found in any of the waters within the jurisdiction of this State, including the waters of the Atlantic Ocean within three nautical miles of the coast-line thereof, shall have on board of the same any purse or shirred nets, or seine or seines, with the necessary instruments and appliances for catching any of the fish mentioned in the first section of this act; and the master, or owner or owners, of every such steam vessel that shall have on board the same any such nets, instruments, or appliances named in this section shall forfeit the sum of one hundred dollars, to be recovered in the manner and for the use mentioned in section four of this act; and said vessel, with all of the rigging, furniture, and appliances attached to the same, shall be liable to be seized, condemned, and disposed of in the manner directed in the said last-named section.

3. *And be it enacted*, That any action under the first and second sections of this act may be commenced by warrant in the court for the trial of small causes and be proceeded in as in other cases when the same are commenced by warrant; any law, usage, or custom to the contrary notwithstanding.

4. *And be it enacted*, That it shall be the duty of all sheriffs and constables, and may be lawful for any other person or persons, to seize and secure any such steam vessel as aforesaid, and immediately thereupon give information thereon to two justices of the peace of the county

* Official copy kindly furnished the United States Fish Commission, by Henry C. Kelsey, secretary of state.

where such vessel shall be held and secured, who are hereby empowered and required to meet at such time and place as they shall appoint for the trial thereof, and hear and determine the same, having first given notice of the time and place so appointed by notice in writing, over their hands, set up in at least three public places within the township where the said vessel is held, at least five days prior thereto, and also served at least five days previously upon the owner or master of said vessel, if he can be found within the county; and in case the same shall be condemned, it shall be sold by the order and under the direction of the said justices, who, after deducting all legal costs and charges, and paying the penalty provided for by the first section of this act, shall pay over the remainder of the proceeds of such sale to the owner or claimant of such steam vessel so seized as aforesaid; one-half of said penalty shall go to the person or persons making the seizure, and the remainder shall be paid to the treasurer of this State for the use of this State.

5. *And be it enacted*, That if any person or persons on such vessel aforesaid shall refuse and not suffer to enter the same or resist, before or after entering, any of the said officers, or other person or persons seizing the same, or otherwise resist them, or any of them, in the lawful seizing of the same, then every person so offending shall forfeit and pay the sum of fifty dollars, to be recovered and applied in the manner hereinbefore directed.

6. *And be it enacted*, That the sale and disposition of the property seized and condemned, as provided for in this act, shall be conducted in the same manner and upon the same notice as prescribed for the sale of personal property seized under execution issued under the act of the legislature of this State entitled "An act constituting courts for the trial of small causes"; and all fish and property of a perishable nature, found in and upon said vessel, shall be sold under the order of said two justices, by giving one day's notice of the time and place of such sale, by setting up advertisements thereof in three public places in the township where such property shall be held, and the proceeds thereof applied in the same manner as hereinbefore provided.

7. *And be it enacted*, That if any owner or claimant of said vessel or vessels and property seized as hereinbefore provided for shall desire to retain possession of the said property so seized, the owner or claimant of such property shall notify the officer or officers before whom the case is being prosecuted, in writing, and request that the property so seized shall be appraised; and the said officers shall be and they are hereby required to prepare a true statement of all property coming into their hands under the provisions of this act; and upon such request of said owner or claimant, three disinterested men shall be appointed, one by the officers, one by the claimant, and one by the joint action of the two appraisers, who shall appraise said vessel and property, the same to be surrendered to said claimant on his giving bonds for the amount of such appraisement, with good and sufficient security for the same and

the payment of all fines, costs, and expenses connected with such seizure and prosecution, otherwise the said vessel or vessels and apparatus to be held as security until all of said expenses incurred are fully paid; and in case of failure on the part of said claimant to comply with the provisions of this section, said property shall be sold as provided for in section four of this act.

8. *And be it enacted*, That the fees and costs and charges under this act shall be as follows: to the two justices, for all services thereunder, five dollars each; to the person making the seizure, or watchman placed in charge of said vessel, two dollars for each day and two dollars for each night that services shall be actually rendered; to the person putting up the advertisements or notices or serving the same, fifty cents for each notice posted or served; for all other services, the same fees that are paid in justices' courts for similar services.

9. *And be it enacted*, That this act shall take effect immediately.

(State of New Jersey, Laws of 1884, chapter 96.)

100.—BRIEF OF THE OBJECTIONS MADE BEFORE LEON ABBOTT, GOVERNOR OF NEW JERSEY, TO THE "ACT TO PROHIBIT FISHING BY STEAM VESSELS WITH SHIRRED OR PURSE SEINES IN ANY OF THE WATERS WITHIN THE JURISDICTION OF THE STATE OF NEW JERSEY."

By LOUIS C. d'HOMERGUE.*

1. The bill in question in its essential features is similar to the one vetoed by Governor Ludlow on the opinion of the then as well as now attorney-general of the State—said opinion being at present on record in your excellency's office, and which I respectfully desire to submit as part and parcel of this brief against this present bill.

2. The letter I wrote to Governor Ludlow under date of January 25, 1882, a copy of which is here appended, as a part of this argument.

3. This present bill is illegal as it is class legislation; it permits one class of vessels to engage in the said fishing and use of described nets, while it excludes another class of vessels from so doing.

4. The State of New Jersey, in becoming a part and parcel of these United States, ceded to the Federal Government the right to make treaties with foreign Governments, and in so doing parted with necessary jurisdiction in all matters pertaining thereto. The United States Government having made a reciprocal treaty with Great Britain to permit the citizens of either country to fish within its limits established by international law, the State of New Jersey cannot pass any laws conflicting with the jurisdiction of the Federal Government, thereby annulling the provisions of foreign treaties.

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* Secretary of the United States Menhaden Oil and Guano Association, 82 John street, New York.

5. The provisions of the bill are against sound State policy, unjust and discriminating, as it would drive those engaged in fishing with steam vessels to take out foreign registers and proceed to carry on their business under the protection of a foreign flag.

6. The bill is illegal and unjust because it seeks to deprive a certain class of vessels of the right recognized by the Federal Government, which has registered and licensed these vessels to carry on the fishing business in the waters within the scope of its jurisdiction.

7. The bill in its provisions is arbitrary and against the principle of all human laws, for it actually prohibits in section 2 a steam fishing vessel with its fishing gear to enter any port of the State under pain of confiscation or fine—whether the vessel by stress of weather, accident, springing a leak, or in any distress whatever, should be caught in any of the waters within tho jurisdiction of this State, including the waters of the Atlantic Ocean within three nautical miles of the coast-line thereof.

8. The jurisdiction of any State along the sea-coast cannot extend beyond low-water mark, in matters relating to commercial or industrial pursuits which the United States have the power to regulate and control or which can be subject-matters of foreign treaties.

101.—REPORT UPON THE RECEIPT AND HATCHING OF AMERICAN WHITEFISH OVA AND PLANTING OF THE FRY IN AUSTRALIA.*

By ALFRED GREENFIELD,

Honorary Secretary of the Nelson Acclimatization Society.

On the 11th of February, 1884, the steamship Zealandia arrived from America at Auckland with one million whitefish ova. The mail agent, in whose charge they were placed, instead of causing the box to be transhipped with the mails by the southern steamer then in port, which left Auckland immediately on receipt of the mails, telegraphed to me asking that instructions might be sent to the secretary of the Auckland society "what to do with the ova." I immediately sent an urgent telegram requesting that they might be sent by the first steamer, but the message did not reach the secretary until the southern steamer had left. So the eggs were unfortunately detained in Auckland until the 14th, when, after receiving a fresh supply of ice, they were placed on board the steamship Takapuna, which arrived at Wellington about 3 o'clock in the afternoon of the 15th. The ova box was immediately transhipped into a small steamer, which left that evening and arrived at Nelson at 9 a. m. on the 16th. It was then conveyed to the society's hatching-boxes and unpacked. A considerable quantity of ice was found on the top and sides of the trays. Four trays were taken out and

* Addressed to Hon. Thomas Dick, Wellington, Colonial Secretary of New Zealand, and by him forwarded to Professor Baird, under date of March 25, 1884.

the ova therefrom placed in the hatching-boxes. The temperature of the moss in the box was 44° and of the water in the hatching-boxes 54°. Of the four trays taken out the eggs in the first two were a good deal caked together, although apparently not dead. The others looked to be in good condition. As soon as the eggs were placed in water hatching commenced, and the next morning a large number were hatched, but a very large proportion of the eggs were found to be bad and had turned color. The temperature in the hatching-boxes had increased to 60°, and a few days afterward was as high as 66°.

Great difficulty was experienced in keeping the fry in the boxes, although fine screens were used for the purpose. But as the water from the boxes discharged into the society's ponds, the fish were not lost.

Immediately after the four trays were taken out the remaining fifteen trays were repacked with ice and sent by rail 24 miles, then by express van 30 miles, to an inland lake, called Rotoiti, and a place prepared in a creek, which runs into the lake, to receive the ova.

Of the fifteen trays of ova placed in this creek a very large proportion hatched, estimated by the man in charge at two-thirds. The temperature was not taken, as both thermometers sent up were broken, but the water is much colder than in the society's boxes, and may be stated at about 48° or 50°.

The same difficulty was experienced of keeping the young fry in the hatching place, although screens were used as in the boxes; and most of them got out into the lake a few days after hatching. I am therefore unable to report on the growth and progress of the fry, except that those in the pond are growing and appear to be thriving. They have been frequently fed with blood.

Had the society received notice of the ova coming, more complete arrangements would have been made for hatching, and the results would have been better ascertained.

In conclusion, I have the honor to ask you to be kind enough to cause a copy of this report to be forwarded to Professor Baird, of the U. S. Fish Commission, with the thanks of this society, as previously conveyed to you in my letter of the 21st ultimo.

NELSON, N. Z., *March* 17, 1884.

102.—NOTES ON THE COD GILL-NET FISHERIES OF GLOUCESTER, MASS., 1883-'84.

By S. J. MARTIN.

[From letters to Prof. S. F. Baird.]

The cod gill-net fishing is most over, the fleet being reduced from 52 to 8 sail. Those remaining did well last week. The boats that used nets are now fitting out for spring fishing, and, had there been more nets, would have used them longer.

GLOUCESTER, MASS., *April* 13, 1884.

The remaining cod gill-net fishermen are doing well. Net fishing will probably be over by May 1.

GLOUCESTER, MASS., *April* 20, 1884.

The cod gill-net fishing for this season ended yesterday morning. There have been 578,000 pounds of codfish caught in the cod gill-nets during the month of April. The amount of fish caught in nets from October 1, 1883, to April 26, 1884, has been large, exceeding the catch inshore of any previous six months. I have from time to time given you the figures. The schooner Morrill Boy, with a crew of seven men, divided into two gangs, and six nets to a man, began its winter's work on November 10, 1883, and has landed $4,300 worth of fish. Each of the crew made $410 clear of all expenses.

Catching fish in nets is expensive. The expenses of each of the crew of Morrill Boy were $100. The nets alone cost $14.50 each, and glass-ball anchors, buoy lines, and buoys had to be purchased.

Five boats that commenced work on November 1, 1883, with a total of forty-two men, did good work, each man having cleared $400. These men fished every night. The expenses of each of these men were also $100. There were fifty-two boats which used nets last winter, four hundred and sixty-eight men employed, and one thousand five hundred and sixty nets used. The average price of the fish landed was $2.50 per hundred, and $285 the average share of each man.

GLOUCESTER, MASS., *April* 27, 1884.

Three small boats, with five cod gill-nets to a boat, set their nets in Ipswich Bay last week, after the cod gill-netters had taken up their nets for the season. They caught 38,000 pounds of large codfish, half male and half female, notwithstanding there were two days that they did not haul their nets. If all the netters had set their nets, as many fish would have been caught last week as was taken during any week in the winter. I do not know how long the fish will remain in the bay; heretofore none had been taken later than May 1.

GLOUCESTER, MASS., *May* 11, 1884.

There have been caught in cod gill-nets during the past week 62,000 pounds of codfish.

GLOUCESTER, MASS., *May* 18, 1884.

There were 18,000 pounds of codfish caught in cod gill-nets last week. The last fish were taken on May 20.

GLOUCESTER, MASS., *May* 24, 1884.

During the past month there were 128,000 pounds of codfish caught in cod gill-nets.

GLOUCESTER, MASS., *June* 4, 1884.

Vol. IV, No. 13. Washington, D. C. July 30, 1884.

103.—ON THE NATURAL AND ARTIFICIAL FERTILIZATION OF SEA HERRING EGGS.*

By Prof. J. COSSAR EWART, M. D.

In 1862 Professor Huxley arrived at the conclusion that herring visit our shores twice a year in order to spawn, some schools arriving during the autumn, while others make their appearance during the winter. The herring which spawn during the autumn chiefly frequent banks on the east coast, while those which spawn during winter are most abundant on the west coast. A report of the Scottish Fishery Board referring to the east coast spawning-beds was published in Nature on November 29 last. The present paper deals chiefly with the Ballantrae spawning-bed, which lies off the coast of Ayrshire.

In 1862 Professor Allman made some investigations for the Scottish Fishery Board, and succeeded in dredging and hatching what was considered herring ova; but since then, although important results have been obtained by the German and American Commissioners of Fisheries, little or nothing has been done in this country.

When examining the Ballantrae bank the author of this paper succeeded in dredging several specimens of herring ova attached to stones, sea-weed, and sea-firs. These stones coated with eggs varied from 6 inches to 1½ inches in length, and from 4 inches to 1 inch in breadth, but in all cases the eggs were attached to a comparatively smooth surface, and they were arranged either in low cones or in comparatively thin layers one or two eggs deep. The eggs on the sea-firs were always attached in small clusters about half an inch in diameter around the stems. On examining the spawn found on the stones and sea-weed, embryos at various stages of development were at once visible, some of them apparently only three days old, while others had distinct eyes, and from their violent movements and their size seemed almost ready for hatching. Some of the egg-coated stones were taken to the University at Edinburgh, where the eggs hatched on March 15, eight days after their removal from the spawning-ground, and to-day (March 17) they are three-eighths of an inch in length, extremely active, and swimming freely about in the water.

By taking soundings over the Ballantrae bank in various directions it was ascertained that it consisted of rock, stones, shells, and coarse sand, and that the depths varied from 7 to 13 fathoms. The outer edge of the bank shelved at most points rapidly until a depth of 17 fathoms

*Abstract of a paper read at the Royal Society, March 27, and published in Nature, April 3, 1884.

was reached, and at this depth the bottom consisted of fine, soft mud. While on the east coast spawning-grounds, examined during the autumn, the surface temperature in most cases varied from 53° F. to 55° F. and the bottom temperature from 52° F. to 54° F., even at a depth of 40 fathoms; the temperature at the Ballantrae bank varied from 42°.8 to 43°.8 F. at the surface, and from 42°.8 to 43°.5 F. at the bottom. The corresponding surface temperature, however, on the east coast during the week ending March 8 was from 2° to 3° F. lower than at Ballantrae.

According to previous observers:

"When spawning takes place naturally the eggs fall to the bottom and attach themselves. But at this time the assembled fish dart wildly about and the water becomes cloudy with the shed fluid of the milt. The eggs thus become fecundated as they fall, and the development of the young ova sticking to the bottom commences at once."

Mr. Mitchell, in his book on "The Herring," referring to the once famous spawning-bed off Dunbar, states that—

"About August 30 the shoals began to deposit their spawn a short distance from the harbor, and on September 3 the fishermen found that a very large body of herrings remained fixed to the ground in the progress of spawning, the ground being of a rocky or stony nature."

While many fishermen believe that herring spawn on hard ground, some believe that they also spawn on a clayey bottom; and while some think that they spawn near the bottom, others affirm that they spawn near the surface. Having secured at Ballantrae a large number of live herring, some of the largest and ripest males and females were placed in a large wooden tank into which a number of stones and a quantity of sea-weed had been previously introduced. After the fish had been about two hours in this tank the stones and sea-weed were examined. Although a few eggs were attached to both stones and sea-weed it was quite evident that the eggs had not been deposited in the same way as those found on the stones dredged on the previous day; but we were not surprised that only a few isolated eggs were found on the stones, because the fish had been disturbed every few minutes by the pouring of water into the tank.

On reaching Rothesay the hatching-boxes and live herring were at once transferred from H. M. S. Jackal to the tanks—a tank into which comparatively little light entered having been selected for the ripest and most vigorous herring. In about half an hour after they were introduced a large, full herring was seen moving slowly about the bottom of the tank, with four other fish making circles around her at some distance from the bottom. Appearing satisfied with a particular stone which she had evidently been examining, she halted over it and remained stationary for a few minutes about half an inch from its surface, the tail being in a straight line with the tank and the pectoral fins near or resting on the bottom. While in this position a thin, beaded ribbon was seen to escape from the genital opening and fall in graceful curves on the surface of the stone, so as to form a slightly conical mass almost identical with a cluster on one of the stones dredged at Ballantrae. As this little heap of eggs increased—some falling to the left side one moment, while others fell to the right the next, according to the currents in the water—the males continued circling round her at various distances, while the other females in the tank remained apart. The males remained from 8 to 10 inches above the bottom of the tank, and formed circles varying from 18 inches to 2 feet 6 inches in diameter. Some of the males were swimming from right to left, others from left to right, and although there was no darting about, no struggling among themselves, there was a peculiar jerking of the tail as they performed their revolutions. Soon the object of this peculiar movement was sufficiently evident. Three or four times during each revolution each fish expelled a small white ribbon of milt, which varied from half an inch to three-quarters of an inch in length, and was nearly a line in breadth across the center, but pointed at both ends, and somewhat thinner than it was broad. These delicate ribbons slowly fell through the water, sometimes reaching the bottom almost undiminished in size, but in most instances they had almost completely dispersed before the bottom was reached. In this way the whole of the water about the female became of a very faint milky color, and practically every drop of it was charged with sperms, as was afterwards ascertained. It will thus be seen that there is no attempt whatever on the part of the males to fertilize the eggs as they escape from the female. While the female is depositing the eggs at the bottom, the males concern themselves with fertilizing the water in the neighborhood, and it will be observed that the males are careful to guard against the influence of currents by forming circles around the female and shedding milt on the way. It matters little how the currents are running, they are bound to carry some of the milt towards the eggs, the milt, like the eggs, sinking though not adhering to the bottom.

This then is the natural process of depositing and fertilizing the ova of the herring in comparatively still water. When the female had deposited a certain number of eggs at any given spot, she moved forward in a somewhat jerky fashion without rising from the bottom, and as she changed her position the males changed theirs, so that the female was always surrounded by a fine rain of short sperm ribbons. A specimen of *Hydrallmannia* sent from Eyemouth seems to indicate that the female moves about among sea-firs and sea-weeds in exactly the same way as she does among stones. On each stem of the colony there is a cluster of ova about the size of a small grape, and all the clusters had reached on arrival the same stage of development as if they had been deposited about the same time and by the same fish.

This method of depositing and fertilizing the eggs accounts, I think, for all the eggs, or at least for a very large percentage of those found attached to sea-firs, sea-weeds, and stones, containing developing embryos.

When a female was depositing her eggs she was very easily disturbed; whenever anything was introduced into the tank she at once darted off. When strong currents were made, she at first seemed to apply herself nearer to the bottom, to make sure, as it were, that the spawn would get fixed before it could be carried away; but when the currents were further intensified she at once changed her position, and arrested the escape of the spawn. A spawning female was held immediately under the surface of the water so as to cause the spawn to escape. When this was done the spawn escaped in long ribbons consisting of a single row of eggs. So firmly do the eggs adhere to each other that in perfectly still water the ribbon was sometimes over a foot in length before it broke. When it had only about 2 feet of water to travel through, it fell in wide loops at the bottom, but when it had to fall over 3 feet the chain broke up into numerous segments which formed an irregular pattern on the bottom. From experiments made, it seems the further the eggs have to fall and the longer they are in contact with the water before they reach the bottom, they are more widely dispersed, and have all the less adhesive power. When the eggs are expressed in water moving rapidly in various directions, the chains soon break into short segments, and the individual eggs and the small groups are often carried a considerable distance before they reach the bottom.

A number of flat stones and pieces of sea-weed were obtained, and a spawning female held over them at different distances in still water, in water with gentle currents, and in water with strong currents. In this way we obtained groups of eggs which mimicked in a very striking manner all the arrangements of the eggs on the stones and sea-weeds dredged on the Ballantrae bank. When gently pressed, a beaded ribbon, consisting of a single row of eggs, always escaped; when there were no currents, it formed a conical heap; when in a gentle current, the ribbon fell in irregular loops, the elements of which rearranged themselves so as to form a flattened cone; but when strong currents acted on it the ribbon was broken into fragments and only a few eggs succeeded in fixing themselves to the objects introduced. When the currents were strong, the males were seen not only to swim nearer the bottom but to expel longer ribbons of milt, which reached the bottom before getting dispersed, and remained visible sometimes for ten minutes. On gently expressing a male under the water it was never possible to expel so fine or so short portions of milt as escaped naturally, but it was extremely easy expelling a ribbon from 18 inches to 3 feet in length, measuring 2 lines across and 1 line in thickness. Such ribbons fell to the bottom and remained almost unchanged for nearly two hours. They then assumed a segmental appearance, and in about three hours and a half had all but disappeared.

Eggs were allowed to escape into a vessel containing fine sand, and into another containing mud. The eggs after being fertilized underwent the early stages of development, but either owing to their moving freely about with the sand particles or owing to their getting coated over with the sand and mud their development was arrested. I have not yet determined finally if the development is arrested when the eggs are detached while development is proceeding, but this seems extremely probable.

When at Ballantrae I noticed that the trammel-nets secured often more males than females. Mr. Wilson, fishery officer at Girvan, informs me that the ripest fish are caught in the trammel-nets, while most of the unripe fish are obtained in the drift-nets, and that at the end of the fishing season there are about three males taken for every two females, indicating not necessarily that the males are more abundant than the females, but rather that the males remain longer on the spawning-ground; and Mr. Wilson believes that herring prefer quiet water free from strong currents when spawning, and that when the weather is fine the herring remain long upon the bank and deposit their spawn leisurely, but when there are strong currents they either hurry the spawning process or disappear into deep water.

As to artificial fertilization and hatching I found, after many experiments at Ballantrae, that the best results were obtained when both the male and female were held under water while the milt and ova escaped, *i. e.*, when the natural process of spawning is followed.

An ordinary wooden tub was obtained and filled with sea-water. Into this a small quantity of milt was expressed, the male being held completely under water while the milt escaped. A glass plate was then held about 4 inches beneath the surface of the water, and, the female herring being held about 1 inch beneath the surface, by gentle pressure the eggs readily escaped in the characteristic narrow beaded ribbon, and, by moving the fish over the surface of the glass, either a close or an open net-work could be formed. At first, where one loop crossed another, the eggs were two or more layers thick, but, either owing to the weight of the eggs or the gentle currents set up in the water, before a few minutes had elapsed the eggs formed a single and almost continuous layer, the net-work arrangement having disappeared. The plate was then allowed to rest for two or three minutes at the bottom of the tub, and a few short ribbons of milt were again introduced. After moving the plate once or twice across the top of the tub in order to wash off any scales that were adhering, it was placed either in a hatching or a carrying box. Many thousands of ova treated in this way contain extremely active embryos, which are expected to hatch on March 22 or 23.

(Professor Ewart exhibited a number of specimens showing herring eggs attached to stones, sea-weeds, and sea-firs, and some of the herring fry hatched on March 24 from the eggs artificially fertilized on March 8.)

LONDON, *March* 27, 1884.

104.—SHAD EGGS SENT TO COLD SPRING HARBOR, NEW YORK, TO BE HATCHED.

By MARSHALL McDONALD.

On May 19 I forwarded from Central Station, Washington, by express to Cold Spring Harbor, New York, 80,000 shad eggs, which were taken from the hatching jars at Central Station, and were twenty-four hours advanced in incubation. The eggs were placed on wire-bottom trays and securely packed in ice, so as to keep down the temperature. The success of the experiment, as reported below by Mr. Mather, superintendent of Cold Spring Hatchery, is gratifying, inasmuch as it promises most important applications in the development of the work of shad propagation. Under date of May 30 Mr. Mather reported as follows:

HATCHING SHAD EGGS IN SPRING WATER.

This experiment was a complete success. On May 20 I received the 80,000 shad eggs. They arrived at 6.20 p. m. and were put in the McDonald jars at 7.30 p. m. The temperature of the package was 55° and of the water 58°. They began hatching about noon on the 24th and finished near noon on the 27th. There was a little fungus on a small bunch of dead eggs in one jar one morning, but no trace of it in the others. The mean temperature was 60°.7 during the nine days they were kept, but the table given below shows that on two days only it rose above that figure, and on one of these it rose to 71°, thus making the mean temperature higher than the temperature of seven days out of nine.

The 78,000 fry were planted in the Nissequogue River, emptying into Long Island Sound below Smithtown, Suffolk County, New York.

Date.	Temperature of water.	Loss.	
		Eggs.	Fry.
May 20	58	380	......
21	60	30	......
22	59	45	......
23	60	60	......
24	71	40	125
25	62	25	20
26	60	20	42
27	58	15	800
28	59	......	150
29	60	......	40
Mean temperature	60.7	615	1,177
Total loss in eggs and fry	....	1,792	

WASHINGTON, D. C., *June* 16, 1884.

105.—REPORT OF A TRIP MADE BY THE FISH HAWK TO THE LOWER PART OF CHESAPEAKE BAY, TO ASCERTAIN THE CHARACTER OF THE FISHERIES FOR SHAD, HERRING, ETC., IN THE SPRING OF 1884.

By Lieut. W. M. WOOD, U. S. N.

[From a letter to Prof. S. F.Baird.]

In obedience to your instructions I left Washington on the 24th of April on a cruise of investigation as far as the mouth of the York River. I visited first the trap-nets on York Spit and in the Poquasin.

There were about one hundred and eighty traps being fished here; but the fishermen report a very bad season. They say they have not taken enough fish to pay expenses. At this particular time they were taking more menhaden than anything else. They report having noticed a good many young shad in their nets this spring, and I succeeded in finding two specimens among a lot of recently-caught fish. They were respectively about 5 and 6 inches long. The probability is that these are last year's young fish which have passed the winter in the bay.

From York River went to Mobjack Bay. Found here one hundred and seventy traps, and the same report as to a bad season.

The next point was the mouth of the Rappahannock, where we found about twenty-nine traps. They also reported a poor season.

All these people ascribed the poor catch to the prevailing westerly and northwesterly winds and gales, which they think kept the fish off the shoals and in deep water.

I ran over to the Eastern Shore and touched at Watt's Island, at the mouth of Tangier and Pocomoke Sounds, but could find no nets being fished there. Then returned to the westward and entered the Great Wicomico. Here they say they had a fairly good season for the first two weeks, but that they had done but little since. About fifty traps fished here. At all these points about the same number of traps are being fished as last year.

From the Great Wicomico entered the Potomac again, finding rather fewer nets in the lower part than last year. The trap-net fishermen near Mathias Point report the season as so far not good. Mr. Smoot, who fishes two traps, says the biggest catch for one day, both nets, was one hundred and fifty shad. At that time they were taking a good many menhaden of a fair size.

Mr. Ewing, who fishes at Windmill Point, the lowest seine haul on the Potomac, reports a very bad season. He says he was behind in his expenses until a week or ten days previous to my visit, when they had a good run of herring, and he was enabled to catch up. Mr. Robb, near Aquia Creek, and Mr. Waller, at Clifton, are both reported to have done well on herring. These seines all cut out between May 1 and 10; but, if the season justifies it, Robb will move up the river and fish Sandy Bar.

The gill-net fishermen in the Upper Potomac report a fairly good season on shad. The first catch of shad in the bay was early in March.

I submit herewith a table showing the number of traps at different points as far up as Indian Head, the places to which the catch is consigned, and the maximum and minimum temperatures of the air and water at the different places visited. I find the fishermen, as a rule, call one trap a net, no matter if there are several in a line, such as might be called a single net of several traps. In this table it is the number of traps given without respect to their location.

In regard to a record of the temperatures at these places during the fishing season, I can suggest no better observers than the light-keepers. There is a light at every point where trap-nets are fished extensively, and I believe the Commission already gets reports from most of them. They do not, however, from Point Lookout, which I consider a most important station for such observations, putting out as it does into the bay at the mouth of the Potomac. There is a new Government wharf at this light, where such temperatures could be taken in deep water without trouble.

Arrived back in Washington on the evening of the 28th of April, and secured at the navy-yard.

FISH HAWK,
Washington, D. C., April 30, 1884.

Table showing the places where fishing was prosecuted in the Potomac and Lower Chesapeake, in the spring of 1884, *the number of nets, places of consignment, and temperatures of air and water.*

Date of Fish Hawk's visit.	Place of catch.	Number of nets fished.	Place of consignment of catch.	Temperatures.			
				Air.		Water.	
				Max.	Min.	Max.	Min.
1884.							
April 25	Mobjack Bay	170	Baltimore and Philadelphia.	60	52	56	52
26	York Spit and mouth of York River.	180	Baltimore, Philadelphia, New York, and Richmond.	67	52	56	52
26	Mosquito Point to Windmill Point.	29	Baltimore	67	53	56	54
27	Great Wicomico to Smith Point	50	Baltimore	67	53	56	54
28	Ragged Point	7	Washington	82	56	60	55
28	Lower Cedar Point	*11		82	56	60	55
28	Pope's Creek to Nanjemoy Creek, both sides of river.	26	Washington	82	56	60	55
28	Nanjemoy Reach	3	Washington	82	56	60	55
28	Chicamuxon Creek	3	Washington	82	56	60	55
28	Powell's Creek	1	Washington	82	56	60	55
28	Mattawoman Creek	1	Washington	82	56	60	55
28	Deep Point	1	Washington	82	56	60	55
28	Occoquan Creek	18	Washington	82	56	60	55
28	Indian Head	2	Washington	82	56	60	55
		502					

*Nine on Maryland side, two on Virginia side.

106.—THE INFLUENCE OF ARTIFICIAL PROPAGATION UPON PRODUCTION ILLUSTRATED BY THE SALMON WORK OF THE SACRAMENTO RIVER, CALIFORNIA.

By CHAS. W. SMILEY.

It is understood that about four years are required for salmon to mature. I would therefore place the yield of 1877 opposite the planting of 1873, and so on. For four successive years the yield has been nearly double the yield of the years preceding the artificial propagation, which commenced in 1873. This appears to have resulted from annually planting about two million fry. The planting of 500,000 fry in 1873 and in 1874 appears to have increased the yield by about a million pounds each year. No record of the production in Sacramento River prior to 1875 is obtainable, but it is known to have been less than six million pounds.

Young salmon hatched from eggs taken by the United States Fish Commission and released in the McCloud River, a tributary of the Sacramento, in California.

Year.	Month.	Number.	Year.	Month.	Number.
1871		None.	1878	October	2,500,000
1872		None.	1879	October	2,000,000
1873	September	500,000	1880	October	2,000,000
1874	September	500,000	1881	October	2,250,000
1875	September-October	850,000	1882	October-November	4,037,000
1876	September-October	1,500,000			
1877	October	2,200,000			18,337,000

Annual yield of the Sacramento River in salmon to the canneries.

Year ending—	Pounds.	Year ending—	Pounds.
August 1, 1875	5,098,781	August 1, 1880	10,837,400
August 1, 1876	5,311,423	August 1, 1881	9,600,000
August 1, 1877	6,493,563	August 1, 1882	9,605,280
August 1, 1878	6,520,768	October 15, 1883	9,585,672
August 1, 1879	*4,432,250		
			67,485,137

* The salmon were as numerous in the river this year as in any previous years, but the small number taken was due to a feud between the fishermen and the canners as to the price to be paid for the fish. For three weeks in the height of the season no fish were taken, except for daily consumption in San Francisco and other markets.

	Pounds.
The average yield during the past three years was	9,596,984
The average yield in 1875 and 1876, before any fruits of fish-culture could have appeared, was	5,205,102
Making a gain per annum due to fish-culture of	4,391,882

The fish are worth 50 cents apiece as they come from the water, their average weight being 7 pounds each.

Value of the 4,391,882 pounds due to fish culture	$313, 706 00
Cost of hatching and planting 2,500,000 fry	3, 600 00
Annual net profit	310, 106 00

The expenditures by the United States Fish Commission on this work and the number of eggs obtained from 1877 to 1882 were as follows:

Fiscal year.	Amount expended.	Eggs produced.
1877–'78	$7, 853 96	7, 033, 000
1878–'79	12, 730 54	10, 310, 000
1879–'80	12, 875 55	6, 650, 000
1880–'81	13, 587 20	5, 800, 000
1881–'82	6, 653 51	7, 500, 000
Total	$53, 700 76	37, 293, 000

Average cost per million eggs, $1,440.

This expenditure was greater than would be necessary merely to increase the supply of fish in the river. Of the 37,293,000 eggs obtained during these five years but 11,000,000 were used to produce what young were returned to the river. The other 26,293,000 eggs were sent to the Eastern States and to foreign countries. Additionally, the experience of the past will enable the commissioners to exercise greater economy. One of the California commissioners stated to a committee of the legislature that "a million of salmon could be artificially hatched and placed in the river for less than $800; and if it were desirable, and the legislature made sufficient appropriation, the commissioners *could fill the river so full of salmon that it would be difficult for a steamboat to pass through them.*" Considering the fact that food does not have to be furnished, these fish, coming from their ocean feeding-grounds to the rivers, as they do, merely to spawn, his statement may be within the bounds of reason.

Writing under date of January 6, 1882, Mr. B. B. Redding, of San Francisco, Cal., said: "Since we commenced putting young salmon into the Sacramento, Pitt, and McCloud Rivers the number of canneries with money invested *has more than trebled*, and more persons are investing money in new canneries. Requests are coming from other parts of the State to have salmon hatched. Fish-hatching, for the purpose of supplying food, has at length become popular."

U. S. F. C., WASHINGTON, D. C., *April* 15, 1884.

107.—TABLES ILLUSTRATIVE OF THE NUTRITIVE VALUE OF FISH.

By Prof. W. O. ATWATER.

[Samples of fish, whole or dressed, and of oysters &c., including or freed from the shell, as ordinarily sold in the New York and Middletown, Conn., markets, were found to contain: 1. Refuse: Bone, shells, and other inedible matters. 2. Edible portion: Water and nutritive substances. 3. Ingredients of nutritive substance (nutrients): Protein, fats, carbo-hydrates, &c., ("non-nitrogenous extractive matters"), and mineral matters—in parts in 100 by weight, as below (nutrients + water + refuse= 100).]

TABLE I.—*Percentages of refuse, water, and nutritive ingredients in specimens of food-fishes and invertebrates as found in the markets.*

Kinds of food-fishes and invertebrates and portions taken for analysis.	Salt.	Refuse bones, skin, shells, &c.	Edible portion.					
			Water.	Nutrients.	Nutrients.			
					Protein.	Fats.	Carbo-hydrates, &c.	Mineral matters.
FRESH FISH.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Alewife, whole		49.4	36.8	13.8	10.0	3.0		0.8
Black bass, whole		54.9	34.5	10.6	9.3	0.8		0.5
Bluefish, entrails removed		48.6	40.2	11.2	9.9	0.6		0.7
Cod, head and entrails removed		30.0	57.4	12.6	11.5	0.3		0.8
Eel, skin, head, and entrails removed		20.2	57.0	22.8	14.8	7.2		0.8
Lamprey eel, whole		45.8	38.5	15.7	8.1	7.2		0.4
Flounder, whole		66.8	27.9	5.3	4.7	0.2		0.4
Haddock, entrails removed		52.5	39.4	8.1	7.3	0.3		0.5
Halibut, sections of body		18.7	62.4	18.9	16.0	2.2		0.7
Herring, whole		46.0	37.0	17.0	10.3	5.9		0.8
Mackerel:								
Rather lean, whole		50.4	37.[illegible]	12.3	9.6	2.1		0.6
Fat, whole		33.8	42.0	24.2	12.5	10.7		1.0
Average, whole		44.6	40.3	15.1	10.2	4.2		0.7
Yellow perch, whole		62.7	29.6	7.7	7.0	0.3		0.4
Pike perch, whole		57.3	34.0	8.7	7.9	0.2		0.6
Pickerel (pike), whole		42.7	45.7	11.6	10.7	0.3		0.6
Salmon:								
In season, fat, whole		38.5	38.7	22.8	14.1	7.9		0.8
"Spent," lean, whole		43.7	43.3	13.0	10.4	2.0		0.6
Shad, whole		50.1	35.1	14.8	9.4	4.8		0.6
Smelt, whole		41.9	45.9	12.2	10.2	1.0		1.0
Brook trout, whole		48.1	40.2	11.7	10.0	1.1		0.6
Salmon trout, entrails removed		35.2	44.9	19.9	12.5	6.6		0.8
Whitefish		53.5	32.2	14.3	10.6	3.0		0.7
PREPARED FISH.								
Dried cod, boned and dried	2.9	0.0	14.7	82.4	75.4	1.9		5.1
Salt cod, salted and dried	15.3	24.9	38.8	21.0	18.4	0.3		2.3
Salt mackerel, "No. 1 mackerel" salted	8.2	22.9	32.8	36.1	16.4	17.6		2.1
Smoked haddock, salted, smoked, and dried	1.5	33.2	48.6	16.7	15.6	0.1		1.0
Smoked herring, salted, smoked, and dried	6.5	44.4	19.1	30.0	20.4	8.8		0.8
Canned salmon, California (Oregon)	1.0	3.9	59.2	35.9	19.3	15.3		1.3
Canned fresh mackerel	1.9	0.0	68.4	29.7	19.7	8.7		1.3
Canned salt mackerel. "No. 2 mackerel" salted	8.3	19.7	34.9	37.1	13.8	21.3		2.0
INVERTEBRATES, SHELL-FISH, ETC.								
Oysters:								
In shell (inferior)[1]		88.8	10.2	1.0	0.5	0.1	0.2	0.2
In shell, best[1]		81.4	15.2	3.4	1.5	0.2	1.3	0.4
In shell, average[1]		82.3	15.4	2.3	1.0	0.2	0.6	0.5
Solids,[2] edible portion average		0.0	87.2	12.8	6.2	1.5	4.1	1.0
Long clams, in shell average		43.8	48.3	7.9	4.3	0.5	1.3	1.8
Round clams, in shell		68.3	27.3	4.4	2.1	0.1	1.3	0.9
Mussels, in shell		49.3	42.7	8.0	3.9	0.5	2.1	1.5
Scallops, edible portion (muscle)		0.0	80.3	19.7	14.7	0.2	3.4	1.4
Lobsters, in shell		60.2	33.0	6.8	5.4	0.5	0.2	0.7
Crabs, in shell		55.8	34.1	10.1	7.3	0.9	0.5	1.4
Crayfish, in shell		87.7	10.0	2.3	1.9	0.1	0.1	0.2
Canned oysters		0.0	85.4	14.6	6.4	1.6	5.1	1.5
Canned lobsters		0.0	77.7	22.3	18.1	1.1	0.6	2.5

[1] In respect to quantity of nutrients.
[2] Including solid and most of liquid shell contents as commonly sold.

Explanations.—Latin names and results of a larger number of analyses from which the above were selected, may be found in accompanying sheets.

TABLE II.—*Percentages of water and nutritive ingredients in flesh, edible portion (freed from bone, shells, and other refuse matters) of food-fishes, and invertebrates.*

[Specimens of flesh of fish and of edible portion (flesh and liquids) of oysters, etc., were found to contain water and nutritive substances, as below. The figures represent parts in 100 by weight. Protein + fats + carbo-hydrates, etc., + mineral matters = nutrients. Nutrients + water = 100.]

Kinds of food-fishes and invertebrates.	Salt.	Water.	Nutrients.	Nutrients. Protein.	Fats.	Carbo-hydrates, etc.	Mineral matters.
FRESH FISH.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Alewife	....	72.8	27.2	19.7	6.0	....	1.5
Black bass	....	76.6	23.4	20.5	1.7	....	1.2
Bluefish	....	78.2	21.8	19.3	1.2	....	1.3
Cod	....	82.0	18.0	16.4	0.4	....	1.2
Eel	....	71.4	28.6	18.5	9.1	....	1.0
Lamprey eel	....	71.1	28.9	15.0	13.3	....	0.6
Flounder	....	84.0	16.0	14.0	0.7	....	1.3
Haddock	....	81.4	18.6	17.1	0.3	....	1.2
Halibut	....	75.2	24.8	18.5	5.2	....	1.1
Herring	....	68.6	31.4	19.0	10.9	....	1.5
Mackerel:							
Rather lean	....	75.1	24.9	19.4	4.2	....	1.3
Fat	....	63.4	36.6	18.9	16.2	....	1.5
Average	....	73.1	26.9	18.6	7.0	....	1.3
Yellow perch	....	79.2	20.8	18.8	0.8	....	1.2
Pike perch	....	79.6	20.4	18.5	0.5	....	1.4
Pickerel (pike)	....	79.7	20.3	18.7	0.6	....	1.0
Salmon:							
In season, fat	....	62.9	37.1	22.9	12.9	....	1.3
"Spent," lean	....	76.9	23.1	18.4	3.6	....	1.1
Shad	....	70.4	29.6	18.8	9.5	....	1.3
Smelt	....	79.0	21.0	17.5	1.8	....	1.7
Brook trout	....	77.5	22.5	19.2	2.1	....	1.2
Salmon trout	....	68.9	31.1	18.5	11.4	....	1.2
Whitefish	....	69.2	30.8	22.7	6.5	....	1.6
PREPARED FISH.							
Dried cod, boned and dried artificially	3.0	14.7	82.3	75.4	1.8	....	5.1
Salt cod, salted and dried	20.6	51.6	27.8	24.4	0.3	....	3.1
Salt mackerel, "No. 1 mackerel," salted	10.6	42.6	46.8	21.3	22.8	....	2.7
Smoked haddock, salted, smoked, and dried	2.0	72.9	25.1	23.4	0.2	....	1.5
Smoked herring, salted, smoked, and dried	11.6	34.4	54.0	36.8	15.7	....	1.5
Canned salmon, California (Oregon)	1.0	61.8	37.2	20.2	15.7	....	1.5
Canned fresh mackerel	1.9	68.4	29.7	19.7	8.7	....	1.3
Canned salt mackerel, "No. 2 mackerel," salted	10.4	43.4	46.2	17.3	26.4	....	2.5
INVERTEBRATES, SHELL-FISH, &c.							
Oysters, shell contents, inferior [1]	....	91.4	8.6	4.5	0.6	1.9	1.6
Shell contents, best [1]	....	80.8	19.2	8.2	1.7	7.3	2.0
Shell contents, average [1]	....	87.3	12.7	5.7	0.9	3.2	2.9
solids,[2] edible portion, average	....	87.2	12.8	6.2	1.5	4.1	1.0
Long clams, shell contents, average	....	85.9	14.1	7.6	0.9	2.3	3.3
Round clams, shell contents	....	86.2	13.8	6.5	0.4	4.2	2.7
Mussels, shell contents	....	84.2	15.8	7.7	0.9	4.2	3.0
Scallops, edible portion (muscle)	....	80.3	19.7	14.7	0.2	3.4	1.4
Lobsters, edible portion	....	81.8	18.2	14.5	1.4	0.6	1.7
Crabs, edible portion	....	77.1	22.9	16.6	2.0	1.2	3.1
Crayfish, edible portion	....	81.2	18.8	16.0	0.5	1.0	1.3
Canned oysters	....	85.4	14.6	6.4	1.6	5.1	1.5
Canned lobsters	....	77.7	22.3	18.1	1.1	0.6	2.5

[1] In respect to quantity of nutrients.
[2] Shell contents as commonly sold, including whole of "solid," and most of liquid portion.

Explanations of technical terms, Latin names, and results of a larger number of analyses from which the above were selected, may be found in accompanying sheets.

TABLE III.—*Comparative expensiveness of actual nutrients of foods, illustrated by costs of protein.*

[The costs of the nutrients (actual nutritive ingredients) in a given food material may be computed by comparing the amounts of the several nutrients, protein, fats, and carbo-hydrates, it contains, with its market price, one pound of protein being assumed to cost, on the average, five times as much, and a pound of fats, three times as much, as a pound of carbo-hydrates. The computed costs of the same nutrient, *e. g.*, protein, in different foods, thus affords a basis for comparing the relative expensiveness of the foods, as in the figures below.]

Meats, vegetables, etc.	Prices per pound.	Cost of protein per pound.	Fish, etc.	Prices per pound.	Cost of protein per pound.
Beef:			Salmon:		
Sirloin, medium fatness	$0 25	$1 08	Early, in season	$1 00	$5 72
Same, at lower price	20	86	Same, when plenty	30	1 72
Round, rather lean	18	70	Shad	12	98
Same, lower	16	62	Shad, when abundant	8	65
Corned, lean	18	56	Bluefish	10	98
Flank,[1] very fat	15	36	Haddock	7	94
Mutton:			Halibut	15	87
Leg	22	1 07	Mackerel	10	80
Side, medium fatness	20	59	Mackerel, when abundant	5	40
Pork:[1]			Cod	8	67
Very fat	16	30	Cod, at lower price	6	50
Smoked ham	18	48	Alewife	3	19
Milk, 8 cents per quart	4	61	Canned salmon	20	70
Cheese:			Salt mackerel	12.5	46
Whole milk	18	38	Salt cod	7	38
Skimmed milk	8	19	Salt cod, lower	6	33
Wheat flour, best	5	19	Oysters,[2] 25 cents per quart	12.5	1 56
Corn (maize) meal	3	12	Oysters,[2] 50 cents per quart	25	3 12
Oatmeal	5	15	Lobsters	12	2 09
Beans	5	14			
Potatoes,[1] 50 cents per bushel	0.8	14			
Potatoes,[1] $1 per bushel	1.7	28			

[1] Contains very little protein.

[2] Shell contents, edible portion.

108.—HOW TO AVOID A SOFT OR MUDDY TASTE OF CARP.

By E. Z. BUTCHER.

[From a letter to Prof. S. F. Baird.]

We catch large buffalo-fish sometimes in summer, in hot weather, out of ponds with muddy bottoms. To prevent the muddy taste that some complain of in carp, I find this the best way: Kill the fish as soon as caught, clean directly, soak in ice water a few minutes, then sprinkle with salt slightly, and hang up to dry. The above will make them *firm, sweet, and good.* I know whereof I speak, as I have bought, dressed, and sold fish for ten years; and those who complain of carp, if dressed and served as above, would not know them as the same fish.

SOLOMON CITY, KANS., *March* 7, 1884.

109.—RECONNAISSANCE OF FLORIDA RIVERS WITH A VIEW TO SHAD HATCHING.

By WM. HAMLEN.

In obedience to instructions, I left Washington on the 28th of February, 1884, for Florida, for the purpose of examining the rivers of that State, and to ascertain their yield of shad and the possibilities of establishing shad-hatching stations.

I arrived at Jacksonville, Fla., on Saturday morning, March 1, and proceeded to the fish market, in which I found 29 shad. From the market I went to the fish dealers and discovered 45 shad, a total of 74, of which number but 5 were roe shad. All the fish were very small and hard. In conversation with a dealer, he informed me that he had not shipped, up to this date during the present season, more than 300 fish, whereas five years ago he shipped ten or twelve thousand by March 1. I also made inquiry about the fishing on the Saint John's River, and was informed that no operations were being conducted on that river this season.

SAINT MARY'S RIVER.—On the afternoon of March 1 I left Jacksonville for Boulogne Station, which I reached at 5.40 p. m. Spent the night there, and early next morning, March 2, procured a boat and went up the Saint Mary's River to about 8 miles above the railroad bridge. Found no fishermen on the river at all in that location, but saw a large number of shad "washing." Returned to Boulogne, where I spent the night.

On the 3d of March I proceeded down the river as far as Calico Hill, where I found 33 shad, all hard.

On the morning of the 4th went still further down the river to Orange Bluff. At a point about midway between Calico Hill and Orange Bluff found five men fishing bow-nets for shad. They averaged about 15 shad each on a tide. At Orange Bluff there were three bow-nets and one gill-net. The former averaged about 15 shad each to a tide and the latter about 25.

I hired a man and boat at Orange Bluff, and left about 3 p. m. for King's Ferry, where I arrived at 6 p. m. On the way I overhauled three bow-nets, and examined 33 shad which were all hard. At King's Ferry I found three bow-nets which averaged 15 shad each to a tide. The fish at this point were very fine, the roes and males being about equally divided.

That same night, March 4, overhauled 76 shad in three gill-nets belonging to Captain Fisher, between King's Ferry and the Brick Yard. Of this number I stripped 13 ripe females from which 240,000 eggs were obtained, which were deposited in the river.

In the afternoon of March 5, overhauled 54 shad that had been caught in daylight. Found none ripe.

March 6 examined 58 shad taken in same three gill-nets. Found 5 ripe fish from which were taken 100,000 eggs, which were also placed in the river between Brick Yard and King's Ferry.

Of the localities examined thus far, I think that either King's Ferry or Brick Yard would be the best point for establishing a shad-hatching station. Captain Fisher commenced operations on January 5, and caught 9 shad at Brick Yard Landing on January 18. He will continue to operate until April 15, if the fishing warrants it. I was informed that on March 9, 1877, some of the fishermen on the Saint Mary's caught as many as 126 shad in two hours' fishing. The net used was a bow net, 11 feet deep, 8 feet wide, and 2-inch mesh.

SATILLA RIVER.—On the 7th of March I left King's Ferry for Fernandina, where I expected to receive further orders. Remained at this point until the 11th, when I received a telegram instructing me to go to the Satilla River and examine it for evidences of shad.

Accordingly I left Fernandina on the 11th for Saint Mary's, Ga., for the purpose of ascertaining the route to Satilla, and to secure the services of a guide. This having been accomplished, I left Saint Mary's on the morning of the 13th by road for the Satilla River, where I arrived, at Jefferson, about 28 miles above Brunswick, at 1 o'clock. Procured a boat and went down the river, but found no shad fishermen at all. Interviewed a man named Henry Thomas, who told me that he had been living on the river about thirty years, and before sawmills were built on the river they used to get 25 or 30 fish from bow-nets in a night's fishing, but that now shad were so scarce they were unable to do anything in that line.

George Scott informed me that he has not seen a shad taken on the Satilla for six or seven years. They caught nothing but trout and bream in their bow-nets; the river was too full of logs to fish gill-nets. Captain Richardson expressed the same views.

Returned to Saint Mary's on the 14th, and proceeded to Fernandina to report the result of my investigations. Received telegraphic instructions to remain at Fernandina until arrival of the steamer Fish Hawk, which was due there the 18th.

FISH HAWK WORK.—Fish Hawk arrived in the morning of the 18th at 7 o'clock, and on the 19th she went up the Saint Mary's River to King's Ferry and selected a position at that point for trying to catch shad and secure eggs, but the fish in this run of shad at that time were very "hard."

On the 20th, I went up the river as far as Calico Hill, where I fished all night, but caught nothing but male shad. Returned to King's Ferry on the 21st and joined the Fish Hawk. Found a telegram instructing me that as soon as Fish Hawk was located to proceed to Washington and report. I accordingly left on the 22d, and arrived in Washington on the morning of the 24th.

RECOMMENDATIONS.—My investigations proved that the best place for capturing shad was the Saint Mary's River between King's Ferry and Brick Yard, and if a vessel properly equipped for the purpose could remove the logs from the river at the places indicated, I think a successful season would be assured.

A hatching station might be located at King's Ferry, where there is a large saw-mill, store for supplies, etc., and plenty of wharf room on which to locate a steam-pump and hatching cones. Fuel is abundant and very cheap, and there is a branch railroad to Hillyard Station.

The hatching station should be supplied with a small boiler and steam-pump, and fifteen cones should be put up. To run this station successfully, I should recommend that ten men be assigned to duty at it. Lumber is very cheap at the mill, should any be needed.

The station should be established about the first of February in order to give plenty of time before the fish begin to run, to clear properly the hauls and reaches on the river of logs, so there should be no impediment to the drifting of the gill-nets.

I should also recommend that two sturgeon nets be supplied—one above and one below the gill-nets and seines in order to protect them from destruction by the sturgeons, which are very plentiful. These nets should be 12-inch mesh, of 42-thread, 40 fathoms long, to fish about 18 feet of water.

WASHINGTON, D. C., *April* 7, 1884.

110.—NOTE ON THE BREEDING OF EELS.

By EDWARD H. THOMPSON.

[From a letter to Prof. S. F. Baird.]

I mailed you yesterday a box containing specimens of the *Anguillidæ* (young). Yesterday morning, while working up material on the "*Gelasmi* of Buzzard's Bay," I noticed the following facts:

West Falmouth Harbor is an inlet from Buzzard's Bay and terminates in a sandy marsh densely carpeted with marsh-grass. Through this marsh a narrow ditch has been cut to drain a contiguous cranberry bog. The ditch has of late years been completely stopped by a thick plank placed athwart it, thus forming a complete *cul-de-sac*. The plank is above common tide-water, but is generally dripping with water that trickles through from the bog above. The part of the ditch of which I speak is hardly, if ever, free from the water, which comes principally from the cranberry bogs. A thick black mud lies on the bottom. As I passed the plank I noticed upon it a singular appearance. Approaching closer, I found it to consist of a large number of tiny eels massed together in a solid bundle. The mass, I should say, could have been contained in a pint measure.

FOREST HILL, W. FALMOUTH, MASS., *May* 17, 1884.

Vol. IV, No. 14. Washington, D. C. July 30, 1884.

111.—ANTON PINTSCH'S MOVABLE FISH-WAY.*

By Dr. M. NOWICKI.

At Kurczyn, on the river Poprad, in Hungary, there is a high weir which prevents the salmon getting up to the spawning ground, and has caused a falling off in the number of salmon.

It was therefore decided, in connection with the attempt which was being made at the time to increase the salmon in the Weichsel district, to open up the Poprad River again to salmon. Count William Migazzy, president of the Upper Hungarian Fisheries Society, and to whom the improvement in Hungarian fisheries owes so much, took steps to provide the weir with a salmon ladder at his own expense.

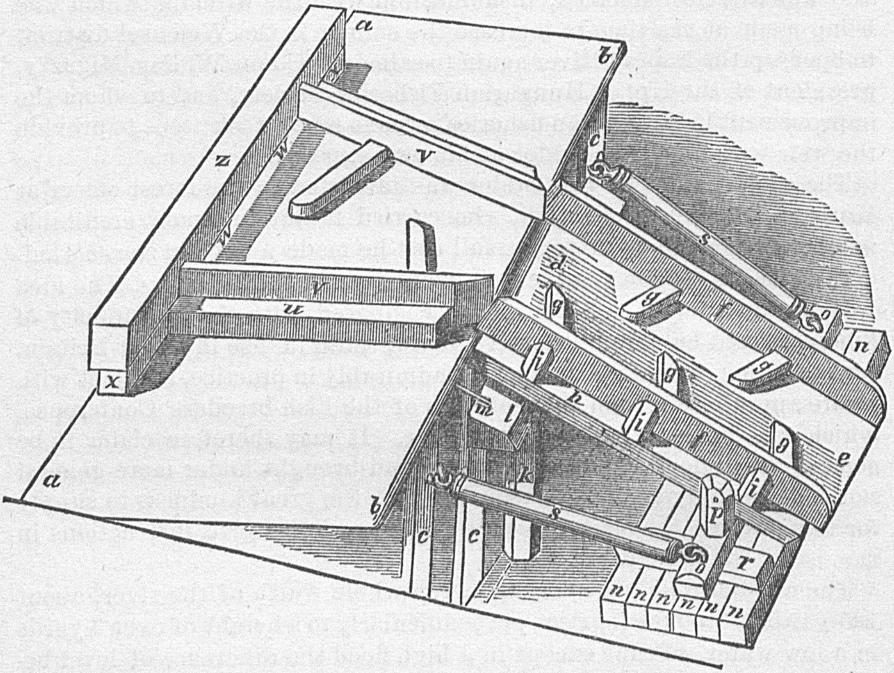
The construction of the ladder was intrusted to the forest officer at Kurczyn, Mr. Anton Pintsch, who carried it out in a most creditable manner, inasmuch as at very small cost he made a wooden *movable* ladder, which he attaches to the weir every year in the autumn. The idea was, at any rate, an original one as compared with the multiplicity of kinds of fixed ladders of massive build, those in use in Great Britain, for example. This ladder answers admirably in practice, and met with entire approbation from the members of the Fish-breeders' Conference, which was held at Dresden last year. It may therefore claim to be somewhat particularly described here and brought under more general notice, especially as Mr. Pintsch has had the great kindness to supply for this purpose the accompanying design and also give instructions in the use of the ladder.

The wooden weir (*a b c*) occupies the whole width of the river, about 125 yards. Its face (*c*) rises perpendicularly to a height of over 3 yards in a low water, so that except in a high flood the difference of level between the water below the dam and that above is too great for salmon to overcome, and for just this reason the use of a ladder is imperative. The broad dam head (*a b*), with gentle slope, is boarded horizontally; its ridge (*a*) is horizontal lengthways, and without crown. Below the dam are several deep pools, in which the salmon lie, and it is over one of these just below the weir that the fish pass is placed.

The ladder (*d e*) has parallel sides (*f*), and a level bottom (*d e*) is made of strong 2¼-inch planks, 16 feet 4 inches long, 3 feet 6 inches wide. The blocks (*g*) are placed widely apart to allow room for large salmon to move about between them easily. The height of these blocks corresponds with the depth of water required for salmon, and the fall is that of the

*Forwarded by the author; also published in *Deutsche Fischerei-Zeitung*, April 22, 1884.

floor of the ladder. The ladder rests on strong beams (*h*), and is kept in its place by several small posts (*i*), which are let into the beams. Its upper end is supported by the wood-work (*k l*), and the lower by the float or platform (*n*). The wood-work (*k l*), close to the front of the dam (*c*), is lower than the dam edge, and consists of the two piles (*k*) and the supporting beam (*l*) mortised on to them. The beam is fastened to weir by strong iron clamps (*m*, 1 inch square), which go through it, and are secured by nuts or screw ends underneath. On this support (*l*) the upper end of the ladder rests free, so that its floor is level with the top of the weir, and just touching it, while the sides of the ladder are higher, so that the water can flow down between them. The ends of the sides



Anton Pintsch's movable fishway.

(*f*, *f*), where they meet the ends of the guides (*v*, *v*), are cut at angles (see illustration) to permit of the ladder working in its place, as the platform rises or falls. The small space between the ladder (*d*) and the edge of the dam (*b*) can be covered by a board nailed to the dam, if it was necessary to prevent any water falling through.

The platform (*n*) floats on the surface of the water, and is held fast by the two bars (*s s*) which are fastened to hooks in the weir and platform. The platform is formed of several 8-inch to 9-inch logs of well-seasoned wood (*n*). These are fastened together by the stout piece (*r*), on which rests the cross-beam (*o*), the ladder being kept in place by nails in the supports (*p*), which act as axles on which it works. The end of the ladder (*e*) projects beyond the platform, and touches the surface of the pool, or dips into it a little, according to the amount of water flowing over the ladder. It will be seen that as the water rises or falls the platform rises or falls with it. In a small water the platform rests motionless; but in a heavy water, forming waves under the weir, it shakes.

The converging guards (*v, v*) are for the purpose of directing the water which comes in at *w*, *under the beam z*, upon the ladder. They are about 12 inches in height, and provided with two blocks, like those in the ladder (*g*), to break the force of the water, and enable the fish to get over. The object of the beam (*z*) is to control the amount of water passing into the ladder at *w* (the height of this opening being only about 6½ inches), and prevent too much water flowing over. In spring and summer high waters prevail in the Poprad, enabling the salmon to get over the high dam; but in autumn there is generally a low water, and the ladder is necessary in September, October, and November.

A flood does not injure the ladder at all, but the winter's ice would tear it away; so, as it is easily taken down, it is then taken away and put so that the platform gets dried well by the sun. The wood-work (*k l*) is left in its place, as being out of danger from ice.

The construction of the ladder, including wood, iron, and labor, costs only $15 at Kurczyn, and the cost of removal and replacing, with any necessary repairs, about $3 or $3.50. The ladder has only been used two autumns, and Mr. Pintsch has often had opportunities of seeing salmon ascending it without difficulty. Before it was put up he had frequently noticed numbers of salmon collected in the pools below the dam, and making vain efforts to get over it, and at last getting caught by the fishermen. But since the ladder has been in use the salmon are rarely seen waiting in this way, as it enables them to get up at once. Models of this ladder are in possession of the Galician Fisheries Society, the Austrian Fisheries Society in Vienna, and the German Fisheries Society in Berlin, and drawings of it have been sent to England and America. As a movable and cheap salmon ladder it seems preferable to the costly fixed affairs. With the necessary modifications required by different conditions in dams and rivers, it offers exceptional advantages, especially where expense is a consideration, and there is not much water to play with. These are my reasons for recommending it.

CRACOW, *April* 27, 1884.

REMARKS ON PINTSCH'S FISH-WAY BY BRÜSSOW.

The question of movable salmon-ways has been discussed among fish-culturists for some time, and the problem seems to have been solved in a very simple and happy manner by the above-mentioned invention; only it will be necessary—

(1.) To weight the platform or raft *n n* with some stones, so it may sink deeper into the water, and that the foot of the ladder may contain more water;

(2.) To increase the height of the opening *w*, which is only 16 centimeters, to 25 centimeters, because otherwise a large salmon cannot slip through below; and

(3.) To place the diverging walls on the weir *v v* somewhat wider apart at the upper end, or, in other words, to make the opening *w w* somewhat longer, so as to get more water into the ladder and make it easier for the fish to ascend.

NOTE ON PINTSCH'S MOVABLE SALMON LADDER, BY R. B. MARSTON.

In a recent account of salmon fishing in Scotland, I referred to the dams on the river Don in Aberdeenshire as preventing the ascent of salmon, except in high waters. Being of opinion that there is often not much good done by merely describing a disease unless you can also suggest a remedy, I said if any of my Aberdeenshire readers desired it I would give some account of the McDonald fish-way. Several gentlemen asked me to do so. Now the only objection that I could think of as likely to be raised against the McDonald pass was its expense, which would probably be very high. But in the German Fischerei-Zeitung of April 22, I find an account of a movable ladder invented by Anton Pintsch, forest-officer of Kurczyn, in Hungary. This ladder is fully described in the German Gazette by Dr. M. Nowicki, of Cracow, and it seems to me to be in every way well worthy of trial in this country.

It seems to me that we are much indebted to Mr. Pintsch for inventing, and Dr. Nowicki for describing, such a very practical and extremely cheap salmon ladder. It can hardly fail to succeed if used on such rivers as the Don in Aberdeenshire, at the horrible weir at Armathwaite on the Eden, at Totnes weir on the Dart, and other similar places where, except in heavy waters, salmon cannot pass up-stream.

FISHING GAZETTE, *May* 24, 1884.

112.—TRANSFERRING CATFISH FROM THE POTOMAC TO THE COLORADO RIVER, ARIZONA.

By MARSHALL McDONALD.

One hundred catfish were sent to Arizona with the recent shipment of 1,000,000 shad for the Colorado River. Of these 10 reached destination and were delivered to Commissioner Gosper, at Prescott, Arizona, who will deposit them in the Colorado River.

UNITED STATES FISH COMMISSION,
Division of Distribution, June 28, 1884.

113.—AN ADVENTURE WITH A WHALE IN THE RIVER TAY, SCOTLAND.*

By Capt. J. W. COLLINS.

A somewhat remarkable adventure with a whale took place in the river Tay, on the east coast of Scotland, in the early part of January, 1884. The appearance of a whale in such a locality—some distance up a river—may, I think, be considered extraordinary, especially at this time when the eager pursuit of man has done much toward reducing the numbers of the larger cetaceans, and has also rendered them shy and wary of approaching such places. It may, however, be explained that during December and January the estuary of the Tay was swarming with young herring, and the whale followed these in and continued to feed on the fish for five or six weeks previous to the attack which resulted in his death. The appearance of a whale on a part of the Scottish coast famous for its whalemen, attracted considerable attention, and several attempts were made to effect its capture by crews of Dundee whale-boats, but the whale constantly eluded those who were pursuing it. On one occasion it came within 400 yards of Broughty Ferry, where it "breached," leaping clear of the water. This action on the part of the whale was like the leap of a salmon, though less active. It rose almost perpendicularly till clear of the water, canting to one side as it fell. It then swam down stream, as if to leave the river, but subsequently returned.

On Monday, January 7, a determined effort was made to kill the whale, which was seen that morning about 10 o'clock off Broughty Ferry. Three boats, one of which was a steam launch, and the others six-oared rowing boats, started in pursuit, heading out toward where it had last been seen. As the steam launch had arrived near to the Newcombe Buoy, the whale came up to blow close by. The men were on the alert, and as the black back rose above the surface the harpooner threw his iron, which was buried in the shoulder of the whale. A flag was immediately hoisted on the funnel of the little steamer to announce to the crews of the other boats that she was "fast." This was encouraging, and the rowers gave way to overhaul the launch, reaching which the boats were taken in tow. The struggle made by the whale after it

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* The account here given of the appearance of a whale in the Tay, the attack made upon it, and its subsequent death, has been compiled from newspaper clippings—chiefly from the Edinburgh Scotsman—which were sent me by Mr. T. F. Robertson Carr, of Edinburgh, Scotland. The facts contained in the newspaper accounts have been strictly adhered to.

It may be mentioned as a parallel case to that given here, that in the city hall (Rathhaus) of Bremen there is a picture of a whale that was killed in the river Weser, near Bremen, in the seventeenth century. From this it would appear that whales occasionally venture some distance up estuaries when in pursuit of food.

was first struck was far less violent than was expected. For some time it swam along so leisurely that a row-boat could keep up with it, and there would then have been little difficulty in getting in another iron, as the "fish" rose every two minutes or so to blow. The shallowness of the river made it impossible for the whale to go down any distance below the surface, as it would doubtless have done in deeper water, and as it did not run fast the whalemen kept a short line, only seven or eight fathoms being paid out.

After it was struck, the whale headed for Broughty Ferry, and in about fifteen minutes was off that place. The weather was fine, the water smooth, and large crowds of people had assembled to witness the chase. Off Lucky Scaup it was deemed desirable to get in another harpoon. For this purpose one of the rowing boats pulled ahead of the steam launch. As the whale rose to blow at short intervals it was not long before a favorable opportunity presented itself, and as its back came above the water, the large gun at the boat's bow was fired by the harpooner, the "iron" getting well "fast". Up to this time the whale, feeling its way down river toward the sea, had not exhibited any remarkable speed. When struck by the second harpoon, however, it displayed some of its power in a determined effort to escape. It seemed, however, to be somewhat dazed—"gallied" as whalemen call it—for it swam in zigzag directions, occasionally going at quite a moderate speed and then rushing through the water at a tremendous pace. It was thought at this time that the second iron had reached its "life," and that the boats would meet with success, for the whale began to spout blood in considerable quantities, coloring the water in his wake a reddish tinge. The flurry continued for some time, the whale making desperate rushes hither and thither in the vicinity of Lucky Scaup, until it at last seemed to get its bearings on the south side of the channel, and started seaward again, keeping that side of the river. It was now going at so rapid a pace that the last boat to fasten lost its hold and was quickly left far astern. As at the beginning, the steam launch was now the only boat fast, though the second row-boat still held on to the steamer's stern. As there was danger that the launch's harpoon might also draw, the crew of the row-boat, by great exertions, pulled ahead of the steamer, and taking advantage of a favorable opportunity, fired, the iron getting well "fast." The whale, notwithstanding it had been spouting blood for some time, seemed to start off seaward with renewed energy after it had been struck the third time. The whalemen did their best to further disable the "fish," firing rockets at it whenever its back rose above the surface.

In the meantime the boats had been lost sight of by those who were on the river side at Broughty Ferry. When it became generally known that the boats had fastened to the whale it was thought best to send a steam-tug after them to render any assistance which might be required. Accordingly the tug Iron King started down the river early in the afternoon and overhauled the whale at the mouth of the Tay, not far from the Buddonness light-house. No time was lost in sending forward the whale-boat, which the steamer had picked up, and it, too, was soon fast.

Between 3 and 4 o'clock the harpoon line of the steam launch was got on board of the tug, which then shut off steam. Thus, in addition to the two boats and launch, the whale had the larger steamer to pull along. But, despite this weight, it exhibited a wonderful amount of energy, swimming swiftly about for a time in various directions. The crews of the boats improved every chance to attack the whale, the keen-pointed lances being repeatedly thrust into it almost to their sockets. From the wounds the blood flew in all directions, giving the surrounding water a crimson tint. Meantime, instead of succumbing, as one might expect, it continued the flurries for several hours, sometimes heading seaward and then retracing its course up the river. In the course of its struggles the whale rose under one of the boats and lifted one end, with its crew, entirely out of water, but luckily no damage was done.

In the meantime the steam launch was sent off to Dundee to procure a supply of bomb-lances and rockets. By the time, however, that the launch reached the river's mouth with the new equipment of whaling implements, night had fairly set in, and the weather being thick added to the darkness, so that no trace of the whale and its pursuers could be obtained.

The crews of the tug and whale-boats had done their best to keep the "fish" inside of the estuary until the launch returned, knowing, too, that if once outside they would have less chance to kill it; but in this they failed, and, what made it worse, in the attempt they parted two of their harpoon lines. This was specially unfortunate, for there were no more harpoons left on board the boats. Nothing, therefore, could be done but to let themselves be towed along, and wait for the "fish" to tire himself out. Heading along the northern side of the Tay, the whale took a run over the shoal water of the Gaa Bank, and by this means temporarily shook off the steam-tug, which was obliged to let go, fearing to bring up on the bank if she held on. Between 6 and 7 o'clock in the evening the bar of the Tay was crossed and the struggling cetacean headed off into the open sea.

The tug had been watching an opportunity to get hold again, and when deep water was reached, about an hour after she let go, she got fast to the line. At first the whale headed off toward Bell Rock, on an easterly course, but after awhile struck off in a northerly direction. It was evidently somewhat confused as to the course it should take to escape from the land, for after getting almost off Montrose, about midnight, it changed to the opposite direction and again started for Bell Rock. This was passed at a distance of about four miles, and when the whale had reached a position within six or seven miles of the Carr Rock, which lies at the mouth of the Firth of Forth, it again changed its course and swam in a northerly direction up the coast. As soon as day broke the harpoon-gun was loaded with an iron bar four feet long, and this was discharged into the body of the whale. Two marlinspikes were sent after the bar, and these were followed by all the iron nuts and bolts that could be found on board. At first these seemed to have considerable effect, for about 8 o'clock in the morning the whale stopped running fast, settled down level with the water, and rolled from side to side, inspiring the whalemen with the hope that it would soon die. But after a few minutes of comparative inaction the whale started off again with such great energy that it pulled the harpoon line in two at about half-past 8 o'clock a. m., when the boats and tug were nearly half way between Bell Rock and St. Andrews. This was certainly discouraging to the boats' crews to see the "fish," which they had so confidently counted on killing, going off free. They could, however, do nothing, except to steam along after the whale, hoping that it might soon die from its numerous wounds, or that an opportunity might offer to get hold of the end of one of the harpoon lines that trailed behind in its wake. Unfortunately the wind soon began to breeze up sharply from the eastward, and a choppy sea getting up, the chase had to be reluctantly abandoned.

On the return of the tug and boats it was reported that the whale was a humpback (*Megaptera* sp.), and it was estimated to be 60 to 70 feet long, with fins 9 or 10 feet in length.

But this animal, which had shown such wonderful vitality and powers of endurance, though it escaped from its would-be captors, was mortally wounded, and a short time later its floating carcass was picked up and towed into Stonehaven by some Gourdon fishermen. It was sold at public auction; and, according to there ports, the sale was the occasion of quite a lively competition between Professor Struthers, of Aberdeen University, who wished to obtain the whale for scientific purposes, and Mr. Charles Ferrier, Green Market, Dundee, who wished to secure it for public exhibition. Bidding commenced at £10, and the price rose gradually till it was knocked down at £226 to the latter gentleman. Professor Struthers has arranged with Mr. Ferrier to get the skeleton of the whale for Aberdeen University after it is unclothed.

The tug Excelsior went to Stonehaven for the purpose of removing the carcass. A strong hawser was attached to the tail of the monster, and the Excelsior steamed slowly around to Dundee. The whale was towed underneath the 70-ton crane at Victoria dock. To the uninitiated the task of raising the animal from the water to the quay seemed an impossibility, and it was confidently asserted that it would have to lie in the water all night. Those who had the matter in hand, however, quietly proceeded with their operations. The huge tail was first gently lifted, and a big chain coiled around it. An attempt was to be made to lift the fish from the water by the tail. It was freely asserted that it would never stand the strain, but would tear asunder in the process. On the signal being given, the crane was set in motion. It rose, foot by foot, and when at last it was altogether clear, three ringing cheers were spontaneously given by the spectators. As it hung in mid-air its huge proportions were set off to full advantage, and the spectators had a fine view of the form and appearance. While it was hanging thus suspended, its length began gradually to increase from the mouth downwards. At first it was thought that it was stretching out by its own weight, but a closer examination showed that it was the tongue that was hanging down. The weight was too great, and the tongue fell into the dock. Two lorries were set ready to receive the carcass, and after several attempts it was placed in position. Having been securely fastened, eighteen horses were yoked to the lorries. The "fish" much improved in appearance after being taken out of the water. The fins and tail were white, the glossy skin appearing beautiful in the moonlight. The time occupied in lifting the "fish" out of the water was a little over an hour. While suspended from the crane, ready to be lowered on the lorries, one of the engineers was hoisted up to the index of the crane, and ascertained that the "fish" weighed 16 tons 8 cwt. The whale was exhibited in East Dock street, Dundee, for a few days. It is stated that several scientific gentlemen in different parts of the country are anxious to secure the skeleton.

WASHINGTON, D. C., *May*, 1884.

114.—CULTIVATING TROUT IN OREGON.

By B. F. DOWELL.

[From a letter to M. McDonald.]

I have just commenced cultivating trout near Portland, Oreg. I have a large spring and a good creek for trout, and I wish to obtain the most approved apparatus for hatching the eggs. I hatched in the Williamson box, last spring, 12,000 eggs, and the young fry are doing very well.

Large fine spotted trout, weighing 6 to 15 pounds each, were caught last month in Applegate Creek, 10 miles south of this place. They were ascending the creek to spawn. I bought several of them which were full of eggs. They are called by the fishermen here Rogue River trout. I think they are of the same species as these in California, which are called the rainbow trout.* I intend to manipulate some of their eggs next year and ship them to my hatching house and ponds at Portland. They are very delicious in flavor and nearly equal in size to the silver-sides of the Columbia and Willamette Rivers in North Oregon.

JACKSONVILLE, OREG., *June* 11, 1884.

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*The fish is, in all probability, *Salmo gairdneri*.—T. H. BEAN.

115.—NOTES ON THE GREAT LAKE FISHERIES, DEPLETION OF BLACK BASS, ETC.

By Dr. E. STERLING.

[From a letter to Prof. S. F. Baird.]

As you seem to be collecting for the National Museum everything that pertains to fish and fishing, I send a landing-net, fish-spear, gaff-hook, and fish-line dryer, all of home make. The landing net is not such as is made by the manipulator of the salmon or trout rod, but such as did good service among the Lake Erie Islands some fifteen or more years ago, when black bass averaged from 3 to 5½ pounds each, and blue pike (*Lucioperca*) by the thousands from 5 to 20 pounds each. With a school of the former ranging from one to many hundreds there was no time for playing with the split bamboo. It was "bait, yank, and hist in" 500 pounds of this fish in part of a day's fishing; and this was lively work and glorious fun. The many friends at home who partook of the harvest of the lake will agree with him and cry, "Repeat, old fisher-friend; the pot and frying-pans are again empty."

The pound nets have little to do with the depletion of the black bass among the smaller islands of this group, as in many cases they are not set within several miles of them. This depletion is caused entirely by hook and line fishing. I have never known a black bass to be taken in a gill net. This fish, a few years so numerous and of full weight, is now fast disappearing, and when found in the market runs from one-half a pound to 2½ pounds each. To be sure, there are a few out-of-the-way places where they hold, to a certain extent, their own in size and number, but this will continue only for a short time in the future.

The blue pike used to go in such immense schools as to destroy the bass fishing while on the grounds. They are a lazy fish on the hook compared with the former and afford little sport to the angler. They drive the bass away by their numbers and voracity, so that if he is not fishing for the market and wishes to continue his bass-fishing, he must change his locality. However, there is some excitement in pulling in two or three 10 or 15-pound pike, especially if you wish to see great expanse of glass eyes, extended gills, shark-like teeth, and a maw large enough to take in the fish himself, but it soon becomes more than work—monotonous.

The landing net was of my invention. The maker of it, often furnishing several for his customers, proposed to have it patented, to which I agreed, but unfortunately for us, on application to the Patent-Office, some one had been there for the same purpose ten years before us. The nets were identical, only mine had the best arrangement for attaching it to the handle.

It is rare to find the blue, yellow, goggle-eyed, wall-eyed, or white pike (all the same fish, *Lucioperca*, only variations of the same species, the result of difference in their surroundings, neither does the difference in structure amount to anything more, and perhaps not as much) on the market averaging more than 1½ pounds from the upper lakes, perhaps 2 pounds, and all scarce at that, 10 to 14 cents a pound undressed. Twenty-five years ago you could buy a 15-pound fish for a quarter of a dollar, and pay a good price at that.

CLEVELAND, OHIO, *May* 27, 1884.

116.—SPAWNING IN GERMANY OF THE LARGE-MOUTHED BLACK BASS SENT FROM THE UNITED STATES IN 1882.

By MAX VON DEM BORNE.

[From a letter to Prof. S. F. Baird.]

You will recollect that you kindly sent to me, in the fall of 1882, by Mr. George Eckerdt, 7 large-mouthed and 75 small-mouthed black bass. In consequence of the long passage the greater part of the lot died, so that I had this spring 3 large-mouthed old fish, and 10 small-mouthed two-year-old bass.

To-day I had the satisfaction of finding that the three large fish had spawned, and the pond actually swarms with fry. I have caught with a small net more than 2,000 and have put them into another pond which is free from other fish.

I have no doubt that next spring the small-mouthed bass will spawn, and that the experiment will be successful.*

BERNEUCHEN, GERMANY, *June* 15, 1884.

117.—TRANSPORTATION OF CLAMS AND OYSTERS,

By R. E. C. STEARNS.

[From a letter to Richards & Harrison, San Francisco, Cal.]

In reply to your question as to the best method for transporting clams and oysters, I would say as to clams that they are in my opinion more difficult to handle than oysters, and further, that the abundance of several varieties of clams on the west coast of America, from and in Puget Sound south along the coast at many points to San Diego, would not warrant the experiment.

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*Another effort was made this year to send black bass to von dem Borne in charge of Captain Briand, of the French line of steamers from New York. Mr. Blackford delivered 40 bass, March 26, on the steamer with orders to leave them at the Havre Aquarium subject to order of von dem Borne. Unfortunately the fish all died at sea in transit.—C. W. S.

As to the oysters which you speak of as occurring at one of the Kurile Islands, if to be sold for immediate consumption, the large ones (adult) are what you want. If, on the other hand, you intend to plant them for subsequent business purposes the smaller ones are better—safer, measurably, to transport, &c.

As to what place you had better plant them in, I am not prepared to answer, as I do not know the conditions or peculiarities of the region in the Kuriles which enter into the particulars of the habitat. It would be prudent to bear in mind that these and similar mollusks do not stand heat well. The cool season of the year would be best for the experiment.

The oysters should be put in rather open crates and mixed in with rock or bladder weed, and frequently watered with sea-water *en route*; kept shady and cool all the time, and jarred or shaken as little as possible, and planted where they will be covered by the tide to the extent that prevails in their native bed; and as a suggestion I should think that near the head of Drake's Bay, on the coast north of San Francisco Bay (which you will see by the map contains a "bight," as the sailors call it), with a rocky or shelly bottom, would or might be a good place.

After planting you will have to look out and protect the bed from the star-fishes, periwinkles, and whelks which are as fond of oysters as the genus *homo*.

If you should deem it best to attempt the experiment, please have your men collect any and all shells as well as some of the larger individuals of the oysters, and send the same to this Institution so that we may examine them here.

U. S. NATIONAL MUSEUM,
Washington, D. C., June 13, 1884.

118.—CATCHING FISH IN A CREEK IN TENNESSEE BY A WATER-SNAKE.

By J. S. WARNER.

Just one mile from where I write a bold spring issues from under a rock and sends out so considerable a stream that it affords power for an old-fashioned saw-mill three-fourths of a mile from the spring. Just a few rods from where I am writing fish 8 to 10 inches in length are caught as they come up stream. Last year I saw a water-snake leaving the creek with a fish about 5 inches in length, just as described by Mr. Nye, in Fish Commission Bulletin, 1883, page 196. I killed the snake, rescued the fish, and returned it to the water, but it seemed to be too badly wounded to recover. The snake was making way for a place of safety where it might devour its prey.

JONESBORO', TENN., *June* 14, 1884.

119.—REPORT UPON THE SHAD AND HERRING FISHERIES OF THE POTOMAC RIVER FOR 1884.

By GWYNN HARRIS.

[From a letter to Col. M. McDonald.]

SHAD.

Number of shad landed and inspected in Washington	231,111
Number of shad landed at Alexandria, Va	74,000
Number of shad landed at Georgetown	670
Number of shad shipped by steamer Corcoran*	19,000
Number of shad shipped to Baltimore by steamer Sue	9,200
Number of shad sold on the different shores and from trap-nets	13,500
Total number	347,481

HERRING.

Number of herring landed and inspected in Washington	5,640,812
Number of herring landed at Alexandria, Va	2,998,000
Number of herring landed at Georgetown	200,000
Number of herring shipped to Baltimore by steamer Sue	58,000
Number of herring sold on the different shores and from trap-nets	1,400,000
Total number	10,296,812

The first herring of the season was caught February 18th. The first shad was taken on March 3d.

The herring product shows an increase of 1,307,551 on the catch of 1883, while the shad figures indicate a decrease of 32,335 as compared with the figures of 1883. (See page 13 of present volume.)

120.—A NEW METHOD OF PROTECTING THE EGGS OF CARP AND REARING THE YOUNG.

By L. T. WHEELER.

[From a letter to Prof. S. F. Baird.]

I have now had three years and a half experience in the raising and hatching of German carp, and it may be that my experiments may be worth something to others, particularly in the South.

All still-water ponds should be as deep as possible so as to prevent stagnation and to insure a certain supply of water when the rainfall is alone to be depended upon.

