Shuman

S-54

UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. Krug, Secretary

FISH AND WILDLIFE SERVICE
Albert M. Day, Director

Special Scientific Report No. 54

A RECORD OF PILCHARD EGGS AND LARVAE COLLECTED DURING SURVEYS MADE IN 1939 TO 1941

by

Elbert H. Ahlstrom

Issued June, 1948

Washington, D. C.

CONTENTS

Page

Introduction and acknowledgments 1

Pilchard spawning survey of 1939 2

Pilchard spawning survey of 1940 4

Pilchard spawning survey of 1941 6

Description of the nets used 7

Measurement of volume of water strained by the nets. 10

Vertical distribution of pilchard eggs and larvae 18

Variation in depth of plankton hauls 22

Standardization factors 24

Enumeration of eggs and larvae. 24

Identification and separation of pilchard eggs and larvae . . . 28

Determining the average number of eggs spawned per day 30

Variability in plankton tow-net catches 31

Appendix A

Table I - Record of oblique hauls made with plankton nets during cruise 8 in 1939 40

Table II - Record of oblique hauls made with plankton nets during cruises 10-15 in 1940 41

Table III - Record of oblique hauls made with plankton nets during odd-numbered cruises 17-27 in 1941 . . . 47

Table IV - Record of pilchard eggs, 1939 52

Table V - Record of pilchard eggs, 1940 53

Table VI - Record of pilchard eggs, 1.0-meter net, 1941 . . 57

Table VII - Record of pilchard eggs, 0.5-meter net, 1941. . 60

Table VIII - Record of pilchard larvae, 1939 62

Table IX - Record of pilchard larvae, 1940 63

Table X - Record of pilchard larvae taken in 1.0-meter net, 1941 69

Table XI - Record of pilchard larvae taken in 0.5-meter net, 1941 74

INTRODUCTION AND ACKNOWLEDGMENTS

This report is primarily a record of numbers of pilchard eggs and larvae obtained from samples collected during three years of survey, 1939-1941, together with data on the hauls in which the material was collected. The information is presented in 11 tables. The text deals with the techniques involved in obtaining the data presented in the tables.

In the pilchard, as in most other species of marine fishes that have been investigated, the size of year broods fluctuates widely. An investigation of recruitment through collections of eggs and larvae has as its major objectives: (1) the estimation of the size of year broods before they enter the fishery, (2) the understanding of the environmental conditions that govern such fluctuations in year broods, and (3) the estimation of the size of the spawning population. The present study has been concerned largely with putting the investigation of recruitment on a basis of quantitative accuracy. It was begun in the spring of 1939 when Fish and Wildlife Service entered into a collaborative program with the Scripps Institution of Oceanography to investigate recruitment in conjunction with the hydrographic conditions off the Pacific coast of the United States. The research on recruitment was under the direction of O. E. Sette, that on oceanography under Dr. H. U. Sverdrup, Director of the Scripps Institution of Oceanography at La Jolla. The sea work was done on the research vessel E. W. Scripps and was continued during 1940 and 1941, after which it was discontinued because of the war.

It is a pleasure to acknowledge the whole-hearted cooperation given by the Scripps Institution of Oceanography, its staff members, and by the members of the crew of the E. W. Scripps. We wish especially to extend our sincere appreciation to Dr. H. U. Sverdrup and to Captain E. D. Hammond of the E. W. Scripps.

All the personnel of the South Pacific Investigations of the Fish and Wildlife Service contributed to a greater or lesser extent to this investigation, either through aid in collecting material at sea, in working with the material in the laboratory, in tabulating data, or in typing the tables and text. 1/

1/ Much of the routine laboratory work was done by persons employed through WPA Projects Nos. 765-08-3-22, 65-2-08-286, and 265-2-08-34.

PILCHARD SPAWNING SURVEY OF 1939

At the beginning of our investigations it was known from the researches of Scofield (1934) that pilchard spawning occurs at least as far south as Magdalena Bay, off Lower California, 1/ at least as far north as San Francisco, and offshore to a distance of over 250 nautical miles. From a study of maturing ova in commercially landed fish, F. N. Clark (1934) had determined the length of the spawning season off southern California to extend from February to August, with a maximum in April and May, and off Monterey from February to July.

The purpose of the 1939 survey was to determine whether or not the entire spawning range of the Pacific pilchard could be delimited, and to develop techniques for collecting and treating the pertinent data. The survey (of 1939) consisted primarily of a single extended cruise 2/ of two months duration, during which the area from off Cascade Head, Oregon, in the north to Sebastian Viscaino Bay in the south, a distance north to south of approximately 1,200 nautical miles, was explored (fig.1). The survey was started from San Diego and proceeded north along the coast to Cascade Head, Oregon. During the trip northward 14 stations were occupied at intervals along the coast. Eight stations were occupied off Cascade Head, Oregon, arranged in a line extending seaward for approximately 230 miles. The cruise then worked progressively southward, occupying 5 additional lines of stations. 3/ The lines extended seaward for 340 miles in some cases. The majority of stations on the lines were spaced at intervals of approximately 30 miles; near to shore, however, the spacing of stations

---

1/ Godsil, 1941, extends the southern limit of this range by recording the collection of pilchard eggs and larvae in the Gulf of California during January and February 1940.

2/ It was preceded by a short cruise off southern California on April 17-20, 1939 during which 10 stations were occupied to test the gear and the methods of using it, and to obtain data on vertical distribution of pilchard eggs and larvae. Data collected on this preliminary cruise are not given in this paper.

3/ The 6 lines of stations were off the following landmarks: (1) Cascade Head, Oregon (stations 827 to 834, occupied May 22-25). (2) Cape Blanco, Oregon (stations 836 to 841, occupied May 26-28). (3) Monterey, California (stations 846 to 855, occupied June 11-14). (4) Point Dume, California (stations 857 to 866, occupied June 16-23). (5) Banda Point, Lower California (stations 867 to 877, occupied June 29 to July 3). (6) Sebastian Viscaino, Lower California (stations 879 to 888, occupied July 5-8).

was closer together than this, while offshore the spacing between the last 2 or 3 stations was nearly double this distance. The original plan of the cruise called for occupying 8 lines of stations between Oregon and central Lower California, but it had to be modified by omitting two lines of stations in the area between Eureka and San Francisco due to adverse weather conditions.

Scofield (1934) had found that pilchard eggs and larvae occurred in the upper 25 fathoms of water. However, to obtain additional information on vertical distribution of eggs and larvae, a method of obtaining samples was employed which also supplied data on vertical distribution. Three closing nets were usually employed in series at each station, each net sampling a distinct depth zone. The usual arrangement of the nets was as follows: an upper net fishing from about 45 meters deep to the surface, an intermediate net fishing from about 80 meters to 40 meters deep, and the lowest net fishing from about 120 meters to 70 meters deep. The nets could be opened or closed at any desired depth by closing devices modeled after those described by Leavitt (1935, 1938). In taking a haul, the nets, attached to the towing cable at the desired intervals, were lowered to their maximum depth while still closed, then opened by means of messengers which slid down the towing cable. The cable had a weight attached to its free end which, during the 1939 season, was a lead bar weighing about 100 pounds. The towing was done at about 1.5 - 2.0 knots per hour. The nets were hauled obliquely upwards by slowly winding the towing cable onto the drum of a powerwinch at a rate which raised the nets at about two meters of depth per minute. Although the speed of the vessel was kept as nearly uniform as possible during a haul, there were unavoidable variations in speed, which were reflected in variations in the angle of stray of the towing wire. To gain information on such variation, the angle of stray was read by means of a pendulum protractor every two minutes during a haul. The flow of water into the net during most hauls was measured by a current meter, fastened at the periphery of the mouth of the net and so constructed that its rotator did not turn except when the net was open. Immediately after the upper net reached the surface, the lower nets were closed by means of messengers. The plankton from each net was washed into the detachable "cod-end," then transferred to quart jars, and preserved in 2 percent formaldehyde.

Information concerning the plankton hauls taken during the 1939 survey is given in tables I, IV, and VIII. Table I gives the location of hauls, time of collection, nets employed, and related data. Table IV comprises a record of pilchard eggs obtained in the samples, and table VIII, a record of the pilchard larvae.

Immediately prededing the hauls at each station, hydrographic samples and observations had been taken. The latter included temperature observations from a series of depths, usually to a depth of 600 meters; water samples from the same depths for determination of salinity, amount of dissolved oxygen, and at times, other chemical constituents of the water such as phosphates; and diatom samples taken from the surface to 60 meters deep at 10 meter intervals by means of an Allen closing bottle of 5 liter capacity. The hydrographic data for the 1939 survey have been published by H. U. Sverdrup and Staff (1943).

PILCHARD SPAWNING SURVEY OF 1940

Experience during the season of 1939 had shown that the spawning range of the Pacific pilchard was too extensive to be satisfactorily surveyed by one vessel, and it became evident that either our facilities would have to be greatly augmented or our efforts confined to a more limited area. Circumstances dictated the latter.

As there was considerable evidence that abundant spawning occurred off the coast of southern California (Scofield 1934), and as a continuation by the Scripps Institution of Oceanography of studies on the oceanography of that area, commenced in former years, was desired, it was decided to concentrate effort in that region. The operating base of the E. W. Scripps being at San Diego was also a consideration in choosing this region for survey.

The spawning survey of 1940, consequently, had the limited objective of surveying the area thought to be the area of most abundant spawning of the Pacific pilchard, but not the complete spawning range. It was planned to take quantitative samples of eggs and larvae over a fixed pattern of stations at frequent enough intervals to determine the amount of spawning within the area and, if possible, the rate of mortality during the planktonic stage of the pilchard in relation to oceanographic conditions. At the same time the Scripps Institution of Oceanography planned to collect hydrographic samples for studying the physical oceanography of the region.

The area surveyed during the 1940 season had its northern limit near to the group of Santa Barbara Channel Islands, its southern limit near the Coronados Islands, and extended 150 miles seaward. The area was covered by 40 stations, shown in figure 2, all of them located over depths exceeding 350 fathoms. The majority of the stations were arranged along five lines

extending approximately west southwesterly from the coast, with a few stations occupying positions between the lines. The area was surveyed 6 times during the period from March 5 to June 7.

Since the depth distribution of pilchard eggs and larvae 1/ had been fairly well established by the 1939 survey, the method of taking plankton samples was modified for 1940. A non-closing net, 1.6-meters in diameter at the mouth, was used to fish from about 75 meters deep to the surface, a zone considered to be deep enough to extend below the lower limit of depth distribution of pilchard eggs and larvae. However, as a precaution against missing deeper eggs and larvae, a 1-meter closing net of the type used the previous season was usually employed below the 1.6-meter net, fishing from about 135 meters in depth to about 60 meters.

In taking a haul the closing net was lowered to about 60 meters depth while still closed (80 meters of towing cable), then opened by messenger. The 1.6-meter net was attached to the towing cable and lowered in 2 to 3 minutes to about 75 meters depth by paying out an additional 100 meters of towing cable. Then the nets were towed slowly upwards by hauling in 5 meters of cable per minute while the vessel was moving at a speed of 1.5 to 2 knots. When the upper net reached the surface, the lower net was closed by means of a messenger and hauled aboard.

At many stations during 1940, two hauls were taken with the upper net to compare the numbers of eggs and larvae obtained from duplicate hauls made under comparable conditions in the same locality. On completing the first haul, the plankton was washed into the cod-end and removed, another cod-end attached, and the net lowered immediately for a second haul. When duplicate hauls were taken at a station, the towing time of each haul was reduced, the net being brought upwards at the rate of 10 meters of cable per minute. The lower closing net was allowed to tow throughout the time occupied in making two hauls with the upper net.

Information concerning the plankton hauls taken with the upper net during the 1940 survey is given in tables 2,5, and 9. Table 2 contains data about the oblique hauls made with the upper net, table 5, a record of pilchard egg numbers taken in the hauls, and table 9, a record of pilchard larvae. A summary of the number of pilchard eggs and larvae taken in the closing net hauls is given in text table 8.

1/ Discussed in a subsequent section.

PILCHARD SPAWNING SURVEY OF 1941

The survey of 1941 was similar to that of 1940 with only minor differences in area covered and gear and methods employed.

The area covered in 1941 differed from that surveyed during 1940 in the following particulars: (1) a line of 4 stations was added to the south of the area surveyed in 1940 (primarily to obtain additional information on drift and survival of larvae), (2) several shallow water stations were added nearer to shore (to give a more complete sampling of the survey area), (3) the spacing of stations within the area was made more regular (fig.3), and (4) due to the extra time involved in occupying the additional stations, a few stations were omitted from areas sampled the previous season (no stations comparable to stations 26, 27, and 33 in the 1940 pattern). The 1941 station pattern consisted of 38 stations, arranged in 6 lines, and 3 inshore stations occupying positions not on the lines.

During the 1941 survey 2 non-closing nets of different sizes and mesh were used together in an assembly with a common bridle for reasons discussed in the following section. The nets fished obliquely from about 75 meters deep to the surface. During rough weather, or at shallow stations (of which there were 5 in the survey pattern), a 1-meter net was used alone; the stratum of water fished at shallow stations depended upon the depth of the water at the station, the net at its greatest depth being kept at a safe distance of 10 or more meters from the bottom. The method of towing was similar to that described for 1940. The angle of stray of the towing wire was determined at 1 minute intervals, however.

The weight attached to the end of the towing wire during the 1941 survey was a specially constructed galvanized iron hemisphere, weighing 60 pounds, to which could be added discs weighing 20 pounds each. During the season, the hemisphere was used with 2 discs (total weight - 100 pounds).

Information concerning the net samples collected during the 1941 survey is contained in table 3, data on pilchard egg catches are given in table 6 for the 1.0-meter net and table 7 for the 0.5-meter net, while data on sizes and numbers of pilchard larvae are contained in tables 10 and 11.

DESCRIPTION OF NETS USED

The details of construction of the nets used during the surveys are given in tables 1 and 2. The nets were of 3 sizes: 1.6-meters in diameter at the mouth, 1.0-meter in diameter, and 0.5-meter in diameter. The 1.0-meter and 1.6-meter nets were of similar design but differed in dimension. In both sizes there was a cylindrical straining section anterior to the longer conical section of the net (fig. 4) and in both the plankton accumulated in a detachable cod-end.

The 1.0-meter nets were of two types, closing and open (non-closing), which were identical in all details of construction except in the anterior canvas section. This section was about four times as long in the closing type as in the open kind to accommodate the opening and closing lines. 1/

The 0.5-meter net was of simpler construction than the two larger types. It lacked the anterior cylindrical straining portion, was approximately conical in shape, and in place of a detachable cod-end it had the posterior tip folded over and tied when towing. It was designed especially to catch smaller sizes of pilchard larvae after it had been found that these were being partly lost through the mesh of the 1.0-meter and 1.6-meter nets. The No. 40xxx grit gauze, of which the 0.5-meter net was constructed, had openings between threads of about 0.30-0.45 mm. (table 2) as compared to 0.70-0.90 mm. for the No. 24xxx gauze and 0.80-0.95 mm. for the cotton scrim of which the 1.0-meter and 1.6-meter nets were constructed. Figure 5 shows the openings in the mesh of the above materials when new in relation to the size of pilchard eggs and small larvae. The size No. 40xxx grit gauze was chosen for the 0.5-meter nets as it seemed to be of fine enough mesh to retain most if not all the smaller pilchard larvae and to strain water freely.

The 0.5-meter net was employed in an assembly with a 1.0-meter net (figure 6). On different cruises of the 1941 survey, the 0.5-meter net was paired with 1.0-meter nets constructed of three different materials: (1) of no. 24xxx grit gauze, (2) of cotton scrim similar to that employed in the 1.6-meter nets used the previous season, and (3) of cotton scrim of another grade but of similar mesh size. The 0.5-meter net served a dual purpose: (1) it gave a more accurate sampling of the smaller sizes of pilchard larvae, and (2) it was paired with the type of nets previously used to derive information concerning the percentage loss of each size of larvae through the mesh of the larger nets.

1/ The operation of the closing net is illustrated in Leavitt (1935) fig. 1; a photograph of the releasing device and messenger used in the operation of the closing net is given by Leavitt (1938) in fig. 2 on p. 379.

1. Details of construction of nets used during surveys

Nets and their parts	Shape	Cross sectional diameter	Length	Material used
		Centimeters	Centimeters	
1.0-meter net:				
Outer canvas band:				
For closing type---	Cylindrical	100	150	Heavy canvas.
For open type	"	100	23	Canvas.
Anterior straining section	"	100	65	No. 24xxx grit gauze1/
Junction band	"	100	20	Canvas.
Middle straining section	Truncate conical	Taper from 100-20	270	No. 24xxx grit gauze1/
Junction band	Cylindrical	20	15	Canvas
Posterior straining section	Truncate conical	Taper from 20-9.5	40	No. 56xxx grit gauze
Junction band	Cylindrical	9.5	10	Canvas
Detachable cod-end:				
Junction band	Cylindrical	9.5	8	Canvas
Bag	Bag-shaped	10	22	No. 56xxx grit gauze
1.6-meter net:				
Outer canvas band	Cylindrical	160	25	Canvas
Anterior straining section	Cylindrical	160	110	No. 24xxx grit gauze1/
Junction band	"	160	20	Canvas
Middle straining section	Truncate conical	Taper from 160-30	475	No. 24xxx grit gauze1/
Junction band	Cylindrical	30	13	Canvas
Posterior straining section	Truncate conical	Taper from 30-13.5-1/2	65	No. 56xxx grit gauze
Junction band	Cylindrical	13.5-1/2	10	Canvas
Detachable cod-end:				
Junction band	Cylindrical	13.5-1/2	6	Canvas
Bag	Bag-shaped	14	30	No. 56xxx grit gauze
0.5-meter net:				
Outer canvas band	Cylindrical	50	17	Canvas
Main straining section	Truncate conical	Taper from 50-10	300	No. 40xxx grit gauze
Canvas band	Cylindrical	10	17	Canvas
Posterior straining section	Truncate conical	Taper from 10-6	62	No. 56xxx grit gauze

1/ Cotton scrim was substituted for No. 24xxx grit gauze in some nets.

2. Comparison of nets used during surveys

Item	Net size (diameter at mouth)				
	0.5-meter	1.0meter		1.6-meter	
Type of material used in body of nets	No. 40xxx grit gauze	No. 24xxx grit gauze	Cotton Scrim	No. 24xxx grit gauze	Cotton scrim
Seasons used.....	1941	1939,1941	1940, 1941	1940	1940
Area at mouth opening (in square meters)	0.196	0.785	0.785	2.0	2.0
Total straining surface in body of net (in square meters).....	2.65	6.75	6.75	20.40	20.40
Ratio of total straining surface to mouth opening.....	13.5	8.6	8.6	10.2	10.2
Average size of openings between threads, in mm.					
New.....	0.45	0.90	0.95	0.90	0.95
Used.....	0.30	0.70	0.80	0.70	0.80
Percent of open space in straining surface of nets after use.....	34	42	29	42	29
Total aperature area in body of net (in square meters).....	0.78	2.84	1.96	8.57	5.92
Ratio of aperature area to mouth opening.....	4.0	3.6	2.5	4.3	3.0

The nets were attached to circular hoops made of galvanized iron pipes. The latter were 2.7mm. in outside diameter for the 1.6-meter nets, were 2.2mm for the 1.0-meter nets, and were 1.7mm for the 0.5-meter nets. In pairing the 1.0-meter and 0.5-meter nets the two rings were welded together side by side and the assembly strengthened by welding two pieces of straight galvanized channel iron to the outside of the two hoops. For lashing the nets to the hoops, grommets were inserted around the canvas duck forward end of the nets at 10 cm. intervals.