As it is next to impossible to keep out native fish, I had to resort to partially artificial means to hatch and protect carp. I have adopted the following plan with eminent success:

About the 1st of May, having first procured a quantity of long sea-moss, I tie it in small bunches and lay it in shallow water near the bank,

* These figures were taken from the account furnished by the clerk of the steamer.

attaching it safely to the bank where it will have as good an exposure to the sun as possible; carp will not spawn in the shade. By the 5th of May in this latitude (32°) the carp will begin to spawn. They may be seen in great numbers, fluttering near the banks in shallow water, and they will be sure to find the moss and to deposit innumerable eggs upon it; the eggs will adhere to the moss from three to four days and then drop off. To protect the eggs and the young from the ravages of other fishes I constructed boxes 10 feet long and 5 wide. The gunnels or side pieces are 1 by 12 with a good water-tight bottom. The ends of these boxes are made of wire cloth sufficiently fine to prevent the escape of the smallest carp and to admit a constant flow of fresh water. The bottoms are covered an inch deep with pure sand. When placed in the water they sink until the water stands from 6 to 8 inches deep in them. As soon as I discover the eggs on the moss I gather up the moss and lay it in these boxes, putting weight enough on to keep it barely under the water. In eight or ten days, according to the temperature of the water, the young will be seen. It is best to anchor these boxes in the middle of the pond, where they will be subjected to the action of the wind and waves and have as fair an exposure to sun as possible. After the young are two or three weeks old they should be protected from the midday sun. It is wonderful how many can be hatched in a box of the size given. As the growth increases they should be divided and kept until they are large enough to take care of themselves, which will be in two or three months, if there are game fish in the pond. I commence feeding when a month old by sprinkling corn-meal in the boxes, but not enough to leave a residuum.

Carp do not spawn in this climate until they are two years old, and at three they spawn enormously. They begin by the 5th of May and run from three to five days only. I had only one that was as late as the 25th this year. I did not observe it spawning but one day, though I watched it closely day and night. I placed all the spawn of this one in a box by themselves; yesterday I bailed the water out of this box, straining through a wire sieve; it is simply wonderful how many young there are—too many to count. I am now selling the young, having sold to one man 1,000 at $15 per hundred, and have demand for every one that I can hatch.

I have given the cultivation of the carp the closest attention, endeavoring to find out the most simple way to hatch and protect them, and one that any farmer could understand and adopt without requiring much time or attention. I have been eminently successful, and there is no reason why others should not be. My oldest carp are now three and a half years old and I expect to exhibit one at the fair in New Orleans that will weigh thirty pounds.

CORSICANA, TEX., *July* 1, 1884.

121.—NEED OF A NATIONAL LAW TO REGULATE THE SIZE OF MESH OF BOTH POUND AND GILL NETS ON THE GREAT LAKES.

By LAFLIN & CO.,
Wholesale Dealers in Oysters and Fish.

[From a letter to Prof. S. F. Baird.]

We would respectfully call your attention to the size of the whitefish now being caught at Saint Joseph, Mich. A fisherman tells us that three years ago large quantities of young whitefish were put in the water there. This spring the same whitefish are being taken out by the tons. The fish are small, only half grown, and will not endure warm weather long after being taken; they are about 8 or 9 inches in length. If they were allowed to grow another year they would increase in quantity and the same fish be a No. 1 fish. The reckless waste of the fish is due to the men fishing there with small mesh gill-nets. We are told some of the meshes are only $3\frac{1}{2}$ inches. If there was a national law preventing the using of any gill-nets less than $4\frac{3}{4}$ or $4\frac{7}{8}$ inches mesh, these small fish would escape and mature into good solid fish. The majority of regular fishermen around the lakes favor stringent laws preventing the taking of small fish, but take no steps, as they don't want to incur the ill-will of their neighbors who use small nets.

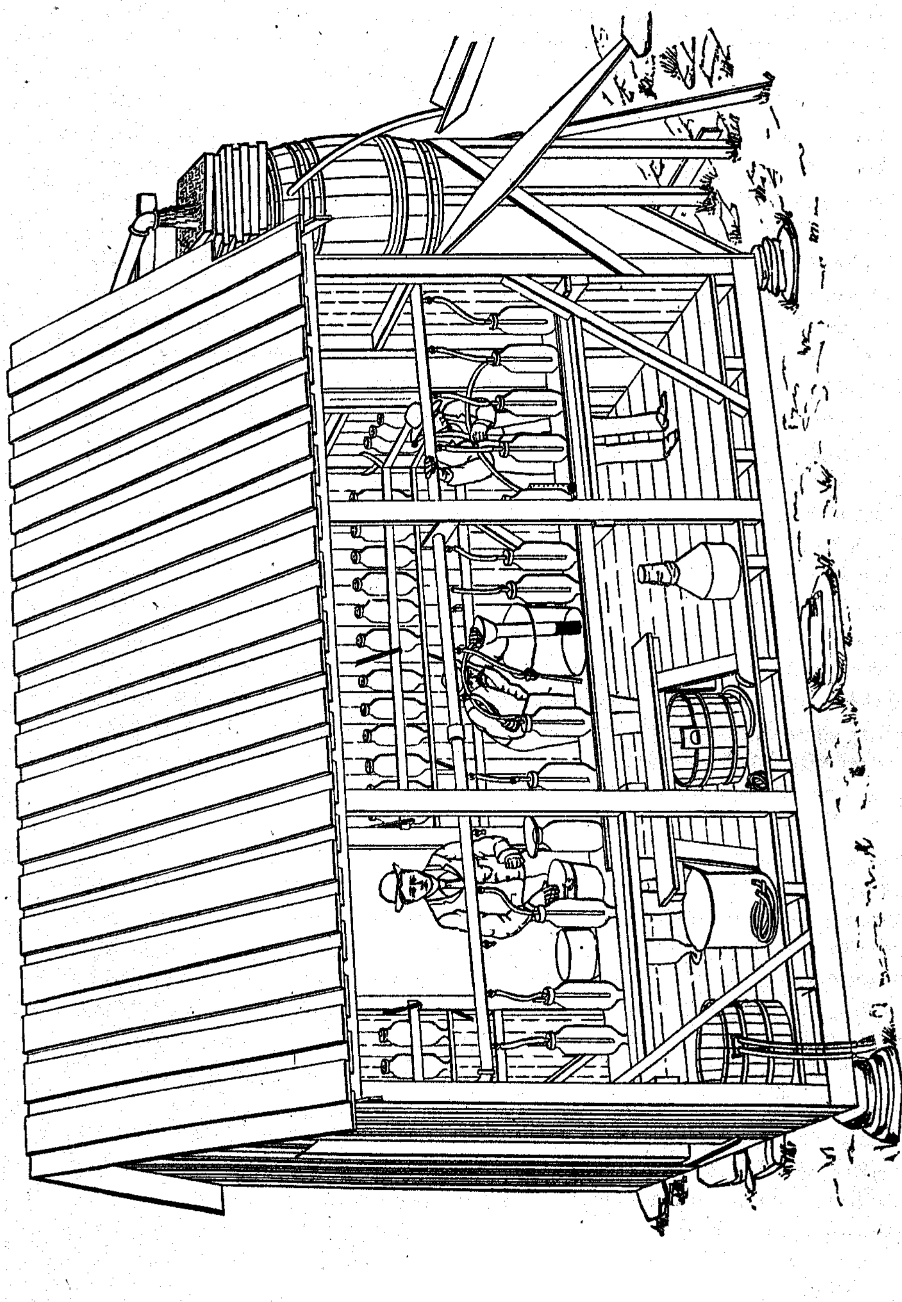
CHICAGO, ILL., (*No.* 40 *State street*), *April* 25, 1884.

We send you a sample in alcohol of the quality of whitefish caught at Saint Joseph, Mich. You can see the fish are immature, and if not caught for one or two years more would become large, besides increasing in numbers by spawning. No State law will reach these parties, for the reason that State or city officers will not push people when they depend on their popularity at home for appointment or election, and besides the mischief is done outside of the jurisdiction of the State of Michigan. Michigan City does nearly as much fishing, and that is in the State of Indiana. At the northern end of the lake it would be hard to determine which State had jurisdiction, Michigan or Wisconsin. In many cases fishermen go 20 and 30 miles away to fish and bring their fish with steam-tugs to shipping points. They could easily prove if arrested in one State that fish were caught in the waters of another State. A national law could be enforced in many places by the Life-Saving Service assisted by the revenue cutters. To limit the size of meshes of both pound and gill-nets for next season would work no hardship on fishermen, as they renew their seines each spring. The fish are literally caught out in Lake Michigan, and where there ought to be a large source of food supply to a rapidly filling country, it is being foolishly wasted by a few men to make a living for the time being, who do not intend to stay in the business permanently.

A law ought also to be enacted regulating the depth of water in which fishing should be done during the spawning season, and there should not be the reckless waste of trout there is each fall. They are caught all around the lake in such quantities that many are valueless and cannot be sold for food. In Green Bay and at Ahnapee, Wis., and in fact all along the western shore of Lake Michigan, trout are caught by the ton and thrown away, because the demand falls off when the catch increases. They are not fit to salt. In June sturgeon are caught and killed for the value of the caviare, when the fish are so abundant that they scarcely bring the cost of transportation. In the spring, all through the Green Bay country, fine large roe pike are recklessly taken from the water and wasted for almost nothing. If, when caught, they were thrown back into the water their spawn would increase the supply for future use. We would suggest to you to write to H. O. Wilson & Co., at Saint Joseph, Mich. They fish with large mesh nets, and they could probably give you other facts. One fisherman, when told he was doing wrong in fishing out such small fish, laughingly remarked that the United States were going to put 10,000,000 more in at Saint Joseph this year for their benefit. We give you a few names of intelligent fishermen at different points around the lake. If you wish to get their ideas, one and all talk of favoring a stringent national law—even those now busy catching small fish.

Names of fishermen and their addresses: G. H. Smith & Sons, Cedar Grove, Wis.; John Borkenhagen, 490 Second avenue, Milwaukee, Wis.; Louis Schultze, fisherman, Milwaukee, Wis.; F. Kocher, fisherman, Milwaukee, Wis.; H. von Ells, fisherman, Milwaukee, Wis.; H. O. Wilson & Co., Saint Joseph, Mich.; Fagan & Fairchild, Sheboygan, Wis.; F. Koehn & Son, Sheboygan, Wis.; Daane Bros., Vostville, Wis.; N. Niguette, Two Rivers, Wis.; John McDonald, Ahnapee, Wis.; E. S. Minor, Sturgeon Bay, Wis.; J. O. Lindquist, Menekaunee, Wis.; E. Boaler, Green Bay, Wis.; L. Bainbridge, Menomonee, Mich.; LeClair & Gundersen, Jacksonport, Wis.; N. Saunders, Fayette, Mich.; Feltus & Bro., Fayette, Mich.; Ainsworth & Co., Sault de Ste. Marie, Mich.; A. Booth & Sons, Chicago, Ill., fish at Escanaba, Mich.; C. Endress & Son, Whitefish Point, Mich.; Boutin & Mahan, Bayfield, Wis.; I. Chambers & Bro., Saint Ignace, Mich.; I. Moule & Co., Saint James, Mich.; R. Connable & Son, Petoskey, Mich.; Little Traverse Bay Fish Company, Harbor Springs, Mich.; Coates & Arnold, Mackinac, Mich.; M. D. Pool, Pent Water, Mich.; A. Warner & Co., Pent Water, Mich.; Cooley Levague & Co., Duluth, Minn.; Dawson & McKeone, Detour, Mich.; Powell Bros., Marquette, Mich.; Hausler Bros., South Chicago, Ill.; I. Degurgus, Ludington, Mich.; William Smith & Co., Frankfort, Mich.; Storms & Co., Montague, Mich.; Waiteman & Lanford, Montague, Mich.; Shriver Bros., Saugatuck, Mich.; Charles Kimball & Son, Michigan City, Ind.

CHICAGO, ILL., *May* 7, 1884.



Striped Bass Hatchery at Weldon, N. C.

Vol. IV, No. 15. Washington, D. C. July 30, 1884.

122.—REPORT UPON THE PROPAGATION OF STRIPED BASS AT WELDON, N. C., IN THE SPRING OF 1884.

By S. G. WORTH.

Having completed a successful season of work in the propagation of striped bass at Weldon, N. C., and as agreed upon with the United States Fish Commissioner in April last, I beg to report the following results:

On April 1, 1884, I sent Mr. C. M. McDowell to take charge of the station, and supplied him with such help as he needed, at first with three men and subsequently with four others, as necessity required. At the time of his arrival the river was somewhat full and very muddy, as it is on all occasions after rains on headwaters. No rockfish had been caught at the time of his arrival, and, indeed, no other fish had been caught except a few shad. I at once put him at work constructing a small hatchery, which he did with the assistance of three employés with a cash outlay of $35. The building was small, being 10 by 16 feet, but well equipped with McDonald jars to the number of fifty or more. The water supply was drawn from the flume of the mills of Mr. T. L. Emry, of Weldon.

By April 10 a few striped bass were taken, but they were small. The height of the run of fish occurred between April 20 and May 1. No ripe fish were seen until April 19, when the river temperature was 58°. The weight of the fish taken on this date was 19 pounds. The last ripe striped bass was taken May 17, when the temperature of the water was 70° to 72°. From the above statement it would appear that the season for hatching striped bass at Weldon would occur between April 10 and May 20.

The first fish from which eggs were taken was caught May 2; the roe was in good condition, the weight of the fish being 15 pounds. Upon examination it was found that the roe was two-thirds spent, but the eggs taken and impregnated numbered 200,000, the quantity being estimated on the basis of 20,000 per liquid quart (impregnated eggs). These eggs were placed upon trays, the hatching jars not being in position for work, but only 50 per cent were found to be good ten hours afterwards, owing to the exceedingly filthy water which at that time was not filtered.

The second fish taken was found May 2, at 7 p. m., weight 42 pounds after being stripped of its eggs. The ovaries were about full, but some of the eggs could not be taken from the fish and were left behind. Of those taken the estimate as above shows 1,150,000. As stated above the hatchery was not ready for the reception of these eggs and all were put into the river in an impregnated state except 50,000 which were placed on trays where they were kept fourteen hours with a loss of 50 per cent. The remaining 25,000 impregnated eggs were put into the river.

The third lot of eggs were taken May 6, at 7 p. m. The fish was one-third spent and weighed 11 pounds; the number of eggs taken was 350,000. The hatchery was still not ready. Of these eggs 40,000 were thrown away owing to the lack of milt. The remaining 310,000 well impregnated were placed directly into the Roanoke River, as were the others previously.

On May 12 the fourth fish was taken, weighing 12 pounds and containing 240,000 eggs. This fish seemed to be about half spent. While these eggs were in excellent condition, 160,000 were upset by the carelessness of a negro boy who sat down upon a loose plank upon which the pans were resting. Of this lot 30,000 were sent by express to the central hatching station at Washington for examination, but they were shipped at such an early stage that coagulation took place. Of this lot 40,000 were placed in the hatching jars and successfully hatched from the shells with a loss of 10 per cent, while the remaining few thousands unaccounted for were lost in transferring from buckets to jars, and in rough handling.

The next fish taken was on May 16, its weight being 15 pounds. A considerable portion of this fish's ovaries was spent, but 60,000 eggs were taken and impregnated and found to be in excellent condition. They were placed in the jars and 42,000 young fish were successfully hatched. Of this lot 25,000 were placed immediately in the Roanoke River at the hatchery, and 15,000 were reserved in the aquarium for the inspection of visitors, who were numerous. Of this reserve lot of 15,000 about half perished while being kept in confinement, and the remainder, 7,500, were placed in the river on the 17th of May. These eggs hatched in thirty-six hours in a temperature of 70° to 72° F. These eggs hatched earlier by eight hours than I have found them to hatch in previous years' experiments in like temperatures.

The last fish was taken on May 17, at 6 p. m., and its weight was 14 pounds, the ovaries being tolerably full. Four hundred and twenty thousand eggs were taken, which were successfully impregnated and introduced into the jars; 210,000 fry were successfully hatched and released in the river, and 10,000 eggs which had been placed upon trays were successfully hatched, the fry being kept upon trays about sixty hours after hatching.

RÉSUMÉ.—Number of fish from which eggs were taken, 6; number of eggs taken, 2,420,000; number of impregnated eggs placed in Roanoke River before opening the hatchery, 1,535,000; number of eggs placed in hatching jars; 520,000; number of fish hatched, 298,000; number of fry actually planted, 280,500; percentage of hatching of eggs handled in McDonald jars, upwards of 50.

From the experience of this season one difficulty has been overcome which heretofore seemed insurmountable, viz., the successful hatching of fish from the eggs. In my former experiments and in that of Maj. T. B. Ferguson, where the rock-fish eggs were handled in McDonald jars and Ferguson cones, there was a very great loss of eggs in the process of hatching; but in the experience of this year it has been found that by working the McDonald jar with a small quantity of water, one quart of water every three minutes, barely keeping the eggs in motion, the hatching resulted in upward of 50 per cent of the total, showing a great advance on previous work with this fish. The water used at Weldon is usually of a muddy character and requires filtering for any kind of hatching. The method of filtering used in the experiments this year was that of placing one tray above another, thus making a series of from 6 to 15, covered with coarse blanket, canton flannel, cheese cloth, and bagging. After operations were commenced but a small quantity of water was found necessary, and through these cloths the filtration seemed quite sufficient.

It may be well to call to your mind again the fact that the striped bass handled at Weldon, were taken almost exclusively in skim nets from bateaux which ply the river from Weldon, a distance of two miles below, and secondarily from fish-traps which are used on the falls at Weldon. About 50 or 60 of the canoes fish there daily during the height of the season, when as many as 6 to 25 fish are taken in each boat per day. All of the ripe fish observed during the season were taken from these boats except three large specimens captured some distance above the falls and above Weldon. Much zeal was required to collect the ripe fish from so many boats scattered over so long a distance, but by dint of effort and careful handling of the fishermen, it is believed that no ripe fish were lost during the time when the hatchery was prepared to receive the ripe fish. At a signal any of the fishermen along the line would know whether ripe bucks were required, and so complete was the co-operation that there was no hesitation on their part to bring the fish promptly forward.

The catch during the season of 1884, like that of last year, was abnormally small, reaching a good many thousand short of an average year, and said to be the smallest catch ever known. During the season of 1883, 9 ripe fish were handled; during this season, 12 were handled; but of the 12 fish, ova were taken from only 6. The total number of eggs this season was 2,420,000. Of these, 1,535,000 were placed overboard in an impregnated state, the hatchery being unprepared for their reception, but of the 530,000 handled in the hatchery on May 12, and subsequently, 298,000 fish were hatched, showing a percentage quite creditable in work so new as this. At Weldon there were actually planted 280,500 fry.

It is my opinion that Weldon, N. C., is altogether a favorable place for hatching this species; as the falls which obstruct the river at this point cause an accumulation of fish which are in better average spawning condition, perhaps, than an equal number of fish which may be found anywhere else in so small an area. If the total number of eggs handled this year could have been turned at once into the hatching jars, the result of the season upon the basis of 50 per cent would have been 1,210,000 fry.

The hatchery which was left behind is in first-rate condition, and everything favorable for future operations and in such readiness that in any other attempt there need be no risk whatever of losing any ripe spawn which may be procured there. As to the possibility of procuring this spawn, it may be well to say that the fishermen almost without exception, though they number more than one hundred, are in full accord with the work of artificial propagation, and are ready to lend every assistance in their power toward building up a permanent station at that place.

I have examined with considerable care the striped bass at the fisheries known as Calm Point, Kittyhawk, Mizell's, Rock Point, and others lying below, between the mouth of the Roanoke River and Jamesville, a distance of 25 miles, and also in large numbers those taken fron the large seines just below the mouth of the Roanoke, and furthermore in the pound nets about Edenton, and have so far failed to discover any point approximating Weldon for the purpose of propagating these fish. It occurs to me that quite a great deal has been accomplished this season at Weldon in having discovered so many million of eggs in such a poor season, and furthermore in finding that the eggs may be successfully handled in the apparatus generally used to-day. As far as the keeping of the fry is concerned there is no difficulty; in former experiments I have found no difficulty whatever in keeping them alive in ordinary shipping cans a period of twelve days with moderate changes of water through the tin strainer tube. I feel gratified at the result at Weldon, and assure you, while my expectations were not fully met as to the number of eggs we should get, that I am entirely satisfied as to the result, and feel all confidence in any future labors at that point. I am glad to state that the citizens of Weldon themselves showed a ready and untiring interest in developing there a station unequaled in any other locality in which I have operated.

Before concluding this report it may be well to mention that while Weldon is a small town, containing only about 1,500 inhabitants, it is yet a very considerable railroad point, five roads terminating there. During the height of the season as many as two hundred visitors a day were welcomed to the hatchery; and during the season probably upwards of two thousand were received.

Table I shows the whole work in brief, and Table II the water and air temperatures during the period of actual operations.

RALEIGH, N. C., *June* 11, 1884.

NOTE BY MR. T. B. FERGUSON.—The report of S. G. Worth, superintendent of fisheries of North Carolina, on his striped bass hatching operations, conducted at Weldon, N. C., under the auspices of the United States Fish Commission, contains a matter of great importance to a large number interested in fisheries and in fishing who have anxiously looked for successes in this direction. As this fish is one of the most important and interesting of all the food-fish of the Atlantic coast, the possibility of arresting its alarming decrease has been looked forward to with great anxiety by many.

Mr. Worth's report is not so important as a record of work that has actually been accomplished as in having demonstrated the practicability of carrying on this important work at the point selected for these operations.

I have never doubted the ability of our experts in fish-culture to care for and develop with but slight loss the eggs of this fish. The difficulty has been in finding a place where the mature fish could be obtained with any certainty.

The Roanoke River near Weldon having proved to be such a locality, I cannot too strongly urge that immediate steps be taken for the establishment of a hatchery at this point, so equipped, and equipped in time for the next season's work, as to insure successful operations on a large scale.

TABLE I.—*Hatching and planting of striped bass or rock-fish at Weldon, N. C.*, 1884.

[Under the direction of S. G. Worth, superintendent; C. M. McDowell, captain of the force.]

Date.	Weight of fish stripped.	Condition of ovaries.	Number of fish stripped.	Number of eggs taken.	Number impregnated eggs placed into Roanoke River at station.*a*	Number of fish hatched.	Number of fish placed in Roanoke River at station.
1884.	*Pounds.*						
May 2	15	Two-thirds spent	1	*b*200, 000	100, 000		
2	42	Ovaries full	1	*c*1, 150, 000	1, 125, 000		
6	11	One-third spent	1	*d*350, 000	310, 000		
12	12	One-half spent	1	*e*240, 000		*f* 36, 000	36, 000
16	15	One-third spent	1	60, 000		*g* 42, 000	34, 500
17	14	Ovaries nearly full	1	420, 000		220, 000	*h*210, 000
Total.			6	2, 420, 000	1, 535, 000	298, 000	280, 500

a The eggs represented by the numbers in this column were taken before the hatchery was ready and were kept on wet trays several hours before being released.

b Eggs ten hours old when planted.

c Twenty-five thousand of these were ten hours old when released. Part of the eggs were left in the ovaries.

d Forty thousand of these were thrown away from lack of milt.

e Of this lot 160,000, after impregnation, were upset upon the ground by a careless bystander, and 30,000 shipped to Washington, D. C., by express, coagulated and perished while in transit, and 10,000 were broken in handling those for express shipment.

f The 36,000 fry hatched from 40,000 eggs.

g There were kept 7,500 fry in an aquarium for inspection, where they gradually died, after some days' confinement.

h The 10,000 fry unaccounted for were hatched from eggs on trays, where they were kept alive sixty hours by way of experiment.

TABLE II.—*Temperatures of air and water at Weldon, N. C., on Roanoke River*, 1884, **during the propagation of striped bass.*

[Under the direction of S. G. Worth, superintendent; C. M. McDowell, captain of force.]

Date.	Temperature of—					
	Air.	Surface water.	Air.	Surface water.	Air.	Surface water.
	7 a. m.	*7 a. m.*	*12 m.*	*12 m.*	*7 p. m.*	*7 p. m.*
April 20	59	60	58	60	54	58
21	56	62	54	58	52	56
22	49	54	48	54	48	52
23	48	52	48	52	48	52
24	50	52	48	52	50	54
25	49	52	54	56	56	58
26	50	52	62	63	59	62
27	55	57	......	......	......	......
28	58	60	70	66	68	70
29	68	64	74	70	70	74
30	62	62	70	66	72	74
May 1	62	65	78	68	76	68
2	70	68	86	70	78	71
3	68	68	78	70	71	70
4	72	74	76	72	78	73
5	72	70	80	72	78	74
6	71	72	74	78	77	73
7	68	72	84	76	74	70
8	63	73	66	72	76	70
9	62	71	64	72	62	70
10	60	68	75	73	70	72
11	64	70	78	73	70	72
12	58	69	68	70	64	70
13	60	68	72	68	70	70
14	71	69	74	70	76	71
15	66	68	73	69	67	70
16	64	68	78	72	72	72
17	58	68	70	69	72	72
18	60	68	75	71	......	......
19	62	68	81	82	78	84
20	72	72	78	74	76	74
21	......	......	78	78	84	74
22	......	......	80	74	84	74
23	73	74	90	78	90	78
24	75	76	82	78	84	78
25	76	78	82	80	86	82
26	71	76	70	76	73	76
27	66	74	70	74	71	73
28	66	68	73	76	70	73
29	52	63	64	73	64	70
30	52	62	60	68	68	72
31	54	62	65	70	75	72
June 1	58	60	68	68	65	71
2	54	62	63	67	75	71
3	58	62	73	73	80	73
4	64	66	74	75	85	75
5	68	68	77	75	84	76
6	70	70	80	72	84	75
7	70	68	84	73	80	75

* The water temperatures were taken in the canal, and not in the river proper.

123.—THE CARP PONDS BELONGING TO THE STATE OF TEXAS.

[From the Texas Farm and Ranch.]

The State fish-ponds at Austin, Tex., are now in a most flourishing condition, and the taste displayed in decorating the walks with flowers and shrubs, and other attractive improvements, reflects great credit upon the commissioner. The ponds are situated close to Barton's Creek (about two miles from Austin), from which they are supplied with cold spring water. There are four of these ponds, three of which are fully stocked with carp of different ages. They are connected with sluices by which they can be dried, and fish may be easily taken or transferred, as required. *At the tap of the bell, the finny boarders dart forward to the refectory with a sound like a distant waterfall*, and a ripple on the surface of the water like that produced by a heavy driving rain. Scraps of bread and vegetables are then devoured, while the water is flecked with gold and silver from the sides and bellies of the feeding fish. "Do the young fish in the adjoining pond also answer to the bell?" we asked of the caretaker. "Oh, no," he replied, "It takes about six months' training to educate them up to that point; but when they have learned the lesson they never refuse to put in an appearance at meal-time." Of all sizes there are at present about half a million carp, with facilities for increasing the number, as the demand for stocking rivers and private ponds increases. Of all fish, it is the best adapted to our climate, both for successful culture and large profit. Its growth is rapid, the fish reaching about 20 pounds in two years; its fecundity is prodigious, more than 700,000 eggs having been found in a breeding fish of moderate size. It does best in still water, is sun-proof, subject to no diseases, and can be fattened like a pig on the refuse of the vegetable garden, for which its teeth are adapted, being large, flat, and situated on the pharynx very far back in the mouth. The quality of its flesh depends upon the character of its food. Carp in running streams or in ponds where limited to mud or rank weeds for subsistence, are no better than the salt-water mullet; but it has been demonstrated by pisciculturists that *when properly fed they are little if any inferior to salmon.*

Of the importance of this fish as a factor in the future food supply of Texas, too much cannot be said; and yet it would seem sufficient merely to state that in a pond only a few square rods in area the farmer can raise, without expense, more than sufficient carp to supply his family the year round. Indeed, we trust the day is not far off when the carp pond, shaded with big trees and willows, and decorated with rose-bushes and flowers, will be the possession of every farmer who aspires to thrift, taste, and good living.

Pisciculture is nothing new. The art of breeding and fattening fish was known to the ancient Romans, and Latin authors tell us all about the fanciful flavors imparted to fishes especially fed for the tables of the wealthy. The Romans borrowed the art from the Chinese, who packed the fish ova in eggs and had them hatched by hens.

Commercial fish-culture is at present largely carried on by the French, where the market is largely supplied from private ponds, and is an important—generally the most important—source of profit to the owners.

AUSTIN, TEX., *May* 1, 1884.

124.—OPENING THE BROAD AND OTHER RIVERS OF NORTH CAROLINA TO SHAD, BASS, ETC.

By FRANK COXE.

[From a letter to Hon. M. C. Butler.]

I have taken great trouble for the past six or eight years to get our rivers thrown open so that shad and other fish can come up as they did forty years ago in great abundance. My plantation is in the fork of Broad and Green Rivers, in Polk and Rutherford Counties, North Carolina, and after they join form Main Broad River, which, together with the Saluda, make the Congaree at Columbia, S. C. The streams I live on are now open to the ocean, as is evidenced by the run of shad at my place. For the last four weeks I have had all the shad and other fish, such as Southern black bass—known here as river trout—that I wanted. My mother, who is eighty years of age, says that when she was very young the river was plentifully supplied with shad and many other kinds of fish. I give these points to show that the rivers are open to salt water, and by referring to the maps you will see that we are nearer to the coast than by any other stream running out of the Blue Ridge Mountains. Ten miles above me is Hickory Mountain Gap, at the foot of Bald Mountain, where the shad have actually been taken in considerable numbers. I believe that it is now an acknowledged fact that shad and salmon must have highly aerated water to lay their eggs in or they will not hatch. Such water is to be found only in our numerous riffles and shoals, which the shad run to from instinct. Consequently the Cherokee Dam, which is about 30 miles below me on Broad River, and was built some forty years since, was the cause of the fish almost disappearing from the river below, as eggs deposited there would not hatch and the fish could not pass above it. Fortunately this dam has at last washed out, and we see the good effects of it in the increased quantity of fish from one end of the river to the other. If the run is kept open I am satisfied we will have one of the finest streams for fish on the Atlantic coast. I would like to have a million or two of shad put in here if possible. Landrum Station, on the Spartanburgh and Asheville Railroad, is about 12 miles from here, and I would have them brought over myself from there. The only trouble this season in protecting the fish has been with the dynamite cartridge. We have a gauger here for a small distillery a few miles below, who was seen throwing these cartridges in the river, which destroyed every fish, large and small, in 50 feet around; and when he was told he would be indicted, said he would like to see the State officer that could arrest him, and the trouble is that three-fourths of the people believe what he says.

GREEN RIVER, N. C., *June* 7, 1884.

125.—MEMORANDUM OF THE PRESENT CONDITION AND FUTURE NEEDS OF THE OYSTER INDUSTRY.

By Lieut. FRANCIS WINSLOW, U. S. N.

I have the honor to submit the following memoranda relative to the present condition of the oyster industry, with special reference to the Chesapeake and Delaware Bays, and I would respectfully press upon your consideration the necessity for as elaborate and extensive measures as possible to arrest the deterioration of the fishery and oyster beds before the latter are entirely exhausted.

The last census gives 22,195,370 bushels as the product of the oyster industry of the United States. Of this yield the Chesapeake and Delaware Bays produced 19,712,320 bushels, or considerably more than three-fourths of the total. Since 1880, however, prices have increased so rapidly that there is a well-founded opinion that the product of the two bays is rapidly decreasing. The exportation of oysters from the Chesapeake and the Delaware has fallen from nearly 1,000,000 bushels per annum in 1880 to about 500,000 bushels in 1883; and the increase in the price of the Delaware stock indicates an insufficiency of that supply equaling 500,000 bushels, or there is reason to suppose that there is a falling off in the product of the Delaware during the last three years of about 1,000,000 bushels, nearly half the yield in 1879. In the Chesapeake the indications are more serious. Prices have doubled within the last five years, and, judging by them, the product has fallen off since 1880 between 4,000,000 and 6,000,000 bushels. The report of the Maryland oyster commission states that the oyster beds of Maryland "are in imminent danger of complete destruction," and that in the last three years they have lost about 40 per cent of their value. The production of the Maryland beds in 1880, according to the census, was over 10,000,000 bushels. A deterioration of value of 40 per cent would indicate a decrease in the production of 4,000,000 bushels, which results agrees with that arrived at through the comparison of prices.

Mr. W. M. Armstrong, a prominent oyster-planter of Virginia, has recently testified before the legislature of that State that the production of the Virginia beds has, of late, fallen off two-thirds. The yield of the Virginia beds in 1880, according to the census, was about 7,000,000 bushels; therefore the diminution of the product is about 4,000,000 bushels at the least. I think 8,000,000 bushels would be a low estimate of the decrease in the Chesapeake and Delaware since the last census. During the last two years packing and canning houses in Baltimore have frequently been compelled to stop work on account of the insufficient supply of oysters (see Baltimore Sun, January 16, 1882), and I was informed last winter by the most prominent packer in Baltimore that he was forced to take at a high price stock so inferior that it would not have been offered in the market five years back. The only locality along the coast where the supply is not diminishing at an alarming rate is in Connecticut. But that State produces but an inconsiderable quantity of oysters compared to the yield of the great bays. The importance of arresting the deterioration of this important industry does not need argument; but from the nature of the fishery and the character of the fishermen no effectual steps can be taken until the usefulness and necessity of intelligent cultivation according to the most approved modern methods is made apparent to the men engaged in the business. The benefits of systematic culture must be actually and tangibly before them before they can appreciate their value; and I know of no other way to accomplish this end than by the establishment of small model oyster farms in the Chesapeake and Delaware regions. I know by experience that the fishermen cannot be reached by anything written or said; they can only be taught by what I may call "object-lessons." The value of model and experimental stations is attested by the great influence such establishments had in assisting the French oyster-culturists in their efforts to restock the oyster beds of the French coast. In 1858 there was a very great scarcity of oysters, and in consequence the Imperial Government undertook the restocking of the beds and the establishment of model oyster farms. To-day the waters of France are again prolific, and the numerous oyster farms, breeding establishments, &c., are all copies of the model establishments of the Government.

In addition to the operation of model farms, I would press the importance of continued investigation of the embryological life of the oyster. The effect of the various influences to which it and the mature animal are exposed should be determined as early as possible. Knowledge of those influences and intelligent appreciation of their effects are absolutely necessary to the success of oyster-culture. Thousands of dollars would be annually saved to the Connecticut oystermen if they could determine, with even approximate accuracy, the date when the attachment of the young brood would occur. Hundreds of thousands would be saved if they had any reliable method of determining the probabilities of the spawning season. Careful, continuous, and elaborate study and investigation alone can determine these points and others of equal importance. Considering the value of successful determination, not only in a scientific aspect, but practically, no effort or expense should be spared to obtain it. Obviously the investigation cannot be undertaken by the fishermen, and if not accomplished by the Government it must rest unsettled for many years.

The area of the great beds of the Chesapeake and Delaware Bays is 471,171 acres; and the product per acre was, in 1880, 41 bushels. At present it is certainly not more than 25 bushels. If the deterioration continues at the same rate, the result is too evident to need comment. That remedial measures should be taken is an imperative necessity.

WASHINGTON, D. C., *March* 12, 1884.

126.—REPORT RESPECTING THE PRESENT CONDITION AND FUTURE PROSPECTS AT SAINT JEROME CREEK FOR THE WORK OF OYSTER CULTURE.

By JOHN A. RYDER.

I have the honor to report that, in my opinion, the place is eminently well fitted for the purpose of oyster experiments since the recent improvements there have been made, and, that with sundry minor improvements, it can be made to offer still greater advantages. These will be discussed in another part of this communication.

I have, as requested, instructed Mr. Ravenel in the art of taking oyster spawn successfully, and have also indicated the lines of experiment which I thought it desirable to follow in the administration of the work to be there conducted, as follows:

1. Artificial rearing from artificially fertilized eggs in some of the smaller inclosures now prepared.

2. The introduction of collectors of various forms into the ponds and open waters under the jurisdiction of the United States Fish Commission.

The collectors which I have recommended are the following:

1. Shells strewn upon the bottom.
2. Tiles, slates, bricks, &c., coated with lime, and then with cement.
3. Oyster shells strung upon wire and suspended from stakes.
4. Brush or faggots fastened about the margins of the ponds.

I have suggested sundry variations in the use of these devices which I have very fully explained to Mr. Ravenel, and I think he will make an effort to do his best to get favorable results.

The following suggestions I would respectfully submit, in the hope that a sufficient appropriation may be granted by the present Congress to carry out improvements which are still desirable, as follows:

The original pond, as it was when the Commission first obtained possession, is still in large part too deeply covered with mud over the bottom to be available in order to obtain the best results in oyster culture. I would therefore suggest that this portion of the property be dredged out during the coming winter in order to deepen this water-right considerably as well as to extend its area where the shores are marshy. This is now the more necessary since the canal has been cut from the creek to the original pond, as a consequence of which the rise and fall of the tide is so much greater that the water is too low at low water to rear and fatten oysters advantageously in this portion of the domain.

The ponds which have been excavated by Mr. Ravenel seem to be suitable for the work, and can be used in their present state for experiments in artificial impregnation and rearing.

The larger ponds which have been inclosed by the work of the dredgers are well suited for planting oysters, since those seen by the writer had made a good growth during the present season. The bottom of these ponds also needs to be excavated in certain places in order to make them deeper and available for planting purposes. The bottom over almost the entire extent of these ponds is hard enough to support the planted oysters, so that no further preparation is needed in them than some slight excavating, which I think might be done at low tide with a scoop and a pair of horses or oxen.

The open grounds, or those not yet inclosed but which open to the creek, are also valuable, since there is an "oyster bar" on this part of the property which could be worked to advantage for supplies of seed oysters in "shelling" and ordinary planting, besides which it might be considerably extended by judiciously directed efforts.

The many desirable features which now unite in Saint Jerome's Creek Station as an experimental establishment would render it now in the highest degree impolitic to abandon the place, especially in view of the large expense already incurred in its equipment and the really valuable improvements which have resulted from that expenditure.

The fact that oyster spat could be taken at Saint Jerome's has been abundantly proven, as shown by my results in 1880; and I doubt if any other place on the Chesapeake offers advantages which in reality surpass those now existing at this station.

The work now to be done is of that character which will enlist the sympathy and interest of the oystermen of the vicinity. We have it in our power to do considerable this season towards demonstrating that the culture of oysters can be so greatly improved by simple and rational methods that the ordinary cultivator may safely undertake the work.

The cultivation of "cove" oysters must also be insisted upon, and inasmuch as Saint Jerome's really fulfills the conditions ordinarily found in the best "coves," the extension of that form of the oyster industry may be greatly aided at this station; since it is well known to dealers that such oysters are more valuable in the markets, and better in every way, it will be our province to show how this kind of work may be increased, as I have already shown why such is the case in former reports.

Altogether, I therefore report favorably to you of the station and its future, though I am not unmindful of the fact that it may happen that the effort to make improvements during the summer may cripple the experimental work; so that I would suggest that the experiments in culture and spat collecting be pushed with unremitting vigor from the 25th or latter part of June to the 1st of September next, so as to obtain as large a showing of valuable data as possible, and, if possible, not to permit any other work to interfere with the obtainment of tangible results.

The entire bottom of the canal, 5 to 6 feet in depth, is also available for cultural experiments to test the effects of currents in fattening and growth. Observations which I have made from time to time have shown me that oysters grow as rapidly at Saint Jerome's Creek as at any place in the bay, and that they are exceptionally "fat" and "large in the flesh" early in the season, and that they are possibly on that account more prolific than the oysters from the open waters, which get less food than those in the waters of this creek, where the choicest food of the oyster is to a large extent held in by the partially land locked condition prevailing, while this food is generated much more rapidly in such places on account of the more effective action of the sun's rays in warming the shallow confined waters.

WASHINGTON, D. C., *June* 17, 1884.

127.—ON THE OCCURRENCE OF CORALS ON THE GRAND BANKS.

By Capt. J. W. COLLINS.

Relative to the occurrence of corals on the slopes of the outer fishing-banks, I beg to say that the place of greatest abundance—of the *Primnoa reseda* more particularly—is on the eastern slope of Banquereau, in from 150 to 200 fathoms or more, and latitude 44° 28′ N. This "spot," which is several miles in extent—the latitude given marks about its center—is covered to such an extent with a coral growth that it seldom happens that trawl-lines set on it are all recovered. The fishermen have learned to avoid the place somewhat, and they have given it the name of "The Stone Fence." Stones of considerable size (as large as the fishing lines will lift) are not infrequently pulled up, and it is possible that a proper investigation of this locality might result in securing some rocks containing interesting fossils.

On what is called the "Middle Prong" of Banquereau, in 44° 13′ north latitude and 58° 02′ west longitude, in from 250 to 350 fathoms of water, I found considerable many corals in July, 1879, and among others several specimens of the gold-banded coral, the latter being more plentiful than I have seen it elsewhere. This place is small, however, not more than three-fourths of a mile in diameter, and would probably be somewhat difficult to find, unless the weather was fine and clear.

Referring to the last-mentioned locality, I find the following in my journal, under date of July 30, 1879, the vessel then being anchored in 205 fathoms, latitude 44° 14′ north, longitude 58° 03′ west: "Four of our trawls were on the 'Spot,' which bears about southeast by east from the vessel, and is about two-thirds of a mile distant, to its nearest edge. It is about three-fourths of a mile in diameter; the bottom, 'catchy,' having a growth of corals of various kinds, including the following varieties: Gold-band coral (*Keratoisis ornata*), great tree coral (*Pavagorgia*), bush coral (*Acanella normani*), and tree coral (*Primnoa reseda*)."

WASHINGTON, D. C., *June* 6, 1884.

128.—REPORT OF ANALYSIS OF A SAMPLE OF FISH GUANO MADE FROM SALMON OFFAL, BY MR. JOSEPH SPRATT, OF VICTORIA, BRITISH COLUMBIA.

By Prof. W. O. ATWATER.

The sample, as received, was fine, dry, and in excellent mechanical condition. The analysis shows an usually large amount of nitrogen and phosphoric acid.

ANALYSIS.

	Per cent.
Water	11.28
Nitrogen	9.88
Equivalent to ammonia	12.00
Phosphoric acid	5.51
Fat (oil)	11.61

Statements explanatory of the composition, commercial values, and agricultural uses of fish guano may be found in the report of the United States Fish Commission, 1877 (pp. 229,236, &c.), from which it will be seen that this sample is of unusually high grade. It has indeed higher percentages of both nitrogen and phosphoric acid, and is, consequently, more valuable for fertilizing purposes than any of the specimens mentioned in that report. It has also a large content of fat, which would, with the nitrogenous matter, give it a very high value for food for stock, in case, as is by no means impossible, fish refuse should ever come into use for this purpose.

I learn by inquiry that fish guano, like other nitrogenous fertilizers, is just now rather cheap and not much in demand in the market. "The 10 per cent ammonia grade has," I am told, "been selling in bulk at factory (near New York) at $24 per ton." This is at the rate of $2.40 per unit of ammonia. At this rate guano, like Mr. Spratt's sample, with 12 per cent ammonia, would be worth $28.80 per ton. The percentage of phosphoric acid is very large, and some buyers might make allowance for it. These, however, are matters upon which I am hardly competent to give full information.

As a fertilizer, fish guano is used mainly in connection with phosphates and potash salts. Used alone its effect is generally inferior to that of materials which contain relatively more phosphoric acid and less nitrogen, and it has, on that account, not come into general use among farmers. It is, however, very much employed by manufacturers as an ingredient of mixed fertilizers. Of late nitrate of soda has been very cheap and has reduced (though I presume only temporarily) the demand for fish fertilizers. In short, the sample is one of a very high grade of fish guano, and unless I greatly err such material will be increasingly in demand in the future.

CHEMICAL LABORATORY, WESLEYAN UNIVERSITY,
Middletown, Conn., July 9, 1884.

129.—SNAKES CATCHING FISH.

[From Forest and Stream.]

The writer, who has fished more or less each season for many years, has long been aware of this habit of snakes taking fish, and after careful observation I am firmly convinced that fish furnish a great source of diet to a large portion of the snake family.

On Saturday last, the writer with a companion was fishing for pickerel in the outlet of a pond near this city, and while thus engaged we were treated to a very remarkable exhibition of this habit among snakes. As our boat was slowly paddled along the shore among the lily pads, the writer, who wielded the rod, noticed a large striped perch alarmed at our approach, dart into a small cove, and the next instant there followed a great commotion in the water. As our boat was moved slightly so as to obtain a better view, we saw a large snake holding the struggling perch in its mouth above the water, and making its way slowly to the shore. Scarcely had it reached the bank with its victim when there rushed from some hidden retreat among the bushes another snake, at least a foot longer than the other, and instantly a terrible struggle took place between them for the fish. Over each other they rolled and writhed upon the ground. One instant both would be tugging at the fish; then the fish would lie upon the ground, and over its struggling form the snakes would roll in battle in a desperate contest for the mastery. At last by a mighty effort the larger beat off the smaller, seized the fish in its mouth, and glided into the water, whereupon the smaller became the attacking party, and another terrible fight took place in the water. At last, as though becoming tired of the unequal combat, the smaller one disengaged itself from the fray, and with a slow, tired motion swam slowly ashore among the bushes when the other, holding his ill-gotten prey at least a foot above the water, went quickly ashore.

It was now time for us to show our hand, and picking up a stone each (for we had previously landed so as better to view the fight) we cast them at his snakeship, and he was soon dead.

The perch was a fine specimen, 8 inches in length, was in good condition, gills bright red, and had the luster in appearance that denoted a healthy condition; it was quite exhausted by the rough treatment and from being out of the water so long, but after we returned it to the stream, after a few erratic movements, it slowly swam out into deeper water. The snakes were both bluish-black in color on back and sides, belly was a deep bloody-orange color, and the one we killed was 4 feet and 10 inches in length. These snakes were no doubt the common black water-snake (*Tropidonatus sipidon*).

LOWELL, MASS., *June* 19, 1884.

130.—OCCURRENCE OF BLACK GROUPER OR JEW-FISH OFF BLOCK ISLAND.

By CHAS. W. SMILEY.

On Thursday, May 15, a strange fish was seen by the crew of the schooner Carrie E. Parsons, Capt. Albert Greenlow, of Gloucester, Mass., about 20 miles southeast from Block Island. When seen the fish was near the surface of the water, on its side, with the side-fin and tail in motion. The men at first thought it was a sunfish. They rowed up to it in a dory, threw a harpoon into it, and towed it alongside the vessel, when it was taken on board and put in the ice-house. It was easily captured. On arriving at Gloucester, May 17, the captain presented it to the representative of the United States Fish Commission, Capt. S. J. Martin, who telegraphed to Professor Baird for instructions as to its disposition. Captain Martin states that no one of the hundreds of persons in Gloucester who came to see it could identify it. On Monday, 19th, it was packed in ice by the Atlantic Halibut Company and forwarded to Washington by express, where it arrived the next day. It was over 6 feet in length and weighed 300 pounds. On May 21 Professor Baird replied to Captain Martin concerning it: "The strange fish referred to in your letter was duly received to-day, in excellent condition, and proved to be, as I thought it would, the southern jew-fish, the existence of which much farther north than Florida we have not been aware of. The fish itself is not considered, especially when it is large, very palatable, but this specimen answers a very important purpose in fixing its geographical distribution. It will also give us an opportunity of making a plaster cast. We have had a specimen of about the same size from Florida, but I think not in so good preservation."

Tarleton H. Bean, curator of the Department of Fishes of the United States National Museum, under date of May 26, 1884, made the following report upon the specimen:

"After having examined the large black grouper which was forwarded from Gloucester last week, I have reached the conclusion that it is *Epinephelus nigritus* (Holbrook), a species which Dr. Holbrook, in his Ichthyology of South Carolina, published in 1860, mentioned as being rare and known only in the waters of South Carolina. It has not been known to occur in any waters north of that State, as far as I know. The species is known as the black grouper, and specimens weighing 300 pounds have been recorded before; the example received from Gloucester weighed 300 pounds. A cast and the skeleton have been preserved. The fish had evidently strayed away from its natural habitat, and its presence off Block Island must have been accidental."

UNITED STATES FISH COMMISSION, *June*, 1884.

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131.—REPORT OF A TRIP BY THE STEAMER FISH HAWK TO THE SAINT MARY'S AND SAINT JOHN'S RIVERS TO HATCH SHAD.

By Lieut. W. M. WOOD, Commanding.

I have the honor to report that under present conditions but little can be done in the way of shad propagation on the Saint Mary's River. The stream is narrow, deep, without shoal places, and has strong tidal currents. Its banks are very steep and overgrown by thickets to the water's edge. The only fishing done is with the bow-net and a very few gill-nets. I have only been able to find eight gillers fishing in the few reaches, miles apart, that are comparatively free from snags. On account of snags and the narrowness of the river the longest nets used by these men are only 25 fathoms and some as short as 12 fathoms. They commenced fishing the 1st of January, and the catch to date, for the various gillers, runs from 100 to 700 shad. An average of about eight per day for the best.

I have had one gill-net fished every tide since the very day of our arrival. The best any one net has done on a tide has been eleven shad and two sturgeon. The ordinary catch is from two to nine. I have also sent spawn takers to overhaul the fish taken by the other gillers who are within reach.

Of all the fish we have seen, but a very small number have been ripe; and never yet have male and female been taken together in proper condition. As the total daily catch of fish is so small the odds are largely against many of both sexes being in proper condition. A few of the few ripe shad taken have been over-ripe, but the majority have been as hard as when first caught in the Potomac.

While Hamlen was here I took him 25 miles further up the river to overhaul the fish taken in the bow-nets fished there and to try one of our gill-nets. He could not fish the latter on account of snags, and the fish taken in the bow-nets were in the same condition as further down.

I have made every effort to use our seine but have at last given it up. We took even less fish in that way than in the gill-nets. There is only one place I could find where it was practicable at all. It took two days hard work to partially clear the haul of snags and saw-logs, and in all the hauls we made not one was perfectly clear. The snags could probably be removed in time but even then it would not pay to fish a seine on this river. As the Saint Mary's is so narrow it can only be hauled on slack water, for if laid up or down stream while the tide is running, to cover a part of a reach, it will either be swept into the other bank or below before it can possibly be landed.

Our biggest haul with the seine was four shad. Usually we caught nothing. I doubt whether any but gill-nets will ever be used here by professional fishermen. The fyke-nets might be used here successfully in place of the bow-nets. The latter are fished in the deep water close to the bank and the fish seem to follow the shore close at certain places, probably look for spawning-beds. A fyke set in these spots would probably take a large number of fish.

A firm of Northern fishermen, engaged in shipping shrimp and fish from Fernandina, asked me to let them know if it would be possible to haul a seine in the Saint Mary's. If so they would fish one next year, but, as stated above, they would not be justified in attempting it.

So far we have not been fortunate enough to secure a single impregnated egg, and for the reasons given above I do not think this river will ever be a favorable locality for shad propagation. Since the first two days we have taken no sturgeon. The only other fish taken have been one small rock, several gar, a few bream, and some catfish.

KING'S FERRY, FLA., *March* 26, 1884.

I have just returned from Jacksonville, where I went to see if there was any chance for shad work on the Saint John's. There was no chance there for shad propagation. I consulted the principal fish dealers, and they told me that very few shad are now coming in. Much longer nets are fished in the Saint John's than here, but the heaviest catch for the season, from January 1 until now, for one boat, was only 1,100 shad. Mr. Mervin, the largest dealer, spoke vaguely of some lakes way up the Saint John's, where he thought enough spawning fish could be taken in the height of the season to make it an object. He also said that the Saint John's shad are smaller fish than those taken elsewhere. The Saint Mary's shad run as large as those taken North.

I have nothing to add to my former report. We have kept up our operations steadily, and have caught about the same number of shad, but still have not been able to get an impregnated egg.

KING'S FERRY, FLA., *March* 27, 1884.

132.—RECONNAISSANCE OF THE SHAD FISHERIES OF WINYAW BAY AND ITS TRIBUTARIES BY THE STEAMER FISH HAWK.

By Lieut. W. M. WOOD, Commanding.

After leaving Fernandina, Fla., I proceeded in this vessel to Georgetown, S. C., to investigate the shad fisheries there, and have the honor to submit the following report:

We arrived on the afternoon of the 5th instant. The shad season was found to be about over and most of the fishermen had left. I was fortunate enough to find Mr. E. Barnes still in town. Mr. Barnes is the largest owner of nets and bags, and ships all the fish caught in the vicinity. Accompanied by him I took the launch and went up the

Waccamaw and Peedee Rivers. I also went up the Black River, a tributary of the Peedee, but only on the two former rivers and Winyaw Bay, into which they empty, is any fishing done.

On account of the character of the bottom and banks no seine hauling is carried on, and the fishing is entirely by gill-nets. This year about thirty nets were fished, averaging 150 fathoms long, 5⅛ to 5¼ inches mesh, and 16 to 18 feet deep. They are not allowed to reach the bottom on account of snags. The average catch this year was about 800 shad per net. Many of the gillers live in flat-boats, moored at convenient localities.

Mr. Barnes's flat is at the junction of Jericho Creek and the Waccamaw. He fishes three nets, employing nine men, viz., a superintendent, two for each net, a cook, and a marketman, who carries the fish in a small boat to town, 10 miles below. Mr. Barnes says they catch very few ripe fish of either sex, but take a good many "down runners," or spent fish. He believes all the fish go long distances above the highest fisheries, which are only a short distance from salt water, to spawn.

On the headwaters of these rivers, owing to the natural difficulties and the absence of market facilities, the only shad caught are taken with bow-nets and short pieces of gill-nets, as on the Saint Mary's, and used for home consumption alone. A great many shad are taken in Winyaw Bay before they leave salt water.

The best of the season here is February and March. On the day of my visit to Mr. Barnes's flat, the 7th instant, his total catch was three shad, and he quit fishing that day. He was paying 30 cents each at first hand for the fish he bought, and I see by the quotations in the Star of the 8th instant that they are being sold in Washington at $25 to $32 per hundred.

It is possible that some little work might be done here before the opening of the season further north. There would certainly be more chance of success than in Florida, as far as my experience goes. I do not think much can be done where the catch of shad is taken by gill-nets, especially as fished in Southern rivers.

As a rule comparatively few shad are taken at a drift, and of these the proportion of males and females is rarely equally divided. Still more rarely are the two sexes in the proper condition for spawning. Especially is this true where by force of circumstances these nets are fished only in the long, deep reaches of the river and never allowed to fish *near the bottom.* Consequently it seems to me most of the fish taken are those running up or down from the spawning-beds near the headwaters, where they cannot be caught except in limited numbers by the bow-net, &c.

We left Georgetown on the evening of the 7th instant, arriving off the Chesapeake early on the morning of the 9th, touched at Norfolk for a couple of hours, and then proceeded to Washington, D. C., arriving on the evening of this date.

WASHINGTON, D. C., *April* 10, 1884.

133.—EXTRACTS FROM A REPORT OF INVESTIGATIONS OF THE SHAD FISHERIES AND RIVERS SOUTH OF CHARLESTON, S. C., WITH A VIEW TO ESTABLISHING STATIONS FOR ARTIFICIAL PROPAGATION.

By T. B. FERGUSON.

I arrived in the Lookout at Savannah during the afternoon of March 20, 1883. The fishermen and fish-dealers in Savannah reported a great scarcity of shad during the season both in the Savannah and neighboring rivers from which the market derives its supply. Shad were selling readily at from $1.50 to $2 per pair.

In order not to lose time I decided to make the examination of the Saint Mary's River before proceeding to the Saint John's so ran up the river as far as the town of Saint Mary's, a place of about 1,000 inhabitants, where we arrived at 4 o'clock, March 21. Engaged a pilot to take the steamer up the river, and left Saint Mary's about an hour later with a strong flood-tide running, and reached Clark's Bluff, a distance of about 30 miles, at 7 o'clock.

At this point I interviewed Mr. Pierson, who keeps a store at the Bluff, and learned from him that the fish were very plentiful this season, but not so much so as a few years back. He takes an average of 100 shad a day in his gill-net, and in the immediate neighborhood there are a number of gill-nets fished. The hoop-net was in use at this point a few years ago and many shad were taken in this manner. This net is operated by dragging at the side of the boat. Its use has been almost entirely superseded by the introduction of the gill-net. The nets used at this point were of 5-inch mesh, about 14 feet deep, and 65 yards in length.

An admirable location for a haul seine is reported at Brick Landing, about a mile above Clark's Bluff. This reach of the river is a favorite place for the shad, and most of the fishermen of the neighborhood drift their nets in this locality. No doubt, at small cost, a haul might be cleared and large numbers of shad taken. Soon after our arrival a drift was made with the gill-net with which the steamer was supplied, and although it was not properly rigged for this special locality several shad nearly ripe were taken. The males were quite ripe. We overhauled, in addition, the catch of two other boats, and found males predominating; a few ripe females and spent fish were taken. The water of the river showed 65° F. at this date, indicating a good temperature for shad hatching. A large female sturgeon, measuring 7 feet 11 inches, with roe fully developed, was taken in our gill-net.

A few miles up the river is King's Ferry, which is 8 miles from the station of the Jacksonville division of the Savannah, Florida, and Western Railroad. We learned that a tramway runs from the station to this point. No doubt, this would be a good locality to establish a station either with the Lookout or Fish Hawk, unless, perhaps, it was found advisable to select a railroad crossing, which is some twenty-five miles further up the river. We heard all the evening the shad "splashing" around the steamer. Had we been provided with hatching apparatus, no doubt a large number of eggs could have been procured at this time in the immediate vicinity.

Being satisfied from the interviews had with several of the residents of the neighborhood that good shad-hatching work could be done at this station or further up the river, I determined to proceed with the investigation of the Saint John's River, so got under way at 6.30 a. m., on the 22d, and reached Saint Mary's after one or two stops on the river, at 12 m. Reached the Saint John's sea-buoy at 3.30 p. m. Taking a pilot we crossed the bar at almost extreme low water, the steamer drawing a few inches over 5 feet.

Stopping at Mayport, which is situated on the right bank of the Saint John's River near its mouth, for the purpose of taking in wood, we secured some excellent oysters from the waters near by. Leaving Mayport, we ran up to Jacksonville, reaching that city at 7 p. m. Observed on the way up many gill-nets set for shad. The fishermen generally complain of the scarcity of fish. Saw several nets overhauled without capturing a single shad. The most important fisheries of the Saint John's River lie between Jacksonville and Mayport, and gill-nets are exclusively used. Yellow Bluff, a small settlement below Jacksonville, is the center of the shad fishing on the river. The fish taken at this point are shipped to Jacksonville, and there marketed or reshipped North. As the principal portion of shad taken in this river are captured in salt water, there is no opportunity afforded of securing eggs in large numbers, the spawn being in an immature condition.

On the 23d we visited the market at Jacksonville and had an interview with Mr. Sullivan, the principal fish-dealer of the town, and learned from him that the fish were generally received about 9 o'clock from the points down the river; that none came to the market from up the river. On this day, Friday, March 23, 184 shad were received. On overhauling these we found that at least two-thirds were females, and the eggs apparently about a week or ten days from maturity. The fish were of good size. We were informed by Mr. Sullivan that the fish examined represented the catch of nine nets of 150 fathoms in length. These nets were of 5-inch mesh and 15 feet deep. It was his opinion that shad were getting more and more scarce every year. Up to that date last season he had shipped 35,000 shad; this year only 10,000.

He was of the opinion that by the last of the month the fish would be found ripe; but I would exceedingly doubt our ability to find eggs in a sufficiently advanced stage taken anywhere in the neighborhood of the mouth of the river where the water is very salt. The males were selling at about 80 cents per pair, and the roe shad at $1. Mr. Sullivan attributes the falling off in the catch to the closing of the mouth of the river by the jetties recently constructed by the Engineer Department, and also to the great numbers of sharks and porpoises which are frequently seen in the narrow channel of the river. The shad in their migration are met by great numbers of their enemies and are driven away.

We got under way at 11.15, from Jacksonville bound for Palatka, which point we reached at 4.15 in the afternoon. At this point I had an interview with S. J. Reynolds, of Lowell, Mass., who had been for years a mackerel fisher, sailing from the port of Gloucester. I learned from him that he had fished several years in the Saint John's. This year he operated eleven nets, 5-inch mesh, 50 meshes deep, and from 175 to 210 fathoms long. Two of these nets were now operated at Welaka several miles up the river. According to law, fishing commences on the Saint John's on December 1, and closes on April 1. He had not seen a ripe shad this season.

I learned that Mr. J. W. Merian, of New York City, operated seven nets of about 150 fathoms long at Palatka; that W. B. Cross, a native of the State, operated two nets of about 200 fathoms. These were all the nets fished in the neighborhood of this city. I caused the nets, five in all, that were being fished that night on the river, to be overhauled and only 8 shad were taken; they were all females, with eggs immature.

At Palatka we secured the services of James Garret, colored, as pilot for the upper river, and sailed for Lake Monroe on the 24th. At Georgetown I caused five nets to be overhauled and found that they were of 4-inch mesh, too small for shad. One channel bass and several mullet and black bass were taken during our stop at this point. The fishermen thought that shad could be taken in considerable numbers at this point, but there were no nets fished for them this year. Last year they reported that they were captured in some abundance in water no more than 2 feet deep.

Finding 5½ feet on Velusia Bar, we had no difficulty in reaching the upper river. Noticing the black bass jumping in the river just above Lake Barefoot, we stopped for two hours and took some nineteen with the fly. They were fat and in exceedingly fine condition. Proceeding up the river, we reached Sanford at 8 p. m., with wind blowing hard from the southeast. On going ashore I learned that there were only two fishermen operating in Lake Monroe. Mr. Alonzo Gitson fished two nets on the upper bar, one 50 and the other 25 fathoms; and Mr. John West fished the lower bar with two nets of 50 fathoms each. The average catch was from 30 to 40 shad a night, the maximum of the season being 60 shad. They reported that they had taken ripe shad some time previous. Those I caused to be examined were within three or four days of being ripe. The usual market price was 50 cents per pair.

Having learned that there was little prospect of establishing a hatching station on Lake Monroe, we left Sanford at 6.55 on the morning of the 25th, and dropped down the river to Blue Spring, reaching there at 9.20. Found black bass exceedingly plentiful at this point. With two rods, fishing exclusively with the fly, 40 were taken in a short time, the largest weighing 5 pounds. Seeing a large number of fish at the point where the water from the Blue Spring enters the Saint John's River, we set the seine around them. The bass, however, jumped over the cork line and none were taken.

Some 600 catfish, measuring from 12 to 25 inches, were taken in the net, and these were fish that could not readily be shaken out, as they had become entangled in the meshes, the men in hauling the net having endeavored to get rid of the same by shaking them out. The fish congregate around the entrance to this spring in immense numbers, possibly attracted by the sulphur of its waters. At many points on the river large numbers of shad might be taken, but the present plenty of gar and catfish in this river, judging from the experience obtained at those points where special examination was made, would render it almost impossible to fish for shad without having the nets destroyed by these fish.

We left Blue Spring on the 26th, and after leaving pilot at Palatka proceeded down the river. Chief Boatswain's Mate Hamlen reports that in the morning before sailing he could see the catfish in immense numbers in the sulphur water just where the spring creek enters the Saint John's. During the day spent at Sulphur Spring, while playing two black bass that I had hooked on the rod at the mouth of Snake Creek, a small alligator, apparently about 4 feet long, took hold of one of the fish close alongside the boat, and before it could be frightened away left the marks of its teeth on the fish. At 8 p. m., it becoming very dark and blowing fresh from the northwest, we anchored for the night off Magnolia.

On the 27th we proceeded down the river, and after a short stop at Jacksonville reached its mouth in the afternoon. Having been informed that large numbers of sheepshead were being taken in the neighborhood of Saint Augustine in the Matanzas River, near Matanzas Inlet, we sailed on the 28th for Saint Augustine, which we reached at 2 p. m.

At Saint Augustine I learned from Mr. Alex. Iwanowski, an intelligent river pilot, that we were a little early to procure ripe sheepshead, and that it was doubtful whether the Lookout could be taken through the Matanzas River. I learned from him that sheepshead were taken a little later in the season in large quantities near the inlet, both north and south of it; that numbers of channel bass and drum could also be taken at this point. The water had been so abnormally cold this season that the fish were late in coming to the inlet. It was his opinion that spawning sheepshead could be readily procured in the Matanzas River a little later in the season.

The Lookout was ordered to return to Washington for service in the waters of the Chesapeake Bay, at which point she arrived on April 19, after having been detained by bad weather on the way.

As imperfect as the investigations of the shad fisheries of the southern coast were, they satisfied me that Saint Mary's River should be selected as the basis of operations during the next season, and that operations may be carried on in this river on a sufficient scale to warrant its being occupied. No doubt in ordinary seasons ripe shad will be taken on this river early in March, and with a floating hatchery, such as the Fish Hawk or the Lookout, equipped with gill-nets such as are now used in the Saint Mary's River, and one or two haul seines, a large number of young fish can be produced before the season commences in the waters in the immediate vicinity of Washington.

The facilities for transporting the young fish to other rivers of the South are ample, as the station may be located on the river within reach of the crossing of the Jacksonville division of the Savannah, Florida, and Western Railroad, and by the roads intersecting with the Fernandina and Jacksonville Railroad.

An experimental station should be established on the Saint Mary's River during the coming season, and it should be ready for operations by the 1st of March. I would recommend, in addition, if Saint Mary's is selected as the river for our future operations at the South, that large numbers of young shad and herring be transported from the stations near Washington and deposited in the Saint Mary's, in order to more quickly increase the supply of shad in this river, and enable us to secure the adult fish in larger numbers in the future.

WASHINGTON, D. C., *June* 15, 1883.

134.—NOTE ON THE DESTRUCTION OF MACKEREL BY DOGFISH.

By Capt. J. W. COLLINS.

Capt. Joseph Smith, of Gloucester, Mass., tells me that while off Wood Island, Maine, in August, 1880, he observed what he supposed to be at first a moderate-sized school of mackerel at the surface of the water. On closer inspection, however, he found that only a small number were mackerel, probably not exceeding more than half or three-fourths of a barrel, and these were completely surrounded by an immense school of dog-fish. The body of dogfish was formed in such a manner as to inclose the mackerel on all sides and underneath, completely preventing their escape. Captain Smith had an opportunity of observing the mackerel closely, and says that many of them, he noticed, were bitten by the dogfish, some being deprived of their tails, and others having wounds on their sides. He is of the opinion that every one of the mackerel was ultimately eaten by the dogfish. It is probable, he thinks, that at first a much larger body of mackerel was surrounded. The school of dogfish he estimated to contain at least enough for one hundred barrels. Another school of dogfish surrounding a small body of mackerel was seen on the same day.

WASHINGTON, D. C., *July* 7, 1884.

135.—NOTES ON THE FISHERIES OF GLOUCESTER, MASS.

By S. J. MARTIN.

[From letters to Prof. S. F. Baird.]

MACKEREL.—The following Gloucester vessels arrived at New York yesterday with good fares of small mackerel, which sold at $1 per hundred, namely: Schooners Golden Hind, 80 barrels; E. L. Rowe, 90; Henri N. Woods, 60; Electric Light, 70; Ethel Maud, 125; J. E. Garland, 100; Goldsmith Maid, 80; Martha C., 100; Addison Center, 80; Henry Dennis, 100; also schooner Elsie Smith, of Portland, 150 barrels.

GLOUCESTER, MASS., *April* 4, 1884.

SUMMARY.—From April 1, 1884, to date there have been fifty arrivals from George's Bank with an average of 18,000 pounds of cod and 400 pounds of halibut to a vessel; twenty arrivals from Western Bank with small fares averaging 23,000 pounds of salt cod and 7,000 pounds of halibut to a vessel; and twelve arrivals from Grand Bank with an average of 31,000 pounds of fresh halibut to a vessel.

MACKEREL.—The mackerel fleet has not done well, the catch being small. Some of the vessels were ten days in getting to market, and their cargoes had to be thrown away, as the mackerel were spoiled. It takes from 800 to 1,000 mackerel to fill a barrel. The greater part of the mackerel has been caught 30 miles southeast of Hog Island. Gloucester has eighty sail engaged in the fishery. Most of them bring their mackerel to market fresh.

The weather out south has been rough up to the present time. Nineteen seine-boats have been lost and some vessels have been badly damaged.

GLOUCESTER, MASS., *April* 13, 1884.

SUMMARY.—Last week there were forty-two arrivals from George's Bank with light fares, averaging 14,000 pounds of salt cod and 300 pounds of fresh halibut to a vessel; twelve arrivals from Western Bank, averaging 35,000 pounds of salt cod and 5,000 pounds of fresh halibut to a vessel; and 3 arrivals from the Banks with fresh halibut.

HALIBUT.—The number of vessels engaged in halibut fishing is larger than last year, there being an addition of four vessels each from Gloucester and Portland. Mr. Samuel Pool, of the Atlantic Halibut Company, of Gloucester, Mass., is at Halifax buying halibut and shipping them to Boston.

HERRING.—Herring appeared on the coast on April 15, and were schooling from Race Point, Cape Cod, to Thatcher's Island, going east. A school of small mackerel was seen 4 miles southeast of Chatham on

April 15. There were twenty-five vessels in New York with fresh mackerel, three-fourths of which were small and sold as low as $1 per thousand. Some of the mackerel caught were so small that the fishermen threw them away. Three fares that were carried in last week were large fish and sold for a good price.

GLOUCESTER, MASS., *April* 20, 1884.

SUMMARY.—Last week there were eighteen arrivals from George's Bank, averaging 13,000 pounds of salt cod and a few halibut to a vessel; seven arrivals from Western Banks, averaging 45,000 pounds of salt cod and 3,000 pounds of halibut to a vessel; three arrivals from the Banks, averaging 28,000 pounds of salt cod to a vessel; and four arrivals from the shore grounds, with average fares of 5,000 pounds of mixed fish to a vessel. There were 15,000 gallons of cod oil brought from Nova Scotia by freight last week for Gloucester parties.

GLOUCESTER, MASS., *April* 27, 1884.

MONTHLY SUMMARY.—The number of pounds of codfish landed at Gloucester during the month of April, 1884, was 2,000,000 less than April, 1883. The fishing at Western Bank this year was a failure. The amount of fish landed at Gloucester during the month of April was as follows: George's Bank cod, 1,862,000 pounds; George's halibut, 59,240 pounds; Western Bank cod, 1,216,000 pounds; Western Bank halibut, 169,000 pounds; Grand Banks halibut, 538,000 pounds; shore cod, 172,000 pounds; haddock, 220,000 pounds; frozen herring, 160,000 pounds; fresh herring, 25 barrels; salt herring, 433 barrels; mixed fish by freight from Maine, 500 quintals; and 533,000 pounds of large cod caught in nets in Ipswich Bay. There were 15,863 gallons of cod oil landed from Newfoundland.

POLLOCK.—Two schooners arrived at Gloucester this morning with 70,000 pounds of pollock. These fish were caught with seine 4 miles from Chatham, and were the first fish of the kind caught this season.

MACKEREL.—Schooner Henry Dennis arrived from the south with 280 barrels of mackerel, the first that have been brought here this season. Captain McClain thinks the prospect fine for a good catch.

GLOUCESTER, MASS., *May* 4, 1884.

SUMMARY.—During the past week there have been twenty-seven arrivals from George's Bank with small fares of 12,000 pounds of codfish to a vessel; five arrivals from Western Bank, averaging 35,000 pounds of codfish to a vessel; five fares from the Banks, averaging 20,000 pounds of fresh halibut; and six arrivals from Chatham, aggregating 200,000 pounds of pollock, caught with seines.

MACKEREL.—The outlook for the mackerel fishery is hopeful, the others dull. Two vessels arrived from Boston yesterday, one with 300 barrels and the other with 400 barrels of mackerel. Mackerel sold yesterday for $6 a barrel, and last Monday for $8.50 a barrel.

GLOUCESTER, MASS., *May* 11, 1884.

SUMMARY.—During the past week there have been sixty-three arrivals from George's Bank, with small fares, averaging 13,000 pounds of salt cod and 400 pounds of halibut to a vessel; five arrivals with fresh halibut, averaging 40,000 pounds to a vessel; twelve arrivals with pollock, aggregating 455,000 pounds; and nine arrivals with salt mackerel, landing 1,374 barrels. Seven arrivals from the shore fisheries landed 140,000 pounds of mixed fish. The pollock were caught with seine from 3 to 4 miles off Chatham. The first mackerel that were caught last year this side of Cape Cod was on May 18. On May 14 of this year 20 barrels of large mackerel were caught with seine.

HERRING AND SALMON.—There have been 70 barrels of herring caught in traps, and 1 salmon, weighing 12¾ pounds, caught in a trap at Kettle Island.

GLOUCESTER, MASS., *May* 18, 1884.

BLACK GROUPER.—I will send you Monday morning for identification a strange fish,* said to measure 5 feet in length, but actually measuring over 6 feet. The fish when seen was on its side, with its side fin at the surface of the water, and was thought to be a sunfish. It was easily captured. No one of the hundreds of persons who have been here to see the fish have been able to identify its genus and species. I hope to hear from you concerning its identity.

GLOUCESTER, MASS., *May* 18, 1884.

The strange fish was caught 20 miles southeast from Block Island. The fish when seen was on its side with side-fin and tail in motion. When seen the men thought it was a sunfish; they rowed up to it in a dory, threw a harpoon into it, and towed it alongside the vessel, where it was taken on board and put in the ice-house. The fish was caught Thursday, May 15, schooner Carrie E. Parsons, Capt. Albert Greenlow. There is no expense on the fish except the box. The Atlantic Halibut Company gave me the ice.

The captain asked me if I could get him the history of the mackerel fishery and one of the last bulletins. If you will send them to me I will forward them to Captain Greenlow when the vessel is in. I am glad the fish was in good order when it arrived in Washington.

GLOUCESTER, MASS., *May* 25, 1884.

SUMMARY.—During the past week there have been thirty-nine arrivals from George's Banks, landing an aggregate of 980,000 pounds of codfish; thirteen arrivals from the Banks, aggregating 220,000 pounds of fresh halibut, and 980 barrels of salt mackerel landed by ten vessels. There have also been landed during the past week 70,000 pounds of haddock, 75,000 pounds of shore fish, and 198,000 pounds of pollock.

* Identified by Dr. T. H. Bean as *Epinephelus nigritus*. Weighing 300 pounds. (See his statement, page 240.)

HALIBUT.—The vessels fishing on George's Banks are doing well. There are thirty-one vessels engaged in halibut fishing. Gloucester has a large fleet in the business. Fresh halibut sold last week at 3½ cents per pound.

MACKEREL.—Ninety sail of the mackerel fleet are off Chatham, where large mackerel, full of spawn, are caught. Five hundred barrels of mackerel that were caught in weirs were shipped from Nova Scotia last week. The mackerel that are caught at Nova Scotia are also large. The first mackerel caught in weirs at Nova Scotia last year was on May 20 against May 16, this year. Most of the vessels of the southern mackerel fleet are at home. They did not make large catches. The 340 barrels of herring caught in traps last week were sold to the fishermen for bait.

MENHADEN.—The following extract is from the Boston Daily Advertiser, of Friday morning, May 23, 1884:

"A correspondent says that Mount Hope Bay and Taunton River have been visited by a tremendous mass of menhaden, the like of which has not been reported for a long time. They came unexpectedly, as few had been noticed till recently. This irruption of menhaden may, perhaps, account for the sudden departure of the scup. They abound all over the bay, but generally move in immense schools, one of which was playing around the piers of the iron railway bridge, and made the river below the bridge, in some places, almost solid. Captain Springer, an old fisherman employed at the draw, estimated the school at the bridge to contain 1,000 barrels at least. Capt. C. C. Winslow, who passed up from below with the fishing schooner Penekese, reports that Seconet River, below the Stone Bridge and Gould Island, is almost solid with menhaden."

GLOUCESTER, MASS., *May* 24, 1884.

SALMON.—A salmon weighing 21¼ pounds was caught in a trap at Kettle Island on May 21.

GLOUCESTER, MASS., *May* 24, 1884.

MONTHLY SUMMARY.—During the month of May there were one hundred and sixty-two arrivals from George's Banks, landing 2,724,000 pounds of salt codfish, and 82,000 pounds of halibut; thirteen arrivals from Western Bank, landing 1,120,000 pounds of salt codfish and 69,420 pounds of fresh halibut; twenty-six arrivals from the Banks, landing 594,000 pounds of halibut; and twenty arrivals with 436,000 pounds of shore fish, one-fourth each of cod, haddock, hake, and cusk. There were also the following arrivals: Twenty-six arrivals with 1,055,000 pounds of pollock; twenty-eight arrivals with 3,780 barrels of salt mackerel.

There were 392 barrels of herring and 132,000 pounds of haddock caught in traps in the harbor last month. The pollock were caught with seine off Chatham. In May of last year 500,000 pounds of codfish were landed from Cape North, while none have been landed this year, the ice preventing the vessels reaching the cape. There were 2,000,000 pounds of codfish landed during the month of May last year, against 1,000,000 during the same month of the present year.

GLOUCESTER, MASS., *June* 4, 1884.

CODFISHING.—During the past week most of the George's fleet did well, the thirty arrivals having average fares of 23,000 pounds of salt codfish. The vessels which went to Cape North for codfish did not catch any in consequence of the ice lasting until the fish had left.

Two striped bass, one black bass, and four porgies were caught in traps in the harbor last week. Two barrels of squid were also taken out of them this morning.

MACKEREL.—Mackerel are coming in slowly, only thirteen arrivals landing 1,705 barrels last week. Three hundred barrels of small mackerel were sold to be canned. Small mackerel extend from Block Island to Portland. The small mackerel on this coast, some larger than last year, when they were classed as number 4, are large enough for number 3. A few large ones have been caught in the traps in the harbor. The school of large mackerel that was seen on the southern coast did not strike this coast, but went in an E.N.E. direction, across the southeast part of George's Banks to Cape Sable. From Cape Sable they took an easterly course down the cost of Nova Scotia. A large amount of mackerel has been taken in the weirs at Yarmouth and Cape Sable, whence 2,400 barrels of fresh and 800 barrels of salt mackerel have been shipped by steamer to Boston. The mackerel have been caught as far east as Cape Canso, Nova Scotia.

There are sixty sail of Gloucester mackerel-catchers after the large mackerel on the Nova Scotia shore. They will follow the mackerel to the Bay of Saint Lawrence.

GLOUCESTER, MASS., *June* 8, 1884.

SUMMARY.—During the past week there have been thirty-seven arrivals from George's Banks, averaging 22,000 pounds of salt codfish and 400 pounds of fresh halibut to a vessel; ten arrivals with averaging fares of 24,000 pounds of fresh halibut to a vessel; eleven arrivals from the Western Banks with 70,000 pounds of salt codfish to a vessel; nine arrivals with averaging fares of 22,000 pounds of shore fish; nine arrivals with mackerel, caught on this shore, but mostly small, landing an aggregate of 2,277 barrels, and five arrivals from Nova Scotia, landing 820 barrels of large mackerel. There have also been 300 barrels of mackerel imported from Nova Scotia.

MACKEREL.—We have sixty sail of mackerel-catchers on the Nova Scotia coast, and they extend from Cape Sable to Cape Canso. Some of the vessels have done well, but all of them were late in reaching the Nova Scotia shore. A large body of mackerel passed to the eastward before the arrival of the vessels. The first mackerel caught at Cape

Sable this year was on May 14, and on last year June 12. Mackerel have been going by Cape Sable for four weeks, and are still passing. A large body passed down the Nova Scotia shore. Contrary to the expectations of the fishermen, the ice did not prevent the mackerel from entering the Bay of Saint Lawrence. In 1846 the ice was so late in leaving the Bay of Saint Lawrence that the vessels could not get to the Menhaden Islands before June 1. The catch of mackerel that year was very large.

To-day I went on board of the schooner Lizzie Jones, which arrived from Cape North, Cape Breton Island, and ascertained from the captain that on June 9 the ice came down 8 miles from the shore. He says there were large schools of mackerel between the ice and the shore. The Nova Scotia vessels which go to the Magdalen Islands to set their nets for mackerel arrived there June 10, and found plenty of mackerel at Pleasant Bay. Some mackerel were taken from traps at Prince Edward's Island on June 11. Most of the mackerel fleet will go to North Bay; some of them are now at Cape North. There are no large mackerel on this coast, and the vessels will not catch small ones, as there is no sale for them.

The schooner Chocorua arrived from the southeast part of George's Banks, and reports plenty of mackerel schooling in 45 fathoms of water.

GLOUCESTER, MASS., *June* 15, 1884.

SUMMARY.—During the past week there were landed at Gloucester 1,296,000 pounds of cod; 95,000 pounds fresh halibut; 120,000 pounds of hake, haddock, cusk, and pollock; 2,018 barrels of mackerel, caught off Newfoundland; and 740 barrels of mackerel from Nova Scotia, caught in weirs.

MACKEREL.—Large mackerel are scarce here, but small mackerel are abundant from Block Island to the Bay of Fundy. Most of the mackerel fleet has gone to the Bay of Saint Lawrence, though but few fish are caught there as yet. Three vessels have just arrived from the Nova Scotia coast with salt mackerel. Captain Jones says that the fishermen around Halifax say that they never before saw so many mackerel pass down the Nova Scotia coast as this spring. Captain Jacobs thinks that the lateness of the ice in the Saint Lawrence has caused many of the mackerel to go to the Newfoundland coast.

Squid are abundant, the weirs being full of them at North Truro. The George's Bank fishermen use them for bait. Dogfish are plentiful. Four fares of small mackerel arrived to-day, three fares being from the Nova Scotia coast. The small mackerel are hardly worth catching. They sold yesterday for \$3.25 a barrel, including the barrel. Large No. 3 sold for \$9 a barrel, including the barrel (worth about 80 cents).

GLOUCESTER, MASS., *June* 22, 1884.

MONTHLY SUMMARY.—The amount of fish landed at Gloucester during June is as follows: There were one hundred and forty-five arrivals from George's Bank, landing 3,476,000 pounds of salt cod and 89,130 pounds of fresh halibut; twenty-three arrivals from Western Bank, landing 1,888,000 pounds of salt cod and 31,000 pounds of fresh halibut. There were 185,000 pounds of salt cod landed from Cape North; 160,000 pounds of salt cod and 18,000 pounds of salt halibut from Flemish Cap; 1,099,000 pounds of shore fish, being mixed half cod and half hake and cusk; 575,800 pounds of fresh halibut, caught on the Banks; and 203,000 pounds of pollock, caught with seines off Chatham.

MACKEREL.—The mackerel landed during June is as follows: Caught on the New England coast, 12,658 barrels; caught on the Nova Scotia coast with seines, 2,000 barrels. Four arrivals from the Nova Scotia coast brought 136,000 pounds of salt cod and 60,000 pounds of haddock. From the Nova Scotia coast there have been imported to Boston 23,000 barrels of salt mackerel, most of this amount having been caught in weirs.

GLOUCESTER, MASS., *July* 2, 1884.

136.—CATCHING ALEWIVES WITH HOOKS BAITED WITH EELS.

By A. R. CRITTENDEN.

[From a letter to Prof. S. F. Baird.*]

While crossing the bridge over the Medomak River at Waldoboro', Me., this forenoon, I noticed on the bank of the river below some twenty or more boys fishing with rod and line, and evidently having good luck, as about every second some one drew out a fish. The fish looked like alewives, but as I had never known them to be taken with baited hooks I came to the conclusion that they were large smelts. On going down to the bank and investigating I found them to be indeed alewives, and I found the bait the boys were using to be live eels, from two and a half to three inches long, which they hooked in the center of the body, leaving them to wriggle at will. In some cases the hook would hardly strike the water before an alewife would be fast to it. One boy had taken over a hundred, and the others had various stocks. I asked the boys how they learned that they could catch them with eels, and all the answer I gained was that, "the boys told them they could." I found that the river was alive with alewives. Men were taking them with dip nets at the fish-way, in the dam just above the bridge.

I observed that hundreds of young eels were making their way up the fish-way, and when an alewife broke water among them they scattered as though frightened. Possibly this fact led the boys to think they were eating the eels, and were thus induced to try them for bait. The alewives were decidedly frisky, some of them at times jumping several

*This letter having been referred to Hon. Theodore Lyman, he states "that on Cape Cod alewives are often taken with shrimp bait or with artificial fly."—EDITOR.

inches out of the water, whether to catch gnats or for mere sport I am unable to say. I remarked to one of the men dipping them that he was taking a good fare, and he replied that what I now saw was not a "flea bite" to what was taken last year, when a man and his son dipped 70,000 from that very place in a single day, he being "high liner" for 1883. This method of taking alewives with eels was entirely new to me, and thinking possibly it might also be so to you I venture to address you in relation to it.

KNOX HOTEL, THOMASTON, ME., *May* 10, 1884.

137.—ON THE CULTIVATION OF SOFT-SHELL CRABS.

By CHARLES C. LESLIE.

In our harbor and along our coast are found millions of the common blue sea-crab, and I have for the past two years been considering why it is that, with the number that are to be found here, we cannot get a supply of soft-shell crabs. The same crabs are found along the coast of Maryland and other States adjacent, and yet I have hunted and failed to find many. At one time I found three and at another time four. But in no instance have I found a half dozen, even after hunting a whole day.

I would be greatly obliged to you if you would kindly tell me if there is any artificial way by which I could secure a supply.

CHARLESTON, S. C., *April* 24, 1884.

REPLY BY PROFESSOR BAIRD.

If you have the same blue crab (which I presume to be the case) as the one furnishing the "soft-shells" of the Chesapeake Bay, there is no reason why you should not find them in this condtion, which is merely their state after the old shell has been thrown off and the new one is being formed.

You might try the experiment of penning up the crabs in a shoal pond, fed by the tide, into which small fish and other marine refuse can be brought by the tide through a grating.

By taking flat stones, bundles of brush, or other substances of a similar character, and laying them over the bottom, you furnish a refuge under which the crabs can crawl. By lifting up these branches from time to time you can find the crabs under them.

This process has, I believe, been actually made the subject of a patent, but the inventor is dead; and the patent, probably, has long since run out.

Of course the defenceless crabs are readily devoured by their stronger relations, and it is therefore advisable to keep them where they can be properly protected from such destruction.

WASHINGTON, D. C., *April* 26, 1884.

Vol. IV, No. 17. Washington, D. C. July 30, 1884.

138.—A FISH-EATING PLANT.

By G. E. SIMMS, Jr.

[In the Fishing Gazette, May 31, 1884.]

I have recently discovered amongst the aquatic weeds placed in my aquarium, where I have also a large number of newly-hatched perch and roach, a novel and unexpected enemy to the pisciculturist in the bladder traps of *Utricularia vulgaris*, which is capable of catching and killing young fry.

My attention was first drawn to it by observing that several of the tiny fish, without any apparent cause, were lying dead on the weeds, while the rest of the brood looked perfectly healthy and in good condition. At first I was somewhat puzzled at the strange position in which they were lying, and in trying to move one with a small twig I was still more surprised to find it was held fast by the head, in what I thought, when I pulled the plant from the water, were the seed vessels; and a still closer examination revealed the strange fact that others of the little fish had been trapped by the tail, and in one or two instances the head and tail of the same fish had been swallowed by adjacent bladders, thus forming with its body a connecting bar between the two.

At first I was undecided how to act, for I could bring to memory no instance in which I had seen the existence of a piscivorous plant—*i. e.*, one preying on vertebrates—recorded in any book I had ever read, and I was unwilling to make such an assertion without the opinion of some one better capable of forming a judgment on the subject than myself; so I placed one or two good specimens in a glass jar and went to the Museum, where I was fortunate enough to see Professor Moseley, who immediately verified my suspicions.

According to Bentham's Handbook of British Flowering Plants, the *Utricularia vulgaris*, or greater bladderwort, is widely distributed over Britain, and although it is local, yet where it is found it grows luxuriantly, seldom appearing in the rivers, but chiefly confining its presence to still ponds and deep ditches, the places where it is most likely to work mischief to the young fry.

A peculiar fact in connection with it is that it has no roots at any time of its life, and the floating, root-like branches which are covered with numerous capillary and much divided leaves are interspersed with tiny green vesicles, which were supposed by a former school of botanists to be filled with water, by which means the plant was kept at the bottom until the time of flowering, when the water gave place to air, and the plant then rose to the surface to allow its bloom to expand.

As a matter of fact, these vesicles exercised no such function, their real work being to entrap minute crustaceans, worms, larvæ, &c., for its support, and without a good supply of which it is impossible to keep it alive in an aquarium.

Their form is that of a flattened ovoid sac, or, in other words, when seen under a low-power microscope, they are precisely like a human stomach, and they are attached at their hinder extremities each by a very short and fine pedicle or foot-stalk in the axil of the leaves.

Each, too, has an opening at the opposite free extremity, somewhat quadrangular in outline, from either side of which project two branched processes, called by Mr. Darwin antennæ.

In fact, I do not suppose they could have received a more appropriate name, because in appearance the whole bladder intimately resembles an entomostracan crustacean, the short foot-stalk representing the tail.

On either side of the quadrangular entrance several long bristles project outwards, and these bristles, together with the branches of the antennæ, form a sort of hollow cone surrounding the entrance, and there cannot be the slightest doubt that they act as a guide for the prey.

The entrance is closed by a valve, which being attached above slopes into the cavity of the bladder. and is attached to it on all sides except at its posterior or lower margin, which is free, and forms one side of the slit-like opening leading into the bladder.

Differing materially from the color of the bladder itself, which is of a brilliant green, the valve is colorless and transparent, and is extremely flexible and elastic.

Animals enter the bladders by bending inwards the posterior free edge of the valve, which, from being highly elastic, shuts again immediately.

The edge is extremely thin and fits closely against the edge of the collar, both projecting into the bladder, and it is extremely difficult, if not impossible, for any animal to escape, although I have observed a long worm do so at the expense of a part of its body; yet, as a rule, it is a case of "all who enter here lose hope."

To show how closely the edge fits, it was found that a daphnia, which had inserted its antennæ into the slit, was held fast a whole day, and on other occasions long narrow larvæ, both dead and alive, were seen wedged between the valve and the collar with their bodies half in and half out the vesicle.

When a fish is caught, the head is usually pushed as far into the bladder as possible till the snout touches the hinder wall. The two black eyes of the fish then show out conspicuously through the wall of the bladder.

So far as is known, there is no digestive process in *Utricularia* neither is there any sensibility to irritation. Mr. Darwin was unable to detect either, his opinion being that whatever nutriment the plant obtained from its prey was by absorption of the decaying matter, and it would appear that the longer of the two pairs of projections composing the quadrifid processes by which the vesicles are lined, which project obliquely inwards and towards the end of the bladder, acts, together with the spring valves at the mouth of the bladder, in utilizing each fresh struggle of the captive for the purpose of pushing it further inwards. If any of my readers wish for specimens of this interesting plant I shall be enabled in a few days to forward them at a very nominal cost.

Of its destructive powers all I can say is, that out of 150 newly-hatched perch placed in a glass vessel only one or two were alive two days subsequently, and I hope in a few days to be in a position to speak of its powers *en natura*.

I must also tender my hearty thanks to Professor Moseley for his unselfish kindness and courtesy in furnishing me with notes and all necessary information, at a time when his hands are full with this term's work, and any one who knows rightly the duties of an Oxford professor will agree with me that the position is an arduous one. Such men as Professor Moseley are few and far between, for, like fishermen, I find that among scientific men there is an amount of jealousy which ought not to exist, and I therefore regard the action of Mr. Moseley in this matter with such feelings of gratitude as are not easily obliterated.

37 *Broad street*, OXFORD, ENGLAND.

139.—A CARNIVOROUS PLANT PREYING ON VERTETBRATA.

By Prof. H. N. MOSELEY.

[From Nature, May 22, 1884.]

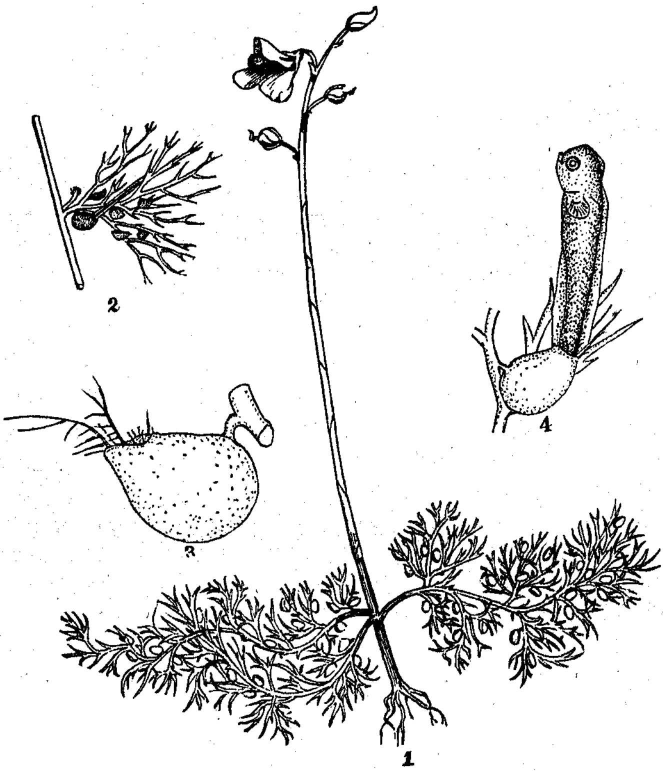
An interesting discovery has been made during the last week by Mr. G. E. Simms, son of a well-known tradesman of Oxford. It is that the bladder-traps of *Utricularia vulgaris* are capable of catching newly-hatched fish and killing them. Mr. Simms brought to me for examination a specimen of *Utricularia* in a glass vessel, in which were numerous young roach newly hatched from a mass of spawn lying at the bottom. Numbers of these young fish were seen dead, held fast in the jaws of the bladder-traps of the plant. I had never seen *Utricularia* before, and am indebted to my colleague, Prof. Burdon Sanderson, for the identification of the plant and a reference to Cohn's research on it. Mr. Simms supplied me with a fresh specimen of *Utricularia* in a vessel with fresh young fish and spawn, and in about six hours more than a dozen of the fish were found entrapped. Most are caught by the head, and when this is the case the head is usually pushed as far into the bladder as possible till the snout touches its hinder wall. The two dark black eyes of the fish then show out conspicuously through the wall of the bladder. Rarely a specimen is seen caught only by the tip of the snout. By no means a few of the fish are, however, captured by the tail, which is swallowed, so to speak, to a greater or less distance, and I have one specimen in which the fish is caught by the yelk sac. Three or four instances were observed in which a fish had its head swallowed by one bladder-trap and its tail by another adjacent one, the body of the fish forming a connecting bar between the two bladders.

I have not been able to see a fish in the actual process of being trapped, nor to find one recently caught, and showing by motion of the forepart of its body signs of life. All those trapped were found already dead, but I have had no opportunity of prolonged observation, and it will be remembered that Mr. Darwin in his account of the trapping of crustacea, worms, &c., by *Utricularia*, states that he was not able to observe the actual occurrence of the trapping of an animal, although Mrs. Treat, of New Jersey, often did so. I think it probable that the fact described by Mr. Darwin, and which is easily verified, that the longer of the two pairs of projections composing the quadrifid processes by which the bladders of *Utricularia* are lined "project obliquely inwards and towards the posterior end of the bladder," has something to do with mechanism by which the small fish become so deeply swallowed, so to speak. The oblique processes, set all towards the hinder end of the bladder, look as if they must act together with the spring valves of the mouth of the bladder in utilizing each fresh struggle of the captive for the purpose of pushing it further and further inwards. On cutting open longitudinally some of the bladders containing the heads and foreparts of the bodies of fish and examining their contents, I found the tissues of the fish in a more or less slimy deliquescent condition, no doubt from decomposition, for Mr. Darwin failed to detect any digestive process in *Utricularia*. The quadrifid processes were bathed in the slimy semi-fluid animal substance, and the processes themselves appeared to contain abundance of fine granular matter, possibly the result of absorption, but the large quantity of surrounding animal matter present rendered the observation uncertain. The usual swarms of infusoria were present in the decomposing matter.

Specimens of the *Utricularia* with the little fish fast in the bladder-trap, and their heads or tails hanging out, can be well preserved in spirits, and show the conditions well, notwithstanding that the plant becomes colorless, and there is no longer the marked contrast between the glistening white dead fish and the green bladders, which in the fresh condition renders the combination of the trap and prey conspicuous.

Mr. Simms, by whose permission I write this, intends shortly to publish an account of his observations himself. I have advised him to endeavor to prepare spirit specimens of *Utricularia* plants with numerous trapped fish *in situ* for sale to those interested in the matter who my care to apply for them.* His address is 37 Broad street, Oxford.

* Specimens of the entrapped fish were received from Professor Moseley by the United States Fish Commission June 9, and are deposited in the National Museum. The *Utricularia* is a large, rootless, water-plant, which floats freely in the water. Its leaves bear the small bladders which entrap the fish fry. Eleven species are enumerated in the Fish Commission Bulletin, 1883, p. 260, as useful in carp ponds. While these do not include the *vulgaris*, it is probable that some of these may have the same ability to catch the small fish. In that case even these plants must be excluded from carp ponds.—C. W. S.



The Fish-catching Bladderwort (*Utricularia vulgaris*).

140.—THE FISH-EATING UTRICULARIA, OR BLADDERWORT.

By Prof. H. N. MOSELEY.

[From a letter to Prof. S. F. Baird.]

I felt sure that the specimen of *Utricularia** would be of much interest to you. I am sorry that probably I cannot procure for you any more specimens with fish entrapped this year. Mr. Simms was unfortunately taken ill a few days after he brought his discovery to me and has been unable to set about preparing specimens since. The season for spawn of the common river fishes was already far advanced when the discovery was made, and I found it before I expected too late to get a satisfactory supply, and also have found the matter not so simple as I at first supposed. I found that a certain residual number of a certain batch of young fish remained weeks with the weed untrapped, either because the weed is only able to catch them when the weather is warm, or because they learn by experience (impossible), or because the plant soon loses its activity in confinement (?). Other experiments seem to show that possibly one certain species of young fish get caught. The matter evidently requires a great deal of investigation. I have only very few specimens, such as I sent you, and I intend to exhibit these at Montreal and possibly at Philadelphia, and to read a short paper on the matter. I can send you plenty of our living *Utricularia vulgaris* should you care to have it. I see Asa Gray in his manual refers to VAR. *Americana* as most common in the United States, but no doubt the two varieties will act alike as to young fish. You will no doubt at once try the plant with young carp. I have not found any case of a young fish already trapped by any specimen of the *Utricularia* taken from the pond in which it grows here, although there are many fish in the pond.

14 ST. GILES, OXFORD, *June* 20, 1884.

141.—MEMORANDUM OF SOME RESULTS OF FISH-CULTURE ALREADY ATTAINED.

By MARSHALL McDONALD.

CARP.—The carp wherever planted under favorable conditions and receiving reasonable care and attention have grown, bred, and multi-

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*The specimen has been figured under the direction of Mr. John A. Ryder (see plate I). Three of the figures are original; one is copied.—C. W. S.

EXPLANATION OF THE PLATE.—*Fig.* 1. *Utricularia vulgaris*, nat. size; plant in flower. (From Maout and Decaisne.) *Fig.* 2. A single cluster of leaves enlarged twice, showing the little bladders in position, one of which has siezed a young fish by the head. *Fig.* 3. A single bladder enlarged sixteen times, showing the two branched filaments at the open end. *Fig.* 4. A bladder enlarged seven times; a young fish has been seized by the tail.

plied rapidly. Thirty thousand distinct bodies of water in every section of the United States have been occupied with this fish. These represent an aggregate area of 100,000 acres of waste water, which have been converted to profitable, almost spontaneous, production, yielding at a moderate estimate 20,000,000 pounds of food per annum and adding $1,000,000 annually to the value of the products of the country.

BLACK BASS.—The black bass has been acclimated in all of the rivers of the Atlantic slope, and while not increasing the aggregate food product of the areas occupied by them, the introduction of this game fish has indirectly contributed to the prosperity of various sections by attracting sportsmen and summer residents.

TROUT.—The mountain sections of New York, New Hampshire, and Vermont have their game and fish well preserved through the efforts of the State fish commissioners; the trout streams being kept up by artificial propagation or planting, and by protection. The summer visitors who are drawn to this region by the fame of its hunting and fishing leave there annually $15,000,000, according to the statement of the New Hampshire commissioner. The larger part of this is to be credited to the efforts in artificial propagation systematically carried on there.

CALIFORNIA SALMON.—The efforts to acclimate this species on the Atlantic slope and in the Mississippi basin have proved abortive, unfavorable temperature conditions, as I have elsewhere shown, having militated against success. This, however, is to be regarded as an experiment in acclimation rather than in fish-culture, the artificial propagating and planting of this species in the Sacramento River having carried the annual production of that river up to double the volume it had before planting was inaugurated, and added to its aggregate value $300,000 per annum.

WHITEFISH.—The propagating and planting of this species in the Great Lakes was undertaken in the face of a rapid decrease, which foreshadowed the exhaustion of these fisheries in a few years. This decrease has been arrested, and the product is again slowly on the increase.

SHAD.—The results of the artificial propagation and planting of shad cannot, in the absence of accurate statistics covering the whole coast, be definitely stated. There is no question but the production of the Chesapeake area as a whole is steadily on the increase, though local causes determine local failures of the fisheries each season; local statistics, being the only measure of increase that we have, of course can furnish us no data by which we can determine the general advance in production. This, however, is shown by the decreased cost per pound of the shad from season to season in the face of a continually increasing demand brought about by increasing population and increased facilities for distribution, the price to-day in the markets of Baltimore and Washington being from $12 to $20 per hundred and from 3 to 4 cents per pound.

WASHINGTON, D. C., *May* 4, 1884.

142.—NOTES ON THE BLUEFISH, MORTALITY OF FLORIDA FISHES, ETC.*

By H. D. PIERCE.

[From letters to Prof. S. F. Baird.]

The bluefish with us is a migratory fish, going north in the spring and returning about the last of November. I never knew of any being taken in summer. The fish I have taken while in spawn would weigh, I should judge, about 6 or 7 pounds; the male fish were not quite so large sa the female. I have never seen them in large schools; they come suddenly and leave the same way. I have never seen or heard of any south of Cape Florida, although I have heard that a few have been taken here in Biscayne Bay. Another thing I have noticed about them is when you have a very cold winter north they are more plenty than when you have a mild winter. If I had known that information was wanted about their spawning, I could easily have procured it at that time; but I will send my son, who is somewhat of a naturalist, to observe them the coming winter and procure such information as you want about them. Will you give me some information as to how to keep the ripe eggs so as to get them to you without their spoiling, as the weather is very warm here at all times.

In regard to my theory that it was cold water which killed the fish, I did not mean in the Gulf of Mexico, but on the Atlantic seaboard of Florida, where I have seen it happen several times, but I have no doubt it is the same in the Gulf. I think that I ought to be a pretty good judge of cold water, as when a boy I took many a swim in the ice-laden streams of Maine, and later in life many an involuntary plunge into the waters of the Arctic Ocean to get out of the way of the flukes of the bow-head whale; and I must say that I never was so thoroughly chilled as on that afternoon in July on the coast of Florida. On that occasion, while disrobed, I saw two or three fish floating about, just alive. I caught one, what is called here a grouper, and carried it home. The next day, upon going to the beach, there were thousands of them ashore, and many floating helplessly about on the surface of the water. They extended about 2 miles along the beach. I have seen the same thing twice since. The only reason or cause that I can give, and I do not know as it will hold good, is that the Gulf Stream, in its rush northward, must have a counter-current inshore, running south. If the Stream can force the warm water of the tropics from the equator to 50° or 55° north latitude, why may not the counter-current bring to Florida occasionally a body of water cold enough to kill fish such as live in the tropics? Of late years I have not kept myself posted at all

* Continued from Bulletin, Vol. III, 1883, p. 332.

in regard to the investigations that have been made with respect to the Gulf Stream and the currents of our coast; but if I had the proper instruments, I would take the temperature of the water from the shore to the edge of the Stream from Cape Florida to Jupiter Inlet, 90 miles at least, several times a year.

I will try to capture some porpoises, so as to send the entire skeletons. I have the lower jaw of what I called a calf sperm whale. The entire whale measured about 18 feet in length. I opened the skull cavity and took out about two gallons of head oil. I saved nothing but the lower jaw. If it will be of any use I will forward it. The jaw is small, not much larger than a porpoise jaw. I think some reference was made to it some two years ago by a man named Spencer, of Jupiter Light.

I have never seen any seals on this coast. As to manatee, I think that skulls and skeletons of them could be obtained from the Indians. I have seen during the summer in New River, some 13 miles north of here, quite a number, and about two weeks ago I saw three opposite the station not more than 200 feet from shore, going north towards New River.

While out on the reef fishing last week, I caught two remarkable fish, something I had never seen before in these or any other waters. They were a flat fish, weighing about three pounds. If I could have saved them I would have sent them to you, but we are so completely out of the world that nothing can be procured here in the way of jars, alcohol, or any other preservative. If you would put something of that kind here I would gladly save all specimens, and we find some queer ones sometimes.

BISCAYNE BAY LIFE-SAVING STATION,
Miami, Fla., October 13, 1883.

There is one other fact in support of my theory of cold water. In November of 1876 I happened to be here at this place on business. I was then living at Lake Worth. While here we had a heavy norther and it was very cold, the thermometer falling to 40°F. Ice formed in tubs and pails on the second day. I procured a boat and went out on the bay and picked up about 50 pounds of pompano, which were chilled to death. The bay and the shores of the ocean were covered with fish of all kinds, which acted in a similar manner to those I had seen off the coast. About noon of each day, while the sun was hottest, no fish could be seen, showing it was the cold. Of the many different kinds I did not see one of our migratory fish. They could stand the cold. Of the fish seen dead in the Gulf of Mexico, and which perished in the wells of vessels, there were no migratory fish, but were all natives of the trop, ical sea. Here the principal fish killed were mullet, a few barracudas, snappers, tarpon, pompano, moonfish, grunts, &c. It chilled the crocodiles so that I captured one 5 feet long with my hands. Biscayne Bay is almost open to the ocean. The warm waters of the Gulf

Stream flow in and out at every tide, but it did not make any change in the temperature of the water. If it had, the fish would have escaped.

BISCAYNE BAY, MIAMI, FLA., *November* 3, 1883.

I cannot imagine any conditions that would bring the cold water to the surface. The Smithsonian Report (page 466) mentions the so-called poisonous water as being discolored and running in long patches or streaks. If the hypothesis assumed there that the dirty water was due to the overflow of the glades or swamps, and that this water had poisoned the fish was true, there would not now be a live fish on this coast. From last November (1882) to October 15, 1883, there had been no rainfall on this coast; the everglades were particularly reeking swamps, basking under the hot tropical sun for almost one year. The Indians who had come out of them in the beginning of winter could not go back again. It is but natural to suppose that under such conditions they would generate a vast amount of poisonous water. The end came October 15, when it began to rain; it rained for eight days; the everglades got such a washing as perhaps they had never known before. As far as the eye could see from this station, north, east, and south, it was everglade water, which all came from New River, 13 miles north of the station. There were no dead fish to be found on either the east coast or the west coast. I noticed it particularly, for if I had found dead fish, I should have to abandon my theory of cold water. As it is, I hold to it more firmly than ever.

In regard to the epidemic of 1880, it took place on the west coast of Florida. The hurricane, which immediately preceded the epidemic, was from the northeast, blowing directly off shore. It was probably blowing at a rate of from 60 to 100 miles per hour, making an overtow that would bring cold water from almost any depth, and of course it would roil the water so that it would be streaked with various colors. They would naturally infer that it was everglade water. The fish that live in the glades do not suffer from the poisonous water, and I have never seen a hole that was 5 feet across that did not teem with fish, turtles, and alligators. I have been in this station one year, but have lived at Lake North, Fla., 60 miles north, for the previous twelve years.

I have stated that I knew of no condition which would bring cold water to the surface, and then went on to make just such a condition, but I think I can prove the latter assertion. When we have hurricanes here, on the east coast of Florida, if they come first from the northeast and end at the southeast, they make a very heavy undertow by blowing the surface water to the shores. At such times and under such conditions we never find any dead fish or anything else of marine life on the coast. But when our hurricane comes from the southeast, and, after blowing eight or ten hours, suddenly becomes calm, while the storm center passes; or, when it suddenly comes in from the southwest or off the land, blowing with a force that would put to shame a Kansas cyclone, that off-shore wind creates an enormous overtow; and, as it does not lower the surface of the water in the ocean, the cold water from the depths below must take the place of the surface water. Under such conditions as I have just described, go to our ocean beach from Cape Florida to north of Jupiter Inlet, and it will be found covered with fish of all kinds, except such as are known as surface fish, or those that live near the surface. They are all, *without exception*, rock or bottom fish; and many, judging from their looks, must have come from a great depth. What is it that brings them to the shore if they are not paralyzed by the cold water? It is after such a time as this that I think I can supply you with a great many kinds of fish new to science. I have seen many kinds that I never heard of and had no names for.

BISCAYNE BAY, MIAMI, FLA., *November* 24, 1883.

I have the pleasure of informing you that I have sent the whale's jaw, through the kindness of Mr. Colonna, of the Coast Survey. I was unable to procure any bluefish spawn the past winter, but in a conversation with Mr. Colonna, who has wintered on Lake Worth, he tells me that they have caught with a seine large quantities of roe bluefish, eating the roe. It is a fact worthy of notice that of the large quantities taken, trolling with hook, none had roe, and the seine only developed the fact that there were not any roe bluefish. I am located so far from what seems to be their favorite ground that I cannot do much, but if I should be transferred to the Jupiter Life-Saving Station, when built, I should be better able to note their habits, &c.

February 26, trolling for Spanish mackerel, I caught seven; weight of the seven, 15 pounds; found spawn in them about half grown. February 27, I caught two Spanish mackerel, and found spawn about the same size as those caught the day before. March 8, saw large schools of young bluefish, about one month old, moving south.

MIAMI, FLA., *April* 7, 1884.

143.—CHARACTER OF THE CARP INTRODUCED BY CAPT. HENRY ROBINSON ABOUT 1830.

By JOSEPH D. REDDING.

[From a letter to Prof. S. F. Baird.]

I inclose a communication from Mr. O'Meara, of Santa Rosa, Cal., to the San Francisco Bulletin. Under date of March 4, 1884, he says:

"I first saw French carp in the autumn of 1837. The fish were in the artificial fish-ponds of Capt. Henry Robinson, of Newburg, N. Y..

"Captain Robinson commanded one of the five lines of packet ships which regularly traded between New York and Havre, and had accumulated a fortune. His country seat at Newburg was a splendid estate of beautiful grounds. A small stream ran through the tract; its bed was in a deep ravine, and its waters emptied into the Hudson River.

"A copious artificial fish-pond, in the center of which was a small island surmounted by a summer-house, was midway between the broad front gateway and the mansion. There was a narrow bridge across the fish-pond to the summer-house, and from the bridge could be seen hundreds of French carp, which Captain Robinson had himself brought with great care from France in his own ship. The place was in charge of a man named Beckwith, a trusted agent of Captain Robinson, during his absence on his voyages, and he devoted especial care to the fish-pond and the carp.

"They were the first of that species of fish I had ever seen, and I remember their form and appearance as well as I do the place, its owner, and all that I have described of the one and the other. I have seen the carp bred from the imported stock of Mr. Poppe, in Sonoma County, California, and on first seeing those I immediately recognized them to be of the same species as the carp I had seen in Captain Robinson's fish-ponds. Although I was young at the time I distinctly remember what Captain Robinson said in his enthusiastic description of the fish.

"At what period he first brought them to this country I know nothing. I remember, however, that he had added to the original stock the year I visited his place, and I am sure that my recollection of the fish itself is as clear as it is of the varieties of fish in New York Harbor, in the North and East rivers, which I used to catch when a boy."

Mr. Robert Poppe, of Sonoma, introduced some carp from Germany in 1872 and claims that his were the first German carp introduced. Mr. O'Meara calls both "French carp." Are both *Cyprinus carpio?*

REPLY BY PROFESSOR BAIRD.

There is much uncertainty as to what was done in the way of introducing carp before the efforts of Mr. Poppe, in 1872; but while it is doubtless the fact that Captain Robinson brought over fish, there is no certainty that they were the genuine carp. I am inclined to think that they were the Prussian carp, an allied species much inferior in value.

A so-called carp is found in great abundance in the Hudson River. I have seen wagon-loads brought up by a single haul of the seine. These appeared to me, when I saw them, to be hybrids between goldfish and the Prussian carp.

In former times it was very difficult to obtain perfectly pure breeds of carp, as they were kept largely in the same waters with goldfish, with which they hybridize very readily.

The improvement in the stock is due almost entirely to the Germans, neither France nor England yet having anything better than the old-fashioned variety, which is of poor quality.

WASHINGTON, D. C., *March* 15, 1884.

144.—SEVERAL OPINIONS UPON HOW TO CATCH CARP.

Compiled by CHAS. W. SMILEY.

In response to numerous requests for information as to the best way to catch a few carp at a time, and without draining a pond, I have examined the principal English sporting books, and have extracted what they have to say on this subject. The first item, however, is by an American who understands fishing for carp.

WITH LINE AND HOOK.—"When I fish for carp I have a fifty-foot line done up on a reel with six or seven small hooks on the line, and without any pole. I bait the hooks with stale light bread, which floats on the surface of the water, and the carp come to the top to suck it down. As soon as they feel the hook they start to run and I reel up the line and play with them until I worry them out and land them without further trouble. After catching one in this way they become very wild and timid, and it is a long time before I can get them to show themselves again. I caught only one with an angle-worm."—OSCAR REID.

SAINT LOUIS, MO., *August* 21, 1883.

BAITS.—"Carp are esteemed among the richest fresh-water fish we have in the kingdom, and are as cunning as foxes. The angler, therefore, must be 'wide-awake' to catch him, and also as patient as a saint. He may, however, fish for him at any time in the day during warm weather. The bait may be either worms or paste. Of worms the bluish marsh or meadow is the best, but a red worm, not too big, will do, or a large gentle; of paste, the best is made of bread and honey, and the spot intended should be well baited beforehand. In a large pond, to draw them together, throw in either grains, or blood mixed with cow-dung, or bran, or any kind of garbage; follow this with some of the small baits you intend to angle with. If you fish for carp with gentles, put on your hook a small piece of scarlet cloth, about the bigness of a pea, soaked with oil of peter (by some called oil of the rock), and keep your gentles for two or three days in a box smeared with honey; and while you are fishing, chew a little bread and throw it in about the place where your float swims. In this way, with due patience, you will prove a match for these crafty fish."—[From Routledge's Handbook of Fishing, London, p, 39.]

BAITS.—"Carp are very uncertain. After a shower on a warm, damp evening, is the best time for fishing. A boiled green pea is a capital bait; also ground-bait with boiled potatoes, and bait with half-boiled pieces. You should ground-bait overnight. Anything will do for ground-bait, chickens' guts, blood, cow-dung, mixed grains, and greaves, mixed with clay. As baits, use paste of all kinds, especially sweet paste, gentles, and red worms.

"A very good way of killing carp is to let the bait sink between the leaves of the water-plants, and gently draw it up and down till you feel a slight nibble, when the line must be loosed until the fish runs away with it. A paste made of common flour and anchovy sauce, with a little water mixed with it to prevent sticking, has been found good.

THE OLD-BOAT METHOD.—"Carp may also be thus taken: Take an old boat, and fill it with brush-wood or other loose stuff, taking care to keep it down with large stones. Tie two ropes to the ends of the boat so as to be able to draw it up again when wanted, and then sink it, leaving it there for a month or two, so that the carp may have time to get accustomed to it, when they will take up their abode in the boat. After you have left it in a sufficient time draw it out again by the ropes tied to it for the purpose, and you will find the fish in their hiding places in the brushwood. It is best to put some food in the boat before you lower it."—[From "Facts and useful hints relating to fishing and shooting," by I. E. B. C., London, 1874, page 26.]

EXPERIENCE.—"Late in July, 1858, on a hot summer's afternoon, I was barbel-fishing in the eddy off Ham Point, Weybridge, the water being quite 20 feet deep and as clear as glass. I did not so much as touch a barbel, but took with my single rod three magnificent carp, weighing respectively 8, 5, and 4 pounds; ten eels, nine large perch, and one bream; the carp gave quite as much play as trout. These were all taken with the lob-worm, using chopped worms for ground-bait.

BAIT AND RODS.—"As a general rule, the red worm will be found the most killing bait, but they will at times prefer a well-scoured marsh-worm or lob. The majority of roach-baits also are used for carp. Use a light stiff rod with fine running tackle and a light float, ascertaining the depth, if possible, the day before, when ground-baiting, as recommended in the preceding chapter, so as to keep out of sight when you commence fishing, and disturb the water as little as you can. Throw in a few chopped worms occasionally while angling, fish on the bottom, and if in a stream strike immediately there is a bite; but if in still water, or a pond, wait a second or two, till the float goes steadily under, and then strike gently, as carp do not take the bait so quickly in dead water as in a stream, where, unless it is taken directly, it is carried away by the current and is gone.

PLAYING.—"When you have hooked a good fish use him gently and patiently, giving him line, winding in and letting out, till he is exhausted. He is an exceedingly strong and artful fish, and will try every possible means to get round a post or stump, or into the weeds, so as to break the line.

KEEP QUIET.—"The grand secret in carp-fishing is to keep quiet and fish fine. Some anglers expatiate on the great merits of boiled green peas and pieces of cherries as very taking baits. One writer advises a worm and gentle to be used on the hook at the same time, so as to offer the carp a choice of baits; probably, had he suggested that a green pea and a cherry be first placed on the hook, it might have been better still; the carp could then have taken vegetables with his dinner and dessert to follow.

To catch Prussian carp.—"There is another species of this fish, termed the Prussian carp, which seldom reaches a pound in weight; in shape and color it is similar to the ordinary carp, partaking very much of the nature of the goldfish and silver-fish, and like them may be kept, when small, in a globe. They are easily caught in ponds during the summer months with a small red or blood worm; fish very fine, with a No. 10 hook and a very small quill float. It is essential that the bait should cover the entire hook and look fresh and tempting. Fish two or three inches from the bottom."—[From the Modern Angler, London, 1883.]

A game fish.—"Carp are in season through March and April, and therefore I have advocated the increase of them in the Thames, as they would afford good support when the ordinary Thames fish are out of condition.

How taken.—"To fish for carp the angler requires to be very quiet and unobtrusive, particularly when they are in ponds. Carp grub for their bait along the bottom, and if the angler keeps quiet and out of sight he may often see them within reach of his rod, rooting along the quiet and shallow water, with their tails or back fins above water. I have often taken them when thus occupied by softly casting my float and tackle out a yard or two ahead of them, in the direction they were traveling, and allowing the bait to lie on the bottom, when I have frequently managed to capture the rover. Carp will take both worms and gentles well at times, but farinaceous baits are more in favor with the carp fishermen of the present day; for if there happens to be a lot of small roach, perch, or eels in the same pond, as there too often is, these will, if worms or gentles be used for ground bait, hasten to the spot and eat up most of it before the carp can find it out; and, added to this, when you begin to fish, the first miserable little eel or perch you take will drive many of the best carp away; and after you have taken two or three, there will hardly be a carp left.

Baits.—"Carp will take a variety of baits, as worms, gentles, wasp grubs, plain and sweet paste, boiled green peas, and potatoes. The last is the best bait that can be used, particularly with big carp; it should be about three parts, or rather more, boiled—rather a waxy sort being chosen—and the best way of baiting with it is to use a small triangle on a single thread of gut, with a small loop to the other end of it, having a good big loop in the line to loop it to. Then take a baiting needle, and, hitching it to the loop of the triangle, draw the gut through the middle of the potato and pull the triangle up so as just to bury the hook points in the potato. Then cut the potato round with a knife neatly till it is about the size of a good-sized gooseberry, and loop it on to the line, the big loop allowing the bait and all to pass through easily. The best way of fishing this bait is with a very light ledger, a small pistol bullet being quite heavy enough. The gut should be rather fine, but strong and sound, as a big carp is a doughty antagonist, and his first rush is not to be sneezed at. I have been broken in it many a time when I have been at all in difficulties; and carp, as they often run up to 10 pounds or 12 pounds weight, and even larger, and have very powerful fins, want careful managing at first. They are, too, pretty cunning, and will run you into a mass of weeds if they can.

DISREGARD NIBBLES.—"Never strike while a carp only nibbles. Wait till he drags the float steadily under, and appears to be going away with it; when, seeing all clear and in order about the line and reel for a rush, you may hit him smartly, and if he is a big one "look out for squalls"; as his mouth is very tough and leathery, you may play him firmly. Get him away as soon as possible from your pitch, so as not to frighten the rest, and land him as far from the pitch as you can. Then come back to the pitch, quietly throw in a handful or two of ground-bait, and follow up with the hook as before, and probably in ten minutes or a quarter of an hour, if the fish are well on, you may see your rush-float "niggle-niggling" again. The best ground bait, of course, for this work is boiled potato.

HAVE SEVERAL "SPOTS."—"If fishing a pond, always bait two, or even three, spots if you can; so that when the fish are rather alarmed at one, you can rest it and go to another, casting in a few handfuls of bait before you leave, to draw them back again. Always fish from the shore, too, if you can, as carp are shy of a boat, and any motion of the water easily alarms them. In fishing with the ledger in a stream you would discard the float, and fish as for barbel, by the feel. In this case, when you feel a nibble, you must yield some inches of line and wait for the tug that announces a bite. This is held to be, by experienced carp-fishers, the best and most killing method of carp fishing, particularly for big fish. The great thing is to let the bait and line rest on the bottom for a foot or two. In this way the carp sees neither the line nor the hook, as he cannot fail to do if he is curious in float-fishing when the depth is exactly plumbed and the bait only just touches the bottom.

OTHER BAITS.—"I have heard a haricot bean, or even a small broad bean, well boiled, spoken of as a capital bait, but I never tried it. It seems, however, a very likely bait. I have no doubt, too, that a lump of pearl barley, such as we use for roach, would be a good bait, using half a dozen corns; and it would be a nice bait to ground-bait with.

FLOATS, &C.—"In float-fishing use as light a float as you can, and have the shots or sinker as far from the hook as you conveniently can; and here, too, if you can do it, I always find that if 4 inches or 5 inches of the hook-gut rests on the bottom it pays best. A worm or other bait only just touching the bottom, with a row of shot 6 inches or 8 inches above it, is very likely to challenge the attention of the carp, who at once sees something he is not accustomed to, and becomes suspicious. To show how different it is when the line rests on the bottom, I once took a 7-pound carp on an eel line with a coarse string snood and worm bait. Carp always nibble a good deal at the bait before they take it, and will often nibble off the tail of the worm, or suck off your paste and leave the hook showing without taking the hook at all. In using paste I prefer sweet paste, made up with honey or brown sugar, to plain, and I have heard of paste made of pound cake being greatly affected by the carp. Poor old Bill Kemp, now with the majority, a capital old carp-fisher at Teddington, used to put on a lump of this as big as a large gooseberry, and fish it with ledger tackle; and he used to take a great many fine carp."—[From "Angling," by Francis Francis, London, 1883, p. 48.]

"Professor Owen, who is a great adept in the art of carp-fishing in ponds, has been kind enough to give me the result of his experience. His practice may be formulated thus:

"1. The summer months are the only time of the year for carp-fishing, and the best period of the day is between sunrise and about 7 o'clock, after which time they usually leave off biting.

"2. The best bait is a brandling.

"3. He has, however, found the following paste a by no means bad substitute; soft herring-roe worked up with bread-crumbs and wool.

"4. He uses the ordinary bottom fishing-tackle with a light float, and fishes about half a foot off the bottom.

"My own experience concurs almost entirely with that of Professor Owen, except as regards paste and bait, with which I never had any sport. I used formerly to use a plain bread-crumb paste, but later experience has convinced me that it was a mistake, and that a well-scoured brandling is the best bait both for carp and tench all the year round.

"In open waters, however, I employ it in a somewhat different way to that adopted by Professor Owen, placing the shot at about 2 feet from the bait and allowing the latter to rest, with about 6 inches of the line, on the bottom. The hook for this purpose should be a No. 7, and the collar of fine round picked gut, stained. The float should be a light porcupine quill, and it will commonly be found expedient to use a reel, as the carp is remarkably powerful, and without this precaution the first rush of a heavy fish is very likely to carry away the tackle. A few broken worms, thrown in from time to time, are the best ground bait; or whole worms, if the place is to be baited beforehand, in which case the depth also should be very accurately plumbed, so as to avoid any disturbance in the water when the angler comes to fish. Having thrown in the bait, it is the best plan to lay down the rod until there is a bite, and not to strike until the float goes under or—the more common result—moves steadily away.

"In very weedy places this mode of fishing is not practicable, and then the best plan is to fish about mid-water, dropping the bait noiselessly in wherever a tempting-looking opening in the weeds presents itself." [From the "Modern Practical Angler," by Cholmondely-Pennell.]

Vol. IV, No. 18. Washington, D. C. Aug. 12, 1884.

145.—NOTES ON THE CULTIVATION OF FISH—MOSTLY AMERICAN—IN FRANCE.*

BROOK TROUT.—Mr. Després has written from Nauteuil-en-Vallée:

"I have only a small number of fry [of *Salmo fontinalis*] from the eggs which you sent me last year, about 200. These specimens, although kept under circumstances only half satisfactory, are in very good condition, having attained on the average from 10 to 12 centimeters [about 4 inches] in length. I think they would have reached a greater size if they had been furnished with regular food independent of what they found in their basin. I intend to give this to them in the future." [*Bulletin*, March, 1883, p. 165.]

CALIFORNIA SALMON.—In returning thanks for the salmon eggs which had been sent him, Mr. Rathelot has written from Grand-Montrouge:

"The eggs of the *Salmo quinnat* which you sent me in December, 1881, came very well. The first, which I placed in a basin in the open air, are large enough; they have attained a length of 22 centimeters [about 8 inches]. Those which I left in my laboratory and which I placed some months after in the same pond are smaller, not having enjoyed while young the same food as the first, which, in addition to the horse-flesh which I give them, found in that stagnant water little worms and other animalcules which increased their growth. They have endured during the hot weather a temperature of 22° C. [71°.6 F.]. They live for the present on very good terms with the blays, gudgeons, barbels, and crawfish. Towards the last of October a quantity of poplar and other leaves having fallen into the pond, the water became much colored. Seeing that my fish would not eat, and not wishing to pursue the experiment further, I was obliged to proceed to clean out the basin. I give these details in order to show that the *Salmo quinnat* does not require a particular kind of water." [*Bulletin*, March, 1883, p. 165.]

THE CONTROL OF WATERS.—Mr. A. Leroy read from a note on the depopulation and restocking of the rivers of France.

Mr. Raveret-Wattel pointed out, on the occasion of this communication, the considerable damage done in the rivers by the inadequacy of certain provisions of the legislation in regard to fish, by poaching, and,

* Translations of items in the Proceedings of the *Société Nationale d'Acclimatation* published in the Monthly Bulletin of the society. Translated by H. P. Jerrell.

finally, by the pollution of the waters, which are poisoned by waste matter from many manufactories.

The President of the Society said that, apart from these different causes of the destruction of fish, there is another, on which too much could not be known to call the attention; this is the "cleansing to a clean border," prescribed by the administration for all the little watercourses. The banks would become absolutely vertical walls; all the plants on which fish spawn would disappear. Now, it is precisely in the little watercourses tributary to the principal rivers that the fry especially are developed. Thus the cleansing to a clean border, when it is not absolutely necessary in order to facilitate the running of water and to assure the supply of manufactories, ought to be done away with as one of the deeply to be regretted causes of the disappearance of fish. Meanwhile, far from being an exception, this cleansing is really an absolute and obligatory practice. From this results an appalling destruction of fish.

Mr. Millet remembered that the question of the depopulation and restocking of the watercourses has often been the object of particular attention on the part of the Society of Acclimatization, which has seen many of the measures which it has proposed for remedying the evil adopted by the administration. Among these measures stands the creation of reservations for fish, from which excellent results have been obtained. More than 820 kilometers [about 510 miles] of navigable streams are actually made into reservations, in which all trespassing, even that with the floating line, is prohibited for five successive years. While recognizing the good effects of reservations, at least in certain places, Mr. Raveret-Wattel thought that it would be well not to exaggerate the efficacy of this measure. In fact, the reservations protect the carnivorous and destructive species as well as those which are not; and the rapid increase of perch and pike has contributed much of late years to the diminution of the other species.

Mr. Millet did not believe that the pike spawned in the reserves. As to the perch, it is easy to destroy the strings of eggs which it attaches to the water plants. [*Bulletin*, April, 1883, p. 263.]

In making an annual report on the works of the Society in 1882, C. Raveret-Wattel spoke as follows:

WHITEFISH.—"Important shipments of eggs of different foreign salmonoids have been sent you again this year by generous donors, among whom, as always, we have to mention first Prof. Spencer F. Baird, Commissioner of Fisheries of the United States. About 250,000 eggs of the whitefish (*Coregonus albus*), sent from New York by his orders, have reached you in perfect condition, and you have been permitted to undertake a very interesting experiment in the acclimatization of this species, the introduction of which in our fresh waters would be a valuable achievement. Mr. Fred Mather, a member of the Commission of Fisheries, has, as usual, had the kindness to lend his co-operation in this shipment, for which we cannot show ourselves too grateful.

CALIFORNIA SALMON.—"Several gifts, likewise very precious, have been made to us by the German Fishery Association, which, on the proposition of its eminent president, von Behr, has generously made it possible for you to attempt the stocking of our waters with choice species which are recommended either for the quality of their flesh or the rapidity of their growth. Let us recall, moreover, that it is due to the gifts previously made to our society by von Behr, that you have been able to announce this year the complete acclimatization of the California salmon (*Salmo quinnat*), in regard to which Messrs. Rathelot and Clermont have given you interesting details.

FISH-WAYS.—"Knowing that the Society of Acclimatization interests itself in all questions which relate to the restocking of rivers and to the protection of migratory fish, the Minister of War appealed to your knowledge of the subject, with a view to the construction of a fish-way for salmon on the Dourduf River at the dam belonging to the powder mill of Pont-de-Buis, department of Finistère. The numerous documents which you possess, from the Commission of Fisheries of the United States and from other sources, relating to fish-ways for salmon, have permitted you to inform the administration regarding the different systems in use and the types which are most advantageous, considering the cost of their establishment and maintenance as well as their utility.

CROSS-BREEDING.—"Mr. Seth Green, of Rochester, N. Y., one of the veterans of American fish-culture, has given you an account of his very curious experiments in the cross-breeding of different species of salmon. Such experiments should be attentively observed, both as a matter of scientific interest and for the practical results which may be obtained." [*Bulletin*, May, 1883, p. 71.]

LAKE TROUT.—Mr. des Vallières, of Meaux, gave an account of the results which he had obtained from the fertilized eggs of the great European lake trout, and of the *Salmo namaycush*:

"The first of these shipments, which contained a small lot of impregnated eggs, reached me in very satisfactory condition. These eggs produced fry in the proportion of 95 per cent. The eggs of the *Salmo namaycush*, which were sent to me in great numbers, have been mostly spoiled when they reached me. I estimate that 50 per cent of the eggs were thrown away on their arrival; and during the period of hatching probably 15 per cent more died in the egg or perished at birth. I attribute these numerous losses to the freezing which took place during the passage from America, and which has produced morbid effects more or less active. Immediately after the absorption of their yelk-sacs, the fry of these two species [*S. namaycush* and the great European lake trout] were put into a little canal, derived from the Brasset, a stream which empties into the Marne some hundreds of meters away. This little canal, well arranged and full of running water, is suited to these fish, which are growing in a normal way and will afterwards be set free in the Brasset, whence they can spread in the Marne and ascend its tributaries. It will not be out of place to remark that the waters of the Marne are suited to the salmon family, for trout weighing 1 or 2 pounds have been taken this winter at Meaux itself.

"In the breeding of which I have the honor of giving you an account, I noticed that the *Salmo namaycush* grew with such rapidity that in two months they were larger than the great European trout hatched three weeks earlier. They also appeared more hardy and more easy of acclimatization." [*Bulletin*, July, 1883, p. 426.]

LANDLOCKED SALMON.—Mr. Rivoiron wrote from Échelles, department of Isère, among other things, as follows:

"In my last letter I told you that two-thirds of the fertilized eggs of your landlocked salmon still remained to be hatched. The hatching took place under the best possible conditions, and I had from the whole lot only a very few spoiled eggs, which became white immediately after the hatching. As a result of leaving one of the troughs exposed a little too much to the sun, we lost about fifty. I put them in the shade, and think that we have now lost only a hundred in all. They are very pretty, quite large, and have been taking food for fifteen days. They are fed on insects and the larvæ of the gnat and the water-flea. We can produce with our six basins about a kilogram [$2\frac{1}{5}$ pounds] of insects daily." [*Bulletin*, July, 1883, p. 427.]

BROOK TROUT AND CALIFORNIA SALMON.—Mr. Noordoek-Hegt, of Apeldoorn, Netherlands, has written:

"My fish-cultural establishment is succeeding. During the past week, under the direction of the commission appointed by the Government, Professors Hubrecht and Hoffman, I have set at liberty in the Yssel River more than 200,000 fry and 5,300 young salmon a year old. I have kept over 100,000 fry, of which it is probable that a part will also be set free, and the rest will remain in my basins until they reach the age of one year. I have a hundred California salmon (*Salmo quinnat*) which were born in my basins and are now four years old. These fish have never been to the sea, and yet they are in excellent health. Their average length is 50 centimeters [about $19\frac{1}{2}$ inches]. In October we succeeded in fertilizing a number of their eggs, and the fry are now doing wonderfully well. This fish [California salmon] is much more hardy than the Rhine salmon.

"My experiments with the *Salmo fontinalis*, an American trout, and a very pretty fish, have also been successful. I had imported eggs from America for two successive seasons. Nearly all of the eggs perished; however, from the two lots, we saved several hundred young fish. In

October last those of the first lot were eighteen or nineteen months old, and we have already been able to impregnate artificially a few hundred of their eggs, which have given us the same number of fry, and all are in the best condition. I am sure that if no disaster occurs we shall produce the *Salmo quinnat* and the *Salmo fontinalis* by thousands.

"I have had this year more than 60,000 fry of common or river trout and of lake trout [probably European], all coming from fish hatched in my establishment. So there is reason to be pleased, and I would be happy if I could show you the results of my work. I have sent to the International Fisheries Exhibition at London a model of my hatching shed, a plan of the establishment, and twenty bottles containing fish, which were all, without a single exception, born in my establishment." [*Bulletin*, July, 1883, p. 428.]

BROOK TROUT.—Mr. Després wrote from Nanteuil-en-Vallée, among other things:

"The preceding parcels of eggs which have been sent me have given good results. I have at the present time a hundred of *Salmo fontinalis* about twenty months old, some of which are more than 20 centimeters [about 8 inches] long. These are the ones which have received as extra food horse-flesh chopped up fine. The others, which have had at their disposal only the natural food which they were able to gather in a basin of considerable size furnished with aquatic plants, show a less development, but their health and vivacity are all that could be desired. This experiment in comparison has convinced me that it is necessary to give them, when they are about seven or eight months old, some artificial food in addition to that which they can find in the water, which is probably insufficient to allow them to attain a good development.

"The specimens of last year are likewise in good condition. They are as yet too small for me to state precisely their number. A rise of water caused me to lose some of them, because of an unfortunate arrangement of the basin which contains them. I have remedied this, and in future will watch with care that a like accident may not happen again. The escaped specimens probably have gone to grow up in the little stream which flows near by the establishment." [*Bulletin*, February, 1884, p. 188.]

SALMO CARPIO.—Mr. Kleiter, director of the fish-cultural establishment at Munich, announced the sending of 2,000 embryonic eggs of *Salmo carpio*, which he was directed to make to the Society of Acclimatization on the part of the German Association of Fish-culture. At this, Mr. Raveret-Wattel recalled to mind that the *Salmo carpio* of Lake Garde is an excellent species of trout, which never becomes very large, but whose flesh is much like salmon and is of an exquisite flavor. One fish-cultural establishment alone, on the shore of Lake Garde, is occupied with multiplying this species, so interesting to propagate, and remarkable, moreover, in this, that the spawning season is continued with certain individuals till June. [*Bulletin*, March, 1884, p. 290.]

LAKE TROUT.—Mr. Dubard, of Vilars-sur-Ouche, likewise requested a shipment of trout eggs. He wrote:

"I am encouraged to make this request of you by a precedent which assures me of almost certain success. Last year I bought from different persons 3,000 impregnated eggs, nearly all of which were afterwards hatched. After keeping them in the hatching apparatus for a fortnight I set these little trout free in a brook of running water 20 meters [22 yards, nearly] long by 1½ meters [5 feet] wide, and there I fed them up to the age of three months on chopped fish without appreciable loss. At this time these young fish had attained on the average 35 millimeters [1.4 inch nearly] in length. Then, thinking that there was nothing further to fear, I set them at liberty in my sheet of water which is fed by many good-sized springs. I ought to say that since then I have seen but little of them, but this is explained because of the depth of the basin, its extent, and the quantity of weeds which cover the bottom. If it is possible, I would prefer to receive some eggs of lake trout, which grows, as I have heard it remarked, much more rapidly than the other species." [*Bulletin*, March, 1884, p. 290.]

LAKE TROUT AND CALIFORNIA SALMON.—Mr. Focet wrote from Bernay:

"In reply to your letter of January 31, 1884, inquiring of me the results which I obtained from some shipments of salmon eggs which your society was pleased to send to me last year, I will state that the result was generally good. In fact, from the incubation of about 12,000 eggs of different kinds of salmon, I obtained about 10,000 fry, which have, on the whole, done well during the four months in which I have fed them on grated cooked meat, frog spawn, and codfish eggs. But I was obliged at the end of this period, being no longer able to feed them or to keep them in my apparatus, to set them free in the streams of Risle and Charentonne. I have taken good care of some specimens in my reservoirs, but only a few, as I have trouble in securing them from two great dangers, 1st, the variation in the depth and condition of the water, and, 2d, the voracity of water-rats and otters.

"In brief, the reports on fish culture, which I have made for ten years have been until now, and will be for the future till further orders, the same, as far as I can put in execution industrial fish culture, that is to say, to so care for the fish that it can be turned over for consumption after three or four years of living in a closed basin. However, my labors have not been without good results. I have restocked two water-courses of a length of at least 24 kilometers [about 11 miles]. Trout there are so abundant that recently, because of an accident which happened to the reservoirs of the gas-works, the ammoniac water killed more than fifteen hundred trout in the course of no more than 2 kilometers [1¼ miles] in the waters of the Charentonne. A fine of more than 1,500 francs [$300] was imposed on the gas company. You see from this what an abundance of fish there was. Some months afterwards, to my great surprise, the evil was repaired. The fish from below, ascending the watercourse, were sufficient to restock it as before.

"At this time all our natural spawners are numerous and in good condition, and we look for the best results.

"One word with reference to the small number of salmon which we find again in proportion to the young fry set at liberty. On the average each year I set free about eight thousand young trout from my purchases, and about two thousand fry of different kinds of salmon which are presented to me. We ought, then, to find them in the same proportions; but we do not. They report to me each year about fifteen or twenty of these specimens, which is a very slight proportion, as you see, and yet for several years I have set free especially lake trout and California salmon. Do they migrate also like the common salmon?" [*Bulletin*, March, 1884, p. 300.]

BROOK TROUT.—Mr. Després wrote from Nanteuil-en-Vallée:

"Last year I received from the Acclimatization Society some eggs of *Salmo fontinalis*, the hatching of which was conducted under the best conditions, and the loss was almost nothing. After the reabsorption of the yelk-sac, which was also accomplished almost without loss, the fry were let run in a basin of oblong shape with a little continuous current on a bottom of sand and gravel with water-plants. I judged that with larvæ and animalcules their food would be sufficient without having recourse to artificial nourishment.

"At the end of eight months I collected about a third of the fry of a size varying from 8 to 10 centimeters [nearly 4 inches in length]. I believe that their development would be greater if a suitable artificial food should be added to that which the young fish naturally find in the water.

"This year I intend to try two methods with the eggs of the *Salmo carpio*, which have been sent me. I would be glad to try them also with some eggs of the *Salmo fontinalis*, if the Society can spare a few.

"The best food, which causes no loss because of congestion of the gills, would be the living prey; but it is almost impossible to procure this in sufficient quantities to supply laboratory basins. In default of this, I have given them with moderate success raw meat, which was tender, and reduced almost to a paste and then mixed with water; the ground flesh of little fish gives the best result.

"My *Salmo fontinalis* are still in my basins. I would like to know whether they can live long in captivity, as the common salmon of France cannot. I am inclined to believe that they can, because their skin and shape show that they are of a variety of trout, either the common or the salmon-trout."

Mr. Raveret Wattel remarked, on the occasion of this letter, that the *Salmo fontinalis*, which is more generally and properly described to-day under the name of *Salvelinus fontinalis*, is an American species of grayling (*Omble-Chevalier*), which inhabits the little watercourses rather than the lakes, whence it gets its common name of brook trout in the United States. It is an excellent fish, of sluggish habits, which can be raised easily and advantageously in closed basins. [*Bulletin*, March, 1884, p. 301.]

BROOK TROUT.—Mr. Garnier, president of the Linnæan Society of Northern France, forwarded a report of Mr. Lefebvre, on the results obtained from eggs of different species of salmon forwarded by the Acclimatization Society. Mr. Lefebvre states that he has succeeded in propagating *Salmo fontinalis*, and that by means of artificial impregnation he has obtained hybrids from this species and the common trout. The eggs have been furnished by one species and the milt by the other, and *vice versa*. The crossing of grayling (female) and *Salmo fontinalis* (male) has been less successful, and only a few fry were obtained. [*Bulletin*, March, 1884, p. 306.]

TROUT.—Mr. Leroy wrote from the country seat of Roussainville:

"I have the honor of acknowledging the receipt of some trout eggs. They arrived in good condition except five, which I fear are spoiled, and ten whose existence seems to me doubtful. I have not thrown them away, nevertheless, but have placed them for hatching in the different vessels. My three sets of hatching apparatus are placed each under a tap, from which flows, without cessation, spring-water at the temperature of 8° C. [46°.4 F.], all in a half-darkened room. These eggs appear to me to be in an advanced period of incubation; two or three have hatched already." [*Bulletin*, March, 1884, p. 306.]

SALMON, TROUT, WHITEFISH, &c.—Mr. Wagner, director of bridges and roads, and manager of the fish-cultural establishment of Bouzey, wrote from Epinal:

"During last year (1883) we received from the Acclimatization Society some eggs of *Salmo namaycush*, *S. fontinalis*, *S. salar* subsp. *sebago*, *Coregonus albus*, and *C. marœna*. These eggs were in very good condition and hatched well, in the proportion of 80 to 100, with the exception of the landlocked salmon which gave only 50 to 100. The fry of the two kinds of *Coregonus*, after the sacs were reabsorbed, were distributed in the fish-pond of Bouzey, which is supplied by the brook of Avière as well as by the waters of the Moselle River, and whose maximum depth is 15 meters [49$\frac{1}{5}$ feet]. Moreover, we succeeded in raising a hundred of each of these two species on the hatching tables by means of little fly larvæ, microscopic insects, and finely strained beef's brains. These fry were kept in a basin 1$\frac{1}{2}$ meters deep, and have attained a length of 9 centimeters [3$\frac{1}{2}$ inches, about].

"The young of *Salmo namaycush*, *Salmo fontinalis*, and landlocked salmon were raised on the hatching tables by means of insects, fly larvæ, and beef's brains. In June they were placed in breeding-trenches of from 4 to 5 decimeters [about 15 to 20 inches] in depth, supplied by running water, and their food has been continued with minced horse-flesh. The young of *Salmo namaycush* and *S. fontinalis* have succeeded well and have attained a length of from 10 to 12 centimeters; but the landlocked salmon have not given the same result. All these fry were kept during the winter in the lower trenches of the hatching shop, and in the spring are to be distributed in the outside basins and preserved at the establishment. Last autumn we noticed that the males were full of milt, but that the females had no eggs; besides many females have died. There are still sixty of these fry which weigh from 250 to 300 grams [about $8\frac{4}{5}$ to $10\frac{4}{7}$ ounces avoirdupois], and we will try to keep them for reproduction, if possible.

"In 1882 we distributed some fry from little Fera of the Lake of Constance, in the fish-pond of Bouzey, and we had this winter the satisfaction of catching specimens from 18 to 22 centimeters in length.

"I avail myself of this letter to ask the Society to send us, if it is possible, some eggs of *Salmo quinnat*, *S. namaycush*, and *S. fontinalis*, in order to distribute the fry in the fish-pond of Bouzey and in the reservations of the Moselle, while preserving a few of each species at the establishment." [*Bulletin*, March, 1884, p. 397.]

SALMON.—Mr. Bartet, chief engineer of bridges and roads, gave the following account of results obtained from eggs of the different species of salmon which were distributed by the Society and placed for hatching in the aquarium of Trocadéro:

"Sixty per cent of the eggs were successfully hatched. The food which was given the fry at the beginning was mud-worms chopped fine and afterwards whitefish, also chopped fine. Their growth has not been rapid; and the young fish are yet in the inclosed water, and have not been set free in the river. During the first four months after the hatching we lost many of these fish, and now only a tenth part remains. Before placing them in one of the aquarium troughs and taking them out of the hatching apparatus, we kept them, for about two months, in an intermediate basin 5 decimeters in depth, with a bottom of pebbles. The less mortality was produced in the hatching apparatus.

"That apparatus consists of eight troughs placed in a row one above the other, each trough being 50 centimeters long by 20 centimeters wide and 15 centimeters deep, whose inner walls are sheets of glass hermetically sealed. It is supplied by water from the Vanne, which is previously filtered through a sponge contained in a terra-cotta pot, from which the discharge is about 150 liters an hour. The eggs were placed on screens formed of a framework of wood and a rod of glass.

"The hatching is conducted normally; that is to say, it takes place in about six weeks after impregnation, and the reabsorption of the umbilical sac occupies the same time. The temperature of the water is kept at between 9 and 10° C. [about 50° F.]. The surviving fish, put together in a common trough, are in good health." [*Bulletin*, March, 1884, p. 308.]

146.—NOTES ON THE HISTORY OF THE FISH-HOOK.

By R. CHRISTENSEN.*

The fact that prehistoric hooks are but seldom noticed in museums is not owing to their rare occurrence or rare discovery, but to their small size and to their appearance, which is not apt to strike the eye; possibly, also, because they closely resemble other implements and are therefore easily confounded with them. The number of undoubted fish-hooks, however, is large enough to show that angling is one of the most ancient occupations.

The oldest fishing implements, however, correspond very little to the newer idea which we connect with the word "fish-hook." As long as no metal was employed there was no material from which a real hook, answering to our ideas of the same, could have been made; there was moreover no type of such an implement. On the other hand, the idea was readily suggested that, if fish could be caught by means of a harpoon fastened to a line, without inflicting a mortal wound, the same object might be reached in a still more satisfactory manner if the fish could be caused to swallow a harpoon or arrow-head fastened to a line. Angling is therefore of more ancient origin than net-fishing. The oldest hooks which have been found are shaped like an arrow-head, having one and sometimes two, three, or more smaller or larger well-pointed beards. The museum of the Antiquarian Society of Prussia, in Königsberg, possesses a number of such hooks. All these hooks show very careful workmanship, and are of such slender form, so well adapted to the nature of the material (bone or horn), as to favor the supposition that this article has been in general use for some time, and has gradually undergone various improvements. These implements date from the Neolithic Age (second period of the Stone Age), and their enormous size will convey an idea of the size of fish caught in those times. A similar implement from the same period is preserved in the Royal Museum at Dresden, but its shape so closely resembles that of an arrow-head that it is impossible to distinguish it from this.

Hooks made of flint are very rare. Two which have been found in the Swedish province of Skåne furnish ample proof that the Scandinavians were likewise acquainted with angling at a very early period. Frequently small flint splinters having a bent point are found, showing evidences of workmanship which in some cases were evidently meant to be tied to a handle at their thick end, and which probably in this way have served as hooks. An implement made of horn and preserved in the Königsberg Museum, above referred to, also favors this expla-

* "*Zur Geschichte des Angelhakens,*" in *Deutsche Fischerei-Zeitung.* Translated by HERMAN JACOBSON, Vol. IV, Nos. 12 and 15, Stettin, March 22 and April 12, 1881.

nation. It will not seem strange that implements of so unassuming a character but rarely find their way into our museums. The fact, however, that angling has, till within a comparatively recent period, been the favorite mode of fishing, much more so than net-fishing, finds further proof in the circumstance that in the houses of the lake-dwellers at Schussenried numerous remnants of pike and of *Silurus glanis* have been found, but none of any other fish.

A second and entirely different form of hooks, shaped like a weaver's shuttle, was known in very ancient times; the central portion was connected with the line, and thereupon entirely enveloped in the bait, so the fish might swallow it whole. This method has still been preserved in some parts, where eels are caught by means of a darning-needle fastened to the line and almost hid in the bait.

There has been a steady development from the arrow-head to the real bent hook, as is shown by an implement which is preserved in the museum of the "Society for Pomeranian History and Antiquity" at Stettin. This rare piece was found imbedded 14 feet deep in marl near Reddies, district of Rummelsburg, in Pomerania. Its material is bone, and at its inner bend the marrow-side of the bone is laid bare, showing that the bone was not sawed lengthwise but crosswise. This gave to the implement a much greater degree of durability, and produced the outlines of its form at the very beginning of the work.

Even the double hook was employed before metals came into use. Such a double hook was made from the antlers of a stag, and found in one of the habitations of the lake-dwellers in Switzerland. At first sight it presents the appearance of grotesque clumsiness, but on closer observation it is seen that the hollows (especially the one on the right side) are a pretty exact facsimile of a modern hook. It will, therefore, not seem improbable that the eccentric position of the center of gravity was not accidental but intentional. Only the right hook is pointed, its form being better adapted to its purpose, and having a tendency to turn upward; that is, it is better calculated for catching fish; while the left hook was probably intended for fastening the bait.

We have more hooks from the Bronze Age, which in Eastern Germany extended to the fourth and fifth centuries. Their material being more pliable, they assume lighter and more slender forms; they have as yet no beard; but artificial bait, though in its simplest form, seems to have been employed at that early time. The Historical Museum at Lübeck possesses some hooks which are made of thin bronze leaves with very sharp points. They have probably served as small metal fish. I am in doubt, however, as to the use of the holes found in pairs in some of them. It seems all the more probable that these implements are artificial bait shaped like fish, as some of the South Sea Islanders were in the habit of employing artificial bait even before they knew the use of metal. In the collection above referred to there is an implement of this kind consisting of a long and narrow piece of mother-of-pearl, to which a hook made of horn is tied firmly.

The oldest iron hooks known are those found in the ramparts of Old Lübeck. As Old Lübeck was surprised and entirely destroyed by Roce, Prince of Rügen, in 1138, and as the new city was not built in the same place, the period from which these hooks date is well defined. The smaller of the two is evidently much older than the larger, and the properties of the metal have been so little utilized as to justify the supposition that this hook dates from the beginning of the Iron Age, while the larger is clearly of much more recent date. Here we find well-known forms reminding us of the hooks which we used in our boyhood's days. There is, of course, as yet, a great difference between these hooks and those found in the ramparts of Old Lübeck, for even the most inexperienced boy would hardly use such gigantic hooks, and even in those days so clumsy a beard would have been laughed at; but as to its general plan this hook does not differ much from the well-known hooks formerly used in Germany.

I will mention an old darre which was found near Alt-Bliesdorf, district of Ober-Barnim, and now in the collection of Mr. Wallbaum in Sucow. It has the size and shape of a tablespoon without a handle, but is quite flat, and made of copper. At the broad end there is a hole for the line, while the pointed end is inclosed by a shuttle-shaped double copper cover (resembling a shell), from which protrudes a medium-sized iron hook of good shape. Spoon and hook are, therefore, firmly connected by this cover by means of three pegs. This implement very closely resembles the spoon-shaped darres which are still in common use.

The merit of having fashioned hooks from steel, according to rational principles, and answering manifold purposes, belongs undoubtedly to the English. Max von dem Borne has described these hooks in his well-known work "*Angelfischerei*" (Line fishing) in the most exhaustive manner. During the year 1880 many different forms of hooks have been brought to our notice through the Berlin Exposition. Some of these hooks have been developed in certain localities independent of other forms, while some are the artificial products of industry, and have been thrown into the market to await the verdict of the fishing public.

Among the hooks peculiar to certain localities I first mention the Japanese hooks. These have very small beards, and are made of thin wire, which is more pliable than elastic; this is all the more surprising, as the Japanese are unexcelled in the manufacture of steel. If, therefore, they give their hooks a certain degree of pliability, this is probably intentional, and may perhaps be explained by the circumstance that their entire fishing apparatus is exceedingly fine. In Berlin they exhibited rods measuring 6 meters in length, with a very thin point, and a line which throughout its entire length has only the thickness of a thin horsehair. At the first glance it will be seen that these hooks are entirely original, and considering the very high degree of development to which line-fishing has attained in Japan it cannot be doubted that these various forms are carefully adapted to certain definite purposes. If we only knew these purposes we would undoubtedly learn much from the Japanese. Many of these forms have been adopted by English manufacturers.

The artificial fly also has gone through a course of development in Japan entirely peculiar to that country. Those which were on exhibition in Berlin consisted of hooks of the smallest kind given in our illustration; the head is of brass, perfectly round, with a diameter half that of the width of the hook, the body is either red, black, or gold colored, or has all three colors. From the head six to eight brown hairs run along the body, extending twice its length, and surrounding it on all sides; everything about it displays an elegance and accuracy of workmanship which need not fear comparison with the finest English flies.

In Switzerland, in the canton of Tessin, a peculiar form of hooks has been employed from time immemorial. They have no beard, and an exceedingly fine and long point, and are used for catching *Salmo thymallus*, trout, and "may-fish."

The Chinese produce clumsy imitations of English hooks, but their own hooks are peculiar, having exceptionally small beards, not on the back of the point, but on the side. This is of great importance, for the beard which is commonly used, and which is on the inner side or back of the point, has two disadvantages; in the first place, it is as unfavorably located as possible for the rapid entering of the hook, which therefore frequently does not catch; and in the second place, it is inclined to come out of itself, for when it enters, a hollow space is created between the beard and the lower bend of the hook, which is prevented from closing up by the portions of the hook which surround it on three sides. Whenever the person holding the line momentarily ceases to pull, the hook gets a chance to slip back, and the beard but too readily finds the necessary space to glide out of the wound without catching anywhere, especially when the parts where the hook has entered are lean and possess but little elasticity, as is the case with the pike. But if the beard is placed more or less on the side of the point, this offers the important advantage that the beard does not hinder the entering of the point; the hollow space referred to above will also be created, but it is not, as in the common hooks, between the beard and the bend of the hook, but on the side of the latter, and is consequently less inclined to close up immediately. The point of the beard, moreover, does not lie right over the center of the hollow space, but close to its edge. Even if the hook should slip back, the beard will always keep close to the edge of the wound, and will, in most cases, fasten itself somewhere, thus preventing the hook from slipping out entirely. Placing the beard at the side of the point, therefore, offers two decided advantages, without having a single disadvantage; and it is really surprising that manufacturers have not given more attention to this matter.

Of new forms which have recently been brought into the market, the following deserve special mention:

1. Longshanks, or hooks whose handle is twice as long as is com-

monly the case. This secures a steadier aim, the injurious angle is decreased, and makes a much longer extent of gut line possible. The place where the gut line touches the point of the shank is much less exposed to any motion, and the frequent breaking of the gut at this point is avoided. These hooks, however, are as a general rule only suited to such bait as will cover the entire shank. It certainly speaks well for these hooks that they were almost simultaneously adopted both in England and America.

2. Warner's needle-eye hooks. The new catalogue of J. Warner & Sons, Redditch, shows a whole series of differently constructed spring double hooks (eight in number). Other hooks of this kind have been known in Germany for some time; a hook of a particularly practical construction was exhibited at Berlin by the firm of Bradford & Anthony, of Boston, Mass.

The same firm has introduced a hook which substitutes an entirely new principle for the beard. As the tongue which takes the place of the beard acts like a spring, the mouth of the fish will, in biting, slip past the point of the tongue, almost without meeting with any resistance, and from that moment any loosening of the hook by accident becomes impossible. Unless something tears or breaks, the fish is hopelessly caught. The considerable angle of this hook will give no trouble, considering the ease with which the slender point enters; in fact, it proves an advantage, because the catching capacity of the hook is thereby considerably increased. The principle underlying this hook is doubtless very ingenious, and unless unforeseen difficulties hinder its practical application, we probably stand at the threshold of a new epoch in the history of the fish-hook.

147.—CALIFORNIA TROUT PLANTED IN ROANOKE RIVER IN JULY, 1883, RETAKEN IN JUNE, 1884.

By MARSHALL McDONALD.

There was received to-day, by express, from Capt. J. W. Sumpter, Big Spring, Roanoke County, Virginia, a California trout weighing, when fresh, about 10 ounces. This was taken in Roanoke River in the vicinity of Big Spring, and is one of 50 planted therein in July, 1883, having been hatched at Wytheville, Va., in March, 1882, from eggs taken at Baird Station, California, and forwarded by express to Wytheville.

Captain Sumpter states that this is the third trout taken, the others having been returned to the river. He says there are a great many small ones, about an inch long, in the branch and the pond, running in schools of 10 or 15 each.

WASHINGTON, D. C., *June* 16, 1884.

148.—THE FISH OF LAKE CHAMPLAIN.

By C. HART MERRIAM, M. D.

[From a letter to Forest and Stream, published February 22, 1883.]

The principal market fish of Lake Champlain are:

Perch, *Perca americana*, Schranck.
Wall-eyed pike, *Stizostedium vitreum* (Mitch.), J. & C.
Black bass, *Micropterus salmoides* (Lac.), Henshall.
Pickerel, *Esox lucius*, L.
Lake shad, *Coregonus clupeiformis* (Mitch.), Milner.
Mullet, *Myxostoma macrolepidotum* (Le S.), Jord.
Bull-pout, *Amiurus vulgaris* (Thomp.), Nelson.
Eel, *Anguilla rostrata* (Le S.), DeKay.
Sturgeon, *Acipenser rubicundus*, Le Sueur.

The above list is not supposed to include all the food-fishes of the lake, but those that are commonly sold in the markets. Of these, the pike, black bass, pickerel, and "lake shad" are by far the most important, each averaging from 3 to 6 pounds in weight, and retailing at Plattsburg for 12½ cents per pound. A few bass are taken with the hook and line and some are speared; with this important exception all the market fish are caught in nets.

What is here known as "lake shad" is a true whitefish, equal in every respect to the whitefish of the Great Lakes. How it came by its local name I cannot imagine, unless, because of its superior flavor and the absence of shad in Lake Champlain, the early inhabitants thought they would do it honor by giving it the name of the most esteemed of the food-fishes of the world. It frequently attains the weight of 8 pounds, and individuals are sometimes taken that turn the scales at 10 and even 12 pounds.

The perch are small and sell for 10 cents per dozen. The mullet averages from 2 to 6 pounds in weight, though sometimes growing to be much larger, and retails for 6 cents per pound at Plattsburg. The bull-pout weighs a pound or a little over, and sells for 8 cents per pound, dressed, or 20 cents per dozen fish, undressed. The eels average from 2 to 5 pounds, and sell for 20 to 50 cents a piece.

The sturgeons weigh from 20 to 100 pounds each, and bring, at Plattsburg, 10 cents per pound, dressed, and 8 cents undressed. Many are speared every spring when they ascend the river to spawn. They run up the Missisquoi with great regularity about the 24th of May, but the dam at Swanton, Vt., prevents them from reaching their old spawning-beds; hence, after remaining less than forty-eight hours, they return to the lake. Whether the spawn is deposited on their way out I have been unable to ascertain. On the 24th of May last, a miller speared one from the bridge at Swanton that weighed 88½ pounds, measured 6 feet 1 inch in length, and contained a bucketful of spawn. Several others were killed in the shallow rapids under the bridge at this time. The next morning sturgeon were seen sporting "like porpoises" in the deeper water below, after which they immediately returned to the lake. They occur at Swanton with such surprising regularity that many of the inhabitants keep spears in readiness for them, and I am told that they rarely vary more than a day or two in the time of their appearance.

The only fish markets of any importance on Lake Champlain are at Burlington, Vt., and Plattsburg, N. Y., the fish selling for a trifle less on the Vermont side. The hotels do not generally patronize the markets, but purchase direct from the fishermen. Practically, all the fish are taken in nets, and those caught after the latter part of April come mostly from certain parts of Grand Isle, which belongs to Vermont. In March and April seines are set to catch the fish upon and on their way to the spawning-beds. Last spring (1882) there were six large seines in the Missisquoi River below Swanton. Few escape to deposit their spawn. The same method is practiced in other rivers, and I am credibly informed that for a period of six weeks each spring from 30 to 40 barrels of fish are shipped daily from the north end of Lake Champlain alone. Most of them go to New York. Inquiries at Rouse's Point disclosed the significant fact that an average of 25 to 30 barrels pass through that place daily "for a period of at least five weeks in the months of March and April." In the spring of 1878, 20,000 pike died in a small pond in which they were placed to await "a raise" in the market price.

LOCUST GROVE, N. Y., *February* 15, 1883.

149.—A LANDLOCKED SALMON CAUGHT IN ERIE CANAL.

By WATTS T. LOOMIS.

[From a letter to Prof. S. F. Baird.]

I have just received a line from Capt. L. A. Beardslee inclosing yours asking about the "California salmon" caught here. The fish was caught in the Erie Canal at this place, and was, according to Seth Green, a landlocked salmon. A large number of landlocked salmon were placed within two or three years past upon the headwaters of the Moose River, and the way here from there is easy.

A large number of California salmon were placed in the Mohawk at this place ten or more years ago, and so far as I know were never heard from. If they visited the sea they could not get back, as Cohoes Falls stands in the way.

LITTLE FALLS, N. Y., *May* 28, 1884.

Vol. IV, No. 19. Washington, D. C. Aug. 12, 1884.

150.—ON THE POSITION AND CHARACTER OF THE FISHING GROUNDS OF THE GULF OF MEXICO.

By SILAS STEARNS.

[From letters to Prof. S. F. Baird.]

I can furnish but a general idea of the position of the Gulf fishing-grounds. We have our courses and exact spots to go to, but I do not think that in so general a search as the Albatross proposes to make they would be of much use.

Our experience has been that wherever there is rocky bottom there is good fishing. So far we have found none below 40 fathoms, when the rocks end and the muddy bottom begins. Our present fishing-grounds extend along the edge of deep water, *i. e.*, 40 fathoms from a point southwest from Pensacola light to the neighborhood of south from Cape Saint George. Inside of this belt are numerous small gullies containing coral, but they are nearly fished out and are rather hard to find. In our range the inshore spots are most numerous in 17 fathoms south from Phillips, or Ocala Inlet. Everywhere south of Cape Saint George good bottom is found closer to the shore, in fact within 2 or 3 miles of it. As can be seen from a chart it extends much farther off.

In this section rocks occur in ridges and knots rather than in gullies, and the fauna is largely different. I think that the character of the fishing-grounds of the coast would be well illustrated by examining along the following courses: Starting just north of Key West in latitude 24° 50′ N., longitude 82° W.; steer northwest 136 miles, then going gradually from the inshore to the offshore grounds; then turn inshore northeast half east to reach the grouper grounds in 7½ fathoms, at a point much fished by the Key West smacks. From this point, if the coast is followed by steering northwest by north 65 miles, many of the grounds as far as Anclote Keys, of probable future use to Lampa and other places near by, would be found; then steer west by north half north 117 miles to go over the grounds lying off Cedar Keys and to reach the eastern limit of the Pensacola, Mobile, and New Orleans fisheries. As before stated, west of this point it is only necessary to run along the edge of deep water to gain a good idea of the bottom, the fishes, &c.

There is an area, marked doubtless on most of the charts, in longitude 88° W., latitude 29° N., which we think is shoal and would furnish good fishing. If it is found to be what we suppose, it would be very convenient for the New Orleans vessels. We are interested to learn the results of experiments with trawls in these waters.

PENSACOLA, FLA., *December* 7, 1883.

RED SNAPPERS AND POMPANO.—I send by express to-day a little box containing a bottle of fine sand-worms, a bottle of sponge-like stuff which the red snappers are now feeding upon, and a few of the pompano shells. During the past month the red snappers have not been biting well, being filled with this spongy matter. We have not noticed the same kind of food in such abundance before this, and I have had a good chance to observe such things. A short time ago I had examined 450 large snappers' stomachs, and in only one case found anything but the matter that I am sending. Snappers are rapidly becoming scarce.

The "pompano shells" are the favorite food of the pompano. It is in pursuit of them that the fish come in shoal water along the sea beaches. The fishermen claim that when these shells wash ashore, pompano are present. We are getting pompano and other shore fishes from Tampa and vicinity. Other kinds, like the bluefish, have not appeared this winter, but I think they will come back some time.