The towing bridle for both the assembly and the individual nets consisted of three ropes about 2 meters long, spliced at intervals around the hoops and leading to a small ring to which was attached a heavier rope, 5 meters long; thus, the bridle was about 7 meters in overall length. It was fastened by a wire clamp to the towing wire.

MEASUREMENT OF VOLUME OF WATER STRAINED BY THE NETS

A measure of the volume of water strained during a haul could be derived, for most samples, from current meter readings. A current meter was usually used in the mouth of a net, located in the center of the mouth in a non-closing net, at the periphery in a closing net. The instruments used had two primary parts: a rotator and a revolution counter, both suitably encased. The rotator was constructed of four curved blades on a free-turning shaft suspended in a metal cylinder open at either end, and was usually geared directly to a counter. Four types of current meters were used during the surveys: three of them differed primarily in the type of counter used, while the fourth had no direct connection between rotator and counter, the shaft from the rotator ending in a magnet which actuated the counter (the latter type proved the least satisfactory.)

Current meters were calibrated at intervals during their period of use, usually immediately before and after each cruise on which they were used. The information needed for calibrating a current meter was obtained by towing the instrument, fastened on the under side of a suitable float, over a measured distance alongside a dock at a range of speeds which exceeded in both directions the range of towing speeds used at sea. To compensate for the influence of tidal and wind currents on the meter readings during the calibration runs, two trials were made at each speed, the second traversing the course in the opposite direction to the first. Usually eight such pairs of runs were made at different speeds during a calibration. The following information was obtained for each run: (1) the distance towed, (2) the length of time required in seconds (as determined by a stop watch) and (3) the number of revolutions registered by the meter. From these were derived: r, the average number of revolutions per second, and d, the average distance covered (in meters) per revolution. The relation of d to r was plotted and a smooth curve fitted to the points.

A comparison of the performance of a current meter on successive calibration trials during a season is illustrated in Table 3, using the calibration data for current meter #5. For each date of calibration is indicated the values of d, when r= 1.6 rev./sec. and when r = 2.9 rev./sec. These values of r were chosen because they bracket the range in the values of r as determined from the readings of this current meter when used while taking hauls.

The value of d when r = 1.6 rev./sec. is so closely similar to the value of d when r = 2.9 rev./sec. that if the average value of d were used for any value of r within this range, the resulting error would seldom be as large as 1%. The differences between the several calibrations are also rather small, the largest deviation being only four percent of the mean. Because of this uniformity of performance, it was decided to use an average calibration figure for this current meter for the season, thus greatly simplifying all computations. The performance of current meter #4, a companion meter to the one discussed above, was similar.

TABLE 3

A comparison of succeding calibrations of current meter #5 during 1941

Date of Calibration	Values of d when r equals 1.6 rev./sec.	2.9 rev./sec.	Average value of d within this range
March 17	.269	.268	.268
April 7	.253	.247	.250
April 14	.273	.267	.269
April 29	.263	.259	.260
May 4	.258	.253	.255
May 30	.257	.257	.257
June 13	.264	.259	.260
June 21	.264	.261	.262
July 3	.267	.264	.265
July 29	.261	.259	.259
Mean	.263	.259	.260

In the other types of current meters used during the surveys the mechanism usually operated somewhat less freely, resulting in a greater disparity in the value of d at different speeds (cf table 4, listing the performance of the several current meters used during the surveys). However, in all instances except one 1/, there was so little change between successive calibrations of a particular current meter during a season that a composite curve based on the combined data of all the calibrations could be used. For hauls involving current meters #1, 2 and 2A, 3, 3B and 3C the value of d was separately determined for each haul from the appropriate calibration curve.

The value of a current meter reading in measuring the volume of water entering a net is dependent upon whether the flow past the meter adequately represents the average flow into the net. Since the greatest difference in flow would be expected to occur between the center and periphery, tests were made during the 1939 season with two current meters in the mouth of the same net (while taking hauls) one occupying a peripheral position, the other a center position.

A comparison of the flow into the net as measured by the two current meters indicated that on 4 out of 9 trials it was greater at the periphery, on 5 out of 9 at the center position. Hence, the flow was not consistently greater at either location, although the average of all trials gave a value 1.5 percent greater at the center of the net as compared to the periphery. The comparison is given in table 5.1/

Since the mean difference was such a small percentage of the usual total flow, the value given by the current meter was taken as directly representing the average flow, and no correction was applied.

1/ Current meter 3A (used in 1940) showed a change in performance between calibrations, and for this meter the individual calibration curves were used.

2/ See in this regard Sette, 1943, p. 210.

TABLE 4

Performance of current meters used during surveys

Current Meter	Nets used with meter	Cruises on which used	Value of d when r equals 1.0 rev./sec.	2/0 rev/sec.	3.0 rev/sec.
1	1.0M silk closing	8	0.395	0.388	0.382
2	"	8	0.370	0.357	0.346
2A1/	0.5M silk	17,18,19	0.364	0.275	0.252
3	1.0M silk closing	8	0.410	0.397	0.393
3A2/	2.0M cotton	14,15	0.242	0.220	0.212
3B3/	0.5M silk	17,18,19	0.384	0.270	0.240
3C4/	0.5M silk	21,23,25,27	0.267	0.226	0.217
4 5/	2.0M silk	10,11,12	0.300	0.300	0.300
5	1.0M various	17 through 27	0.269	0.261	0.259

1/ Current meter #2 refashioned so that counter was actuated magnetically.

2/ Current meter #3 with a replacement counter.

3/ Current meter #3 refashioned so that counter was actuated magnetically.

4/ Current meter #3 refashioned with a mechanical counter directly geared to rotator.

5/ Lost at sea during cruise #12.

TABLE 5

Comparison of flow into a net as measured by two current meters fastened in the mouth of the same net — one at the periphery, the other in the center of the mouth.

Station No.	Apparent Flow Center	Apparent Flow Periphery	Difference	Per cent Difference
	Cubic meters	Cubic meters		
867	759	815	+ 56	+ 7
868	474	484	+ 10	+ 2
869	540	492	- 48	- 9
870	585	591	+ 6	+ 1
871	608	631	+ 23	+ 4
872	602	584	- 18	- 3
873	558	533	- 25	- 4
874	522	461	- 61	- 12
875	569	551	- 18	- 3
Mean	580	571	- 9	- 1.5 1/
St. Dev.				6.5
St. Error				2.3

1/ The mean percent difference, irrespective of sign, is 5.0.

The volume of water entering a net during a haul was determined from the current meter reading for the haul in four steps:

(1) The average number of revolutions registered by the current meter per second (r) during the haul was computed.

(2) For the above determined value of r the value of d was read from the appropriate calibration curve.

(3) The length of the column of water entering a net during a haul (D) was then secured by multiplying d by the total number of revolutions registered during the haul.

(4) The volume of water entering a net during a haul (V) was determined by multiplying the above value of D by the cross-sectional area in square meters, of the mouth of the net. The resulting value represents the flow into the net in cubic meters during the haul.

For hauls lacking current meter readings either because mechanical difficulties had prevented proper registration, or because no meter had been used in the nets (current meters were seldom employed at shallow stations or during rough weather) the preceding method could not be used to compute the volume of water strained by the nets in taking the hauls. However, as the angle of stray of the towing wire had been obtained at one or two minute intervals during all plankton hauls, the relation between the tangent of the angle of stray and the volume of water entering a net as determined from hauls having current meter readings could be utilized to obtain a rough estimate of the volume of water strained in hauls for which current meter data were lacking.

The relation was determined from a regression of r on the tangent of the angle of stray. Within the range covered by our data the relationship seems to be adequately represented by a straight line. Owing to differences in the straining capacity of nets constructed from different types of material and to differences in the amount of water passing per revolution through the several current meters, it was necessary to obtain a regression for each combination of current meter and net employed. The regression lines were fitted by the method of least squares. (Table 6 gives constants of the regressions and the standard error of estimate for five combinations of meters and nets.) Using the appropriate regression, a value of r was read from the line which corresponded to the average tangent of the angle of stray of the haul in question. Then the estimated volume of water strained during the haul was determined as outlined above. Although for any given haul the standard error of estimate of r and hence of the computed volume of water strained would be fairly large, yet over a number of hauls these discrepancies would tend to average out, hence the reliability of the group as a whole would be greater than any individual determination.

TABLE 6

Constants of the regressions of revolutions per second on the average tangent of the angle of stray of the towing wire

Combination of current meter and net	Av. tangent of angle	Av. rev./sec.	Standard error of est. of r	Values of regression line: $\bar{r}$ when tan. $\angle$ = 0	Values of regression line: Increase in $\bar{r}$ per unit tan.
No. 3A, 1.6-meter cotton scrim (cruises 14, 15)	0.986	1.995	0.334	0.590	1.426
No. 4, 1.6-meter silk (cruises 10, 11, 12)	0.985	2.073	0.206	1.227	0.859
No. 5, 1.0-meter cotton scrim (cruises 17, 23, 25)	0.953	2.212	0.265	1.212	1.049
No. 5, 1.0-meter cotton scrim 1/ (cruises 18, 19)	0.918	1.984	0.207	1.100	0.967
No. 5, 1.0-meter silk (cruises 21, 27)	0.921	2.587	0.285	1.765	0.893

VERTICAL DISTRIBUTION OF PILCHARD EGGS AND LARVAE

Information about vertical distribution was obtained from three sources: (1) data of hauls taken by the two or three closing nets used in series at most stations during 1939, (2) data of hauls taken by the closing net used below the regular net at about two-thirds of the stations during the 1940 survey, and (3) from special series of horizontal hauls with closing nets taken at a series of depths during 1939 and 1941.

The zone fished by each closing net during the 1939 survey was approximately as follows: upper zone, 42 meters to surface; middle zone, 81 meters to 38 meters; lowest zone, 120 meters to 72 meters. The exact depth fished by each net varied from haul to haul (see table 7), depending upon the amount of wire cable released in lowering the nets (50 meters of wire between nets on some hauls, 55 meters on others, and 60 meters on still others), and the angle at which the nets were towed while taking a haul.

As can be seen by referring to table 7, most of the pilchard eggs and larvae collected during the 1939 survey were taken in the upper zone: 98.5% of all pilchard eggs and 93.1% of all pilchard larvae. The remainder were collected in the intermediate zone: pilchard larvae in four samples, with most of the specimens occurring in the sample from station 853, pilchard eggs in four samples, with most of the specimens occurring in the samples from stations 852 and 855 (in the latter case there was no upper net haul for comparison). Neither pilchard eggs nor larvae were taken in the lowest net of the series, although it was used at 19 of the 24 stations at which pilchard eggs and larvae were collected.

The above data indicate that nearly all pilchard eggs and larvae were distributed no deeper than 42 meters; even the eggs and larvae taken in the intermediate net samples could have been collected near to or above 42 meters, as the upper level fished by this net was estimated to be between 40 to 33 meters at these stations.

A much larger number of data are available from the 1940 survey. During this season a 1.0-meter closing net was used below the upper net at a majority of the stations (the closing net was used at 148 stations, but due to failure of the net to open at some stations and to close at others, only 133 proper samples were obtained.)

Pilchard eggs were found in 16 of the closing net samples and in 108 of the samples taken with the upper net at the same stations. The number of pilchard eggs taken in the lower net hauls was approximately 420 as compared to 119,300 in the upper net at the same stations (both expressed in terms of standard hauls), or about one-third of one percent as many. A more detailed comparison is given in table 8.

TABLE 7

Depth distribution of pilchard eggs and larvae - 1939 survey

Station	Upper net haul			Intermediate net haul			Lowest net haul		
	Depth	Eggs	Larvae	Depth	Eggs	Larvae	Depth	Eggs	Larvae
	Meters	Number	Number	Meters	Number	Number	Meters	Number	Number
812	0-34	20	20	35-72	0	0	-	-	-
813	0-39	0	6	35-77	0	0	-	-	-
814	0-37	19	1	39-74	0	1	78-111	0	0
827	0-37	3	0	36-74	0	0	72-111	0	0
829	0-45	18	0	38-90	1	0	76-135	0	0
834	0-46	1	0	43-92	0	0	86-138	0	0
839	0-40	3	0	35-75	0	0	65-108	0	0
841	0-39	0	1	40-74	0	0	75-106	0	0
848	0-40	7	0	36-77	0	0	68-110	0	0
849	0-44	4	0	42-84	0	0	80-120	0	0
850	0-38	1	0	30-72	0	0	58-103	0	0
851	0-45	217	0	28-66	0	0	-	-	-
852	0-43	4153	6	33-82	44	2	64-117	0	0
853	0-44	48	25	39-84	2	53	74-120	0	0
854	0-46	80	0	38-87	0	0	72-124	0	0
855	0-47	?	0	39-89	20	0	66-119	0	0
857	0-44	0	6	37-83	0	0	71-119	0	0
862	0-45	55	3	40-86	0	0	76-123	0	0
863	0-44	0	11	38-84	0	0	72-120	0	0
864	0-44	0	726	39-84	0	0	74-120	0	0
865	0-46	0	28	40-88	0	3	75-125	0	0
866	0-47	0	2	39-89	0	0	74-128	0	0
870	0-38	0	3	42-76	0	0	-	-	-
878	0-46	0	1	41-92	0	0	-	-	-
Total		4629	839		67	59		0	0
Av. depth	0-42			37.6-81.3			72.4-118.8		

The above data indicate that nearly all pilchard eggs and larvae were distributed no deeper than 42 meters; even the eggs and larvae taken in the intermediate net samples could have been collected near to or above 42 meters, as the upper level fished by this net was estimated to be between 40 to 33 meters at these stations.

A much larger number of data are available from the 1940 survey. During this season a 1.0-meter closing net was used below the upper net at a majority of the stations (the closing net was used at 148 stations, but due to failure of the net to open at some stations and to close at others, only 133 proper samples were obtained.)

Pilchard eggs were found in 16 of the closing net samples and in 108 of the samples taken with the upper net at the same stations. The number of pilchard eggs taken in the lower net hauls was approximately 420 as compared to 119,300 in the upper net at the same stations (both expressed in terms of standard hauls), or about one-third of one percent as many. A more detailed comparison is given in table 8.

At the 133 stations where the closing net was used below the upper net pilchard larvae were taken at 109 stations in the upper net but at only 5 in the closing net. An estimated 5900 larvae were present in the standardized upper net hauls as compared to 38 in the closing net hauls taken at the same stations or about two-thirds of one percent as many in the latter.

The upper limit of the stratum fished by the 1.0-meter closing net during the 1940 survey averaged approximately 57 meters deep while the lower limit of the stratum fished by the upper net was approximately 73 meters deep, resulting in a zone of overlap of approximately 16 meters that was fished by both nets. Undoubtedly many of the eggs and larvae taken in the closing net came from this zone.

The evidence presented thus far on depth distribution has been of value in delimiting a zone within which nearly all of the pilchard eggs and larvae occur. This zone comprises the upper 40 to 50 meters of depth. To obtain more detailed data on depth distribution of eggs and larvae at individual stations, special series of horizontal hauls with closing nets from a series of depths were taken during 1939 and 1941. This material has been reported upon by Silliman (1943), and will be only briefly considered here.

TABLE 8

Comparison of the number of pilchard eggs and larvae taken in 1.0-meter lower net hauls (fishing from approximately 135 to 60 meters deep) in upper net hauls at the same stations during 1940 survey

Number in upper net hauls	Number of stations	Number of Stations with eggs or larvae in lower net hauls	Percent of stations with eggs or larvae in lower net hauls	Number 1/		Percent of total in lower net hauls
				In upper net hauls	In lower net hauls	
Eggs						
0	25	0	0	0	0	-
1-50	26	0	0	478	0	0
51-100	8	1	12	608	11	1.81
101-500	32	3	9	8,048	37	0.46
501-1000	14	1	7	9,933	9	0.09
1001-5000	23	7	30	48,105	245	0.51
5001 & over	5	4	80	52,173	118	0.23
Total number	108 2/	16	15	119,345	420	0.35
Larvae						
8.25 mm. or less:						
0	46	0	0	0	0	-
1 or more	87	2	2	4,847	34	0.70
8.25 mm. or longer:						
0	43	0	0	0	0	-
1 or more	90	4	4	1,051	4	0.37
Total number	109 3/	5	5	5,898	38	0.64

1/ Number of eggs or larvae put in terms of standardized hauls.

2/ Total number of stations with eggs in upper net hauls.

3/ Total number of stations with larvae in upper net hauls.

Data on depth distribution of pilchard eggs, based on 7 series of hauls, indicated that approximately 90 percent of the pilchard eggs occurred above 20 meters and 98 percent above 30 meters. Within the upper 20 meters, the greatest concentration occurred between 10-20 meters at 4 stations and between 0-10 meters at 3 stations, (in one of the later series there was no sample taken in the 10-20 meter zone). When the logarithm of the number of pilchard eggs taken in each haul of a series was plotted against the average depth of the haul in meters, there was an indication that the decrease in abundance with depth below the center of abundance was logarithmic.

Although there are eleven series of depth distribution hauls that contain at least a few pilchard larvae, they were abundant in only three series. The vertical distribution of larvae was somewhat deeper than eggs, for less than 50 percent were found above 20 meters and only about 75 percent above 30 meters. However, 96 percent were above 40 meters and nearly 100 percent were in the zone ordinarily fished by the upper net during the 1940 and 1941 surveys. As has been pointed out by Silliman, the problem of sampling larvae is complicated by their relative scarcity in hauls taken during daylight hours. This is readily apparent in the standardized numbers given in Tables VIII - XI and will receive attention in further studies on the subject.

VARIATION IN DEPTH OF PLANKTON HAULS

In taking hauls during the 1940 and 1941 surveys the net was lowered on 100 meters of cable to assure getting the net below the zone of occurrence of pilchard eggs and larvae. The net was then brought obliquely upwards according to the procedure outlined in a previous section. However, because of unavoidable variations in speed of towing and also in the condition of the sea, plankton hauls differed in the depth of the stratum fished, even though the procedures employed in taking the hauls were identical. The depth reached by the net on the average was about 73 meters, but it varied from 59 meters to 88 meters in extreme instances. The extent of the variation in depth of hauls is given in table 9.