PENSACOLA, FLA., *March* 8, 1884.

151.—A CALIFORNIA SALMON TAKEN IN JAMES RIVER.

By W. RUSSELL ROBINSON.

[From a letter to M. McDonald.]

It gives me pleasure to report to you the capture on the 16th instant, about 20 miles below the city, in a herring seine, of a California salmon of 9 pounds' weight. The fish was kept for me several days, but the messenger not finding me it was cut up and sold in the market. The fisherman bringing it to market did not know what it was, but it was recognized by a fish-dealer who purchased it for $1. This dealer is familiar with salmon, as he very often gets on order small lots of the Atlantic salmon frozen from New York dealers. The pink flesh and fat condition is mentioned by a gentleman who bought a part of it, and the remains of the head place beyond doubt the fact of its being a salmon. I do not know whether it was male or female. It appears to me highly improbable that the only salmon entering the river should be caught, and I have high hopes of others being reported. I have seen all the important dealers, and offered controlling price for any other that may come in. I hope to send you a fresh specimen on ice. May not climatic or other causes, as yet not understood, be the reason for such a long delay in the return of the fish from the sea. Mr. Palmer and our association are very much cheered. It is a pleasant break of the monotony that has hung over the James River salmon question for these many years.

RICHMOND, VA., *May* 26, 1884.

152.—THANKS OF THE EXECUTIVE COMMITTEE OF THE LONDON INTERNATIONAL FISHERIES EXHIBITION FOR THE PARTICIPATION BY THE UNITED STATES.

By JAMES RUSSELL LOWELL.

[Dispatch No. 666, to Hon. F. T. Frelinghuysen, Secretary of State.]

I take great pleasure in transmitting herewith a copy of a letter addressed to me by the chairman of the executive committee of the great International Fisheries Exhibition, London, 1883, requesting me to convey to the Government of the United States the special expression by His Royal Highness the Prince of Wales, by the president, and the members of the executive committee, of their gratitude for the admirable manner in which our Government has so effectively and generously responded to the appeal for co-operation in the past exhibition.

I am also requested to bring to the notice of the Government of the United States the valuable services of Professor Goode and other gentlemen in organizing the American section of the exhibition and in the jury department.

LEGATION OF THE UNITED STATES,
London, November 19, 1883.

LETTER FROM MR. EDWARD BIRKBECK, CHAIRMAN, TO MR. LOWELL, NOVEMBER 16, 1883.

I am desired by His Royal Highness the Prince of Wales, the president, and by the members of the executive committee of the International Fisheries Exhibition to request your excellency to convey to the Government of the United States the special expression of their gratitude for the admirable manner in which the Government of the United States has so effectively and generously responded to the appeal for co-operation in the past exhibition.

It has been a matter generally acknowledged by all classes of the community that it was impossible to conceive a better interpretation of the wishes of the promoters of this exhibition than that so methodically and so ably rendered by the learned and experienced staff of gentlemen who were charged by Prof. Spencer F. Baird to give the benefit of their experience and advice to us. The rapid organization and the specially successful arrangement and decoration of the United States court have been the theme and the general admiration of the public, and I trust that we may be allowed to request you to bring under the notice of your Government the eminent services of the learned Prof. G. Brown Goode, who has so worthily and actively represented the Commission of Fish and Fisheries. His services have not only been of an administrative character, but the active part which he has taken in the conferences and in the discussions which have taken place throughout the exhibition were acknowledged to be of very great benefit and advantage to all those concerned.

We would wish also to bring under your excellency's notice the service of the assistant commissioners, Messrs. Earll, Bean, Clark, and Captain Collins and the gentlemen in charge of special exhibits, who have so ably carried out the duties intrusted to them by your Government.

And, further, we cannot conclude without expressing our gratitude for the eminent services rendered in the jury department, for the whole of the Exhibition, by the following gentlemen, namely, Messrs. Earll, Hitchcock, Russell, and Clark, and also Captain Collins and Lieutenant McLellan, who were so good as to undertake the onerous duties of the jury work.

(The great International Fisheries Exhibition, London, 1883. Royal Horticultural Gardens, Exhibition Road, South Kensington.)

LONDON, *November* 16, 1883.

153.—PROPOSED PROPAGATION OF CATFISH AS A FOOD-FISH.

By DAVID S. JORDAN.

[From a letter to Prof. S. F. Baird.]

I feel very favorably inclined toward the catfish for the purpose mentioned. The two best species, so far as my experience goes, are *Amiurus nebulosus* and *A. melas.* The white cat of the Potomac (*A. albidus*) is good looking, but I have had no experience with it in life.

A. nebulosus (*catus : atrarius*) is the common cat of the Schuylkill, Delaware, Hudson, and the Great Lakes. It is the species so successfully introduced into the Sacramento, and it is now daily in large numbers sent to the San Francisco markets. I should suppose that some seining point on the Great Lakes or the Delaware River would be the best place to get this.

A. melas is darker and grows rather smaller. It is very hardy and grows rapidly, getting its full size in about three years. It is widely distributed, but I have found it commonest where I was born, in the Genesee country. I had these on the farm, when a boy, and reared them in a large frog pond, fed by rains only. They are at least not inferior to the other in hardiness or in quality as food.

Of the larger cats *A. nigricans*, reaching a weight of 25 to 50 pounds, is probably the best. In the South are numerous others of which *A. natalis*, also a small species, seems to promise most. But for the North and for other countries, *A. nebulosus* is probably best worth trying.

INDIANA UNIVERSITY,
Bloomington, Ind., April 30, 1884.

154.—BROOK TROUT FROM MONADNOCK LAKE AND CRISTINE LAKE, NEW HAMPSHIRE.

By TARLETON H. BEAN.

Curator of Fishes, National Museum.

With reference to the trout recently received from Mr. Walter J. Greenwood, fish and game warden, Dublin, N. H., I have the following communication to make: These trout have also been made the subject of a letter to Mr. Richardson from Mr. J. H. Kimball, of Hillsborough, N. H.; they have been referred to, also, in the Boston Journal of March 22, under the title of "Dublin Trout;" and are also mentioned in Forest and Stream of March 27, 1884, page 170, second column, under the title "A Peculiar Fish."

After a careful examination of the individuals received from Mr. Greenwood I arrive at the conclusion that they are the common brook trout (*Salvelinus fontinalis*), differing in no respects, so far as I can see, from the usual type of the species excepting in their pale coloration and few vermilion spots—variations which I have frequently observed in trout from widely different localities. In order to aid in determining the species I record the following characters of the Monadnock Lake trout:

It is a *Salvelinus* without hyoid teeth. The gill-rakers are 15 or 16 in number; there are about 115 tubes in the lateral line, the number of rows of scales of course being much greater. The eye equals the snout in length and is contained 4½ times in the length of the head. The maxilla reaches a little beyond the vertical from the posterior margin of the orbit and is nearly one-half as long as the head. The origin of the dorsal is nearly midway between the tip of the snout and the root of the upper caudal lobe. The length of the pectoral is one-sixth of the total without caudal. Dorsal, 10; anal, 10. Coloration, silvery gray on the upper parts, whitish below; pectorals, ventrals, and anal largely vermilion; vermilion spots on the sides, few in number.

WASHINGTON, D. C., *April* 5, 1884.

THE DUBLIN TROUT.

[From the Boston Journal of March 22, 1884.]

The peculiarities of Dublin trout have caused the speculations of anglers and others, during the last half century at least, and as the subject seems to be revived by the Dublin fish wardens, the following letter from Professor Agassiz, written about twenty-five years ago, will be interesting. After some male specimens were sent, as Professor Agassiz requested, he wrote that the examination of them only confirmed his previous opinion that the trout were specifically distinct, adding that there must be others like them found elsewhere, as nature did not make a distinct species for one little locality; this last letter cannot now be found.

DEAR SIR: I duly received the two specimens of trout which you have forwarded to me. They reached Cambridge in a perfect state of preservation, and I was not a little surprised on examining them to find that they belonged to an undescribed species. I have carefully compared them to-day with all the trout occurring in the United States which I have thus far been able to secure, from Lake Superior to Labrador, and as far south as they reach, and I find them to differ specifically from all. As the specimens are all three females, I should be much obliged if you would secure some males for me. Should so-called lake herring, or whitefish, as they are also called, be found in your waters, which I suppose to be the case, I would be much obliged if you could secure some of these for me.

Allow me to close by returning my best thanks for the specimens you have sent me, which I have at once put up in my museum.—L. AGASSIZ.

CAMBRIDGE, MASS., *October* 12.

THE CRISTINE LAKE TROUT.

I have examined the trout recently received from Cristine Lake, New Hampshire, whence they were sent by Mr. S. M. Crawford, and find them to be *Salvelinus fontinalis* (Mitch.) Gill & Jor.

The proportions and other specific characters are the same as in the Monadnock Lake trout recently reported upon, but the coloration is different. The ground color of the sides and upper parts is a rich purple, the sides are profusely ornamented with crimson spots, and the pectorals, ventrals, and caudal, even now, are largely suffused with vermilion. Another peculiarity of these trout is their elegant shape.

WASHINGTON, D. C., *April* 8, 1884.

155.—SNAKES DESTRUCTIVE TO CARP.

By RUD. HESSEL.

[From letters to Prof. S. F. Baird.]

During the past few days a great many snakes have appeared at the ponds, many of which have been killed, as follows: August 4, 16; August 5, 32; August 6, 52; August 7, 32; August 8, 39; August 9, 14; August 10, 15; August 11, 21. This makes 221 snakes killed in one week.

In the smaller snakes I found from 9 to 15 young carp, and in the larger ones sometimes over 25, besides undigested skeletons of fish. They contained no frogs or tadpoles. We can, therefore, see that one medium-sized snake devours 40 young carp per day, for they digest very quickly. That would make for 225 snakes 9,000 carp per day, and 63,000 per week. That number is correct, sir! and it shows that snakes are more injurious than cranes, herons, and other birds.

I kill them by shooting, oftentimes seeing only a small part of the head in the water, or hiding beneath water-plants. I have had opportunity to see how they catch the young fish, and how they devour them. An old wall constitutes their best hiding-place. I often shoot them sitting in the cracks of the old wall, the head looking outside, watching the poor little fishes.

UNITED STATES CARP PONDS, *August* 12, 1883.

August 15 and 16, I did not kill any snakes, by reason of the low temperature and rain. On the following days I killed 72: August 17 52; August 18, 7; August 19, 8; August 20, 5.

UNITED STATES CARP PONDS, *August* 20, 1883.

The snakes, so numerous in the ponds for some time past, have almost wholly disappeared. During the past five days I shot only 3, though watching closely for them. Since July 1 we have killed over 900, mostly by shooting.

UNITED STATES CARP PONDS, *August* 26, 1883.

During the past week I killed about 150 snakes in the west pond. To-day I killed 19. All had young carp in their stomachs.

UNITED STATES CARP PONDS, *September* 25, 1883.

156.—WHAT MUSK-RATS SOMETIMES EAT.

By CHARLES CARPENTER.

[From a letter to Prof. S. F. Baird.]

An old trapper, who trapped for years in the marshes of Sandusky Bay, tells me that musk-rats usually live on the roots and tops of water-plants, but in severe winters, when the water freezes deep, they do eat fish.

The winter of 1842 and 1843 I spent on Put-in Bay Island (South Bass Isl.). I trapped and speared a little. It was a severe winter. The shallow water froze to the bottom, and on opening some houses, I found half-eaten fish in them, which, I think, were black bass. In one house I found the remains of two fish of good size.

A few years ago I saw a musk-rat on the ice before my house, and on looking at him with a spy-glass, saw he had a large fresh-water clam which he was trying to open. Mr. S. G. Goodrich in his Animal Kingdom, page 483, says, "In winter, when hard pressed, they sometimes devour each other, and when one is wounded the others eat him."

KELLEY'S ISLAND, OHIO, *January* 29, 1884.

157.—THE DESTRUCTION OF CARP BY THE MUSK-RAT (FIBER ZIBETHICUS).—METHODS OF TRAPPING THE RODENT.

By HENRY W. ELLIOTT.

[Abstract.]

On June 10, 1883, I placed forty choice goldfish in my pond. Later in the season the water became low and so clear that the contour of the bottom and the contents of the pond were exactly revealed. On August 25 only five goldfish remained, but these had grown remarkably. No fish had been seen dead or injured, though the pond was constantly under the eyes of myself and family. No geese, ducks, turtles, water-snakes, bitterns, or kingfishers had been noticed about the pond; and, concluding that the fish had escaped at the outlet pipe, I placed a wire screen over it and dismissed the subject.

Towards the end of September I saw a large musk-rat in the pond, but the animal saw me at the same time and instantly disappeared. As I knew well that there were no musk-rat burrows in the banks of my pond, I concluded that it must live in a 6-inch tile-drain that served as an inlet pipe. Accordingly I immediately put a common steel-trap into the tile, and had the satisfaction of catching the musk-rat a few days afterwards. A neighbor told me that this was the destroyer of my fish, but I answered that the authorities denied a fish diet to the musk-rat, declaring it to live upon vegetables, grain, and mollusks. I began to think anew upon the subject, however, and called upon another neighbor, who has a large carp pond. Like myself, he was unable to account for the loss of his fish, but on drawing off his pond and finding only one large carp instead of the hundreds he should have had, and discovering seven or eight musk-rat holes in the banks, he concluded that these musk-rats were the cause of the destruction and disappearance of the fish. I have since learned that carp ponds in Virginia, Pennsylvania, and Illinois have been robbed and the fish destroyed by musk-rats.

The attention of fish-culturists should be quickly drawn to this danger, and the prompt destruction of the musk-rats may save much loss in the propagation of carp and goldfish. The nocturnal habit of the musk-rat in feeding renders trapping the only practicable method by which to get rid of this pest. A common steel-trap should be set, placed under the water at the entrance of the musk-rat's hole, a stout stake being driven into the bank above and the chain securely attached to it. The musk-rat when either coming out or going in is likely to step upon the flat trigger and is caught, when it may easily be killed.*

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*The American Field, of October 20, 1883, gives the following instructions for catching musk-rats:

"Get half a dozen of Newhouse's steel-traps. Set them near the edge and under the water in about 1 inch of water. Put upon a stick slanting out over the water and in front of the trap, a piece of parsnip. Set the trap lightly. This will catch every musk-rat, they being vegetable eaters as well as fish eaters."—C. W. S.

The hog-like character of carp in plowing up the bottom and banks of the pond, thereby keeping the water muddy and rendering themselves invisible, enables the entrance to the musk-rat's burrow to be concealed until the water is drawn off. The fry and older carp stupidly poke themselves into these burrows, thus making themselves an easy prey to these active rodents. When ice forms, and the carp settle numb and torpid to the bottom, then, in my opinion, the ravages of the musk-rat are most to be feared by the fish-culturist; but before that time he should get rid of these pests.*

CLEVELAND, OHIO, *November* 1, 1883.

158.—THE MUSK-RAT AS A FISH EATER.

By C. HART MERRIAM, M. D.

That the musk-rat is not commonly considered a fish eater is evident from the absence of reference to such habit in the published accounts of the animal. Robert Kennicott is, so far as I have been able to ascertain, the only author who mentions this trait. He says: "Except in eating mollusks, and occasionally a dead fish, I am not aware that this species departs from a vegetable diet." ["Quadrupeds of Illinois Injurious and Beneficial to the Farmer," 1857, p. 106.]

At a meeting of the Biological Society of Washington, held in the National Museum, December 14, 1883, Mr. Henry W. Elliott spoke of the "Appetite of the Musk-rat." He stated that in certain parts of Ohio the musk-rat did great injury to carp ponds, not only by perforating the banks and dams and thus letting off the water, but also by actually capturing and devouring the carp, which is a sluggish fish, often remaining motionless, half buried in the mud. In the discussion that followed, Dr. Mason Graham Ellzey said that from boyhood he had been familiar with the fact that the musk-rat sometimes eats fish. In fact, he had seen musk-rats in the act of devouring fish that had recently been caught and left upon the bank. The president, Dr. Charles A. White, narrated a similar experience.

On the 7th of February, 1884, I brought this subject to the notice of the Linnæan Society of New York, and asked if any of the members knew the musk-rat to be a fish eater. Dr. Edgar A. Mearns said that he had long been familiar with the fact, and that it was no uncommon thing to see a musk-rat munching a dead fish upon the borders of the salt marshes along the Hudson. He has shot them while so engaged.

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*Under date of November 16, 1883, Dr. Hessel, superintendent of the Government carp ponds at Washington, says: "The musk-rats have now taken to their winter quarters, and not one is to be found at the ponds. Four weeks ago I smoked out all their holes with sulphur and saltpeter. I then filled them up with earth."—C. W. S.

He further stated that the musk-rat is very destructive to nets, destroying the fishermen's fykes in scores by entering them in quest of fish and then tearing the nets in order to escape.

Dr. A. K. Fisher said that at Sing Sing, N. Y., he had often known musk-rats to enter fykes, sometimes drowning, but oftener escaping by gnawing the meshes, thus doing considerable injury to the nets. He supposed they entered the nets because placed in their line of travel. He further stated that he knew that fykes made of fine wire were used with success in capturing these animals.

Mr. William H. Dall, the well-known Alaskan explorer, now of the Coast Survey, kindly favors me with the following: "In July, 1863, I visited Kankakee, Ill., on a collecting tour for river mollusks. You know how musk-rats throw up mounds of the shells they dig out. I examined many of these for *unios*, &c. On several I saw the skeletons of fish (chiefly suckers, I believe), partly or wholly denuded of their flesh, and showing the marks of musk-rat, or, at least, rodent teeth. I also saw the shell of a common mud-turtle so gnawed and in the same situation. I did not see the animal in the act of feasting, which, I believe, is done chiefly at night; but I have no doubt that the fish and turtle were eaten by the musk-rat as well as the mollusks associated with them in the same pile."

Under date of March 5, 1884, I received from Dr. Fisher the most valuable record yet obtained concerning the habit in question. Dr. Fisher writes: "A few days since two young men were fishing through the ice for pickerel, with live bait, at Croton Lake, Westchester County, New York. Several times they were troubled by having one of the lines pulled violently off the bush and run out to its full length. Finally they saw the line start again, and pulling it up quickly they landed a large musk-rat on the ice."

Here is an authentic instance, not of a musk-rat eating dead fish on the bank, but of actually capturing a live fish in the water under the ice. Fortunately the fish was attached to a hook and line, and the musk-rat was caught and killed.

In the year 1820 there appeared in a New York newspaper (The Statesman) a series of articles entitled "Letters on the Natural History and Internal Resources of the State of New York, by Hibernicus." They were reprinted in book form in 1822. Their real author was Governor De Witt Clinton, a man of letters, eminent as a statesman, distinguished as a scientist, and justly celebrated as a philosopher. In the ninth letter he speaks of the musk-rat as the most formidable foe of the canal, stating that it perforates the banks and thus lets off the water. Respecting this animal as a fish eater, he says: "In winter, when the water is frozen, musk-rats go under the ice and prey on the fish. They are very destructive to trout, which is already in the canal."

LOCUST GROVE, N. Y., *March* 29, 1884.

159.—NOTES ON A DISEASE AFFECTING CRAWFISH IN GERMANY.*

By C. RAVERET-WATTEL.

The disease affecting crawfish, which is now doing so much damage in France, rages with perhaps even more severity in some parts of Germany and Austria, where this epidemic is the object of the research of many investigators whose labors have often been mentioned in the *Bulletin* of our society. One of the last numbers of the periodical of the German Association of Fish-culture† contains some information on this subject which has seemed to me worthy of recapitulation, because it states some new facts which it may be useful to record.

Max von dem Borne, founder of the important fish-cultural establishment at Berneuchen, has observed the progress of this disease in the Mietzel River,‡ a stream 60 kilometers [about 33 miles] in length, which flows from the Lake of Soldin and empties into the Oder River near Clewitz. The Mietzel, which is unfortunately obstructed by eight dams which hinder the passage of fish, is a stream abounding in fish, and moreover greatly esteemed until recently for the abundance and size of its crawfish.

"At Berneuchen," says Max von dem Borne, "where the river belongs to me for about 10 kilometers [about 6 miles] we have also this year (1883) taken many crawfish, which have been made use of at the time of reproduction." During the first fortnight of September they began to see these crustaceans leave the water and scatter along the banks for several yards. On the 10th of that month they could still make a good catch. But soon a sort of migration took place; the crawfish seemed to flee, to abandon the Mietzel. Numbers of them, large and small, dead or dying, could be found daily on a horizontal metallic lattice placed at the mouth of the brook for trout. Most of them were mutilated, having lost one or more members. On September 14, sixty of these crustaceans, kept in a well-boat in the middle of the river, died in a mass, and on proceeding to fish the river on the 16th and 17th, it was learned that there was not a single living crawfish left.

It was in 1880, and from the Oder, that the disease began to invade the lower course of the Mietzel. The following year it ascended as far as the dam of the metallurgical works at Kutzdorf. In 1882 it appeared further up. Finally, in 1883, one could see it gain ground and hasten its advance from month to month, for, during the month of October alone, it passed over two dams. The waters of the Mietzel are not pol-

* *La maladie des Écrevisses en Allemagne.* From the *Bulletin Mensuel de la Société Nationale d'Acclimatation de France.* February, 1884, p. 200. Translated from the French by H. P. JERRELL.

† *Circulare des Deutschen Fischerei-Verein,* 1883, No. 5.

‡ Max von dem Borne, *Die Krebspest in der Mietzel.*

luted by waste matters from any manufacturing establishment; the appearance of this epidemic, therefore, cannot be attributed to this cause. Moreover, symptoms of disease have never been noticed among the fish inhabiting this river.

Max von dem Borne proceeded to experiments, which seem to show that the cause of the disease is found, if not in the water, at least in the mud of the river. He said:

"I caused to be sent me by a leading fisherman of Soldin (a locality further up the river than Berneuchen, and not yet contaminated) some perfectly healthy crawfish, which I placed in a cemented trough at my establishment. This trough was traversed by a strong current of water coming from the Mietzel, and the bottom was covered with a layer of mud taken from the same river, but no diseased or dead crawfish was put in this trough. Nevertheless, at the end of nine days all the healthy crawfish which I had placed there began to show signs of disease, and in a day or two afterwards all were dead. I always noticed the following symptoms: The crawfish contracts on one side; it continually rubs its head and eyes with its walking claws; the whitish color of the lower part of the abdomen becomes red; and the animal lies on its back and dies. It is worth saying, however, that the crawfish which I placed under observation on the 18th and 26th of last November have remained perfectly healthy up to the present, and they are even occupied in spawning."

At the request of Max von dem Borne, von Linstow*, physician of the staff-office at Hameln, has given special attention to this disease among crawfish, and the examination of a great number of these crustaceans which he has made leads him to admit that he is certainly in the presence of a parasitic disease. Dr. von Linstow has also stated that the disease propagates itself in ascending watercourses. As soon as they feel the disease the crawfish become restless. Generally they leave the water, wander around on the banks, and on the way usually lose some claws and often their pinchers, and finally they lie on their backs and die.

Like Max von dem Borne, Dr. von Linstow believes that the water contains the cause of the mischief, and that it serves as a vehicle for it. He has seen, in fact, that if healthy crawfish coming from localities as yet uncontaminated are placed in streams where the epidemic rages, these crustaceans are quickly attacked by the disease and destroyed in a little while.

Dr. von Linstow says: "The researches made with a view of discovering the cause of the evil have given rise to different opinions. According to Professor Harz, of Munich, the disease might be caused by the trematode, now for a long time known under the name of *Distoma cirrigerum*, which might invade the muscles of crawfish in great numbers. My attention was then immediately directed to this parasite, but

* *Mittheilungen des Herrn Dr. von Linstow in Hameln über die sogenannte Krebspest.*

I have not found a single member of this species in the many diseased or dead crawfish which I have examined. In consequence, it is perfectly clear to me that it is not this parasite which does the mischief. I will mention some leeches, some *Branchiobdella astaci*, Odier, and *B. parasita*, Henle, as well as some psorospermic corpuscles 0.15 millimeter [.0059 inch] in length, a few of which were found in the thorax of certain crawfish. By analogy with what takes place in various contagious diseases, some persons have been led to think that a cryptogamic growth could be the cause of the mischief. But the results reached in following out this hypothesis have been entirely in the negative. On the contrary, it is certain that nearly all the organs of the diseased crawfish—the tissues of the heart, the cavity of the stomach and also of the intestines, the nerve ganglia, most of the muscles, the adipose tissue, the gills, &c.—are full of a multitude of little ovoid, cellular substances, which sometimes accumulate in such quantity at certain points that the organs are torn asunder. This accounts for the frequent loss of claws. These ovoid corpuscles measure 0.02 millimeter [nearly .0008 inch] in their longest diameter and 0.013 millimeter [about .0005 inch] in their shortest diameter. They can easily be colored red by picrocarminic acid."

How do these corpuscles get into the organs of the crawfish? This is difficult to explain. We do not find that they make any kind of motion, even when we get them from crawfish which have scarcely ceased to live. It is supposed that these cellules spread progressively in the water during the decomposition of the dead crawfish, and that in this new condition they continue a certain development. "I have no doubt," says Dr. von Linstow, "that they belong to the animal kingdom and to the sub-kingdom of Protozoa, and it is probable that in its perfect state the parasite should be classed among the Gregarinidæ or the Amœbea."

The question of learning whence these corpuscles come, and how we can protect the crawfish from them, remains as yet entirely unanswered; but a step is taken towards its solution when we discover the enemy to be opposed. Henceforth the problem to settle, as Dr. von Linstow continues, would be, so Dr. Leukart thinks, that of the cultivation of this parasite outside of the organs of the crawfish; and if its development can be attained under these conditions we shall doubtless arrive at the determination of the question by what means and in what manner the parasite finds its way into the tissues of the crawfish.

When we consider the difficulty there is to distinguish, without the aid of the microscope, the diseased crawfish from those which are healthy, we can ask whether the consumer has not some risk to run from the putting up for sale of crawfish which were already somewhat affected. The reply, Dr. von Linstow affirms, is that the crawfish, even though diseased, can be consumed without any fear, because the protozoan which causes the disease is not among the number of the parasites of man, and also because it is inevitably killed by cooking the crawfish.

In conclusion, I would add that according to Mr. Oscar Micha, who carries on both at Berlin and at Cologne a considerable trade in crawfish, a few very young crawfish are beginning to reappear in many of the streams where extermination was complete and where no attempt at restocking has yet been made. Now, as in these streams no adult crawfish was able to escape destruction—when, on the one hand, the immigration of individuals coming from uncontaminated localities seems improbable, and when, besides, we meet no specimen of an age capable of reproduction—we are led to think that the young crawfish which appear were born before the invasion of the epidemic, which they alone have been able to resist. In this case the immunity which they would have enjoyed should be attributed to the fact that the very young crawfish have the habit of burrowing and passing the first part of their existence at a great depth in the beds of the rivers. In their holes, where they often are more than a meter [yard] from the water, no doubt they can escape the action of certain noxious influences and of certain principles of disease carried by the water. Thus it could be explained how the epidemic, which could have brought about the disappearance of all the crawfish of a river, has nevertheless spared those crustaceans which were out of its reach under the protection of a thick layer of earth. New observations will doubtless permit it soon to be settled in this respect.

160.—FLOATS FOR THE SO-CALLED FATTENING OF OYSTERS.

By JOHN A. RYDER.

[From a letter to Prof. S. F. Baird.]

You have sent me some letters regarding Weems's floats for fattening oysters. What their structures are like I do not know, but doubtless some one has a patent on them.

The simplest and most practical structures of the kind which I have seen are the storage and fattening floats used by Mr. Conger, of Franklin City, Md., and now in use by all the shippers and planters in the vicinity of Chincoteague Bay. I have already described them briefly in my paper on the result of the work at Stockton, although I have been informed that similar structures, or rather structures serving similar purposes, are in use on the oyster-beds along the shore of Staten Island, New York.

It is probably a fact that in all of these contrivances they take advantage of the effect produced by fresher water upon oysters which have been taken from slightly salter water. The planters of Chincoteague call this "plumping the oysters for market." It does not mean that the oysters are augmented in volume by the addition of substantial matter, such as occurs during the actual appropriation of food, but only that the vascular spaces and vessels in the animals are filled with a larger relative amount of water due to endosmose. It is a dealer's trick to give his product a better appearance in the market, and as such I do not think deserves encouragement, but rather exposure.

Mr. Conger, who claims to have been the originator of the floats used in Chincoteague Bay, has actually resorted to warming fresh water to 60° F. in winter by steam pipes running underneath the wooden inclosure surrounding the "fattening" or "plumping" float. One good "drink," as he expressed himself to me, renders the animals fit for sale and of better appearance.

Conger's floats are simply a pair of windlasses supported by two pairs of piles driven into the bottom. Chains or ropes which wind upon the windlasses pass down to a pair of cross pieces, upon which the float rests, which has a perforated or strong slat bottom, and a rim 18 inches to 2 feet high. These floats I should think are about 8 feet wide and 16 feet long, perhaps 20. These structures are usually built alongside the wharfs of the packing and shipping houses and are really a great convenience in conducting the work.

WASHINGTON, D. C., *November* 1, 1883.

"WEEMS'S" FLOATS FOR FATTENING AND IMPROVING OYSTERS.

We have just commenced our business and have very flattering prospects of success. I inclose a letter received from one of our patrons, which I will be glad if you will kindly read and return to me.

On Saturday last I took a load on one of our floats (about 5 p. m.) and returned the oysters to the party's wharf Sunday afternoon. The oysters were shucked Monday morning. Before they were fattened, a tubful shucked 6 quarts "ordinary" and 2 quarts "selects"; after they were fattened the same quantity shucked 6 quarts "ordinary" and 4 quarts "selects." Besides the increased quantity, the party said the condition and flavor of all were much improved. The water is yet comparatively warm, but as soon as we have a good frost that will cool the water we are confident of getting much better results.

The process until now has been a monopoly (although the means used are greatly inferior to our float), controlled by Mr. D. D. Mallory and his successors, Messrs. A. Boot & Sons, who used their process with great satisfaction and profit. Messrs. H. F. Hemingway & Co., L. W. Counselman & Co., and William Taylor, esq., of this city, have had considerable experience in fattening oysters, and it will no doubt afford them pleasure to give you any information on the subject you may desire.—L. N. COX, *Manager*.

BALTIMORE, MD., *October* 25, 1883.

The result of our experience with your float, coupled with our thorough practical knowledge of oysters, enables us to pronounce your float a success, and we recommend its use to every oyster-packer in the country.

We think you can with safety prepare to do a large business in floating oysters, as a single practical test will demonstrate beyond a doubt the great advantage in the way of increased quantity and improved quality and condition of the oyster after floating to be gained by the use of your float. Your charge of 5 cents per bushel for the use of your floats is very moderate and reasonable.

If you can do the work, and will make it known that you are prepared to do it, we think that within three weeks you will be working for every packer of any consequence in the city, and that you will be taxed to your utmost to fill the demand that will be made upon you. After October 1 probably we will require two of your floats every day.—H. F. HEMINGWAY & Co.

BALTIMORE, MD., *September* 24, 1883.

161.—THE COLUMBIA RIVER SALMON—A HATCHERY NEEDED.

By E. C. HOLDEN, Secretary.

The Astoria Chamber of Commerce respectfully asks for the establishment of a salmon hatchery, by the General Government, on the Columbia River or its tributaries.

It is expected that the railroad will be connected with the river, forming a continuous uninterrupted line across the continent before the month of August, 1883, and in time to distribute any spawn taken in that year.

The Columbia River salmon for distribution would be unequaled, while the restocking of the parent waters would be of great value. The catch on the Columbia in 1882 was not less than 1,600,000 fish, and surely so great an industry and consumption needs fostering. We exported from the Columbia River, in 1882, 540,000 cases, valued at $2,900,000. There are 24 salmon canneries now at Astoria and 10 more within 30 miles, representing a permanently invested capital in ground, buildings, machinery, &c., of at least $850,000. No other river in the United States produces so fine a quality of salmon (*quinnat*); it is preferred in every market of the world, has more oil and a finer color and flavor, and commands an average of 15 per cent in price over the product of any other river.

ASTORIA, OREG., *December* 29, 1882.

Vol. IV, No. 20. Washington, D. C. Aug. 12, 1884.

162.—BRIEF NOTES UPON FISH AND THE FISHERIES.

By CHAS. W. SMILEY.

[Mainly extracts from the official correspondence.]

CAUSE AND CURE OF MUDDY FLAVOR IN FISH.—J. M. C., writing in Forest and Stream, of March 6, 1884, says that three years ago, during the months of June, July, and August, the creeks in Fillmore County, Minnesota, were teeming with brook trout, and he seldom, in a day's fishing, failed to take 50 fish, averaging half a pound each. Now, he is satisfied with half a dozen of the same average weight. The first great cause of the decrease was the breaking up of all land that could be tilled for wheat. The wash from plowing filled the streams with mud, and no suitable places were left for spawning. He says that trout caught when the streams are muddy lose all their flavor, while in from five to eight days after the water becomes clear they are as fine-flavored as before the flood. Last summer, from the middle of May to the last of June, he caught from one to five bass nearly every day. When the water was muddy the bass were contaminated; when clear, they were free from any taint of mud. The past five years grangers have paid more attention to stock-raising, and have seeded down the valleys, hence the wash is small. Plants are again growing in the running brooks, affording cover for trout, and their quality has improved.

M. P. Peirce, speaking of the edible qualities of carp, illustrates the same fact by Jersey chickens, which are raised on offal, and then fed on pure food and clean water for a short time prior to being offered for sale.

VITALITY OF CARP DEPRIVED OF WATER.—In a letter dated Charlottesville, Va., March 18, 1884, Mr. R. T. W. Duke writes:

"On Saturday evening I caught *with a hook* a carp which would weigh about 4 pounds. I put it in my bath-tub filled with water. Yesterday, about 8 o'clock a. m., I put the carp in a small box surrounding it with wet moss and forwarded to Lynchburg by express. It reached there about 4 p. m., and I learn this morning from my friend to whom it was sent that when taken out and placed in a tub it was as lively as could be. We ate a small carp Sunday morning and thought it very good."

DANGER OF CONFUSING PURE GERMAN CARP WITH THE POOR HYBRIDS OF NATIVE WATERS.—Replying to an inquiry about the carp in the Hudson River, Professor Baird says:

"I cannot speak positively in regard to the action of Captain Robinson in connection with the carp.* I can only say that I have examined

* Reference to Capt. Henry Robinson's carp will be found on p. 25, Bull U. S. F. C., 1882; and on p. 266 of this volume.

numbers of specimens of the so-called carp of the Hudson River, and found it to be essentially a goldfish, reverted to its original condition. I think it likely that Captain Robinson's carp were the so-called Russian carp, a very inferior variety, which had hybridized with the goldfish introduced at the same time by him or some one else, and producing a combination without the virtues of either. I can at any rate say that the fish introduced by the United States Fish Commission are totally different from any previously in Eastern waters, and of much superior quality as an article of food. Some years ago, when at Sing Sing, I examined several cart-loads of so-called carp, with the result indicated. I have since examined various fish sold as carp in the New York market, and with the same results."

THE FOOD VALUE OF THE CARP.—When writing to Hon. J. G. Carlisle, Speaker of the House of Representatives, January 4, 1884, Professor Baird said: "There is naturally much difference of opinion as to the value of the carp as an article of food. No one who has at his command the choice fishes, such as salmon, trout, whitefish, mackerel, sheepshead, red snapper, &c., would be likely to attach a high value to the flesh of the carp. But in Germany and Austria it constitutes the principal article of consumption in the interior, and brings precisely the same price in the city markets as the native trout. In Berlin it brings about 25 cents per pound. Much, of course, depends upon the mode of cooking and the idiosyncrasies of the taster.

"What we claim, in patent specification parlance, is to furnish a fish which can be reared with a minimum of labor in waters of any character—warm or cold, muddy or clear, confined or extended—and one that will attain an enormous growth in a very short time, and by its readiness to live on vegetable offal, will convert such substances as corn, pumpkins, squashes, cabbages, wild rice, seeds of aquatic plants, &c., into wholesome animal food in countries where other varieties of such food cannot be obtained. It may safely be stated that a given amount of vegetable matter fed to carp will produce twice as much flesh as when given to pigs or poultry."

CARP IN SUSQUEHANNA RIVER.—Mr. A. C. Krueger, of Wrightsville, Pa., July 22, 1884, reports a carp weighing about 4 pounds, being taken in a set-net below the Columbia dam on the Susquehanna. It had doubtless escaped from some private pond, but may have been in the river some time.

CARP IN LAKE ERIE.—Mr. C. Sterling, secretary of the Michigan State Agricultural Society, writing from Monroe, Mich., December 10, 1883, reports that one of the Monroe fishermen had found in his catch of whitefish a fine specimen of German carp, which weighed 3¾ pounds. The pond from which it was taken was located in Lake Erie, about three-quarters of a mile from the mouth of the Raisin River.

PRICE-LIST OF CARP, GOLDFISH, AND SILVERFISH.—Mr. H. W. C Muth, of Mount Healthy, Hamilton County, Ohio, who received 40 carp from the United States Fish Commission December 15, 1880, is successfully rearing them for sale. His price-list for 1883 was as follows:

German carp (scale, mirror, and leather): 25 for $3; 50 for $5; 75 for $7; 100 for $8; 10 per cent off for 500 or more.

Fringe-tailed goldfish (red, pearl, and variegated): 25 for $8; 50 for $15; 75 for $20; 100 for $25; 10 per cent off for 300 or more.

Goldfish (red, pearl, and variegated): 25 for $4; 50 for $6; 75 for $8; 100 for $10; 10 per cent off for 300 or more.

Silverfish: 25 for $1; 50 for $1.50; 75 for $1.75; 100 for $2; 10 per cent off for 500 or more.

PRICES OF SCALE AND MIRROR CARP.—Charles S. Medary, Passaic Valley Carp Fisheries, Little Falls, New Jersey, submits the following price-list of carp:

"Mirror carp, ten months old, $75 per 100; mirror carp, ten months old, selected, $85 per 100; scale carp, ten months old, $70 per 100; scale carp, ten months old, selected, $80 per 100; special rates on large orders. In warm climates these fish will grow to 14 or 16 inches long by November next, and many will spawn this year. In northern climates they will grow to 8 or 10 inches by November next, and spawn next year. Orders must be accompanied by remittance. No orders filled for less than $25. Cans for shipping, $2 to $3, according to size."

THE CARP REARED BY THE UNITED STATES FISH COMMISSION IN 1878.—In a report upon the distribution of carp prior to July 1, 1881 (Report of the Commissioner for 1882, p. 943), it is stated that carp were first brought to Washington in the spring of 1878, and that they "first spawned in 1879." It appears from the following letter by Professor Baird to an applicant, and dated December 10, 1878, that a few young were reared that season, but that none were taken from the ponds for distribution:

"The only way of securing the carp is by drawing off the water of the pond in which they are confined, and storing the fish of different grades, sizes, and species in separate reservoirs until the original ponds fill up again, when the breeding fish are restored to their place. The young fry can then be taken at any time and shipped to destination.

"As the construction of these reservoirs involved extensive excavations in a malarious part of Washington and the exposure to the air of some fifteen acres of mud and rank vegetation, it was considered inexpedient to commence the work until the occurrence of frost or even ice about Washington should give the assurance that no injury to the public health was likely to result, this feeling of course being intensified by the yellow-fever epidemic of the present year and the fear of involving the city in any evil consequence.

"It was not until early in November that the work upon the reservoirs could be commenced, and this once begun, although prosecuted with great vigor, was retarded by bad weather, the defection of workmen, the difficulty of obtaining the proper kind of cement for the brick-work, and other causes beyond our control; and it was not until the beginning of December that these reservoirs were finished and ready for use.

"By this time, however, it was ascertained that the carp had gone into winter quarters by burying themselves in the bottom of the pond, and, as the drainage of these ponds would leave the fish in the exposed mud and involve their certain death, it was considered necessary to defer further action until the coming spring. Probably in the early part of April the work will be begun and the stock of young fish available for distribution ascertained.

"It is, of course, impossible to say now in what numbers this stock exists, but we hope to be able to supply a considerable portion, at least of the applications already on file. In any event we shall have a much larger number of breeding fish in 1879 than we had in 1878, and we have every reasonable assurance that in the summer of next year a supply of fish will be available sufficient to meet the current requirements."

THE CARP TRADE IN AUSTRIA.—From one estate in Southern Bohemia from 370,500 to 492,000 pounds of carp are sent to Vienna annually.

MARSH-HENS AND NIGHT-HERONS CATCH CARP.—Under date of July 17, 1883, Dr. Rud. Hessel writes: "The other day I shot a marsh-hen with 38 young carp in the stomach and a night-heron containing the heads of 78 young carp."

CARP SENT TO THE SANDWICH ISLANDS.—Writing from Wailuka, November 17, 1882, F. H. Enders, M. D., says: "On August 27, 1882, 20 carp, recently arrived from California, and measuring from 1 to 1½ inches in length, were placed in a pond about 150 feet square by from 1 to 5 feet in depth. It is supplied with water from a spring. On November 15, 1882, the pond was drained and 15 fish found, none of which measured less than 11½ inches and some were 13 inches in length and very fat. The water of this pond contains about 1 per cent of iron and a dense growth of moss from top to bottom. It is prolific in tender buds and shoots, upon which the fish subsist, as they have never been fed since being put in the pond. These fish, I presume, will spawn in a few months, when we hope to raise at least 10,000 next year, as they have no enemies to disturb them."

CARP SENT TO CUBA.—I have received by the steamship Newport, of New York, two large cans containing twenty-six live German carp. Three of them died during the trip, and as I was obliged to keep them in the cans for a day while I found a place to put them until I could take them to my farm, seven of them died during that day. I suppose it was on account of the heat they felt on the sudden change of climate. I have the rest in a very large fountain in the open air, and I have no doubt they will be all right.—J. N. ODVARDS.

HAVANA, CUBA, *March* 17, 1883.

CARP SENT TO BRAZIL.—It is with pleasure I report the safe arrival of thirteen beautiful specimens of the survival of the fittest out of one hundred carp which was shipped to me from New York by steamer Borghese. They were thirty-nine days at sea. The greater portion of them died before the steamer reached St. Thomas. None died during the last ten days of the voyage. Your instructions for keeping them were not carefully observed. The person who had them in charge fed them on hard-boiled eggs.—J. W. COUCHMAN.

RIO DE JANEIRO, BRAZIL,
Rua do Ouvidor, No. 130, *January* 6, 1883.

In a letter dated January 24 Mr. Couchman writes that, owing to an accident to the tub in which he was keeping the thirteen carp pending the completion of his pond, all but four perished. These four had been making rapid growth.

CARP, GOLDFISH, IDES, AND CATFISH HANDLED AT CENTRAL STATION.—Mr. J. E. Brown makes the following statement of the number of pond fish handled at Central Station during the season of about eight months ending June 1, 1884:

Leather carp:	
Received	149, 500
Shipped by express and car	148, 768
Scale carp:	
Received	19, 178
Shipped by express and car	14, 341
Mirror carp:	
Received	12
Shipped by express and car	8
Goldfish:	
Received	4, 100
Shipped by express and car, or delivered to applicants	3, 514
Golden ides:	
Received	24
Shipped	19
Catfish:	
Received	150
Shipped by car	100

Some of the fish were in very poor condition when received, particularly the scale carp, in which there was considerable loss.

WASHINGTON, D. C., *June* 7, 1884.

SHIPMENT OF ADULT CARP TO SOUTH CAROLINA.—The transportation of adult fish is very rarely attempted, especially as the Commission is not able to furnish them to applicants. Very unusual circumstances, however, made it desirable to send twenty large carp to Mr. B. J. Donaldson, Georgetown, S. C. Messenger F. L. Donnelly took charge of them at 5 p. m., April 10, 1884, and left Washington via Atlantic Coast Line Railway, reaching Georgetown at 4.40 p. m., April 11. As Mr. Donaldson's plantation is located on an island in the river several miles above Georgetown, it was necessary to keep the carp at that place overnight. Notwithstanding the close attention given them, one of the smaller died. The other nineteen were delivered safely on the following morning.

THE LARVÆ OF MOSQUITOES AS FOOD FOR CARP.—Lahaway makes the following statement in Forest and Stream: "Does the carp feed on the mosquito in its larval form of 'wiggler' and 'tumbler'? From a fact that came under my observation last summer I am decidedly of the opinion that they do. My carp ponds, four in number, are located in Ocean County, New Jersey, in the cranberry region, where, as is well known, mosquitoes do abound. Three years since I constructed a pond of about five-eighths of an acre but a short distance from the house, and was not mistaken in my supposition that this pond would not tend to diminish the supply of mosquitoes. But last May I placed in this pond a few carp, received from the Government the preceding autumn. In August last, when bitter complaints were uttered all over the country at the abundance of mosquitoes, we had very few, so few indeed that my attention was attracted by it. Some carpenters in my employ at the time reported that while on their way to my place they were 'nearly eaten up' by these pests, but when they got there they ceased to be annoyed by them.

"The female mosquito, as is well known, deposits her 250 or 350 eggs on the surface of quiet water. These hatch out in a few days, and are known to many country people as the 'wiggler.' In ten to fifteen days these are changed into 'tumblers', in which form they remain five to ten days, thus spending from fifteen to twenty-five days in the water before they become denizens of the air and acquire their musical and phlebotomizing capacities. The carp doubtless find their larvæ most palatable tidbits, that are greedily sought after. In one particular the chosen habitats of carp and mosquitoes are alike, both delighting in warm waters."

OCEAN COUNTY, N. J., *February* 12, 1883.

FISH BUREAU IN PORTLAND, ME.—About April 1, 1884, a fish exchange was organized in Portland, Me., with forty-two members. Mr. George Trefethen was made president and Mr. O. B. Withen, secretary.

SHAD HATCHING IN CONNECTICUT.—Last season Mr. Henry J. Fenton, by direction of the State commission, went to the fisheries of Farmington River, and as the shad were caught collected the spawn, after which the fish were taken to market. From these eggs he raised 3,200,000 young, and turned them into the same river to return three or four years hence.

CALIFORNIA TROUT IN DELAWARE RIVER.—The American Angler, of April 5, 1884, announced that California trout are making their appearance in Delaware River, a boy having taken a two-pounder near Narrowsburg, N. Y., March 28, 1884.

SHEEPSHEAD ABUNDANT.—Writing from New York, June 12, 1884, Mr. E. G. Blackford reports the catch of sheepshead along the coast from North Carolina to Long Island as exceptionally large and of good quality. They sold as low as 5 cents per pound during the first week of June.

ON THE WEIGHT OF BROOK TROUT.—On page 9 of the Bulletin for 1882 of the United States Fish Commission, Livingston Stone has given some weights of *Salmo fontinalis* (*Salvelinus*). Professor Agassiz pronounced the Rangeley trout to be true *Salmo fontinalis*. The trout in question, said to have been caught by Mr. Page, but really caught by my colleage, Mr. Stanley, weighed 10 pounds, and was a true *fontinalis*. The *Salmo oquassa* never attains a greater weight than 6 or 7 ounces; it is peculiar to Rangeley and Moostocmaguntic Lakes. Mr. Stanley, some three years since, in dipping for *oquassa* or blue-back trout in October, caught in his net a *Salmo fontinalis* of the enormous weight of 12 pounds.—E. M. STILWELL.

BANGOR, ME., *September* 17, 1882.

A LARGE HERRING.—A herring measuring 13 inches in length, 7 inches in girth, and weighing 12 ounces, was forwarded by Mr. Wilson, fishery officer, March 28, to Prof. Cossar Ewart, Edinburgh University. The herring, which is a splendid specimen, was caught about 3 miles south of Girvan, off Ardmillan Point, by Dugald Robertson, Campbeltown, in the seine trawl-net. [Edinburgh Scotsman, March 29, 1884.]

A METHOD OF DESTROYING NOXIOUS FISHES.—The method frequently adopted by fish-culturists to destroy noxious fishes is to introduce quicklime into the pond. This for a time exerts a very destructive influence, but before long becomes inert by slaking and forming a harmless combination. If the water is drawn off after liming, of course it would be very much better, and at the end of a week carp or any other fish could be introduced.

Dr. Rud. Hessel, superintendent of the carp ponds, said, November 23, 1883: "Some four hundred eels have been killed during the last eight days in the east pond, and there are still more. One barrel of lime is required to exterminate them."

TANKS FOR TRANSFERRING FISH FROM THE MISSISSIPPI RIVER TO KANSAS.—The following is extracted from a letter of W. S. Gile, of the Kansas State fish commission: "My plants of native fish in the streams of the State this season were an entire success. In order that I might plant fish of such size as to become spawners the coming season I had some zinc tanks made and incased with wood holding about two barrels of water, laid them down, had a hole cut in the top at one end large enough to put in and let out the water and fish, filled the tank two-thirds full and set it endwise with the car to prevent too much slopping, and aerated when the cars were standing with an air pump with about 6 feet of hose attached. In this way I transported nine varieties of fish caught in the Mississippi over 500 miles with good success. Each plant contained two varieties of pike a foot long."

VENANGO, KANS., *December* 27, 1883.

MENHADEN, HERRING, EELS, AND LOBSTERS.—Mr. Willard Nye, jr., writing from New Bedford, Mass., November 23, 1883, says: "The latter part of October there were a good many menhaden in the Acushnet River, and the middle of this month they were quite plenty around Montauk Point, Long Island. The fishermen speak of there being considerable increase in the schools this year over last. They have caught a good many of those fall herring in the traps around here for the past month, and they are as round and fat as mackerel, if not more so. If potting for eels is not stopped soon, they will exist only in the memory of the inhabitants when they used to be plenty. I was surprised at the number of lobsters crawling around on the sand shoals—south of Gardner's Island, Long Island Sound—and there did not seem to be many fishermen to catch them—perhaps this explains it."

Inspections of marine products in the District of Columbia for eleven years ending June 30, 1883.

[From the reports of the health officer.]

Years.	Shad.	Herring.	Bluefish.	Fish (bunches).	Sturgeon.	Oysters (bushels).	Clams.	Crabs.
1873	852, 900	3, 789, 800	326, 200	553, 761	496	448, 557	524, 000	336, 600
1874	628, 637	6, 567, 240	89, 841	567, 291	919	569, 372	1, 163, 000	297, 250
1875	464, 215	1, 674, 465	56, 430	557, 203	1, 240	305, 737	1, 110, 725	446, 525
1876	319, 079	1, 488, 950	47, 500	483, 111	919	355, 437	704, 975	316, 498
1877	131, 199	2, 572, 124	5, 450	361, 749	635	295, 997	863, 470	347, 415
1878	121, 785	2, 507, 500	40, 425	271, 727	1, 060	351, 317	938, 225	366, 450
1879	327, 537	3, 497, 259	70, 570	219. 635	952	316, 377	148, 079	584, 661
1880	321, 235	6, 858, 839	253, 458	179, 556	1, 094	361, 427	1, 301, 750	698, 780
1881	462, 517	9, 628, 683	349, 483	201, 444	1, 124	319, 702	994, 390	342, 344
1882	350, 309	6, 439, 635	164, 757	211, 268	1, 759	359, 354	989, 921	364, 508
1883	258, 711	4. 960, 426	61, 310	296, 419	1, 752	353, 402	1, 247, 064	587, 335
Total	4, 238, 124	49, 984, 921	1, 465, 424	3, 903, 164	11, 950	4, 036, 679	9, 985, 599	4, 688, 375

SUCCESSFUL INTRODUCTION OF LAKE TROUT, SALMO NAMAYCUSH, IN FRANCE.—C. Raveret-Wattel, writing under date of Paris, October 4, 1883, says: "You will learn, doubtless, with pleasure, that the eggs of the lake trout that you have had the kindness to forward to our society have very successfully hatched. The fry are the most lively that I have ever seen. They thrive marvelously well, and are almost twice as large as the fry of our common trout of the same age. *Salmo namaycush* seems to be a very remarkable fish—extremely hardy. It is certainly a precious species in all regards to acclimate in our fresh waters, and we are much indebted to you for having afforded to our society the possibility of the experiment."

THE SALMON CROP OF 1883.—Mr. Robert E. C. Stearns, of Berkeley, Cal., has forwarded the following statement, taken from the San Francisco Chronicle of Thursday, December 13, 1883.

"There were taken from the Sacramento River and tributaries for the year 1883, ending October 15, and delivered to the different packing firms 451,957 spring salmon and 160,542 fall salmon, weighing 7,349,988 pounds. The wholesale dealers have received 115,004 spring salmon and 52,902 fall salmon, making a total number of 780,405 salmon, weighing 9,585,672 pounds."

COLUMBIA RIVER SALMON.—The run of salmon on the Columbia River has been very large. Recently the canners were obliged to throw away six thousand fish, which, with their present facilities, they were unable to take care of. The canners have been doing their utmost to keep up with the fishermen, but the supply exceeds the canners' abilities. It is thought that the season's catch will be unusually large. [From The American Field, July 26, 1884.]

SALMON CANNING IN BRITISH COLUMBIA.—The Delta Cannery is the largest in British Columbia. Commencing operations only five years ago, its business has assumed such proportions that it now employs a force of over 400 men, 280 Chinese and 160 Indians, and a fishing outfit consisting in part of 38 boats and nets, 2 seines, 1 steam-tug, and 4 scows. The cannery covers a space 160 by 120 feet, is two stories high, and in some respects is the best furnished on the Pacific coast. It is provided with a boiler 16 feet long and 4 feet in diameter, twelve tanks, two retorts of 3,360 cans capacity each, filling and soldering machines, four lacquer baths, and every convenience for the rapid and thorough performance of the various operations necessary to secure the highest degree of perfection in the preparation of this most excellent article of food. Chinamen, under the supervision of experienced white foremen, are employed for the canning process and Indians for catching the fish, receiving from $1.25 to $2 per day, the net tenders the latter amount. The daily catch per boat ranges from fifty to three hundred salmon, the fleet sometimes bringing in twelve or fifteen thousand. This season (1882?) the run has been so extraordinary that the Delta Cannery put up 1,280 cases in a single day, and 6,600 cases in six days. Messrs. Page & Ladner, the managing partners of the firm, showed me their product for the last month, amounting to the enormous quantity of 25,000 cases, or 1,152,000 cans, covering every available space of the immense lower floor to the height of over 5 feet, the largest number ever packed by any one establishment during the same period of time. Two hundred and fifty barrels of salmon, or about 13,000, were also salted within the month. The company ship their goods direct to London or Liverpool through the firm of Welch, Rithet & Co., of Victoria.—[Newton H. Chittenden, in "Guide to British Columbia."]

THE SALMON CANNERIES ON FRASER RIVER.—Mr. Louis C. d'Homergue, of Brooklyn, N. Y., writing to the Daily Eagle of that city from San Franciso, Cal., in April, 1882, says: "The salmon canneries on the Fraser River are eleven in number, and these caught and shipped to England 580,000 boxes, containing each 48 cans of a pound each, while on the Columbia River, in the United States, thirty-two canneries only made 366,000 boxes of 4 dozen-cans each. In this country our resources are allowed to be drawn upon without regulation, while in the English possessions everything is well regulated. Under English laws no canneries or fish-rendering works under the new law can be established on the Mackenzie and Fraser rivers, except at a location indicated by the fishing commissioner under a yearly license of $250 and a tonnage license for each boat employed; they can only fish for certain fish at and between certain times, and then only in the districts indicated within their licenses. The number of factories at various localities is left to the discrimination of the fishing commissioner, who being appointed for life at a round yearly salary and being a man of great knowledge in such matters cannot be improperly influenced. The result of this restrictive system is that every British subject engaged in the fisheries is doing well and the fish are plentiful, while those on the Columbia are scratching every year harder, from the comparative scarcity of fish, which will, probably, in a few years disappear, as they have in the Sacramento River."

HATCHING SALMON AT DENNYSVILLE, MAINE.—Mr. Benjamin Lincoln makes the following statement: The Fish Commissioners of our State sent me 40,000 salmon eggs. I succeeded in hatching out and putting into the river 36,000 young salmon in good condition, which, if nothing happens, ought to increase the run of salmon in our river.

It is stated that this river (the Dennys) is the only river in the United States in which the salmon will take an artificial fly. Do you know whether that is the case; and, if so, what can be the cause of it? We have taken three here this spring with rods. But it is so cold and wet that there are but very few in the river.

DENNYSVILLE, ME., *June* 2, 1884.

RIPE SCULPINS IN VINEYARD SOUND.—Mr. Vinal N. Edwards, in letters to Prof. S. F. Baird, writes as follows: "Day before yesterday I found sculpins in the Sound very plentifully, and every one was a milter. Last month I could catch none but those with eggs. Some of them had 8 rays in the dorsal fin and some 9 rays, In the anal fin there were 13 and 14 rays."

WOOD'S HOLL, MASS., *November* 23, 1883.

"I send to-day some jars of sculpin spawn that washed ashore on Nobska Point, and some white roes from the milters. November 20 I went off in the Sound fishing and found the sculpins very plenty, and all were milters. I went again yesterday and found them still very plenty and all milters. The milt was running out of some of them. Still the spawn is very small and black on the outside. There have been no sculpins caught with eggs for about a month. Then they were all females and no milters. Can it be that the spawners come along and lay their eggs, and then the males come along in three or four weeks and milt them? I have tried every fall, in October and the first of November, and never caught a milter, but every one had eggs, then they would go and I did not try again, thinking the sculpins had all gone by."

WOOD'S HOLL, MASS., *November* 30, 1883.

LARGE HALIBUT AND POMPANO.—April 24, 1884, Mr. E. G. Blackford, of Fulton Market, New York, received a halibut which with head and tail on weighed 426 pounds. It was the largest he ever handled. May 30, he received his largest pompano, weighing 35 pounds. It was caught off the coast of North Carolina.

SHARKS.—Commander J. R. Bartlett, of the Hydrographic Office, United States Navy, at Philadelphia, sent the following memorandum: June 10, 1884: "American steamship D. J. Foley, at Philadelphia, from Port Antonio, on June 6, ran through an immense school of sharks from latitude 35° 30′ to latitude 36° 30′ on the meridian of 75° W. The captain reports that he shot 60 of them."

THE ROCKY MOUNTAIN WHITEFISH (COREGONUS WILLIAMSONII) IN OREGON.—In forwarding a specimen of this fish for identification Mr. I. R. Moores wrote: "They are a very fine pan fish; by some claimed to be equal, if not superior, to our mountain trout—very solid and white flesh. They are found in Mill Creek, a tributary of the Willamette River at Salem, 175 miles from the ocean. They come in immense quantities with the first fall rains in October and November, hundreds and thousands being taken by seines along the creek and in ponds caused by the overflow. They are very nearly of one size and length, and when alive, having no slime whatever, they can be handled as readily as corncobs. As far as we can learn reliably these fish are only found in Mill Creek, and there only since the construction of the locks at the falls of the Willamette two years ago. Several of us who have given the subject some attention, are of the opinion that they are a salt-water or estuary fish, and have come through the locks at Oregon City in their fall migrations for spawning."

PORTLAND, OREG., *February* 27, 1883.

RECORD OF WHITEFISH EGGS RECEIVED AND HATCHED AT DRUID HILL HATCHING HOUSE, BALTIMORE, MD.

I.—*Lot of* 50,000 *received December* 20, 1882.

Of this lot 49,407 hatched February 12, 1883; of which 54 fish were lost in handling, making a total loss of 647. The average temperature of air during incubation was 34½°, of water 38½°. The fry were deposited as follows:

Date.	Place.	Number.
1883.		
Feb. 14	Deep Branch	10,000
15	Tuckahoe Creek	10,000
16	Greensborough	10,000
17	Third Haven	10,000
18	Sherwood's Mills	8,861
Mar. 4	Deep Branch	492
	Total	49,353

II.—*Lot of* 100,000 *received December* 30, 1882.

Of this lot 95,500 hatched February 5,1883, and the fry were deposited as follows:

Date.	Place.	Number.
1883.		
Feb. 14	North East River, Cecil County, Maryland	15,000
14	Millington, Chester River, Kent County	15,000
15	Octoraria River, Cecil County, Maryland	11,500
15	Big Elk River, Cecil County, Maryland	11,500
19	Patapsco River, Howard County, Maryland	10,000
21	Curtis Creek, Anne Arundel County, Maryland	5,000
23	Mount Winans, Baltimore County, Maryland	5,000
27	Laurel, Patuxent River, Howard County, Maryland	15,000
28	Transquaking River, Dorchester County, Maryland	7,500
	Total	95,500

A NEW HATCHING BOX.—Prof. Cossar Ewart, F. R. S., has devised a new hatching box for adhesive eggs, to take the place of the "Clark" hatching box. The advantage of Prof. Ewart's box is that the glasses are arranged in a horizontal position, so that the embryos when hatched pass at once into comparatively still water, instead of having to run over and under a varying number of vertical glass plates.

TRANSFERRING FERTILIZED HERRING EGGS TO SPAWNING BEDS.—Professor Ewart has described an easy method of stocking spawning beds, capable of being readily used by the fishermen themselves. All that was required was an ordinary wooden tub and a shallow, galvanized-iron tray about 20 inches in diameter, with the bottom consisting of two portions each hinged to a central bar so as to open downwards. The object in view is to deposit stones on the spawning bed coated with fertilized ova. To do this the tray is placed in the tub, which is then filled with sea-water. In the tray a number of flat stones are arranged; the water is then fertilized, and the stones coated with eggs. This done the tray is lowered to the bottom by means of four cords, two attached to the rim of the tray and one to each half of the bottom. When the tray has reached the sea-floor the cords attached to the false bottom are set free and the tray raised by the cords attached to its edge, the result being that the egg-coated stones are left at the bottom. By this method the fishermen, without any trouble or expense, could add two hundred or three hundred eggs for every herring they removed from the sea, and thus do their best to restore the balance of nature which their operations disturb. [From Nature, March 27, 1884.]

DESTRUCTION OF FISH BY DUTCH NETS.—Extract from letter of L. H. Hardy, dated Raleigh, N. C., January 19, 1883: "We have in Carteret County, North Carolina, a great many fish, and our people live by catching and selling them. For the last four years our waters, both in the sounds and ocean, have been obstructed by Dutch nets, which have proved very destructive to our fish. Thousands of fish too small to be serviceable are caught by these nets and suffered to remain in them until they are dead, and then turned out to drift upon the shore in numbers that would seem incredible to relate. Sometimes these small fish are taken and worked up for manure, and at other times they only go to feed the crabs. Thus millions of good fish are being destroyed yearly that are not worth a cent while so small. These nets do more damage on the outside, in the ocean, than they do in the sounds."

TERMINATION OF THE TREATY OF WASHINGTON IN 1885.—At a meeting of Gloucester fishing owners and masters of fishing vessels held in that city in 1882, a memorial to Congress was adopted, wherein, after citing the 33d article of the treaty, it was continued: "Now, therefore, we, the outfitters, owners, and fishermen of the United States, knowing and believing that the results of said treaty have not only been detrimental to the interests of the United States, but unjust and monstrous in the valuation by the Halifax commissioners of the British shore fisheries, do hereby pray your honorable body to cause notice to be given at the earliest practicable moment of the desire of the United States to terminate the operation of the fishery articles of said treaty, and all other treaty provisions relating to the fisheries on the shores of Canada and Newfoundland, for the following reasons: To the end that the British and American fishermen may each in their own waters enjoy the right to take fish unmolested, and have equal commercial rights in the waters of either country."

EDIBLE QUALITIES OF THE POLE FLOUNDER.—In the New York Times, of August 14, 1882, Mr. Barnet Phillips said: "There are many varieties of flat-fish in our waters, variously designated as the smooth flounder, the rusty flounder, the sand flounder, the four-spotted flounder, but none of them are equal to the English sole. The dabs and flukes of the New York markets, if properly prepared, are, however, quite edible. But there is one flat fish, the pole flounder (*Glyptocephalus cynoglossus*), which, found on our coast, is quite the equal of any sole caught in European waters. It resembles in form the general appearance of the flat fish, but is more elongated, and will weigh from 2 to 3 pounds. The mouth is exceedingly small, and, strangely enough, for this reason, as the fish cannot easily take the hook, it has not as yet been caught with a line. As it lives in rather deep water, it has to be taken with a drag-net. Some years ago its presence was determined by the United States Fish Commission, and from time to time these fish have been distributed to the appreciative in order that their quality should be tested. Last week Professor Baird forwarded to Mr. E. G. Blackford some half dozen of these pole flounders, with the request that the merits of these fish should be determined. The pole flounder was found to be in every respect the equal of the sole. Its flesh was firm and white, without that muddy flavor peculiar to our flounder. One peculiarity of the fish, in which it differs from the flounder, is that the spines which surround the fish, the continuous dorsal fin, are not set into the body with hard bones, which in the flounder fill the mouth with spiculæ, recalling a pin-cushion. These bones in the pole flounder are placed in a gelatinous substance, which forms one of the most agreeably edible portions of the fish. If this fish could be caught in quantity it would become a most important addition to our catalogue of American fishes, for it would replace, if not surpass, the sole."

THE SHAD FISHERIES AT LAKE MONROE, FLORIDA.—Writing from Sanford, Fla., March 3, 1881, Mr. D. L. Way says:

"Mr. Fisher, who is conducting the shad fisheries at the head of Lake Monroe, states that shad are now ripe with roe, and that he could furnish from 50 to 75 a night that could be stripped. He says that when he takes a ripe one he either strips the eggs into the water or lets the fish go. He is deeply interested in the preservation of the roe. He further says that in about ten days, or at any time thereafter, he can furnish 200 or 300 for stripping every night. The shad spawn as far up the Saint John's and tributaries as there is running water. The bar at the head of Lake Monroe is a noted spawning-ground for shad. Owing to a large extent of shallow water there, with clean, sandy bottom, and facilities for protecting the spawn and young fish, it will be a most desirable place for a hatchery. He likewise says he has had much experience in this very line, having assisted Seth Green as early as the year 1863 in catching and stripping shad.

"After the shad-fishing season is over this year he is going to seine for catfish and gars (two fish that are specially destructive to spawn and young shad) and sell them for fertilizing purposes."

THE SHAD FISHERIES NEAR HAVRE DE GRACE, MD., 1883.—On June 20, Frank L. Donnelly proceeded to Havre de Grace, Md., to ascertain as far as practicable the catch of the different seines operated in that neighborhood, and also the statistics of the shipments of fish from that port, both to Baltimore and to northern markets, the length of seines used at the different fisheries, &c.

He visited the owners and persons in charge of the six principal fisheries in that vicinity, and from them obtained the facts compiled below:

Table of Havre de Grace shad fisheries, 1883.

Fishery.	Length of seine.	Depth of seine.	Number of men.	Number of shad taken.	Kind of power used.	
					Boat wing.	Land wing.
	Fathoms.	*Feet.*				
1. Western float	800	26	40	7,800	Engine	3 horses.
2. Eastern float	800	23	40	5,500	....do	Do.
3. The island fishery	930	30	45	8,000	....do	Do.
4. Float fishing	417	40	40	5,500	2 horses	2 horses.
5. Float fishing	750	20	50	13,367	Engine	Engine.
6. Float fishing	510	25	44	6,800	....do	2 horses.
Total	4,207	20 to 40	259	46,967	6 engines;	15 horses.

SALES OF FISH.—He learned from the only wholesale shippers of fish in Havre de Grace that their sales were almost exclusively in Philadelphia, and this season (1883) they had shipped to that city 16,500 shad, which had been caught by gilling or drift-net fishermen.

The Baltimore market is supplied by bay fishermen and "run-boats" from the float and shore fisheries. It was impossible to get an accurate statement of the shad shipped to Baltimore.

It will be seen from the above that 46,967 shad were caught by the six principal fisheries in the vicinity of Havre de Grace. Also 16,500 shad were caught by the gilling or drift-net fishermen on the Susquehanna, making a total of 62,967 shad. If statistics from all the floats and shore-fisheries and drift-net fishermen on the Susquehanna River and at the mouth of the Chesapeake Bay could be gathered, Mr. Donnelly thinks it would show a total catch of 100,000 shad for the season.

WASHINGTON, D. C., *June* 27, 1883.

SHAD HATCHING IN CONNECTICUT IN 1884.—The catching of shad, for the purpose of securing the spawn for artificial propagation on the Housatonic River, closed about July 1. Mr. Fenton, who has had charge of the hatching, gives some very interesting facts in regard to it. The total number hatched out and deposited in the rivers will exceed 3,000,000, of which one-half have been emptied into the Connecticut River, at Enfield Bridge, and the remainder into the Housatonic. Mr. Fenton estimates the average number of eggs secured from each fish at 30,000, although, at least in two cases, he has secured fish that had over 60,000 eggs each, the eggs from the two fish filling a common-sized milk-pan. The fish were emptied into the river at the turn of the flood tide, so that as the tide goes out the young shad are carried down the river far enough so that the impurities emptied into the river from the paper-mill may not kill them. Mr. Fenton seems to think that the acids discharged in the river are not so destructive to fish as is generally supposed, and says, in support of his views, that several days since, just after the hatching of several thousand shad, the vats of the paper-mill were discharged into the river while the tide was rising, and consequently the impurities were forced up the river to the hatching-boxes, a few hundred yards above the mill, filling them with impure water, so that the young fish could not be seen; but after the tide went out and the water became pure no perceptible harm had been done the fish.

Besides the young shad placed in the river here, the United States Fish Commissioner placed 1,000,000 fish in the river at Milford, although he is doubtful if many of these live to reach the Sound, as not only do they have to run the risk of being devoured by the bass and pickerel in the lake, but the passage of the dam during the month of September, when the water is low, is doubtful, and if they take to the canal and pass through the water-wheels of the different shops, they go to sure death, as has been seen at Windsor Locks. [Forest and Stream, July 17, 1884.]

Penning rockfish at Battery Station.—Lieut. W. F. Low, U. S. N., who was in charge of the station in April, 1883, wrote: "I am informed that last June some four hundred rockfish were placed in the pool at this station. The last authentic account I have of them before the ice formed is from Mr. Mitchell, the lighthouse keeper, who tells me that he saw a great many of them on several occasions near the surface of the water and always swimming in the same manner, namely, round and round.

Since I have taken charge of the station (five weeks) four dead ones have been found, all very thin. Yesterday we made a haul in the pool and captured two live ones and a dead one. The dead one was covered with mud and had evidently been dead some time. Of the live fish one was a male and the other a female. The female measured 28 inches and the male 20. Both were in poor condition and no evidence of food was found in them. The head of the female was much bruised, as if from constant rubbing against some hard substance. The haul was not a very thorough one, as the seine hung several times, and we were obliged to lift the leads some distance from the bottom on each occasion."

Battery Station,
Havre de Grace, Md., April 5, 1883.

Vol. IV, No. 21. Washington, D. C. Aug. 13, 1884.

163.—THE SPECKLED CATFISH.

By J. F. JONES.

[From letters to Prof. S. F. Baird.]

The general species of fish is common, but the valuable and highly appreciated variety that I have domesticated is different from all of the kind, both in habit and color. The "speckled catfish" is naturally a pond fish, and found only in one locality in the South; at least, such is my information and observation. That locality is on Flint River, running south and emptying into the Chattahoochee some distance below Columbus, Ga. Many years ago this fish was plentiful, being found only in still water, lagoons, or ponds. The Flint River runs through the Pine Mountain. Not far south or north of the mountain these fish cease to occupy the waters and inhabit only the tributaries to the river, including a space of about 50 or 75 miles.

Some time since I determined to try and domesticate them, and the effort has resulted in success. The species is easily tamed or domesticated. They can be trained like pigs; increase and grow fast when well supplied with food; subsist upon vegetation, but in the absence of it can be fed any kind of fruit, such as peaches, apples, persimmons, watermelons and the like, corn, wheat, and sorghum seed. I put fifty, 3 inches long, in a cotton basket and set it in my pond. I fed them well on corn shorts and dough. In the short space of six weeks they grew to be 6 and 7 inches long and trebled in weight. They spawn when one year of age, and twice a year—May and September. Last spring I procured only eight wild ones. After feeding them well up to this time they have spawned in May and September and have filled my pond. They have grown to be 15 and 18 inches long and weigh 4 and 6 pounds. They take care of their own young and trouble no other fish, bite readily at hooks, and offer all the sport at catching that a trout does.

They resemble the leather carp more than any other fish, are oval from head to tail-fin on the back, and have a sharp mouth. The under part, or belly, is as white as cotton. The sides and back are as spotted as a leopard. The flesh is perfectly white and tender, and no better for the table is to be found; bones are rather small and slender. At the same time they carry more flesh than any fish I ever saw. They love a pond of clean water and a mud bottom. All the floods that come cannot wash them from their home unless the whole of the pond is carried away. They will not go in running water if they can avoid it. Disturb them, and, like a carp, they will sink in the mud to hide.

They can be caught conveniently in a gill-net, but with great difficulty in a seine.

My pond covers 5 acres of land, the largest and best pond in Western Georgia. It is a perfect mass of fish and has been constructed only eleven months. The water is from an inch to 5 feet deep, and abounds in vegetation. I could sell it for a fine price, but I would not exchange for the best four-horse farm in Georgia. The twenty little carp you sent me last winter, then about 3 or 4 inches long, are now 20 inches in length. I had two old ones that I bought, and they have stocked my pond with hundreds now about 8 or 10 inches long.

HOGANSVILLE, GA., *October* 31, 1883.

I am anxious to send you some of my "speckled cat," and to have you test their value as a domestic fish in the Government ponds. I can send you some alive without danger.

I am sending the September spawn all over the Southern States now, and when they are properly introduced they will give the laborers or farmers all the meat needed.

HOGANSVILLE, GA., *November* 5, 1883.

164.—THE MIGRATIONS OF THE SALMON (SALMO SALAR L.) IN THE BALTIC.*

By Prof. A. J. MALMGREN.

From time immemorial there have been caught in Finland salmon in whose mouth or entrails have been found hooks of a form and character entirely unknown in these regions. In all the salmon streams which fall into the Gulf of Bothnia, not excepting the most northern, the Tornea and Kemi, it is quite common to find such hooks. They are found every summer, even in the Kymmene River, which empties into the Gulf of Finland, although not so frequently as in some of the other rivers. At the Raatti salmon fishery in the Ulea River, where all salmon are cleaned before they are sold, the fishermen gather every year a large number of strange hooks taken from the mouths and stomachs of salmon. Thus, I was informed during my last visit to Raatti in August, 1883, that among about 3,000 salmon caught since the end of June, weighing on an average from 25 to 30 pounds, there were at least 25 fish from which brass hooks were extracted. At the Klockarsand's government fisheries in the Kumo River, near Biorneborg, a considerable number of similar hooks are taken from salmon every summer.

With few exceptions, of which I shall speak later, the hooks found in salmon are of the same kind. They are made of brass wire, varying in thickness from 2 to 2½ millimeters [from one-twelfth to one-tenth of an

* "*Laxens* (*Salmo salar L.*) *vandringar i Ostersjön.*" From *Aftryck ur Sporten*, No. 2, 1884. Translated from the Swedish by HERMAN JACOBSON.

inch], a little compressed at the bend of the hook, and varying in length from 9.5 to 11.5 centimeters. Most of them measure about 10.5 centimeters [$4\frac{1}{8}$ inches] in length; and the opening of the hook has a breadth of from $2\frac{1}{2}$ to $3\frac{1}{2}$ centimeters [from 1 to $1\frac{3}{8}$ inches]. To the hook there is frequently attached a piece of line, varying in length, generally still good, and measuring 1.5 to 1.8 millimeters [about one-sixteenth of an inch] in thickness. To this piece of line, if it is of sufficient length, there is generally attached a few inches from the hook a leaden weight of conical shape, bored through lengthwise, and weighing from 10 to 20 grams [about half an ounce]. Occasionally one or two letters or other marks are engraved on these weights. Fig. 3 shows such a brass hook with

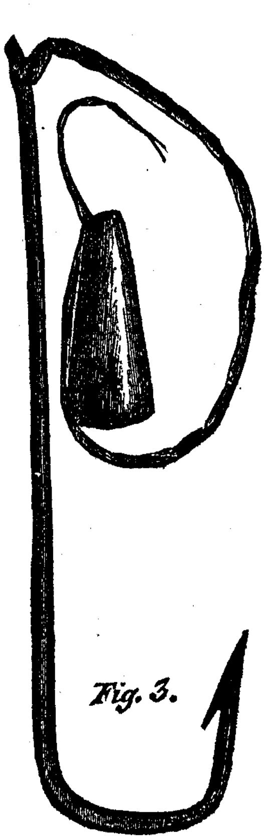

Fig. 3.

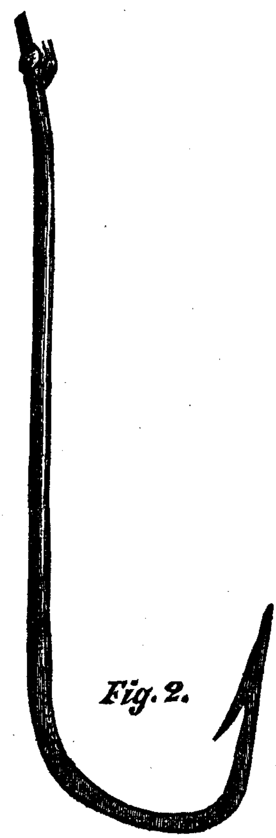

Fig. 2.

its weight, taken from the stomach of a large salmon caught last July at the Muhos salmon fisheries in the Ulea River, about 4 miles from its mouth. On this weight the letters C and K can easily be distinguished on each side. Fig. 2 shows another hook of the same kind taken from a salmon near Uleaborg. All the hooks referred to as well as the weights are hand-made, and therefore vary somewhat in size and shape. The many hooks which have passed through my hands, and which had been taken from salmon caught in the rivers Tornea, Kemi, Simo, Ijo, Haukipudas, Ulea, Sukajoki, Pyhäjoki, Kumo, and Kymmene, have all been of the same general type, and were evidently all intended for the same object.

As the question whence these characteristic and frequently occurring hooks and weights came is of great interest even from a practical point of view, I have given some time to its examination. The result of my researches show with a considerable degree of certainty that these hooks came to us from the north coast of Germany, where they are very generally used during winter for catching salmon. From statements by Professors Wittmack, Benecke, Möbius, and Heincke, it appears that during the winter months, especially during March and April, very successful salmon fisheries with hooks and lines are carried on along the northern coast of Germany from Rugen to Memel, at a depth of from 30 to 60 meters [about 16 to 32 fathoms] and at a distance of from 10 to 30 kilometers [about 6 to 20 miles] from the shore. This method of catching salmon seems to have been very generally used from ancient times on the coast of Pomerania, where it is more common than in any other part of the German coast. According to Professor Benecke, however, it has during the last twelve years spread as far east as Memel, and possibly also to some parts of the Russian coast. The apparatus used in these fisheries resembles in all its leading features the salmon-line used on the coasts of Skane and Blekinge [Sweden], but the hooks and weights as well as the line are different from those employed in southern Sweden. Professor Benecke, of Konigsberg, to whom I sent a brass hook taken from a salmon caught in the Ulea River, wrote me a letter entirely confirming the conclusion at which I had arrived, namely, that these hooks came from the coasts of Prussia and Pomerania. As they are not used in any other part of the coast of the Baltic or anywhere in the Baltic, it is evident that the salmon carry these hooks to Finland from the Prussian and Pomeranian coasts, where they are used in the salmon fisheries and where the fishermen annually lose a considerable number.

Occasionally large hooks of tinned iron or steel wire are found in salmon caught in Finland. These hooks are of an entirely different kind from the Pomeranian brass hooks, and the two in my possession do not at all resemble each other. The one taken from a salmon caught near Christinestad by Mr. Hasselblatt, and presented to me by Mr. H. O. Fontell, of Christinestad, resembles in shape, looks, and size the hooks which are used in winter for catching salmon in the open sea near Bornholm,* and in the southeastern part of Skane and Blekinge. This hook is fastened to a conical leaden weight by means of a peculiarly constructed hemp line, measuring about 3.5 millimeters [about one-eighth

* Capt. Ivar Brenner, of Helsingfors, has had the kindness to send me, for the purpose of comparison, two salmon hooks, with line and weight, brought by him from Bornholm. These hooks, even to the smallest detail, are the exact counterparts of the hook from Christinestad.

of an inch] in thickness, and is nearly 9 centimeters [$3\frac{1}{2}$ inches] long, the opening measuring 3.5 centimeters [$1\frac{3}{5}$ inches]. The hook, weight, and line so exactly resemble the apparatus of this kind used near Bornholm and in southeastern Skane for catching salmon, that there can be hardly any doubt that these hooks came from Bornholm and southern Sweden. The other iron hook, which was taken from a salmon caught in the Kumo River, and a sketch of which is given in Fig. 1, also greatly resembles the Skane salmon hook, but is somewhat

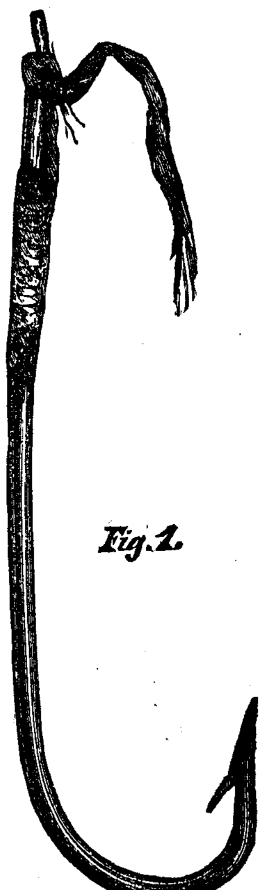

Fig. 1.

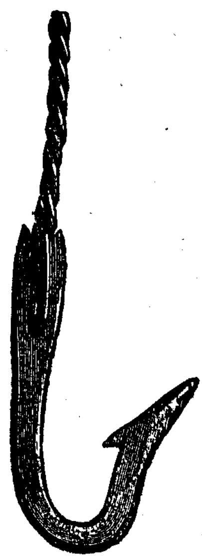

Fig. 4.

longer, measuring 11.5 centimeters [$4\frac{1}{2}$ inches], and is made of somewhat thicker wire. The end of a thick and strong hemp line, which is still attached to the hook, shows that the line was of the same kind as those used in salmon fishing near Bornholm, in Skane and Blekinge; and it is therefore tolerably certain that this hook likewise comes from the same region of the southern Baltic. The fact that these iron hooks are but rarely taken from salmon caught in our streams is probably owing to the circumstance that the Scandinavians use much stronger lines for salmon fishing than the Germans.

Besides the above-mentioned hooks taken from salmon which are unknown in Finland, I have recently received from H. O. Fontell, of Christinestad, a hook made of thick, flattened brass wire taken from a salmon caught in the sea near Christinestad by Mr. Hasselblatt. This hook is about 4 centimeters [1½ inches] long, of a very peculiar shape, and is firmly attached to a double brass wire 40 centimeters [15¾ inches] long and almost 1 centimeter [two-fifths of an inch] thick, which passes through two holes in the hook. I do not feel positive as to whence this strange hook may have come, but I suppose that it must have come from the Russian shore of the Baltic. To give a better idea of this hook I have sketched it in Fig. 4.

Dr. Rudolf Lundberg describes the hook and line fisheries for salmon which are carried on on the southeastern coast of Skane as follows:*

"Fishing with salmon lines begins in autumn after the close of the herring fisheries, and is continued all through the winter whenever the weather permits. These lines are constructed in such a manner as to float on the surface and are fastened only at one end, the other being free, so it can float with the current. The part which keeps the apparatus in its place is called the 'string,' and is anchored at the bottom by means of a large stone. After the stone has been sunk, about a fathom of the string is hauled up, and a glass float is fastened to the string. Eight to twelve fathoms above this another glass float is fastened, and from 4 to 6 feet below this the line is fastened to the string. The line is kept floating near the surface by means of four wooden or cork floats. At present only three hooks are used (formerly five or six were used) on each line, whose length is 30 fathoms. The hooks, made of tinned iron wire, are tolerably strong (8 centimeters [3 inches] long and almost 4 centimeters [1½ inches] across the opening), and are baited with herring which are cut just below the anal aperture, and are attached to the hook in such a manner that its point passes through the eye, and sticks out at the side. The salmon lines are set, one after the other, at such intervals that they may not become entangled when swayed to and fro by the current. The glass float before referred to keeps the string up in the water and prevents its being carried about by the current. This apparatus is set at a depth of from 20 to 30 fathoms, the farther from the shore the better. As long as the water is still warm in autumn, fresh bait should be put on the hooks every day. When the water gets colder,

* The German method of catching salmon with lines resembles (to judge from Professor Benecke's description) very much the Swedish method; but the Germans seem to use only one hook for every line, while the Swedes use three. It is said that the Germans use as bait, besides herring, also roach and *Cyprinus vimba;* and there are frequent complaints that the hooks are lost. The salmon are also frequently devoured by seals, which leave only the head.

the herring will keep three or four days without turning sour; if the bait becomes stale the salmon will not bite. During the autumn salmon fisheries there are four men in a boat with from 40 to 60 salmon lines."

The occurrence of strange hooks in salmon caught in the rivers emptying into the Gulf of Bothnia, both in Sweden and Finland, was mentioned a century and a half ago. Thus Nils Gisler says in the "Transactions of the Swedish Academy of Sciences" for 1752, p. 99: "In the Angermann River there are annually caught many salmon from which large hooks are taken, some of steel and others of brass. Some of these hooks have pieces of line attached to them in a good state of preservation, some of them measuring 2 fathoms in length, with leaden weights sometimes resembling in their shape church bells, with letters, names, and places of residence marked thereon. In the Njurunda River two hooks were taken from salmon in 1728, which in their shape differ greatly from other hooks. Such hooks are not often found in this river, as the large sea salmon do not often enter it, unless there is very high water, as was the case in the year referred to above. The hooks found in the other rivers are generally all of one and the same kind. Specimens of hooks taken from salmon in different places have been sent to the Royal Academy of Sciences. I do not know whether they are found in all kinds and varieties of the sea salmon and in the lake salmon and salmon trout. Sometimes hooks have been taken from salmon which had been caught far up the streams; thus one was taken in 1746 from a salmon caught 6 miles up the Lulea River. * * * Here, in Norrbotten, such hooks are not used."

From time immemorial salmon-fisheries with hooks and lines have been carried on during the winter near the coasts of Bornholm. The apparatus used is very much like the one used in Skane, and the salmon-fisheries, especially net-fisheries, are said to have increased very much in these waters during the last ten years. It is specially reported that the number of small salmon and young salmon, weighing from 1 to 3 pounds each, has increased greatly since 1874, when these fisheries were comparatively small. The number of salmon-nets, which in 1874 was small, amounted in 1880 to upwards of 6,000. On the Baltic coast of North Germany the salmon-fisheries, both with hooks and lines and with nets, have considerably increased of late years, and the number of young salmon, weighing from 1 to 3 pounds, has particularly increased. The firm of M. Radmann & Son, of Berlin, report that last year 40,000 young salmon, weighing on an average $1\frac{1}{4}$ pounds, were brought to Berlin from the coast of Pomerania.

The comparatively frequent occurrence in the salmon caught in our rivers and on our coasts of brass hooks like those used on the coast of North Germany proves, beyond a doubt, that many of the salmon, after having visited the coast of North Germany, return to our waters. Others have, during their migration to the Gulf of Bothnia, visited Bornholm and the southeast coast of Sweden, as the iron hooks used in those localities and taken from salmon caught in Finnish waters prove conclusively. Since it is well known that the salmon as a rule return, for the purpose of spawning, to the rivers which they left as young fry, we are justified in supposing that the largely increased number of salmon and young salmon which during recent years have visited the coasts of Bornholm, Pomerania, and Prussia, are principally, and perhaps exclusively, fish which have been hatched in the salmon rivers of Finland and Northern Sweden. It is only about twelve or fourteen years that the salmon have been protected in the Finnish rivers, and during this period the salmon-fisheries in the Southern Baltic have increased and improved to a very noticeable degree. But if Finland (and also Sweden) is to enjoy, to a greater degree than has hitherto been the case, the fruits of protecting the salmon in the rivers of Finland during the spawning period, the catching of young salmon near Bornholm and on the coasts of North Germany ought to be stopped as soon as possible. This object would be greatly furthered if some international arrangement on this subject could be arrived at between all the Baltic States.

By marking salmon it has been found in England and Scotland that the various kinds of salmon during their stay in the sea prefer to visit certain portions of the coast in order to seek their food. Thus, according to Frank Buckland, the coast of Norfolk, especially near Yarmouth, is said to be the favorite place of the bull-trout [*Salmo eriox*], which is found in large numbers in some of the English and Scotch rivers. David Milne-Horne, who possesses the most thorough knowledge of everything relating to the salmon-fisheries in Scotland, and more especially in the river Tweed, states, as an instance of how soon a fish of the salmon kind can change its feeding-ground, that a bull-trout which, on March 29, 1852, had been marked in the Tweed with a silver thread bearing an inscription, was caught near Yarmouth on April 2, of the same year, after having traveled almost 300 miles in four days. Another fish was marked in the Tweed on March 10, 1880, and was caught near Yarmouth on May 5, 1880, after a journey of fifty-five days. As the salmon (*Salmo salar*), according to the experience gained in Scotland, is said, during its visits to the sea in seeking food, to prefer places where there is a sandy bottom, and as on the German coast between Memel and Rugen, near Bornholm, and on the southeastern coast of Sweden, the bottom of the sea is sandy, and as all the other conditions for a successful production of salmon food are found there, the cause of the regular visits of our salmon to these coasts must be found in these circumstances. The regular migrations which the salmon undertake in spring to the rivers emptying into the Gulf of Bothnia and the Gulf of Finland are made exclusively for the purpose of spawning.

HELSINGFORS, FINLAND, RUSSIA, *February* 6, 1884.

165.—GREAT RESULTS OBTAINED WITH LITTLE WATER.*

By Dr. BRUMME.

I am of opinion that nothing is so much calculated to advance the interests of the fisheries, and more especially of artificial fish-culture, as truthful accounts of the establishment and working of artificial fish-hatcheries. I presume that most readers have, like myself, perused with pleasure and attention the various reports on practical experiments, without in the least disparaging theoretical treatises on different subjects connected with fish-culture, whose value and proper place in fish-cultural literature no one will deny. For the practical man and the fisherman, however, communications regarding the experiences of others will be of special interest; for they will cause him to think and institute comparisons with his own experiences, and may help him in making the best use of the natural conditions of his own locality.

I myself owe to such accounts and reports relative to different fish-cultural establishments as have frequently been given in these columns, the impetus and directions for creating a hatching and feeding establishment for trout and salmonoids, under such peculiar circumstances that a description of these and a brief account of my little establishment will perhaps be found welcome by some.

There is a small spring at my disposal which rises under a neighboring water-mill, and which, even during a rainy season, yields only 20 to 25 liters [about 6 gallons] of water per minute. The water is perfectly clear all the time, and both in summer and winter its temperature is constantly $7\frac{3}{4}^{\circ}$ R. [$49\frac{1}{2}^{\circ}$ F.]. For about 60 paces the water runs under ground, through wooden pipes lined with zinc, and then flows into my grounds. My entire establishment consists of three basins laid in cement, the first holding 1.1, the second 13, and the third 20 cubic meters of water. The water in all these basins is renewed in about twenty-five hours. Although the change of water is exceedingly slow (there is absolutely no current inside the basins), the temperature of the water—even during a period of excessively hot weather, such as we had during last July—will never be higher than 10° R. ($54\frac{1}{2}^{\circ}$ F.), because the basins are in the ground and their sides are, consequently, not exposed to the rays of the sun; and because, in view of the possibility that the rays of the sun may be very hot, the entire establishment is surrounded by an earth wall 6 feet high, planted with shrubs and trees. During midsummer only the declining sun of the evening reaches the surface of the water in the basins, while the fish can enjoy the cool shade during the other part of the day. The water in the basins is 80 centimeters deep, with the exception of the first and smallest basin, into which the spring

*"*Mit wenig Wasser viel erreichbar.*" From *Deutsche Fischerei-Zeitung*, Vol. vi., No. 48. Stettin, November 27, 1883. Translated from the German by HERMAN JACOBSON.

enters, and which, by various subdivisions, has been transformed into a meandering ditch, which serves for hatching the eggs and raising the young fish. This ditch is only from 12 to 15 inches broad, and its sides are lined with turf. Its fall varies; here and there it widens out into deeper, pond-like places, and it is covered with a dense growth of cresses and other plants which thrive in cold water. Its bottom is covered with fine gravel; in some places it is muddy, and, by placing in it pieces of clayey slate, numerous hiding-places for the small fish have been provided. The two other basins have a gravelly bottom, occasionally mixed with mud, of which, as I think, the trout is very fond. In these basins numerous hiding-places have also been provided, as well as small hillocks, with diminutive caverns and tunnels of pieces of limestone. All around the edges of the basins there are banks of moss and turf, whose roots and blades reach into the water, and thereby serve to increase the number of worms, larvæ, &c. While the water in these two basins is always kept at a depth of from 80 to 100 centimeters [about 32 to 40 inches], the depth of water in the first basin or ditch is never more than from 3 to 5 centimeters [$1\frac{1}{5}$ to 2 inches]; thereby a lively current is produced, which is an indispensable condition for feeding the young fish, for the food intended for fish of that age should be moved along by the current, so as to make it appear alive. If necessary the current in the ditch, as well as the depth of water in the basins, can be increased or diminished.

As I live in a very flat country without forests or brooks, the creation of a trout-hatchery became the subject of many discussions and discouraging remarks. Like Noah, when he built his ark, I had to bear many a sneer; but the results have changed all this, and the mockers are now all on my side. I have once more furnished the proof that much can be done with little water, if it is only good, for I have succeeded in raising in my small basins or ditches about five hundred trout, which I received as young fry from Einsiedel during last March. I put out one thousand, but one hundred soon perished through a grave mistake, and the other four hundred were caught by kingfishers and wagtails. These fry grew, during seven months, to be fish measuring from 12 to 18 centimeters [about 5 to 7 inches], and weighing as many grams [about half an ounce]. I also succeeded in feeding several hundred two and three-year-old trout so as to make them fine food-fish, some of which weighed $1\frac{1}{2}$ kilograms [$3\frac{1}{3}$ pounds]. I now commence to hatch several thousand eggs of salmonoids and hybrids in simple wooden boxes, whose inside has been charred, and I have no doubt that I shall succeed in that experiment as well as in raising young fish in inclosed basins, a fact which so far does not seem to be generally credited.

As regards the method employed in managing my little hatching and raising establishment I would state the following: As food for young fry, I have successfully employed fresh white cheese, meat chopped fine, and especially the young of amphipods and other small aquatic animals, thousands of which were soon caught in the neighboring mill-pond by means of a gauze net. I can also recommend a mixture of white cheese and ground meal with a little water, kneaded into balls. For the further development of the young fish which have grown up this summer, I have provided a small basin, connected with the others, measuring 1 meter [39.37 inches] in breadth, 2 meters in length, and 1 meter in depth, and by placing in it small stone hillocks, and making hiding-places, it has become a pleasant place of sojourn for fish. Hence the fish can again ascend to the basin originally inhabited by them, and thus live either in shallow or deep water.

As food for trout which are several years old, I have very successfully employed a mixture of white cheese and Nicklas's fish-food, in a proportion of 3 to 2. These two substances must, of course, be kneaded together by means of water and then be fed to the fish in the shape of noodles. The large fish also get raw meat, frog larvæ, small frogs, worms, snails, amphipods, &c. There is nothing better for fish than to vary their food from time to time. Too large a quantity of substances containing much nitrogen seems to cause diseases among the trout. The old adage, *variatio delectat* (variety is pleasing), also applies in this case. In place of Nicklas's food I have recently begun to use, also, the American ground meat (meat-flour, which is frequently used as food for cattle. It is my opinion, however, that this food should be employed cautiously. I shall at any rate continue my experiments with this ground meat and with Nicklas's food, and at some later date report as to the results. One thing I can state even now; this is, that my trout did not seem to like Nicklas's food when given to them by itself. For days they will leave the food untouched, and most of it is eaten by the crawfish which I have placed in my basins in large numbers as guardians of public order, and which have to see to it that nothing is wasted.

This is, in brief, my hatching and feeding establishment, consisting, therefore, of a very small spring, three basins, and two wooden hatching boxes, without the trace of a hatching-house; and up to spring, 1884, I expect to have raised in it about 10,000 eggs of different kinds of trout and hybrids, so that, in all probability, I shall have next summer about 10,000 fine food-fish. Only by closely following the rules laid down by nature for the life of trout, and by making use of all the hints given both in this paper and in other publications, have I succeeded in furthering the interest of the fisheries in a country like ours, which has been but little favored by nature; and in making, within a space of only 100 square meters, the best use of a spring, which thus furnishes now not only a cooling draft, but a fine fish for the table.

Would that this communication might aid in awakening greater interest in Germany for the important fishery industries! Much money is still lying hid in out-of-the-way nooks and corners of our country.

LÖBEJUN, NEAR HALLE ON THE SALLE.

166.—SOME OF THE DIFFICULTIES WHICH CONFRONT OYSTER BREEDERS.*

By H. H. PIERCE.

[From two letters to Prof. J. A. Ryder.]

At the suggestion of Mr. Eugene Blackford, of New York City, I take the liberty of addressing you a few lines regarding certain points relating to the oyster business.

The company of which I am treasurer have several beds of planted "seed," upon which last season's spawn set to a considerable extent. We have a quantity of shells near our oyster house also and are desirous of planting these shells at once, so as to catch the spat of this season. Our experience and practical knowledge in this direction is very limited. Can you assist us? To inform you definitely of what we want to know, it is perhaps well to ask the following questions:

1st. The bottom under and above the principal part of our beds being sand, covered by from 1 to 3 inches of mud, should we plant our shells before spawning takes place, or immediately after it commences?

2d. How can we tell from the appearance of the oyster when it is ready to emit its spat?

3d. After the spat is emitted how soon does it attach itself to its future home, and how long is it supposed to float before sinking to its resting-place?

4th. How long after becoming attached to its resting-place before it becomes sufficiently developed to be discernible to the naked eye?

5th. What is the general appearance of the young oyster when first large enough to be seen by the naked eye or by the aid of an ordinary magnifying glass?

6th. How can we secure Government assistance in the way of scientific investigation and experiment in Sinepuxent Bay?

SNOW HILL, WORCESTER CO., MD., *June* 7, 1883.

We have been almost daily planting shells since the 1st of June, in a small and experimental way, in close proximity to one of our beds of two-year-old oysters and upon which we find a considerable "set," varying in size from that of the diagram in your esteemed favor before us—supposed to represent the oyster about ten days after fixation—to about the size of a half dollar. So far, our operation seems to have been pretty nearly in line with what you have suggested.

We are anxious to make our business here as large as practicable, and to this end desire to avail ourselves of all the scientific assistance we

* These letters introduced the remarkable series of experiments conducted by Messrs. Pierce and Ryder at Stockton, and described in Bull. F. C. 1883, p. 281; 1884, p. 17 and p. 43.—C. W. S.

can get, and sincerely hope you may be able to visit and give us such advice and instruction as may seem best to you after examination of our grounds and work.

We may add that the oyster industry in these waters is rapidly becoming very large. It is claimed that there have been this season over 500,000 bushels of seed from the Chesapeake planted here. It seems to me that much may be done here towards raising our own seed. Thus far the shells which we planted early in this month do not appear to show any "set" of spawn, though they still remain pretty clean and free from muddy deposit.

If you can favor us with a visit, we shall be most happy to be initiated fully into your views and methods and do all in our power to assist you in your experiments.

STOCKTON, WORCESTER CO., MD., *June* 15, 1883.

167.—CAN HERRING LIVE AND INCREASE IN INCLOSED WATERS?*

By W. FINN.

The following contribution towards the solution of this interesting problem has been communicated to the editor of the Norwegian Journal of Fisheries:

About the end of May several barrels of salt "great herring" from Lofoden were received in Bergen. These fish had been caught during the first half of the month, and the person who received them forwarded some specimens to the editor for the purpose of investigation. The specimens which were examined showed the following dimensions:

	Length.	Height.	Breadth.
	*mm.**	*mm.*	*mm.*
No. 1. Spawner	338.5	73	32
No. 2. Milter	354.5	68	34
No. 3. Milter	349.0	71	28
No. 4. Spawner	336.0	73	32

* About 25 millimeters make 1 inch.

These herring were, therefore, of the same size as large spring herring and Iceland herring, or as the former so-called "great herring."

The examination of the sexual organs showed the following results:

	Length.	Height.	Weight.
	mm.	*mm.*	*Grams.**
No. 1. Spawner	165	34	45
No. 2. Milter	154	33.5	49
No. 3. Milter	182	36	61
No. 4. Spawner	182	40	100

* About 28½ grams make 1 ounce.

* "*Kann der Häring in geschlossenen Gewässern leben und sich vermehren?*" From the *Deutsche Fischerei-Zeitung*, Vol. VI., No. 46, Stettin, Nov. 13, 1883. Translated from the German by HERMAN JACOBSON.

No. 4 was almost ready to spawn, and the sexual organs of the other three were so much developed that the latter half of May must be supposed to have been their spawning season. At the same time several spawners were examined which had been caught in the middle of March in the Mjöfiord in Iceland. The maximum length of these herring was 347.5, 353.5, and 350 millimeters, respectively, and the weight of the spawn-bags 71, 62, and 91 grams, respectively. The spawning season of these Iceland herring sets in probably somewhat earlier than that of the Norwegian herring. We have merely stated this because the spawning season of both these kinds of fish sets in later than that of the spring herring.

The Loffoden herring had been caught in the Borgefiord. This fiord, which is scarcely half a mile long, and somewhat narrower, is connected with the Polar Sea by a narrow sound, not quite a quarter of a mile long, which can only be crossed by boats in a few places when the tide is in, and which is almost dry when the tide is out. The Pollen, a sheet of water farther inland, which is somewhat larger than the fiord, is connected with the latter by a short watercourse about 3 feet deep. The greatest depth of this fiord is said to be 40, and that of the Pollen 60 fathoms. In the fiord the tide can be noticed, but not in the Pollen, whose waters are said to contain but little salt. The herring prefer to stay in the fiord, but they have also been caught in nets in the Pollen. Besides herring the *Gadus virens* is occasionally caught in the fiord, and both here and in the Pollen not a few salmon and salmon trout. It is said that there are no other fish in these waters.

From information furnished by the inhabitants of this region, it appears that about ten years ago, during the "great herring" period, herring first made their appearance in these waters, some probably as early as the autumn of 1871, and that, unable to leave them, they propagated here, which may be concluded from the circumstance that young fry of all sizes are found, even up to the "Christiania herring," which must be considered as the oldest offspring of the immigrants. The large specimens which we examined belonged, therefore, to the original immigrants. The fisheries take place almost exclusively in spring when the ice has melted, and when large schools of herring appear on the coast. It is difficult, however, to catch the herring, because they are very shy. At other times they are but rarely caught in nets. As only nets with large meshes are used, only full-grown fish are caught. During the present year 30 tons have been taken; but as a general rule the quantity is much less. In exceptional cases 50 tons have been taken in a year.

From all the information obtained it seems certain that one and the same tribe of herring has lived and propagated in this natural aquarium. The conditions, strange in more than one respect, under which these herring have been compelled to live during this long period in their involuntary imprisonment, do not seem to have had any hurtful influence on their well-being, or to have shortened their life; provided, of course, that the specimens which we examined were some of the original immigrants. Undisturbed by all their enemies, man alone excepted, and seemingly free from care as far as obtaining food was concerned, this quiet life has possibly aided in lengthening their existence. On the other hand, their offspring seem to be somewhat feeble, as is also the case with the salmon in inclosed waters. A more thorough examination of the conditions of temperature, food, saltness of the water, and a number of herring of different age at different seasons of the year would be of great interest, and would form an exceedingly valuable contribution to the natural history of the herring; as it is highly probable that we have here before us one and the same generation at a different age.

As there are several places in Norway where the conditions are the same as in the Borgefiord, the editor of the journal from which we have given the above extract has requested all persons interested in this subject to furnish him with information in regard to it.

168.—FISH IN THE NATIONAL PARK AND TRIBUTARIES OF SNAKE RIVER—PROPAGATION OF WHITEFISH.

By J. E. CURTIS.

[From a letter to Prof. S. F. Baird.]

I spent two months of the past summer in the Yellowstone National Park, and while there an item concerning fish came to my notice, which I would call your attention to. I have hope of your using your influence that some effort may be made towards preventing the destruction of certain kinds of fish. This seems to me would be the right and proper thing for the Government to do, particularly in that portion of the country which has been dedicated to the people as a national park. There is a lake there called Lake Henry, situated on the public road built by the Government leading from the Upper Geyser Basin to Virginia City. This lake is the headwater of one of the tributaries of Snake River. I spent some three or four days in a thorough examination of this lake, and have become satisfied that it is the breeding ground of the salmon-trout, which are so plentiful in Snake River and its tributaries. There was no boat on the lake, and of course I could get over it only on a clumsily constructed raft poled around by the men I had with me. The trout in this lake were in schools three or four deep, one above the other, seemingly packed as close together as fish could conveniently be, and these schools extended as far as the eye could reach. There is going on a terrible destruction of these fish by the visitors of this park by spearing, and there is not only taken out as high as 600 to 700 pounds in one night, but they wound and mutilate nearly as many as they catch.

In previous years a man netted immense quantities of these fish (trout), and I am informed that he is now making arrangements to go into this lake and again net out these fish. If your influence can be used to bring about their protection and prevent their destruction I think that it will preserve a plentiful supply of this class of fish for all time in the Snake River and its tributaries. I did not see in this lake a single fish of any kind other than the salmon trout, and their numbers seem to me to be beyond conception. While there I fished in the Gallatin and its tributaries, the Madison and its tributaries, also the Yellowstone and its tributaries. I found, to my surprise, an abundant supply of grayling as well as trout in these rivers. I also found another kind of fish equally as gamy as either a trout or the grayling, known in that country and called by the people a whitefish. This fish in shape was very similar to the grayling, having the same dorsal fin far back on the fish as the grayling only not so large, and not having such variety of color as the fin of the grayling has; and one marked peculiarity of this fish is that its mouth is the exact shape of that of the sucker. The flesh of this fish is equal to that of the trout, if not superior, and one among the few fish that it has been my fortune to find which was fat enough to cook itself. While there I heard one other name for this fish. I met a man on the Yellowstone River who told me that the correct name of the fish was the "sterlet" or "steret"; how he spelled the name I do not know; I spell it to you simply to pronounce the name he gave the fish. This fish is found in the Yellowstone, Gallatin, and Madison Rivers. While the grayling was very plentiful in the Madison and Gallatin and their tributaries, I did not find any in the Yellowstone.

I have hoped for a long time to be able to give you definite information in regard to my efforts in the propagation of whitefish in the inland lakes in the State of Michigan. In a previous communication to you I gave the names of lakes and localities where I planted whitefish and the number so planted. I have received from parties residing in the vicinities of those lakes several well-developed whitefish weighing from 8 to 10 ounces, and I have recently been informed by a reliable gentleman who lives near Klinger Lake, Saint Joseph County, Michigan, one of the lakes where I planted fish, that one was speared there this fall weighing 3 pounds. I regret exceedingly that I was unable to procure the fish for examination. I am, however, soon to make some thorough experiments in these lakes to demonstrate whether or not these fish have grown and multiplied, and I will most gladly, when this is done, give you the result.

TOLEDO, OHIO, *November* 26, 1882.

Vol. IV, No. 22. Washington, D. C. Aug. 13, 1884.

169.—NOTES ON THE SHAD SEASON OF 1884, WITH REFERENCES TO OTHER SPECIES.

By CHAS. W. SMILEY.

The following items have been received from different sources, and indicate generally a good season:

THE DELAWARE RIVER.—A shad weighing over 7 pounds was speared below the canal company's dam in the Delaware River at this place last night (May 3). This is the first shad of the season, and its early appearance in these upper waters is another illustration of the success that has followed the efforts of the United States Fish Commissioner in restocking the Delaware with shad. For twenty-five years preceding the restocking, which was begun in 1872, no shad was seen further up stream than Milford, 30 miles below Lackawaxen, although they had been at one time plentiful at Hancock, over 50 miles above here. Thousands were annually taken between Lackawaxen and Hancock in eel-weirs and bush-seines, the rough and rocky part of the river preventing the drawing of nets. Not only the mature fish were captured, but the young fry were destroyed in immense numbers by hundreds of traps. This indiscriminate slaughter of shad, from the head-waters of the Delaware to tide-water, resulted in their total disappearance from the stream above Milford, and in 1872 the fisheries at that place yielded only single fish where they had once rewarded the fishermen with enormous hauls.

In 1875, three years after the restocking experiments had been tried, there was a notable increase in the catches at Milford, and in 1876 shad again appeared as far up as Lackawaxen. The increase has been large and steady ever since, and now shad arrive here in large schools every spring. They are unable to go further up the river, as the canal company's dam is an obstruction which they cannot overcome. But for that, the upper waters of the Delaware would soon be as well supplied with shad as they were half a century ago. As they are now protected against bush-seines and eel-weirs, and as nets cannot be successfully used above Milford, there would be no means for the people up the valley to take the fish, except by spearing, which is the manner in which they are captured at Lackawaxen. They gather at the foot of the dam and remain there. Men and boys collect at night at the bulkheads and breakwaters. By throwing strong light on the water by means of jacks the fish are plainly brought to view and are speared by the hundred. The one killed last night was the largest one ever seen so far up the river.

SALMON.—At the time the river was restocked with shad, salmon were also introduced into it. It was believed that this would be followed with great success, as the Delaware is a natural salmon and trout stream, and when the valley was first settled by the whites teemed with both of these fish. In 1877 a large salmon was captured near Port Jervis, and one weighing 9 pounds was killed at Easton. Since then, however, none have been taken, although they have been introduced by the thousand both in the upper and lower waters.

TROUT.—The stocking of the river with California trout has been a success, as they have appeared in large numbers in the upper stream and its tributaries, according to reports from those regions.

LACKAWAXEN, PA., *May* 4, 1884.

THE HUDSON.—The run of shad for a few days past has been heavy. One fisherman caught over 600 in one day last week, another over 400, and single drifts of from 50 to 200 fish each are reported. The water is yet "roily" from the spring freshets. The fish are unable to see the fine thread nets used, hence the fishing can still be done by daylight. The heavy run of shad has reduced the prices rapidly, and fine fish can now be had here for from 15 to 20 cents each.

For many miles the river is now daily filled with shad nets, and the passing boats and vessels navigate the channel with great difficulty. There is great strife among the fishermen for the first place or best chance to throw their nets.

STURGEON AND BASS.—It is found that sturgeon are more plentiful in the river than usual so early in the season and the huge fish are giving considerable trouble by tearing the nets. Large bass have also been taken of late, and a few California trout have been caught at some points.

KINGSTON, N. Y., *May* 7, 1884.

NARRAGANSETT BAY.—John H. Barden writes to Professor Baird as follows: "We are having an excellent run of shad in our bay this year, from what we put in four years ago. For the past two years we have not been able to plant any, which will give a small run for the next two years. There is nothing that we can do that will help all classes so much as a good supply of fish. We have one of the best bays in the world and we want a large supply to put in.

"ROCKLAND, R. I., *May* 6, 1884."

We have had the best run in our bay this year for the past ten years, from those put in four years ago.

PONAGANSETT, R. I., *June* 5, 1884.

WARREN RIVER AND GREENWICH BAY.—Mr. Henry T. Root, of the Rhode Island Commission of Inland Fisheries, writing to the editor of the Providence Journal, says: "In the article 'Some Notes about Fish,' in this morning's Journal, the writer attributed the plentifulness of shad in the Warren River and Greenwich Bay to the unusual height of the Connecticut River and its coolness, owing to the late melted snow. Allow me to suggest a more plausible theory, and one more to the credit of the instinctive habits of the shad. In June, 1881, Mr. Newton Dexter, of the Rhode Island Commission of Inland Fisheries, placed in the upper waters of the Warren River 500,000 young shad. The present spring is the time that these shad should return in their mature state. Many of us have been awaiting this very time, believing that we should not be disappointed, and that the quantities of shad caught in our waters this season would materially reduce the price, and such has proved to be the fact. At this writing more shad by many hundreds have been taken from Warren River than were taken there during the whole of last season, and by many it is thought the biggest run of shad has not yet arrived. The theory of snow-water having forced the shad to seek warmer waters may apply to their being repelled from Palmer River in such numbers as to account in a measure for the quantities in Greenwich Bay."

SAINT JOHN'S RIVER.—Writing from Palatka, Fla., December 15, 1883, Mr. H. H. Cary, superintendent of Georgia fish commission, said: "The shad have commenced running in the Saint John's River. Several were caught this morning or last night near this place in gill-nets. On making examination I find they are mostly males. I found one female with roe pretty well developed, but not ripe. I will spend several days in endeavoring to find the spawning grounds of the shad in the Saint John's. So far as I know, this is an unsolved problem, as there are no shoals in this river. I am impressed that the spawn is cast upon the sands of upper lakes connected with or really forming a part of the river. If any results are obtained the United States Commission shall have the benefit of them."

POTOMAC RIVER.—The following is compiled from an article which appeared in the Washington Evening Star of May 24:

The season has been a decided failure, worse than any season since 1878, when the catch was a little below the present season. Most of the fishermen set out early to get upon their respective shores with their gangs of men and appliances. Some of these lessees started down stream in February, and by the middle of March all were off, together with hundreds of gill netters and trap netters, to occupy the spaces in the river between the seines. Moxley's Point, the landing so long occupied by the late James Skidmore, about 15 miles down on the Maryland shore, was among the earliest occupied, with Capt. Edward Faunce to superintend the gang of thirty men. His 300 fathoms of seine have been actively engaged every ebb and flow of the tide, but with indifferent success.

As a general thing, herring make their first appearance before the shad. The first herring taken this season was on the 18th of February, when 23 were caught at Moxley's Point. During the succeeding days of February only 1,033 herring were brought up to this market, and not one shad. The first shad caught this year was on the 5th of March, when 6 were sent up to market. About this time the cold weather came again and the fish were driven back into the bay by the northwest winds. No more shad were seen until the 10th of March, and but few herring.

The 3d of March, 3,672 herring were brought to this market, and no more were caught till the 10th of March, when 530 were landed; the 24th of March, 20,262 were received, the largest number for any one day in that month. The total number of herring in March from all the shores, on both sides of the river, was 185,540, and of shad, 20,351. April is the best month for the yield of fish in the Potomac. This city is only one of the many markets for Potomac shad and herring, but generally very large numbers of fresh shad are brought to our wharves to pack in ice. The number caught up to and including the 17th of May is 5,404,997 herring and 222,082 shad.

As before stated, the seines are nearly all cut out, but the river is bristling with trap and gill-nets from the highest tide-water to the Chesapeake Bay. With a very slight exception, every one engaged in fishing has sustained a positive loss. For instance Moxley's Point operated by the late James Skidmore's heirs did nothing. Heretofore this shore has been reckoned as first-class among the successful ones; next in detail is Bryan's Point, operated by Mr. Conrad Faunce, an old and reliable fisherman; then comes Greenway, Pamunkey, and Chapman's Point, before considered good shores, but this season they are failures. The above shores are on the Maryland side. On the Virginia side we have Ferry Landing, White House, Stony Point, and Freestone Point. These shores generally yield a small but sure profit, but this season they made signal failures, losing in the aggregate about $7,000. The only exception to this general rule of loss is the Clifton, operated by Mr. Waller; The Gums, fished by Mr. Jerry Raub; and Windmill Point, operated by Messrs. Ewing & Co.; the last three named being the three lower shores on the Virginia side. Their success is attributable to the peculiarity of location, being shallow and flatly formed, together with a combination of circumstances such as the great rains in February and March, and northwest winds that prevailed during the month of April. These shores were the great center of attraction for the branch herring.

In regard to the artificial plants, were it not for the services of the United States Fish Commission, necessity would compel a cessation of fishing the large shores; and the Potomac, as far as the large fisheries are concerned, would be a thing of the past. In view of the fact of there being no legislative protection for shad and herring, they are fished in season and out of season, hence the almost extinction of one of our best food-fishes.

The following will show the decline in the numbers of shad. During the present season there have been caught and brought to the fish wharf in this city 226,721 shad, while in 1868 Mr. John Gibson sent alone from Stony Point and High Point 219,205, nearly as many shad as all the fishermen on the Potomac sent to the wharf the present season.

At that time all the following shores were fished: On the Maryland side: Tent Landing, Moxley's Point, Bryan's Point, Greenway, Gut Landing, Pamunkey Point, Chapman's Point, Stump Neck, Budd's Ferry, and Goose Bay. On the Virginia side: Ferry Landing, White House, Stony Point, High Point, Marshall Hall, Freestone Point, Cock-Pit Point, Opossum Nose, Mr. Hoes', The Clifton, Arkendale, The Gums, Tumps, Windmill Point, and Caywood's, besides a host of smaller shores not mentioned. Some of the large fisheries were leased and rented for large sums annually, as the following will show. The shores on the Maryland side, ranged in price per annum from $500 to $1,000, while those on the Virginia side ranged still higher, Stony Point renting annually for a number of years for $2,500, Freestone Point from $1,300 to $3,500, White House from $1,000 to $2,000, and other shores in proportion. At present but few of the large shores are fished, owing to the scarcity of fish.

No one cares to assume the risk incurred, while those which are fished are at very low rents, and many of them conditionally, the owners not caring to have their shores remain idle.

NANTICOKE RIVER.—E. L. Martin writes:

"We are just feeling the beneficial effects of the shad deposited by you in the Nanticoke. I am informed by old fishermen that notwithstanding the backward and unfavorable spring, there have been more shad taken from the Nanticoke than for many years. I have never seen larger or better ones.

SEAFORD, DEL., *May* 1, 1884.

SACRAMENTO RIVER.—The Havre de Grace Republican says:

"We learn from Commander Frederick Rodgers, U. S. N., now stationed at Mare Island, California, that shad are now being caught in large quantities in San Francisco Bay and other waters of California. There were no shad there until they were introduced by the United States Fish Commission several years ago, thus proving beyond a doubt the good results of their labors."

170.—MEMORANDA ON LANDLOCKED SALMON.

By CHARLES G. ATKINS.

A.—SYSTEMATIC POSITION.—There have been thought to be several distinct species, or at least several naturalists finding landlocked salmon in this or that district have thought them new species and have called them *Salmo sebago*, *S. gloveri*, &c. Within a few years Dr. Bean and others in Washington have carefully compared them with *S. salar*, and find no specific difference.

The difference in size is commonly very great, landlocked salmon in general being but one-fourth or one-fifth the size of the river or sea salmon. There are also differences in color. Landlocked salmon never in the breeding season assume so bright colors as male river or sea salmon. Aside from these unimportant differences may be mentioned as more important the difference in habits, landlocked salmon not going to the sea, as a rule, though it is likely that it sometimes has occurred to stray individuals to descend the Saint Croix or Presumpscot to the sea. They find their normal sea in the lakes. Also it may be noted that though in maturity the landlocked salmon are smaller, in embryonic stages they are larger, the eggs being perhaps 10 per cent greater in diameter.

Another interesting point of comparison is the retention of the embryonic markings to a much greater age by landlocked salmon than by river salmon. I have seen a Sebago salmon 13 inches long with the dark bars on the sides still very distinct, and in removing the skin of adult landlocked salmon, I have found the marks still distinct on the under side of the skin and on the membrane that still covered the flesh, as though the restriction of the landlocked salmon to fresh water had stopped its development, keeping it still in a somewhat embryonic stage.

B.—RANGE.—FOUR DISTRICTS IN MAINE, viz.:

1. Basin of Presumpscot River (Lake Sebago, &c.).

2. Basin of Sebec River, a branch of the Penobscot. These salmon are not known to be found in other parts of the Penobscot Basin. It is singular that they have not spread all through the Penobscot, as it has many lakes seemingly well suited to them.

3. Basin of Union River, Hancock County.

4. Basin of Saint Croix River.

The fish of the Presumpscot and Saint Croix had earlier a wider range than the others, and in both rivers were occasionally caught almost down to tide-water. Within twelve years I have seen two that were taken at Cumberland Mills on the Presumpscot.

C.—SIZE OF ADULTS.—This varies much. The Sebago fish often reach 8 and 10 pounds, and sometimes 15. Saint Croix (or Schoodic, as we commonly call them) salmon rarely exceed 6 pounds, and average 2½. They are larger in some parts of the Schoodic Lakes than others, but these differences are not constant. For instance, in 1875, those caught at Dobsis were nearly twice as large as those of Grand Lake Stream, but the latter have increased in size year after year, until now they are about the same size as the Dobsis fish. The Union River fish are large, about like the Sebago salmon; the Sebec fish are about like the Schoodic in size.

There are local differences recognizable to one acquainted with the different varieties, but hardly to be described. One interesting point of difference between Schoodic and Sebec fish is this: Sebec fish mature at a smaller size than the Schoodic,* and, while still small, frequent the

* Later researches indicate that this is true only in comparison with the fish of Grand Lake. In some of the other Schoodic lakes we find fish that mature when of small size.

same grounds with the large fish. Sebec salmon, apparently mature, having lost the red spots and dark bars, may be taken on the same day, all the way from 8 inches up to 2 feet in length, but of Schoodic salmon, as taken at Grand Lake Stream, I have never seen a mature fish which was less than 12 inches long, very few are less than 15, and never one that had lost bars and red spots was less than 11; and these small fish, as well as the smaller ones with bars and spots (8 or 9 inches long), are rarely found with the larger fish.

D.—GRAND LAKE STREAM.—This is the headquarters of the variety of the Schoodic Lakes. That is, to no other stream do so many salmon resort to spawn; and in no other lake do so many find their home as in Grand Lake. After the prevailing backwoods system of nomenclature, the stream that flows out of Grand Lake is called Grand Lake Stream. Here, as in many other instances that I know of, the salmon move down from the lake into its outlet at the spawning season instead of up into the tributaries. It follows that the young fish, instead of dropping down with the current as young sea salmon do, are in the habit of ascending their native streams till they reach deep water above.

Grand Lake is one of the finest sheets of water in Maine, with clean, wooded shores, and very clear water. Grand Lake Stream is a bright, dancing stream, 3 miles long, with quick water almost every rod, and abundant spawning grounds.

E.—THE BREEDING OPERATIONS.—For eight years we have been conducting almost the entire business of spawning for the fish. Our traps span the stream at the outlet of the lake. No fish now get past us except by accident. With fine-meshed nets we build a series of inclosures. Those which the fish first enter are on the principle of a weir or pound, and few fish ever get out against our will. They come in mostly by night. Every morning we count our catch and sort them, taking spawn from all that are ready. The earliest fish begin to spawn in the stream before the end of October; we begin to take eggs a few days later, from the 4th to the 8th of November. Many of the females have to be kept some days before they are ripe. (Not so with the Penobscot fish—sea salmon—which are generally all ripe together, and some days earlier than the Schoodic.) The yield averages 1,600 eggs per female. We commonly catch four females to three males. The males come in earlier in the season. The first run is nearly all males; the last, nearly all females. The ripe fish continue to come in until November 20; sometimes not all are manipulated till December. Often there is severely cold weather during the spawning season. We operate under cover of a roof. Sometimes ice shuts us off from communication with the lake; but if not, we take the fish we have manipulated in cars and tow them 1 or 2 miles up the lake, where they are set free. One-fourth of the spawn taken is hatched here and the fry let loose in Grand Lake, to avoid exhausting the supply. There has been no falling off as yet. The fry are planted along the shore scatteringly where there are loose, rough rocks for them to hide under.

We have three spawn houses, or rather one developing house (exclusively so) and two hatching houses. The developing house is fed with lake water. Its location compels us to vacate it in March, but the long stay of the eggs in the cold lake water keeps development back, so that none are hatched and grown enough for planting until June, when their natural food has become abundant.

Our best hatching house stands on the lake shore and is a very substantial structure, partly under ground, with massive stone walls; it has capacity for developing 4,000,000 eggs or hatching 1,000,000. Troughs are arranged on six floors, and water runs through the series, so that it can be used at least three times, with ample facilities for aeration. We pass water from one trough to another by letting it fall in a broad, thin sheet over the side of the trough. This is very effectual, and young hatched in this house are exceedingly vigorous. The above hatching house covers 1,500 square feet of ground. We have also a neat little cottage for the superintendent, a lodge for the foreman, an ice-house, and a wood-house, all in convenient proximity.

Our method of manipulating fish is perhaps common. We use the "dry method" wholly. Ten-quart tin milk-pans receive the spawn and milt. The fish are used just as the "dipper" hands them up, male or female first, as may chance. After the eggs of four or five fish are taken and well milted another hand takes them, agitates them diligently for a few minutes, and then washes them off at once, after which they stand in pans on shelves till it is convenient to carry them to the hatching house. Careful observation has shown that impregnation is instantaneous upon contact of milt, and all agitation and waiting is merely to secure contact. Milt in pure water loses spawn in a few seconds, retaining scarcely any power after one minute. Eggs likewise soon lose their capacity for impregnation if put into water; but a little water does no appreciable harm within a few minutes. Either eggs or milt can be exposed to air for hours without losing power. The mucus that comes with the eggs from the fish does not act on milt or eggs like pure water; milt in it retains its power for hours. If males are scarce we strain out the milted liquid from a spawn pan and use it again. In a can standing in water I have kept it forty-eight hours and then used this mixed mucus and milt effectively.

Three-quarters of our eggs are shipped away. The owners are Maine, Massachusetts, Connecticut, and the United States. We pack in sphagnous moss, wet to imbed the eggs, and dry to surround this mass. Surrounded by 3-inches dry moss they go on a sled, in the morning, with the temperature 10 to 15 degrees below zero, 28 miles (taking the whole forenoon), without the frost penetrating to them. The eggs are ready to pack as soon as the eyes become black. We send all off from January to March. What we keep hatch in May and are set free in June.

BUCKSPORT, ME., *February* 15, 1883.

171.—NOTE ON THE REGENERATION OF THE SCALES OF THE GERMAN CARP.

By JOHN A. RYDER.

In the early part of 1884 a fine specimen of the German carp, of the mirror variety, was brought from the carp ponds to the Armory Building, where it was placed in one of a number of large aquaria. Unfortunately in handling the specimen, which is now nearly 18 inches long and 5 inches wide, one of the largest scales of the large lateral series was knocked off, so that after a careful examination the writer expressed himself satisfied that the injury received by the fish was considerable, and that there could be no doubt that nothing of the scale remained, though it is probable that the "bed" or tissue from which the scale grew was preserved, but the outer investment of the scale was almost altogether gone. The scale in question was situated just behind the right operculum, and was nearly or quite an inch wide vertically.

Dr. R. Hessel, who was present when the scale was knocked off of the fish, picked it up and kept it. There is therefore no doubt whatever that it was wholly removed.

After about five months have elapsed, or at the time of the present writing, an examination shows that a new scale has been formed in the situation where the first one grew, similar in form to the old one, but apparently thinner, the outer skin investing it being also less densely pigmented than that which covers the scale in a corresponding position on the opposite side of the body.

When the scale was first lost the surface from which it had been removed was congested, though the irritation in the vicinity seemed to subside after a fortnight or thereabouts, so that but little evidence of the injury remained, except the whitish appearance of the skin where the scale was originally situated. It is still lighter in color, but is otherwise perfectly healthy, though the fish had been for a time infested with fungus, from which it recovered entirely, in spite of the fact that an abraded surface was exposed which would render it more liable to succumb to the inroads of the vegetable parasite.

To what extent the scales of fishes may be regenerated, and under what conditions, the writer is not able to say, but there is no doubt whatever that such regeneration sometimes occurs, as in the case cited above. Without taking the trouble to look up the literature relating to the regeneration of the scales of fishes, of which there does not, so far as he is aware, seem to be much, the writer has thought the foregoing well-authenticated case of the regeneration of these structures worthy of record, so that others might be profited in case it should be desired to investigate the subject still farther. It is doubtless true that, as in the case of the nails, where if the underlying epidermis or "nail bed" is lost the nail does not again grow out, so in the case of the fish, if the entire investment of the scale, both internally and externally, was removed the latter would not be formed again.

This observation has some slight practical value, since in the transportation of young carp it frequently happens that the scales which, as in many fishes, are not firmly embedded in the superficial layers of the skin, are accidentally removed in handling, even when considerable care is exercised, to the apparent injury of the individuals. If it is true that under ordinary circumstances scales which have been lost without impairing the tissue from which they have been formed are again produced in the situation and of the same size as the scales which have been removed, then it is evident that such an injury is not very serious, even if not desirable, and that it will not very greatly interfere with the growth and health of the young fish.

WASHINGTON, D. C., *July* 25, 1884.

172.—THE STURGEON FISHERY.

By H. C. HOVEY.

In the month of May, when sturgeon most abound, the market is usually supplied with other and choicer varieties of fish. Hence, until recently, this really valuable food-fish has been neglected and its commercial importance underestimated. This difficulty has been met and overcome by the enterprise of New York packers. The process consists in placing the sturgeon, as soon as caught and dressed, in a large freezer, where, by a patented method, they are frozen solid as they lie in boxes. This process is so perfected in the works at Salem, N. J., that 125 sturgeon, averaging 85 pounds each when dressed, can be frozen every seven hours. The fish are afterwards taken out of the boxes and stored in large rooms, through the center of which a freezing apparatus extends which is charged anew every day. By this means the fish can be kept for months until they come into demand.

The sturgeon range from Georgia, in winter, to Saint John, N. B., in summer, and are followed up in their season by men expert in their capture. Large gill-nets are used in this business, each about 200 fathoms long and with meshes a foot in size.

The Delaware River is the principal field of operation. Sturgeon enter this stream about the 22d of May, and in such immense numbers that nets about a quarter length have to be used, larger ones being at that time unmanageable. Mr. Blackson, an experienced fisherman, tells me that he has seen them so abundant that his net would sink with their weight as soon as it was thrown out. The average catch per net is from 25 to 30 fish apiece at each cast. This lasts about two weeks. The sturgeon move steadily up-stream towards the head of the river, and then suddenly disappear about the 10th of June, after which they must be sought elsewhere. How they get out of the river without being caught is a mystery. All that the fishermen know about it is, that one day they are busy catching fish and the next all their nets are empty.

The boats used in this business are all constructed on the same plan; about 24 feet keel, 7 or 8 feet beam, capable of carrying about 30 sturgeon apiece. A boat load of big ones looks, oddly enough, like a load of small logs.

The flesh of the sturgeon, as is well-known, is rather coarse and oily; and, as much depends on its right preparation for the table, we took some pains to inquire how it is cooked by the wives of the fishermen themselves, who ought to know as well as anybody, seeing that it constitutes a staple article of their diet. From several methods recommended, we give the two that seem the most promising:

The first method is to cut the flesh into slices and parboil them to get rid of the superfluous oil, and then fry them in a thin batter.

The second method is to cut up the meat into squares, 2 inches thick, which are to be thoroughly boiled, and then pickled for two days in spiced vinegar, after which they are ready for eating, and are considered excellent by the fishermen.

The usual way of preparing sturgeon for market, however, is by smoking. Strips an inch or two thick are put through a pickling process, then hung on hooks over slow fire of corncobs or sawdust of hard wood. After thus smoking for a single night they are ready to be shipped to any part of the country.

The preparation of caviare is an important part of the business. While this is not yet in as general use in this country as in Russia and other parts of Europe, where it is in so high esteem that no repast is served without it, it is coming into favor, especially in the Western and Southern States. There are two sorts of caviare, the soft and the hard, the latter being worth about twice as much as the former. The value of the best hard caviare in the South, early in the spring, is said to be from 15 to 20 cents a pound.

In order to make the best article, it is necessary to strip the roe from the sturgeon as soon as possible after the fish has been caught. Before being dried, it is rubbed through a coarse sieve to break the eggs apart, and to free them from the membranous tissue. Next, the roe is thoroughly salted, after which it stands a certain length of time. Then it is emptied into fine sieves, where it remains till it is so dry as to roll like shot. The finished caviare is packed in casks previously lined with napkin linen, each layer being salted with fine table salt. Each keg holds about 150 pounds. With proper care, the caviare may be kept for a year or longer. For the trade it is often canned like fruit, in which condition it will stand transportation to warm countries and will keep an indefinite length of time. It may be eaten as put up without further preparation, though it is thought to be improved by the addition of a little vinegar or lemon-juice. Pressed caviare is a favorite with Russian soldiers, who are said to take a liberal supply in their knapsacks whenever they are going on a long march. Improvements might be made, no doubt, in the preparation of American caviare, and the subject is worthy of receiving the especial attention of packers.

SCIENTIFIC AMERICAN, *July* 26, 1883.

173.—THE CULTIVATION OF THE SEA.*

By Dr. KARL VON SCHERZER.

Yesterday's meeting of the Society for Promoting Useful Knowledge (*Gemeinnützige Gesellschaft*) was taken up by an exceedingly interesting and instructive lecture by the ministerial counselor, Dr. von Scherzer, on the subject of "The Cultivation of the Sea."

"Neptune's empire is far more fertile than the most productive field. There are no waste places in the water as there are on the land, and it is only owing to the comparative ignorance as regards nature's institutions and purposes that thus far aquatic animal and vegetable life has been cultivated only to a very limited degree. How many thousand square miles of virgin soil would have to be plowed to produce uninterruptedly as much nutritive substance as the vast sea produces without ever becoming exhausted! The constant and rapid increase of population, in connection with its constantly-increasing demand for food, makes a corresponding increase of the articles of food an absolute and urgent necessity. Agriculture is encroaching upon the pasture-grounds which are needed for stock-raising, and threatens to make meat still more expensive than it is at present. For this reason it seems the part of true wisdom to benefit mankind by supplementing the insufficient harvests of the fields by the harvests of the watery empire."

In this connection Dr. von Scherzer in his lecture gave a vast number of highly-interesting facts, which deserve to be known in wider circles.

In Great Britain 120,000 men and 37,000 boats are engaged in the fisheries proper (not including the various manufactures of fishery products), and the capital invested in this maritime industry amounts to about 1,000,000,000 marks ($238,000,000). The quantity of fish annually caught in British waters amounts to about 600,000 tons, so that on an average every fisherman annually catches 5 tons of fish. At Billingsgate, the famous London fish-market, about 800,000 pounds of fresh fish are sold every day, which as to nutritive matter corresponds

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* *Die Bewirthschaftung des Meeres.* In *Leipziger Tageblatt und Anzeiger.* Leipsic, March 13, 1884. Translated from the German by HERMAN JACOBSON.

to about 1,000 head of cattle. The annual total value of the British sea-fisheries is 500,000,000 marks ($119,000,000).

Norway, with its unfavorable climate and its small population of about 1,800,000, annually exports 50,000,000 marks' worth of fishery products ($11,900,000), which does not include the amount consumed at home, valued at from 15,000,000 to 20,000,000 marks ($3,570,000 to $4,760,000).

France employs 22,000 boats with 80,000 men in the sea-fisheries proper, and 46,000 persons (mostly women and children) in the coast-fisheries, the total yield amounting in value to 70,000,000 marks ($16,660,000).

Italy's harvest of the sea annually amounts to 40,000,000 marks ($9,520,000); and Russia's annual harvest from the sea-fisheries alone amounts to 70,000,000 marks ($16,660,000).

The German Empire, on the other hand, and the Austro-Hungarian Empire, whose combined population is about one-fourth of the entire population of Europe, and whose coasts are washed by the waters of three seas rich in fish, have as yet done but little towards the cultivation of the sea, and towards gathering in the harvests which it affords to any one who stretches out his hands. According to official statistics the entire German coast states have not more than 30 large fishing establishments, employing about 300 persons, while the small establishments number 10,700, employing about 14,000 persons, making an average of hardly 1½ persons to each establishment. This state of affairs can scarcely be considered satisfactory, considering the fact that Hamburg, Bremen, Lubeck, Hanover, Schleswig-Holstein, the two Mecklenburgs, Oldenburg, and finally Prussia, with its long coast line from Stralsund to Memel, offer numerous opportunities for maritime enterprise. Unfortunately there are hardly any exact and special data as regards the annual result of the German sea-fisheries. Even the voluminous and expensive official report of the Berlin International Fishery Exposition of 1880 does not give the desired information. From various commercial reports we gather the fact that the entire quantity of products of the sea imported into Germany in 1882 represented a value of 77,000,000 marks ($18,326,000), including 52,800,000 marks' ($12,566,400) worth of salt herring! But it is not stated in these reports how much of this quantity was imported by foreign fishermen in vessels sailing under foreign flags.

Even in such a specifically German ocean as the North Sea we find but comparatively few German fishing vessels, while the English, Dutch, Danes, Swedes, and Norwegians enrich themselves from this sea, and thereby also increase their naval strength. The annual result of the Austrian sea-fisheries, which employ about 9,400 persons and 2,900 boats, scarcely reaches 4,000,000 marks ($952,000), and therefore bears no proportion to the wealth of fish contained in the Adriatic, and to a coast line extending for more than 2,600 nautical miles.

After Dr. von Scherzer had given an interesting sketch of the vast extent of the fisheries of some countries outside of Europe, especially in the United States, accompanied by some characteristic illustrations of the most important treasures of the watery kingdom, he passed from the sea-fisheries to the fresh-water fisheries in rivers, ponds, and lakes, and gave a vivid description of the vast and truly beneficent efforts for improving the fisheries, made by the United States Government, efforts which have been crowned with the most astonishing and brilliant results. In this respect Prof. Spencer F. Baird, the distinguished ichthyologist and director of the world-renowned Smithsonian Institution at Washington, which, under the modest motto, "to diffuse knowledge among men," has done so much for science and accomplished such great results, has, by his wise and extensive measures, given a great and healthy impetus to artificial fish-culture, and has in these efforts been supported most liberally by his Government, which, during the years 1871 to 1879, has appropriated no less than $1,306,000 for this useful purpose.

From the almost overwhelming mass of statistical data and instructive information, which kept the attention of the audience till the end of the lecture, we will quote only the following as showing the vast importance of the cultivation of the sea. The daily quantity of fish food consumed per head of the population is: In London, one-seventh pound; in Paris, one-half pound; in Berlin, one-fortieth pound; in Vienna, one four-hundredth pound. This comparatively small quantity in the German cities indicates a neglect in the matter of utilizing the vast treasures of the sea as food for the masses, for recent scientific investigations have shown that one hundred parts of fish-flesh contain 12 or 13 per cent of blood and strength-producing matter, therefore only 5 per cent less than beef, and 4 or 5 per cent more than wheat bread.

One pound of beef costs, in Leipsic, from 70 to 75 pfennige (about 16 to 17½ cents), including a great many bones (for the butchers of all civilized nations have made the custom of the so-called "throwing in" of the bones an economical principle), while one pound of codfish, even at the retail price, only costs 20 pfennige (4½ cents).

"All that is needed for supplying the great masses of our population all the year round with a cheap, well-flavored, and wholesome article of fish-food is to cultivate our water area in a suitable and rational manner, to improve our means of communication, and to reorganize our local markets."

The large audience rewarded the lecturer by loud and long-continued applause. Dr. von Scherzer stated that he would gladly comply with the wish of the chairman and publish a full report of his lecture, thereby making it accessible to a larger circle.

LEIPSIC, GERMANY, *March* 12, 1884.

174.—THE FISH OF DEVIL'S LAKE, DAKOTA.

By HENRY W. LORD.

[From a letter to Prof. S. F. Baird.]

Devil's Lake is about 50 miles long, and has a shore-line of over 300 miles. The water is slightly salt, very bright and clear, and in many places said to be very deep. The water has the greenish tint of sea water, and along the shore where the waves are beating and evaporating on the rocks and sand it produces the exact smell of the sea-shore. The only fish in the lake of any size are the common long-nosed pickerel of the eastern ponds and rivers (of the *Esox* family, I think). They are very numerous, and are caught in great quantities. Of small fish, the minnows are in vast numbers. The settlers all think that the minnows are young pickerel, but I am convinced that not one in a thousand is pickerel, though they look enough like them to suggest the idea. I think they are a little thrown back and come to maturity at about 2 inches in length. I also observe among them a very few of what are usually called shiners, so common in all eastern brooks, but have never seen any that were more than two and a half inches long. When I talked with you it seemed to be your opinion that the rockfish (striped bass, I suppose), so numerous in the Potomac, would thrive here. I have no doubt they would. You also thought the whitefish would do well. I have no doubt that the several varieties of land-locked salmon and lake trout would thrive admirably. Of course all kinds would be subject to depredations from the pickerel, but the millions of other minnows in the lake would at least divert attention from the new plant and give them good chance for escape. I think it would be very important to send a good supply of eels. I believe they would thrive prodigiously. They could not get away, as the lake is absolutely landlocked.

Directly north of the city, and 6 miles distant, are the Sweet Water Lakes, a group of lakes which appear, according to the map, to be connected. These lakes have no outlet. They extend about 12 miles in length, and cover much ground. They appear to be deep. There have been a few settlers on the banks for two or three years, and they all agree that there are no fish of any kind in these lakes, except very small minnows, which are, as I saw yesterday, very numerous. The water in these lakes is entirely fresh and sweet and pure. I think that a supply of black bass should be sent both for these fresh lakes and for the large lake. They will hold their own against pickerel or any other predatory fish. Eels would also do well in the fresh-water lakes.

DEVIL'S LAKE, DAKOTA, *July* 28, 1884.

175.—NOTES ON THE FISH AND FISHERIES OF JAPAN.

By CHARLES H. BALDWIN.

The Japanese are a very poor people, and you will probably realize it more when I tell you that the lower Government officials receive a salary of only 8 or 10 yen per month, and on this in many cases they have to support large familes, pay house rent, &c. Ten yen is equal to $6 silver. In fact, without the least exaggeration, were the inhabitants to eat three square meals a day, as we do, the nation would become bankrupt in less than three months. Fortunately rice and vegetables, their only diet, are cheap. Clothing and house rent ditto.

Fish is a luxury and dearer here than at home. They are to a great extent warm-water fish; at least, all that are caught in this section of the country. Spanish mackerel are quite plentiful. We have also the true mackerel, but for some unexplained reason it is never found fat in our markets. In fact, as we have them they are genuine leather-bellies, and the poorest fish in the market. Sharks, skates, and dogfish are eaten, in fact anything looking like a fish, no matter how far gone, will find consumers. Flounders, such as we used to catch at home from the wharves, sell readily here for about 15 or 20 cents.

We have two excellent species of salt-water fish, which I think would be appreciated by our fishermen, viz, the tar (*Sawanus margmollis*) and the sawara. The former is shaped something like the shad, but of larger size, often 2 feet in length. The meat is firm and white without any fat, but an albuminous jelly makes up for the lack of this and gives the fish a fine flavor. The sawara is shaped much like the barracuda and spotted in the same way, but is much larger, has some fat, and the flesh has a fine flavor.

The methods pursued by fishermen here in taking fish are very destructive and tend to make fish scarce. Very few are caught by hook and line, but mostly in drag-nets. Some time ago a friend of mine, editor of the local paper published in Kobe, whose father is one of the Government inspectors of salmon fisheries in Scotland, visited the salmon-trout fisheries on Lake Biwa. These fish, by the way, never go to the sea, although the affluent of the lake would permit it, but ascend the small streams running into the lake to spawn. At the mouth of one of the principal streams where the largest fishery is situated, we noticed a large net stretched completely across the river, and we asked how the fish could ascend the river. "We never allow any to go up," replied the fishermen quite naively. This we found to be the cause of the fish becoming scarce. The local government has now removed the obstruction. There is a fish-breeding establishment on the lake, under the direction of natives who learned the art in the United States.

KIYOTO, JAPAN, 1883.

Vol. IV, No. 23. Washington, D. C. Aug. 14, 1884.

176.—DESTRUCTION OF FISH CAUSED BY NETS OF SMALL MESH IN LAKE MICHIGAN.

By G. A. SHELEY.

I spend from six weeks to two months during the summer fishing with hook and line in this vicinity. While visiting the different fishing camps I have inquired as to the size of mesh used in pound fishing. I find it varies from 3½ inches to 1½ inches. The latter is proving very destructive, as they catch with the 1½-inch net all the smaller-sized whitefish and trout. Tons of these are destroyed yearly, until now the gill-net fishermen cannot catch one where they formerly caught hundreds. The cause of this is the destruction of the smaller fish, which are killed by being handled in the pounds. It will not be but a short time before whitefish will be as scarce in Lakes Huron and Michigan as they are in Lake Erie. Their disappearance in the latter lake is due to pound-nets and the small meshes used. I have inquired of fishermen and find that in their opinion net-fishing (at least the pound) should be discontinued during the month of November, as it is then that the fish go to the shoals to spawn, and in this locality you will find pounds set on both sides of the shoals and in such a position as to catch great numbers of the fish before they spawn.

The fishermen bring from one to three tons of whitefish to Mackinaw daily. Those who have been engaged in fishing, and are still fishing, state that the small meshes destroy tons of fish which if allowed to have their freedom would in a year or two become large fish. Fish which four years ago brought on the island about 4 cents per pound are now selling at 9 cents. The cause of this is the scarcity, and at the present time there are but a few points near here where any can be caught. I should think that, if not contrary to law to use revenue cutters for the purpose, it would be of great benefit to the consumer and the country at large to have one of these cutters ordered to inspect these nets and see that they use no meshes smaller than allowed by law, and also, if it could be done, to have the pounds removed from the vicinity of spawning grounds during the month of November.

Congressman Springer advised me to write you on this subject, as I am very much interested in the preservation of the fish in the lakes. Mr. Springer is at present visiting the island, and could assist you in obtaining information as to the facts I have stated.

CEDAR POINT COTTAGE,
Mackinaw, Mich., July 21, 1884.

177.—NOTES UPON OYSTER EXPERIMENTS IN 1883.

By Lieut. FRANCIS WINSLOW, U. S. N.

[From letters to Prof. S. F. Baird.]

I have delayed from day to day to inform you of the progress of my experiments at Hampton, hoping that I would be able to announce some definite result, but we have had such bad luck since the middle of June that as yet we have been unsuccessful in securing the attachment of the spat. Our first experiments were full of promise. I found, as I wrote you, a number of young oysters fastened to the glass collectors in my apparatus and at about the same time Dr. Brooks found them in his troughs; but no subsequent experiments have brought about like results. We found, however, that there was no difficulty in keeping the young in the troughs after the shell had formed, and after experimenting with my apparatus (an arrangement of glass tubes) for a month I concluded to have a number of wooden troughs made, and after depositing oysters in them, keeping up a constant current of water until the oysters had either disappeared or attached. The troughs, four in number, are 4 inches wide, and 2 inches deep, with a total length of 64 feet. Partitions are placed at an angle with the sides, so as to intercept the water and increase the length of the current and form as many eddies as possible. The bottom and sides we have covered with glass and shells for "cultch." The length of the current is 110 feet and over four hundred eddies are formed in it. The young oysters, after the shells have developed, are placed in the head of the troughs, and though exposed to a strong, steady current of water, which is constantly changed by means of a steam pump which is kept going night and day, very few escape from the lower end, the majority remaining in the eddies. Those at present in the troughs have been there over two weeks and though we have not of late found any on the glass slides, we have washed them off the shells and so far as I can judge a considerable number are still living. Our greatest trouble, an unaccountable one, has been in securing the artificial impregnation of the eggs successfully. Not once in twenty times do the eggs advance as far as the first stages of segmentation and during the last two weeks we have been successful but once in carrying the eggs to the swimming stage. Neither Dr. Brooks nor myself can explain the failure; the difficulty is one we never experienced before. We have varied every influencing condition and have used oysters from every locality in this vicinity without effect. Since the middle of June we have not succeeded ten times, though we have fertilized eggs nearly every day. The oysters are now nearly through spawning, and but little more can be done this season. I have written to New Haven to find out the condition of oysters in the sound and should the report be favorable and the next examination of the troughs indicate a continuance of the experiments as advisable, I will, with your approval, move up to Long Island Sound and make this attempt. Should the Fish Hawk come in before I leave I will try and arrange for the transportation of the troughs by her.

FORT MONROE, VA., *August* 4, 1883.

After I wrote you last from Fort Monroe I made several examinations of the glass slides in the oyster apparatus with fairly satisfactory results. Though the young oysters had not fastened themselves to the glass, yet they had grown somewhat and were vigorous and healthy, with plenty of food in their stomachs. The slides examined had from one to four oysters on each, and fully four hundred slides were in the apparatus. It is hardly possible to find, with the microscope, so small an embryo as that of the oyster on an opaque body such as an oyster shell, but I have no doubt that many more embryos were caught by the shells and partitions in the troughs than we detected on the glass slides. As the animals were doing so well I thought best to continue the experiment until some result was reached, which end would be attained shortly, as the oysters at the last examination were over three weeks old and are now nearly five. Finding it impossible to fertilize the eggs successfully, and as I was advised by Mr. Rowe, of this place, that the oysters here were doing well and still spawning, I concluded, in the absence of instructions from you, that I would make an attempt at New Haven. I accordingly left the apparatus at Hampton in charge of Dr. Brooks, with instructions to continue it in operation until the oysters either attached or disappeared. Any results obtained are to be made public through the Fish Commission, but I do not anticipate anything of value from a biological point of view. I hope, however, that the young oysters have fastened by this time, and I regret that I cannot give you definite information upon that point. I find the oysters here pretty well out of spawn, not more than one in twenty being fit for fertilization. I have made some experiments, but not with sufficient success to justify setting up an apparatus at all similar to the one at Hampton. I am sorry that I did not get up here sooner, as the season has been very favorable and a large attachment of spat is expected by the oyster growers; but so far as my labors are concerned, the season is about finished.

NEW HAVEN, CONN., *August* 22, 1883.

I have lately received a letter from Dr. Brooks reporting the result of the final examination of the water troughs containing the artificially raised oysters. The examination was made on the 21st and 22d of August, but I regret to say without success, the young oysters having disappeared. Dr. Brooks writes that he went over all the shells and slides very carefully without success, but as he subsequently examined all the oyster ground in the vicinity of Hampton, the piles of the wharves, shells along the beach and on the beds, and oysters, without finding any young of this year's growth, he thinks it possible that the failure of the experiment was due to conditions and influences beyond our control rather than to any inherent defect in the apparatus. Coupling the absence of any "set" about Hampton Roads, with the difficulty we experienced all summer in securing the fertilization of the eggs, it is possible that Dr. Brooks is correct in his opinion. Certainly the oysters did not die for want of food, as when from four to five weeks old they were in a healthy condition, with full stomachs and receiving an abundant supply of water.

I much regret that we should again have failed both in producing young oysters and in gaining additional information of biological interest. We have, however, discovered a method by which food can be supplied the oysters in unlimited quantities, which is a considerable advance, and may lead to the solution of the problem in the future.

At my request Dr. Brooks has stored the troughs with the apparatus and furniture of the Johns Hopkins laboratory at Hampton, so that they may be readily available for next summer should you consider it advisable to continue experimenting.

NORTH DUNBARTON, N. H., *September* 13, 1883.

178.—THE OYSTER AS A POPULAR ARTICLE OF FOOD IN NORTH AMERICA.*

By CARL RUMPFF,

Member of the German Parliament.

[Read at the meeting of the German Fishery Association, March 8, 1884.]

Accidentally I learned last year, partly from the president of the association and partly from the published reports of the association, that after all attempts to transplant the North Sea oysters to the coasts of the Baltic had failed, the same failure had to be chronicled as regards the efforts to transplant to the Baltic the North American oyster (*Ostrea virginica*). The reasons why none of these oysters have propagated in the Baltic have been thoroughly investigated by Professor Möbius, of Kiel; and it has been ascertained that the failure was owing to two causes, viz., the smaller degree of saltness of the water (in the North Sea and on the coasts of the United States, 2½ to 3 per cent; in the Baltic only 1.3 to 1.5 per cent), and the colder temperature generally prevailing during a considerable part of the winter.

Further investigations of the German Fishery Association directed attention to more northerly districts of the American continent; and

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* *Ueber die Bedeutung der Austern für Volksernährung in Nord-Amerika.* From Circular No. 3, 1884, of the German Fishery Association, Berlin, April 4, 1884. Translated from the German by HERMAN JACOBSON.

through the kind assistance of the Canadian Government it was proved by actual observations made near Prince Edward Island, not far from the mouth of the Saint Lawrence, relative to the saltness of those coast waters and to other circumstances, that the oysters in those regions, which are very plentiful, are for four months out of the year exposed to the most severe cold (often causing these waters to be covered with ice), and that the natural conditions greatly resembled those of the Baltic. These observations have made me feel confident that an attempt to transplant oysters from Prince Edward Island to the Baltic would prove successful; and I have therefore taken all the necessary steps to have the experiment made this spring.

I took up this matter with a great degree of interest, as a ten years' sojourn in the United States had given me the opportunity to learn the great importance of oyster-culture, not merely to supply the tables of the rich, but also to produce a popular article of food for the masses, which the oyster has become in a constantly growing degree. As far as my statistical information goes, the United States during last year consumed at least 30,000,000 bushels of oysters (200 oysters to the bushel). New York alone consumed about 20,000 bushels per day, making the enormous quantity of 4,000,000 oysters per day. This does not include the clams, the annual consumption of which in the United States I estimate to be at least 8,000,000 bushels.

The clams are bivalves, having very thick shells and resembling the oyster. They bury themselves in the sand of the coast, and can, when the tide is down, be dug out with very little trouble, as the places where clams are hid under the sand can easily be recognized by the narrow channel left in the track of the clam, so as to keep its connection with the sea water. Many people prefer clams to oysters, and next spring I intend to offer a chance for making an experiment on a large scale to acclimatize them with us; that is, I shall place a quantity of clams at the disposal of the fishery association for distribution along the coast of North Sea. The coast of the Baltic is not suitable for the purpose, because the less degree of saltness would be unfavorable to propagation.

Oysters, as well as clams, have in the United States actually become articles of food for the masses, including even the poorer classes. Three causes have principally contributed towards this result:

1. Oysters and clams are cheap articles of food in America.
2. The way they are prepared, even among the poorer classes, is exceedingly simple.
3. The poor classes in America entirely agree with our epicures that oysters and clams are a great delicacy.

Of the cheapness of the oysters in America I shall immediately convince you, when I state that for the larger number of consumers, especially the laboring classes, the oysters are taken from the shell as soon as caught, and are, as in New York, taken in barrels to the markets during the night, and are there sold by the liter [quart]. Such a liter varies in price from 5 to 10 cents, and therefore costs on an average 30 German pfennige. To this are added 2 quarts of milk, at 12 pfennige = 24 pfennige, some salt, pepper, &c., and broken crackers to the value of 30 pfennige, and we get a most excellent soup or stew, enough for four persons (costing about 25 cents).

The second cause, the easy mode of preparing the oysters, is self-evident, for it takes only about ten minutes to cook such a soup, and this is done simply and cheaply on the small oil-stoves which are so generally used in America. Unmarried laborers find in the common restaurants, for the trifling sum of five cents, an oyster stew which is sufficient to satisfy their hunger.

As regards the third point, I can testify from my own experience that an oyster stew prepared in this manner is a most delicious dish, highly relished even in the best circles.

You are probably acquainted with the fact that in the United States oysters are eaten prepared in many different ways—stewed, roasted, broiled, pickled, &c.—and I am firmly convinced that these various methods of preparing oysters would soon become popular in Germany if oysters would cease to be a mere luxury and be sold cheaply everywhere.

Permit me to embrace this opportunity to remind you of another point, and one which awakens in me feelings of chagrin, viz., the fact that more than 6,000,000 marks [$1,428,000] of German money annually goes to foreign countries for oysters imported by us. This financial reason ought to compel us to increase our own oyster-culture, if possible.

After the necessary beds of oyster shells, which form the best foundation for oysters, have been prepared in various places along the coast of the Baltic pointed out as favorable by Professor Möbius, I shall furnish a large quantity of both kinds of Canadian oysters—the long one (*Ostrea canadensis*) and the round one (*Ostrea edulis*)—to be planted in the places indicated, hoping that they may become the starting-points for the constant and permanent spreading of these valuable shell-fish. If we succeed in transplanting oyster-culture to the Baltic, there will be no limit to the fertility and the spreading of the oysters, for, according to Brooks, a full-grown oyster produces 9,000,000 eggs. It is to be hoped that the association will finally succeed in developing this small seed-grain to that point to which it has grown in the United States, viz., to furnish a cheap and palatable article of food for the masses.

On the continent of Europe we are constantly making efforts to render our soil more fertile; and we should endeavor to do the same not only with regard to our rivers and brooks, but also as regards the sea, and, by the experiments to which I have referred, make ourselves independent of foreign countries as regards the production of oysters.

BERLIN, GERMANY, *March* 8, 1884.

179.—BRIEF NOTES UPON FISH AND FISHERIES.

By CHAS. W. SMILEY.

[Mainly extracts from the official correspondence.]

PRICES OF SMALL NETS.—For the benefit of correspondents who are continually inquiring about nets for taking carp and other pond fish, the following prices are quoted from the catalogue of William Mills & Son, 7 Warren street, New York. Probably other dealers furnish about the same things at corresponding prices:

	Inches long.	Cotton (each).	Linen (each).
Fine mesh, minnow nets	12	$0 30	$0 45
Do	14	35	50
Do	16	40	50
Do	18	50	65
Do	20	60	75
Do	24	75	1 00
Do	30	1 00	1 25
Do	36	1 25	1 50
Do	48	....	2 50
Cotton dip nets, three-quarter inch mesh	16	30	....
Do	20	35	....
Do	24	40	....

A SUGGESTION FOR AVOIDING THE DANGER INCIDENT TO THE TRANSFER OF FISH FROM THE SMACKS TO THE COLLECTING STEAMERS.—Mr. John Bland, of 62 Harley street, Cavendish Square W., London, writing under date of December 17, 1883, to General Chester A. Arthur, President of the United States, makes the following suggestion:

"In a paper read at one of the conferences held in connection with the exhibition it was said that one of the most arduous and dangerous duties of the modern sea-fisherman was to carry the fish from the smack in which they were caught, to the collecting steamer, more lives being lost in this part of the work than in any other. It is obvious that it would be very imprudent in rough weather for the steamer to attempt to stay alongside the smack a sufficient length of time for the whole of the take to be transferred directly from one to the other, so a small boat has to go to and fro several times, to the great risk of its occupants.

"An extremely simple and inexpensive method of saving this dangerous labor has occurred to me. I would suggest that, at a distance of sixty or a hundred yards, the collecting steamer throw by rocket a slight line to the smack. By means of this line the smack would draw to itself an endless rope, to be arranged over a loose block 6 or 8 feet above the deck. A box or barrel of fish would be attached to the lower part of the rope, by means of a simple hook, then dropped overboard and drawn to the steamer by steam power. A few minutes immersion would not do the slightest harm to the boxes, and, as the water would support the greater part of the weight, a dozen packages of fish might be attached to the rope at the same time, with a short distance between them, say one box for every 6 yards of rope. By this means I believe the catch could be transferred day or night, and in almost all weather, with a tenth part of the present labor and no risk to life or boats, as quickly as the steamer could haul the boxes up her sides. A supply of empty cases could be sent to the smack in the same manner."

A RAINBOW TROUT REARED FROM EGGS BROUGHT FROM CALIFORNIA.—On February 19, 1884, Mr. H. R. Clarke, of the South Side Sportsmen's Club, of Oakdale, Long Island, wrote to Professor Baird as follows: "I send you, per Adams Express, a rainbow trout measuring 20 inches in length and weighing 3 pounds 4 ounces. It died day before yesterday. I thought I would send it to you just to show the size and form, its colors being almost faded out. It was raised from the eggs you so kindly gave us four years ago. I measured one this morning that is 23¾ inches in length. I think it will weigh over 4 pounds, being four years old in March. There are at the present time in our preserves 104 from the original hatching of the 1,000 eggs from you, 1,050 two years old, and over 10,000 one year old. Those two years old will weigh from one-half to 1¼ pounds."

GROWTH OF RAINBOW TROUT.—A correspondent of Forest and Stream, writing from Waterville, N. Y., March 6, 1884, says: "Two years ago about 10,000 California mountain trout were put into a pond in this village. The next spring we found that the growth of these trout, compared to that of our native trout, was astounding. The following August one weighing three-quarters of a pound was caught by a small boy. I would never have believed that their growth was so rapid had I not seen the fish weighed. The trout at the time this large one was caught were a little over a year old. Now many of our fishermen are wild on the subject of California trout, and we shall put 20,000 more into the same pond again this summer. But for one, I do not think that they compare with our own brook trout in gameness, flavor, or beauty. But our experiment was a decided success. For the past three or four years we have been stocking our streams with brook trout, and find the fishing very much improved thereby. Unless something unforeseen occurs we shall continue to stock them every year."

THE VALUE OF A WHALE.—C. A. Williams & Co., of New London, Conn., received returns, May 20, of the sale of the products of a whale captured recently by the crew of ship Lizzie P. Simmons, of that port. The whalebone fetched $12,230 and the oil $3,490 in Scotland, making the total value of the whale $15,720. This is the largest yield from a single whale on record. The monster was caught in Cumberland Inlet. [New York Tribune, May 22, 1864.]

SENDING TROUT EGGS FROM GERMANY TO ENGLAND.—According to the Fishing Gazette of January 19, 1884, Dr. F. Zenk, proprietor of the Seeweise Fish-breeding Establishment near Würzburg, Germany, is sending to England lake trout eggs, *Salmo fario.* They are forwarded in a square box containing another smaller, perforated box embedded in damp moss. This being opened disclosed more damp moss, beautifully cool, and in the midst of this, enveloped first in coarse wadding and then in fine muslin, a nest of splendid eggs. A lot received by the Fishing Gazette contained only a dozen or two of dead ones in the whole lot. The dead eggs, being white and opaque, are easily discerned by their contrast to the beautiful, translucent, orange-tinted, eyed ova. Dr. Zenk offers 80,000 of these eggs at 9 shillings per thousand. Those hatched and deposited in England last year and the year before are reported to be doing very well.

ARRIVAL OF GERMAN TROUT EGGS.—The steamer Donau, of the North German Lloyds, recently brought 70,000 eggs of *Salmo fario* to this country. Forty thousand of these were consigned to Mr. E. G. Blackford on account of New York. The eggs were of two kinds, large and small, and were sent to Cold Spring Harbor for distribution. They have been divided between Northville, Mich.; Central Station, Washington; Wytheville, Va.; Caledonia, N. Y.; and Cold Spring Harbor. They came from the ponds of Mr. C. Schuster, Freiburg, Baden, and were in good order. The North German Lloyds made no charge for transportation. [From Forest and Stream, March 6, 1884.]

DEAD FISH.—Thousands of dead fish, mostly perch, have been washed ashore off Lake Mendota during the past week. It is said that Street Commissioner Bishop removed from the city shore of Mendota one day not less than 15 tons of dead perch. Dr. Rowley, of Middleton, reports that the shores near his village are covered with victims of the same finny tribe, and the people out there are considerably alarmed as to the consequences of so much decaying matter. From microscopic examination of the dead fish, Dr. Rowley has come to the conclusion that the deadly animal is a parasite, which attacks its victims near the gills. The first symptom of distress is noticed by the fish throwing its head out of the water and gasping. In a few moments it is entirely helpless. The water of the lake for days past has presented thousands of floating bodies of fish. It is thought the worst is now over. The health of the city prompts vigorous work.—MADISON, WIS., *July* 19, 1884. [From the American Field, July 26, 1884.]

SHAD IN THE POTOMAC, 1854 to 1881.—Mr. Withers Waller, writing from Markham, Fauquier County, Virginia, says:

"When I commenced fishing in 1854 there were fifty large seines hauled on the Potomac. Now I doubt if there are more than eight or ten. During all the years from 1854 to 1860, inclusive, fish were very abundant, with the exception of 1857, when there were scarcely any, and the fishermen lost heavily. From 1854 to 1860 we caught an average each year of 1,500,000 herring and 30,000 shad, with the exception of 1857, when there were no fish. In 1861, '62, '63, '64, '65, and '66 there was no fishing on the Virginia side as low down the river as Stafford County, near Aquia Creek, and I suppose very little anywhere on the Potomac. 1877 and 1878 were good seasons, the catch amounting to from 800,000 to 1,000,000 herring and 15,000 shad. In 1879 there were scarcely any fish. With a seine 1,200 fathoms long, and worked with fifty men and seven horses, I caught only 150,000 herring and 4,000 shad during the season of thirty days. Since then there has been a gradual increase, ranging from 300,000 to 400,000 herring and 8,000 shad, which has scarcely paid expenses, and unless there is a change within the next five years there will not be a large seine hauled on the Potomac. Artificial hatching has not come up to my expectations, though there is no telling how scarce fish would be but for the artificial propagation. I think if the Government would rent the shores on four or five creeks, which could be worked at the cost of building two small steam-launches, and allow no fish to be taken out of these creeks, that it would do more to restock the river with fish than the same amount of money laid out in any other way. Take all the shores in Aquia Creek, for instance, which could be rented for $500 to $800. Some other creeks could be rented in the same way. This plan, together with the hatching, would, I think, give us a plentiful supply of fish.