In the discussion of vertical distribution it was shown that less than 1/3 of one percent of the eggs and 2/3 of one percent of the larvae occurred below 57 meters. As the shallowest haul was 59 meters deep, there can be little doubt that almost all hauls were deep enough to encompass the vertical range of the eggs and larvae.

Difference in depth of hauls was due primarily to difference in boat speed while hauling. A higher speed than usual resulted in a greater departure of the towing wire from the vertical with the

TABLE 9

Variation in depth of plankton hauls taken with the upper net

Item	Season 1940	Season 1941
No. of hauls	346	225
Amt. of wire released in lowering net . . meters	100	100
Range in depth (100 x cosine average angle of stray) meters	59-88	62-84
Mean depth . . . . . meters	73.42	73.66
Standard deviation . . . . . meters	5.0	3.6

consequence that the net went less deep and spent more time in each unit of depth traversed. For a slower speed than usual, the reverse was true. As hauls were of similar time duration, the shallower hauls were towed for more time in the upper layers where pilchard eggs and larvae were mainly distributed and for less time in the relatively barren zone below 30 to 40 meters than was true of the average haul, while for the deeper hauls the reverse was true.

To take such variation in depth of hauls into consideration, the average volume of water strained per unit of depth (v) was determined for each haul by dividing the estimated volume of water strained in making a haul (value of V in step 4 above) by the depth of the haul in meters. For this purpose, the depth of a haul was determined by multiplying the length of the cable released in lowering the net (in meters) by the cosine of the average angle of stray.

STANDARDIZATION FACTOR

To compare hauls having different values of v, all hauls were adjusted to the basis of a standard amount of water strained per unit of depth. The standard chosen was 10 cubic meters of water strained per meter of depth fished. This particular value was used because it gave a factor of approximately 1.0 for the 1.0-meter net. A standardization factor (S factor) was derived for each haul by dividing v, the volume of water strained per unit of depth, into 10. The standarized haul, then, should be equivalent to a vertical haul taken from approximately 73 meters deep to the surface with a net having a cross-sectional area at the mouth of 10 square meters.

The standardization factors for the oblique hauls made with plankton nets during the three years of survey are given in tables I to III (last column of figures).

ENUMERATION OF EGGS AND LARVAE

Pilchard eggs and small larvae were so abundant in many plankton hauls that it was found desirable to use only a portion of such samples for estimating the numbers of these categories. This was especially true of the 1940 material taken in the 1.6-meter nets, as these samples contained about 2-1/2 times as much plankton as similar hauls made with the 1.0-meter net during 1939 and 1941. However, larvae 8.0 mm. and over in length, because of their lesser abundance, were sorted from the entire sample in all instances; even so, the largest sizes were poorly represented. Also the 1939 samples were completely sorted for eggs and larvae, and the 1941 material for all sizes of larvae. Two methods of obtaining fractional portions of a sample were used during the investigation.

The method used in fractioning the 1940 material was similar to that described by Sette for mackerel (1943, p.211). A sample was placed in a graduate two-liter container and the volume of plankton and liquid brought up to a total of 2,000 cc. by adding prepared sea water. A uniform mixture of the plankton was obtained by stirring. Fractions of the sample were then removed with a straight sided dipper holding 16-2/3 cc. Usually the sample was divided into four portions: 2 portions; 2-1/2% each (50 cc. or 3 dippers in each), a third fraction containing 5% of the sample (100 cc. or 6 dippers), and the remainder consisting of 90% (1800 cc.). The two smaller portions were sorted for pilchard eggs and larvae of all sizes, the 5% portion for larvae of all sizes, while the remainder was sorted for larvae 8.0 mm. and more in length. Although is is possible to obtain accurate results by the dipper method under favorable conditions of dilution, mixing, and depth of dip, 2/ it was not found possible to maintain there conditions in our routine handling of large numbers of samples. A tendency to oversample was brought to our notice by results obtained from sorting the large larvae. Larvae over 8.0 mm. in length were first sorted from 10% of the material, as before described, and then from the remaining 90%. The fractions supposedly comprising 10 percent of the sample were found to contain an average of 14.1% of the larvae of this size group. The possibility that this sorting of the 10% fractions had been more thorough than that of the 90% portions was ruled out when reexamination of the material showed the 90% remainder to have been sorted as thoroughly (for large larva) as the 10% portions. In subsequent computation of total counts per haul of eggs and small larvae, it was assumed that there was 41% oversampling in the fractions of these categories.

For the fractioning of the 1941 material an apparatus was constructed, using a modification of the sampler described by S. G. Gibbons (1933). 3/

2/ This was established by experimentally fractioning samples containg known numbers of eggs and larvae.

3/ The sampler was constructed largely through the efforts of Ralph Silliman.

The instrument consisted of two copper cylinders, one of which slid snugly into the other; the outer cylinder was open at the top and closed by a flat copper disc at the bottom in which there were two holes, fitted with rubber stoppers, through which material could be removed; the inner cylinder was open at both ends, but had radial partitions which divided it into quarters. The plankton material was placed in the outer cylinder in prepared sea water, agitated to make a uniform mixture, then the inner cylinder was slid into the outer, effectively dividing the plankton into four quarters. Two of the fractions were removed from the apparatus through the two openings in the bottom, the plankton remaining in the other two sections was saved as a unit. Any fraction could be further quartered, if desired. By suitable marks on the two cylinders the same relative position of one to the other was maintanied throughout the fractioning of samples. Two fractions, each containing approximately one-quarter of a total sample, were sorted for eggs and larvae, and the remainder was sorted for all sizes of larvae. For test purposes the remainders of some samples were sorted for eggs also.

On testing the apparatus it was found that the quarters were accurate to one percent by volume, but complete counts of eggs and larvae showed that the two quarters routinely sorted contained only 48% of the sample, on the average. The discrepancy was due to specimens getting caught in the interstices of the apparatus when fractioning the samples and being freed into the half of the sample remaining in the apparatus when the inner cylinder was removed.

In sorting the plankton samples or fractions, all species of fish eggs and larvae were carefully separated from the other constituents of the plankton. The volume of plankton to be sorted was often large, even in a fraction, and the other organisms in the plankton often made sorting quite difficult. The 0.5-meter net used in 1941 retained so much fine plankton that sorting of these was especially difficult. As a check on the completeness of sorting, a routine was adopted in which many of the samples were examined a second time, and, in a few instances, a third time also.

The results obtained from a number of such reexaminations are summarized in table 10. A higher percentage of eggs and larvae were overlooked in the first sorting of the finer plankton taken by the 0.5-meter net than among the somewhat coarser plankton taken by the 1-meter net. Smaller-sized larvae made up the bulk of those found in the reexaminations.

Pilchard eggs and larvae taken in the reexamination of the samples listed in table 10 are included in the totals for the stations given in tables V, VI, X and XI. The totals for most other stations 1/ listed in the tables are estimates based on the first sorting, and, consequently, are smaller than their true values, on the average, by the percentages indicated in table 10.

TABLE 10

Completeness of sorting of 85 samples 2/

Categories	Number of Samples	Count of individuals			Percent in Reexamination
		First sorting	Reexamination	Total	
Pilchard eggs					
1.0-meter net	42	37621	1105	38726	2.85
0.5-meter net	43	5891	314	6205	5.06
Other fish eggs 3/					
1.0-meter net	42	9672	74	9746	0.76
0.5-meter net	43	2060	45	2105	2.14
Pilchard larvae					
1.0-meter net	42	3221	163	3384	4.82
0.5-meter net	43	2252	177	2429	7.29
Other fish larvae 4/					
1.0-meter net	42	2436	81	2517	3.22
0.5-meter net	43	1451	118	1570	7.52

1/ The following hauls not included in table 10 were also reexamined: both 1.0-meter and 0.5-meter net samples 1721, 1751, 1923, 2115; 1.0-meter net samples 1714, 1760, 2114, 2124; 0.5-meter net samples 1732, 1911, 1912, 1921, 1922, 1928, 1931, 1932, 1934-37, 1941-44, 1946, 1947.

2/ The samples taken with the 1.0-meter net that are included in this analysis were from the 1941 survey and were collected at the following stations: 1711, 1713, 1734, 1743, 1753-1755, 1761-1764, 1916, 1917, 1925-1927, 1945, 1952, 1955, 1964, 2113, 2162, 2163, 1876-1879, 1881-1895. Samples in the 1800 series were collected on April 8 and 9, 1941, for a special study which will be reported upon in a separate paper. The 0.5-meter net samples were taken at the same stations listed above, with the addition of the 0.5-meter net sample for station 1880.

3/ Anchovy eggs not included as very few were retained by the 1.0-meter net.

4/ Anchovy larvae not included, but percentages were similar to pilchard larvae.

IDENTIFICATION AND SEPARATION OF PILCHARD EGGS AND LARVAE

The pilchard egg was identified and described by Scofield and Lindner (1930). Amplified descriptions are given by Scofield (1934) and Ahlstrom (1943). The egg of the Pacific pilchard closely resembles that of the European pilchard, Sardina pilchardus. The developing egg, as taken in the plankton collections, is spherical, measures about 1.70 mm. in diameter (range 1.35-2.05 mm.), has a wide perivitelline space, a single oil globule (0.16 mm. in diameter), and an irregularly segmented yolk. The egg membrane is thin, unsculptured, quite transparent, and rather easily broken. The pilchard egg is not likely to be confused with those of other species taken in our material.

As a preliminary step in studying the egg material, the development of the pilchard egg was separated into eleven stages of development on the basis of readily observable morphological characters, a brief description of which may be found in Ahlstrom, 1943 (pp. 9-12, plates 1,2). Subsequently the eggs were grouped into age categories, the eggs in each category representing those spawned during a single day. This is possible because pilchard spawning takes place during a brief, relatively fixed period of the night (according to present evidence spawning occurs mostly between 8 P. M. and midnight), and as a result there are definite hiati in developmental stages between the eggs spawned on successive nights. Use has been made of this in studying the relation between water temperature and the rate of development of pilchard eggs (Ahlstrom, 1943), and this relation, in turn, has made it possible to check on the accuracy of the separation into age categories in doubtful cases. 1/

1/ The majority of pilchard eggs collected during the surveys had been developing at temperatures between 13.5°C and 16.0°C (total range 10.75°C to 17.6°C, temperature at 15-M depth.) Pilchard eggs develop to hatching in about 2-1/2 days at 16.0°C and in about 3-1/2 days at 13.5°C. From the temperature of the water at a station and the time of collection of the haul, it is possible to estimate the number of age categories that the sample would contain if spawning had taken place on each of the several nights previous to collection. When a sample contained fewer age categories than this estimated number, an analysis was made of the stages of development of the eggs present in the sample to determine which age categories were represented by zero spawning.

The pilchard larva was identified by Scofield and Lindner (1930), and a more extended description is given by Scofield (1934). For convenience, all individuals of pilchards taken by us in plankton hauls are referred to as larvae, including newly hatched individuals, 2.5 to 3.5 mm. long to the largest specimen taken in the plankton hauls, 28.5 mm. long. The pilchard larva is very slender in shape. The thin intestine extends along the ventral side of the body for about 5/6 of the length. The fins are developed in the following sequence: Pectorals at a larval length of about 5 mm., the dorsal fin at a length of about 8 mm., caudal fin at 8 to 15 mm., anal fin at about 12 mm. long, and pelvic fins at about 20-25 mm. long.

Pilchard larvae closely resemble anchovy larvae, which are superficially similar in form, and both occur in abundance in many collections. Larvae of the two kinds that have the dorsal fin developed may be separated by the following character: in anchovy larva the anal opening is one to two myotomes anterior to the termination of the dorsal fin while in the pilchard it is 5 to 7 myotomes beyond. The dorsal fin is seldom developed on pilchard larvae smaller than 8 mm. or on anchovy larvae smaller than 7 mm. and for these smaller sizes the ratio that the distance from tip of snout to anal opening is of the total length 1/ is a useful character for separating the two kinds. This ratio is approximately .73 in the anchovy and .82 in the pilchard (see table 11). Expressed in another way, the vent in the pilchard is located less than 1/5 of the length of the body from the posterior end, while in the anchovy it is located about 1/4 or more of the length of the body from the posterior end. In addition, the intestine of the anchovy is deeper and the body thicker than in pilchard larva of corresponding length (see table 11). Pigmentation is also of some use, although it is not as conspicuous in these smaller sizes as it becomes somewhat later. On both types of larvae pigmentation is located along the ventral side, but there is more of it on the pilchard. For example there are about 10 pairs of pigment spots just above the digestive tract in its anterior half in the pilchard (i.e., anterior to the pylorus), but only 5 pairs in the anchovy. As a safeguard, all larval material of these two kinds was examined at least twice for completeness of separation.

1/ From the tip of the snout to the end of the notochord.

TABLE 11

Diagnostic characters for separating pilchard and anchovy larvae under 8.5 mm. in length

	Pilchard larvae			Anchovy larvae		
	Mean	Range	St. dev.	Mean	Range	St.dev.
Length to anus in standard length	1.216	1.19-1.24	0.014	1.370	1.31-1.45	.033
Depth in standard length	18.1	15.4-26.3	2.0	13.7	11.4-19.6	1.5

Pilchard larvae were measured to the nearest 0.5 mm. of length. All measurements were made with the aid of a low power dissection microscope: larvae 5.5 mm. and smaller were measured by means of a calibrated eye-piece micrometer, while all larger larvae were measured with a transparent millimeter rule. The measurements were taken from the tip of the snout to the end of the notochord; the caudal fin or finfold was not included in the measurement.

DETERMINING THE AVERAGE NUMBER OF EGGS SPAWNED PER DAY

In determining the average number of eggs spawned per day, all age categories 1/ were used in the determination except those that did not include a whole day's spawning through the accident of occupying a station while spawning or hatching was going on. The following age categories were omitted: eggs of category "A" collected between 8 P. M. and 6 A. M., and eggs of categories "C" or "D" in which over 80% of the eggs of the category were in the stage immediately preceding hatching. 2/

1/ In the age category designated A are included eggs spawned not longer than 24 hours prior to collection; B, eggs spawned within 24 to 48 hours of collection; C, eggs spawned within 48 to 72 hours of collection; and D, eggs spawned within 72 to 96 hours of collection.
2/ "C" or "D" eggs in which all or most of the eggs were in the stage immediately preceding hatching, would usually have had a portion of eggs already hatched and thus would not represent a complete day's spawning.

The average number of eggs per day in a sample (n') was derived from the formula:

$$n' = \frac{nx.\ n}{d(n-u)}$$

where n_x is the total number of eggs in those categories which were fully represented in the samples, d, the number of such categories, n, the total number of eggs in the haul and u, the number of eggs that were unclassified as to stage. This has the effect of pro-rating unclassified eggs among the several age categories.

In the record of pilchard eggs collected during 1940 and 1941 given in tables V and VI, the average number of eggs spawned per day is given in the last column. The age categories used in determining the average number per day in each sample are marked by an asterisk.

Variability in plankton tow-net catches.

Some information on the reliability of the data in tables IV to XI has been gained from a study of the duplicate hauls taken at many stations during 1940. The two hauls were taken successively, not simultaneously, but in as nearly identical a manner as possible. A paper dealing with the variance of the numbers of pilchard eggs in a set of 24 of these paired hauls has been published by Silliman (1946). He was able to separate the variability due to real differences in egg concentrations at different stations from the sampling variability between the two hauls at a station, the former accounting for roughly 90 percent of the total variability. As regards the sampling variability between the paired hauls at a station, he concluded that the count of eggs in one haul could not be considered significantly different (at the level P = 0.05) from the count in the other unless it was about half or double as large.

However, much smaller differences in the means or sums of eggs in groups of counts would be significant. Silliman (1946, p. 82) attempted to express this as a narrowing of the fiducial limits with increase in number of counts but his table of fiducial limits is valid only where the counts within a group are of uniform magnitude. Typically, the egg counts for the various stations occupied during a cruise range through several orders of magnitudes and for the mean or sum of such groups of counts Silliman's fiducial limits would not hold. The difficulty arises from the circumstance that in computing

the variances Silliman found it necessary to use the logarithm of the counts instead of the counts themselves. As a consequence the fiducial limits must be expressed as ratios or percentages. For very large counts a given percentage represents a very much larger number than for very small counts. In the variance of the mean or sum of a series of counts the contribution from large counts would be far different from that of small counts in the same series. The problem of assessing the reliability of means or sums of eggs for a given area computed from the counts in hauls from the several stations in that area therefore is complicated. It has yet to be solved.

From an analysis of variance on the counts of larvae taken in the paired hauls, I found that the number in one haul could not be considered significantly different from the number in the other unless it was about triple or one-third as large. In addition to this larger sampling variability between hauls taken at the same station, the sampling of larvae was also complicated by their relative scarcity in hauls taken during daylight hours, and by the partial loss of the smaller sizes through the mesh of the 1.0-meter and 1.6-meter nets. These problems will be dealt with in a subsequent paper.

LITERATURE CITED

AHLSTROM, ELBERT H.

1943. Studies on the Pacific pilchard or sardine (Sardinops caerulea) 4. Influence of temperature on the rate of development of pilchard eggs in nature. U. S. Dept. Int., Fish & Wildlife Service, Spec. Sci. Report No. 23, mimeo., 26 pp.

CLARK, FRANCES N.

1934. Maturity of the California sardine (Sardina caerulea) determined by ova diameter measurements. Calif. Div. Fish & Game. Fish. Bull. No. 42, 49 pp.

GIBBONS, S. G.

1933. A new type of sampler for use in the quantitative analysis of plankton collections. Conseil Perm. Internat. p. l'explor. de la Mer, Jour. du Conseil, vol. 8, No. 2, pp.195-200.

GODSIL, H. C.

1941. N. B. Scofield Progress report for 1940. Calif. Div. Fish and Game, vol. 27, No. 2, pp. 39-43.

LEAVITT, BENJAMIN B.

1935. A quantitative study of the vertical distribution of the larger zooplankton in deep water. Biol. Bull, vol. LXVIII, No. 1, pp. 115-130.

1938. The quantitative vertical distribution of macrozooplankton in the Atlantic Ocean basin. Biol. Bull. vol. LXXIV, No. 3, pp. 376-394.

SCOFIELD, EUGENE C.

1934. Early life history of the California sardine (Sardina caerulea) with special reference to distribution of eggs and larvae. Calif. Div. Fish & Game. Fish Bull. No. 41, 48 pp.

_____ and LINDNER, M. J.

1930. Preliminary report of the early life history of the California sardine. Calif. Fish & Game, vol. 16, No. 2, pp. 120-124.

SETTE, OSCAR ELTON

1943. Biology of the Atlantic mackerel (Scomber scombrus) of North America. Part I: Early life history, including the growth, drift, and mortality of the egg and larvae populations. Fish. Bull. Fish and Wildlife Service, vol. 50, pp. 149-237.

1943. Studies on the Pacific pilchard or sardine (Sardinops caerulea) I - Structure of a research program to determine how fishing affects the resources. U. S. Dept. Int., Fish & Wildlife Service, Spec. Sci. Report No. 19, mimeo., 27 pp.

SILLIMAN, RALPH P.

1943. Thermal and diurnal changes in the vertical distribution of eggs and larvae of the pilchard (Sardinops caerulea). Sears Foundation: Jour. Marine Research, vol. 5, No. 2, pp. 118-130.

1946. A study of variability in plankton tow-net catches of Pacific pilchard (Sardinops caerulea) eggs. Sears Foundation: Jour. Marine Research, vol. 6, No. 1, pp. 74-83.

SVERDRUP, H. U. and STAFF.

1943. Oceanographic observations of the Scripps Institution in 1939. Record of Observations, Scripps Institution of Oceanography, vol. 1, No. 2, pp. 65-160.

1944. Oceanographic observations of the "E. W. Scripps" cruises of 1940. Record of Observations, Scripps Institution of Oceanography, vol. 1, No. 3, pp. 161-248.

GUIDE TO TABLES IN APPENDIX

Guide to headings of tables I— III—
Record of oblique hauls made with plankton nets.

Station:

Table I. - The single cruise is numbered 8, the stations are numbered 11 to 90, the cruise number precedes the station number, thus 811 is station 11 of cruise 8. Where two hauls are listed for a station, the first was taken with the upper net, the other with the intermediate net. As neither pilchard eggs nor larvae were taken in the lowest net, fishing from about 120 meters to 72 meters, no data are given for these hauls.

Table II.- The cruises are numbered 10 to 15 in chronological sequence. The stations are numbered in sequence from 01 to 40 (-42). The stations had a fixed position for the season; hence, they retained the same number on successive cruises. In designating a particular time of occupying a station the cruise number precedes the station number; thus, 1001 refers to station 01 occupied on cruise 10, 1101 to station 01 occupied on cruise 11, etc.

A somewhat different system of designating the stations was followed by the Staff of the Scripps Institution in their "Oceanographic Observations" dealing with the 1940 cruises. On cruise 10 (X) the stations were designated 101 - 140, on cruise 11 (XI) the stations were designated 201 - 240, on cruise 12 (XII) the stations were designated 301 - 340, etc.

Table III. - The cruises are numbered 17, 19, 21, 23, 25, 27 (The hiati are due to short special cruises having been made between the regular survey cruises). The stations are numbered 11 - 17, 21 - 28, 30, 31 - 37, 40, 41 - 47, 51 - 55, 60, 61 - 64. The three stations ending in 0 were inshore stations. The other stations were arranged in six lines, with the most northerly line having the stations numbered 11 - 17, the next adjacent line to the south having the stations numbered 21 - 28, etc. Hence, the first figures in a station designation (that in the 10 position) refers to the number of the line, the second figure (that in the unit position) to the location of the station on the line, the lowest number on a line being nearest shore, the highest at the seaward end of the line. In designating a particular time of occupying a station, the cruise number precedes the station number; thus, 1713 refers to the occupancy during the 17th cruise of the third station seaward on the northern line, 1963 to the occupancy during the 19th cruise of the third station seaward on the most southerly line, etc.

The following stations were not occupied:
1939 - 824, 845
1940 - 1006, 1007, 1016, 1107, 1113 - 1116, 1118, 1126, 1127, 1133, 1212, 1213, 1218, 1222, 1224, 1225 -1239, 1509, 1518.

1941 - All stations were occupied on every cruise. Data for 0.5-meter net are not given for cruises 25 and 27.

All other stations omitted from the following tables were occupied but had no pilchard eggs or larvae in the plankton samples.

Position: North latitude, west longitude.
The position given for some stations in tables II and III is slightly different from the position indicated in the "Oceanographic Observations" of the Scripps Institution dealing with the same stations. One reason for these apparent discrepancies is that the position given in our tables is the estimated position at the time of taking the net hauls, which sometimes differed slightly from the position of the boat when the oceanographic observations were taken. In a few instances the difference is due to a recalculation of the position of the station subsequent to the cruise. Because such changes were usually slight, and because their use would make necessary the recalculation of portions of our data, the earlier estimate of the position of the station was retained.

Date: Month given in Roman numerals, the day of the month in Arabic; thus, V-10 is May 10.

Hour: The time indicated is approximately that of the mid-depth of the haul as the net was being brought upward; thus when 100 meters of wire were released in lowering the net, the time given is the time when half of the wire (50 meters) had been taken in when bringing the net (gradually) to the surface. The hours are given on a 24-hour basis; thus, 23:40 is equivalent to 11:40 P.M.

Net type: Three sizes of nets were used during the surveys, indicated by the following:
0.5M - net 0.5 meter in diameter at the mouth.
1 M - net 1.0 meter in diameter at the mouth.
2 M - net 2.0 square meters in area at the mouth (1.6 meters in diameter at the mouth. In the text this net is referred to as the 1.6-meter net).

The type of material composing the main body of the net is indicated by the following symbols:
S - Net constructed of No. 24XXX grit gauze.
SF - Net constructed of No. 40XXX grit gauze.
CO - Net constructed of cotton scrim netting.
C - Net constructed of cotton scrim netting of a different grade
The symbol Cl indicates a closing net.

Duration of haul: Given in minutes to the nearest half minute.

Depth meters: Depth of stratum fished in meters (For explanation refer to section on "Variation in depth of plankton hauls").

Volume of water strained: In cubic meters (For explanation, refer to section on "Measurement of volume of water strained by the nets"). Estimates followed by a question mark were not based on current meter readings.

S. Factor: Standardized haul factor (For explanation, refer to section on "Standardization factors").

During cruises 11 - 15 of the 1940 season two hauls were taken with the 2M net at most stations, the second immediately following the first. They are listed in table II in the order taken. The standardized haul value for each of such paired hauls is equal to one-half that of a normal standardized haul; hence, the combined figures for the two hauls are equivalent to one standardized haul. In recording the number of pilchard eggs and larvae taken in such paired hauls, only the combined total for the two hauls is given.

During the 1941 season a 1.0-meter net and a 0.5-meter net were towed together at most stations. The standardized haul values are put in terms of a normal standardized haul for each net. They differ in this respect from the paired hauls listed in table II. Data for the 0.5-meter net is not given for cruises 25 and 27, but for odd-numbered cruises 17 through 23 a record is given of all hauls taken with the 0.5-meter net except stations 2331, and 2361.

Guide to headings of tables IV to VII -
Record of pilchard eggs

Only those hauls are included in which pilchard eggs were found on examining a fractional part of the sample. In table VII the record covers odd numbered cruises 17 through 23 only.

Number of normal eggs: Number of normally developing pilchard eggs.

Total number of eggs: Includes all pilchard eggs taken in a sample, both normal and abnormal. Pilchard eggs were classed as abnormal when the embryos were stunted and misshapen in appearance.

A: Eggs spawned within 24 hours of collection.
B: " " " 24 to 48 hours of collection.
C: " " " 48 to 72 " " "
D: " " " 72 to 96 " " "

Unclass.: Unclassified eggs. - Refers to deteriorating eggs that could not be classified with certainty.

n: Total number of pilchard eggs in a standardized haul.

Average - n': Average number of pilchard eggs in a standardized haul per day of spawning represented. (See section on "Determining the average number of eggs spawned per day").

* An asterisk follows the age categories used in the determination of n'.

Guide to tables VIII to XI. - Record of Pilchard Larvae.

Midpoint of size classes: The larvae are grouped into size classes which have the following midpoints and ranges:

Midpoint of size class (in mm.)	Range of lengths included (in mm.)
3.25	2.25 - 4.25
4.75	4.26 - 5.25
5.75	5.26 - 6.25
6.75	6.26 - 7.25
7.75	7.26 - 8.25
8.75	8.26 - 9.25
9.75	9.26 -10.25
10.75	10.26 -11.25
11.75	11.26 -12.25
12.75	12.26 -13.25
13.75	13.26 -14.25
14.75	14.26 -15.25
15.75	15.26 -16.25
17.25	16.26 -18.25
19.25	18.26 -20.25
21.25	20.26 -22.25
23.75	22.26 -25.25
(27.25)	25.26 -29.25

Total: A summation of the numbers of a size class taken in the standardized samples of the stations occupied during a cruise.

Table I - Record of Oblique Hauls made with Plankton Nets during Cruise 8 in 1939.

Station	Position North Latitude	Position West Longitude	Date	Hour	Net Type	Duration of Haul	Depth, Meters	Volume of Water Strained	S Factor
811	32° 56.5'	117° 25'	V-10	23:40	1M-S	22.5	0-38	340.5	1.12
				22:40	1MC1-S	22.0	33-69	355.9	1.08
812	33° 12'	117° 50'	V-11	08:40	1M-S	20.5	0-34	292.8	1.15
813	33° 37.5'	118° 26'	V-11	15:00	1M-S	20.5	0-39	457.3	0.85
814	33° 54.5'	119° 04'	V-11	23:15	1M-S	22.5	0-37	326.6?	1.14
					1MC1-S	22.5	39-74	310.9	1.31
827	45° 01'	124° 21'	V-22	20:00	1M-S	20.0	0-37	250.7?	1.48
829	44° 59'	125° 02'	V-23	09:30	1M-S	26.0	0-45	277.2	1.64
					1MC1-S	26.0	38-90	381.4	1.30
834	44° 38'	129° 39.5'	V-25	08:40	1M-S	26.0	0-46	397.6	1.16
839	42° 47'	125° 30.5'	V-27	18:30	1M-S	23.5	0-40	344.0?	1.15
841	42° 51'	124° 49'	V-28	05:00	1M-S	25.0	0-39	381.0?	1.02
848	36° 24'	122° 40.5'	VI-12	05:00	1M-S	27.0	0-40	394.5?	1.01
849	36° 14.5'	123° 15'	VI-12	12:40	1M-S	26.0	0-44	360.2?	1.22
850	35° 57.5'	123° 48'	VI-12	19:15	1M-S	27.0	0-38	336.5	1.12
851	35° 42'	124° 19.5'	VI-13	03:40	1M-S	28.0	0-45	452.9	0.92
852	35° 25'	124° 41'	VI-13	10:10	1M-S	24.0	0-43	289.3?	1.48
					1MC1-S	24.0	33-82	235.4	1.98
853	35° 10.5'	125° 16.5'	VI-13	17:15	1M-S	24.0	0-44	284.9?	1.55
					1MC1-S	24.0	39-84	250.2	1.90
854	34° 34'	126° 23'	VI-14	07:00	1M-S	24.0	0-46	272.1?	1.67
855	34° 18.5'	126° 51'	VI-14	16:15	1M-S	21.0	0-47	275.8	1.69
					1MC1-S	21.0	39-89	227.8	2.17
857	31° 31'	124° 03'	VI-16	02:25	1M-S	25.0	0-44	296.9?	1.47
858	32° 02'	123° 08'	VI-16	14:10	1M-S	25.0	0-43	383.4	1.12
862	33° 16'	120° 03'	VI-22	10:20	1M-S	24.0	0-45	287.5	1.56
863	33° 03'	120° 33'	VI-22	17:30	1M-S	24.0	0-44	282.7?	1.55
864	32° 49'	121° 04'	VI-23	00:30	1M-S	25.0	0-44	284.9	1.54
865	32° 34'	121° 35'	VI-23	07:40	1M-S	25.0	0-46	278.5	1.64
					1MC1-S	25.0	40-88	333.2?	1.46
866	32° 17'	122° 05'	VI-23	12:50	1M-S	24.0	0-47	267.2?	1.76
870	31° 05'	117° 41'	VI-30	03:00	1M-S	28.0	0-38	575.5	0.66
878	26° 29'	121° 26'	VII-4	07:00	1M-S	29.0	0-46	539.7	0.85

Table II - Record of Oblique Hauls made with Plankton Nets during Cruises 10-15 in 1940.

Station	Position North Latitude	Position West Longitude	Date	Hour	Net Type	Duration of Haul	Depth, Meters	Volume of Water Strained	S Factor
Cruise 10:									
1001	33° 57'	119° 09.5'	III-12	04:00	2M-S	24.0	0-75	1884.0	0.40
1002	33° 49.5'	119° 46'	III-13	09:30	2M-S	25.5	0-69	2039.4?	0.34
1003	33° 42.5'	120° 11'	III-13	13:50	2M-S	25.0	0-66	1953.0?	0.34
1004	33° 39'	120° 33'	III-13	18:10	2M-S	24.5	0-70	1914.0	0.37
1005	33° 34'	120° 56'	III-13	22:30	2M-S	25.5	0-72	1964.4?	0.37
1008	33° 38.5'	119° 38'	III-13	05:50	2M-S	25.0	0-75	1580.4	0.48
1009	33° 25'	120° 42'	III-14	02:10	2M-S	24.5	0-79	2070.0	0.38
1010	33° 35.5'	118° 26.5'	III-10	17:45	2M-S	23.0	0-86	1507.2?	0.57
1011	33° 30'	119° 16'	III-13	01:30	2M-S	26.0	0-77	1797.0?	0.43
1012	33° 16.5'	120° 00'	III-14	22:10	2M-S	25.0	0-71	1962.0?	0.36
1013	33° 14'	120° 21'	III-14	18:10	2M-S	24.0	0-71	1618.2	0.44
1014	33° 09'	120° 41'	III-14	11:00	2M-S	26.5	0-73	1915.2	0.38
1015	33° 04'	121° 05'	III-14	07:10	2M-S	26.5	0-72	1992.6	0.36
1017	33° 16'	118° 54'	III-9	12:40	2M-S	25.0	0-77	1730.4	0.44
1018	33° 00'	120° 19'	III-14	14:40	2M-S	24.0	0-71	2335.2	0.30
1019	33° 25'	117° 53'	III-10	10:40	2M-S	25.0	0-71	1730.4	0.41
1020	33° 10'	118° 16.5'	III-9	20:30	2M-S	27.5	0-71	1191.0	0.60
1021	33° 09.5'	118° 40'	III-9	16:20	2M-S	27.0	0-70	2002.8	0.35
1022	33° 05'	119° 12'	III-9	08:00	2M-S	26.0	0-72	1723.8	0.42
1023	32° 53'	119° 35'	III-8	19:30	2M-S	28.0	0-73	2227.2	0.33
1024	32° 52'	119° 54'	III-8	15:10	2M-S	29.0	0-77	1851.6	0.42
1025	32° 45'	120° 12'	III-8	11:00	2M-S	28.0	0-75	1990.8	0.38
1026	32° 34'	120° 39'	III-8	06:10	2M-S	26.5	0-76	1647.0	0.46
1027	32° 33'	120° 58'	III-8	01:40	2M-S	27.0	0-77	1478.4	0.52
1028	33° 09'	117° 38'	III-10	05:40	2M-S	27.0	0-77	1834.8	0.42
1029	32° 56'	118° 00'	III-10	01:20	2M-S	26.0	0-76	1867.2	0.41
1030	32° 46.5'	118° 58'	III-6	23:30	2M-S	26.0	0-68	1888.8	0.36
1031	32° 39.5'	119° 38.5	III-7	07:15	2M-S	27.0	0-70	2022.0?	0.34
1032	32° 31'	119° 52'	III-7	11:10	2M-S	25.5	0-60	1995.4	0.30
1033	32° 17.5'	120° 15'	III-7	18:00	2M-S	26.0	0-82	1435.2	0.57
1034	32° 33'	118° 40'	III-6	17:50	2M-S	26.0	0-76	1647.0	0.46
1035	32° 31.5'	117° 27'	III-5	11:30	2M-S	26.0	0-69	1959.6	0.35
1036	32° 27.5'	117° 48.5'	III-5	17:30	1M-CO	20.0	0-73	501.8	1.49
1037	32° 22'	118° 07'	III-5	22:30	2M-S	24.0	0-71	1683.6	0.42
1038	32° 17'	118° 23'	III-6	03:10	2M-S	30.0	0-70	1987.2	0.35
1039	32° 13'	118° 45'	III-6	08:00	2M-S	25.0	0-68	1846.8	0.37
1040	32° 09'	119° 05'	III-6	12:30	2M-S	23.0	0-77	1510.8	0.51
Cruise 11:									
1101	33° 58'	119° 10'	III-26	16:40	2M-S	19.0	0-77	1320.0?	0.29
				17:05	2M-S	21.0	0-80	1218.0	0.33
1102	33° 49.5'	119° 45'	III-27	08:40	2M-S	14.0	0-69	1023.6	0.35
				09:00	2M-S	15.0	0-64	1111.2	0.29
1103	33° 42'	120° 15'	III-27	16:30	2M-S	17.0	0-77	1316.4	0.29
				16:50	2M-S	19.0	0-77	1282.2	0.30
1104	33° 38'	120° 31.5'	III-27	22:10	2M-S	15.0	0-61	1261.2	0.24
				22:30	2M-S	14.0	0-59	1246.2	0.24
1105	33° 30'	120° 50'	III-28	02:40	2M-S	17.0	0-74	1124.4	0.33
				03:05	2M-S	16.0	0-74	1114.8	0.33
1106	33° 25'	121° 08'	III-28	07:15	2M-S	14.0	0-67	1129.8	0.59
1108	33° 35'	119° 36'	III-27	03:45	2M-S	15.0	0-73	1075.4	0.34
				04:10	2M-S	18.0	0-74	1251.6	0.29
1109	33° 18.5'	120° 39'	III-28	12:00	2M-S	28.0	0-65	2631.6	0.25
1110	33° 37'	118° 29.5'	III-26	03:55	2M-S	20.0	0-71	1642.2	0.22
				04:20	2M-S	20.0	0-71	1534.2	0.23
1111	33° 30'	119° 16.5'	III-26	23:00	2M-S	14.0	0-64	1044.0	0.31
				23:20	2M-S	14.0	0-68	960.0	0.35
1112	33° 17'	120° 01.5'	III-28	16:50	2M-S	26.0	0-77	1988.4	0.39
1117	33° 18'	118° 54.5'	III-24	21:50	2M-S	16.0	0-65	1518.0	0.21
				22:10	2M-S	15.0	0-59	1323.0?	0.22
1119	33° 23.5'	117° 51.5'	III-25	20:20	2M-S	13.5	0-73	1150.2	0.32
				20:40	2M-S	14.0	0-63	1243.2	0.25

Table II (Cont'd.) - Record of Oblique Hauls made with Plankton Nets during Cruises 10-15 in 1940.