FIRST BREEDING OF SALMON AND TROUT IN CANADA.—Breeding salmon and trout by artificial process was first practiced in Canada by Richard Nettle, esq., then superintendent of fisheries, in 1858, in a Government hatchery at Quebec. The experiments were measurably successful. Mr. Nettle was enabled to deposit vivified eggs in considerable numbers and to hatch out and distribute a large proportion of living healthy fry. He also transported impregnated ova to Australia. This enterprise was authorized by several ministers, the Hon. Mr. Cauchon, Judge Sicotte, and the Hon. William MacDougall. It was not continued by the latter because the means provided by the legislature were absorbed in controlling and improving the salmon rivers proper, all available resources being required to guard the streams against destructive practices which had brought the salmon fishery in the province of Quebec to the verge of ruin. Mr. Nettle, however, succeeded single-handed, and with a very meagre outfit, in proving the feasibility of breeding salmon and trout by artificial means, and he deserves the credit of initiation and perseverance involving severe exposure and strong personal enthusiasm. Another successful instance of artificial salmon-hatching occurred in 1867, under instructions from the Hon. P. Mitchell, on the Miramichi River, New Brunswick, conducted by Messrs. Stone and Goodfellow, assisted by W. H. Venning, esq., inspector of fisheries for that province.—W. F. Whitcher in the Montreal Gazette, May 5, 1884.

DECLINE OF THE CANADIAN SALMON FISHERIES.—Regarding the alleged increase of produce from rivers in which salmon artificially bred have been placed, and the corresponding decrease from rivers dependent on natural propagation, Mr. W. F. Whitcher, formerly inspector of fisheries of Ottawa, Canada, says in the Montreal Gazette of May 5, 1884:

"That a fluctuating decline of the salmon fishery since 1874 has occurred throughout the eastern section of the Dominion of Canada it is useless and unwise to deny. The precise extent to which this declension has been arrested during a series of years, on the one hand by reserving and guarding the natural spawning grounds, eradicating abuses, imposing restrictions in the modes, and curtailing the periods of fishing, by constructing fish-ways and removing obstructions to the ascent of salmon, by opening up new and extensive breeding areas, and by regulating and protecting the inland fisheries generally, and on the other hand by planting salmon fry artificially hatched— all of these form a fair subject for impartial inquiry."

He then gives figures, from which I compile the following table:

Table of salmon caught in Quebec, New Brunswick, and Nova Scotia for fourteen consecutive years, 1869–'82.

Years.	Pounds.	Per cent. of 1874's yield.
Period preceding artificial hatching.		
1869	2,466,920	41
1870	4,012,992	66
1871	3,646,475	60
1872	3,745,302	62
1873	5,54[illegible],929	91
1874	6,047,994	100
Period of artificial hatching.		
1875	3,413,192	56
1876	2,615,555	43
1877	3,332,935	55
1878	3,712,476	61
1879	3,162,638	52
1880	1,768,645	28
1881	1,282,669	21
1882	2,142,886	35

In the three provinces named, under the natural system there was a gradual increase in the yield. Artificial fish-hatching was resumed in Eastern Canada in 1873–'74. After eight years of artificial hatching, the quantity fell in 1881 to 21 per cent of what it was at the beginning.

Mr. Whitcher seems opposed to artificial hatching, and the above figures are used to argue its inefficiency. Of course the advocates of fish-culture should also stare these facts squarely in the face, and ascertain what are the causes of this remarkable decline in the midst of their best efforts.

CALIFORNIA SALMON REARED IN WISCONSIN.—The first California salmon put into Geneva Lake were deposited in April, 1876. There were 25,000 sent to me from the United States hatchery in Michigan. Later in the season the Wisconsin commission put in 15,000 more. There were about twenty taken last summer weighing from 2 to 4 pounds each. This summer I had heard of only four or five having been taken, the largest of which weighed 3½ pounds, so that I was hardly prepared for so large a fish. He was 30 inches long, 18 round, and weighed 12¾ pounds. It was a male fish, so of course I cannot report on the development of the ovaries. The hooks in maw and jaw were well developed, and as this is about the spawning season of the California salmon I feel convinced that the pair were looking about for a spawning place. The flavor of the salmon was most excellent. The meat was of a light pink color, but not as dark as the native California salmon we find in the markets. In other respects it was quite as good. It was taken by a boy while trolling with a spoon hook near the shore, in about 15 feet of water. An hour after, Mr. William Welsher, the superintendent of the hatchery and ponds, saw another one, about the same size, in the locality where the first one was hooked. From this circumstance I infer that they had paired and had come up from the deep water to look for a spawning ground or for a way out of the lake. They were near the mouth of a small stream which empties into the lake, and which has its source about one mile back.—N. K. Fairbanks, Geneva Lake, Wisconsin, August 5, 1880.

We have taken another California salmon in Geneva Lake, or rather in the stream emptying into it.

On Sunday, Sept. 19th, Mr. W. A. Welsher went to the brook to catch some minnows for bait, and heard a splashing in the brook under a bunch of willows. Supposing it to be a mink or musk-rat, he did not at once go to the spot, but, as the commotion continued, he took an observation, and to his surprise discovered seven or eight large salmon. He had no means of capturing them at the time, but the next day went with a net and propagation-pans, expecting to take both male and female fish. He only found one—a fine female weighing 8½ pounds and full of ripe eggs.

These fish were spawning, and of course were up this small brook for no other purpose. It is a small stream, only 1 mile from the springs which feed it to the lake, but has water enough for them to get up without trouble, and has also a good many holes and hiding-places.—Geneva Lake, Wisconsin, September 23, 1880.

TROUT-BREEDING.—I commenced the first of last December to catch trout from the spawning beds by fishing through the ice with a beardless hook. I got 30,348 eggs, of which I hatched 95 per cent or more. I had on one screen 2,300 eggs, and I kept account of the bad ones. I took out 92 bad eggs, and I think it was about the average. I have the very best of running water. I did not kill or lose more than 11 trout in the operation.

I finished catching for spawning purposes on the 7th of January, 1884. The trout spawned here in Crestine Lake until May. On one spawning bed I took some occasionally all winter, in order to satisfy myself that they were spawning all winter. Those that I caught thus I put back.—S. M. Crawford, Camp Percy, Stark Water, N. H., *July* 26, 1884.

NOTE ON SEA BASS, SKATES, ETC.—Mr. Fred Mather, writing under date of July 29, 1884, says: "I spent last week at Pasque Island, by invitation of Mr. James L. Vallotton, of the Pasque Island Club. Six men fished all the week and only took six fish; the largest one was 17½ pounds. I did not take any. The Cuttyhunk Club is not taking many, neither is the Squibnocket Club, nor are the trap-net fishermen.

"At low tide we took plenty of sea bass, which are not yet spawning there. I obtained four eggs from two skates and they had many yelks yet to cover, showing that they have just begun. The eggs are now at Cold Spring Harbor, N. Y."

A LARGE BASS.—L. B. Crooker, collector of internal revenue, Aurora, Ill., reported in 1880: "I saw weighed and measured a small-mouthed black bass caught in Fox River, near this point, the other day. Its weight was 7 pounds 6 ounces; its length, 23 inches. This is the largest fish of this variety I have ever seen during a lifetime in the West. I believe it to be the largest ever caught in Northern Illinois."

FISH AND OYSTERS FOR NEW SOUTH WALES.—Mr. Charles Kahlo, consul at Sydney, New South Wales, reported, under date of August 28, 1883, that the annual consumption of dried, salted, and preserved fish is about 5,000,000 pounds annually, about one-half of which is brought from California. The duty on fish is 2 cents per pound.

The oysters found in this and adjacent colonies are of a very poor quality. If American oysters could be shipped in cans so as to arrive in good condition they would meet with ready sale. [House Mis. Doc. 12, Forty-eighth Cong., first session.]

EXPORT OF PEARLS AND PEARL-SHELLS FROM MEXICO.—The following table has been compiled from report of Warner P. Sutton, consul-general at Matamoros, November 30, 1883. [House Mis. Doc. 12, Forty-eighth Cong., first session, part 2, p. 233.]

Articles.	Average for five years, ending June 30, 1882.	Year ending June 30, 1882.	Year ending June 30, 1883.	Total for seven years, ending June 30, 1883.
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*
Pearls	32, 984. 02	37, 500. 00	18, 500. 00	220, 920. 10
Pearl-shells	42, 856. 27	71, 141. 82	44, 414. 00	329, 837. 17
Total	75, 840. 29	108, 641. 82	62, 914. 00	550, 757. 27

IMPORTS AND EXPORTS OF GERMANY.—The imports and exports of cod and herring are given by Commercial Agent Smith, of Mayence, in kilograms, as follows [House Mis. Doc. 12, Forty-eighth Congress, first session, part 2, p. 727]:

Period.	Dried cod.		Salted herring in casks.	
	Imports.	Exports.	Imports.	Exports.
In September, 1882	54, 200	600	11, 986, 200	9, 600
In October, 1882	82, 600	500	12, 269, 500	13, 600
In September, 1883	93, 700	900	10, 672, 800	16, 800
In October, 1883	148, 300	1, 900	14, 170, 000	22, 500

THE ALLEGED CAPTURE OF A SALMON IN THE HUDSON.—Writing from Cold Spring Harbor, N. Y., August 9, 1884, Mr. Fred. Mather says: "Early in June I went with Mathew Kennedy, of Hudson, one of the State game protectors, to capture the illegal pound-nets near Rhinebeck, which were a great nuisance to the shad fishermen. Mr. Kennedy is a shad fisherman, in season and by lawful means, himself, and he told me that some time in May last he captured a salmon in his shad seine on 'Hudson Middle Ground.' The fish would weigh about three pounds. Mr. Kennedy inspected it and allowed it to go again. He has fished for over twenty years, and has seen salmon in the markets, and seems confident that his fish was a salmon."

Effects observed by N. Simmons upon temperature produced by wrapping a cotton comforter about a round-shouldered fish-can.

Hour temperature observed.	Temperature of water in covered can.	Temperature of water in uncovered can.	Variation.
	°	°	°
June 12, 1 p. m	64	64	0
June 12, 3 p. m	63	66	3
June 12, 5 p. m	63	67	4
June 12, 7 p. m	61	66	5
June 12, 9 p. m	61	65	4
June 12, 11 p. m	60	64	4
June 13, 1 a. m	59½	63	3½

PRICE OF CARP.—Under date of August 15, 1884, Mr. N. L. Kabler, of Bedford Springs, Campbell County, Virginia, advertises in the Lynchburg News that he has 150,000 scale and mirror carp for sale, as follows:

Those 2 to 3 inches long	$3 per hundred.
Those 3 to 5 inches long	5 per hundred.
Those 10 to 12 inches long	12 per dozen.
Those 12 to 18 inches long	20 per dozen.

In making this and similar announcements the U. S. Fish Commission passes no judgment upon the purity of the carp, as it is not informed upon the facts in the case.

Trawling record of the U. S. steamer Fish Hawk, August 23, 1883.

No. of station.	Bearings.		Time of day.	Temperature of water.		Depth.	Character of bottom.	Direction of wind.	Remarks.
	Latitude north.	Longitude west.		Surface.	Bottom.				
	° ′	° ′		°	°	*Fathoms.*			
1156	40 13	70 29	6 a. m	67	45	60	Mud	South	Trawl was put over at 6 a. m., reaching bottom at 6.05, remaining down 30 minutes; 150 fathoms wire rope out. Specimens obtained: Phycis tenuis 1; Citharichchys, 2.
1157	40 14	70 29	6.35 a. m	70	45	62	Soft mud	South	Trawl was put over at 6.35 a. m., reaching bottom at 6.40. Hove in trawl at 7.25; 150 fathoms rope out; surface 1023.4—70° F. Specimens obtained: Phycis, 8; Merlucius bilinearis, 1.
1158	40 16	70 31	8 a. m	67	45	62	Soft green mud	South	Trawl was put over at 8 a. m., reaching bottom at 8.05. Hove in trawl at 8.50; 180 fathoms wire rope out. Specific gravities: surface 1023.5—67½° F.; 5 fathoms, 1023.5—66½°, 10 fathoms; 1023—67°. Species obtained, Phycis tenuis. many
1159	40 20	70 33	10.15 a. m	67½	44	55	Soft mud	South, light	Trawl was put over at 10 15 a. m., reaching bottom at 10.20. Hove in at 10.50. Specific gravities: surface, 10236—67½° F.; 5 fathoms, 1023.8—67½° F.; 15 fathoms, 1023.8—67° F. Specimens obtained: Phycis, 8.
1160	40 24	70 35	11.25 a. m	70	43	41	Black mud	South, light	Trawl was put over at 11.25 a. m., reaching bottom at 11.35. Hove in trawl at meridian; 100 fathoms wire rope out. Specific gravities: surface, 1023.6—70° F.; 5 fathoms, 1023.8—68° F.; 10 fathoms, 1023.9—67½° F. Specimens obtained: Phycis tenuis, Phycis chuss, Merlucius bilinearis, few; Glyptocephalus cynoglossus, 3; Paralichthys oblongus, few; Flounders, 2 specimens; Enchilyopus, 4.
1161	40 28	70 37	12.45 p. m	69	44	45	Black mud	South, 2	Put over trawl at 12.45 p. m., reaching bottom at 12.50; 125 fathoms wire rope out. Specific gravities: surface, 1023.6—69° F.; 5 fathoms, 1023.8—68° F.; 10 fathoms, 1023.86—8° F. Specimens obtained: Phycis, 2; Flounders. 2; species Lophius piscatorius, 2· Enchilyopus, 4; Merlucius, unknown species.
1162	40 32	70 39	2.15 p. m	68	46½	45	Black mud	Southwest, 2	Trawl put over at 2.15 p. m., reaching bottom at 2.20; 125 fathoms wire rope out. Hove in trawl at 2 45. Time heaving in, 10′. Specific gravities: surface 1023.6—68° F.; 5 fathoms, 1023.8—66° F.; 10 fathoms, 1024—66° F. Specimens obtained: Paralichthys oblongus, 4; Flounders, 2 species, 5; Merlucius, 1; Phycis, few; Sculpin, 1; Enchelyopus, 2; Lophius, 2; unknown, 1.
1163	40 35	70 41	3.25 p. m	71	46	31	Sand and mud	Southwest, 2	Trawl put over at 3.25 p. m. Time going down, 05′. Hove in trawl at 3.50. Time heaving in, 05′. Specific gravities: surface 1023.4—71° F.; 5 fathoms, 1023.2—70 F.; 10 fathoms, 1023.2—69.° Specimens obtained, Lophius, 1; Sculpin 1; Merlucius, few; Phycis, few, two species; Paralichthys, few; Flounders, 2 species.

Trawling record of the U. S. steamer Fish Hawk, August 23, 1883—Continued.

No. of station.	Bearings. Latitude north.	Bearings. Longitude west.	Time of day.	Temperature of water. Surface.	Temperature of water. Bottom.	Depth.	Character of bottom.	Direction of wind.	Remarks.
	° ′	° ′		°	°	*Fathoms.*			
1164	40 43	70 45	5 p. m.	70	44	31	Mud	Southwest, 2	Put over the trawl at 5 p. m. Time going down, 05′; 100 fathoms wire rope out. Hove in at 5.25. Time heaving in, 06′. Specific gravities 1023.6—70° F.; 5 fathoms, 1023.4—68° F.; 10 fathoms, 1023.4—68° F. Specimens obtained: Glyptocephalus, 2; Merlucius, 8; Phycis, 8; Sculpin, 1; Paralichthys, few; Flounders, few.
1165	40 50	70 49	6.25 p. m.	68	45	32	Gray sandy bottom	Southwest, 2	Put the trawl over at 6.25 p. m. Time going down, 05′; 100 fathoms wire rope out. Hove in the trawl at 6.55. Time of heaving in, 05′. Specific gravities: surface, 1023.4—68° F.; 5 fathoms, 1024.8—65° F.; 10 fathoms, 1025—58° F.

Vol. IV, No. 24. Washington, D. C. Sept. 16, 1884.

180.—EFFECT OF COLD ON FISHES.

By NEIL HEATH.

[Abstract, by Chas. W. Smiley, of a paper read before the Auckland Institute, July 2, 1883.]

It is asserted that, though shallow rivers and ponds have been converted into solid ice in countries where the winters are protracted and severe, all the imprisoned fish have not been destroyed, but that, when the ice had thawed, many of them were restored to their usual health. Though dead in appearance they were only asleep hibernating, and like many animals that pass the long winters in a state of lethargy, they would in due time recover their animation. It is not an easy matter to ascertain that in such rivers and ponds the whole of the water is unquestionably frozen, and obviously the theory must be held over until we can prove that the waters were completely frozen, and that the fish had actually been imprisoned in the solid ice.

It struck me that as the Mataura with her freezing-chamber was lying at the wharf a few facts might be learned which would throw light upon the subject. The Mataura was freezing her cargo of sheep for the London market, and why should she not, if intense and continuous cold only suspended the life of the fish, carry to England slabs of ice inclosing numerous specimens of fish hitherto unknown in that land, and which would only require to be thawed in English rivers? Why put ourselves to the trouble of bringing ova to New Zealand, only to be destroyed by native species, when we could thus import vigorous, full-grown fish?

I will place before you a statement of the steps which have been taken to show that fishes can return to life and energy after imprisonment in ice.

Captain Greenstreet, of the Mataura, cordially helped me to use the freezing-chamber in the vessel, and in it were placed two pannikins, the one containing a salt-water fish in salt water, and the other a gold-fish in fresh water. At the same time two other pannikins were placed in the "shoot," the coldest part of the freezing apparatus, the one containing a salt-water fish, and the other a silverfish. The water in these vessels was at the ordinary temperature. The cold in the shoot being many degrees below zero F., it did not take long to convert the water into ice, and at the end of an hour and a half I was satisfied that all of both kinds of water had become solid, and that the two fishes were as hard and firm as the sheep that were hanging in the freezing chamber. Both pannikins were then removed and placed in tubs filled with water at the ordinary temperature. The one contained salt water for the salt-water fish, the other fresh water for the silverfish. In a short time the heat of the water in the tubs found its way to the surface of the ice in contact with the interior of the pannikins. The blocks, becoming in consequence reduced in bulk, parted, the former finding its way to the bottom, the latter remaining at the surface. On examining these blocks of ice it was observed that both fishes must have retired from the surface of the water towards the bottom during the freezing, and that about half an inch of the lower part of the silverfish rested on the bottom of the vessel. It must therefore have been outside the ice. The other fish was entirely surrounded. The appearance of both was identical. Both lay on the side, the head was higher than the tail, the distended gills were filled with ice, and the iris of the eyes had neither dilated nor contracted; the aqueous humor was apparently frozen. The rays of light no longer penetrated to the retina, and the eyes presented the appearance of balls of opaque ice. The silverfish was the first to be free, and it was observed that at the moment when the fin near the gill was freed from all restraint the little organ commenced to move very gently, so much so that it was impossible to say but that motion was due to the parting of the ice. A few moments later there was no mistake about the matter. The fish was alive. The tail resumed its activity. As soon as the ice had disappeared from the gills, they began to open and close, and the little fish moved about languidly, dreamily, groping its way. Up to this time the aqueous humor of the eye had not thawed, all was darkness to the fish. It seemed to be feeling its way, but soon the ice was dissolved, light entered, and the silverfish was swimming as easily and nimbly as ever. It is now alive in a glass tank.

The salt-water fish was gradually detached from the encircling ice, but close attention failed to notice any signs of life. When entirely free it sank to the bottom dead. Perhaps the sudden contraction of the water at freezing point following so rapidly upon the expansion had in some way injured the fish. Obviously the air-bladder had burst, for all buoyancy had departed. Why did the fish which had been taken from the sunny waters of the Pacific but a few weeks previously survive an ordeal that proved fatal to one fresh from the cooler waters of the Waitemata? I cannot tell.

It may yet be proved that fishes, which are usually classed with cold-blooded animals, can survive imprisonment in ice. Even the slight injury caused by the fishing-hook to the salt-water fish may possibly have contributed to its death.

I frequently visited the freezing-chamber to see how the other prisoners were faring. The former two had been placed in the "shoot," and consequently I had had no opportunity of observing how they behaved as the ice gradually closed around them. But in the freezing-chamber there was every facility for doing so. In an hour the increasing coldness of the water in the pannikins was rendering their movements less active. They glided from one side to the other, and from the surface to the bottom, but in an uneasy manner. Their attitude was that of expectancy. An hour afterwards they were apparently going to sleep, the goldfish on its side, the other in its ordinary position. The fins kept moving in a lazy manner; there was no twitching, no abrupt action. The motion reminded one of the vibration of a wire slowly but surely coming to rest. The eyes were clear, and to all appearances a deep and placid sleep was falling stealthily upon them. Two hours afterwards they were in the same position, but there was no movement. The ice was advancing upon them. Some of the spikes of ice had already reached parts of their bodies, and reflecting the light from the candle produced a beautiful combination of color. The two creatures were sleeping in the light of a gorgeous sunset. After eight hours' exposure to the temperature of the freezing-chamber, and two more to the much lower temperature of the snow-box, I felt sure that the ice was solid. I removed the pannikins to the thawing-tubs and sat down to watch for indications of life, but none appeared. When freed from the ice the salt-water fish floated about for a short time in the same position as that occupied when it was inside the block of ice, and then slowly sank to the bottom. The goldfish on being freed continued to float for upwards of an hour, during which I sat watching it. Next morning it was still floating, not erect like the other, but on its side, with the tail slightly depressed. It was apparently dead. At night it maintained the same position, and I gave it up for dead.

I have made this statement in hope that others who have time and more enlarged facilities for carrying out a series of experiments will proceed with the investigation. (From Transactions and Proceedings of the New Zealand Institute, 1883, vol. xvi, pp. 275–278.)

181.—THE SCOTCH COD AND LING FISHERIES.*

The great Scotch cod and ling fisheries last from March till July along the northeastern coast of Scotland and near the Shetland and Orkney Islands. Vessels furnished with a deck are beginning to be employed in these fisheries with great success. At the end of June the larger vessels give up the cod and ling fisheries and engage in the herring fisheries on the east coast of Scotland. The crews of these vessels are composed exclusively of experienced fishermen, and, in a vessel of 30 tons, the crew generally numbers 7 or 8 men. They are not paid in cash, but receive their share of the catch. The fishing is done by lines.

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* *Det skotske Torske- og Langefiske.* From the *Norsk Fiskeritidende*, Vol. III, Bergen, January, 1884. Translated from the Danish by HERMAN JACOBSON.

As regards the yield of the Shetland fisheries, we will here give an extract from the report of the Norwegian vice-consul at Lerwick: "The cod and ling fisheries near the Shetland Islands commence in the beginning of April, and continue till the first week in June, when the herring fisheries commence. The cod and ling fisheries were formerly continued till the end of August; but at present, when the herring fisheries are more profitable, they cease earlier in the season. These fisheries are carried on with boats having a deck, and a keel measuring 35 to 45 feet. Completely equipped such a boat costs 9,000 to 10,800 crowns [about $2,250 to $2,700]. The crew are generally the owners of the vessels. They make up between them from 1,800 to 2,700 crowns [$450 to $675], and borrow the rest from some fish-dealers to whom they sell the fish at the market-price. When the fisheries are successful, the entire debt is often paid off in the course of one cod and herring season, which closes at the end of September."

Fishing expeditions are annually made to Iceland and the Faroe Islands from the Shetland Islands and from several English ports. The fish which are caught on these expeditions are salted on board and landed on the Shetland Islands, where they are made into klip-fish. In 1882 the catch of cod and ling amounted to 3,666,596, of which number 121,337 hundredweights of klip-fish were made, and 7,737 tons of salt fish.

To the above we add the following data:

Of the entire quantity of fish, 741,329, which were made into 951,230 kilograms of klip-fish, about 1,000 tons (14 fish to 18 kilograms), were caught by 56 vessels of about 52 tons each and 12 men per vessel. Of these vessels 16 were from the Orkney Islands, and 40 from the Shetland Islands. The remainder of the fish were caught by boat fishermen. The fisheries were most productive near the Shetland Islands, where 1,413,865 fish were made into klip-fish, at the rate of 9½ fish to 18 kilograms [about 40 pounds].

As regards the fisheries with vessels, on which the fish were prepared at sea, they were carried on in—

Years.	Vessels.	Average yield, fish.
1874	154	12,800
1875	137	14,800
1876	125	10,400
1877	130	14,100
1878	133	19,300
1879	115	13,800
1880	92	15,800
1881	98	13,400
1882	56	13,200

All of these fish were made into klip-fish. From the above figures it appears that these fisheries have declined steadily.

182.—ON APPARATUS FOR COLLECTING OYSTER SPAT.

By JOHN A. RYDER.

[From a letter to Mr. R. M. Bache.]

The sowing of shells upon the firm bottom for the fixation of spat has been the most successful method in the United States, and is now extensively practiced in the vicinity of New Haven. When the bottom is thickly covered with ooze I should counsel the use of brush stuck into the bottom, with the branched tops projecting upward into the water—or palisades of brush might be placed in such places together with garlands of oyster shells, with holes punched through them and strung on galvanized wire, and the whole supported on the brush or stakes to keep them from being buried in the mud on the bottom. Mud and sediment is of all the enemies of the oyster the very worst, especially to the young fry and spat, millions of millions of which are annually smothered and killed by it.

The detachment of the young oyster or spat from the cultch or collectors, would, I think, hardly be profitable in this country, nor do I think it at all necessary if old oyster shells are used for collectors. The shells with the adherent spat can be readily transported and sown entire, as they do not interfere with each other at all. In some cases, of course, too many young oysters are attached to one shell. In such cases it would be an advantage if some very cheap and detachable coating could be put over the shells, which could be flaked off and broken so as not to destroy the individual young. As many as one hundred oysters will sometimes stick to one valve of a clam or oyster. Then, of course, many of them will be crowded to death by the growth of others around them.

The method of sowing shells for the purpose of getting "seed" is now profitably carried on at New Haven, spat being worth 60 to 80 cents per bushel when only as large as a dime and still adherent to the old shells, which are allowed to go into the measure together with the young.

It would be worth while for some ingenious American to experiment upon the manufacture of some kind of cheap cultch for catching a set of spat, to be distributed over the bottom in the same way as shells are. The disengagement of the spat from roofing-slate is readily effected if the slates are first coated with a mixture of lime and sand which has been allowed to set thoroughly before the slates are put out into the water in nests. The "nests" are simply the series of slates as supported in a simple wooden frame to keep them off the bottom and out of the mud. In this case the coating of mortar, with the adherent spat, can easily be removed without injury to the latter.

WOOD'S HOLL, MASS., *September* 21, 1883.

REPLY BY MR. R. M. BACHE.

I agree entirely with the opinion that the practice of coating surfaces, unless the coating could be very cheaply executed, would not be profitable in this country. Obviously, the difference between this country and other countries generally, in this respect, is the same as that which in this country precludes the close culture obtaining in Europe and elsewhere in the cultivation of land. But that admitted, it still remains the fact, which Mr. Ryder concedes, that if some surface could be found or cheaply manufactured from which spat could easily be detached, a great desideratum would be supplied. I have been much impressed with this throughout my observation of this shore.

I do not find that the spat has any substance or surface of predilection. I find it uniformly distributed on twigs, bark, tin, shells, bricks, stones, &c. On all these it is closely adherent; so much so as to be inseparable without mechanical force sufficient to break the shells of the smaller animals. Thus the embryo, having run the gauntlet of currents, predatory animals, mud, sand, &c., and having reached a certain point of development, which would seem to secure a fair chance of existence to maturity, is really still engaged in as severe a struggle for existence as at first, for germ crowds upon germ, so as often to make an incrustation of two or three layers from the same season's spawning. This is inevitable; but, in considering the question from a commercial point of view, what does not seem to be inevitable is that such multitudes of spat should be destroyed in the attempt to procure seed. The destruction is as nothing compared with that from nature's action, but these animals of which I am speaking are in the merchant's hands to be utilized, and in utilizing them he destroys myriads. Putting out of the question the mere loss of individuals, this represents lost labor.

It is, then, most important that spat caught should be available, and I see in none of the surfaces adopted one which combines efficiency and cheapness. The question of the shape of the surface seems not to have attracted much attention, but it is an important factor in the problem. However, that apart, for we are concerned at present more particularly with detachability as derived from character of surface as distinct from its form, and although its character (as in the roughness of stones) is directly related to indetachability, I confine myself to fragility of surface. If, then, there can be no objection to pitch (see page 33, part 2, of the "Practical Guide," &c., by Felix Fraiche) on account of its aromatic principle, I should suppose that it would be what is required to produce fragility of surface combined with economy of preparation. At ordinary temperatures pitch makes a very brittle film, and at moderate temperatures it softens under water; even in the summer it would be brittle; in the sun it would be softish. Put on it the highest temperature convenient, so as to have the slightest film, dipped or brushed, it would make a cheap, durable, and either fragile or soft surface.* If I have an opportunity next spring, as I expect to have, to try it, I will do so, and report the result to you as soon as the spat is large enough to make removal desirable. Comparison can then be made with removal from surfaces otherwise prepared, or natural.

GREEN CREEK, CAPE MAY COUNTY, N. J., *September* 30, 1883.

183.—TRAPPING KINGFISHERS, RODENTS, AND OTHER ENEMIES OF TROUT.

By DIRECTOR HAACK.†

The question whether large central fish-cultural establishments or numerous small ones, if possible located close to the waters which are to be stocked with fish, should be aimed at has been answered so decidedly in favor of the latter that it will hardly be necessary for me to discuss this question. I will here only cite some illustrations from my own practice, in order to give a clearer idea of the danger of concentrating large masses of fish within a comparatively small space.

It is well known that the French administration of the Huningen establishment did not devote much attention to the raising of the finer kind of food-fish, or, for that matter, of other fish, its activity mainly consisting in shipping impregnated eggs. I suppose that all are fully aware how extensively fish-eggs were shipped, and in what a liberal manner the French administration distributed entirely free the products of its establishment far and near.

When I took charge of this establishment thirteen years ago it was one of my first objects to give some attention to the raising of the finer kinds of food fish, it being my aim to transform the Huningen fish-cultural establishment into an institution where fish-culturists might study the treatment of the finer kinds of food-fish from the egg to the salable fish. One of my first steps was to construct a ditch about 1 kilometer (about 1,100 yards) in length for raising trout; this ditch, imitating as near as possible a natural trout-brook, was to receive the young trout as soon as the umbilical sac had been almost consumed. In the very first year I met with good success, as I was able to take from this ditch in autumn several thousand finely-developed trout. During the second year the result was still more favorable, because I had greatly improved the ditch. This ditch receives its water from a small trout-brook, the Augraben; the fish were invariably placed in it some time before the umbilical sac had been entirely absorbed.

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* The cost of pitching surfaces and detaching spat afterwards will probably be too expensive in practice, in view of the fact that sowing shells can be so cheaply done.—J. A. RYDER.

† *Central-Fischzuchtanstalten oder zahlreiche Kleinere Anstalten?* From Circular No. 4, 4, 1884, of the German Fishery Association, Berlin, June 30, 1884. Translated from the German by HERMAN JACOBSON.

In the autumn of 1873 I took from my ditch 15,000 trout about the length of a man's finger, some even as long as a hand. In 1874, however, the number of trout decreased, and this decrease continued until I was on the point of ceasing to place young trout in the ditch. In spite of placing in it a large number of trout, I finally did not take more than a few hundred from it in autumn. I also found that the increase of the enemies of fish kept step with the increase of the fish. Kingfishers, which formerly had appeared only occasionally, soon came in great numbers, and of course did great damage to the trout in the open ditches. I managed, however, to keep them under proper control by following the advice of Max von dem Borne, and placing along the ditches a large number of the excellent kingfisher traps manufactured by Adolph Pieper, in Moers. At present, numerous kingfisher traps are placed along all my trout brooks and ponds, and a kingfisher which comes in this neighborhood is sure to be caught within a few days. In spite of this, the raising of young trout seemed to languish. Occasionally the results were somewhat more favorable, but I never again reached even approximately the large numbers of the first years.

Three years ago I ascertained that a large number of shrew-mice (*Wasserspitzmäusen*) had found their way into my brooks. For a long time all my efforts to master these little animals, which are well-known enemies of the eggs and young of fish, proved in vain, as I did not succeed in finding a suitable trap for catching these mice. One of my Alsatian neighbors, to whom I confided my trouble, advised me to try a very simple wire-spring trap, which he had successfully used for catching common mice. The first attempt made last year proved successful, and this year I procured two hundred such traps, which I distributed along my brooks and ditches. The result was perfectly surprising. Since April 1, 1884, therefore, in five weeks' time, I have caught with these traps 86 shrew-mice and 8 water-rats. The trap closely resembles Pieper's kingfisher trap, only it is constructed in a much lighter manner, and does not have the little board in the center on which the kingfisher alights. Above the spring there is a small contrivance to which bait can be attached. For bait I use a small piece of fish. These traps are manufactured by Schmerber Brothers, of Mulhausen, in Alsace, and cost only 25 marks [$6] per hundred. In every one of the shrew-mice which I dissected I found a considerable quantity of indigested and half-digested young trout—in some as many as 10. No further proof is needed to show that a number of these mice is sufficient to depopulate a well-stocked brook in a comparatively short time.

I believe that now I am master of the situation, for during the last few months shrew-mice have been caught only occasionally. My brooks at present again swarm with young, strong trout, and it remains to be seen whether some new enemy will make its appearance and prevent too great a production of fish within a narrow space.

HUNINGEN, ALSACE, GERMANY, 1884.

184.—EXPERIMENTS IN PENNING SEA-FISH.

By SMITH E. HUGHES.

[From letters to Prof. S. F. Baird.]

Five or six years ago I believed Sea Grove, N. J., now called Cape May Point, would become a watering-place. I thought that the mouth of Old Pond Creek could, by artificial means, be made a harbor for small boats, accessible at high tides, so I built jetties and wharves, and had a basin of about $1\frac{1}{2}$ acres dug out, the mud and sand being used to fill up the wharves. I succeeded in making it accessible for small boats about three-fourths of the time, and several boat-loads of lumber and material were delivered in that way, but in less than three years it resulted unfavorably.

I then determined to make the basin a place for storing fish, as they could be caught in abundance in May and June of each year and be disposed of in July and August. In order to do this, I fixed gates between the jetties, entirely controlling the flow of water. I also put in iron grates to hold the fish. When all was ready, I put in a few hundred pounds of trout or weak-fish as an experiment. They all died but about fifty or one hundred pounds, which lived without much care until the 25th of November following. The survivors grew to be large, fine, fat fish.

The meadows above for some weeks previous to that time had been very dry, and about the 24th of November there came a cold and heavy rain, which washed the meadows, and the water flowing into the basin killed the balance of the fish in one night. I attributed the loss of these fish to impure or poisonous water. Some of the fish may have died in handling. Last season I cut off the fresh water and put in the basin about 5,000 pounds of fish. I drained it off so as to give about one-half fresh water from the bay every day. I think that the hawks carried off one-fourth or more of the fish, for it did seem that all the hawks in Cape May County fed there. They were shot at and some of them killed, but we could not drive them away. I then covered the whole basin with wires about 5 feet apart. If I had not done this I believe every fish would have been carried off. It being still and clear water, the hawks had little trouble in seeing and capturing their prey. When the bay was a little rough we could see them by tens and twenties for miles away making straight for my basin. I assure you it is a waste of time and money to stock ponds with any kind of fish when hawks abound, unless they are protected in some way.

By some mismanagement with the man in charge a quantity of creek water got in the basin again and killed some fish, but this was made good at the next flood tide, and the balance lived, and were taken out in the latter part of August in as fat and nice condition as fish could be. I feel satisfied that from June to August some of them increased from one-fourth to one-third in size. With two seasons of experience I fancied that I knew the cause of disasters and could make the business a success the next year.

So this last spring I threw up banks to cut off the back creek water entirely and replaced the wires over the basin from 3 to 5 feet apart. I also put in a trunk, with lumber, from the basin to about 30 feet beyond low-water mark in the bay through which the tide ebbed and flowed. I then built a wharf, from which we could work the nets and catch all the fish we wanted on flood tides, sending them in through the trunk into the basin without handling them at all. The whole arrangement seemed to work well, and I suppose we had over 20,000 pounds in the basin with but very little loss of fish. It was a grand sight to see them swimming about in the basin. The account spread, and many people came from a distance to see them.

On last Monday I received word from my men to come down immediately. I arrived on Wednesday morning, and to my surprise found half or more of the fish dead. I was satisfied that all would die if left in the basin, and so I took out the grates and raised the gates and let all that were afloat, dead and alive, out into the bay. I assure you it was a disappointment to me; not only the thought of so many fish dying, but the expense and trouble of my whole arrangement seemed to be a a total loss.

Now I ask if you will be kind enough to explain to me why this sudden change should take place with the fish. My men tell me that on Sunday, June 23, they looked fresh and lively up to 9 o'clock at night, when they left; by Monday noon great quantities were dead. On Monday night after sunset they heard a great commotion in the water all over the pond, some of the fish jumping 2 feet out of the water, and before I arrived on Wednesday I judge more than half were dead when I let them go. There is at high tide on an average 4 feet of water which would be let off to 2 feet for a change. They had on that day the same change, about one-half the water as usual for weeks before that.

The water flowed in and out at the same place, and as only about one-half the water could be changed each day, much of the old water must have remained at the upper end of the basin. As an evidence of this, much grass grew on the muddy bottom at the upper end. I do not think many of the fish remained in it except at high tide, and when the water was let off a few apparently sick fish remained among it. It is all a mystery to me, as old fishermen tell me that the fish feed among this grass in the sounds; others tell me they think they were poisoned by some one intentionally. I cannot think so. But I do believe there was disease among them, or that such quantities of fish in the amount of water exhausted the oxygen from the water to such a degree as to make it poisonous. The fish when dead looked well; the eyes were bright and glistening, the gills fresh and red, the fish bright and healthy, without discoloration or loss of scales.

27 QUEEN STREET, GERMANTOWN, PHILA., PA., *June* 30, 18[illegible]

I have decided to go down after a few days and put in a few more fish. After coming so near to making the experiment a success, and with the experience I have gained in the last few years, it may result in success in the future. I now feel almost assured that my place is adapted for the purpose of penning fish, with some additional expense of having it dug deeper and arranged so that the water will flow in at one end of the basin and run out at the other end at every tide. When once attained, the principle will be followed by many fishermen, and perhaps companies will be formed to carry on the business along the coast and bays, taking trout and some other fish while coming in during the spring—May and June—and striped bass in the fall of the year—November and December.

No person has any conception of the number of fish passing in and out of the bay until they learn something of it by actual experience. Although thousands of tons of valuable fish are destroyed annually by porpoises, sharks, and other fish of prey and by the hawks, there could be thousands of tons captured for wholesome and cheap food without their being missed from the waters. The capturing of them and transferring them into the basins is attained without even lifting them out of the water and with but very little loss.

27 QUEEN STREET, GERMANTOWN, PHILA., PA., *July* 10, 1883.

REPLY BY PROFESSOR BAIRD.

As far as I can judge, the difficulty must be the warmth of the water in the shallow inclosures to which you refer, and the deficient supply of oxygen for so large a number of fish.

In our experience of carrying fish, we find that for a difference of temperature of 50° and 70°, nearly three times as much water is required for the latter as for the former. As the water is now probably well up to 70°, this would be, in itself, an explanation.

I would strongly advise that, if possible, you put a few of the fish in your inclosure, say 20 or 30, and see how they behave.

We have succeeded in penning up striped bass in a basin on an island in the Susquehanna River and keeping them until June. The number of fish, however, was in much less proportion to the water than that indicated by you.

The practice of penning fish is in vogue in France, where, however, I presume the depth of water is considerably greater and the temperature less. There is no reason why it may not be done here also. I am working in that same direction, constructing basins for penning codfish, mackerel, and other northern species, to hold them until their eggs are ripe and they can be treated by artificial impregnation. I doubt whether the matter of furnishing hiding-places for the fish is particularly important. This, however, can be managed by bringing in floating seaweeds to form a surface over the water and serve to oxygenate it. This floating green scum cannot in any way injure the water or fish.

WASHINGTON, D. C., *July* 5 *and* 14, 1883.

185.—METHOD OF CATCHING CARP WITH A HOOK.

By PAUL QUATTLEBAUM.

[From a letter to Chas. W. Smiley.]

I use a beardless hook for two reasons. It can be taken from the mouth of a fish with greater ease and does less injury. I often catch carp for visitors to examine, and then return them to their native element. They may also be removed to other ponds in good condition. For catching small fry I use no cork; for large fish I prefer one, with lead enough on the line to sink the hook a few inches in the water, but they will take it at any depth. Late in the afternoon or early in the morning is the best time of warm weather. When the sun is shining brightly, and its rays strike deep down into the waters, the carp retires from his feeding-grounds and remains at rest until the shade of the evening lures him from his quiet retreat. On warm cloudy days, when trained to artificial feeding, the carp may be caught at any hour, but less readily about noon. It is a waste of time to angle for them in cold weather. It is well known that the carp declines all food in freezing weather, and that the appetite varies with the temperature of the water to a certain degree. In my ponds, near Leesville, I can catch either kind of carp as above stated from April to December. I train them to come to the surface of the water for food so as to enjoy the pleasure of seeing them scramble for it. The cheapest of light bread, made of middlings or shorts, expressly for the fish, is what I use. The same answers for baiting the hook, but a piece of waffle, cut the right size for the fish you desire to catch, is better, being tougher and not so easily taken from the hook by the fish. I first collect the fish together by throwing in a handful of small bits of bread—say one-half inch square—then I drop in my hook, attached to a strong line at the end of a suitable cane, and in less than a minute I am almost sure to bring a carp to grass. More time is generally consumed in putting the bait on the hook and taking the fish off of it than in luring him to take the bait.

The young fish hatched early last May are now 5 or 6 inches long.

LEESVILLE, S. C., *July* 30, 1884.

186.—CARE OF GOLDFISH.—QUERIES OF WILLIAM ROSENSTIHL, JR., WITH REPLIES.

By JOHN A. RYDER.

I have an aquarium with goldfish, and there are several things that I do not understand:

1. The water I am using in the aquarium is from a well slightly tinged with alum. Will this injure them? I have been using the same kind of water for six months.

2. There collects on their mouths, back, and fins a white substance. What is it? And what is the cause?

3. Occasionally I take the goldfish out of the aquarium to clean it, and in putting the goldfish back with fresh-drawn water in the aquarium, at first they move off very lively; but in the course of an hour they commence to swim on top and seem to breath the air. This they will continue to do for nearly a whole day. Why is this? Why is it also that when coming to the top they blow out bubbles?

4. Day before yesterday I cleaned it. Yesterday and to-day there are two of the goldfish that go to the bottom, and rest perfectly flat on the pebbles in bottom. I have the aquarium in my store near a window. A little sun will strike it of an evening, and I have it arranged in this manner: A tin tank, holding 16 gallons of water, is raised about 24 inches above the level of the water in the aquarium and is connected with a lead pipe, coming under the aquarium, and a small pipe is extended from the lead pipe up through the center of the aquarium and the spray is thrown 3 feet high. Every day I have fresh water drawn. The aquarium holds 30 gallons of water.

5. I am feeding them on a food (which is specially prepared for them) of which I send you a sample.

6. Will these goldfish spawn in the aquarium? How should I treat them if they do?

7. There are two of them with their tails seeming to shed. What is the cause?

8. Is there anything I can put in the water to make them healthy?

UNION SPRINGS, ALA., *March* 14, 1883.

REPLY BY MR. RYDER.

1. I do not think the alum in the water is good for the fish.

2. The accumulation of white substance may be from the water, or possibly may be fungus. The description is not definite enough to decide.

3. Fish will come to the surface when it is warm and snap the mouth as though for air. The air-bladder of the goldfish communicates with the throat or stomach, which accounts for the bubbles expelled.

4. When the fish lie on the side it is usually a sign that they are sick, or do not have enough pure water.

5. I do not know the nature of food used, or, judging by the sample, whether it is the best for the purpose.

6. The goldfish will spawn in an aquarium, but in order to give them a chance to deposit their eggs in a safe place, there should be a water-plant, upon which the females will discharge their ova, and to which they will adhere, and on which they will hatch out.

7. Those with the tails "seeming to shed" have probably had the skin abraded or injured by rough usage.

8. There is nothing that can be put in the water that will make the fish healthy. Avoid nostrums, but make the conditions of life normal to the fish and they will thrive. It has been the writer's experience with large goldfish that if there are enough of water-plants in a spacious tank, or even if the sides are merely coated with an abundance of microscopic green algæ, that they will take little food which they may be offered and live apparently in perfect health for years. Too many plants in the water are just as bad as none at all. The plants give off oxygen to the water, which is of advantage to the fish.

WASHINGTON, D. C., *April* 13, 1883.

187.—EXPORTS OF FISH-OIL FROM NORWAY, 1878-'82.

By FREDRIK M. WALLEM.

[From a letter to Prof. S. F. Baird.]

As far as now known, the exportation of fish-oil (including whale-oil, &c.) has been as follows:

Years.	Liters.	Gallons.
1878	11,900,000	*3,143,980
1879	12,700,000	3,355,350
1880	15,200,000	4,015,850
1881	10,460,000	2,763,540
1882 (January 1 to October 31)	8,750,000	2,311,750

* This is calculated on the basis of the United States standard gallon of 231 cubic inches, which contains 3.785 liters. The liter contains 61.028 cubic inches.

The proportion of cod-liver oil in 1882 was less than in other years, as the whale and other fisheries were more successful than usual. The quantity of cod-liver oil exported must be over 60 per cent of the whole, while the cod-liver oil for medical purposes (three grades) is at least 33 per cent. The price of this oil for medical purposes fluctuated greatly in Europe during the spring of 1882. At present the price of the best grade ("steam refined") is $26.80 per barrel. During 1881 its average price was $22.25.

BERGEN, NORWAY, *December* 21, 1882.

188.—TEN QUESTIONS CONCERNING THE HABITS AND BREEDING OF LANDLOCKED SALMON, WITH REPLIES.*

By CHARLES G. ATKINS.

Question 1. Do they live only in large lakes having a depth of more than 100 feet?

Answer. The depth of the lakes inhabited by them is not ascertained with certainty, but I believe that some of them will be found to be less than 100 feet deep. As to area, some of the lakes I believe to measure less than 1,000 acres. The largest, Lake Sebago, measures about 50 square miles.

Question 2. Do they live only in lakes surrounded by mountains (alpine or sub-alpine lakes)?

Answer. The lakes in which they most abound are surrounded by low land. Lake Sebago is in a flat sandy country, and around Grand Lake in the Schoodic chain are probably no hills that rise more than 600 feet above its surface. None of the others are in a strictly mountainous country.

Question 3. Are there many lakes in the United States in which landlocked salmon are found?

Answer. All the lakes in the United States containing them are about twenty in number, included in four small river basins in the State of Maine. This is a very small proportion of the lakes of the country, the State of Maine alone having several hundred of them.

Question 4. What is the usual weight in the market?

Answer. The usual weight of the landlocked salmon from the Schoodic lakes is 2 pounds; from the Sebago region, 5 pounds.

Question 5. What is an extraordinary weight?

Answer. An extraordinary weight is 5 pounds for the Schoodic fish and 12 pounds for the Sebago fish; though the former sometimes reach 10 pounds and the latter 18 or 20.

Question 6. Are they more esteemed and sold at a higher price than lake trout?

Answer. They are esteemed higher than any of the trout.

Question 7. In what month do they spawn?

Answer. They begin to spawn in October, but perform the operation mainly in November, finishing about November 20.

Question 8. Do they spawn in the lake like whitefish, or in rivulets like lake trout?

Answer. They spawn in running streams like the brook trout (*S. fontinalis*), which also often lives in lakes, but the true lake trout always spawn in the lakes like whitefish.

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* The questions were asked by Von Behr, president of the German Fishery Association.

Question 9. Mr. Palmer says they are not good for pond culture; is it so?

Answer. In small artificial ponds their growth is less rapid than that of brook trout.

Question 10. Are they caught by angling? In what month? What baits are employed?

Answer. They are taken with hook and line, mainly in May and June, often in July, September, and the winter months. They will take bait to some extent all months in the year. The usual baits are, in May, the rind of salt pork; in June, the artificial fly; in the winter, a small living fish.

189.—REPORT ON BLACK BASS SENT FROM AMERICA TO GERMANY IN 1883.*

By MAX VON DEM BORNE.

Of the 7 wide-mouthed and 45 narrow-mouthed bass which Mr. Eckardt, jr., brought from America in February, 1883, the greater number died, probably in consequence of the long journey, so that this spring there remained only 3 of the former and 10 of the latter, which I placed it two ponds, supplied with gravel beds for spawning. The 3 wide-mouthed fish were ready to spawn, but the 10 narrow-mouthed ones will not reach that condition until next year. The former are probably best suited for the water of the lead region, such as I possess, and the latter for stony bottoms.

To-day I had the pleasure of noticing in the pond containing the 3 wide-mouthed black bass a large number of young fish of shape entirely unknown in these regions—small fish of a pitch-black color, resembling tadpoles. With a fine gauze catcher we caught more than 2,000 in about an hour, and placed them in a pond containing no fish whatever, but a great number of diminutive crustaceans (*Flohkrebse*). I have, therefore, reason to hope that this importation has proved a success. The 3 old fish have grown very rapidly, and have now reached half an arm's length.

I am waiting to hear from Professor Beneke relative to the use of the diminutive crustaceans (*Flohkrebse*). From Dubisch I have learned how to raise enormous quantities of infusoria for fish-food.

BERNEUCHEN, GERMANY, 1884.

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* *Mittheilungen über blackbass.* From Circular No. 4, 1884, of the German Fishery Association, Berlin, June 30, 1884. Translated from the German by HERMAN JACOBSON.

NOTE.—An account of the spawning of the black bass sent to von dem Borne in 1882 will be found on page 219.—EDITOR.

Vol. IV, No. 25. Washington, D. C. Sept. 16, 1884.

190.—ARRANGEMENT WITH THE LIFE-SAVING SERVICE AND THE LIGHT-HOUSE BOARD FOR COLLECTING WHALES, PORPOISES, SHARKS, AND STRANGE FORMS OF MARINE LIFE.

By CHAS. W. SMILEY.

Reports of the stranding of strange animals upon the sea-shore are often found in newspapers, but for practical purposes are of little value, because time has usually elapsed sufficient to allow the specimens to decay or to be removed. In order to enable the Fish Commission to secure some of these forms of life the Commissioner addressed the following letter to the superintendent of the life-saving service:

"I beg leave to call your attention to a service, in the interest of science and of the fishing industry, that can readily be rendered by those connected with the life-saving stations.

"As United States Commissioner of Fish and Fisheries, I am desirous of obtaining a complete collection (to be deposited in the National Museum) of illustrations of the various marine animals, the occurrence or capture of which is only occasional. I refer more particularly to whales, porpoises, blackfish, grampuses, and the various other forms of the whale family. These are frequently thrown ashore by the storms, or stranded in shoals, or taken in weirs, but beyond exciting a passing interest on the part of the bystanders, very little further is heard of them. In addition to these, I may mention the great basking or bone shark, and any unknown or unidentified marine monsters, such as might possibly suggest the idea of the far-famed 'sea-serpent.'

"I would ask, therefore, that instructions be given to the persons connected with the Life-Saving Service, during the period of official duty or at other times, to advise me promptly, by telegraph, of the appearance, in their vicinity, of any such animals, and to endeavor to keep them in proper condition and prevent their being cut or otherwise mutilated until I can send some word. I would cheerfully pay the full value of the oil or blubber of these animals, so that there might be no inducement to cut them up. A telegram sent to the nearest station, addressed 'Professor Baird, Washington, D. C.,' will come to me without prepayment being required, if marked 'Government business, collect.' If out of the reach of the telegraph, the announcement may be sent by mail. On receipt of this communication, which should give some idea of the nature and condition of the specimen, I will at once respond—in some cases sending an expert to prepare the specimen for the Museum.

"Some of these animals, if not too large, can be forwarded directly to Washington; others I may wish to have cast in plaster on the spot and the skeleton only removed.

"I would also be glad to be informed, in a similar manner, of the first appearance, at tolerably long intervals, of schools of mackerel, menhaden, blue-fish, porpoises, blackfish, &c."

Under date of February 2, 1883, Mr. S. I. Kimball, the superintendent, issued a circular to all the keepers and crews of United States life-saving stations, prefacing it as follows:

"Your attention is called to the letter addressed to this office by Prof. Spencer F. Baird, U. S. Commissioner of Fish and Fisheries, and you are requested to render him all the assistance possible in furtherance of the objects specified therein not incompatible with the performance of your regular duties."

In just one week from the date of that circular the following telegram was received from J. B. Edwards, keeper of Amagansett Station No. 10, via East Hampton, Long Island, February 9, 1883:

"Have specimen of shark 9 feet 8 inches long. Three feet around largest part. Not identified by any one here. Weight 200 to 300 pounds. At present fresh."

The fuller account by letter soon arrived. It was as follows:

"The head, shaped nearly like a shark, quite flat, no teeth, and as large as any part of the body; mouth quite large; eyes I think more like a beast than shark; the skin rough like a shark, dark gray color. The fish is different from anything we have seen here before. It is not a sea-serpent, but a new kind of fish to us. Length, 9 feet 8 inches; weight, about 300 pounds."

The shark was sent for and proved a valuable specimen. Other reports followed every few weeks, so that nine months later the following list was furnished by Professor Baird to a correspondent applying for it:

"Quite a number of specimens have been already received, including some of much interest on account of their rarity. The animals reported thus far have been cetaceans and fishes, but it is probable as time passes we shall obtain specimens not only of vertebrate animals, but of the invertebrates as well. You will observe by the following list that many of the specimens were from New Jersey:

Dolphin (*Tursiops subridens*), Fire Island, N. Y.
Pigmy sperm-whale (*Kogia goodei*), Spring Lake, N. J.
Dolphin (*Tursiops subridens*), Turkey Gut, near Cape May, N. J.
Bottle-nose whale (*Ziphius cavirostris*), Barnegat, N. J.
Shark (*Pseudotriacis microdon*), Amagansett, N. Y.
'Star-gazer' (*Astroscopus* sp.), Life-Saving Station 6, N. C.
'Lump-fish' (*Cyclopterus lumpus*), Point Judith, R. I.
'Flute-mouth' (*Fistularia serrata*), Point Judith, R. I.
'Angel-fish' (*Pomacanthus arcuatus*), Barnegat, N. J.

"No such arrangement as the one under consideration exists in any other country.

"Its importance to the advancement of the knowledge of the larger marine vertebrates cannot be overrated. Hitherto zoologists have been forced to content themselves with examination of specimens of which the stranding has been reported indirectly through the newspapers or otherwise. In the majority of such cases the rapid progress of decomposition has made it impossible to preserve more than the skeleton, and so it has come about that the external appearance of many large species is quite unknown. By the present admirable arrangement, however, and the extension of our railroads, a specialist can be dispatched to almost any point on the eastern coast in time to observe in a fresh state any stranded animal which may have been reported.

"Washington, D. C., November 13, 1883."

In return for the services rendered by the Life-Saving Service, copies of the reports of the Smithsonian Institution, and the reports and bulletins of the Fish Commission, are sent to the Atlantic coast stations.

Under date of November 13, 1882, a letter similar to that addressed to the superintendent of the Life-Saving Service was addressed to Vice-Admiral Stephen C. Rowan, U. S. N., chairman of the Light-House Board. Under date of February 13, 1883, the chairman of the Board addressed a circular to all keepers of light-stations, quoting Professor Baird's letter, and saying:

"Your attention is called to the letter addressed to this office by Prof. Spencer F. Baird, U. S. Commissioner of Fish and Fisheries, and you are requested to render him all the assistance possible in furtherance of the objects specified therein not incompatible with the performance of your regular duties."

Very little has resulted from the instructions to light-house keepers, as their duties do not call them to patrol the coast.

WASHINGTON, D. C., *July* 31, 1884.

191.—USE OF LIGHT IN SEA-FISHING.*

That light exercises a certain influence on fish is an ascertained fact; but how far it operates to attract or repel is uncertain. The drag-net fishermen have learned that, when there is much phosphorescence in the sea, herring enter the nets reluctantly, as the light which the nets produce by their movement in and through the water frightens the fish away. The idea underlying the method by which light is utilized for the capture of anchovies, of which more is said further on, is that its influence is more to repel than to attract fish. It is, however, not our purpose here to pursue this question further, but only to mention some

*From *Norsk Fiskeritidende*, Vol. III, No. 2, April, 1884, pp. 114–116. Translated by TARLETON H. BEAN, M. D.

examples of the use of light in sea-fishing without regard to the mode in which it operates.

Periodically there appears in autumn, from August to the close of October, a pike-like fish, *Belone acus*, in great schools. They are captured on dark nights in the following manner:* Upon arriving at the fishing place the sail is taken in, whereupon they pull cautiously around searching for the schools. These are easily discovered, because they are constantly pursued by dolphins, which gorge themselves upon the *Belone*. As soon as a school is discovered a fire is kindled in an iron vessel which is fastened to the bow, whereupon the boat is swung noiselessly around many times in order that the light may be thrown in all directions. "Attracted by this," says the author, "the fish collect around the boat and remain near it, often even following its revolutions. Thereupon the school is decoyed literally to the shore as it follows the boat, which is rowed cautiously towards the beach. In doing this, however, care must be exercised not to touch the bottom, as the least shock will frighten the fish away. A couple of meters from the shore the headway is stopped, the oars are taken in, and the fish are scooped up from both sides with dip-nets. At first a few fish are scared off, but they quickly return and join the main school, which does not move. In this way a thousand kilograms of fish are frequently taken in the space of a couple of hours."

At many places in the Mediterranean anchovy fishing is prosecuted in a similar way. When a school has collected around the torch-bearing boat, another boat encircles it with a net, whereupon the lights are extinguished. The spell is broken; a quick stroke of an oar in the water causes the last remnant of them to disappear, and in the meshes of the nets the deluded fish must pay the penalty of their recent blindness or confusion. In your country, in Altenfjord, possibly also in other places, light is sometimes employed in the herring fishing in autumn. When the school has been brought to a standstill by the use of light, the fish are scooped up with dip-nets, and the yield is often gratifying.

During the London Fisheries Exhibition there was exhibited from Tarragona, Spain, a boat with an open well in the middle in which well could be placed a box furnished with a glass bottom and in its lower portion with glass sides, in which box lamps could be placed. The box was lowered so far that the glass sides and the flame of the lamps were below the bottom of the boat so that the light could shine in all directions. So far as I remember, it was especially intended to be used for the capture of cuttle-fish. In Newfoundland, also, light is often employed in the capture of these mollusks. The fishermen make a fire on the shore and the light so absorbs the attention of the cuttle-fish that with the incoming tide they are stranded on the beach where they are picked up. Where it frequents the deep water, and where there is a long beach, the method of fishing just mentioned as occasionally employed will be

*Nicolas Chr. Apostelides, *La pêche en Grèce*. Athens, 1883.

worthy of a trial, though in such places it is not used for the capture of cuttle-fish. Here is employed an artificial decoy fish made of wood formed nearly like a flat-bottom boat with pieces of glass set in the bottom and sides. It is of the size of the body of an average cuttle-fish, and is trolled after the boat. According to the author previously mentioned, the ancient Greeks towed after the boat a female in order to attract the males, which were then scooped up with the net. Since at the present time it is often difficult to procure a female, the modern Greeks substitute for the natural decoy an artificial one.

The capture of fish by means of light is extensively employed in shallow-water and in fresh-water fishing, but it is confined to the taking of fish singly. In the sea fishery light is employed also in some places, as we have seen, for the capture of fish in schools. The reason why this "auxiliary weapon" has not come into general use is twofold: partly because of technical difficulties, and partly because its operations with the means which people hitherto have been able to command have been confined to a very small territory in comparison with that operated upon by other means of capture. The development of the electric light will probably lead to its more extended use in the fishery service than hitherto; but we assume that its especial use must be as a means of dazzling the fish, which will arrest them until they can be caught with other implements. Its use in the purse-net and trawl-net (*Synkenot*) fishing is therefore only a question of time.

192.—THE MODE OF LIFE OF EELS.*

By HERR HINKELMANN.

When you ask fishermen how it comes that the yield of the eel fisheries on our Baltic coast varies greatly in the different years, you will always get the answer that this is owing to the direction and the force of the wind. Observations on the mode of life of eels, made by me for a number of years, have fully corroborated these statements of the fishermen.

As far as our coast is concerned, the eel fisheries are most successful in autumn, during a southeast wind, while when the wind is from the northeast, east, and south-southeast, the results of the fisheries in most places leave much to be desired. During all other winds from the west the yield of the fisheries is reduced to a minimum, so that they become absolutely unprofitable. Of less influence than the direction of the wind is its force. It may, however, be laid down as a rule that the stronger

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* *Ueber die Lebensweise der Aale.* From Circular No. 3, 1884, of the German Fishery Association, Berlin, April 4, 1884. Translated from the German by HERMAN JACOBSON.

the wind the richer the yield, provided that a sudden storm does not destroy the fishing apparatus before the eels have begun to move.

The migration of the eels in autumn is carried on during the night, beginning about one hour after sunset; is strongest from midnight till 2 o'clock in the morning, and ceases about one and one-half hours before sunrise. Views are greatly divided among fishermen as to whether, during day-time, the eels hide among the aquatic plants near the shore, or whether they stay in deep water at a greater distance from the coast. As far as my own observations go, I am led to suppose that during day-time the eels only avoid the shallow places where there is but little vegetation, but that as a general rule they keep at no great distance from the coast, in order to continue their migration in the evening.

This migration is going on the more cautiously the calmer the weather, and for this reason many eels cannot be caught in standing apparatus during calm weather and in clear water. I thus remember that during a beautiful but very dark September night 100 eels were caught with a small net at a single haul, near a large number of fish-baskets from which the following morning only from 15 to 20 eels were taken, although it is certain that many eels were constantly passing the baskets.

To watch the eels among the fish-baskets along the coast, select a very dark autumn night, when the sea is strongly phosphorescent and when there is absolutely no wind, or the evening twilight soon after sunset, and full opportunity will be afforded to observe the life and doings of the eels. It is only under very peculiar conditions of weather that the eels migrate in large schools. It is probable that when the sky is thickly clouded—but even then only during a storm—the largest schools move along our coast, although large masses have been observed in various places during calm weather. In the autumn of 1879 I observed soon after sunset a large school of eels in the Little Belt whose appearance astonished me very much. When later I mentioned it to the fishermen of the neighborhood, I was told that the eels often formed an immense ball, rolling along the coast towards the north. There cannot be any doubt that this migration towards the Cattegat is connected with the spawning of the eels.

It is a very rare occurrence to find a migratory eel on the coast in spring, while so-called summer eels are often caught with fish-baskets and spears. Among the summer eels I have never succeeded in finding a male, much and often as I have searched for it. Among the migratory eels caught last fall in the Gjenner Bay there was a male eel, measuring 51 centimeters [20 inches] in length, the largest which I have ever seen.

The number of male eels seems to increase with the saltness of the water, so that more male eels are invariably found among those caught on the coast of Zealand than among those caught on the coast of Schleswig-Holstein.

198.—THE WEIGHT OF FISH IN DIFFERENT CONDITIONS.*

From Aalesund we have received the following statement concerning the relation between fresh, salted, and dried fish. A hundred fish weighed as follows:

	Kilograms.
Round	385
Rough-dressed	275
Split	220
Brine-salted	180
As klip-fish	110

According to this statement 100 kilograms of split fish should yield 50 pounds of klip-fish, and 100 kilograms of salted should produce 61.1 kilograms of klip-fish, or, in other words, for each 100 kilograms of weight in the split condition, the fish loses in salting 18.2 kilograms, and in drying 31.8 kilograms. As will be seen from the annual report of the association, page 6, the Icelanders estimate 50 kilograms of klip-fish from 100 kilograms of round fish, and 66.7 kilograms of klip-fish from 100 kilograms of salted fish, which involved a loss of 25 kilograms during the salting and 25 kilograms during drying process. According to the experiment made in the United States, which is mentioned on pages 131 and 132, the loss there in salting was 27.3, while in drying, on the contrary, it was only 8.7. In our country we calculate on the average in dry salting a loss of 32 in the process of salting, and 34.7 in drying. The Aalesund fish lost as little in salting as 18.2 kilograms for the reason that they were brine-salted; † but their great excess of moisture would be removed later in drying and pressing, during which they lose 31.8 kilograms.

A chemical analysis of these fish, and information concerning their durability would have been interesting, because the Scotch, who also practice brine-salting, estimate only 39.3 kilograms of klip-fish to 100 kilograms of crude fish.

The readers of the Tidskrift, who may be in possession of trustworthy statements concerning the relative weights of fresh, salted, and dried fish, are earnestly requested kindly to furnish these to the editor. Information as to the kind of salt, the quantity used, the time during which fish have remained in salt, the appearance of the fish, the time it has lain in pickle, the amount of moisture and salt it contains (according to chemical analysis), the place where it was caught, and the statement as to whether it was worked over or not, and how long, will add to the value of the statement.

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* From *Norsk Fiskeritidende*, Vol. III, No. 2, April, 1884, pp. 191, 192. Translated by TARLETON H. BEAN, M. D.

† See page— on the purchase of fish in salt.

194.—THE WORLD'S MARKET FOR KLIP-FISH, ROE, AND HERRING.*

By PAUL GEORGE PAULSEN.

THE KLIP-FISH MARKET.—The quantity of salt and dried fish exported from France in 1881 was as follows:

	Kilograms.
To Spain	1,200,000
To Italy	1,899,000
To Algiers	878,000
To Greece	909,000
To Turkey and Egypt	254,000
To the West Indies	494,000
To Réunion	110,000
To other countries	298,000

Making a total of 6,042,000 kilograms [about 13,322,600 pounds], against 4,300,000 during the preceding five years.

THE ROE MARKET.—In 1881 France imported—

	Tons.
From Norway	40,600
From the Netherlands	1,300
From Great Britain and Ireland	200
From the United States	2,200
From British North America	1,000
From St. Pierre, &c	2,400
From other countries	100

In all 47,800 tons, against 60,200 during the period of 1876–'80.

THE HERRING MARKET.—In 1882 there were imported into Danzig, Prussia—

	Tons.
From Norway and Sweden	10,800
From the Netherlands and France	900
From Scotland	150,200
From the Prussian fisheries	7,400
In all	169,300

On hand at Danzig at the end of the year, 72,900 tons.

* *Verdensmerkedet.* From the *Norsk Fiskeritidende,* Vol. III, Bergen, January, 1884. Translated from the Danish by HERMAN JACOBSON.

The average annual importation into Memel, Königsberg, Danzig, Stettin, and Hamburg, during the period 1879 to 1882, was as follows:

Country.	Tons.	Per cent.
From Norway	237,000	25.4
From Sweden	12,800	1.4
From Denmark	4,500	0.5
From the Netherlands	25,800	2.7
From France	12,800	1.4
From Scotland	636,700	68.2
From the Prussian fisheries	3,500	0.4
From America	100	....
Total	933,200	....

Of this quantity there were imported into—

City.	Tons.	Per cent.
Memel	24,300	2.6
Königsberg	197,200	21.1
Danzig	146,300	15.7
Stettin	382,200	41.0
Hamburg	183,200	19.6
Total	933,200	....

In 1881 France exported the following quantity of dried, salt, and smoked herring:

	Tons.
To Great Britain and Ireland	19,500
To Russia	1,200
To Germany	16,300
To Belgium	500
To Algiers	600
To other countries	1,200
Total	29,300

195.—ON THE CONDITIONS UNDER WHICH TROUT EXIST IN THE GERMAN WATERS.*†

By PROFESSOR KUNKEL.

Investigations of this matter revealed the remarkable fact that in Western Franconia, in portions of the country lying in the closest proximity, there is an essential difference in the occurrence of trout in the

* From "*Vortrag des Professors Dr. Kunkel in Würzburg über die Existenzbedingungen der Forellen in unsern einheimischen Gewässern.*" From Circular No. 4, 1884, of the German Fishery Association, Berlin, June 30, 1884. Translated by HERMAN JACOBSON.

† Read at the monthly meeting of April 7, 1884, which was, like former meetings, numerously attended by all classes of the population from far and near. There was an address by Professor Kunkel, of which this is an abstract, a general discussion of various matters relating to the fisheries, and the distribution of fish and fishing apparatus.

various natural watercourses. As all the other external conditions (climate) of these brooks are the same, the reason for this phenomenon can only be found in the difference of the geological strata from which these brooks take their origin; it is a fact that a difference in these geological strata goes hand in hand with the appearance of these brooks and with the varying occurrence of fish. The waters which come from speckled sandstone (in the Spessart and Rhon Mountains) are clear and transparent, and contain trout, without any artificial aid, as far as particles of such sandstone reach, while brooks which spring from shell-lime are invariably void of fish. This fact is all the more remarkable, as those waters which spring from speckled sandstone contain fewer dissolved particles than any other water in Germany. Of dissolved carbonic acid only a faint trace can be chemically discovered, and dissolved lime is found only in very small quantities. These particles, which are found in considerable quantity in shell-lime brooks, form the most important substratum of all organic life. Aquatic plants live on carbonic acid, which is fixed, as it were, by the lime contained in the water. The aquatic flora of the speckled sandstone brooks is also unusually poor in individuals and species compared with the rich flora of the shell-lime brooks. Water-plants, however, are indirectly an essential condition of the well-being of trout, by serving as food for water-snails, the larvæ of various insects, and small crustaceans. This investigation, when extended over a wide area, also showed that in other parts of the country waters containing lime were very rich in fish. Great credit is due to the late Professor Weith, of the University of Zurich, for having shown in the report of the Swiss Department in the International Fishery Exposition of Berlin (1880), that among the Swiss waters (both lakes and brooks) those were always richest in fish, especially salmonoids, which contained relatively the largest quantity of dissolved carbonic acid and lime. For this reason it could safely be predicted that the attempt to introduce young trout into the shell-lime brooks of Franconia would prove successful. The result has proved the correctness of this prediction. In several brooks, which for a period of three or four years were stocked with young trout, the fish flourished to an extraordinary degree; there are more fish than in equally strong watercourses of the sandstone formation, and owing to the abundance of good natural food, the fish grow much more rapidly than in other waters, so much so that, compared with them, trout from the speckled sandstone waters must be termed decided failures. The shell-lime brooks, therefore, fulfil the first condition of the well-being of trout, viz., to supply good and sufficient food for fish of every age. The case is different, however, as regards the second condition, viz., the favoring of propagation. In this respect the trout (and in fact all salmonoids) require very peculiar conditions, because the eggs, after having been laid and become impregnated, need a very long time (a quarter of a year and more) till the little fish are hatched. During all this time the eggs should be washed by perfectly clear running water of even temperature. The least turbidness of the water will cover the outer shell of the egg with a layer of slime which constantly increases in thickness. The egg, which also has a sort of breathing process (absorption of oxygen and ejection of carbonic acid), is choked thereby and dies. Even a very superficial examination of our shell-lime brooks shows that they do not meet the requirements of the hatching period. They always appear slightly turbid, owing to a fine white sediment, which consists principally of carbonate of lime (with some clay and oxide of iron). The springs of these brooks are generally quite clear and pure, but before they have flowed any considerable distance they become more and more turbid. The aquatic plants withdraw from the carbonated lime dissolved in the water part of its carbonic acid, and thereby make it more difficult to be dissolved in water. This sediment of carbonated lime, together with some clay, which by a mechanical process is carried away from the bed of the brook, produces the unavoidable turbidness of our waters. Another essential condition of the well-being of trout is that they should not have too many other fish to share with them the natural food contained in the brooks. For this reason (besides the requirements of the hatching period), the trout are found only in the higher portion (near the springs) of our natural water-courses. If pike and other fish get in the streams, some fine specimens of trout will still be found, but no longer large numbers. The conclusion to be drawn from the above observations is simply this, that it will amply repay the trouble to place young trout in suitable brooks in our neighborhood (Franconia) which are not too strongly polluted by refuse from villages, &c. Unfortunately the brooks will have to be stocked every year, if a proper stock of fish is to be obtained, because young fish from naturally laid eggs will not flourish in these brooks. The first and principal point aimed at should be that the young fish are strong and healthy and carefully hatched in suitable water. Neglect in this respect is probably the reason that many an experiment has proved a failure, and that many a willing heart has been sadly discouraged.

196.—MARTIN BRANDT'S METHOD OF PRESERVING FRESH FISH AND OTHER ARTICLES OF FOOD.*

The more the fish trade extends to greater distances from the fishing stations, and the more the improved and enlarged fisheries at times overstock the market, does it become the more necessary, in order to avoid losses, not only to preserve the fresh fish by pickling or some other process, but also to prepare them in such a manner that they may be safely stored away until there is a better market. This object has been

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* "*Martin Brandt's Methode zur Konserveirung frischer Fische und anderer Nahrungsmittel.*" From the *Deutsche Fischerei-Zeitung*, Vol. vii, No. 28, Stettin, July 8, 1884. Translated from the German by HERMAN JACOBSON.

sought for several years, and efforts are still being made in the same direction. If it should become possible to preserve fresh fish for months in such a manner that the flesh does not lose its delicate flavor, a problem will be solved by which, among other things, many drawbacks connected with transportation would be avoided.

Mr. Martin Brandt, the well-known Danish preserver of fish, who last year returned from Tobolsk, Siberia, where he was called to start a large preserving establishment, has now, according to the Danish *Fiskeritidende*, discovered a method of preserving fresh fish and other articles of food which probably solves the problem in a satisfactory manner, and at any rate deserves attention. Mr. Brandt is at present endeavoring to have his method patented, and intends to establish a fish-preserving business and general fish business at Rostock, Mecklenburg, Germany, because he thinks this a particularly favorable place through which, in his opinion, a large portion of the fish will pass which are imported into Germany from Denmark.*

It is well known that, so far, all methods of preserving have some drawbacks, or are suffering from some imperfections. The best method is the so-called Appert method, according to which the fish are preserved in tin cans. The imperfections of this method are not so much in the manner of preserving the fish, as in the circumstance that fish put up in such tin cans has nearly everywhere to pay a heavy duty. Since the year 1876, Martin Brandt has employed this method in his preserving establishment at Ringkjobing, Denmark, and finally produced about 100,000 cans per annum, a quantity hardly reached by any other establishment in the north of Europe. When Germany, to which country he principally exported his goods, placed a heavy duty on preserved fish, he had to give up his establishment at Ringkjobing.

To preserve the fresh fish in ice is, if carried out consistently, undoubtedly the best method. Both fish and flesh retain their shape and looks, but, in order to obtain a favorable result, a very large quantity of ice is needed, whose weight and the space occupied by it increase the expense of transportation very considerably. The construction of ice-boxes and the buying of ice-machines likewise involve a great expense. Competent judges also say that the method of keeping fish on ice has some drawbacks, as heat is developed during the melting of the ice, which, by generating steam, favors the inroads made by fungi.

Of older methods we must mention the one by which the fish were kept alive for a considerable period. But the number of fish which can be kept alive by this method is comparatively small, and every day of delay before the fish can be sold increases the loss. The fish are be-

* This opinion would have to be proved by experience. A very large proportion of the fish imported into Germany from Denmark are live fish, and the most natural port of debarkation for these is Stettin, which may now almost be considered a suburb of Berlin. In Stettin the fish are received in perforated boats, and in the same manner pass through the River Oder and the Finow Canal to Berlin. Mr. Brandt, therefore, probably refers only to the transportation of fresh fish.—Editor, *Deutsche Fischerei-Zeitung*.

coming leaner from day to day, lose their fine looks, and finally become unfit for human food.*

Martin Brandt's new method is said to have this advantage—that it does not change the shape, looks, and flavor of the fish, and prevents the development of fungus. It is done by compressed air. It may be continued for an unlimited period and be employed in the holds of vessels, railroad cars, warehouses, &c. For lining the rooms where the fish are kept metal or cement is used. The preserving medium weighs very little, as 1,000 cubic feet of compressed air weigh but 10 pounds.

In Mr. Brandt's warehouse a pipe runs along the wall from the floor to the ceiling, and back again, twisting several times, and finally ending on the floor. The machine or development apparatus consists of an iron cylinder connected with a so-called vacuum air-filter. The cylinder is filled with air compressed by about 200 atmospheric pressure. By means of the vacuum apparatus the machine is connected with the pipe in the warehouse, and the compressed air flows, after a valve has been opened, with great velocity through the filter and the pipes. New air is also introduced in the vacuum apparatus through cotton filters, thus purifying it of all matter apt to decay, and, united with the stream of compressed air, it continues to pass through the pipes. As the air expands it loses some of its warmth and is gradually cooling off. When let out of the pipes the air, which has now become quite cool, rises evenly throughout the room, and drives the warm air, filled with germs of fungi, through an opening in the ceiling. As the inventor claims, fish and meat can be kept fresh for an unlimited period in rooms whose air has been purified in the manner described above.

197.—A LIST OF THE BLANK FORMS, CIRCULARS, AND MINOR PUBLICATIONS OF THE UNITED STATES FISH COMMISSION, FROM AUGUST 1, 1883, TO AUGUST 1, 1884.†

By CHARLES W. SCUDDER.

447. Blank for abstract of disbursements, by H. A. Gill, disbursing agent of the U. S. Fish Commission. 8 columns. August 8, 1883. 1 p., with filing on reverse. 43 by 56 cm.

448. Blank for acknowledging receipt of letters. September 6, 1883. 1 p. 20.5 by 25.5 cm.

449. Circular letter announcing that the sending of U. S. Fish Commission Bulletin signatures will be discontinued until receipts for former signatures are returned. Hektograph. September 8, 1883. 1 p. 20.5 by 25.5 cm.

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* This is true, although the process is not so rapid as some people imagine. We hardly think that any other method will entirely replace this one. In the first place, it is, wherever practicable, the cheapest method of preserving fish, and, in the second place, many consumers desire live fish (at least freshwater fish). The quantity of fish which is preserved in this matter is not small, but, on the contrary, enormous.—Editor, *Deutsche Fischerei-Zeitung*.

† This is a continuation of the list in F. C. Bulletin, Vol. III, page 129.

450. Circular letter offering bound volume of the U. S. Fish Commission Bulletin in exchange for signatures sent. Hektograph. September 20, 1883. 1 p. 20.5 by 25.5 cm.

451. Postal to chief clerk of Smithsonian, requesting him to cancel Smithsonian letters. Hektograph. October 18, 1883. 1 p., and address on reverse. 7.5 by 13 cm.

452. Circular letter offering authors copies of their articles in the U. S. Fish Commission Bulletin. Hektograph. October 16, 1883. 1 p. 20.5 by 25.5 cm.

453. Notice to carp applicants that they will be supplied between November 1, 1884, and January 1, 1885. December 1, 1883. 1 p., and penalty on reverse. 7.5 by 13 cm.

454. Circular letter to State fish commissioners offering salmon, trout, and whitefish eggs. December 1, 1883. 1 p. 20 by 25.5 cm.

455. Blank for quarterly return of equipment stores. December 1, 1883. 1 p. 23.5 by 35 cm. Bound pamphlet. 47 pp. each.

456. Blank for quarterly return of navigation stores. December 1, 1883. 1 p. 24 by 26.5 cm. Bound pamphlet. 29 pp. each.

457. Blank for quarterly return of scientific stores. December 1, 1883. 1 p. 24 by 37 cm. Bound pamphlet. 30 pp. each.

458. Blank for quarterly return of engineers' stores. December 1, 1883. 1 p. 13.5 by 35.5 cm. Bound pamphlet. 10 pp. each.

459. Blank for ledger of equipment, navigation, and scientific stores. December 1, 1883. 26.5 by 36 cm. Bound pamphlet. 106 pp. each.

460. Circular letter transmitting account upon vouchers and instructions concerning signatures. Reprint of No. 343. December 7, 1883. 1 p. 20 by 25 cm.

461. Blank for thermometer ratings. Corrections according to standard thermometer of the U. S. Fish Commission. January 10, 1884. 1 p. 20 by 23 cm. Bound volume, 500 pp. each.

462. Envelope for the U. S. Commission of Fish and Fisheries, with penalty notice attached. January 4, 1884. 1 p. 11 by 26.5 cm.

463. Circular letter inclosing carp application. General distribution from November 1 to January 1. January 10, 1884. 1 p. 13 by 20 cm.

464. Postal receipt for U. S. Fish Commission publications. January 10, 1884. 1 p., and return address with penalty notice on reverse. 7.5 by 13 cm.

465. Blank for requisition of articles or labor. Revise of No. 327. January 16, 1884. 1 p. 20 by 24.5 cm.

466. Circular letters to Wood's Holl subscribers, giving the advantage of a laboratory at Wood's Holl and asking for the $1,000 promised. Hektograph. September 19, 1882. 1 p. 20 by 32 cm.

467. Circular to Alpena employés, giving instructions regarding the taking of whitefish eggs. November 1, 1883. 1 p. 14 by 28 cm.

468. Circular letter announcing shipment of eggs from Northville or Alpena Stations and inclosing No. 469. December 1, 1883. 1 p. 21.5 by 28 cm.

469. Blank for record of eggs shipped from Northville, Mich. 16 items and recapitulation. December 1, 1883. 1 p. 21.5 by 29 cm.

470. Circular letter to carp applicants announcing that the carp supply is exhausted, and that carp will be furnished next fall. Hektograph. January 16, 1884. 1 p. 20 by 25 cm.

471. Blank book for recording the catch of salmon and alewives. 8 columns per folio. April 16, 1884. 1 folio 17 by 21 cm.

472. Notice to foreign correspondents that they may acknowledge receipt of Fish Commission Bulletins on post-cards of their own country. Hektograph. February 1, 1884. 1 p., on back of No. 413. 12 by 20 cm.

473. Blank for certificate that bills are correct statements of expenses incurred in service of the U. S. Fish Commission. March 1, 1884. 1 p. 8 by 21 cm.

474. Specifications for the paddle-wheel steam seine-boat Canvas-Back. February, 1882. 12 pp., each 21.5 by 28 cm.

475. Blank for recording applications for fish. 13 columns per folio. March 31, 1884. 1 p. 25 by 35 cm. Bound volume, 150 folios each.

476. Shipping tag for U. S. Fish Commission stations. 3 items. April 19, 1884. 1 p. 8 by 16 cm.

477. Blank for record of shipments of fish and eggs from U. S. Fish Commission stations. 10 columns. April 19, 1884. 1 p. 21.5 by 36 cm.

478. Blank for receipts of fish and eggs at U. S. Fish Commission stations. 12 columns. April 19, 1884. 1 p. 21.5 by 15.5 cm.