Station	Position North Latitude	Position West Longitude	Date	Hour	Net Type	Duration of Haul	Depth, Meters	Volume of Water Strained	S Factor
1120	33° 09.5'	118° 16'	III-25	05:55	2M-S	16.0	0-76	1164.0?	0.32
				06:25	2M-S	15.0	0-71	1177.0	0.30
1121	33° 08.5'	118° 39'	III-25	01:50	2M-S	24.0	0-71	1989.6	0.36
1122	33° 05'	119° 14.5'	III-24	17:20	2M-S	22.0	0-71	1794.0	0.40
1123	32° 52'	119° 37'	III-23	11:20	2M-S	24.5	0-68	1907.4	0.36
1124	32° 45'	119° 54'	III-23	17:00	2M-S	25.0	0-71	2025.6	0.35
1125	32° 43'	120° 15'	III-23	22:45	2M-S	50.0	0-74	2472.0	0.30
1128	33° 10'	117° 37'	III-25	15:25	2M-S	17.0	0-74	1402.4	0.26
				15:50	2M-S	17.0	0-72	1369.8	0.26
1129	32° 55.5'	118° 01'	III-25	10:40	2M-S	14.0	0-72	1023.0?	0.35
				11:00	2M-S	12.0	0-65	1088.4	0.30
1130	32° 45'	118° 51'	III-22	13:55	2M-S	15.0	0-76	957.0	0.40
				14:15	2M-S	15.0	0-66	1185.6	0.28
1131	32° 35.5'	119° 36'	III-22	21:50	2M-S	24.0	0-74	1609.8	0.46
1132	32° 24.5'	119° 55'	III-23	04:30	2M-S	25.0	0-73	1255.2	0.58
1134	32° 35'	118° 41'	III-22	10:05	2M-S	22.0	0-64	1465.8	0.22
				10:30	2M-S	16.0	0-73	1158.0?	0.31
1135	32° 33'	117° 27'	III-21	00:05	2M-S	20.0	0-79	1572.0	0.25
				00:35	2M-S	18.0	0-76	1326.0	0.29
1136	32° 27'	117° 47'	III-21	05:20	2M-S	17.0	0-84	1155.6	0.72
1137	32° 22'	118° 07'	III-21	10:55	2M-S	14.5	0-63	1140.0	0.28
				11:10	2M-S	15.0	0-66	1171.2	0.28
1138	32° 17'	118° 24'	III-21	15:00	2M-S	15.0	0-71	1008.6	0.35
				15:20	2M-S	16.0	0-74	968.6	0.38
1139	32° 11'	118° 43'	III-21	19:15	2M-S	15.0	0-75	1088.4	0.34
				19:35	2M-S	14.0	0-70	991.2	0.35
1140	32° 07'	119° 01'	III-22	00:15	2M-S	17.0	0-78	1099.2	0.35
				00:35	2M-S	14.0	0-70	1197.6	0.29
Cruise 12:									
1201	33° 54'	119° 07'	IV-12	03:35	2M-S	17.0	0-76	1236.5?	0.31
				04:05	2M-S	18.0	0-71	1406.0?	0.25
1202	33° 48'	119° 46.5'	IV-12	17:35	2M-S	15.0	0-77	1086.0?	0.36
				17:55	2M-S	15.0	0-75	1044.0?	0.36
1203	33° 44'	120° 11'	IV-12	23:05	2M-S	15.0	0-80	1047.0?	0.38
				23:20	2M-S	15.0	0-79	1058.5?	0.37
1204	33° 39'	120° 33'	IV-13	04:05	2M-S	13.0	0-76	946.0?	0.40
				04:25	2M-S	15.0	0-78	1074.5?	0.36
1205	33° 32'	120° 59'	IV-13	09:05	2M-S	15.0	0-78	1074.5?	0.36
				09:25	2M-S	15.0	0-73	1139.0?	0.32
1206	33° 25'	121° 21'	IV-13	13:30	2M-S	23.0	0-78	1640.0?	0.47
1207	33° 20'	121° 41'	IV-13	17:40	2M-S	24.0	0-83	1608.0?	0.52
1208	33° 36.5'	119° 33'	IV-12	13:35	2M-S	14.0	0-76	1018.0?	0.38
				13:55	2M-S	15.0	0-70	1172.0?	0.30
1209	33° 25'	120° 39'	IV-14	14:50	2M-S	23.0	0-82	1558.0?	0.53
1210	33° 38'	118° 32.5'	IV-11	05:55	2M-S	15.0	0-70	1074.0?	0.32
				06:15	2M-S	16.0	0-70	1146.0?	0.30
1211	33° 32'	119° 15'	IV-12	09:15	2M-S	19.0	0-70	1484.0?	0.24
				09:35	2M-S	16.0	0-74	1203.0?	0.31
1214	33° 09'	120° 45'	IV-14	08:50	2M-S	14.0	0-81	963.0?	0.84
1215	33° 04'	121° 05'	IV-14	04:20	2M-S	23.0	0-81	1583.0?	0.51
1216	32° 56'	121° 32'	IV-13	22:40	2M-S	27.0	0-81	1860.0?	0.44
1217	33° 19'	118° 55.5'	IV-9	22:30	2M-S	15.0	0-73	1042.0?	0.70
1219	33° 24'	117° 52'	IV-10	23:25	2M-S	16.0	0-72	1116.5?	0.32
				23:40	2M-S	15.0	0-71	1059.0?	0.34
1220	33° 09'	118° 15'	IV-10	09:20	2M-S	15.0	0-67	1112.5?	0.30
				09:40	2M-S	15.0	0-68	1095.5?	0.31
1221	33° 07.5'	118° 41.5'	IV-10	04:30	2M-S	26.0	0-70	1865.0?	0.37
1223	32° 52.5'	119° 34'	IV-9	13:10	2M-S	27.0	0-81	1730.5?	0.47
1226	32° 40'	120° 37'	IV-8	21:45	2M-S	24.0	0-72	1677.0?	0.43
1227	32° 31'	121° 06'	IV-8	16:00	2M-S	25.0	0-72	1746.0?	0.41

Table II (Cont'd.) - Record of Oblique Hauls made with Plankton Nets during Cruises 10-15 in 1940.

Station	Position North Latitude	Position West Longitude	Date	Hour	Net Type	Duration of Haul	Depth, Meters	Volume of Water Strained	S Factor
1228	33° 09.5'	117° 36'	IV-10	18:20	2M-S	15.0	0-71	1064.0?	0.33
				18:40	2M-S	15.0	0-69	1086.0?	0.32
1229	32° 56'	118° 00'	IV-10	13:10	2M-S	15.0	0-67	1101.0?	0.31
				13:30	2M-S	16.0	0-73	1112.0?	0.33
1230	32° 50'	118° 56'	IV-7	12:40	2M-S	14.0	0-75	952.0?	0.39
				13:00	2M-S	15.0	0-76	1004.0?	0.38
1231	32° 35'	119° 36'	IV-7	19:00	2M-S	33.0	0-73	2280.0?	0.32
1232	32° 25'	120° 03'	IV-8	03:15	2M-S	24.0	0-72	1685.0?	0.42
1233	32° 18'	120° 30'	IV-8	08:50	2M-S	14.0	0-64	1062.5?	0.30
				09:05	2M-S	15.5	0-68	1133.0?	0.30
1234	32° 35'	118° 41'	IV-6	14:40	2M-S	13.0	0-88	772.0?	0.28
				15:00	2M-S	13.0	0-78	852.0?	0.46
1235	32° 31'	117° 27'	IV-4	10:35	2M-S	14.0	0-72	1221.0	0.30
				10:55	2M-S	14.0	0-73	1179.5	0.31
1236	32° 25.5'	117° 44'	IV-5	03:35	2M-S	14.0	0-73	1218.0	0.30
				04:00	2M-S	14.0	0-78	1039.0	0.38
1237	32° 18'	118° 00'	IV-5	09:15	2M-S	14.0	0-80	1002.5	0.40
				09:35	2M-S	16.0	0-79	1073.0	0.37
1238	32° 14'	118° 19'	IV-5	16:45	2M-S	15.0	0-76	1004.5?	0.76
1240	32° 05'	119° 00'	IV-6	06:45	2M-S	32.0	0-81	2051.0?	0.40
Cruise 13:									
1301	33° 55'	119° 13.5'	IV-30	02:25	2M-S	15.0	0-78	1051.5?	0.37
				02:45	2M-S	16.0	0-76	1117.0?	0.34
1302	33° 47.5'	119° 43'	IV-30	16:45	2M-S	15.0	0-71	1017.0?	0.35
				17:05	2M-S	15.0	0-75	1064.0?	0.35
1303	33° 43'	120° 11'	IV-30	23:10	2M-S	16.0	0-73	1158.0?	0.32
				23:30	2M-S	17.0	0-72	1248.5?	0.29
1304	33° 36'	120° 35'	V-1	04:20	2M-S	15.0	0-81	1042.0?	0.39
				04:40	2M-S	17.0	0-86	1113.5?	0.38
1305	33° 32'	121° 00'	V-1	10:05	2M-S	16.0	0-75	1129.0?	0.33
				10:25	2M-S	15.0	0-72	1091.0?	0.32
1306	33° 26.5'	121° 20.5'	V-1	13:35	2M-S	16.0	0-73	935.5	0.39
				13:55	2M-S	16.0	0-74	879.0	0.42
1307	33° 22'	121° 41'	V-1	17:40	2M-S	15.0	0-73	840.0	0.44
				18:00	2M-S	17.0	0-76	1087.5?	0.35
1308	33° 36.5'	119° 35'	IV-30	12:40	2M-S	16.0	0-74	1140.5?	0.32
				13:00	2M-S	17.0	0-72	885.5	0.41
1309	33° 28'	120° 40.5'	V-2	12:45	2M-S	15.0	0-79	1015.0?	0.39
				13:05	2M-S	16.0	0-78	1094.5?	0.36
1310	33° 38.5'	118° 28'	IV-29	18:00	2M-S	16.0	0-72	1126.5	0.32
				18:20	2M-S	15.0	0-72	1101.5?	0.33
1311	33° 27.5'	119° 18.5'	IV-30	08:00	2M-S	15.0	0-70	1118.0?	0.31
				08:20	2M-S	16.0	0-74	1140.5?	0.33
1312	33° 19'	120° 04'	V-2	21:55	1M-CO	15.0	0-76	479.5	0.77
				22:15	1M-CO	15.0	0-76	454.0	0.83
1313	33° 14'	120° 22.5'	V-2	17:00	2M-S	13.0	0-75	850.0	0.44
				17:15	2M-S	14.0	0-72	919.5	0.39
1314	33° 10'	120° 46'	V-2	8:05	2M-S	17.0	0-83	1101.5?	0.37
				8:25	2M-S	15.0	0-73	905.5	0.41
1315	33° 01.5'	121° 03'	V-2	3:50	2M-S	16.0	0-78	914.5	0.43
				4:10	2M-S	15.0	0-76	887.0	0.43
1316	32° 54.5'	121° 31'	V-1	22:35	2M-S	16.0	0-74	1140.5?	0.32
				22:55	2M-S	16.0	0-76	1123.0?	0.34
1317	33° 23'	118° 55	IV-27	12:45	1M-CO	23.0	0-83	612.0	0.68
				13:10	1M-CO	25.0	0-82	709.0	0.58
1318	33° 02'	120° 14'	IV-26	17:50	1M-CO	22.0	0-81	755.5	1.08
1319	33° 24.5'	117° 52'	IV-28	11:55	2M-S	18.0	0-78	1258.0	0.31
				12:15	2M-S	19.0	0-78	1264.5	0.31
1320	33° 09'	118° 15'	IV-27	21:25	2M-S	15.0	0-77	1053.0	0.37
				21:45	2M-S	15.0	0-80	1180.0	0.34
1321	33° 10'	118° 40'	IV-27	17:00	1M-CO	24.0	0-76	976.0	0.78

Table II (Cont'd.) - Record of Oblique Hauls made with Plankton Nets during Cruises 10-15 in 1940.

Station	Position North Latitude	Position West Longitude	Date	Hour	Net Type	Duration of Haul	Depth, Meters	Volume of Water Strained	S Factor
1322	33° 03'	119° 13.5'	IV-27	07:30	1M-CO	24.0	0-76	767.5?	0.99
1323	32° 51'	119° 41'	IV-27	02:30	1M-CO	24.0	0-81	747.5?	1.09
1324	32° 48'	119° 59'	IV-26	22:10	1M-CO	24.0	0-81	748.5?	1.09
1325	32° 45.5'	120° 16.5'	IV-26	11:50	1M-CO	15.0	0-77	481.0?	0.81
				12:15	1M-CO	23.0	0-76	741.5?	0.51
1326	32° 40'	120° 36'	V-3	06:30	2M-S	14.0	0-72	864.0	0.41
				06:55	2M-S	18.0	0-77	1212.0	0.32
1327	32° 34.5'	121° 07'	V-3	12:05	2M-S	16.0	0-74	1226.0	0.30
				12:25	2M-S	14.0	0-70	1132.5	0.31
1328	33° 07.5'	117° 38'	IV-28	06:50	2M-S	19.0	0-75	1388.5	0.27
				07:15	2M-S	18.0	0-75	1330.0	0.28
1329	32° 54.5'	117° 59'	IV-28	02:05	2M-S	17.0	0-74	1116.5	0.33
				02:25	2M-S	16.0	0-78	1153.5	0.34
1330	32° 50'	118° 56'	IV-25	12:30	2M-S	17.0	0-74	1224.0?	0.30
				12:50	2M-S	17.0	0-74	1060.0	0.35
1331	32° 33.5'	119° 32.5'	IV-25	18:50	2M-S	17.0	0-80	952.0	0.42
				19:10	2M-S	14.0	0-78	870.0	0.45
1332	32° 32'	119° 56'	IV-26	00:45	2M-S	15.0	0-74	1010.5	0.37
				01:00	2M-S	15.0	0-78	978.5	0.40
1333	32° 27'	120° 25'	IV-26	06:50	2M-S	15.0	0-85	866.5	0.49
				07:10	2M-S	15.0	0-83	908.0	0.46
1334	32° 26'	118° 38.5'	IV-24	07:45	2M-S	25.0	0-75	1741.0	0.43
1335	32° 32.5'	117° 27'	IV-22	22:55	2M-S	15.0	0-74	1043.0	0.36
				23:15	2M-S	16.0	0-73	1256.5	0.29
1336	32° 27'	117° 47'	IV-23	03:20	2M-S	16.0	0-78	951.0	0.41
				03:40	2M-S	17.0	0-79	1144.0	0.35
1337	32° 22'	118° 07'	IV-23	08:15	2M-S	17.0	0-83	1004.5	0.41
				08:45	2M-S	17.0	0-80	1155.0	0.35
1338	32° 16'	118° 25'	IV-23	13:00	2M-S	15.0	0-76	1053.0?	0.36
				13:20	2M-S	15.0	0-77	1042.0?	0.37
1339	32° 10'	118° 42.5'	IV-23	17:10	2M-S	16.0	0-77	1146.5	0.34
				17:30	2M-S	15.0	0-74	1069.0	0.35
1340	32° 01'	119° 03'	IV-23	23:40	2M-S	25.0	0-75	1756.5	0.42
Cruise 14:									
1401	33° 57'	119° 11'	V-16	04:25	2M-CO	16.0	0-70	746.0	0.47
				04:45	2M-CO	17.0	0-70	627.5	0.56
1402	33° 47'	119° 46'	V-16	19:30	2M-CO	16.0	0-72	885.0	0.41
				19:50	2M-CO	14.0	0-71	785.5	0.45
1403	33° 41'	120° 11.5'	V-17	01:45	2M-CO	16.0	0-73	740.5	0.50
				02:05	2M-CO	16.0	0-71	761.5	0.47
1404	33° 40'	120° 36'	V-17	06:50	2M-CO	15.0	0-62	845.0	0.37
				07:10	2M-CO	15.0	0-64	771.5	0.42
1405	33° 37'	120° 58'	V-17	11:35	2M-CO	15.0	0-71	753.5	0.47
				11:55	2M-CO	15.0	0-71	793.0	0.45
1406	33° 30'	121° 20'	V-17	16:05	2M-CO	15.0	0-68	792.0	0.43
				16:25	2M-CO	16.0	0-67	842.5	0.40
1407	33° 23'	121° 41'	V-17	20:35	2M-CO	14.0	0-70	600.5	0.59
				20:55	2M-CO	16.0	0-70	583.0	0.60
1408	33° 38.5'	119° 36'	V-16	14:50	2M-CO	17.0	0-71	816.0	0.44
				15:05	2M-CO	16.0	0-70	862.0	0.41
1409	33° 24'	120° 39.5'	V-18	15:10	2M-CO	15.0	0-70	864.5	0.41
				15:25	2M-CO	16.0	0-71	873.0	0.41
1410	33° 40.5'	118° 25'	V-15	11:40	2M-CO	15.0	0-65	914.5	0.35
				12:00	2M-CO	18.0	0-71	886.5	0.40
1411	33° 31.5'	119° 23.5'	V-16	10:30	2M-CO	15.0	0-62	592.5	0.66
				10:50	2M-CO	16.0	0-63	628.5	0.63
1412	33° 17'	120° 01'	V-19	02:10	2M-CO	17.0	0-72	1023.0	0.35
				02:30	2M-CO	18.0	0-74	962.5	0.39
1413	33° 14'	120° 21'	V-18	19:25	2M-CO	17.0	0-72	1056.0	0.34
				19:50	2M-CO	17.0	0-73	951.0	0.38

Table II (Cont'd.) - Record of Oblique Hauls made with Plankton Nets during Cruises 10-15 in 1940.