479. Blank for daily register of eggs received and hatched at U. S. Fish Commission stations. 21 columns per folio. April 19, 1884. 1 folio 36 by 43 cm.

480. Blank for record of air and water temperatures at U. S. Fish Commission stations. 12 columns. April 19, 1884. 1 p. 22 by 36 cm.

481. Blank for abstract of disbursements, by H. A. Gill, disbursing agent of the U. S. Fish Commission. 6 columns. April 11, 1884. 1 p. 20 by 32.5 cm.

482. Blank letter for transmitting drafts on Assistant Treasurer of the United States. April 21, 1884. 1 p. 20.5 by 25.5 cm.

483. Blank postal declining to furnish U. S. Fish Commission Reports, and giving prices charged by the Public Printer for them. April 23, 1884. 1 p., and penalty notice on reverse. 8 by 13 cm.

484. Return envelope, Herbert A. Gill, disbursing agent, with penalty notice attached. April 23, 1884. 1 p. 9 by 21.5 cm.

485. Blank for receipt for check from Herbert A. Gill on Assistant Treasurer of the United States. May 27, 1884. 1 p. 7.5 by 19. 5.

486. Envelope for U. S. Commissioner of Fish and Fisheries, with penalty notice attached. May 27, 1884. 1. p. 9 by 21.5 cm.

487. Circular letter ordering that no liabilities shall be incurred by the U. S. Fish Commission, without detailed requisition. Hektograph. May 26, 1884. 20.5 by 26.5 cm.

488. Circular letter offering duplicate specimens of marine invertebrates collected by the U. S. Fish Commission. Hektograph. June 20, 1884. 2 pp. 20.5 by 25.5 cm.

489. Blank for record of temperature and specific gravity on steamer Albatross. 12 columns. July 11, 1884. 1 p. 25.5 by 41 cm.

490. Circular letter ordering all articles wanted from the navy yards to be obtained on requisition. Hektograph. April 3, 1884. 1 p. 20.5 by 25.5 cm.

491. Circular letter forwarding certificate of diploma of honor awarded by the London Fisheries Exhibition in 1883. January 25, 1884. 1 p. 20 by 25 cm.

492. Circular letter forwarding silver medal awarded by London Fisheries Exhibition in 1883. January 25, 1884. 1 p. 20 by 25 cm.

493. Blank for receipt for silver medal awarded by London Fisheries Exhibition in 1883. January 25, 1884. 1 p. 8.5 by 19.5 cm.

494. Circular letter forwarding gold medal awarded by London Fisheries Exhibition in 1883. January 25, 1884. 1 p. 20 by 25 cm.

495. Blank for receipt for gold medal awarded by London Fisheries Exhibition in 1883. January 25, 1884. 1 p. 8.5 by 19.5 cm.

496. Circular letter of invitation to exhibition of California and Oregon salmon and trout at Armory Building. March 19, 1884. 1 p. 8 by 12.5 cm.

497. Circular letter of invitation to exhibition of Atlantic and Pacific slope salmon at Armory Building. April 2, 1884. 1 p. 13 by 19.5 cm.

498. Circular letter asking information regarding the whale fisheries. May 30, 1884. 1 p. 19 by 24.5 cm.

499. Circular letter transmitting Fish Commission Report. June 18, 1884. 1 p. 19.5 by 25.5 cm.

500. Blank for receipt for Fish Commission Report. June 18, 1884. 1 p. 12.5 by 19.5 cm.

INDEX TO THE FOREGOING LIST OF BLANKS, CIRCULARS, ETC.

[NOTE.—The references are to numbers, not to pages.]

Vol. IV, No. 26. Washington, D. C. Sept. 16, 1884.

198.—NOTES ON THE FISHERIES OF GLOUCESTER, MASS.

By A. HOWARD CLARK.

[From letters to Prof. S. F. Baird.]

SPECIMENS.—To-day we received a spotted catfish 4 feet long, a beautiful specimen. I send it in ice to the Smithsonian Institution. The spawned herring struck here Saturday, September 20, a fortnight earlier than last season. Among the specimens received within the past week are some very fine branches of white and red coral; a piece of the latter (*Paragorgia arborea*) measured 4½ feet in height. The Gussie Blaisdell brought some sea-corn (eggs of *Gasteropoda?*), 19 inches high.—*September* 22, 1879.

HERRING.—On Saturday, September 20, spawned herring appeared in the vicinity of Norman's Woe. Through the following week a few were taken. On Sunday, September 28, they were taken in considerable quantities. On Monday there was an increase, on Tuesday, Wednesday, and Thursday they were very abundant. On Friday, October 3, they disappeared from this locality. On Saturday and Sunday, October 4 and 5, some were taken near Marblehead. Since then none have been seen. About 100 vessels from Gloucester, Boston, and other places were engaged in this fishery. On Wednesday afternoon, October 1, 71 vessels were kept busy. The nets used were the common gill-nets, 2½ to 2¾ inches mesh. In many cases the nets were sunk by the weight of fish, and in a few cases they were never recovered. The Cape Ann Advertiser stated the number of barrels taken at 2,500, but I have found, by calling upon each dealer, that 9,580 barrels were received in the Gloucester market. On October 3, 2,000 pounds of pollock were brought to Gloucester, being the first of the season. On October 6, 4,000 pounds of large pollock were brought in.

MACKEREL.—A fleet of 125 mackerel fishing vessels put in here October 6, because it was too rough for fishing. There arrived this morning two mackerel catchers, the Edward Everett and the Phœnix; the former with 160 barrels, the latter with 150 barrels of good mackerel, caught yesterday 20 miles east by south of this place; about one-fourth of the fish were No. 1. Last year at this time the mackerel had about disappeared. Recently we received a specimen of *Lycodes vahlii*, the third one in the country. Received October 7, by schooner Herbert M. Rogers, among other things, 25 young black dogfish, each 6 inches long, taken from the parent.—*October* 9, 1879.

STORM.—The terrible storm of Tuesday caused the loss of at least one

Gloucester fishing vessel; the W. J. King went on the rocks on the outside of Eastern Point, and is smashed into small pieces; the crew saved themselves.—*February* 5, 1880.

MOVEMENTS OF VESSELS.—Mackerel seiners are hurrying south. Twenty-four vessels have already gone from here, and nearly as many more are getting ready. I believe that last year the first mackerel were taken April 13 off Delaware Breakwater. The George's fleet now numbers 110 sail. They have been doing well. The fresh halibut fleet is reduced to 20 sail; the last ones that arrived encountered great fields of ice down as far as Sable Island, and one vessel lost all her trawls by the ice cutting the buoy lines. Shore fishing in Ipswich Bay has been very poor of late; the fleet is very much reduced; fishing off Gloucester has slightly improved; yesterday 6 small craft averaged 1,000 pounds each. The haddock fleet numbered 60 sail through the winter, and is now fast reducing in number, because getting ready for George's and mackerel fishing. Frozen herring are still plenty from Eastport and Menan; nearly 20,000 barrels have been sold here for bait, some of the George's men taking 20,000 herring in number.—*March* 24, 1880.

PREPARING COD FOR MARKET.—The following are the questions of Fredrik M. Wallem, of Norway, with the answers:

1. What size of cod do the fishermen cut?—All sizes, from 1 foot in length upwards, as they are caught. Those measuring 27 inches and over from tip to tip are called large; all others, small; the fishermen receive half price for the small.

2. How far down do they cut the backbone away?—Two-thirds of the way to the tail. The fish are split clear to the tail and the upper two-thirds of the backbone taken out.

3. How do they do with the fish when cleaned?—The split fish are washed in salt water, about a thousand pounds being put in a trough and cleaned with brushes. They are then ready to be put in butts and salted. Small and large fish are kept in separate butts.

4. How much salt is used for 1,000 fish and what kind?—A butt or hogshead of fish contains about 900 pounds; four bushels of salt are used to a hogshead, as follows: A layer of salt, then a layer of fish (flesh up), and so on in successive layers of salt and fish until the butt is full, when the last half bushel is thrown on (the last two layers of fish being flesh down). Cadiz salt is the kind mostly used for codfish. Trapani salt is frequently used on Grand-Bankers, which make trips of three or four months. Liverpool salt is used for mackerel and herring.

5. How much weight is put on for pressing, or is a machine or screw used?—No weight, machine, or screw is used, except to press the fish into the packages for shipment.

6. Where is the fish dried and for how long?—They are left in the butts four days, or longer, if the weather is not suitable for drying. If left for a month or longer more salt must be added. Taken from the

butts the fish are spread upon flakes or wooden frames (flesh up) to dry. If the weather is clear, with dry winds, they will dry in two days (sometimes in one day); at night they are made into piles (about 100 pounds to a pile) on the flakes (flesh down) and protected by wooden covers. If very dry fish are needed, they must be "water hawsed" before going on the flakes; that is, taken from the butts and piled on a board floor (flesh down) to the height of 4 feet and width of 5 feet (or lengths of two fish). They are left in this condition for one or two days in order to allow the brine to drain off. These will cure more quickly and be firmer than fish not "water hawsed." When fish are split aboard the vessels they are piled in the hold flesh up. On a short trip (two or three weeks) one bushel of salt is used to 300 pounds of fish; on a long trip (from one to three or four months) more salt is used, sometimes a bushel to 100 pounds of fish. When landed from the vessels the fish are washed in salt water and resalted in butts. If from a long trip they may be washed and "water hawsed" without resalting.—*March* 26, 1880.

SPECIMEN OF SQUID.—I have just received a letter from Professor Verrill concerning the specimen of squid sent him ten days ago. He says: "The head of the squid belongs to a young specimen of *Architeuthis harveyi*. It is the youngest yet discovered and of interest on that account; moreover, it is in a better state of preservation than any of the other specimens yet preserved, so that it shows some additional points of structure. It is therefore a very interesting and useful specimen."—*April* 9, 1880.

COD AND HERRING.—Since January 12, cod have been very scarce in Boston Bay. Westward of Thatcher's Island at that date they suddenly disappeared from the grounds where they had usually been abundant at that season. Day before yesterday, April 22, fish reappeared 7 miles to the southeast of Eastern Point, when a vessel with seven men took 5,000 pounds of large cod in one day, in trawls with small herring for bait. Boats are hurrying to get ready for this the opening of the spring fishing. Herring are also making their appearance. On Tuesday night the first net of the season was set near Eastern Point, and two herring were caught; Wednesday night a few more were taken; Thursday night, thirty or forty to a net. Several nets are now being set in the same vicinity. With plenty of herring the boats and dories may do a good work this spring.—*April* 24, 1880.

COD AND SPECIMEN OF RARE DEVIL-FISH.—A school of cod seems to have "struck in" near Newburyport. Schooner Lucy Devlin, of Swampscott, arrived here yesterday with 30,000 pounds of large cod, which were taken on Friday and Saturday with trawls 7 miles east from Newburyport bar in 32 fathoms of water. They used small herring from Provincetown for bait. The fleet in Ipswich Bay numbers only four or five sail. The small devil-fish in lot 678 is reported by Professor Verrill to be the second specimen received of the new species *Octopus obesus*.—*April* 26, 1880.

EVAPORATED COD AND HALIBUT.—I inclose a half pound each of evaporated cod and halibut; the latter was made yesterday, the first ever produced. The cost of each will be about 50 cents per pound at retail. Mr. Alden has not yet done much in this manufacture, but expects to make a success of these new preparations. Codfish lose about 90 per cent of their weight in the process; halibut, only about 75 per cent.—*May* 1, 1880.

SQUID.—Some of the George's men have been going eastward for bait, and on their way to George's stopped at Grand Manan Bank and caught some codfish there. Two salmon were taken from the weirs at Kettle Island yesterday morning; also a few mackerel. The schooner J. J. Clark, Captain Anderson, arrived yesterday afternoon from Hyannis and vicinity with 275 barrels of squid, salted in bulk, averaging 800 to a barrel. He will take them to Saint Peter's and sell for bait to French fishermen. One other Gloucester schooner is now at Dennisport on a similar trip. Captain Anderson reports that the squid made their appearance at Montauk Point as early as May 4 and worked along to the eastward. They are caught in from 2 to 3 inch mesh gill-nets by shore fishermen, who sell them to the vessels. Last year this business proved a failure to the vessels engaging in it. After finding no squid on the shoals they proceeded to Cape Breton and Newfoundland to seine the squid, but were prevented by the natives. Captain Anderson, then in schooner Cadet, was prevented from seining at Cape Breton, and consequently had to purchase; much to his loss.—*May* 14, 1880.

WHALES, SQUID, MACKEREL, ETC.—Whales have recently been numerous in this vicinity, and shore boats report many of them swimming about. Four dead ones have been towed into this harbor; the largest was 65 feet long. I hear from Dennisport that the squid have struck in. One vessel caught 150 barrels last Saturday. Last year I am told that they did not make their appearance till May 20. Mackerel are occasionally caught in the Kettle Island weirs at Magnolia. Thursday morning, May 6, eleven mackerel were taken from the two weirs. May 12, caught sixty fair-sized ones. I hear from Cape Cod that many are taken there. The George's men have to cruise around in order to find fish; some get cod on Grand Manan Bank, stopping there in their way to George's. Most of them get bait now at Greenport, Vineyard Sound, and vicinity. They report menhaden plentiful thereabouts.—*May* 13, 1880.

MENHADEN.—Two vessels are fitting for the Greenland halibut fishery, and will start in about a week. There appears to be an abundance of herring offshore a few miles, but very few come within the range of the nets set by the shore fishermen. Several barrels of menhaden have been taken hereabouts in the weirs at Kettle and Milk Islands. At the former a variety of fish are taken each day, including recently some salmon, striped bass, tautog, menhaden, mackerel, herring, perch, and young pollock. It looks now as if there would be an abundance of menhaden this season. Last year that fishery was a total failure north of Cape Cod. As we went about the harbor yesterday I noticed innumerable little red specks such as young fish feed upon, floating near the surface, the first I have seen this year. I find that I was mistaken in saying that the squid at Hyannis are caught in gill-nets, for they are taken in weirs and traps, the netting being from 2 to 3 inches mesh.—*May* 21, 1880.

CATCHING SQUID OFF CAPE BRETON.—Capt. Chas. Dagle, schooner Joseph Story, and Capt. David Melanson, schooner Crest of the Wave, expect to leave here about June 7 on a squidding trip to Cape Breton and Saint Peter's. They propose to get squid near Saint Ann's, Cape Breton, and to sell them at Saint Peter's. They specially request me to write to Washington and inquire whether they have the right to catch the squid by setting a trap or weir from the vessel; no leaders to run from the shore, but an ordinary trap with leaders from the vessel would be used in the harbors of Cape Breton. As last year vessels were prevented from seining squid, they dare not try that method again, but wish to know whether traps will be allowed. They are afraid to try even this method unless they can get special word from Washington defining their rights or granting them permission. For the purchase of squid from the natives both time and money are required, for the squid are then taken by jigs, and sometimes unreasonable prices charged. By using traps often large numbers of squid are taken in a short time and at little expense.—*May* 28, 1880.

SQUID OFF CAPE BRETON.—Your letter concerning the capture of squid in traps was received yesterday and read to Captains Dagle and Melanson, whom I advised to write to Secretary Evarts through Captain Babson. Captain Dagle informs me that the natives at Cape Breton capture squid with jigs only because they cannot afford traps or seine, being dependent almost entirely on the sales of the squid, &c., to fishermen. Captain Babson wrote to Secretary Evarts some time ago, asking for definite instructions to be given the fishermen, but has received no reply. Our fishermen are anxiously waiting for decided action, that they may know what course to pursue. There are indications that the mackerel will this season work eastward, some think into the bay of Saint Lawrence, in which case trouble might ensue. I informed Professor Verrill of the appearance of squid on the coast, and he obtained some from Wood's Holl; and on Friday last I sent him twenty-five from here on ice, taken in the trap at Kettle Island.

MACKEREL FROM THE SOUTH PACIFIC.—I received yesterday two salt mackerel from the South Pacific Ocean, near the coast of Chili, brought by bark Silas Fish, now at New York and soon to make another voyage to the same region. Mate R. A. Hooper, of the bark, states that the mackerel strike along the coast of Chili in November and continue till spring, working to the southward. The natives do not consider the fish eatable.—*June* 2, 1880.

SPECIMENS SENT.—I send you by express a package containing menhaden feed, stomachs, and spawn, collected by Mr. Frank Fowle, engineer on porgy steamer Geo. H. Bradley, of New Bedford. There are three samples of spawn taken from the menhaden, one from off Shinnecock, Long Island, May 25, 1880; one from Gardiner's Bay, Long Island, June 26, and one from Fort Pond Bay, Long Island, July 1. He saved the largest and ripest. In some cases he found that he could squeeze the spawn out. I send also the spawn of an unkown fish, supposed by some of the fishermen to be menhaden spawn. It came up in the seine from the bottom. While in Fort Pond Bay, July 1, Mr. Fowle noticed in the forenoon quantities of red feed at the surface of the water which the menhaden were eating eagerly. He saved some of it by skimming it from the surface of the water and straining. In the afternoon of the same day the feed sank below the surface, as also did the menhaden. He caught some menhaden, and upon opening the stomachs found some of the feed almost alive, so that it could be positively identified. Mr. Fowle states that he never saw this feed so abundant at any other time or place. He feels confident that this is genuine menhaden feed, and together with Captain Abbe, of the same steamer, is anxious to hear from you regarding it. Several of the porgy steamers have been eastward this season, but I hear of few menhaden being taken north of Cape Cod, although fishermen arriving here have reported schools of menhaden seen along the coast of Maine.—*July* 6, 1880.

MACKEREL ABUNDANT.—Mackerel continue very abundant hereabouts. Over a hundred boys and men were fishing for them this forenoon in the immediate vicinity of Parson's salt wharf, East Gloucester. Last evening Rocky Neck Cove was full of the fish. Some good-sized ones are taken, but most of them are small. In the nets at Eastern Point a considerable quantity of No. 2s was taken. In the Squam River they are plentiful, with blue-fish chasing them. Off Eastern Point yesterday afternoon Captain Babson tells me that horse-mackerel were very numerous, schools of mackerel hugging the shore in their endeavors to escape their enemies. Captain King, of schooner Reporter, from the eastward, reports mackerel solid all along from here to the Bay of Fundy. Large mackerel are becoming more plenty. He says that mackerel, sharks, and horse-mackerel are very numerous, as is natural when so many fish are found. He saw no feed swimming, though what fish were taken had herring shrimps in their stomachs.—*July* 15, 1880.

FISH-TRAPS.—On Saturday, with Captain Martin, I visited the fish-traps, 8 in number, along the shore westward of Eastern Point. All are floating traps similar to Webb's patent trap at Milk Island. Their location is as follows: Two on the west side of Kettle Island; one opposite the island, on the main shore; one on the west side of Egg Rock, off Manchester; two on the east side of the entrance to Manchester Harbor, and two small traps on the west side of Misery Island. I have obtained facts about the fish taken in these several traps, and find that it will be advisable to visit them at least once a week, for otherwise there will be too much guess-work about the catch; besides, occasional fish of unusual varieties should be watched for.—*July* 19, 1880.

MACKEREL.—The mackerel along this shore appear to be increasing in size. Among those from Kettle Island traps this morning there were about 2,000 No. 1s, some of them from 15 to 18 inches long, though not fat. Mackerel taken by the seiners in Massachusetts Bay continue, however, to be small. What large ones are found seem to be from the traps. I hear to-day of two more traps set: one set yesterday or day before, off Coney Island, near Marblehead; the other off Folly Cove, on the north side of Cape Ann.—*July* 20, 1880.

SMALL MACKEREL.—Our harbor has been full of small mackerel to-day. Three vessels have set seines inside of Eastern Point; and one off Five-Pound Island, in the upper harbor, obtained 20 barrels. Upwards of a hundred small boats are in various parts of the harbor, with boys, getting as high as half a barrel apiece. I have examined the stomachs of a great number and find nothing in them. I send herewith a small lot of food from upwards of two hundred mackerel taken yesterday morning in Kettle Island traps. In a seine set off Ten-Pound Island this morning, besides 70 barrels of mackerel, I noticed flounders, skates, sculpins, and a wry-mouth or ghost-fish. I think that the mackerel are kept in by schools of horse-mackerel.—*July* 21, 1880.

FINBACK WHALE.—Recently a carcass of a finback whale 55 feet long drifted ashore on Long Beach, some two miles from here, opposite Milk Island. I went to see it, and offered two men $10 if they would get the skull bones out. They worked on it almost two days, and gave up the job. Captain Martin and I went there early yesterday morning, and worked three hours until high tide. We secured the lower jaw-bones, and think that we can get the whole skull after the flesh has decayed a little more.—*July* 23, 1880.

HATCHING MONK-FISH.—We put some monk-fish spawn in one of the Chester hatching-boxes, and it hatched out yesterday, just a week from the time it was placed in the box. They are funny little fish, although the experiment is of no practical value.—*July* 23, 1880.

MACKEREL.—FIRST ARRIVAL FROM SAINT LAWRENCE BAY.—The first vessel to arrive here from the Bay of Saint Lawrence this season came on Saturday. It was the schooner Mary Fernald, with 408 barrels of mackerel, after being gone a month and a day. They report some of the mackerel very large, though most of them are No. 2s and No. 3s. The trip was taken close to Prince Edward Island, between Malpeque and Cascumpeque, all within the 3-miles limit. There were mackerel farther off shore, but mixed with herring. They report that the mackerel had red feed in them, though they saw no other food. The success of this vessel has started several more besides the four or five Gloucester vessels already in the bay. One of the vessels which take temperature and observations for us is among the number fitting out. I have asked two of the vessels to save some mackerel food, &c. On our visit to Kettle Island trap, Saturday forenoon, we saw a few barrels of large mackerel—No. 1. Measured one mackerel, 18¾ inches long. Major Low informs me that in 1860 he measured a mackerel 22½ inches long.—*July* 27, 1880.

HATCHING MONK-FISH.—On July 15 we found a string of monk-fish spawn (30 feet long) under our wharf clinging to the piles. We preserved some in alcohol, as in the large jar, with label properly marked. We placed a portion of the spawn in one of the Chester hatching-boxes and moored it alongside the wharf, where we watched the development from day to day. The eggs gradually separated from the jelly-like substance that had held them together, and on July 19 began to show the shape of fish. July 22 we found the fish alive in the condition preserved in the small vial sent. One week was taken for the hatching. July 27 we took some from the box and noticed that the yelk-sac was absorbed on a few of them. I send a bottle of them as found July 29, when they were lively and swimming near the surface of the water.—*July* 30, 1880.

HADDOCK.—Schooner H. A. Duncan, twelve men, 87 tons, belonging to George Steele, fully equipped and ready with ice and crew aboard, is to start to-day on a haddock trawling trip.—*September* 18, 1880.

RESULTS OF STORM.—The recent gale did some damage to the Gloucester fleet, and several vessels arrived yesterday disabled. One banker was towed into Portland with both masts gone. The captain of the schooner Laura Sayward reports that while at anchor on George's he saw two men drifting by on a piece of wreck. He cut the cable and was able to rescue the men, when it was too rough to lower a boat. One man has been reported washed overboard from schooner Frederick Geering while the vessel was scudding under bare poles.—*September* 13, 1880.

MACKEREL.—The schooner Victor has arrived from Grand Bank. While in Newfoundland for bait the crew had some trouble, coming to blows with the natives. I am glad to say that the fleet is doing unusually well. Yesterday a mackerel seiner came in with 430 barrels.—*September* 21, 1880.

TRIP TO GREENLAND.—The schooner Mary E., Captain Madson, arrived here yesterday from Greenland. He reports that the vessel left Gloucester April 27; proceeded to Canso and completed crew; proceeded to Flemish Cap, reaching there May 27; staid there till June 28, taking about 75,000 pounds of codfish; left for Greenland; encountered only one field of ice, and this when some 100 miles from Flemish Cap; reached Greenland July 12, and left August 31, reaching Gloucester September 22. The vessel went as far north as Holsteinborg, fished about 20 miles from the coast, and obtained about 80,000 pounds of flitched halibut, making a total stock of about $6,000. Captain Madson tells me that he never saw the route to Greenland or the coast more free from ice, and yet the weather was unusually windy, heavy winds from the southwest often preventing their fishing. He expected to find other Gloucester vessels on the coast, but none were there. Last year walruses were abundant; this year they are scarce; sharks, however, were plentiful, injuring a great deal of gear by biting off the hooks. Captain Madson says he was the first who ever got a trip of fish from Flemish Cap. This was in 1872. One other vessel, schooner Carrie S. Dagle, went the same year. In 1871 a vessel, schooner George Peabody, went there from Salem, but lost gear and anchor, and got no fish. In 1873 and 1874 trips were made there with other vessels. In 1875 and 1876 no vessels from Gloucester fished there. In 1877 and 1878 he made trips to Flemish Cap and Grand Bank. In 1879 he made half a trip to Flemish Cap and finished up the season by going to Greenland. This year he obtained, as above stated, 75,000 pounds of cod on Flemish Cap and 80,000 pounds of halibut at Greenland. Two other vessels, the Concord and Carrie S. Dagle, went to Flemish Cap this year. The Mary E. is rather a small vessel, only 67.22 tons, and this makes a good season's work for her. Capelin made their appearance on the coast of Greenland about a fortnight after the vessels reached there.—*September* 23, 1880.

PUFFING PIG.—I have a puffing pig, caught in a net this morning. It is a perfect specimen, 3 feet long, and weighs 38 pounds.—*September* 27, 1880.

TILE-FISH.—The schooner H. A. Duncan, about which I telegraphed recently as ready for the trip to the *Lopholatilus* ground, arrived a few days since from a week's trip. She stocked $512.—*October* 2, 1880.

HATCHING HERRING.—I have made a successful experiment in hatching herring in one of the Chester floating hatching-boxes. On Saturday last I went to Kettle Island hoping to get some herring and procure some ripe spawn. No herring were in the trap, but by hauling the trap we found masses of herring spawn some half inch thick matted on the bottom netting. We gathered some, brought it in a large tin bottle to Gloucester, and put it in the hatching-box alongside the wharf. A microscopic examination that day showed the eggs entirely undeveloped, with yelks whole. On Monday the yelks in many cases were burst and the fish developing. On Tuesday we could see the little fellows alive in the egg, though very small. On Wednesday they were still in the egg, larger and wriggling about as if trying to get out; under the microscope we could see the heart beat. Thursday they were out of the shell in considerable numbers. To-day a multitude of the cunning infants are in the tank, thus showing that five or six days were required to develop the fish. The temperature of the water on Saturday was 55° F.; Sunday, 54°; Monday, 54°; Tuesday, 55°; Wednesday, 54°; Thursday, 50°; Friday, 53°.—*October* 15, 1880.

COD, HAKE, POLLOCK, AND SHORE FISHERIES.—Capt. George Martin (son of Capt. S. J. Martin), of schooner Northern Eagle, wishes to make a trial of gill-nets for cod fishing in Ipswich Bay. Before getting an outfit for the vessel he would like to use the three cod gill-nets we have in stock at Gloucester. Perhaps the use of such nets may result in profit to the fishermen, especially at times when bait is scarce. A small school of cod has appeared on the outer grounds off Thatcher's Island. Hake are unusually plentiful and pollock are abundant. It is the opinion among the fishermen that the shore fisheries will succeed this winter.

MENHADEN.—I heard to-day that on Friday last menhaden were numerous off Plymouth, where the steamer George Humphrey took 600 barrels. I heard also that during the previous week schooner Phantom took 75 barrels; Henry Friend, 45 barrels; Ossipee, 100 barrels. These are the only hauls of menhaden that I have heard of north of Cape Cod, although menhaden may have been taken by gill-nets in Casco Bay during the summer.—*November* 1, 1880.

199.—NOTES ON THE FISHERIES OF GLOUCESTER, MASS.

By S. J. MARTIN.

[From letters to Prof. S. F. Baird.]

Four weeks ago the prospect for a large catch of fish on the Grand Banks was doubtful, as the whole fleet was seeking bait for four weeks. But on June 25 capelin struck the coast of Newfoundland in great abundance and all the vessels got bait. On reaching the Banks codfish were found to be plentiful. One vessel caught 30,000 pounds for three days consecutively. The prospect for a large catch is good, as squid came on the Banks when the vessels left for home.

During the past week there have been 33 arrivals from George's Banks, with good fares, averaging 25,000 pounds of codfish to a vessel. The vessels were absent from home from ten to fourteen days. Last week there were also 4 arrivals from Grand Banks, averaging 125,000 pounds of codfish to a vessel; 11 arrivals from the Banks, with small fares of 23,000 pounds of fresh halibut to a vessel; 6 arrivals with salt mackerel, 4 fares of small and 2 of large, caught at Block Island. The large mackerel caught at Block Island sold for $16.50 per barrel. Small mackerel sold yesterday for $5 per barrel.

In a letter dated Surrey, Prince Edward Island, June 30, 1884, Capt. Charles Martin says: "We have seen no mackerel yet, though we were over to the west shore on June 27, and down the island June 28. Again we saw none yesterday, but to-day a few were to be seen with a school of herring off Surrey. There are about a dozen sail, some of which have been to Chaleurs Bay, but found no mackerel. We left forty sail at North Cape." Again, in a letter dated Surrey, Prince Edward Island, July 6, 1884, Capt. Charles Martin says: "There are 45 sail here to-day.

No fish schooling yet. Yesterday the wind was southeast, to-day it is southwest."

GLOUCESTER, MASS., *July* 13, 1884.

During the past week there have been 54 arrivals from George's Banks, with average fares of 23,000 pounds of salt codfish; 5 arrivals from Grand Banks, with 120,000 pounds of salt codfish to a vessel; 8 arrivals from the Banks, with 24,000 pounds of fresh halibut to a vessel; and 24 arrivals, averaging 350 barrels of salt mackerel to a vessel. Most of these mackerel are small, and were caught in the Bay of Fundy. No mackerel have yet been caught in the Bay of Saint Lawrence, and 50 of the 165 sail that went there for mackerel are on their return home. The disappearance of the mackerel that were seen down the Nova Scotia shore is a mystery which has not yet been solved. If the whole fleet comes on this coast, small mackerel will sell at a low figure. Yesterday small mackerel sold at $4.50 per barrel, with the barrel, which is worth 70 cents. There are 10 sail of mackerel catchers in the harbor, with 3,500 barrels of mackerel that were taken in the Bay of Fundy. I think mackerel will be sold to-morrow at $4 per barrel.

GLOUCESTER, MASS., *July* 20, 1884.

SUMMARY.—There has been the largest amount of fish landed at Gloucester the past week of any week in eight years. There were 67 arrivals from George's Banks, with 1,680,000 pounds of salt cod; 17 arrivals from the Grand Banks, with 2,780,000 pounds of salt cod; 7 arrivals from the Grand Banks, with 182,000 pounds of fresh cod and 65,000 pounds of hake; 80,000 pounds of shore cod; 120,000 pounds of cod from the Western Bank; 220,000 pounds of salt cod from Banqereau; and 6 arrivals with 1,000 barrels of salt mackerel. Mackerel are reported plenty in the Bay of Fundy, but of small size. To-day 5 vessels arrived from the Bay of Fundy, with 1,500 barrels of salt mackerel.

GLOUCESTER, MASS., *July* 27, 1884.

SUMMARY.—The amount of fish landed in Gloucester in July was as follows: There were 186 arrivals from George's Banks, with 3,841,000 pounds of salt cod and 36,900 pounds of fresh halibut; 28 arrivals from Grand Banks, with 4,120,000 pounds of salt cod and 19,000 pounds of fresh halibut; 9 arrivals from Western Bank, with 660,000 pounds of salt cod and 6,500 pounds of fresh halibut; 9 arrivals from the coast of Nova Scotia, with 302,000 pounds of salt cod and 8,500 pounds of halibut; 34 arrivals from the Banks, with 780,000 pounds of fresh halibut; 522,000 pounds of shore fish; 22,818 barrels of mackerel from the Bay of Fundy; 770 barrels of mackerel from Block Island; 478 barrels of mackerel from the Bay of Saint Lawrence; 260 barrels of mackerel caught in traps; making a total for July of 246 arrivals, with 9,445,000 pounds of cod, 850,900 pounds of halibut, and 24,326 barrels of mackerel.

GLOUCESTER, MASS., *August* 6, 1884.

200.—SANITARY REPORT ON OLD PROVIDENCE ISLAND, UNITED STATES OF COLOMBIA.

By C. G. HERNDON, P. A. SURGEON, U. S. N.

The island of Old Providence is situated about 250 miles north of Colon, from which place it can be frequently reached by schooners trading between the two places. This island, with Santa Catalina, from which it is separated by a very narrow and shallow channel, is some 4 miles long from north to south and from 2 to 3 miles wide. With the adjacent island of Saint Andrews, it forms a part of the State of Cartagena, and is governed by an official appointed by the Bogota Government, resident at Saint Andrews. The island is mountainous in its central part, one peak being as much as 1,100 feet above the sea. Its structure is coral line. On the northwest part is a harbor nearly a mile wide and extending about the same distance into the land. The mountains and hills are very rocky and covered with thickets of thorny bushes. The soil is not, as a rule, arable except along the sea-shore, where there are many little farms which extend entirely around the island. The seasons are the wet and dry; as a rule, the former begins in the latter part of April or the first of May, and continues up to the first of December. During the dry season the trade-winds are continuous, and keep the temperature at about 78° F. During the rainy season the heat is oppressive.

The arable portion of the island is very productive; sugar-cane, the cotton-plant, white potatoes, sweet potatoes, bread-fruit, yams, and both sweet and bitter cassava grow abundantly. The bitter cassava is eaten by the people up to a certain stage of its growth, after which it is fed to the hogs which thrive upon it. Excellent oranges, limes, pines, cocoa-nuts, tamarinds, &c., grow in abundance. Uncommonly fine poultry, good beef, kid, large and small pigs, can be bought at very reasonable prices. The adjacent waters swarm with fine fish and turtle.

The population, numbering between 800 and 1,000, is a mixed one, and contains but few pure whites; it is for the most part a mixture of negro and Indian, with a streak of Spanish and American blood. The negro element is for the most part from former slaves, who were sent over from Jamaica. The Indian and Spanish elements come from the mainland, and the American from seamen who have visited the island in trading vessels. The men are uncommonly tall, well developed and fine looking, and as a rule are industrious and thrifty; they engage in farming, fruit-growing, and stock-raising; many of them are expert fishermen and turtle catchers, and not a few are employed as seamen on vessels engaged in trade between the island and the United States, the

Spanish main, and Colon. The women are for the most part employed in household duties, though sometimes they work on the farm. As a rule they marry young; the child-bearing period, as a rule, begins when they are sixteen, and often continues up to the fifty-second year. Many of them are very prolific; several of them told me they had given birth to as many as fifteen children. While this may be true in many cases, I saw a large number affected with serious uterine disorders, which seemed to be due to early child-bearing, and who had been more or less disabled for years. A number of them dated their trouble to a protracted and hard labor, which had occurred early in their married life, and since which no conception had taken place. During labor they are attended by midwives who have no knowledge whatever of obstetric procedures. I had an opportunity to converse with some of the midwives, and while they seemed amiable and anxious to do their best for their patients, they had absolutely no knowledge of the subject. The people generally are very courteous in their manners and amiable to a degree. They are scrupulously neat in their persons and dress.

The whole population, judging from those I met, is an uncommonly intelligent one. It was the exception to find an adult who was unable to read and write, and in walking about the island I several times saw children, with books and slates, standing by their elders and saying lessons to them. Education is encouraged by the Bogota Government, and a schoolmaster is paid from the public funds. A strong religious sentiment seemed to pervade all classes, many of them being members of the Baptist Church, of which there are two in the island. The marriage ceremony must be performed by a magistrate, and, as a rule, is afterward also solemnized by a minister. A number of people live along the shores of the harbor, and though without any sharply defined boundaries, this settlement has been named Isabel.

Upon the arrival of the ship at Isabel I learned from some natives who came on board that a number of people in the island were greatly in need of medical attention. The next morning I went on shore and had a conversation with a Mr. Archibald, the leading merchant of the island, who corroborated the statement. I proposed to him to have a room fixed up for me as an office at some convenient place, and told him if he would do so I would come in at certain hours every day during the stay of the Albatross in port and do what I could for the people. To this he readily assented, and immediately began to fit up in his own house a large, well lighted and ventilated apartment for an office; he also sent out word to various parts of the island by people who came in during the day to make purchases that I would be at his place every morning. I was met at the outset by a difficulty in the great scarcity of medicines in the island and the entire absence of even the simplest surgical appliances. Two merchants in the town kept for sale a few medicines, but their stock in trade was very small, and consisted principally of patent purgative preparations; a small quantity of quinine and tincture of the chloride of iron was found. In this dilemma the medical and surgical outfit of the Albatross was drawn on as far as stores could be spared. I was told that no physician had ever resided in the island, and that sometimes the people, when very much in need of professional advice, go up to Saint Andrews, or even to Colon; but only a few can afford to do this, as the trading schooners charge heavily for a passage. The island seems to have been singularly free from epidemics of all kinds. No vaccination has been practiced for years, and yet there has not been a single case of variola introduced, notwithstanding the commercial relations existing with Colon, where the disease is not at all uncommon. I urged upon several of them the importance of vaccination, for should the disease ever once get a foothold its ravages would be great. Unfortunately the Albatross was without virus at the time, otherwise I would have been allowed to vaccinate many. It may be that they are protected to some extent against variola and yellow fever by the negro element running through many of them.

This island presents an excellent field for professional work for well qualified medical missionaries, or for a young practitioner, who, during a residence here for a year or two, would gain a far more extensive personal experience than he could, as a rule, hope to gain at home in a much greater length of time. The place is easily reached, at frequent intervals, by trading schooners from Colon.

The following enumeration of diseases will give an idea of the nature of the cases which I saw during my visit to this interesting island: Febris intermittens and remittens, adynamia, diabetes, lumbago, rheumatismus (articular and muscular), anæmia, senectus, epilepsia, hysteria, neuralgia (facial and intercostal), cataracta, conjunctivitis, ptrygium, hypertrophia cordis, palpitatio, asthma (catarrhus, bronchial, and nasal, acute and chronic), phthisis, pleuritis (with purulent effusion), ascites, congestio hepatis, constipatio (acute and chronic), fistula in ano, prolapus ani, splenitis (acute); also one case of chronic enlargement of spleen, vermes (lumbricoids, common), gonorrhœa, phymosis, necrosis (of ribs and of bones of foot and leg), eczema, ulcers (leg and foot), vulnus laceratum (almost entire scalp had been torn from head by machinery of a sugar-mill), ammorrhœa, menorrhagia, prolapsus uteri, lacerati cervix uteri, ante and retro flexures of uterus, ovarian tumor, lucorrhœa (very common). The amount of venereal disease in the island is very small, only three cases in all being seen, and these were in men who had contracted the disease elsewhere.

FISH COMMISSION STEAMER ALBATROSS,

Key West, Fla., April 16, 1884.

201.—TREATMENT OF THE CASELLA-MILLER THERMOMETER.

By LOUIS P. CASELLA.

[From a letter to Prof. S. F. Baird.]

I regret to learn the difficulties you describe in connection with some of my thermometers. I incline to believe that I could correct most of the thermometers you may have which are not broken, and will be most glad to do all in my power, if you will let me have them, telling your assistant to pack them carefully so as to prevent their being further disarranged.

The usual precaution against disarrangement in the first instance is that they should not be kept lying flat; that when sent from place to place the indices should be lifted well up from the mercury. If by chance a small portion of mercury gets over the bottom of the index, hold it flat and use the magnet to draw it slowly up. With the head quite raised, tap it smartly on the palm of the hand, the portions of mercury become detached and fall down to the main column. Warm the surface freely before the fire, then hang up; they thus become united.

As these are the only thermometers that register the maximum and minimum temperature they were adopted with my arrangement, and have thus shown the temperature of all depths of the sea in a way that has not yet been contradicted, though I regret this tendency to disarrangement which I have acknowledged from the first. Should you send yours for repair, I propose adopting an arrangement of case that will, I hope, enable me to employ an easier kind of index. This I will try to have ready so as to apply to yours or to part of them when they come.

147 HOLBORN, LONDON, E. C., *May* 21, 1884.

202.—HATCHING BLACKFISH AND SPANISH MACKEREL.

By R. E. EARLL.

[From letters to Prof. S. F. Baird.]

This morning, while at the fish-wharves, I discovered that nearly all of the blackfish (*Centropristis atrarius*) were thoroughly ripe, and eggs would run from fully 50 per cent. of the females in handling. I took a number of thousand and impregnated them. They sink readily in salt water, and have a diameter of $\frac{1}{27}$ of an inch. I saved some in alcohol and glycerine. Many of the other species are well advanced and will spawn in two or three weeks at most. I shall try to get a full series of ovaries in alcohol for future examination.

CHARLESTON, S. C., *March* 25, 1880.

I have spent a week with Colonel McDonald at New Point, on Mobjack Bay, where we have been engaged in collecting specimens and statistics of the extensive pound fisheries of that locality. We found several species ripe or nearly so; among them were a number of important food-fishes, including the Spanish mackerel (*Cybium maculatum*) and porgy (*Ephippus faber*). These have free sinking eggs about $\frac{1}{30}$ of an inch in diameter. The Spanish mackerel are next to the shad the most important species in the locality; they are just beginning to spawn, and the height of the season will probably not occur before the 1st of July. We secured several thousand eggs of the porgy and kept them until well advanced, but could not remain long enough to hatch them out.

NORFOLK, VA., *June* 6, 1880.

Spanish mackerel have been taken in fair numbers in this vicinity for two weeks. I cannot yet report anything definite, but will write in detail soon. May be obliged to go further down the sound before I can gather satisfactory information.

CRISFIELD, MD., *June* 24, 1880.

The work in hatching of mackerel at Crisfield has been a great success and I have hatched out fully half a million young mackerel. The course will probably not answer for the work, but I have an impression that a very simple and inexpensive apparatus can be constructed and made to answer admirably. The spawning season has hardly arrived, but most of the fish are well matured.

I am now on my way down the bay to examine the lower pounds with a view to enlisting the sympathies of the fishermen in the work in case you should decide to begin hatching mackerel, and also to gather additional data about this and other species.

ON BOARD STEAMER HELEN, *July* 1, 1880.

The outlook for extensive work in the artificial propagation of the Spanish mackerel is excellent, and Cherrystone, an excellent harbor on the eastern shore of Virginia, is the most desirable location. The pound owners in that locality are thoroughly interested in the matter, and offer not only to furnish all the eggs needed free of charge, but also to assist in the work as much as possible. I am fully convinced that a station located at Cherrystone, with the necessary apparatus, could easily hatch out a hundred million young mackerel by the 1st of September. The eggs are unusually hardy and hatch in from 18 to 20 hours. The Ferguson bucket could be made to answer in the work, but by far the best apparatus would, I think, be the Clark hatching trough as modified for the cod work.

I send you by to-night's express a bottle of young mackerel hatched at Crisfield, Md., June 30, and have quite a quantity of them here.

WASHINGTON, D. C., *July* 8, 1880.

Vol. IV, No. 27. Washington, D. C. Sept. 25, 1884.

203.—THE SEA-FISHERIES OF FRANCE AND ALGIERS.

By BENJAMIN F. PEIXOTTO, U. S. Consul at Lyons.

[From Reports of the Consuls of the United States on the Commerce, Manufactures, &c., of their Consular Districts, pp. 659–661, inclusive.]

1.—FISHERIES OF FRANCE.

In my dispatch No. 281, of December 9, 1882, I gave some account of the sea-fisheries of France for 1881.* I have now the pleasure to report some additional facts relating to the fisheries of 1882.

BOATS AND FISHERMEN.—During the year 1882 the French fisheries employed 22,891 boats, of an aggregate tonnage of 156,287, while 136,799 persons were engaged in fishing.

VALUE.—The value of the product caught amounted to $17,941,878, representing an increase over the product of 1881 of more than $1,930,000. All the branches of fishing were not equally favored.

HERRING.—The catch of herring, for example, which furnishes no small part of the little ports of the Normandy coast from Dunkirk to Havre, suffered seriously from bad weather, a portion of the fishing fleet being dispersed by the tempests. The yield from the herring fisheries reached only 56,250,000 pounds, against 87,750,000 pounds, the capture of 1881, while the merchantable value fell from $1,737,000 in 1881 to $1,447,500 in 1882.

COD.—The cod-fisheries were better; 156 boats left for Newfoundland at the commencement of the season, with an equipment of 5,165 men. They returned with over 40,000,000 pounds of fish, which brought $1,679,679. In 1881 they captured 39,600,000 pounds, which sold for $1,505,400.

To Iceland, where the cod is also found, 211 boats, with 3,698 fishermen, were sent. Their capture amounted to 27,000,000 pounds, against about 22,000,000 pounds during the previous year, which realized $2,895,000.

SARDINE-FISHERIES.

Coasting fishing is followed by those who have but slight resources, and who are unable to form connections with commission and forwarding capitalists. These fishermen are aided by their wives and children. Sardines form the principal, if not exclusive, object of their search. For several years they have been compelled to abandon their usual fishing grounds and have recourse to the open sea. Their boats not being

*Published in Consular Reports, No. 27.

equal to this enterprise, the Government has come to their assistance for the construction of the proper vessels. At several points, and notably at Croisie, a large number of fishermen have vessels of 20 to 25 tons, with which they explore the deeper sea. The past year, however, the fish again approached the shores, enabling the small boats to make considerable capture and of large size.

As a whole, the sardine-fisheries for 1882 were excellent; 512,000,000 sardines were caught, selling for $3,088,000, an increase of considerably over a million dollars from 1881. It is said, however, that no dependence can be placed upon the continuance of such good luck, and boats of proper and sufficient capacity must be built to explore the open sea.

Coasting fishing was not less prosperous for other varieties. Over 119,000,000 pounds of varied sorts of fish, valued at $7,500,000, were taken. In fact, it is this product which furnishes the general markets and supplies the popular demand.

ARTIFICIAL OYSTER BEDS.

Special mention must be made of oysters, the commerce in which, referred to in my report before mentioned, has continued to largely increase. In 1881, though the yield was greater (374,985,770 oysters), the price obtained was but $397,918, whereas with the product last year of only 155,761,399 the sum of $444,514 was realized.

The industry of artificial rearing of oysters continues prosperous. The parks produce largely and yield good profits. The quarter of Teste alone furnished for consumption from the 1st Septemper, 1881, to the 15th June, 1882, upwards of 268,000,000 oysters reared in these beds.

The total shell-fish product of 1882 amounted to 372,841,830, bringing $310,471. It will be seen that it is the artificial culture which almost exclusively supplies the market.

There are at present 45,464 oyster parks in France, established on public lands, and paying the Government a trifling rental. These parks, or beds, occupy over 46,000 persons, of whom 16,317 are seamen exempt from taxation. They cover an area of over 29,000 acres, and every year an average of 725 acres are developed. It is an industry which requires little capital, and, properly understood, yields regular and certain profit.

2.—FISHERIES OF ALGERIA.

The foregoing remarks relate to France, properly speaking. Her colonies, and particularly Algeria, should not be overlooked in taking account of her fisheries. For the first time, this year the Government has made a report on the Algerian fisheries, from which I deem it of interest to present the following interesting features:

Of fishermen, 4,916, mounting 1,044 boats, were engaged in the Algerian fisheries in 1882. The value of the fish caught amounted to $784,148, consisting principally of mackerel, thon, allaches, sardines, and anchovies. Scarcely any mussels or oysters were taken, but shell-fish abound plentifully. The total capture exceeded 11,000,000 pounds.

As a general rule, the coast of Algeria yields abundance of fish. Fishing is particularly good in the Gulf of Oran and Arzew, but from these points to Castiglione, a distance of over 1,200 miles, fishing is little followed, for the lack of a market along the sea-coast.

Algiers and its neighborhood is a very important center for fish; so is the Bay of Callo and the town of Phillippeville. At Bone and La Calle there is less animation, but sedentary species are here caught which are not found elsewhere. Coral-fishing is special to Algeria, 40,000 to 45,000 pounds of coral being the annual product. La Calle is the central point of this industry, occupying yearly 160 boats and from 1,200 to 1,300 men. The coral yield of 1882 represented a value of $190,000.

Coral is obtained by means of a wooden apparatus in the shape of a cross, having in its center a leaden slug or stone for ballast. Nets, the meshes of which are loose, are hung on the bars of the cross and dragged at the bottom of the sea and among the nooks and crevices of the rocks. These nets, winding about the coraline plant, break up or off its branches, which adhere to the meshes. The apparatus is drawn up by the fisherman whenever he thinks it sufficiently laden. There is also a net provided with large iron nails, having thus great force, to break the coral, but this apparatus is prohibited. The *scaphandre*, or cork jacket, is used only in exceptional cases. Algerian fisheries would no doubt become more productive if greater facilities were afforded for communication with the interior.

I cannot close without again urging the importance of encouraging our home fisheries. It is an industry of twofold importance. It is followed by a class of brave and hardy men, from which, as in other countries, may be recruited our best sailors. In the near future, when our merchant marine will once more assume the importance it possessed before the late war, this class may give us the force we shall then require, and American sailors sail American ships once more.

UNITED STATES CONSULATE, LYONS, *October* 24, 1883.

204.—DISCUSSION AT THE DRESDEN CONFERENCE IN 1883, OF THE KINDS OF FISH EGGS TO BE OBTAINED FROM THE UNITED STATES.

In general the conference agreed that the experiments in acclimatizing American fish have been accompanied by many valuable results.

Mr. Haack and Mr. Schuster did not strongly favor the California salmon (*Salmo quinnat*), because experience had taught them that at

* *Die Fischereiconferenz in Dresden* 1883. *E. Einführung ausländischer Fischarten.* From the *Bayerische Fischerei-Zeitung*, vol. ix, No. 13, Munich, May 16, 1884. Translated from the German by HERMAN JACOBSON.

the time of sexual maturity this fish had not proved hardy, and because they also thought that its meat did not have as delicate a flavor as that of other species of salmon. Dr. Staudinger stated that in the region of the Danube, where the migratory salmon (*Salmo salar*) is not found, there were many who desired to see the California salmon introduced.

No special desire was expressed for American lake trout, but Dr. Staudinger suggested, and was in this unanimously supported by the conference, that, considering the great value of the American whitefish (*Coregonus albus*), and the favorable results of hatching experiments, more eggs of this fish should be imported, particularly with the view to continuing the experiments which had so far proved successful, and which could be called thoroughly successful only if continued on a large scale. It is desirable to well stock such alpine lakes as the Walchen Lake, Ammer Lake, &c., with this species.

As regards the American brook trout (*Salmo* [*Salvelinus*] *fontinalis*) Von Behr stated that quite a quantity of eggs of this fish had already been produced in Germany, and that he would see to their proper distribution. Dr. Staudinger thought that the *Salvelinus fontinalis* would certainly flourish in the brooks of the alpine and subalpine regions. In these regions no trout are found, and for this very reason people took great interest in seeing the *Salvelinus fontinalis* acclimatized. For this purpose Dr. Staudinger, supported by Mr. Schuster, considered it very desirable to continue the importation of the eggs of this fish from America. The conference approved and recommended that the eggs should be furnished, especially to those hatching establishments where successful attempts had already been made to raise the *Salvelinus fontinalis.*

Messrs. Haack and Schuster warmly advocated the importation of eggs of the rainbow trout (*Salmo irideus*). Mr. Haack considered this species of fish the most valuable and promising of all the fish introduced from America. Mr. Schuster also stated that the eggs and fish of this species are particularly valuable, although he was not quite so enthusiastic on the subject as Mr. Haack. The conference recommended to acquire as many eggs of the rainbow trout as possible, and to carefully distribute them.

As regards the American landlocked salmon it seemed to be the prevailing opinion that for the present no more eggs should be asked for. It was thought that this fish would offer no greater advantage than our own German lake-trout, and it was not deemed desirable to mix too many species of closely related fish.

The importation of eggs of *Trutta carpio* from Garda Lake, in Italy, did not meet with favor. On motion of Mr. Staudinger, however, 20,000 to 30,000 more eggs may be obtained for Ammer Lake, which seems well adapted to it.

MUNICH, *May* 16, 1884.

205.—NOTES ON THE DECREASE OF LOBSTERS.

By RICHARD RATHBUN.

[A paper read before the American Fishcultural Association.]

One of the most important of our sea-coast fisheries is that afforded by the American lobster, the *Homarus americanus* of naturalists. This interesting crustacean, the largest of its kind in North American waters, ranges from Labrador in the north to Delaware in the south, but is most abundant and most sought for along New England and the southernmost of the British coast provinces.

Its great abundance and rare flavor are not unfrequently mentioned in the early annals of New England, and it probably formed an important element in the food supply of the sea coast inhabitants of colonial times. As a separate and distinct industry, however, the lobster-fishery does not date back much, if any, beyond the beginning of the present century, and it appears to have been first developed on the Massachusetts coast, in the region of Cape Cod and Boston, although some fishing was done as early as 1810 among the Elizabeth Islands and on the coast of Connecticut. Strangely enough, this industry was not extended to the coast of Maine, where it subsequently attained its greatest proportions, until about 1840. Concerning the history of this unique fishery but few authentic records of any kind exist, nor was any attempt ever made to estimate its extent and value prior to the census investigations of 1880. We are, therefore, left without much reliable data for comparing its past and present conditions, and for solving the many problems which now, in the minds of many, seem to threaten its continued prosperity.

The great question at issue, and one which demands the earnest attention of every lobster fisherman and dealer, is whether lobsters are decreasing in abundance and will eventually become rare and difficult to obtain, or whether they are still as plentiful as ever and show no indications of approaching extinction. While we hope for the latter, we are forced to acknowledge that a careful study of all the materials at our command inclines us to the belief that the abundance of lobsters has very perceptibly diminished within comparatively recent times, and that, unless some active measures are instituted to prevent continued decrease in the future, a great and irreparable injury to the fishery will ensue.

Although, as we have just said, the lobster-fishery is without a carefully recorded history, we have been enabled, through the assistance of many intelligent fishermen and dealers, some of whom have shown themselves to be very capable observers, to trace back the conditions of the fishery through a number of years. The results so obtained have been embodied in a report prepared for publication by the United States Fish Commission. It has been suggested that a short statement of some of the facts bearing upon the supposed decrease might be of interest to the members of this association, and it is for that purpose that the following brief notes have been prepared:

Concerning the distribution of lobsters, it may be stated that a few stray individuals have been occasionally recorded from the extreme northeastern corner of Virginia, but the Delaware Breakwater may more properly be regarded as the southern limit of their range. On the New Jersey coast they are somewhat more abundant, and give rise to a limited fishery in the neighborhood of Atlantic City and Long Branch. Though formerly quite plentiful and extensively fished for in New York Bay and Hell Gate, they are now nearly exterminated from that region, due to overfishing combined with the pollution of the waters by the refuse from large factories. Along the Connecticut shores they are moderately common, while at the eastern end of Long Island and in the region of Block Island, the outer Elizabeth Islands, and Martha's Vineyard they afford a very profitable industry.

The entire coast line of Massachusetts abounds in lobsters wherever the character of the bottom is suited to them; but overfishing has nearly depleted some of the shallow-water areas which were once prolific, as at Provincetown. The sandy shores of New Hampshire furnish only a moderate supply, but on the Maine coast they are much more abundant than anywhere to the southward, and the yearly fishery greatly exceeds in quantity and value those of all the other States combined. This State is, in fact, the main source of supply for all the principal markets of the United States. Contrary to the belief of many persons, the lobster is not a migratory animal in the common acceptation of that term as applied to fishes. On the approach of cold weather it leaves the shallow areas near shore and retreats into somewhat deeper water, where the temperature remains milder and more uniform during the winter. As the spring advances it returns to its summer haunts. These spring and fall migrations vary as to time and extent on different portions of the coast, occurring earlier in the spring and later in the fall at the south than at the north. During the summer they often approach very close to the beaches, and in some favorable localities, especially on the coast of Maine, the traps set for their capture become partially uncovered at low water. The more usual depths for the summer fishery are, however, those of a few fathoms. The winter grounds are in depths of twenty to fifty or sixty fathoms, and generally not far from those of the summer, especially in regions where the water deepens rapidly.

In so far as it has been possible to make the observations, it is supposed that the different schools of lobsters, if we can so define them, return to about the same shallow places every spring, and do not journey northward or southward along the coast to any very great extent, although there may be a gradual interchange of ground in the course of time. If this supposition be correct, as appears most natural, and there are many facts to substantiate it, each geographical region is more or less independent of all others, and not influenced by large and frequent migrations from them. This division into distinct schools, and defined geographical regions, while an arbitrary one, not strictly existing in nature, serves to simplify the argument which we desire to make, and which is to this effect: That continued overfishing in any one region will tend to eventually reduce the stock of lobsters in that region, without the hope of its being replenished by early accessions from neighboring regions, and that the almost total depletion of that region is, therefore, quite within the bounds of possibility. This is not the case with such truly migratory fishes as the mackerel, menhaden, and herring, and the laws which govern the movements of the latter cannot be applied to the lobster. In support of this proposition there are several well-authenticated instances of the almost entire extinction of lobsters in what were formerly regarded as exceedingly rich regions, and since lobster fishing has been more or less abandoned in those regions, the abundance of lobsters has never perceptibly increased.

Another strong proof of the continued decrease in abundance of lobsters has been the gradual decrease in the average size of those brought to market. It is not rational to suppose that lobsters grow less rapidly now than in former years, or have in any way become dwarfed in size. On the contrary, it has been overfishing, restricted by legislation which protects the young, and influenced by the higher prices paid for the larger individuals in the fish markets which has caused the greater diminution in the supply of large lobsters. A strict observance of existing laws may prevent the total extinction of the species, but it cannot maintain the average size of those taken for market much, if any, above the limit prescribed by those laws. This limit in nearly every instance is, moreover, about the size of the young female just beginning to spawn, and, therefore, with absolutely no protection for the spawning female, excepting in the close season, during which there is but little spawning, it is doubtful whether existing legislation is of much avail. A careful consideration of all the facts available certainly indicates that a marked decrease in the size of lobsters is proof of an equally great, if not a greater, diminution in the supply.

It is not possible within the scope of this short paper to strengthen our conclusions with a long array of facts, but the brief statement of some of our evidence must here suffice.

One of the best illustrations of the great decrease in the abundance of lobsters is furnished by the once famous fishing grounds of Cape Cod. The lobster fishery was first started in this region about the year 1800, by Connecticut lobstermen, who carried nearly their entire catch to New York city. As early as 1812, the citizens of Provincetown began to entertain fears that unless some restrictions were placed upon the fishery, the extermination of the species would be speedily effected. Protective laws were at once passed by the legislature of Massachusetts, and from that time to the present they have been continued in one form or another, but all without avail unless it may have been to somewhat prolong the fishery which might otherwise have been much earlier destroyed. The fishermen of Provincetown did not themselves engage in lobstering until about 1845, but between then and 1850 the fishery was greatly expanded and a large trade started with New York city. In fact about this time the latter market received nearly its entire supplies from the vicinity of Provincetown. A great many men engaged in the fishery, using the old style of hoop-net pots and catching from 100 to 200 lobsters each every night. These were prosperous times, and yielded the inhabitants of the town a profitable income. The carrying smacks obtained large fares and were kept busy. No marked diminution in the supply was noticed until about 1865, since which date there has been a rapid decrease in abundance from year to year, obliging the lobstermen to resort to other occupations for a living. In 1880 there were only eight men engaged in lobstering, and although they used the most improved appliances, their annual gross earnings were only about $60 each.

On the coast of Maine, although the fishery is of much more recent date, it has already exhibited many unfortunate changes, and in numerous places there has been a marked decrease in the average size of individuals caught. The shore fisheries have also, in some cases, been well nigh exhausted, and the fishermen forced to resort to more distant grounds. When the fishery first began, hoop-net pots were in general use, but soon after the introduction of lath pots competition caused them to be universally employed. From year to year the fishermen increased the number of pots they used, and the custom of setting them trawl fashion rapidly came into vogue. These changes were due to the competitions of trade, the desire to obtain larger catches and for one man to perform the work of two. The fishing grounds were strained to their utmost, and there was no fear of an overstock, as the canneries were ready to buy all that were not taken by the market smacks. More recently the fishermen have begun to return to the old method of setting their pots singly, and why? Because they say the lobsters are more scattered over the bottom, and that by altering the position of the pots every time they are set they fish better. But why should they be more scattered now than formerly unless they are more scarce? In 1864 lobsters were so abundant at Muscle Ridges that three men tending forty to fifty pots each caught all the count lobsters which one smack could carry to market, making a trip once in eight days. In 1879 the same smack was obliged to buy the entire catch of fifteen men in order to obtain full fares, and at times required to visit other localities to complete the load.

Regarding the Booth Bay region, very nearly the same may be said. As late as 1856 lobsters were very abundant about the islands of Booth Bay Harbor, and the fishery was carried on close to the shore in slight depths of water. The season lasted about six months, and each man setting fifty pots could make about $500 during the season. By 1869, the number of fishermen having increased, however, the season's stock was reduced to about $175 per man, and the average size of lobsters had greatly diminished. This caused the fishermen to try farther out from shore, and the fishery is now mainly carried on in depths of 25 to 35 fathoms. The facts of these changes were furnished from many places in this section between Cape Small Point and Pemaquid Point.

The canneries have undoubtedly largely influenced this result on the coast of Maine, as all sizes of lobsters large enough to pay for the handling are consumed, and the ready market thus afforded has tempted the fishermen to save every specimen that enters their traps. It is unquestionably this extensive destruction of the young that has hastened the decrease; but that the decrease is not solely due to the presence of canneries is evidenced by the statements we have already made regarding other sections of the coast.

In the Saco district, although there are no canneries located nearer than Portland, a smack trade between the fishing grounds and the canneries to the eastward has recently been started, and several witnesses have testified to a marked falling off in the proportionate catch since it began. The average catch per man is now about one-third what it was twenty years ago, and while in 1876 a barrel of lobsters averaged 65 by count, an average of 80 lobsters is now required to fill a barrel.

On the New Hampshire coast the decrease for twenty years is stated to have been from 50 to 75 per cent.

From Rhode Island and Connecticut we have complaints regarding a decrease in abundance and size of lobsters similar to those already noted from the more Northern States; but the statements we have given constitute but a small proportion of the evidence we have obtained.

That this evidence is unimpeachable as to a general and lasting decrease we would not now affirm, but to our minds it has been conclusive. To press a definite and unfavorable opinion, however, regarding so extensive and valuable a fishery after the meager returns of a single investigation, extending through only one or two years, would scarcely be justifiable, but it has seemed to us that public attention should be now attracted to the subject, as it appears in the light of the Tenth Census.

The fishery has had such a rapid growth, and the demands upon it have so exceeded its capacity, that the problem of weighing evidence has been somewhat difficult. The total catch of lobsters has increased from year to year, but so has the number of fishermen and the number of traps used even in greater proportion, and the grounds have been enlarged until they now cover an exceedingly broad area, and extend into deeper water than was ever dreamed of formerly in connection with this fishery. The decrease in the average catch per trap and man, in the yearly earnings and in the average size of lobsters, has kept pace with the increase in the fishery; the inshore grounds in many places have been nearly depleted, and in some of the deeper areas the lobsters are so much scattered that it is no longer profitable to set the traps in trawls. If a continuous and rapid decrease should be proved, what can be done to stop it and insure the future prosperity of the fishery? The task of remedying the evil will be much more difficult than the proof of its existence, and the question is one regarding which we have as yet no definite ideas.

Past legislation has certainly not been very effective, nor can any laws avail much until the true character and extent of the evil has been determined; neither are laws beneficial unless they can be enforced; an exceedingly difficult task in the case of any fishery.

The question of artificial propagation has been raised, and a few unsuccessful attempts have already been made to carry it on. But the failures have not been without cause, as we do not yet even know the rate of growth of lobsters, or whether they require six or a dozen years to attain the adult size, which is about ten or eleven inches. Immediately after hatching they swim freely about at the surface of the water, and continue their erratic ways of life during most of the first season, after which they settle down upon the bottom and assume their future habits.

The first task, therefore, which we suggest for the would-be benefactor of the lobster fishery is a most thorough investigation of all points bearing upon the natural history of the species, upon the changes which have occurred in the fishing grounds, and upon the relations of the total catch for each section to the number of fishermen and traps set, and the average size of the lobsters taken.

With the census returns, soon to be published, as a starting point, a plan of the work can be easily sketched out, and the figures there given may serve as a basis for future calculations.

206.—REARING CARP IN ALKALINE WATER.

By E. S. STOVER.

[From a letter to Prof. S. F. Baird.]

Your request for specimens of young carp raised in alkali water and sample of the water is received, and I shall take great pleasure in complying.

I received this lot of carp from Mr. Menaul at Laguna, N. Mex., in the spring of 1883, he having received them from you the fall before. As it was the first in this part of New Mexico I gave them some very severe tests, simply to see if they were hardy and would do well in alkali water. I dug a small hole in the ground that was full of alkali, the whole ground about being incrusted with it, and in this hole which filled itself from the surface water I put two of the carp, really expecting that it would kill them. But to my surprise they flourished in it, and, if anything, did better than those which I put in the basin of my fountain which contained pure water from the well.

When winter came I took all of them (some 18) and put them in a large tank of pure cold water fed by a windmill from a deep well, and kept them there until April last without any food whatever, or without any mud or other substance for protection. The tank was about 10 feet deep and froze over several times during the winter, the thermometer standing as low as 14° above zero for several weeks. From this tank I transferred them to a shallow pond dug in the alkali bottom near by, which has simply been supplied from the surface water draining in through the quicksand. In this pond at the age of two years and after such treatment they have bred, which I think proves conclusively that they are a very hardy fish. I did not lose one of them during the tests or since. Since putting them in the pond I have fed them liberally on corn-meal mush, wheat bread, spoiled cheese, &c., and they have grown wonderfully. I am confident they will be a great success in the Rio Grande Valley and other parts of New Mexico.

The Rio Grande is well stocked with catfish, suckers, eels, and several other varieties. I am confident that carp would do finely in it also.

ALBUQUERQUE, N. MEX., *August* 10, 1884.

207.—ON THE SCARCITY OF MACKEREL IN THE GULF OF SAINT LAWRENCE.

By Capt. J. W. COLLINS.

In view of the fact that the reciprocity treaty with Great Britain will soon expire by limitation, and that it is possible another may be negotiated, affecting to a greater or less degree the prosperity of the fishery industries of the United States, I assume that additional and reliable information relative to the mackerel fishery in the Gulf of Saint Lawrence may be of interest. The accumulation of such data may enable the legislative and executive departments of our Government to gain a more comprehensive idea of the subject under consideration and to estimate more accurately than could otherwise be done the probable gain or loss to our fishing interests by a renewal of the treaty on its former basis. It is not, of course, necessary for me to dwell on the well-known fact that the extraordinary claims made by Canada when the treaty to which I have referred was made, and also before the Halifax Commission, were based chiefly on the assumption that fishermen of the United States derived great profits from being able to participate in the inshore mackerel fisheries of the Gulf of Saint Lawrence. Therefore I beg to submit the following facts relative to the mackerel fishery of the Gulf, and which I have obtained from an interview with my brother, Capt. D. E. Collins, who returned last Saturday, August 30, from a cruise in the Gulf:

He left home June 18, in the schooner Susie Hooper, of this port, fully equipped for a mackerel trip, and carrying two purse-seines and two seine-boats. Together with many others of the mackerel fleet that sailed about the same time, he went directly to the Gulf of Saint Lawrence, which he cruised over in all directions looking for mackerel wherever he thought they were liable to be found.

He estimates that a fleet of 200 New England mackerel vessels—the finest we have and commanded by the most expert and experienced fishermen—were in the Gulf seeking fish in every nook and corner, whenever the weather permitted. Notwithstanding the utmost exertions that might be expected from ambitious and capable men were put forth, June and nearly all of July passed away without any mackerel being taken worthy of mention. Indeed, before the end of July many of the fleet had become discouraged and left the Gulf, in some cases, I think, without a single barrel of fish. However, many vessels remained, and as late as July 20, while riding out a "breeze" under the lee of the West Cape of Prince Edward Island, my brother counted 110 other mackerel schooners at anchor in the same place. It may be stated here that the weather during July was exceptionally rough, so much so that the vessels were compelled to seek shelter under headlands, capes, and in harbor, a considerable portion of the time. Some half-dozen strong gales occurred during the month. As a matter of course, this kind of weather hindered seining operations, and what is worthy of remark, is the fact that the vessels on our own coast at the same time were hindered little if any by unfavorable weather.

In the latter part of July the Gulf fleet saw some mackerel about Tignish, Prince Edward Island, and on the New Brunswick coast opposite, in the vicinity of Miramichi Bay and Escuminac Point. A few good catches were obtained by the lucky ones, but these were exceptional, the majority getting small catches or nothing. The Susie Hooper took 37 barrels. As soon as this "spurt" was over she went to Bradelle and Bank Orphan, where from Tuesday, August 4, to Saturday, August 8, she took 150 barrels of mackerel. These were the last she caught, though she remained in the Gulf three weeks longer. These fish were taken about 35 to 40 miles from the land, Perce Hills being just distinguishable above the water.

Leaving the locality where the fish had been taken, as no more could be seen, the Susie Hooper stood to the westward, entered Chaleur Bay, and August 10 was at Paspebiac. On the following day she sailed out of Chaleur Bay, stretched across to North Cape of Prince Edward Island, and then worked down the north side of that island until she reached East Point a few days later. It goes without saying that a sharp lookout was kept for schools of mackerel, but none were seen until she was near East Point. During the remainder of her stay in the Gulf the Hooper cruised about the south side of Prince Edward Island, from Eastern Point to Georgetown, and in Saint Georges' Bay, north of the entrance to the Strait of Canso. As previously stated, nothing was added to the fare.

My brother tells me that the schools of fish about the northern part of Prince Edward Island, that were taken near the last of July, were composed largely of herring, comparatively few mackerel being mixed with them. There were enough, however, to tempt the eager fishermen to set their apparatus and to take the risk of having their seines torn on the bottom. The mackerel, both there and about the southern part of the island, were generally in such shallow water that they could not be caught in seines, since the latter would catch on the rocky bottom. And it often happened that the fishermen had the mortifying experience of seeing their seine torn to shreds and the mackerel they had surrounded making their escape through the holes, On one occasion Capt. Solomon Jacobs set his seine in the shallow water off Georgetown. It caught foul of the bottom, was torn all to pieces, and even the purse rings were stripped off. Another source of annoyance was the horse mackerel, which were very abundant, and which often interfered to hinder the fishermen from making good hauls. On a certain occasion Capt. John Y. McFarland had sounded out a spot of clear bottom where he could shoot his net without fear of having it torn on the rocks. Watching his opportunity he at length got a chance to set his seine around a fine school of mackerel. While it was being pursed up he saw the fish passing into the net beneath the boat's bottom. But the sequel proved that the smaller fish were being driven by horse mackerel which had also entered the seine, and when they found themselves enclosed by a circle of twine, they made a desperate rush, tearing their way through the net in all directions, not only injuring the apparatus very seriously, but at the same time causing the escape of the mackerel that otherwise would have been captured.

Besides all this, the mackerel did not "show up" well in the Gulf, and, as a rule, could not be seen for longer than five minutes at a time. In consequence, the fishermen had scarcely time to get into their boats and leave their vessel's side, after seeing a school of mackerel, before the fish disappeared and perhaps not to be seen again.

The mackerel that were about the North Cape of Prince Edward Island, early in August, apparently moved down the north side of the island. These were followed by a fleet as far as East Point. It was supposed that schools of the same body of fish were seen, at a later date, August 15 to 20, in Saint George's Bay, off Cape Jack, at the northern entrance of the Strait of Canso, and even in the strait itself. These fish, of which only momentary glimpses were obtained, were supposed, and doubtless correctly, to be making their way out of the Gulf. But whether or not they were the same mackerel that had been observed a short time previously off North Cape, is, of course, impossible to determine, though this is the opinion of many of the fishermen.

To sum up the results attained, up to this date, we have the following: Of the fleet that went to the gulf, some fifteen or twenty vessels have obtained fares ranging from 300 to 600 barrels of mackerel; three-quarters of the fleet have made losing voyages, and a considerable number of these have only from 10 to 100 barrels for their season's work.

As an illustration of the difficulties and uncertainties attending the Gulf fishery it may be stated that Capt. Eben F. Lewis arrived yesterday, after spending the whole summer in the bay, with only 45 barrels of mackerel. And when my brother came through Canso, August 22, Capt. Solomon Jacobs was reported to have less than 100 barrels. Even these had been taken recently, for when Captain Jacobs was in Canso to refit early in August, after having spent nearly two months cruising in the Gulf, it was reported in the press that his entire catch to that time amounted to but one trout and a single mackerel.

Considering that Captain Lewis and Captain Jacobs have for the past five or six years been the "high-line" mackerel fishermen of the United States, and that both of them have made catches and stocks that have never been equalled by any others, it will be easy to see that the failure of the Gulf mackerel fishery is due to causes that may be considered unsurmountable. A better idea of this subject can, in my opinion, be gained from the foregoing statements than might be obtained from a great mass of data of the ordinary kind. For in the majority of cases it is clearly shown that skill, tact, knowledge of the grounds, and the most determined energy, have utterly failed to accomplish results that might reasonably be looked for where the conditions are at all favorable. It is worthy of remark that, in the mean time, the vessels on our own coast—chiefly in the Gulf of Maine, a few at Block Island—have made exceedingly large catches. I think it would not be an exaggeration to say that 1,500 to 2,000 barrels of mackerel have, in several instances, been taken by a single vessel since the middle of June. And in some cases schooners have left the Gulf of Saint Lawrence almost empty, and ten or twelve days later have arrived in Gloucester with a full fare—300 barrels or upwards—caught off our own shores.

In this connection I desire to mention that Capt. S. J. Martin, the Fish Commission agent, has done the Gloucester fishermen a very important service by replying to telegrams sent him from ports in the Gulf of Saint Lawrence, and by acquainting the skippers of some of the vessels with the state of affairs at home. Feeling assured that the information he sent was reliable they acted upon it, and immediately left the gulf. In some instances that have come under my observation these vessels arrived in Gloucester with full fares, caught in the Gulf of Maine in less than two weeks after getting the news from home. It is difficult to estimate correctly how much good may have been done, for news sent to one skipper might influence the action of a dozen others, who, knowing the first had sent a dispatch of inquiry, would naturally wait to learn and profit by the reply.

GLOUCESTER, MASS., *September* 1, 1884.

208 NOTES ON THE SCOTCH HERRING FISHERIES.

By T. F. ROBERTSON CARR.

[From a letter to Capt. J. W. Collins.]

The herring fishing is now in full swing; there never before were known such takes. Fancy 4,000 crans of herrings thrown into Frazerburg bay. The prices were very low this last week, in fact will not pay the wear and tear of gear. One thing that is operating very imperiously against the fishing is that a great many fishermen in the north use a very small meshed net. They go 35 to 50 miles off to meet the shoals, and in most cases tow in. This is at the beginning of the season. The fish are then too oily, not fit to cure for the continental market, and, in short, they are perfect rubbish. The English markets have been packed with this stuff, selling at 12 for a penny. Now, when the fine, large, matured herring go into the market, the buyers object to giving a decent price for them. They have got up a cholera scare, so, for these two reasons, fishermen and all concerned in the herring business are having a hard time of it.

BERWICK-ON-TWEED, ENGLAND, *August* 11, 1884.

209.—PORPOISE-FISHING AT CAPE MAY, NEW JERSEY.

By FREDERICK W. TRUE.

Curator of Mammals, U. S. National Museum.

Having received an invitation from the officers of the Cape May Porpoise Oil and Fishing Company to inspect their operations, I visited the locality in middle of the present month. My assistant and myself received all possible courtesy during our visit, and I would here renew the thanks which I offered verbally to the president of the above-named company.

The species of porpoise captured is known to science as *Tursiops tursio*, and although, so far as I could ascertain, our fishermen have no common name for it, it may, at least for the present, be designated in English as the Bottle-nose dolphin. It reaches a length of 10 or 11 feet when full-grown. The color of the back and pectoral and dorsal fins is a gray of greatest or less depth, while the belly is pure white. The beak is rather short and stout, and there are forty-four or forty-six teeth in each jaw. The species is one of the commonest in the North Atlantic, occurring both on our coasts and those of Europe in great abundance.

The company was organized early in the present year principally by gentlemen of Cape May City. Although the capital invested is considerable there have been large drains upon it for apparatus for experiments, some of which have not led to satisfactory results. The fishery was commenced with two steamers, but it was found upon trial that the nets could be better managed by the use of one steamer and several small boats. The tug-boat now employed is of fair size, but is considered to have too much wood-work above deck, which prevents the nets being properly stowed. The tug is accompanied by two yawls and a surf-boat. The crew consists of about twelve men. Two kinds of nets have been experimented with, one having wings and a very long, narrow pot (thus somewhat resembling in form a fyke-net), the other being a simple net of stout twine with large meshes. The latter net is the one at present in use. With it is employed another net having fine meshes.

The method of the fishery is a simple one, and consists merely in patrolling the shore with the steamer and surrounding by means of the nets any school which is met with near land. The coarse-meshed net is paid out around the school somewhat in the manner adopted in the menhaden fishery, and the fine-meshed net is then run around inside the first. The use of this second net is to entangle and drown the porpoises as well as to prevent their breaking through the coarser net. The ends of both nets are brought to land, and the hauling-in is done from the beach.

In the haul which I witnessed a school of about twenty-five porpoises was surrounded, but unfortunately three of them, in their efforts to escape, rolled up the nets at the bottom and allowed the rest to escape. The bottle-nose dolphin does not attempt to jump over the net as the "puffing pig" (*Phocæna communis*) does, but seeks to escape by diving beneath or breaking through it. The company has thus far captured over two hundred specimens.

The products obtained are oil, hides, meat, and fertilizer. All portions of the body are utilized. I was informed that the blubber seemed to be growing thicker at this season. The hide and blubber are removed together. The skin is then laid on an inclined currier's board and the blubber shaved off and dropped into a tub below. The oil is extracted by heating the blubber in large boilers. Experiments have also been made in cold-pressing. The dressed hides are sent to Newark, N. J., to be tanned, and the flesh finds a market in Philadelphia. The bones and other refuse go to form a fertilizer.

The energy with which the fishery is prosecuted merits success. There are many difficulties presented by a new enterprize of this character, which are not encountered in long-established industries.

There is a crude porpoise fishery at Hatteras which has been in existence many years. It is my intention to visit the locality during the coming fall, for I suspect that the species of porpoise captured is entirely distinct from that taken at Cape May.

U. S. NATIONAL MUSEUM, *August* 25, 1884.

Vol. IV, No. 28. Washington, D. C. Sept. 29, 1884.

210.—NOTE UPON THE EFFECT OF HIGH PRESSURES ON THE VITALITY OF MINUTE FRESH-WATER AND SALT-WATER ORGANISMS.*

By A. CERTES.

I have the honor of presenting to the Biological Society the note which I deposited in the Academy at its session of March 17 last, on the culture under shelter of germs from the waters and sediments of the Travailleur and the Talisman. (*Comptes rendus*, No. 11, p. 690.) On this occasion I ask permission to give a brief review of some new experiments which I have made with various microscopic organisms by subjecting them to high pressure for a period varying from seven hours to seven full days. This communication will, I hope, tend to lessen, if not to cause to disappear entirely, the differences, more apparent than real, which Dr. Regnard pointed out at the last session between the conclusions reached by his experiments and by mine. Thus I fully agree with Dr. Regnard's opinion "that the infusoria of the surface of the sea could not, without slow acclimatization, live in the depths, and that for these parts, as for all the others, there must be an abyssal fauna." It is nevertheless true that our experiments differ, both as to the aim we have in view and the conditions under which they have been made.

As far as I am concerned I have made it my aim to find out by what processes organic matter has been reduced to an inorganic state in the great depths of the sea. After the expedition of the Travailleur, in 1881, I at first searched directly for "microbes" by examining microscopically the sediments obtained by osmic acid and treated with coloring reagents. Not finding anything by this process, I had recourse to the method of cultivation; but from the very beginning I was fully aware that it would not be capable of producing genuine "microbes" from great depths, like those from the material gathered by the Talisman, but that I would have to place these "microbes" under their normal conditions of physiological activity. It is difficult to produce these conditions, and it is only by way of experiment that I at first sought to ascertain the effect of high pressure on unicellular organisms, both infusoria and "microbes," which we find near the surface. I had also to study how to avoid sudden pressure and a sudden stoppage of pressure, which in nature occur only by way of accidents.

At my request, and by the kind intercession of Mr. Cailletet, Mr. Ducretet has slightly modified the regulations for using his apparatus.

* *De l'action des hautes pressions sur la vitalité des micro-organismes d'eau douce et d'eau de mer.* Paris, 1884. Translated from the French by HERMAN JACOBSON.

In the apparatus which I use there are two receivers and two manometers instead of one. The receivers are either isolated or placed in communication, just as it is desired, by means of a stop-cock, which allows to accumulate the pressure or to decrease it, without too many precautions, in the first receiver. One can then, by means of the stop-cock, transmit the effect which has been obtained from one receiver to the other, as slowly as is desired. Thus in all my experiments, except when I made a mistake, it has taken nearly half an hour to rise from 0 to 500 atmospheres, and *vice versa*. In order to reproduce still more completely the conditions of nature, I have endeavored never to exceed from 400 to 500 atmospheres, which represent the average pressure of the depths explored by the submarine expeditions.

If I have rightly understood Dr. Regnard's different communications, these conditions, except as regards the experiment of which he has given an account at the last meeting, differ very materially from those which he sought to produce. No wonder, therefore, that the results obtained by me differ from his.

By working in the manner indicated, and always taking care to determine beforehand the species of infusoria or small organisms which I subjected to pressure, I have obtained the following results:

At a pressure of 100 to 300 atmospheres, maintained for seven, twenty-four, forty-eight and seventy-two hours, certain organisms were killed; others came out of the apparatus as lively as they entered; others again fell into that state of latent life of which Dr. Regnard speaks. At 450 to 500 atmospheres the number of live organisms decreases, and that of dead organisms, or those which have fallen into a latent life, increases. In the first experiment—of which I have already given an account to the academy—the *Chlamydococcus pluvialis*, when subjected for seven hours to a pressure of 100 to 300 atmospheres, all came out of the apparatus as lively as they were when put into it. The majority of the other infusoria had died. In a second experiment, prolonged for forty-eight hours, at a pressure of 300 atmospheres, fresh-water infusoria, such as *Paramecium colpoda* and *Vorticelles*, had fallen into a state of latent life; others had died. On the other hand, *Euplotes charon*, *Euplotes patella*, and *Pleuronema marina*, marine infusoria, had remained active. Other species, especially *Holosticha flava* and *Actinophrys*, had died.