Station	Position North Latitude	Position West Longitude	Date	Hour	Net Type	Duration of Haul	Depth, Meters	Volume of Water Strained	S Factor
1414	33° 11'	120° 49'	V-18	11:30	2M-CO	15.0	0-68	969.5	0.35
				11:45	2M-CO	14.0	0-65	997.5	0.33
1415	33° 06'	121° 09.5'	V-18	07:10	2M-CO	14.0	0-68	927.5	0.37
				07:30	2M-CO	14.0	0-68	856.0	0.39
1416	32° 58.5'	121° 34.5'	V-18	01:45	2M-CO	17.0	0-73	505.0?	0.44
				02:15	2M-CO	17.0	0-75	740.0	0.51
1417	33° 21.5'	118° 57'	V-13	03:55	2M-CO	17.0	0-69	913.0	0.38
				04:15	2M-CO	17.0	0-74	876.5	0.42
1418	33° 00'	120° 11'	V-19	06:50	2M-CO	15.0	0-74	847.5	0.44
				07:10	2M-CO	16.0	0-65	926.5	0.35
1419	33° 25.5'	117° 51.5'	V-14	04:50	2M-CO	18.0	0-73	879.5	0.42
				05:10	2M-CO	17.0	0-69	977.5	0.36
1420	33° 12'	118° 14'	V-13	13:10	2M-CO	17.0	0-83	702.5	0.60
				13:30	2M-CO	18.0	0-66	929.0	0.36
1421	33° 11'	118° 38'	V-13	08:30	2M-CO	15.0	0-72	800.5?	0.45
				08:55	2M-CO	14.0	0-69	560.5	0.61
1422	33° 07.5'	119° 15'	V-12	22:45	2M-CO	14.0	0-72	630.5	0.57
				23:05	2M-CO	15.0	0-71	808.0?	0.44
1423	32° 53'	119° 40'	V-19	12:35	2M-CO	15.0	0-68	832.0	0.41
				12:55	2M-CO	15.0	0-65	831.0	0.39
1424	32° 45'	119° 58'	V-19	17:15	2M-CO	15.0	0-71	644.0	0.55
				17:35	2M-CO	17.0	0-73	663.5	0.55
1425	32° 43'	120° 20'	V-19	22:25	2M-CO	17.0	0-74	770.5	0.48
				22:45	2M-CO	16.0	0-67	861.0	0.39
1426	32° 38'	120° 40.5'	V-20	03:20	2M-CO	17.0	0-69	823.5	0.42
				03:45	2M-CO	18.0	0-74	730.0	0.51
1427	32° 30'	121° 08'	V-20	08:35	2M-CO	15.0	0-72	897.5	0.40
				08:55	2M-CO	15.0	0-71	842.0	0.42
1428	33° 06.5'	117° 36'	V-13	23:20	2M-CO	14.0	0-70	786.5	0.45
				23:40	2M-CO	14.0	0-69	787.0	0.44
1429	32° 56'	117° 58'	V-13	18:20	2M-CO	14.0	0-67	873.5	0.38
				18:40	2M-CO	15.0	0-73	652.5	0.76
1430	32° 45'	118° 56'	V-12	16:05	2M-CO	17.0	0-74	610.5	0.60
				16:25	2M-CO	16.0	0-76	565.5	0.68
1431	32° 36'	119° 38.5'	V-21	02:05	2M-CO	17.0	0-71	735.0	0.48
				02:25	2M-CO	16.0	0-68	657.0	0.52
1432	32° 35'	120° 09'	V-20	19:30	2M-CO	18.0	0-75	998.5	0.38
				19:55	2M-CO	18.0	0-72	939.0	0.39
1434	32° 22'	118° 48'	V-12	10:10	2M-CO	14.0	0-66	722.5	0.46
				10:30	2M-CO	15.0	0-71	726.5	0.49
1435	32° 33'	117° 27'	V-10	22:00	2M-CO	16.0	0-67	1150.0	0.29
				22:25	2M-CO	15.0	0-68	1054.5	0.32
1436	32° 28'	117° 47.5'	V-11	03:40	2M-CO	18.0	0-72	1060.0	0.34
				04:05	2M-CO	20.0	0-73	978.5	0.38
1437	32° 23'	118° 08'	V-11	09:00	2M-CO	14.0	0-69	812.5	0.42
				09:20	2M-CO	15.0	0-72	814.0	0.45
1438	32° 16.5'	118° 29'	V-11	14:10	2M-CO	18.0	0-72	1186.5	0.30
				14:30	2M-CO	17.0	0-75	901.0	0.42
1439	32° 09'	118° 47'	V-11	20:00	2M-CO	14.0	0-73	781.0	0.47
				20:20	2M-CO	15.0	0-73	705.0	0.53
1440	32° 00'	119° 07'	V-12	02:35	2M-CO	18.0	0-79	867.5	0.45
				02:55	2M-CO	17.0	0-74	876.0	0.42
1441	32° 19'	119° 25'	V-21	11:10	2M-CO	17.0	0-72	1080.0	0.33
				11:30	2M-CO	17.0	0-66	1058.0	0.32
1442	32° 13.5'	119° 45'	V-21	06:50	2M-CO	14.0	0-67	988.0	0.34
				07:10	2M-CO	17.0	0-75	771.0	0.38
Cruise 15:									
1501	33° 56'	119° 10'	VI-4	23:05	2M-CO	17.0	0-76	845.5	0.45
				23:30	2M-CO	17.0	0-70	615.5	0.57
1502	33° 49.5'	119° 46'	VI-5	14:00	2M-CO	17.0	0-78	803.0	0.49
				14:20	2M-CO	18.0	0-80	875.0	0.46

Table II (Cont'd.) - Record of Oblique Hauls made with Plankton Nets during Cruises 10-15 in 1940.

Station	Position North Latitude	Position West Longitude	Date	Hour	Net Type	Duration of Haul	Depth, Meters	Volume of Water Strained	S Factor
1504	33° 37'	120° 34'	VI-6	01:50	2M-CO	29.0	0-78	1184.0	0.66
1505	33° 31'	120° 58'	VI-6	07:00	2M-CO	26.0	0-79	1013.0	0.78
1506	33° 27'	121° 17'	VI-6	12:30	2M-CO	27.0	0-80	1126.0	0.71
1507	33° 22'	121° 35'	VI-6	17:00	2M-CO	28.0	0-79	1364.0	0.58
1510	33° 40'	118° 26.5'	VI-4	13:30	2M-CO	16.0	0-76	970.0	0.39
				13:50	2M-CO	17.0	0-73	988.0	0.37
1512	33° 18.5'	120° 00'	VI-7	16:15	1M-CO	23.0	0-73	756.5	0.97
1513	33° 18'	120° 27'	VI-7	11:50	2M-CO	15.0	0-65	1020.5	0.32
				12:20	1M-CO	26.0	0-79	891.5	0.44
1514	33° 11'	120° 46'	VI-7	07:30	2M-CO	27.0	0-73	1531.0	0.48
1515	33° 04'	121° 05'	VI-7	03:15	2M-CO	27.0	0-76	1544.5	0.49
1516	32° 56'	121° 26'	VI-6	22:10	2M-CO	26.0	0-86	1151.0	0.75
1517	33° 20'	118° 52'	VI-2	02:50	2M-CO	16.0	0-81	619.5	0.66
				03:10	2M-CO	18.0	0-78	751.5	0.52
1521	33° 10'	118° 38.5'	VI-2	08:00	2M-CO	16.0	0-78	682.5	0.57
				08:20	2M-CO	15.0	0-80	486.0	0.83
1522	33° 06'	119° 11'	V-30	13:15	2M-CO	16.0	0-75	959.5	0.39
				13:30	2M-CO	16.0	0-75	951.0	0.40
1523	32° 49'	119° 40'	V-30	19:10	2M-CO	16.0	0-68	1103.0	0.31
				19:30	2M-CO	16.0	0-69	944.0	0.36
1524	32° 48'	119° 58'	V-30	23:50	2M-CO	16.0	0-74	787.0	0.47
			V-31	00:10	2M-CO	16.0	0-72	890.5	0.40
1525	32° 44'	120° 22'	V-31	05:30	2M-CO	17.0	0-74	850.0	0.44
				05:50	2M-CO	16.0	0-73	802.5	0.46
1526	32° 41'	120° 44'	V-31	10:15	2M-CO	16.0	0-66	1101.5	0.30
				10:35	2M-CO	15.0	0-62	1151.5	0.27
1527	32° 30'	121° 07'	V-31	15:25	2M-CO	16.0	0-73	896.0	0.41
				15:40	2M-CO	15.0	0-69	1011.5	0.34
1530	32° 49.5'	118° 59'	VI-1	20:10	2M-CO	16.0	0-82	795.0	1.03
1531	32° 27.5'	119° 40'	VI-1	12:15	2M-CO	18.0	0-75	760.0	0.50
				12:35	2M-CO	16.0	0-79	809.5	0.49
1532	32° 29'	120° 00.5'	VI-1	02:25	2M-CO	18.0	0-68	1009.5	0.34
				02:45	2M-CO	17.0	0-73	967.5	0.38
1533	32° 22'	120° 27'	V-31	21:35	2M-CO	16.0	0-76	883.0	0.43
				21:55	2M-CO	16.0	0-69	979.5	0.36
1534	32° 34'	118° 41'	V-29	10:40	2M-CO	17.0	0-73	997.0	0.37
				11:00	2M-CO	17.0	0-68	988.0	0.34
1535	32° 31'	117° 27'	V-27	21:35	2M-CO	14.0	0-68	982.5	0.35
				21:55	2M-CO	17.0	0-73	1032.0	0.36
1536	32° 26.5'	117° 47'	V-28	03:00	2M-CO	18.0	0-82	749.5	0.55
				03:20	2M-CO	17.0	0-82	674.5	0.61
1537	32° 22'	118° 07'	V-28	08:45	2M-CO	17.0	0-78	1068.0	0.36
				09:10	2M-CO	19.0	0-78	1082.5	0.36
1538	32° 17'	118° 26'	V-28	14:40	2M-CO	20.0	0-75	994.0	0.75
1539	32° 05'	118° 44'	V-28	20:30	2M-CO	25.0	0-75	1434.0	0.52
1540	31° 55'	119° 04'	V-29	01:45	2M-CO	18.0	0-81	948.0	0.43
				02:10	2M-CO	18.0	0-78	938.5	0.41
1542	32° 12'	119° 47'	VI-1	06:50	2M-CO	17.0	0-74	779.0	0.48
				07:10	2M-CO	17.0	0-70	762.0	0.46

Table III - Record of Oblique Hauls made with Plankton Nets during Odd-numbered Cruises 17-27 in 1941.

Station	Position North Latitude	Position West Longitude	Date	Hour	Net Type	Duration of haul	Depth, Meters	Volume of Water Strained	S Factor
Cruise 17:									
1711	33° 52'	119° 19'	III-26	18:00	(1M-C	24.5	0-75	631.2	1.18
					(0.5M-SF			173.0?	4.32
1712	33° 50'	119° 42'	III-26	22:10	(1M-C	23.5	0-68	628.1	1.08
					(0.5M-SF			171.8?	3.95
1713	33° 44'	120° 06'	III-27	02:30	(1M-C	24.5	0-79	709.1	1.12
					(0.5M-SF			156.1?	5.07
1714	33° 40'	120° 27'	III-27	06:40	1M-C	24.0	0-67	616.5	1.09
1715	33° 36'	120° 50'	III-27	10:50	(1M-C	23.5	0-68	660.1	1.03
					(0.5M-SF			159.8?	4.21
1716	33° 34'	121° 12'	III-27	15:40	(1M-C	24.5	0-74	698.7	1.06
					(0.5M-SF			185.7?	4.00
1717	33° 32'	121° 40'	III-27	21:20	1M-CO	24.5	0-64	698.7?	0.91
1721	33° 39'	118° 36'	III-29	14:20	(1M-C	23.0	0-70	609.6	1.15
					(0.5M-SF			170.2?	4.13
1722	33° 36'	119° 00'	III-29	10:00	1M-CO	24.0	0-69	631.6?	1.09
1723	33° 30'	119° 25'	III-29	05:50	1M-CO	23.0	0-74	568.8?	1.30
1724	33° 25'	119° 44'	III-29	01:40	1M-CO	17.0	0-55	399.4?	1.36
1725	33° 18'	120° 06'	III-28	21:30	1M-CO	22.5	0-68	600.4?	1.13
1726	33° 16'	120° 28'	III-28	17:20	1M-CO	23.0	0-74	565.9?	1.31
1727	33° 12'	120° 54'	III-28	13:00	1M-CO	23.5	0-77	555.1?	1.39
1728	33° 04'	121° 23'	III-28	08:30	1M-CO	24.0	0-71	616.9?	1.15
1730	33° 36'	118° 10'	III-29	17:45	1M-CO	8.5	0-26	209.1?	1.24
1731	33° 20'	118° 07'	III-29	21:50	(1M-C	24.0	0-68	720.1	0.95
					(0.5M-SF			174.7?	3.90
1732	33° 14'	118° 30'	III-30	02:50	(1M-C	23.5	0-75	762.8	0.98
					(0.5M-SF			155.6?	4.80
1733	33° 10'	118° 46'	III-26	10:10	(1M-C	24.0	0-69	669.9	1.03
					(0.5M-SF			191.0?	3.63
1734	33° 02'	119° 12'	III-26	06:00	(1M-C	24.0	0-74	763.4	0.98
					(0.5M-SF			148.3?	5.02
1735	32° 55'	119° 35'	III-26	01:30	(1M-C	23.5	0-73	537.7	1.36
					(0.5M-SF			148.5?	4.93
1736	32° 50'	119° 58'	III-25	21:10	(1M-C	25.5	0-66	720.7	0.92
					(0.5M-SF			173.6?	3.80
1737	32° 44'	120° 18'	III-25	17:30	(1M-C	23.5	0-70	651.6	1.08
					(0.5M-SF			155.1?	4.53
1740	33° 13'	117° 28'	III-30	17:30	1M-CO	12.0	0-18	296.6?	0.62
1741	33° 04'	117° 32'	III-30	15:50	(1M-C	23.0	0-73	503.9	1.45
					(0.5M-SF			146.7?	4.99
1742	32° 58'	117° 51'	III-30	12:00	1M-C	23.0	0-71	737.3	0.96
1743	32° 49'	118° 16'	III-30	07:45	(1M-C	24.0	0-66	617.7	1.08
					(0.5M-SF			168.0?	3.95
1744	32° 45'	118° 36'	III-24	20:10	(1M-C	25.0	0-62	834.6	0.75
					(0.5M-SF			196.0	3.18
1745	32° 36'	119° 00'	III-25	01:00	(1M-C	24.5	0-77	807.4	0.95
					(0.5M-SF			163.4?	4.69
1746	32° 30'	119° 26'	III-25	07:00	1M-C	26.5	0-64	889.0	0.72
1747	32° 24'	119° 50'	III-25	11:10	(1M-C	24.5	0-66	743.0	0.89
					(0.5M-SF			171.5?	3.86
1751	32° 33'	117° 29'	III-21	21:45	(1M-C	27.0	0-69	764.2	0.91
					(0.5M-SF			214.4?	3.23
1752	32° 26'	117° 51'	III-23	20:30	(1M-C	25.5	0-75	683.4	1.09
					(0.5M-SF			155.5	4.80
175[illegible]	32° 18'	118° 14'	III-24	02:00	(1M-C	24.0	0-71	691.2	1.03
					(0.5M-SF			154.1?	4.61
1754	32° 11'	118° 35'	III-24	07:20	(1M-C	24.0	0-63	794.4	0.79
					(0.5M-SF			153.8	4.07
1755	32° 03'	118° 59'	III-24	12:40	(1M-C	25.0	0-78	802.7	0.97
					(0.5M-SF			172.8	4.49
1760	32° 32'	117° 13.2'	III-21	17:30	1M-CO	10.0	0-27	266.8?	1.02
1761	32° 11'	117° 17'	III-22	03:40	(1M-C	27.0	0-74	705.8	1.05
					(0.5M-SF			193.6	3.84

Table III (Cont'd.) - Record of Oblique Hauls made with Plankton Nets during Cruises 17-27 in 1941

Station	Position North Latitude	Position West Longitude	Date	Hour	Net Type	Duration of Haul	Depth, Meters	Volume of Water Strained	S Factor
1762	32° 02.5'	117° 35'	III-22	08:30	(1M-C	24.5	0-74	633.0	1.17
					(0.5M-SF			169.6	4.38
1763	31° 54'	117° 53'	III-22	13:30	(1M-C	25.0	0-67	712.2	0.95
					(0.5M-SF			177.7	3.79
1764	31° 46'	118° 26'	III-22	19:40	(1M-C	25.0	0-71	716.7	1.00
					(0.5M-SF			174.3	4.10
Cruise 19:									
1911	33° 53.5'	119° 21.5'	IV-22	07:10	(1M-CO	23.5	0-71	460.6	1.54
					(0.5M-SF			155.1?	4.57
1912	33° 50'	119° 45'	IV-22	11:00	(1M-CO	23.0	0-70	625.3	1.12
					(0.5M-SF			182.2?	3.83
1913	33° 45'	120° 06'	IV-22	15:40	1M-C	23.0	0-81	568.8?	1.42
1914	33° 40'	120° 25'	IV-22	21:30	1M-C	27.0	0-79	687.5?	1.15
1915	33° 34'	120° 44.5'	IV-23	02:40	1M-C	23.0	0-72	641.8?	1.12
1916	33° 29'	121° 06'	IV-23	07:40	(1M-CO	24.0	0-69	658.1	1.06
					(0.5M-SF			178.6?	3.89
1917	33° 21'	121° 36'	IV-23	12:40	(1M-CO	24.0	0-78	538.2	1.44
					(0.5M-SF			159.8?	4.86
1921	33° 38'	118° 36'	IV-24	21:30	(1M-CO	24.0	0-72	538.2	1.33
					(0.5M-SF			186.7?	3.83
1922	33° 35'	118° 59'	IV-24	17:30	(1M-CO	23.0	0-77	458.2	1.69
					(0.5M-SF			136.6?	5.66
1923	33° 31'	119° 25'	IV-24	13:50	(1M-CO	23.0	0-77	490.2	1.58
					(0.5M-SF			139.4?	5.55
1924	33° 25'	119° 43'	IV-24	10:30	1M-C	21.0	0-64	591.2?	1.08
1925	33° 19'	120° 02.5'	IV-24	07:10	(1M-CO	24.0	0-73	482.9	1.51
					(0.5M-SF			154.1	4.72
1926	33° 14.5'	120° 32.5'	IV-24	02:20	(1M-CO	24.0	0-84	398.2	2.11
					(0.5M-SF			138.2?	6.08
1927	33° 09.5'	120° 56'	IV-23	21.20	(1M-CO	24.0	0-70	591.6	1.19
					(0.5M-SF			162.7?	4.32
1928	33° 03'	121° 24'	IV-23	16:30	(1M-CO	23.0	0-75	561.8	1.34
					(0.5M-SF			153.2?	4.90
1930	33° 36'	118° 10.5'	IV-25	01:00	1M-C	9.0	0-28	223.6?	1.27
1931	33° 20'	118° 07.5'	IV-17	11:30	(1M-CO	24.0	0-75	557.7	1.34
					(0.5M-SF			145.4?	5.13
1932	33° 14'	118° 30'	IV-18	21:20	(1M-CO	24.0	0-72	651.6	1.11
					(0.5M-SF			184.8?	3.92
1933	33° 04.5'	118° 51.5'	IV-19	02.45	1M-C	24.0	0-83	578.7?	1.43
1934	32° 56'	119° 14'	IV-19	07:45	(1M-CO	24.0	0-72	565.1	1.28
					(0.5M-SF			172.8?	4.18
1935	32° 53'	119° 37'	IV-19	12:30	(1M-CO	23.0	0-82	482.7	1.71
					(0.5M-SF			145.4?	5.67
1936	32° 45'	119° 57.5'	IV-19	18:15	(1M-CO	24.0	0-72	513.1	1.40
					(0.5M-SF			161.3?	4.45
1937	32° 44'	120° 23'	IV-20	00:40	(1M-CO	24.0	0-79	570.4	1.38
					(0.5M-SF			142.6?	5.51
1940	33° 16'	117° 33'	IV-25	06:15	1M-C	16.0	0-43	444.5?	0.98
1941	33° 01'	117° 32'	IV-25	09:10	(1M-CO	22.5	0-70	610.6	1.14
					(0.5M-SF			167.0?	4.19
1942	32° 57'	117° 50.5'	IV-17	06:00	(1M-CO	24.0	0-76	574.1	1.33
					(0.5M-SF			143.0?	5.33
1943	32° 49'	118° 16'	IV-20	22:10	(1M-CO	24.0	0-73	576.7	1.26
					(0.5M-SF			162.7?	4.47
1944	32° 42.5'	118° 40'	IV-20	18:10	(1M-CO	23.0	0-72	546.7	1.32
					(0.5M-SF			131.9?	4.44
1945	32° 36'	119° 00'	IV-20	14:30	(1M-CO	23.0	0-77	472.1	1.64
					(0.5M-SF			158.7?	4.88
1946	32° 29'	119° 26'	IV-20	10:30	(1M-CO	23.0	0-74	559.6	1.31
					(0.5M-SF			175.7?	4.18

Table III (Cont'd.) - Record of Oblique Hauls made with Plankton Nets during Cruises 17-27 in 1941.