In the last experiment which I made, fresh-water organisms were for thirty-six hours subjected to a pressure of 520 atmospheres. When taken from the apparatus most of the *Chlamydococcus* appeared to have fallen into a state of latent life; some had died, and others were still active; but entirely green individuals had resisted in greater number than those whose chlorophyl had begun to assume a red color. In the same tubes I was able to show to two of your colleagues, a quarter of an hour after they had been taken from the apparatus, rotifers in full activity. The tardigrades, which had fallen into a state of latent life, revived more slowly. In all the experiments certain "microbes," which were very numerous in the tubes, when subjected to pressure disappeared, others moved about as soon as taken from the apparatus.

It appears, therefore, that under the conditions which I produced, the effects of high pressure vary not only between the different species but also between the individuals of the same species. It seems, moreover, that it makes a great difference whether the pressure or stoppage of pressure is more or less rapid. It is therefore not impossible that with a stronger pressure continued for a long time no surface organisms would survive, but that they would all indiscriminately die. This should be proved by experiments.

I cannot pass in silence the effect of high pressure on the carbuncled, charred "bacterid." With Dr. Roux we subjected carbonaceous blood to a pressure of 600 atmospheres for a period of twenty-four hours. This blood retained all its virulence, and experiments made with it proved entirely successful.

It will be seen that in none of these experiments had I touched the problem of fermentation or putrefaction. The experiments made by Dr. Regnard with yeast seem to agree with what is already known regarding the sleep of the mycodermic cells which are found in sparkling and sugared wines. At a certain given moment these cells no longer decompose sugar, either because they have become subjected to the paralyzing action of carbonic acid, or because their food gave out, or, finally, because—as Dr. Regnard's experience also seems to prove—the pressure produced by the tension of gas hinders the fermentation. But it may also be asked whether other ferments, especially those possessing much body from great depths, do not obey other laws. This is the problem which at the present time engages my attention, and which I am endeavoring to solve.

211.—ON THE SCARCITY OF MACKEREL IN THE GULF OF SAINT LAWRENCE.

By Capt. J. W. COLLINS.

The results which have been obtained in the mackerel fishery of the Gulf of Saint Lawrence by American vessels during the present season, are clearly and forcibly set forth in the following notes and sworn statements of captains, for which I am indebted to Capt. Fitz J. Babson, collector of customs at Gloucester. These facts, which may well supplement those already submitted concerning the same subject, demonstrate in the strongest possible manner that so far from deriving any benefit from a participation in the fisheries of the Gulf, the vessels of New England have suffered a severe pecuniary loss by leaving our own waters. It is worthy of notice that of the reports obtained from ten vessels *three came out of the Gulf without a single barrel of mackerel*, and of the catch made by the other seven schooners, *only 50 barrels* *of fish were taken within the three-mile limit.* It is also noteworthy that the captains who have submitted and sworn to these statements are known to be experts in the mackerel fishery, their vessels are among the finest of the New England fishing fleet, they carried large and experienced crews, and in every instance when they did not come directly home from the Gulf, they succeeded in catching large fares of mackerel in a few days off our own shores. The vessels all belong to the Gloucester fleet.

Taken in their chronological order, we have first a statement from Capt. Stephen B. Cole, master of schooner Delia E. Norwood (74 tons, 16 men in crew), who arrived from the bay of Saint Lawrence * July 19, having been cruising for three weeks in the Gulf without catching any mackerel.

"We were in all parts of the bay, and did not at any time see any mackerel. In coming from the bay and while on the coast of Maine, we took 374 barrels of mackerel, [worth] about $1,500. I consider that we lost by going into the bay $3,000 at least."

Capt. William W. King, master of schooner John S. Bray (79 tons, 16 men), who arrived in Gloucester, July 27, from a six weeks' trip to the Gulf of Saint Lawrence caught only 15 barrels of mackerel in the gulf, none of which were taken inside the three-mile limit. The following, dated Gloucester, July 30, 1884, is the statement of Captain King:

"When I first went into the bay [Gulf of Saint Lawrence], I went to East Point, Prince Edward Island, where there were about 17 American vessels; never got a mackerel or saw one. From there went to North Cape [P. E. I.] with the fleet [but] got nothing there; then to West Cape, Prince Edward Island; got nothing there; came back to Malpec; went down the "bend" of the island; from there to Margaree [Island], Cape Breton shore; got nothing; went to Cape George Bay; went to North Cape [P. E. I.] again; from there to Escuminac; got nothing this time; came back to Cascumpec and got 15 barrels [of mackerel]. One vessel, the Isaac Patch, took 35 barrels [of mackerel], which were all that were taken to my knowledge. We were [purse] seining; did not see a vessel hooking or hand-lining for mackerel while in the bay. Saw no large bodies of mackerel anywhere. Saw a few mackerel in schools containing from one to five or six barrels. Coming back, off our own shores, saw large bodies of mackerel, and took 250 barrels between Mount Desert and Seal Island.

"It is my judgment, based on an experience of ten years' successive fishing, that the mackerel off our own shores are always moving in large bodies, and are available for seining, but when they go into the Gulf of Saint Lawrence they break up and scatter for food, and in this condition are not available for seining.

* The Gulf of Saint Lawrence is almost always spoken of by the fishermen as "The Bay," or the "Bay of Chaleur," sometimes as the "North Bay," and more rarely by the name of Gulf.

"When the hand-line or hooking process was the only means used for taking mackerel there were five or six hundred vessels in the Gulf in one fleet, and by the large amount of bait thrown by them the mackerel were brought together in large quantities. But under our present means [system] of taking, viz., seining, no bait is used, and consequently the gulf mackerel fishing is worthless and useless to the American fisherman.

"WILLIAM W. KING."

Capt. George H. Martin, master of the schooner Ethel Maud (77 tons, 16 men), of Gloucester, arrived home July 30 from the Gulf of Saint Lawrence, where he spent a week without having taken any mackerel at all. Captain Martin made the following statement:

"I, George H. Martin, master of the schooner Ethel Maud, of Gloucester, do hereby say on oath that I have just returned home from a mackerel trip to the Gulf of Saint Lawrence; that I was unable to procure a single barrel of mackerel in the bay, but on my way home I secured a full trip off Mount Desert. I gave the gulf a full trial for the taking of mackerel, and from my own personal observation, and from all that I could ascertain, I do not consider the fishery of any value whatever to our people."—GEORGE H. MARTIN.

"Sworn and subscribed before me this 30th day of July, 1884."—F. J. BABSON, collector.

Capt. George McLain, master of the schooner Henry Dennis (91 tons, 16 men), arrived at Gloucester, July 30, from a six weeks' cruise in the Gulf of Saint Lawrence. He brought home 138 barrels of mackerel, of which none were taken inside the three-mile limit. Captain McLain says, "I do not consider the gulf fishery of any value whatever to our people."

Capt. William P. Gray, master of the schooner Commodore Foote (61 tons, 16 men in crew), who arrived July 30 from a trip to the Gulf of Saint Lawrence, makes the following statements:

"I, William P. Gray, master of the schooner Commodore Foote, of Gloucester, do hereby on oath depose and say that I went from Gloucester on a mackerel trip bound for the Gulf of Saint Lawrence; that I took 180 barrels of mackerel 15 miles off Cape Sable, which I landed at Halifax, Nova Scotia, and sent home; thence I proceeded into the Gulf of Saint Lawrence, where I passed six weeks; that I went all over the bay, giving it a complete trial for the taking of mackerel, and only succeeded in taking 30 barrels of mackerel. I consider that I am $3,000 stock out by going into the bay for mackerel, and I do not regard the gulf fisheries of any value whatever for this season. On the contrary they have proved a big outset."—WILLIAM P. GRAY.

"Sworn and subscribed before me this 30th day of July, 1884."—F. J. BABSON, collector.

Capt. Merrill B. King, master of schooner M. S. Ayer (76 tons, 16 men in crew), arrived at Gloucester July 30 from a cruise in the Gulf of Saint Lawrence, where he spent four and one-half weeks seeking for mackerel, but without taking a single barrel. Captain King makes the following statement:

"Coming home, off Mount Desert, Maine, took 370 barrels of mackerel. The going to the Gulf of Saint Lawrence was a great damage to me, my loss of time and failure to take any mackerel making a loss of $3,500."

Capt. Joseph I. Tupper, master of the schooner Jennie Seaverns (107 tons, 16 men), arrived in Gloucester August 15, from the Gulf of Saint Lawrence. He caught only 55 barrels of mackerel during the eight weeks spent in the gulf, none of which were taken inside the three mile limit. Capt. Tupper says:

"On returning from the bay, and on the coast of Maine, we caught 400 barrels of mackerel in six days; value of which is $1,800. I regard the pecuniary damage to me by reason of going to the bay at $4,000."

The schooner Landseer (94 tons, 16 men in crew), Capt. James McDonald, arrived in Gloucester August 21, having spent two months in the Gulf of Saint Lawrence, during which time 105 barrels of mackerel were caught, 50 barrels being taken within the three-mile limit. The value of these fish caught within 3 miles of the shore, exclusive of the cost of barrels, salt, packing, and inspection, was $250. Captain McDonald tersely sums up the results of his trip to the gulf in the following sentence:

"I regard my loss by reason of going into the bay at $2,000."

Capt. James L. Anderson, master of the schooner William H. Jordan (86 tons, 18 men), who arrived in Gloucester August 20, stated that he spent four weeks in the bay, but caught only 30 barrels of mackerel. On his way home he took 300 barrels of mackerel in ten days' fishing off the coast of Maine. He owns another vessel, which remained on this coast, and he says of her:

"My other vessel caught 1,030 barrels of mackerel while I was in the bay."

Capt. John P. Aiken, master of schooner Bartie Pierce (90 tons, 17 men), returned to Gloucester August 25, from a five weeks' trip to the Gulf of Saint Lawrence, where she took only 20 barrels of mackerel.

When it is understood that statements similar to those given above might be multiplied by taking the testimony of almost every fisherman that has been engaged this year in the mackerel fishery of the Saint Lawrence, it will be easy to comprehend the fact that while the method of taking mackerel with purse seines remains in vogue, we can count on deriving little or no benefit from a participation in the in-shore fisheries of the British provinces.

GLOUCESTER, MASS., *September* 9, 1884.

212.—TWO HUNDRED TONS OF DEAD FISH, MOSTLY PERCH, AT LAKE MENDOTA, WISCONSIN.

By PHILO DUNNING and others.

We take the liberty of addressing the United States Fish Commission upon a matter of some concern to this community, and do so upon the assurance of Dr. Philo R. Hoy, of Racine, and Governor Rusk, that the matter will receive favorable consideration.

Madison lies between two of a series of four lakes, the larger one of which is known as Fourth Lake, or Lake Mendota, and the smaller, Third Lake, or Lake Menona. The discharge of water is from Fourth Lake into Third Lake, and so on from Second to First Lakes to the Rock River. All of these lakes are well stocked with fish; perch, pickerel, white and black bass, whitefish, and some other varieties. The same families of fish are found in each lake.

About two weeks since, the perch of Fourth Lake commenced dying in all parts of the lake. As they came to the surface they were driven by the waves to the shore. Great numbers have been driven upon what may be called the city shore, becoming very offensive. Probably upon this shore a greater portion of fish have been driven than upon other parts of equal length of the shore of the lake. What we designate as the city shore is probably three-quarters of a mile in length, and its form, together with the prevailing winds, have tended to bring upon it a somewhat greater portion of the fish than have gone to the other portions. The city has had a force of men constantly employed in the work of burying the fish as they come in. The force has averaged from twelve to fourteen men with teams. On one day thirty-eight were employed. It is estimated by the street superintendent that he has buried in excess of a hundred tons, calling a wagon load with double sideboards a ton. The fish dying are mostly perch. Latterly quite a number of whitefish have been found with the perch and a few suckers and white bass, but no more of the varieties of fish other than perch and whitefish than we expect to find each year. The perch will average about a quarter or a third of a pound in weight. A day or two since some perch minnows were noticed to be dying. We are told that the dying continues up to this time. We are inclined to think that fully 100 tons have been buried, but we feel quite justified in saying that 75 tons have. The lake is from 6 to 8 miles long—8 at the greatest length—and from $2\frac{1}{2}$ to 5 miles wide—5 at the greatest width. Assuming that twice or three times as many fish as have been buried lie upon other parts of the shore, the destruction of fish, chiefly perch, is fully 300 tons. Can you explain the cause?

Although the flow of water is from Fourth Lake into Third Lake, and so on, the fish in Third, Second, and First lakes are not as yet affected.

A small quantity of sewage (that is from a few private sewers) is discharged into Fourth Lake; also some chemicals from the laboratories of the State university, and also a little gas tar from the insane asylum gas works situated on the north side of the lake opposite the city. The sewage, waste chemicals, and tar are put into the lake at three points each remote from the other. But it is also true that a much larger amount of sewage is discharged into Third Lake, in volume not less than three or four times that which is discharged into Fourth Lake and as well as some gas tar.

Dr. Hoy was called here, and has made an examination of the fish. His report upon the same is to be sent to us later. He is also to write you upon the subject. Professor Birge, of the State university, is said to have made some examinations also, and is reported to have sent the results of his examination to you.

By express we send you a jar containing several of the fish taken just before death. We hope that your examination of these fish, with the aid of such suggestions as Dr. Hoy and Professor Birge may make, will put you in possession of the facts of the case sufficiently for an opinion as to the cause, and if possible enable you to suggest a remedy for this calamity. It were a calamity if it were merely the loss of the fish, but there may be in it also a threat of sickness to our people. In passing upon this matter will you be good enough to give your opinion upon the significance of this as threatening sickness.

It may be proper to state that various suggestions have been made as to the cause of this trouble. One is that a small worm attacks the gills or throat of the fish; a worm is said to have been taken from a weed upon which the fish had been feeding, the weed being found to some extent in the intestines of the fish. Another is, that it is caused by a parasite feeding upon the gills. Dr. Hoy undertook to analyze the water of the lake, and reports it nearly as pure as the artesian water with which the city is supplied.

It is also said that in years past the fish of this lake in considerable numbers have died. Every year there are some dead fish. In or about 1844 the whitefish came ashore in quantities as great as the perch now, and on several occasions fish in considerable numbers have come ashore. (Philo Dunning, State Commissioner, and B. J. Stevens, Mayor of Madison.)

MADISON, WIS., *August* 4, 1884.

THE DEAD PERCH IN WISCONSIN.—A singular disease is affecting the perch in the lake here, which I am unable as yet to account for. They are dying in great numbers. About 200,000 have died in the past two weeks. They show no trace of fungus or other disease. The only thing which is unusual about them is the gills, which, with the liver, are gorged with blood. Whether that is abnormal for a fish which dies of disease, I do not know. There is no fungus, the dying fish having a perfectly clear skin; they are fat or lean, male or female, full or fasting.

Perch are about the only fish that are dying; at least 95 per cent. of them are perch. There are a few white bass, still fewer suckers, and an occasional pike and sunfish. (E. A. Brigs, Professor of Zoology, University of Wisconsin, Madison, Wis., July 28, 1884.)

Mr. DUNN'S THEORY.—Having for years past followed the business of a fisherman for a livlihood, I am frequently asked, What kills the perch in Fourth Lake? My suspicion was not aroused to a great extent until I saw, day by day, an unaccountable increase in the death-rate. A living parasite or worm exists in the lake that causes the trouble. The color of this parasite on first being taken out of the water is of a light gray, with green stripes crosswise of the body, about one-half an inch in length. It is generally found where the weeds and grass are the thickest, adhering to the stems of the grass and weeds where it is easily seen by the perch who frequent these places in quest of food. The perch immediately detach the parasites from their hold, and they are at once forced towards the stomach for digestion, but on reaching the walls of the throat they fasten themselves as they do to the grass in the lake. All efforts on the part of the fish to remove them are useless, as their adhering powers are similar to those of a blood sucker. The parties heretofore examining the fish have not been able to detect this parasite, consequently their verdict was that nothing could be found as to the cause of the deaths. The fish on coming to the surface are almost dead, with hardly life enough left to move about. On examining these you will almost in every case find nothing. Now and then you will find some specimens containing this parasite fastened to the wall of the throat in the region of the gills. Then we must look there for the cause of trouble. The parasite attacks the throat and causes inflammation by irritating that part of the body. The fish is finally overcome and strangulation takes place. In order to test what I say, catch some perch in the neighborhood where there seems to be the most in a dying condition. Let your line down to the bottom and you will have no trouble in catching the fish. You will, in every case, find three to ten of these parasites working in the throat of each fish. While the fish are dying they release themselves and return to their natural abiding place on the grass and weeds. The writer verily believes that no other fish existing in the lake will feed upon these parasites except the perch. If any other did partake of them, the same result would follow.

In regard to the whitefish dying: It is nothing unusual, as more or less die, according to the temperature of the water, every year. The hotter the summer season, the more dead whitefish will be seen floating on the surface. They live in the coolest water in the lake, which is the deepest. The presence of any large fish drives them out of their favorite place, and being naturally very tender, when they pass into water of a great deal higher temperature, death ensues. Try this experiment: Take minnows out of the lake in the summer season and place them in well-water; death follows. Now, take minnows in winter-time out of the lake and put well-water upon them, and death also follows. There is too sudden a change of temperature. Apply this experiment in the whitefish case, and you have the reason of their death. (From Wisconsin State Journal, August 5, 1884.)

THE BIRDS DYING ALSO.—About ten days ago the swallows and sparrows began to die at the State Insane Hospital, and day by day many of the innocent creatures have fluttered helpless to the ground and soon become dead. Great numbers of the birds abound around the hospital, and the sudden and numerous deaths, not only in the immediate neighborhood of the hospital, but throughout the entire farm, have occasioned genuine surprise. The birds will suddenly drop to the ground while flying through the air overhead, in places entirely remote from telegraph wires, trees, or other obstructions against which it is possible to injure themselves, and die without a flutter or any indication of pain. The doctors and attendants at the hospital have repeatedly thrown the birds into the air again, in the hope that they would be able to resume their flight, but in every instance they have fallen back to the earth again, to die. Governor Rusk has observed a few of the dead birds around his home, and others residing on the shores of Lake Mendota have noticed the same phenomenon.

Superintendent Buckmaster, of the State Insane Hospital, has a theory in regard to the cause of their deaths. He says that myriads of flies swarm upon the putrefying bodies of the dead perch upon the shores of Lake Mendota, where they feast, and that these flies are eaten in great quantities by the birds, which would indicate that the death of the latter is attributable to the same cause as that of the former. If the birds really do die from eating the flies, then the superintendent states that he believes the fish, upon which the flies feed, are troubled with blood-poisoning. The mystery of the fish mortality certainly deepens, and is greatly intensified by the fatality which has so recently stricken the birds.

In this connection it may be well to say that a little boy residing in this city drove off the railway bridge into Lake Menona, a few days ago, and was stung so severely in one of his eyes by some animal beneath the surface of the water that he has been unable to use it in any way since. When he sustained the injury he saw no object, and feels confident that it must have been done by some insect or worm very small in size. (From Wisconsin State Journal, August 6, 1884.)

TWO HUNDRED TONS HAULED AWAY.—The *mortality of perch* and other fish in Lake Mendota, Wisconsin, continues, and scientific men from various parts of the country have been called to investigate the matter. Thus far 200 tons of dead fish have been hauled away from the shores of the lake by the city authorities. The worst mortality prevails when the lake is very still or gently stirred by a south wind. On a rough estimate 3,000,000 fish have died in the lake, and their bodies have drifted to the shore. Perch are the only fish dying whose death cannot be accounted for. Whitefish are going to a certain extent, but they die every year on account of being driven from the cold water near the mouth of the springs which supply the lake, where they congregate, into the warm water which prevails everywhere else. A few pickerel also are seen dead, but not enough to cause the idea of an epidemic. It is the perch which get the best of fishermen now by their death. The dead perch range in size from one-half pound to 2 pounds. They have strewn the shore for nearly four weeks. Cart-loads are taken away and buried, but still the shore is covered with their carcasses. Every gale, every breeze that blows, strews them over the waves. Theories are numerous regarding this disease. One attributes it to an insect that gets into their windpipe and chokes; another notices a black spot near the gill and attributes to its presence the cause of which death is the effect. (Madison Transcript, August 7, 1884.)

213.—DESTRUCTION OF FISH-FOOD BY BLADDERWORT (*Utricularia*).

By S. A. FORBES.

[From Forest and Stream, September 4, 1884.]

While the very interesting fact of the destruction of young fishes by the bladderwort is occupying the attention of your readers, permit me to mention another method than that of direct destruction by which these plants must often greatly hinder the multiplication of fishes in waters infested by them. In an article on the entomostraca of Lake Michigan and adjacent waters, which I published in the American Naturalist for July, 1882, I remarked that in ten "bladders" of *Utricularia vulgaris*, taken at random, I found ninety-three animals, either entire or in recognizable fragments, and representing at least twenty-eight species. Seventy-six of the animals found were entomostraca, and belonged to twenty species. Nearly three-fourths of both individuals and species were cladocera. Just one-third of all the animals found in the bladders belonged to the single species *Acroperus leucocephalus* Koch. Now, my studies previously made of the food of young fishes, reported chiefly in the third bulletin of the Illinois State Laboratory of Natural History, showed that the principal food of all young fishes, with quite insignificant exceptions, consists of the very class of minute animal forms which the bladderwort is constantly engaged in selecting from the water by means of the hundred of bladders with which each plant is covered. It thus not only occasionally entraps the youngest fishes, but likewise habitually and continuously contends with them for food, and may be said to thrive largely at their expense.

NORMAL, ILL., *August* 29, 1884.

214.—NOTES ON THE FISHERIES OF GLOUCESTER, MASS.

By S. J. MARTIN.

[From letters to Prof. S. F. Baird.]

SUMMARY.—Last week witnessed the largest receipt of fish at this port for several years, the total amount of codfish landed being 4,020,000, of which 3,080,000 pounds was brought from Grand Banks. One-half of the fish from Grand Banks was brought by Nova Scotia vessels. There were also landed 212,000 pounds of fresh halibut and 12,565 barrels of mackerel, including 956 barrels from the bay of Saint Lawrence. The 260 barrels of herring caught in nets and traps in the harbor have been sold to the fishermen for bait.

MACKEREL.—Small mackerel are plenty on the eastern shore, and extend from Mount Desert to Cape Sable in the Bay of Fundy and as far up as Grand Manan. Large mackerel are scarce on the New England coast, the amount caught being about 5 barrels out of every 100 barrels. The remainder ranks as No. 2, No. 3, and No. 4. They bring a low price, and sold yesterday at $3.75 per barrel, with the large ones included in the lot. I hear from the Bay of Saint Lawrence from three to four times a week, and learn that the prospect for a large catch of mackerel is good. On August 12 and 13 the vessels made large hauls off Souris, Prince Edward Island, one vessel catching 400 barrels of mackerel in two days. Mackerel are late in North Bay this summer, owing to the length of time ice remained in the bay. The ice did not leave the bay until June 2, and the mackerel would not enter until the water became warm. I think the mackerel that have been seen at Green Bay, close to the strait of Belle Isle, were driven that way by the ice. The mackerel in the Bay of Saint Lawrence are very fat and large.

BLUEFISH.—Yesterday, as schooner Phantom was on its way out after mackerel, a school of fish was seen 3 miles from the mouth of Gloucester Harbor. A seine was set and 136 bluefish taken, which were sold for $75.

HAKE.—Hake have been a failure this year, not enough being caught to supply the market.

SWORDFISH.—Swordfish have been plentiful. Last week 2 boats landed 25 swordfish each, from Jeffries Bank, the 50 aggregating 15,625 pounds, and sold at 5 cents per pound. On August 1 there were 4 swordfish brought in, and sold at 10 cents per pound.

GLOUCESTER, MASS., *August* 17, 1884.

CODFISH.—During the past week there have been eighty-seven arrivals from the fishing grounds, landing 1,878,000 pounds of salt codfish, two-thirds of which was brought from Grand Banks. There were six arrivals with 165,000 pounds of fresh halibut. There were four arrivals to-day from Grand Banks. Four vessels from Nova Scotia sold their fish at $1.60 per hundred pounds. The Grand Banks cod-schooner Ethel, of Nova Scotia, had 370,000 pounds of salt codfish, the largest trip of salt codfish ever landed in Gloucester by one vessel. This cargo was sold at $1.65 per hundred pounds. The Gloucester firms will lose a great deal on the Grand Banks fish, as the Nova Scotia vessels are stocking the place with fish at low prices. I have known some firms to pay $2.25 per hundred for Grand Banks codfish.

MACKEREL.—There have been landed 8,417 barrels of mackerel caught in the Bay of Fundy, and 3,551 barrels caught in the Bay of Saint Lawrence. There were shipped from Canso by rail 1,314 barrels of mackerel. The mackerel taken in the bay are of good quality, large and fat, three-fourths of the amount caught being No. 1, and the remaining quarter No. 2. No. 1 mackerel from the Bay of Saint Lawrence sold at $13 per barrel, and the Bay of Fundy mackerel sold at $3.75 per barrel, "as they run." Vessels from North Bay report mackerel schooling from Cape Canso to Cape Sable, and that they are of the same size as the mackerel in the Bay of Fundy.

GLOUCESTER, MASS., *August* 24, 1884.

MONTHLY SUMMARY.—The receipts of fish at Gloucester during the month of August were as follows: Eleven million eight hundred and twenty-six thousand pounds salt cod, 647,250 pounds fresh halibut, 147,900 pounds salt halibut, 41,322 barrels salt mackerel, 370 barrels herring, and 85 swordfish weighing 26,340 pounds.

The above fish arrived from the following grounds: George's Bank, 118 fares, 2,578,000 pounds salt cod and 46,050 pounds fresh halibut; Grand Bank, 41 fares, 8,380,000 pounds salt cod and 72,500 pounds salt halibut; Grand Bank, Banquereau, &c., 21 fares, 599,000 pounds fresh halibut; Western Bank, Banquereau, &c., 9 fares, 474,000 pounds salt cod and 5,400 pounds salt halibut; Bay of Saint Lawrence, 14 fares, 7,332 barrels salt mackerel; American shore, 88 fares, 33,990 barrels salt mackerel; shore fishing grounds, coast of Maine, &c., 314,000 pounds salt fish, mixed; swordfishermen, 85 swordfish, weighing 26,340 pounds; traps near Gloucester, 370 barrels herring, 100 barrels mackerel; off Gloucester Harbor, in seine, 134 bluefish.

The first arrival from the Greenland fleet, schooner H. M. Rogers, brings home 80,000 pounds salt cod from Flemish Cape, and 70,000 pounds salt halibut taken off the Greenland coast.

GLOUCESTER, MASS., *September* 1, 1884.

THE GREENLAND HALIBUT FISHERY.—I have gained the following information about this fishery, two vessels having arrived from that region during the past week. These vessels came home earlier than in former years and have left several vessels on the coast. The two schooners arrived are the M H. Perkins and Herbert M. Rogers. The former vessel fished in the usual grounds of Holsteinberg and brings home 80,000 pounds of flitches of halibut from Greenland besides 70,000 pounds of codfish taken on Flemish Cap. She reached Greenland July 12, about a week earlier than others of the fleet, and found fish at once, and having secured a full fare left Greenland August 2, which is about the date of beginning the fishery there in past years, the size of fish ranging about as usual. The weather was fine and no difficulty was experienced in fishing. She left on the ground the schooners Shiloh, Mist, Byron Hines, Mary E., Herman Babson, and the Sarah Putnam. The last-named vessel belongs in Beverly, Mass., the Byron Hines hails from Yarmouth, Nova Scotia, and the other vessels are owned in Gloucester. The particulars of the other vessels will be reported as fast as they arrive.

The Herbert M. Rogers fished on a new spot of ground in latitude 63° 33′, about 30 miles off shore from Candham or Codport; the water was from 60 to 84 fathoms deep; used halibut and cod for bait and found halibut abundant, securing a full fare of 70,000 pounds of flitches in fourteen days. This vessel had stopped on Flemish Cap on the way to Greenland and caught 80,000 pounds of codfish. She left Greenland July 28, having been there since July 14. This is the shortest time-trip ever made to Greenland, and by far the shortest stay on that coast.

ICELAND HALIBUT FISHERY.—Three vessels are engaged in the Iceland halibut fishery. They left Gloucester May 20, 22, and 24. They are the schooners Alice M. Williams, David A. Story, and the Concord. No definite information has yet been received from this fleet, although from meager reports it is expected they will secure full fares. The weather has been favorable. Will write about the trips as soon as they get home. They are expected any time now.

SWORDFISH FISHERY.—The fishery for swordfish off the New England coast this season is very prosperous. The fleet numbers 42 sail, hailing from ports all the way from Newport to Portland. The fishing began at the usual time and is likely to continue through this month. A number of the fleet have landed their catch here and found ready sale. In August 85 swordfish, weighing about 24,000 pounds, were shipped from here to New York and other markets. The first arrival here was on July 28. The fish were caught on Western Jeffries, and sold at 10 cents per pound. The fare was 28 fish, which averaged about 320 pounds each. This makes 113 swordfish landed here fresh, weighing about 33,000 pounds. The largest fish weighed 613 pounds, exclusive of head and tail, and was one of the first lot brought here. The price during August was from 4½ to 5 cents per pound fresh, or $12 per barrel salted. The salt ones were landed by mackerel vessels—about 20 barrels, or about 4,000 pounds, being the catch thus far of the mackerel men. This amount may be added to the 33,000 pounds of fresh. The weight of the fresh fish, as given above, is exclusive of heads, swords, and tails, so that the live weight of the fish would be much greater.

The season began off Block Island and gradually worked eastward, striking the southern part of George's and then across George's, and on the shore grounds, particularly Jeffries' Bank, where all of those landed here were taken. I have talked with the skippers of the vessels and they say this is the best year they ever had, both because the fish are plenty and prices good. The captain of the Village Belle, of Newport, who was here last week, Wednesday, said he caught 31 swordfish in a week's cruising off Noman's Land, all big fellows, and in one day he had 7 fish struck and captured. He sold the catch at Newport, as did many of the other vessels. He had just come here from his cruising south of Cape Cod. The fleet has been north of Cape Cod for the past fortnight or three weeks, and they are now cruising from abreast of Boone Island to Mount Desert Rock. The schooner Morrill Boy, of Gloucester, Capt. Russell Gill, fitted out for swordfishing July 16, and has landed since that date 40 swordfish, about 13,000 pounds, without heads and tails, realizing 5½ cents per pound at Portland. The fleet now land much of their catch at Portland, which is the only market east of here. Some go to Boston. The only other landing places that I know of are New Bedford and Newport. I will report any further information I can gather about this fishery.

MACKEREL.—Mackerel are very abundant on the New England coast, though small in size. The price is very low, only $3.50 per barrel, including the barrel—that is before they are packed. In the bay of Saint Lawrence, Gloucester mackerelmen have in some cases done well, securing full fares of large fish that sold for $10 to $11. The catch by the Gloucester fleet in the bay in August was between 7,000 and 8,000 barrels as against 33,000 barrels on this shore. The season bids fair to be a great one for mackerel. During the last few days they have been close in shore about Cape Ann. Traps along shore hereabouts taking large quantities were full of mackerel this morning, but no sale for them, as the canneries here have shut down. The cannery of J. J. Burns & Co. is probably permanently closed and the firm in litigation with numerous parties—a regular failure resulting from poor management. The factory of James G. Tarr & Bro. is closed for a short time on account of the low price of the canned product.

GLOUCESTER, MASS., *September* 2, 1884.

The past week has been a busy one in some branches of the fisheries, particularly the mackerel fishery and the swordfish fishery. In the George's Bank codfishery the number of arrivals has been twenty-four, with fair trips. From the Grand Bank there have been several arrivals with full fares. The second vessel of the Greenland fleet to arrive reached here September 1 with 90,000 pounds flitched halibut and 50,000 pounds of cod. The sword fishermen have landed about 200 fish during the week, and report them still abundant westward of here.

The vessels in this fishery now number about 100 sail and are largely bakers, belonging along the Maine coast.

Mackerel have been very abundant, a large fleet arriving daily with full fares. The number of vessels arrived here the twenty-four hours with mackerel has been 39, with 12,230 barrels; of which 10,909 barrels were shore catch, and the rest taken in the Bay of Saint Lawrence. About 20 vessels are now in the bay. The catch there this year by the American fleet, numbering 49 sail, has been between 12,000 and 13,000 barrels.

GLOUCESTER, MASS., *September* 8, 1884.

215.—TRAPPING GASPEREAU IN TANGIPAHOA RIVER.

By J. DOCK. HARRELL.

[From a letter to Prof. S. F. Baird.]

We are also beginning to note the increase of the gaspereau in our river. Previous to the war they were plentiful. but during the war there was a system of trapping inaugurated, which in a few years almost exterminated them. They are white, resembling the buffalo in shape, and have been caught here weighing from 20 to 50 pounds. They have two bones imbedded in their head that seem to have no connection with any organ of the head whatever. They have been caught this size by means of a trap known here as a wing-dam trap. This is built with a strong fall to the mouth and latticed to allow the water to pass through; fingers extend back of the fall-board which prevent the fish from taking any side advantage of the current and force of water produced by the fall-board. The trap is generally placed in the middle of the river in shallow water, and a dam constructed on each side to the bank is built of stakes and brush in the shape of a letter V, with the trap in the center where the wings join. The dam is built to raise the water to a depth of 3 to 4 feet above, and allows no fish to proceed down stream without being caught. A current is produced in front of the trap so that if one of any size stops within 3 feet of the mouth of the trap, in the twinkling of the eye he feels himself going over the fall-board. Then there is no chance in the world for him to save himself. This is a system of trapping that should be a direct violation of the law.

Bass* are found to be on the increase here, and are discovered in numbers from 3 inches long upward. They are very game when hung with a hook.

OSYKA, MISS., *August* 1, 1884.

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*A specimen sent was pronounced by Dr. Bean to be the fresh-water drum or sheepshead (*Haploidonotus grunniens*).—C. W. S.

Vol. IV, No. 29. Washington, D. C. Oct. 1, 1884.

216.—ON MANUFACTURED FOOD FOR TROUT AND CARP.*

By Dr. C. O. HARZ.

FOOD-FLOUR (*Futtermehl*).—The component parts are the same as in the food cylinders (*Futter zylinder*), but its looks indicate a less degree of decay and worthlessness. Here, likewise, the presence of articulates can easily be proved. The meat-flour (*Fleischmehl*) does not play such a prominent part, and after the food has been weighed several times, it may possibly form one-third of the whole. Peas and corn can easily be distinguished and considerable quantities of other cereals can be noticed. On the basis of my extensive and careful examinations I think I can state with certainty that the two kinds of food in question are composed of the following ingredients:

1. The cylinder-food consists of:

	Parts.
Ground meat (including articulates)	60 to 65
Rape or linseed	5 to 10
Corn	9 to 10
Peas	9 to 10
Flour, among it some oat-meal	5 to 10
Cooking-salt	10

2. The food-flour (*Futtermehl*) consists of:

	Parts.
Ground meat	30 to 35
Rape or linseed	19 to 21
Corn	9 to 10
Peas (or vetches)	18 to 22
Flour and oats	18 to 22
Cooking-salt	1 to 2

For the preparation of fish-food I would (on the basis of the analysis of the food referred to above) recommend the following receipts:

1. For cylinder-food, take—

	Pounds.	Price of the best quality.
		Marks.
Ground meat	65	9.75
Ground linseed	3	30
Rape-seed flour	2	20
Coarse corn flour	10	65
Peas	10	80
Coarse flour (if possible, wheat)	10	95
	100	12.65 [$3 10]

**Ein Fischfutter zür Forellen und Karpfen.* From the *D. F-Z.*, Vol. VII, No. 14. Stettin, April 1, 1884. Translated from the German by HERMAN JACOBSON.

This mixture, with the addition of 10 pounds of cooking-salt and water, is kneaded into a stiff, tough paste, and by means of a sausage-squirt, with an opening the size of a thick lead-pencil, laid out on boards which are sprinkled with flour, and there allowed to dry. It is possible that an addition of ground cockchafers will make the food more enticing for the fish and it is worth while to try it. In that case one might use 50 pounds of ground meat and 15 pounds of cockchafers. The corn might be replaced by peas or field beans, which are cheaper and much more nutritious, and the food would doubtless be improved thereby.

2. For the food-flour (*Futtermehl*) take—

	Pounds.	Price of the best quality.
		Marks.
Ground meat	30	4.50
Linseed flour	5	50
Rape-seed flour	15	75
Corn	10	65
Peas	20	1.60
Grain, flour	20	1.90
	100	9.90 [$2.33]

To every 100 pounds of the mixture as much as 10 pounds of common salt should be added.

If we examine the quality of the articles of food analyzed above, as to their chemical composition, and especially as to the quantity of particularly valuable substances contained in them, we arrive at the following result:

There are contained in—

	A.—Cylinder-food.	*B.*—Feed-flour.
	Per cent.	*Per cent.*
Proteine	53	35
Fat	10	12
Hydrates of carbon	16	30

According to Dr. E. Wein, the practical value is as follows:

A. $[(53+10)\times 16]+[16\times 3.2]=$ 10 marks, 59 pfennigs [$2.52].

B. $[(35+12)\times 16]+[30\times 3.2]=$ 8 marks, 48 pfennigs [$2.01].

But, as was stated above, when we buy the ingredients we must pay 12.65 marks [$3.01] for cylinder-food, and 9.90 [$2.33] for feed-flour. We refer here, of course, to the best quality, for an inferior article may be bought from dealers for 22 marks [$5.23]. Under these circumstances there is of course no prospect of making it pay to raise fish on these substances.

In food suitable for fish-culture one looks, of course, for a certain percentage of albuminous matter, fat, and hydrates of carbon; but in using the different ingredients one should see to it that there is not too great a difference between their practical value and their price. It will be found to be exceedingly injudicious to use corn for this purpose. For corn, oats, or rye may be at any time substituted to advantage; for, according to Dietrich and König, there are, on an average, contained:

	Proteine.	Fat.	Hydrate of carbon.
	Per cent.	*Per cent.*	*Per cent.*
In corn	8.09	3.5 to 4.05	65.43
In rye	13.31	1.96	65.16
In barley	12.09	2.09	64.97
In oats	12.66	6.09	54.30

Corn costs at present about 6½ marks ($1.54) per 100 pounds, while the other three cereals may be bought for from 4 marks 30 pfennigs ($1.02) to 5 marks ($1.19).

Instead of linseed or rapeseed, sesame cake may be used to advantage, which costs only 5 marks ($1.19) per 100 pounds, and contains 33 per cent. albumen, 13 per cent. fat, and 24 per cent. substances free from nitrogen. A pound of fat or a pound of albumen would therefore cost only 10 pfennigs (2.3 cents), and a pound of hydrates of carbon only 2 pfennigs. In order to make the mixture more binding it will be found advantageous to add a few kilograms of linseed cake per 100 pounds.

Peas may be entirely omitted, or the cheaper vetches may be substituted for them. A portion of the ground meal might also be omitted, or be replaced to advantage by cockchafers. Dried cockchafers can easily be procured for 9½ marks ($2.26) per 100 pounds, while ground meal costs 15 or 16 marks ($3.57 to $3.80) per 100 pounds. The composition of both these articles is very similar.

According to Dittman, dried cockchafers contain—

	Per cent.
Proteine	66.5
Chitine	4.52
Fat	16.06
Particles of ashes	4.52

while ground meal contains, according to Dietrich—

	Per cent.
Water	8.86
Proteine	75.06
Fat	12.30
Ashes and sand	2.30

According to Pott—

	Per cent.
Water	10.48
Proteine	72.46
Fat	12.42
Ashes and sand	4.88

And according to J. Lehmann—

	Per cent.
Water	10.14
Proteine	73.52
Fat	12.70
Ashes and sand	3.77

As with domestic animals, so with fish, favorable results can be looked for only if the food is fresh and of the very best quality. The outlay for this food should be as little as possible, for otherwise, taking into consideration the great difficulties connected with the raising of fish, the use of artificial food will hardly repay the trouble.

I would, therefore, advise fish-culturists to buy the necessary ingredients and mix their own food; then they will know what they have and can draw correct conclusions from the results, and, if necessary, make improvements in the food. Food bought at random has always two great defects. In the first place one does not know its component parts, and in the second place it is possible that the component parts are of the most inferior quality.

I would strongly recommend to fish culturists the following mixture:

FORMULA.

	Pounds.	Percentage of—		
		Proteine.	Fat.	Hydrates of carbon.
Ground meat	60	44.50	7.20	0.90
Sesame cake	20	6.60	2.60	4.60
Linseed cake	4	1.12	0.30	1.30
Oats	16	1.92	0.96	8.64
Total	100	54.14	11.06	15.44

TABLE OF COST.

Practical value.		Value in marks.	Cost in marks.
Ground meat, 60 pounds, containing	44.5 per cent. albumen =44.5 × 16=7.12 7.2 per cent. fat = 7.2 × 16=1.15 0.9 per cent. hydrates of carbon= 0.9 × 3.2	8.29	9.30
Sesame cake 20 pounds, containing	6.6 per cent. proteine 2.6 per cent. fat = 9.2 × 16=1.47 4.6 per cent. hydrates of carbon= 4.6 × 3.2=0.14	1.61	1.00
Linseed cake, 4 pounds, containing	1.12 per cent. protiene 0.3 per cent. fat =1.42 × 16=0.22 1.3 per cent. hydrates of carbon=1.3 × 3.2=0.04	.26	.40
Oats, 16 pounds, containing	1.92 per cent. proteine 0.96 per cent. fat =3.22 × 16=0.51 8.64 per cent. hydrates of carbon=8.64 × 3.2=0.27	0.78	1.07
Total		10.94 [$2.60]	11.77 [$2.80]

The difference between the practical value and the price is therefore very small, and the expense can be still further reduced if a portion of the ground meat is replaced by cockchafers and a portion of the oats by cheap flour.

217.—ON MANUFACTURED FOOD FOR TROUT AND CARP.*

By CARL NICKLAS.

There has lately been published an article by Prof. C. O. Harz, giving the results of his microscopic examination of my food for trout and carp manufactured by Louis Goos, of Heidelberg. These results astonished me, for Dr. Harz has found in this food, with the exception of ground meat, all sorts of ingredients except those of which it is composed. The following sentence is characteristic of the entire examination: "I was not able to arrive at any definite results as to the presence or absence of linseed."

In order to be absolutely certain that Goos had manufactured the food in strict accordance with my receipt, I informed him of Dr. Harz's examination, requesting him to have the food, which had already been chemically examined at Marburg, also analyzed microscopically. I give below the result of this analysis:

MARBURG, *May* 9, 1884.

Mr. LOUIS GOOS, *Heidelberg* :

The specimen of fish-food transmitted November 3, 1883, by the Association for Furthering Fish-culture in the district of Kassel (Mr. Georg Seelig, in Kassel), when examined March 25, 1884, was found to contain—

	Per cent.
Water	13.34
Proteine substances	46.75
Fat	10.50
Hydrate of carbon	16.87
Wood-fiber	1.60
Mineral substances	10.83

This fish-food, according to the microscopical examination, is mainly a mixture of ground meat (meat-flour), an article of food which at present is used very extensively in agriculture, and flour prepared from the fruits of leguminous plants (probably vetches); its ingredients are, therefore, highly nutritive. Wheat and oats occur in small quantities, and indeterminable substances in exceedingly insignificant quantities.

PROF. DR. DIETRICH,
Director of the Experimental Agricultural Station.

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* "*Ein Fischfutter für Forellen und Karpfen.*" From the *Deutsche Fischerei-Zeitung*, vol. vii, No. 23; Stettin, June 3, 1884. Translated from the German by HERMAN JACOBSON.

I can accept this as a correct result, because it does not expect more from the microscope than that instrument can accomplish, and leave it to my readers to compare it with the result obtained by Dr. Harz. It is evident that insignificant quantities of indeterminable substances cannot be avoided, and every farmer knows that even if he cleans his grain ever so carefully some particles will slip in which do not belong to it.

Dr. Harz's article, however, causes me to make the following statement: To avoid mistakes I must state that the "food-flour" which Dr. Harz examined is no fish-food—would, in fact, be very expensive if used as such—but a dog-food manufactured by Goos for many years. I therefore need not consider it at all in this connection.

I was greatly surprised by Dr. Harz's statement that the food, after having stood in a room for twenty-four hours, developed a peculiar, disagreeable odor. From my own experience I must term this as pure imagination, for I kept this food for at least six months in my study, partly in small pieces and partly in open cigar-boxes, and I could never discover even the slightest odor. Since I moved into my present quarters—in October, 1883—I keep this food in my garret, and although it has become damp during winter, I cannot discover any odor whatever. I also keep a small quantity in my room, for feeding the fish in my aquarium, and cannot notice any odor. It is possible that the food examined by Dr. Harz had for some time been kept in a damp cellar and become infested with roaches and other vermin, which would to some degree explain the result of his examination and the odor.

Owing to the nature of the ingredients which Dr. Harz thinks he has discovered in the food, he has come to find it expensive, for which, however, I cannot blame him very much, since in my article "on the artificial feeding of carp"* I made use of the expression, "I have not taken into account the cost of producing the food, thus placing it at a much lower price." I have corrected this mistake in my article on the same subject in the *Bayerische Fischerei-Zeitung*, 1883, No. 1, 19–23, and I would recommend Dr. Harz to study this article. He has, moreover, not taken the salt into account. On the other hand Dr. Harz's erroneous calculation may be excused by the circumstance that he has based it on the cheap ingredients of the food, as erroneously found by him, while it consists of comparatively expensive materials. If Dr. Harz will take into account the cost of production and the salt, and consider that the manufacturer wants not only to make the interest on the capital invested in buildings, machinery, implements, &c., but also some net profit, he will hardly find Mr. Goos's price too high.

A person who manufactures the food himself will of course obtain it cheaper than if he buys it; but whether the gain will pay for the labor is a question which will be answered differently according to circum-

* F. C. Report 1882, p. 1009.

stances. For a person who needs but little of this food it may be advantageous to manufacture it himself; if he does this, he is not bound to follow the receipt for my food as manufactured by Goos, but he will find in my article referred to above several receipts, and may make different combinations based on my standard. There will be less doubt of fish taking kindly to this food than to that made according to Dr. Harz's receipt. But persons who have to use the food in their ponds by the hundred-weight—and in preparing my food I principally looked to feeding on a large scale, for which purpose the food should be made so as to keep for a long time—will, I think, do decidedly better to buy the food than to manufacture it themselves. It involves a considerable outlay for machinery, implements, and labor. Leaving out of the question the matter of expense, it will prove more advantageous to buy the food, because the fish will then always get the same kind of food, which is of some importance. A change of food is invariably followed by a temporary decrease in the weight of the fish.

I shall not follow Dr. Harz in his theoretical digression on the practical value of my food, as this would lead me too far; and I will only state in this connection what I said as early as 1879, in my work, "Agricultural double book-keeping and its relation to the income of farms," on page 30, on the practical value, which is of a relative character and cannot, as E. Wein does, be expressed in absolute figures, such as those employed by Dr. Harz in his calculations.

Briefly stated, the "practical value" of an article of food (or in fact of anything) is represented by the net gain over its price, obtained by using it, when it may be said to meet the requirements and circumstances of the buyer; while the "value of an article when bought" (*ankaufs wert*) is a price which yields a net gain above the mere price paid for it. This applies to my fish-food, as I believe I demonstrated in the article referred to, by figures, even if only approximately. Proof of this is furnished in Harz's article where he says "that the food has found great favor, and enjoys an excellent reputation among practical men." Dr. Harz finally thinks that he is rendering a great service to fish-culturists by recommending to them for fish-food a mixture of sesame, lindseed-cake, and oats. As regards the qualitative chemical combination Dr. Harz has followed my standard of fish-food, and nothing can be said against him in this respect; but I have serious doubts whether trout will eat sesame and linseed-cake, or oats. At least I have never heard that they eat anything of the kind. It may be possible that carp will eat such food. It is therefore doubtful whether fish-culturists when having my food and other kinds of food which have stood a practical test will venture to experiment with it.

MUNICH, BAVARIA, *May* 20, 1884.

218.—BRIEF NOTES UPON FISH AND FISHERIES.

By CHAS. W. SMILEY.

[*Mainly extracts from the official correspondence.*]

THE FISHERIES OF SYRIA.—The fisheries along the coast of Syria are neither extensive nor important, the fish caught being of inferior quality. Roach, mullet, and tunny are the principal varieties, and may be taken in all seasons of the year. Fishermen are few, and the amount of capital invested in boats and fishing tackle is small. The fisheries controlled by the governor of Beirut are leased to the highest bidder annually, who receives 20 per cent. of the value of all fish caught in his district. Last year the lessee paid $3,280, which sum forms part of the sum appropriated to defray the expenses of the court presided over by the local governor. The value of the fish is estimated at $20,000. A coarse sponge is found near Beirut, but little attention is given to sponge-fishing on the Syrian coast. (From reports of the consuls of the United States on the commerce, manufactures, &c., of their consular districts, page 641.)

CARP FOR SALE.—Mr. L. H. Pigg, editor of the Pittsylvania Tribune, Chatham, Va., writes under date of September 6, 1884, that he has 150,000 young carp for sale at the following prices:

For 100 carp, 2 to 5 inches long	$5
For 500 carp, 2 to 5 inches long	$20
For breeders, per pair	$2 to 5
For a five-gallon transportation can	$1

Mr. Pigg obtained 25 carp from the United States Fish Commission November 11, 1881, and 20 more November 8, 1882.

THE FISH-CATCHING BLADDERWORT.—Prof. A. S. Minot, of Boston, states that he has observed young fish trapped by *Utricularia* when at large in the natural condition.

Mr. C. J. Bottemanne, of Bergen-op-Zoom, Netherlands, calls attention to the following record on this subject: In the "Physiologie of Plants" of Prof. Hugo de Vries, Amsterdam, C. L. Brinkman, 1880, I find, page 205, that *Utricularia vulgaris* "if a small water animal swims against one of the bladders it is caught at once;" and page 206, "if a branch with leaves of *Utricularia* is put in a glass of water with plenty of animal life, after a few hours every bladder has caught one or more of them."

He adds: Ever since, I have taken the *Utricularia* as eaters of fish embryos, as I call the newly hatched fish till they have got their proper form and are able to care for themselves, and was under the impression every one knew it, as the book was printed for the use of the higher class of schools (viz, *Uoogere, Burgerscholen*).

219.—THE CANADIAN FISHERIES.

By L. Z. JONCAS.

[Abstract of a paper, read before the British Association for the Advancement of Science at its Montreal meeting, August, 1884.]

The paper begins with some general reference to the importance of the subject, and with a quotation from a report by the Hon. Peter Mitchell, the first minister of marine and fisheries, whose thorough knowledge of every branch of that department, and whose zeal and ability in the application of that knowledge to the performance of his duty as minister, made it one of the most important under the Government. The writer then proceeds to deal with the extent of Canada and of its fisheries: "Bounded by three oceans, on the north by the Arctic, on the east by the Atlantic, and on the west by the Pacific Oceans, it has over 5,500 miles of maritime coast, washed by waters abounding in the most valuable fish of all kinds. Of its numerous inland seas we may mention the Hudson Bay, the Strait—which would be better named a sea—of Davis, the Gulf of Saint Lawrence on the Atlantic Ocean, the Polar Sea, and Baffin's Bay on the Arctic Ocean. We might also mention the Straits of Belleisle, of Canso, and Northumberland, and the Bay of Chaleurs, in the Gulf of Saint Lawrence, the Bay of Fundy between Nova Scotia and New Brunswick, and the Gulf of Georgia between Vancouver and the mainland of British Columbia. In addition to which are the Lakes Superior, Huron, Erie, and Ontario, the largest of many others, great inland seas, the area of which is equal to 27,000 square miles." Mr. Joncas points out that, excluding the great inland seas of the Northwest Territory and the sea-coast of British Columbia, whose fishery resources have not yet been fully developed, the older Provinces of Ontario, Quebec, Nova Scotia, New Brunswick, and Prince Edward Island, have 2,500 miles of sea-coast and inland seas, besides smaller lakes and rivers abounding in fish of great commercial value. "Whether, therefore, we regard them as being abundant and important for domestic use, or in their much larger import as a valuable resource, capable of ever-increasing development and limitless reproduction, employing an amount of capital reckoned by many millions of dollars, and engaging the labor of hundreds of thousands of persons; encouraging maritime pursuits, fostering commercial marine, promoting foreign trade, keeping always and productively in active training an independent spirited class of sea-faring men, the teeming waters of the British-American possessions present to our view a national property richer than any moneyed estimation could express."

Coming to the question of the value of the fisheries, Mr. Joncas claims that they are the richest and most profitable in the world. According to the reports of the fishery department the value of Canadian fish product in 1870 was $7,573,000; in 1880 it had increased to $14,500,000, and by the latest report, that for 1883, it had reached $17,500,000. He points out that although our system of inspection and oversight, and our method of collecting statistics have greatly improved, they are still necessarily imperfect, and do not include the enormous catch which goes on by settlers for their own consumption; and he claims that the $17,500,000 can be considered as representing only the fish prepared for export or sold on the Canadian markets. He estimates the value of fish caught and consumed by the native population of Manitoba, the Northwest, and British Columbia at $5,000,000; and of the other provinces of the Dominion at $14,000,000, making in all the sum of $36,000,000 as the annual value of the fish exported and used for domestic consumption in the Dominion. The paper then goes on to prove by comparison that "the fisheries of British North America are the most productive of the whole world." In Canada we have 50,000 men regularly employed in the fisheries; their labor, as seen by the last official return, produced fish to the value of $17,500,000, or $350 for each fisherman. Great Britain employs 113,640 men, and their labor, according to the figures given by H. R. H. the Duke of Edinburgh, produces 615,000 tons of fish, representing a value of $35,000,000, or $309 for each fisherman, a difference in favor of the Canadian of $41. In the United States are employed 132,000 fishermen, the catch being valued at $44,500,000, or $337 per man, a difference in favor of the Canadian fishermen of $13. It is pointed out that an important part of the $44,500,000 worth of fish taken by the United States fishermen were caught in Canadian waters. "It must also be noted," Mr. Joncas remarks, "that on account of the severity of our climate our fisheries can only be worked about seven months in the year, from the beginning of April to the end of October, so that the Canadian fisherman earns in seven months $41 more than the English fisherman, and $13 more than the fisherman of the United States, who work from January to December."

The conclusion of the writer is that the Canadian fisheries have not yet reached 25 per cent. of their possible development, a fact due in some part to the inferior equipment heretofore employed in the fisheries as compared with that employed in United States and British fisheries. In this respect, however, improvement is taking place. "Owing to the encouragement given by our public men during the last years, the building of Canadian fishing craft has progressed rapidly. The swift schooners of Nova Scotia, New Brunswick, and of the other maritime provinces, can already by their sailing qualities compete fairly with the American fishing vessels, reported to be the best of their class in the world." Reference is made in the paper to the use of the steamers now used in our lakes, in the fisheries, to the sums of money spent by the Government annually in building harbors of refuge and light-houses, and to the bounty of $150,000 annually given to the encouragement of the fishermen, and a strong appeal is made for still further encouragement. Replying to the question as to the possible exhaustion of the fisheries by their greater development, the writer states that fresh-water fisheries, such as salmon, trout, whitefish, &c., and the sea shell-fisheries, such as oysters and lobsters, may be with time exhausted by indiscriminate fishing, and he points out that these fisheries should be protected by severe and thoroughly enforced regulations. These regulations are in force in Canada, and are producing good results. He claims, however, without saying that protective regulations are unnecessary in the case of the sea fisheries, those of cod, mackerel, herring, &c., that it is impossible to exhaust them, or even to appreciably lessen their numbers by the means of fishing now in use, especially if protecting them during the spawning season, we are content to fish them from their feeding-grounds; and in proof of this he cites the fact that for 300 years fishing in the Gulf of the Saint Lawrence has been going on without diminishing the supply of fish; on the contrary, every year "millions are added to the millions caught before." It is admitted that in certain localities there may be an apparent decrease at certain seasons, but this is due to accidental causes. "The changes in the migration of fish may be due to the temperature; to the currents or to the disappearance from certain places of those myriads of small fish which serve as food to the cod and other fish. It must also be remembered that fish are erratic in their habits, and that they are plentiful to-day in localities where they had not been seen for many years." The fecundity of cod, herring, and mackerel negatives the idea of exhaustion, and reference is made to the report of the royal commission, presided over by Professor Huxley, as establishing the same fact. The law of compensation in nature, by which portions of the world more favored for agriculture by climatic conditions, are compensated for in our northern climes by immense fish preserves, the great fishing interests being, as stated by Hervey, "dependent on the Arctic current as the farming interest is on the rain and sunshine which ripen the crops." The Arctic seas and the great rivers which they send forth are swarming with minute forms of life, constituting, in the words of Professor Hind, in many places a living mass, a vast ocean of living slime; and the all-pervading life which exists there affords the true solution of the problem which has so often presented itself to those engaged in the sea fisheries, where the food comes from which gives sustenance to the countless millions of fish which swarm in the waters of Labrador and Newfoundland and in the Dominion and United States waters. It is computed that while the cold water area subtending the coast of the United States is about 45,000 square miles, that subtending the British American shores is 200,000 square miles, a proof of the superior value of the British North American fisheries. Only one-half of our 5,000 miles of sea-coast has been properly worked. The most important of the deep-sea fishing grounds are the Atlantic coast of Nova Scotia from the Bay of Fundy round the southern part, around the coasts of Cape Breton, New Brunswick, and Prince Edward Island, embrace the Bay of Chaleurs and the Gaspe coast, and extend to the island of Anticosti, the Labrador, and the Magdalen Islands, and along this coast the cod, the herring, the mackerel, the lobster, and numerous other fisheries of less importance are carried on successfully.

THE COD-FISHERY.—Last year the catch amounted to 1,611,586 quintals, valued at $6,366,000, adding to which cod sounds and cod oil to the value of $225,555, we have a total, as the value of the cod-fishery last year of $6,591,555, divided as follows:

Nova Scotia	$3,977,599
Quebec	1,778,290
New Brunswick	716,496
Prince Edward Island	119,170
Total	6,591,555

And in this sum is not included the quantity consumed by the twenty thousand families engaged in this industry. The cod-fishing season varies somewhat in the different provinces, but may be said generally to be from April to November inclusive. Some interesting particulars are given as to the mode of carrying on the cod-fishing, especially as to the catching of the caplin as bait, it being stated, as illustrating the immense shoals of caplin that fill the bays, "that a man standing inshore, with a casting net, will often fill a cart in less than an hour; with small seines a couple of men can fill a small boat in about the same time." These caplin are of considerable commercial value. On the disappearance of the caplin about the end of June, the launce, the herring, the mackerel, the squid, the smelt, the clam, &c., are used as bait. The cod being mostly taken by hand lines and set lines, the cost of bait is great, being estimated at one-fourth the value of the cod taken. With the view of decreasing this proportion, the example of Norway, where the gill-net is largely used in the cod-fishery, is recommended to be followed. It is found to be much more profitable than fishing with set lines or bultows. The cod-fishing is carried on in Canada either in vessels of a tonnage of from 60 to 100 tons on the Great Banks or in open boats at a few miles from the shores. Vessels employed in the fishery are manned by from ten to thirteen men, the owner of the schooner, who also supplies all necessary fishing tackle, receiving half the catch. In Quebec and Prince Edward Island the fishing is carried on chiefly in open boats, and hence at great disadvantage, so much so that the reports show a noticeable diminution in the quantity of fish caught in the Province of Quebec during recent years, a fact which induces Mr. Joncas to urge very strongly improvements in fishing vessels and gear, and the abandonment of the vicious supplying system by which advances in food and clothing are made to the fishermen at the commencement of each season, leaving, as it does, the fishermen almost constantly in debt. The principal markets for dry codfish are Italy, Spain, Portugal, Brazil, British and Spanish West Indies, and the United States. The finest cod in all America, it is claimed, is cured on the coast of Gaspe, in the Province of Quebec, where the effects of the mists generated by the Gulf Stream are least felt. According to latest statistics, the West Indies paid us for dried codfish $2,000,000, United States over $500,000, Brazil $500,000, Europe $500,000, and British Guiana $250,000. The incidents of the cod-fishing are very valuable. Oil is taken from the liver; the head, tongue, and sounds form a good article of food; the offal and bones are converted into an excellent fertilizer; the roes are used as a bait for the sardine fisheries of France and Spain, and the swimming bladder is converted into isinglass. Great regret is expressed by the writer at the absence of enterprise in the Province of Quebec for the utilization of these incidents of the cod-fisheries, and some interesting facts are given in order to prove how valuable a resource they might be made.

THE HERRING FISHERY.—This, excluding local consumption, and the quantity used for bait, was valued at $2,136,000. This sum, although considerable, represents only to a small extent what this industry is capable of in the matter of development. In the Province of Quebec, with its ten thousand fishermen, 1,100 miles of maritime coast, numerous bays, famous for their abundance of herring, the annual export of herring does not reach 2,000 barrels. The writer's opinion is that the export of herring, if the industry was properly encouraged by capital and developed, would easily reach from $5,000,000 to $6,000,000 annually, and he bases this opinion upon an examination of what has been and is being done in Great Britain, France, Holland, and other countries. As soon as the ice disappears in the spring the herring come in in immense shoals. Those caught early in the season are less valuable than are those caught between the months of August and December. The former are sent chiefly to the West Indies, the latter, carefully gutted, are packed for the United States and European markets, the best being the celebrated Labrador herring.

The following was the export of herring in 1882:

Pickled, 423,042 barrels	$1, 739, 943
Smoked, 1,060,416 boxes	311, 807
Fresh, 16,050,000 pounds	83, 533
	2, 135, 383

THE MACKEREL FISHERY.—This fishery in Nova Scotia and New Brunswick particularly is steadily improving, the class of vessels now used bearing fair comparison with those used by American fishermen, which are said to be the finest in the world. The Quebec fishermen have, however, given but little attention to the mackerel fishing. "The mackerel is met with off the coast of Nova Scotia, in the Bay of

Fundy, in the Gulf of Canso, but nowhere is it more plentiful than in the Gulf of Saint Lawrence, off the coast of Prince Edward Island, in the Bay of Chaleurs, and in the numerous coves and bays formed by the group of islands called Magdalen Islands." The chief market for our mackerel is found in the United States, although some are sent to Great Britain and the West Indies. The annual value of the mackerel fishery, according to recent returns, is $1,250,000.

LOBSTERS.—The development of the lobster canning business has been very great in recent years. In Prince Edward Island there was in 1871 only one establishment; ten years later the number had increased to 120. There were put up on the island in 1871, 6,711 cans; in 1878, 1,649,800 cans, and in 1882, 6,300,000 cans. In 1870 New Brunswick had one canning establishment, putting up 20,000 cans, ten years later 6,000,000 were exported from the province to different markets. Nova Scotia exported 30,000 cans of lobsters in 1870, and 5,000,000 in 1882. Quebec is behind in this industry as well, producing last year but 800,000 cans of lobsters. There are to-day in Canada 600 establishments engaged in canning lobsters, the product of which is 17,500,000 cans, valued at $3,000,000, almost as much as the value of the product of our herring and mackerel fisheries combined. These figures represent 52,500,000 lobsters taken in Canadian waters in 1882. The number of lobsters taken in England does not represent 3,000,000 in each year. The ease with which the shell fisheries may be exhausted and the difficulty of reviving them has induced the Government to impose regulations for the prevention of indiscriminate fishing of the lobster on our coasts.

THE FRESH-WATER FISHERIES.—Coming to the fresh-water fisheries Mr. Joncas deals first with the salmon fisheries, and states that they show a tendency to gradual decrease, and this in spite of the regulations made by the Government limiting the fishing season, prescribing the implements that may be used, and providing by artificial breeding establishments, at great cost, for the replenishing of the rivers. He urges, without reflecting upon the devotion and intelligence of the present fishery overseers and guardians, that more should be appointed, and a more constant and effective protection thus afforded; and he urges moreover, that the angler, who indulges in fly fishing for sport, should be required to stop at the same time as the fisherman who fishes for a living is compelled to take up his nets. The salmon fishery, however, is far from exhausted. In 1882 Canada exported salmon, fresh, canned, and pickled to the value of $3,000,000. The United States is the principal market for fresh salmon and Great Britain of salmon preserved in tins. British Columbia is the most famous of the provinces for its salmon fishery, the industry having already assumed large proportions. In 1879 the catch was 3,000,000 pounds; in 1882 it had increased to 12,000,000 pounds. The capital invested in the salmon fishery of British Columbia is estimated at over $2,000,000. In addition to the canned salmon exported from British Columbia over 5,000 barrels of salted salmon have also been exported, the demand for the fish thus preserved being steadily increasing. Trout of all kinds abound in many Canadian rivers, and the best are the sea-trout and the salmon-trout. Whitefish and trout fisheries are carried on on a large scale chiefly in the lakes of Ontario. These lakes are properly called great inland seas, Superior covering an area of 31,000 square miles, and Erie, Huron, and Ontario combined, 52,000 square miles. Many rivers empty their waters into these lakes, and these abound in food-fish, the delicacy and flavor of which are well known; salmon-trout, whitefish, sturgeon, pickerel, pike, bass, perch, &c., abound in them. The fishermen of the Canadian lakes use gill-nets and trap-nets, and their vessels are either sailing boats of from 20 to 30 feet in length, or small steamers called fishing tugs, one advantage of the latter being the speed with which fish can be conveyed to railway stations to be transported in refrigerators to market. The produce of whitefish, trout, &c., from the lakes in 1882 was 4,500,000 pounds, sent fresh to market, besides 5,079 barrels of the same fish salted, 9,753 barrels of trout, and 41,380 barrels sturgeon, bass, pike, mukallonge, and other fish, making a total of 56,197 barrels, or a total of 15,739,700 pounds as the marketed products of the lake and river fisheries. There are besides these the river fisheries of the maritime provinces, giving an aggregate value for the fresh-water fishes of the Dominion of $4,000,000. The paper closes with some reference to the general commercial value of the fisheries, it being claimed that "the fisheries are not only important to us in consequence of the vast amount of wealth that can be drawn from the deep, apparently without diminishing or exhausting its source, but because by this means a body of able and hardy seamen may be found to conduct the commerce of a maritime country during peace and to become its gallant defenders on the ocean in time of war."

220.—ON THE ABUNDANCE OF HALIBUT NEAR ICELAND.

By Capt. J. W. COLLINS.

While in England, in the summer of 1880, after leaving the Berlin Fishery Exhibition, I was told by English fishermen, sailing from Grimsby, that they had often found halibut in extraordinary abundance while fishing for cod at Iceland. I was much interested in these statements, first because Capt. John S. McQuinn, of Gloucester, went to Iceland in the schooner Mambrino Chief, in 1873, on a "salt halibut" trip, and failed to get a fare—a result which until now has prevented other Gloucester fishermen from visiting that locality; and second, because I knew that, if halibut are as abundant in the waters around Iceland as they were represented to be by the Grimsby fishermen, American vessels might, by going there, make far more profitable voyages for flitches than they are liable to make on the west coast of Greenland.

Bearing this in mind, and considering it important to obtain as much knowledge of practical value to American fishermen as possible, I took every occasion while in London, in the summer of 1883, to gather additional testimony on this subject, from both the fishermen and vessel owners that visited the Fisheries Exhibition. Several of the latter had once been fishermen. Those with whom I conversed relative to this matter were among the most reliable and intelligent men of the class to which they belong. There was, too, such a remarkable similarity in the statements, each individual telling the same story, of the almost marvelous abundance of halibut about Iceland, that I felt certain that so many experienced fishermen could not all be mistaken or misled regarding a fish with which they are so familiar. Several told me that on some occasions they have been obliged to stop fishing for cod owing to the great numbers of halibut on the banks, since these fish were of no value to them, and actually proved a nuisance by destroying their gear. The Grimsby vessels which go to Iceland are welled smacks—locally known as "Codmen"—that fish with hand-lines for cod and ling, salting their catch until a few days before their departure from the fishing ground. The fish taken during the last two or three days' fishing are put in the well and kept alive for sale at the home port, the salted cod usually being sold at Faroe Islands.

I felt so sure of the correctness of the information I had obtained relative to the abundance of halibut at Iceland, that, while at Gloucester last winter, I called the attention of several parties to the matter, who were either fishermen or interested in the fisheries. Among others, I gave to Capt. John Dago a detailed statement of what I had learned from the English fishermen. In previous years Captain Dago had made several trips to Greenland for flitched halibut, and I have recently learned that, acting on the information I gave him, he has gone to Iceland this summer. Another schooner, the Alice M. Williams, from the firm of D. C. & H. Babson, of this city, has also gone on the same voyage. The question of the abundance of halibut at Iceland will be pretty definitely settled by the result of their cruises. Nothing definite has yet been learned of the success of these two vessels, but had they not met with a reasonably fair prospect for making a good catch, it is probable they would have been home before this.

If they meet with good success, a new field will be opened up to the enterprise of our fishermen, which at this time is of special importance owing to the scarcity of halibut on the banks, and the difficulties attending a voyage to Davis Straits.

I shall acquaint you with the result of those experimental trips when the vessels return home and the facts are made available. I have much confidence in a favorable issue.

GLOUCESTER, MASS., *August* 16, 1884.

Vol. IV, No. 30. Washington, D. C. Oct. 1, 1884.

221.—ARTIFICIAL SEA WATER FOR AQUARIA.*

By R. E. HOFFMANN.

In former years hardly any salt-water aquaria were found in inland countries, because the expense and trouble of furnishing a constant supply of salt water were too great. Even the Berlin aquarium, with its abundant funds, was so far from the nearest sea-coast as to make the supply of natural sea-water uncertain, and it suffered from this condition of affairs. The people of Berlin wittily called this chronic condition of their aquarium its "sea-sickness." Although every new institution has to pass through a period of so-called "children's diseases," this peculiar "sickness" of the Berlin aquarium proved very obstinate, and even threatened the life of the young and tender child whose birth had been hailed with so much joy. The Vienna aquarium had to pass through similar experiences, and the stockholders were obliged to pay dearly for the experiment. As matters stood at the Berlin aquarium, the use of artificial sea-water seemed very desirable; but many a well-planned experiment based on scientific principles proved a failure; for, although the component parts of sea-water are well known, and any chemist can easily prepare it from a receipt, it seemed at first impossible, in a chemical way, to breathe the "breath of God" into our scientific sea-water, and to impart to it the secret of true vitality. At last, however, long after the institution had been opened, Dr. Hermes succeeded in solving the problem in a scientific manner, and proved in the most incontrovertible way that the maintenance of inland salt-water aquaria was no longer dependent on the nearness of the sea-coast. Dr. Hermes succeeded in satisfying every demand, as regards sea-water, within one week.

The very bold assertion of the director of the zoophyte aquaria in the zoological garden in Regent's Park, London, that artificial sea-water, even if a chemical analysis cannot discover the least difference between it and natural sea-water, is never beneficial to animals and plants, has been disproved by the success of the Berlin aquarium. Since we have succeeded in manufacturing artificial sea-water which possesses all the qualities necessary for the life of animals and plants, and which, by the use of suitable apparatus, can be kept fresh for years, nothing prevents inland towns from having sea-water aquaria, which, in many respects, are peculiarly interesting.

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* *Ueber künstliches Seewasser für Aquarien.* From the *Deutsche Fischerei-Zeitung*, vol. vii, No. 30; Stettin, July 22, 1884. Translated from the German by HERMAN JACOBSON.

As sea-water aquaria have a great future in Germany and will rapidly increase in number if proper directions for their maintenance are given, I will describe the manufacture of the water in such a manner that any one can easily prepare it himself. To 50 liters (about 13¼ gallons) of pure hard well water take 1,325 grams (46½ ounces) of common salt, 100 grams (about 3½ ounces) of sulphate of magnesium, 150 grams (about 5¼ ounces) of chloride of magnesium (chlormagnesium), and 60 grams (about 2 ounces) of sulphate of potassium, all of which can be obtained at any drug store, but generally not entirely pure; and foreign admixtures and impurities may easily cause the death of all the animals. Each of these chemicals is dissolved in water by itself; afterward they may all be poured together and allowed to stand quietly for several hours, so that little stones and other impurities may settle to the bottom. All particles of dirt floating on the surface should be carefully removed by dipping. The mixture is then poured into another vessel and diluted with fresh water until the hydrometer indicates the proper degree of saltness. The quantities given above will produce about 50 liters (about 13¼ gallons) of sea-water.

This composition I have ascertained comes very near to that of natural sea-water, for, besides the component parts given above, it also contains small quantities of soda, iron, and potash. I obtain the chemicals for preparing my sea-water, which contains all the seven ingredients in their true proportions, from a friend of mine who is a chemist and am prepared to supply others. Most of the sea-water found in the market contains only the four first-mentioned salts, and is likewise suitable for filling the basin. One should be careful, however, not to put animals in such freshly manufactured sea-water, as this would almost beyond a doubt kill them. It is well known that sea-water is 0.027 gram heavier than fresh water; its weight is therefore 1.027. Everything in excess of this weight must be carefully corrected from time to time by pouring in fresh water as the water evaporates, while this is not the case with the salts. The solid ingredients of sea-water constitute about 3½ per cent. of its weight, or one-half ounce to a pound of water. A hydrometer is indispensable for ascertaining the degree of saltness.

Newly manufactured sea-water should be placed in the open air in some cool place, and allowed to stand for some time. If one has any live salt-water algæ adhering to stones they should be added, because they impregnate the water with oxygen. After some weeks the algæ will spread all round them clouds of diminutive seeds, which adhere to the walls and quickly grow under the influence of light. By supplying oxygen they make the water, after it has been filtered several times, still more fitted to receive animals. Of sea-plants, the green ulvæ and the confervæ are particularly suitable for recently manufactured salt water.

In the beginning only a few hardy animals should be placed in the water, which will flourish and thrive in it; and after awhile an attempt may be made with more tender animals, which, if placed in the water in the beginning, would probably have died. If no algæ can be obtained, the water should be allowed to stand longer. Any one who can afford to wait until a green cover of algæ spreads over the panes, will do well to defer placing the animals in the water till that time, and a little patience is very commendable during the entire process. Like wine, salt water, if properly treated, improves with age, as special apparatus continually supply it with oxygen by night, and keep it agitated. The water in the Hamburg aquarium has not been changed for fifteen years, and is still perfectly clear, transparent, and odorless, in short, of the very best quality; and all that has to be done is to make up for accidental losses or evaporation. The water of the salt-water aquarium is changed or filtered only when it begins to get turbid, or if some change is to be made in the arrangement of the aquarium. It will always be advisable, however, to keep at least a double supply of sea-water on hand, and place it in the cellar in well-corked bottles, as any sudden emergency will then be fully met.

I have never been able to obtain natural sea-water which was as clear as the artificial, through which one can see everything distinctly, even in the most remote corner of a large aquarium, which it would be very difficult to do in natural sea-water. I have brought up sea-water in a dipper, which, when poured into a glass, was as clear as crystal and had a brilliant blue color; but this is possible only on the high-seas, and when the water is brought up from a considerable depth. Fishermen take too little care and trouble in this respect; close to the shore they will dip up the water resembling a thick, yellow, and stinking juice, and ship it to other places. For this reason I use artificial sea-water prepared in the manner indicated above, and even without adding any plants, I succeed in keeping my animals alive.

It is self-evident that the principal point in constructing salt-water aquaria is the treatment of the water, which, after all, is the element which decides the well-being and sickness, life and death of the animals. Care should be taken to keep the water well supplied with oxygen, which is easily done by means of the aerating apparatus; and to see to it that the normal proportion between the salts and sea-water is always maintained, and as soon as anything appears to be wanting in this respect, it should be supplied. As soon as the water begins to get turbid, it should be filtered, and during an abnormal state of the weather it should be cooled. Only when these conditions are fulfilled, will it be possible to keep up a successful salt-water aquarium; only thus shall we be enabled to have in our rooms an exact representation of the bottom of the sea, with all its mysteries and wonders. I, therefore, repeat in conclusion, "The treatment of the water is the main thing."

BERLIN, GERMANY, *July* 22, 1884.

222.—THE OYSTER INDUSTRY OF THE WORLD.

By G. BROWN GOODE.

[Abstract of a paper read before the American Fishcultural Association.]

The oyster industry of the world is seated chiefly in the United States and France. Great Britain also has a few natural beds still remaining, and a number of well-conducted establishments for oyster culture which are supplied with seed oysters from continental oyster parks. Canada, Holland, Italy, Germany, Belgium, Spain, Portugal, Denmark, Norway, and Russia have also oyster industries, which are, however, comparatively insignificant, and in the case of the last two countries hardly worthy of consideration in a statistical statement.

Recent and accurate statistics are lacking except in two or three instances. A brief review by countries, in the order of their importance, was presented. The oyster industry of the United States was shown to employ 52,805 persons and to yield 22,195,370 bushels, worth $30,438,852, and that of France in 1881 employed 29,431 persons, producing oysters valued at $3,464,565; the industry of Great Britain yielded a product valued at from two to four million pounds sterling; Holland was shown to have a considerable industry in the province of Zeeland, and to have produced native and cultivated oysters to the value of $200,000; Germany has an industry on the Schleswig coast valued at about $400,000, while the products of other European countries mentioned were too insignificant to deserve a place in this brief abstract. An estimate of the total product of the world was presented as follows, the figures being given in the number of individual oysters produced:

United States	5,550,000,000
Canada	22,000,000
Total for North America	5,572,000,000
France	680,400,000
Great Britain	1,600,000,000
Holland	21,800,000
Italy	20,000,000
Germany	4,000,000
Belgium	2,500,000
Spain	1,000,000
Portugal	800,000
Denmark	200,000
Russia	250,000
Norway	250,000
Total for Europe	2,331,200,000

The oyster industry is rapidly passing from the hands of the fishermen into those of oyster-culturists. The oyster, being sedentary, except for a few days in the earliest stages of its existence, is easily exterminated in any given locality, since, although it may not be possible for the fishermen to rake up from the bottom every individual, wholesale methods of capture soon result in covering up or otherwise destroying the oyster banks or reefs, as the communities of oysters are technically termed. The main difference between the oyster industry of America and that of Europe lies in the fact that in Europe the native beds have long since been practically destroyed, perhaps not more than 6 or 7 per cent. of the oysters of Europe passing from the native beds directly into the hands of the consumer. It is probable that from 60 to 75 per cent. are reared from the seed in artificial parks, the remainder having been laid down for a time to increase in size and flavor in the shoal waters along the coasts.

In the United States, on the other hand, from 30 to 40 per cent. of all the oysters consumed are carried from the native beds directly to market. The oyster-fishery is everywhere carried on in the most reckless manner, and in all directions oyster-grounds are becoming deteriorated, and in some cases have been entirely destroyed. It remains to be seen whether the governments of the States will regulate the oyster-fisheries before it is too late, or will permit the destruction of these vast reservoirs of food. At present the oyster is one of the cheapest articles of diet in the United States, while in England, as has been well said, an oyster is usually worth as much as, or more, than a new-laid egg. It can hardly be expected that the price of American oysters will always remain so low as at present; but, taking into consideration the great wealth of the natural beds along the entire Atlantic coast, it seems probable that a moderate amount of protection will keep the price of seed oysters far below the present European rates, and that the immense stretches of submerged land along our coasts e-pecially suited for oyster-planting may be utilized and made to produce an abundant harvest, at a much less cost than that which accompanies the complicated system of culture in France and Holland.

223.—BRIEF NOTES UPON FISH AND THE FISHERIES.

By CHAS. W. SMILEY.

[Mainly extracts from the official correspondence.]

FISH-CULTURE IN OREGON.—Mr. B. F. Dowell, writing from Jacksonville, Oreg., August 30, 1884, says: The yearling trout at my ponds near East Portland are from 6 to 8 inches long, and those hatched this spring from 1 inch to $1\frac{1}{2}$ inches long. I now have about 7,500 lively fry. All are doing well. Two of my neighbors have commenced raising fish. I can get salmon eggs enough next season from the canneries at the mouth of the Columbia to feed my fish very cheaply. So far I have been feeding my trout on eggs from that place, and on liver from Portland. I am satisfied I can raise trout to perfection. I am now engaged in making the third pond.

Klamath Lake, Goose Lake, Back Lake, Crater Lake, Toule Lake, in this vicinity, and many smaller lakes in the Cascade range of mountains, are well calculated to raise large quantities of black bass and whitefish. The black bass particularly would be suitable to stock Toule Lake, Link River, and Lower Klamath Lake, where great quantities of suckers now abound. They would feed on the suckers and cause them to decrease. The black bass would increase very rapidly.

The German carp is a big, thrifty, bony fish, just like the big Indian suckers which now fill Toule Lake, and which run up Lost River in the spring into Oregon to its head. It is a good fish to supply food for the millions on a large and cheap scale; but the salmon, the black bass, grayling, trout, and whitefish, will always command a better price.

The Oregon legislative assembly has made two or three small appropriations for a fish ladder at Oregon City. It will take $12,000 or $15,000 to make a good permanent one, blasted out of the solid rock, and after the McDonald patent. The increase in the Upper Willamette would be worth four times the money in three years. There is no place on the Pacific coast better for salmon than the Willamette above the falls, but not a salmon can now ascend above Oregon City to spawn. The completion of this ladder and the introduction of black bass and whitefish into Oregon would be a lasting benefit to the citizens of Oregon. In time these three things would feed millions of people with the best of food. But few carp will be eaten when there is plenty of salmon, black bass, whitefish, and trout.

DECREASE OF GRAYLING IN AU SABLE RIVER.—Mr. D. H. Fitzhugh of Bay City, Mich., writing September 22, 1884, says the graylings put into Au Sable river some years ago are about exhausted. It is a very fine trout stream.

TO DESTROY MUSKRATS.—Dr. Hessel has been greatly annoyed by these pests. He has destroyed many. His mode is to suffocate them, as follows: Four pounds of sulphur mixed with half a pound of saltpetre finely pulverized, set on flat stones or a piece of sheet iron, say half a pound, or a pound to a hole (as it costs but a few cents), and placed in the holes; after burning a few minutes, close the holes with sods. The saltpetre insures the combustion of the sulphur, which is certain death to all within. Others have also tried it with success.

A LARGE BASS FROM THE POTOMAC.—September 20, 1884, Mr. J. C. Clagett, of Frederick, Md., caught in the Potomac, at Point of Rocks, a small-mouthed black bass, which was shown at the Health Office, and measured $23\frac{3}{4}$ inches in length, $14\frac{3}{4}$ inches around behind the gills, $16\frac{3}{4}$ inches at the dorsal fin, and weighed 6 pounds 10 ounces.

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