Station	Position North Latitude	Position West Longitude	Date	Hour	Net Type	Duration of Haul	Depth, Meters	Volume of Water Strained	S Factor
1947	32° 25.5'	119° 48'	IV-20	06:40	(1M-CO	23.0	0-70	587.9	1.19
					(0.5M-SF			152.3?	4.60
1951	32° 31'	117° 30'	IV-14	23:50	(1M-CO	25.0	0-72	694.8	1.04
					(0.5M-SF			174.5	4.14
1952	32° 26'	117° 52'	IV-16	23:30	(1M-CO	23.0	0-72	610.0	1.18
					(0.5M-SF			145.4?	4.96
1953	32° 22'	118° 14'	IV-16	19:10	(1M-CO	25.0	0-72	656.1	1.10
					(0.5M-SF			159.5?	4.53
1954	32° 21'	118° 43'	IV-16	14:00	(1M-CO	23.0	0-82	574.5	1.42
					(0.5M-SF			134.8?	6.05
1955	32° 12'	119° 12'	IV-16	08:30	(1M-CO	26.0	0-75	565.5	1.33
					(0.5M-SF			164.3?	4.58
1960	32° 33'	117° 14'	IV-14	19:15	1M-C	9.5	0-23	286.0?	0.81
1961	32° 07.5'	117° 20'	IV-15	05:10	(1M-CO	25.0	0-74	716.0	1.03
					(0.5M-SF			176.0?	4.20
1962	31° 58'	117° 44.5'	IV-15	10:20	(1M-CO	25.5	0-72	644.2	1.12
					(0.5M-SF			174.9	4.12
1963	31° 53'	118° 03'	IV-15	14:50	(1M-CO	24.0	0-82	562.2	1.45
					(0.5M-SF			147.8?	5.51
1964	31° 44'	118° 29'	IV-15	20:00	(1M-CO	25.0	0-71	682.2	1.04
					(0.5M-SF			168.0?	4.22
Cruise 21:									
2111	33° 51.5'	119° 18.5'	V-15	02:20	(1M-S	24.0	0-78	691.6	1.13
					(0.5M-SF			149.7	5.21
2112	33° 46.5'	119° 46'	V-15	07:30	(1M-S	23.5	0-75	724.6	1.03
					(0.5M-SF			143.0	5.24
2113	33° 45'	120° 06.5'	V-15	12:20	(1M-S	23.0	0-78	687.1	1.14
					(0.5M-SF			144.3	5.41
2114	33° 43'	120° 25'	V-15	17:30	1M-C	24.5	0-77	638.7?	1.20
2115	33° 35.5'	120° 52'	V-15	23:30	(1M-S	24.0	0-75	714.8	1.05
					(0.5M-SF			128.6	5.81
2116	33° 31.5'	121° 16'	V-16	05:10	1M-C	25.0	0-74	676.3?	1.10
2117	33° 28.5'	121° 42.5'	V-16	09:45	1M-C	24.5	0-74	665.7?	1.11
2121	33° 38.5'	118° 36'	V-13	21:20	(1M-S	23.5	0-74	817.8	0.91
					(0.5M-SF			134.7	5.52
2122	33° 35'	119° 00.5'	V-13	17:20	1M-C	19.0	0-57	555.3?	1.06
2123	33° 30.5'	119° 25'	V-13	14:00	(1M-S	22.5	0-69	684.2	1.01
					(0.5M-SF			139.1	4.97
2124	33° 25'	119° 44'	V-17	07:20	1M-C	21.0	0-68	555.3?	1.23
2125	33° 19'	120° 07'	V-17	03:50	1M-C	24.0	0-75	640.4?	1.18
2126	33° 14'	120° 32'	V-16	23:10	1M-C	24.0	0-76	634.4?	1.20
2127	33° 08'	120° 57'	V-16	19:00	1M-C	24.0	0-71	678.5?	1.04
2128	33° 02'	121° 22'	V-16	14:45	1M-C	24.5	0-72	680.7?	1.06
2130	33° 36'	118° 10'	V-14	00:40	1M-C	9.5	0-29	232.6?	1.23
2131	33° 21'	118° 08'	V-11	05:20	(1M-S	24.0	0-79	680.1	1.17
					(0.5M-SF			137.5	5.77
2132	33° 14'	118° 31'	V-11	09:40	(1M-S	25.5	0-72	861.5	0.84
					(0.5M-SF			162.5	4.46
2133	33° 08'	118° 54'	V-11	13:40	(1M-S	24.0	0-74	996.5	0.75
					(0.5M-SF			222.0	3.36
2134	33° 02.5'	119° 14'	V-11	17:15	(1M-S	23.0	0-68	759.1	0.89
					(0.5M-SF			112.7	6.01
2135	32° 56'	119° 38'	V-11	21:15	(1M-S	23.0	0-71	694.0	1.03
					(0.5M-SF			109.5	6.50
2136	32° 48'	119° 59'	V-12	01:50	(1M-S	24.0	0-74	740.5	1.00
					(0.5M-SF			119.6	6.20
2137	32° 39'	120° 20.5'	V-12	06:20	(1M-S	24.0	0-73	734.0	0.99
					(0.5M-SF			128.2	5.67
2140	33° 16'	117° 32.5'	V-11	00:10	1M-C	16.5	0-49	436.2?	1.13
2141	33° 03'	117° 32'	V-10	21:30	(1M-S	23.5	0-72	828.9	0.86
					(0.5M-SF			146.6	4.88

Table III (Cont'd.) - Record of Oblique Hauls made with Plankton Nets during Cruises 17-27 in 1941.

Station	Position North Latitude	Position West Longitude	Date	Hour	Net Type	Duration of Haul	Depth, Meters	Volume of Water Strained	S Factor
2142	32° 56'	117° 51'	V-10	18:00	(1M-S	23.0	0-77	739.3	1.05
					(0.5M-SF			142.1	5.45
2143	32° 49'	118° 16'	V-13	03:50	(1M-S	24.0	0-73	835.2	0.87
					(0.5M-SF			181.1	4.03
2144	32° 41.5'	118° 39.5'	V-12	23:45	(1M-S	23.5	0-73	760.9	0.95
					(0.5M-SF			166.4	4.36
2145	32° 35.5'	118° 59.5'	V-12	20:10	(1M-S	24.0	0-76	781.3	0.97
					(0.5M-SF			153.7	4.93
2146	32° 31'	119° 26.5'	V-12	16:00	(1M-S	23.5	0-72	1015.1	0.71
					(0.5M-SF			172.0	4.20
2147	32° 18'	119° 50'	V-12	11:40	(1M-S	24.5	0-74	942.1	0.78
					(0.5M-SF			164.8	4.47
2151	32° 31.5'	117° 26.5'	V-8	23:10	(1M-S	24.0	0-73	908.4	0.81
					(0.5M-SF			208.7	3.50
2152	32° 36.5'	117° 46.5'	V-10	14:10	(1M-S	24.5	0-80	702.4	1.14
					(0.5M-SF			151.3	5.31
2153	32° 27'	118° 14'	V-10	09:00	(1M-S	24.0	0-72	940.4	0.76
					(0.5M-SF			203.8	3.52
2154	32° 15.5'	118° 38'	V-10	04:30	(1M-S	24.0	0-77	823.8	0.93
					(0.5M-SF			177.3	4.33
2155	32° 07'	119° 02'	V-9-10	00:00	(1M-S	23.5	0-74	790.9	0.94
					(0.5M-SF			168.2	4.41
2160	32° 32.5'	117° 14'	V-8	19:40	1M-C	10.0	0-28	249.7?	1.12
2161	32° 11'	117° 17'	V-9	03:50	(1M-S	24.0	0-78	712.0	1.09
					(0.5M-SF			167.6	4.63
2162	32° 05.5'	117° 39'	V-9	08:15	(1M-S	24.0	0-73	786.2	0.92
					(0.5M-SF			170.0	4.27
2163	32° 00'	118° 01.5'	V-9	12:40	(1M-S	23.0	0-77	744.6	1.03
					(0.5M-SF			159.8	4.81
2164	31° 43'	118° 26.5'	V-9	17:30	(1M-S	24.0	0-76	780.5	0.97
					(0.5M-SF			165.6	4.56
Cruise 23:									
2311	33° 53.2'	119° 19.2'	VI-3	20:20	(1M-C	24.0	0-74	627.5	1.17
					(0.5M-SF			145.3	5.07
2312	33° 49'	119° 44'	VI-4	01:30	(1M-C	26.0	0-78	539.0	1.45
					(0.5M-SF			134.2	5.84
2314	33° 37.5'	120° 28'	VI-4	12:20	1M-CO	25.0	0-79	581.4?	1.35
2315	33° 33'	120° 52'	VI-4	21:15	1M-CO	23.5	0-79	543.7?	1.45
2317	33° 23'	121° 39.5'	VI-5	11:50	1M-CO	24.0	0-74	596.3?	1.23
2321	33° 38'	118° 39'	VI-3	14:00	(1M-C	24.0	0-73	658.3	1.11
					(0.5M-SF			156.3	4.66
2322	33° 36.5'	119° 00'	VI-6	18:10	1M-CO	24.0	0-75	587.5?	1.27
2323	33° 30.5'	119° 25'	VI-6	14:30	(1M-C	25.0	0-63	807.6	0.79
					(0.5M-SF			158.3	4.00
2324	33° 25'	119° 43.5'	VI-6	10:30	1M-CO	24.0	0-69	634.4?	1.09
2325	33° 17'	120° 05'	VI-6	06:50	1M-CO	23.5	0-73	589.8?	1.23
2326	33° 13'	120° 30'	VI-6	02:10	1M-CO	24.0	0-75	590.4?	1.26
2327	33° 08'	120° 55.5'	VI-5	21:10	1M-CO	23.0	0-76	554.7?	1.37
2332	33° 14'	118° 30'	VI-8	06:15	1M-CO	24.5	0-75	596.7?	1.26
2333	33° 07.5'	118° 55'	VI-8	11:10	1M-CO	24.0	0-76	575.7?	1.32
2334	33° 02'	119° 15'	VI-8	15:40	1M-CO	23.5	0-76	569.6?	1.33
2335	32° 49.5'	119° 34.5'	VI-8	23:45	1M-CO	24.5	0-76	587.7?	1.30
2336	32° 41'	119° 53'	VI-9	06:30	1M-CO	24.0	0-76	572.8?	1.33
2337	32° 32'	120° 14'	VI-9	11:10	1M-CO	23.5	0-76	569.6?	1.33
2340	33° 15.5'	117° 32.5'	VI-2	03:30	1M-CO	13.0	0-32	370.7?	0.85
2341	32° 59'	117° 32'	VI-2	23:30	(1M-C	24.0	0-72	635.7	1.13
					(0.5M-SF			156.4	4.59
2342	32° 59'	117° 49'	VI-10	15:30	(1M-C	24.0	0-72	706.7	1.02
					(0.5M-SF			173.7	4.14
2343	32° 49'	118° 16'	VI-10	11:20	(1M-C	23.0	0-74	678.9	1.10
					(0.5M-SF			166.3	4.47

Table III (Cont'd.) - Record of Oblique Hauls made with Plankton Nets during Cruises 17-27 in 1941.

Station	Position North Latitude	Position West Longitude	Date	Hour	Net Type	Duration of Haul	Depth, Meters	Volume of Water Strained	S Factor
2344	32° 41'	118° 38'	VI-10	07:20	(1M-C	23.0	0-73	494.9	1.48
					(0.5M-SF			126.3	5.79
2345	32° 36'	119° 00'	VI-10	03:20	(1M-C	23.0	0-71	490.0	1.45
					(0.5M-SF			118.7	5.98
2346	32° 32'	119° 26'	VI-9	22:10	(1M-C	24.0	0-78	518.6	1.50
					(0.5M-SF			135.2	5.74
2347	32° 20'	119° 49'	VI-9	16:45	(1M-C	24.0	0-71	557.7	1.28
					(0.5M-SF			135.2	5.27
2351	32° 30.5'	117° 25.5'	VI-10	20:45	(1M-C	23.0	0-72	687.7	1.04
					(0.5M-SF			169.0	4.24
2352	32° 27.5'	117° 52.5'	VI-11	01:45	(1M-C	24.5	0-72	690.5	1.04
					(0.5M-SF			163.9	4.37
2353	32° 21.5'	118° 19.5'	VI-11	07:45	(1M-C	23.5	0-71	682.6	1.05
					(0.5M-SF			161.9	4.41
2354	32° 18'	118° 42'	VI-11	11:30	(1M-C	23.0	0-73	661.8	1.11
					(0.5M-SF			158.6	4.62
2355	32° 05'	119° 00'	VI-11	15:30	(1M-C	24.5	0-79	642.2	1.23
					(0.5M-SF			153.7	5.04
2362	32° 01.5'	117° 37.5'	VI-12	05:30	(1M-C	24.0	0-71	644.6	1.10
					(0.5M-SF			170.9	4.16
2363	31° 54'	118° 01.5'	VI-12	01:15	(1M-C	24.0	0-78	635.9	1.22
					(0.5M-SF			170.3	4.55
2364	31° 47'	118° 26'	VI-11	20:50	(1M-C	23.0	0-76	681.0	1.11
					(0.5M-SF			171.4	4.41
Cruise 25:									
2514	33° 42.5'	120° 30'	VI-27	10:00	1M-C	24.0	0-75	573.4	1.31
2515	33° 41'	120° 54.5'	VI-27	14:30	1M-CO	24.5	0-73	614.9?	1.18
2517	33° 28'	121° 40'	VI-27	23:45	1M-CO	24.0	0-77	566.9?	1.39
2525	33° 18'	120° 04'	VI-28	19:15	1M-C	24.0	0-76	682.6	1.11
2527	33° 05'	120° 50'	VI-28	10:40	1M-CO	24.0	0-74	596.3?	1.23
2530	33° 36.5'	118° 10.5'	VI-25	20:20	1M-CO	9.0	0-27	215.8?	1.24
2532	33° 14'	118° 28.5'	VI-29	14:10	1M-C	23.5	0-75	577.3	1.30
2535	32° 54'	119° 37'	VI-30	02:50	1M-C	25.0	0-77	484.5	1.59
2536	32° 47'	120° 00'	VI-30	07:15	1M-C	23.5	0-75	539.0	1.39
2537	32° 40'	120° 17'	VI-30	10:50	1M-C	24.5	0-72	614.2	1.18
2540	33° 16'	117° 32.5'	VI-25	14:20	1M-CO	12.0	0-35	314.4?	1.10
2545	32° 35'	119° 00'	VI-30	23:15	1M-C	24.0	0-74	508.8	1.45
2547	32° 27'	119° 45'	VI-30	15:30	1M-C	23.0	0-73	553.0	1.32
2551	32° 35.5'	117° 27'	VII-1	15:50	1M-C	23.0	0-68	719.5	0.94
2552	32° 27'	117° 52'	VII-1	20:10	1M-C	23.0	0-74	671.0	1.10
2553	32° 20'	118° 15'	VII-2	00:20	1M-C	23.5	0-76	635.3	1.20
2554	32° 14'	118° 37'	VII-2	04:20	1M-C	24.5	0-77	569.4	1.35
2555	32° 08'	118° 59'	VII-2	08:20	1M-C	23.5	0-71	609.8	1.17
2561	32° 12'	117° 20'	VII-3	02:50	1M-C	24.0	0-77	810.7	0.95
Cruise 27:									
2716	33° 37'	121° 20'	VII-24	03:30	1M-S	25.0	0-77	731.8	1.05

Table IV - Record of Pilchard Eggs, 1939.

Station	Number of Normal Eggs				Total Number of Eggs					
	A	B	C	D	A	B	C	D	Unclass.	n
Cruise 8:										
811-M 1/		3		3		4	1	3		8
812-U 2/	1	2	8		8	3	9			20
814-U	1	8	3	1	1	12	5	1		19
827-U			1	1	1		1	1		3
829-U	7	2	8		8	2	8			18
829-M			1				1			1
834-U	1				1					1
839-U			3				3			3
848-U	6				7					7
849-U			1		2	1	1			4
850-U					1					1
851-U	86	3			213	4				217
852-U	1417	806	191	7	3113	830	203	7		4153
852-M	12	8			24	12			8	44
853-U									48	48
853-M									2	2
854-U	37	17	3		57	20	3			80
855-M 3/	9	9	2		9	9	2			20
862-U		2	36	17		2	36	17		55

1/ This sample is credited to the intermediate net haul. However, it may belong to the upper net haul and have been inadvertently referred to the wrong net by a mixing of labels.

2/ U, - Upper net haul; M, - intermediate net haul.

3/ The sample of the upper net haul was lost. It undoubtedly contained pilchard eggs.

Table V - Record of Pilchard Eggs, 1940.

Station	Number of Normal Eggs				Total Number of Eggs						Average
	A	B	C	D	A	B	C	D	Unclass.	n	n'
Cruise 10:											
1001	2	2	49	9	2	2*	60*	16		80	31
1002	17	8	21		17*	8*	21*		4	50	17
1003	4	28	28	21	6*	30*	28*	55		119	21
1004	49	158	886		53*	166*	1154*		2	1375	458
1005	12	139	295	58	12	255*	370*	68	10	715	317
1008			16	5	*	*	24*	59		83	8
1009		4	692	37		10*	1404*	99	4	1517	709
1010	48		8		72*	*	8			80	36
1011		42		66		186*	6*	198	24	414	102
1012	30	116	507	841	30	211*	580*	999	2	1822	396
1013	741	154	179		1656*	209*	228*		9	2102	701
1014	2352	129	13		3292*	146*	13		2	3453	1720
1015	12	39	45		16*	43*	49*			108	36
1017	31	99	12		68*	136*	24*			228	76
1018	327	851	56		572*	1053*	78*		30	1733	578
1019	98	69	23		162*	81*	23			266	122
1020			117			25*	176*	8		209	100
1021	30	74	30		60*	118*	35			213	89
1022	340	347	35		469*	400*	35			904	435
1023	14	9			19*	14*				33	16
1024	310	152	165		461*	207*	165		7	840	337
1025		58	48		*	143*	96*			239	80
1026		45	117		*	45*	143			188	22
1027		44	190			51*	241*			292	146
1028	42	18	41		83	30*	53			166	30
1029		17	11			23*	40*		11	74	37
1030		96	25	30		333*	55*	111*	5	504	168
1031	102	258	141		141	273*	141			555	273
1032	156	283	55		258*	313*	55			626	286
1033		8			16*	8*				24	12
1034	474	1122	376		1175*	2219*	720*		78	4192	1397
1035	84	79	15		109*	84*	15			208	96
1036	105	189			126*	231*			21	378	189
1037				18		*	*	30		30	0
1038		114	361			139*	480*			619	310
1039	433	402	299		521*	412*	299*		5	1237	412
1040	372	500	107		515*	543*	114			1172	529
Total	6185	5653	4963	1085	9911	8147	6933	1643	214	26848	10292
Cruise 11:											
1101		1410	977		17*	1873*	1501*		37	3428	1143
1102	31	149	65	298	31*	166*	70*	311*		578	145
1103	411	237	80		540*	253*	80*		8	881	294
1104		65	27	24		137*	37*	41		215	87
1105		9	42			14*	52*			66	33
1106		8	16		*	8*	16*			24	8
1108		12	13	5	14	26*	88*	23	24	175	66
1109		17			*	31*	*			31	10
1110	3	12	28		6	27*	44*		3	80	37

Table V (Cont'd) - Record of Pilchard Eggs, 1940.

Station	Number of Normal Eggs				Total Number of Eggs						Average
	A	B	C	D	A	B	C	D	Unclass.	n	n'
1111		5	34	29		5*	155*	103*		263	88
1112	220	1193	204		770*	2150*	545*		412	3877	1292
1117		43	95			46*	120*	27	15	208	90
1119		8	31			21*	35*	13		69	28
1120	39	34	8		92*	79*	30			201	86
1121	374	293	207		1212	480*	510*		242	2444	549
1122	202	73			589*	174*	22			785	382
1123	5	556	171		10*	627*	227*			864	288
1124		20	35		*	25*	45*		5	75	25
1125			4			4*	4*			8.	4
1128	4	8	4		4*	12*	4		4	24	10
1129	4	66			4*	119*	*		5	128	43
1130	16	617	394		38*	777*	515*		27	1357	452
1131		26	19			77*	19*	6		102	48
1132					8	*	*			8	0
1134	581	34	4183		906*	34*	4869*			5809	1936
1135		8	131			15*	165*		4	184	92
1136	470	296	162		908	388*	162*			1458	275
1137	452	129	318		800*	129*	330			1259	464
1138	823	121	151		1322*	126*	151			1599	724
1139	495	181	137		731*	191*	151			1073	461
1140	14	381	270		74	436*	315*			825	376
Total	4144	6011	7806	356	8076	8450	10262	524	786	28098	9536
Cruise 12:											
1201				9		*	*	13		13	0
1202	25	5			60*	15*	*		20	95	32
1203				21		*	*	21*		21	7
1204				6		*	*	6		6	0
1205	77	205	18		184*	334*	18*		36	572	191
1206	94	20	60		121*	27*	60*		13	221	74
1207	161	365	569		212*	526*	781*		15	1534	511
1208	123	76	54	22	200*	108*	54*	30	11	403	124
1209	67	30	67		216*	127*	224*		30	597	199
1210	44	178	68		62*	224*	86*		5	377	126
1211	754	243	514	12	1218*	342*	689*	12	52	2313	767
1214		12	107		*	24*	877*			901	300
1215		7	21			7*	21*			28	14
1216						*	*	12		12	0
1217		554	594	30		1314*	812*	90	20	2236	1072
1219	5	5	5		5	10*	15*			30	12
1220	12	8	30		20*	8*	42*			70	23
1221	310	989	142		515	1399*	284*		68	2266	868
1223	7		276	145	7*	*	480*	428	33	948	168
1226		6	55			12*	73*			85	42
1227	64	18	6		76*	24*	6			106	50
1228		101			13*	110*				123	62
1229	212	5	13		344*	14*	22			380	179
1230	510	641	667		729*	663*	727*			2119	706
1231	10	59	790		42*	141*	1362*		5	1550	517
1232	30	30	186		54	30*	264*		12	360	152

Table V (Cont'd) - Record of Pilchard Eggs, 1940.

Station	Number of Normal Eggs				Total Number of Eggs						Average
	A	B	C	D	A	B	C	D	Unclass.	n	n'
1233	33	4	21		46*	4*	33*		4	87	29
1234	4		97		8*	4*	159*			171	57
1235		4				4*	*			4	2
1236	125	224	171		369	303*	361*		11	1044	336
1238		11	11		*	11*	11			22	6
1240	39	28	28		39*	28*	28			95	34
Total	2706	3828	4570	245	4540	5813	7489	612	335	18789	6660
Cruise 13:											
1301			5			*	5			5	0
1302	40	297	99		60*	307*	109*		5	481	160
1303				4		9*	8*	8		25	8
1304	93	49	158	49	169	65*	229*	186		649	147
1305	37	83	163	65	69*	153*	334*	143	18	717	190
1306	6	11	6	11	12*	23*	11*	17		63	15
1307	28	61	11	35	48*	61*	11*	53		173	40
1308		238	20		6*	325*	35*		13	379	126
1309	439	778	308	48	553*	799*	314*	48		1714	555
1311	36	164	128		213*	376*	1206*		54	1849	616
1312		345	111	48		603*	189*	107*	34	933	311
1313	5218	3214	3339		8036*	3453*	3640*		12	15141	5047
1314	834	1655	1531	167	1716*	2177*	1892*	1039		6824	1928
1315	12	1578	1535	168	24	2252*	1945*	216	42	4479	2118
1316		1685	1433	121		2673*	2309*	791	383	6156	2656
1318	151	394	197		575*	970*	637*		349	2531	844
1319		4			*	8*	*			8	3
1322	140	56	42	112	670*	182*	140*	307	14	1313	334
1323			76	31		*	122*	31		153	61
1324		123	1027	306		843*	2407*	3847*	169	7266	2422
1325	11	82	11		11*	93*	11		11	126	57
1329			5			*	5			5	0
1330	5	304	130	29	9*	580*	191*	39	71	890	283
1331	6	997			6*	1197*				1203	602
1332		76				82*	*			82	41
1334	6	18			54*	232*	80*		24	390	130
1335				114		*	4*	178		182	2
1336	29	97	56		62	114*	97*			273	106
1338	5		5		5*	*	15*			20	7
1339	5	48	369		19*	121*	744		5	889	70
1340		144	150			300*	234*			534	267
Total	7101	12501	10915	1308	12317	17998	16924	7010	1204	55453	19146
Cruise 14:											
1401		40			15	113*	*		47	175	77
1403			35			*	42*			42	21
1404	12	433	272		35*	627*	482*		106	1250	417
1405		70	315	938	*	70*	353*	1251		1674	141
1406	41	1890	3814	1436	41*	1902*	5039*	1985	47	9014	2340

Table V (Cont'd) - Record of Pilchard Eggs, 1940.

Station	Number of Normal Eggs				Total Number of Eggs						Average
	A	B	C	D	A	B	C	D	Unclass.	n	n'
1407		33	59	109		33*	84*	142*	8	267	89
1408		6	6		*	6*	12*		6	24	8
1409	6	1914	491		12*	2669*	888*		149	3718	1239
1410	5				5*	*	*			5	2
1411	28	515	18	37	139*	598*	18*	93		848	252
1412		31	115			36*	131*			167	84
1413	51	20	10		107*	30*	20		5	162	70
1414	1116	1375	938	75	1859*	1685*	1341*	159	84	5128	1655
1415	27	54	53	5	147*	154*	90*	31	38	460	142
1416	43	609	392	510	43	664*	493*	634	67	1901	600
1417		6				6*	*		5	11	6
1418	66	227	416		96*	255*	441			792	176
1419						5*	*			5	2
1420		8			*	8				8	4
1422		89	193	51-6		200*	305*	125*55	32	717	220
1423	17	74	136		45*	103*	204			352	74
1424	16	39			39*	47*	8			94	43
1427	210	6			262*	6*				268	134
1430	417	106	10		1178*	148*	27		35	1388	680
1431			21			*	21*			21	10
1432		5			*	5*				5	2
1434	1672	572	7		2756*	620*	7*			3383	1128
1437	49	161	6		189*	273*	73		6	541	156
1438		22	15		13*	26*	80			119	20
1439		1161	696			2231*	1234*		37	3502	1751
1440		114				169*	*		13	182	91
1441			18		*	*	18			18	0
Total	3776	9580	8036	3161-6	6981	12689	11411	4420-55	685	36241	11634
Cruise 15:											
1504		455	250	9		539*	287*	18		844	413
1505					11*	*	*			11	4
1506	10	90	10		20*	100*	10*		10	140	47
1510				5	*	*	*	5		5	0
1512			110	68	*	*	124*	82		206	41
1513	113	9	41		208*	9*	41			258	109
1514	34	13	20		54*	13*	27			94	34
1515			215			*	284*			284	142
1517			7		7	*	22			29	0
1521	171	96			238*	96*			8	342	171
1522	6				28*	*	*			28	9
1526					4*	*				4	2
1527					6*	*				6	3
1530		15				30*	*			30	15
1531		21			*	28*				28	14
1534					*	5*				5	2
1537	15		10		15*	*	15*			30	10
1539			7			*	7*			7	4
Total	349	699	670	82	591	820	817	105	18	2351	1020

Table VI - Record of Pilchard Eggs, 1.0-Meter Net, 1941

Station	Number of Normal Eggs				Total Number of Eggs						Average
	A	B	C	D	A	B	C	D	Unclass.	n	n'
Cruise 17:											
1711	32	16			62*	19*	2		1	84	41
1712		131	142	5		194*	160*	32	14	400	184
1713	27	7	1		72	10*	5*		2	89	8
1714	307	168	62		472*	176*	62*		2	712	237
1715	9	85	132		15*	86*	132		1	234	50
1716	38	56	60		63*	62*	71			196	62
1717		155	276			212*	371*		4	587	294
1721	3	18	1		5*	23*	1			29	14
1722	136	578	25		204*	687*	25			916	445
1723	30	157	256		52	219*	353			624	219
1724		2309	1112			3214*	1570*		99	4883	2442
1725		68	42	2		89*	54*	4	2	149	72
1726	33	11	5		49*	14*	5		6	74	34
1727	17	32	20		17*	35*	23			75	26
1728	98	796	514		167*	956*	576*			1699	566
1731	76	487	63		76	617*	73*		6	772	348
1732	1	5			1	10*				11	10
1733	91	67	5		115*	70*	5			190	92
1734	27	59	48		53*	92*	54		3	202	72
1735	12	177	234		30	289*	426*		39	784	376
1736		1675	1419	21		2277*	1675*	36	11	3999	1982
1737	99	2556	234		173*	2817*	272			3262	1495
1741	1320	797			1704*	1036*			51	2791	1396
1742	92	158			146*	160*			2	308	154
1743	685	205	15		830*	209*	15		4	1058	521
1744	14	146	88		28	172*	107*			307	140
1745	2	8118	328		4	9920*	401*		91	10416	5206
1746	57	33	41		84*	50*	43			177	67
1747	6	266	120		19*	278*	123			420	148
1751	1	31	18		1	46*	30		2	79	47
1752	4	46	92		7	58*	104			169	58
1753	22	180	320		50	249*	385		8	692	252
1754	332	200	16		424*	209*	17*		2	652	217
1755	98	40	14		146*	43*	16			205	94
1761	40	117	61		80	204*	124		3	411	206
1762	82	59	6		122*	68*	7			197	95
1763	8	21			38*	29*				67	34
1764	27	25			38*	30*			3	71	36
1730	3	1870			6*	1978*			5	1989	994
1740	6	5			12*	9*				21	10
1760	9	1			13*	1*				14	7
Total	3844	21931	5770	28	5378	26917	7287	72	361	40015	18751
Cruise 19:											
1912	9	5	4		21*	12*	6*			39	13
1914		58	9			80*	11*	2		93	46
1915	30	64	53		72	94*	69*			235	82
1916	1	11	22		35*	46*	49*		12	142	47
1917	11	46	196		43*	88*	255			386	66
1922		7			*	7*	11		4	22	4
1923	8	311	510		10*	452*	660*		5	1127	376
1924	7	355	457	4	25*	789*	900*	6	119	1839	611
1925	107	465	577	65	231*	642*	779*	85*	15	1752	438
1926	21	106	171	15	70	188*	253*	34	11	556	225
1927	1	22	71	33	1	111*	280*	60	33	485	210

Table VI (Cont'd) - Record of Pilchard Eggs, 1.0-Meter Net, 1941

Station	Number of Normal Eggs				Total Number of Eggs						Average
	A	B	C	D	A	B	C	D	Unclass.	n	n'
1928	1	20	17		8*	33*	21			62	20
1932		2				2*	2*			4	2
1933		6				6*	*			6	3
1934	1	61	250		1*	117*	432*		5	555	185
1935	110	456	548		295*	648*	865*		14	1822	607
1936	274	773	605		762*	1277*	833		15	2887	1025
1937		89	108			233*	283*		32	548	274
1941	2				2*	2*				4	2
1942	6	3	3		6*	3*	6			15	4
1943						*	3*			3	2
1944		25	12		*	26*	12		1	39	14
1945	8	14	113		23*	22*	174*		8	227	76
1946	3	5315	212		11*	8361*	372*		340	9084	3028
1947	20	114	474		144*	213*	1007*		17	1381	460
1951		4	30			6*	45*			51	26
1952	1	73	26		1	120*	48*		18	187	93
1953	195	69			349*	110*			2	461	230
1954	6	18			9*	24*				33	16
1955	130	97	178		235*	129*	238		1	603	182
1961			4			*	4			4	0
1962	2	2			2*	2*	2			6	2
1963		6	6		*	9*	9			18	4
1964		4	68	2		11*	111*	4		126	61
1960					2*	*				2	1
Total	954	8601	4724	119	2358	13863	7740	191	652	24804	8435
Cruise 21:											
2112		2	2		*	2*	2			4	1
2113	300	978	103		496*	1083*	108*		5	1692	564
2114	304	248	56		549*	322*	64		11	946	440
2115	4	4	201	44	85	16*	644*	392	354	1491	432
2116	4	164	126		7	252*	232*		7	498	246
2121		2				2*	*			2	1
2122	2	2			2*	2*				4	2
2123	2				2*	4*				6	3
2124	373	55	32		1122*	118*	71		10	1321	624
2125	5		2		7	*	2*			9	1
2132	4	4			6*	9*				15	8
2133	5	3			7*	5*	*			12	4
2134		169	110		*	181*	119			300	90
2135	5	62	360	225	5	178*	908*	714	136	1941	584
2136		19	170	261		31*	296*	432		759	164
2137	21	6	2		33*	6*	4*			43	14
2142		6			2*	8*				10	5
2143		2	2			4*	6			10	4
2147		13	37		*	14*	45			59	7
2152	7	45			12*	59*				71	36
2161	3	10	1		4	11*	2			17	11
2162	224	46			470*	59*			2	531	266
2163	81	21			177*	26*			1	204	102
2164	2				2*	*				2	1
2130	1	14			1	22*	*			23	11
2140						2*	*			2	1
2160	2				2*	*	*			2	1
Total	1349	1875	1204	530	2991	2416	2503	1538	526	9974	3623

Table VI (Cont'd) - Record of Pilchard Eggs, 1.0-Meter Net, 1941

Station	Number of Normal Eggs				Total Number of Eggs						Average
	A	B	C	D	A	B	C	D	Unclass.	n	n'
Cruise 23:											
2314	362	42	152		533*	45*	205			783	289
2317	3				3*	*				3	2
2322	29	43	13		47*	51*	26			124	49
2323	15	18	9		25*	25*	27*			77	26
2324	27		2		49*	2*	2*			53	18
2325	299	404	251		402*	414*	269*			1085	362
2326			8			*	8*			8	4
2333		3			*	3*				3	2
2334	20	22	18		81*	30*	24*		6	141	47
2335		3	140	149		3*	197*	241		441	100
2336			25		*	*	55*			55	18
2342					*	2*				2	1
2344			12		*	*	15*			15	5
2345		39	9			60*	18*		3	81	40
2346		9	31	31		9*	37*	37		83	23
2347	54	35	56		59*	35*	56			150	47
2351			2			*	2*			2	1
2352		2				2*	*			2	1
Total	809	620	728	180	1199	681	941	278	9	3108	1035
Cruise 25:											
2514		5			*	13*	*			13	4
2515			12		*	*	12			12	0
2525	30	2			32*	2*				34	17
2532		3	3		*	3*	3*			6	2
2535	7	56	6		10	59*	6*			75	33
2545		3				3*	*			3	2
2554			3		*	*	3			3	0
2555					*	*	2			2	0
2561		2				2*				2	2
2530		3	3			3*	3			6	3
2540	2				2*	*				2	1
Total	39	74	27		44	85	29			158	64
Cruise 27:											
2721						2*				2	2
2742		2				2*				2	2
2753						2*				2	2
2730		2				2*	*			2	1
2740			2		*	*	2			2	0
Total		4	2			8	2			10	7

Table VII - Record of Pilchard Eggs, 0.5M Net, 1941.

Station	Number of Normal Eggs				Total Number of Eggs					
	A	B	C	D	A	B	C	D	Unclass.	n
Cruise 17:										
1711	39				65	4			4	73
1712		49	82			49	82	33	16	180
1713	25	15			60	20			5	85
1715	4	21	29		4	25	50			79
1716	24	40	24		40	44	32			116
1721		21				33				33
1731		219	24			281	47			328
1732	10	15	5		10	20	10			40
1733	62	33	4		91	44	4			139
1734	10	35	25		20	35	35		15	105
1735	5	109	123	5	10	139	187	5	20	361
1736	95	577	655		95	893	750			1738
1737	9	933	170		75	1347	245			1667
1741	514	300			644	400			15	1059
1743	145	47			212	47	5		5	269
1744	6	48	19		12	89	54			155
1745	10	4197	156		10	5563	224			5797
1747	4	77	50		4	127	85			216
1751	10	52	23		10	81	33			124
1752	5	29	67		19	39	86			144
1753	29	227	308		81	279	331		12	703
1754	159	122	4		232	163	4		4	403
1755	76	62	9		175	62	13			250
1761	50	158	96		92	181	111		8	392
1762	70	48	9		88	57	9			154
1763	27	8			80	12				92
1764	16	8			36	20				56
Cruise 19:										
1911			10				10	10		20
1912	40	8		8	56	8		8		72
1916	4	16	8		31	32	27		8	98
1917	9	19	87		24	19	165		5	213
1921							8			8
1923		183	212			249	290			539
1925	38	122	293		80	216	458		14	768
1926	36	73	48	6	36	85	78	18		217
1927		17	30	22		56	90	35	26	207
1928		15	44		10	15	44			69
1931		11				11				11
1932				8				8		8
1934		79	227			92	248			340
1935	106	472	460		212	578	543		12	1345
1936	271	382	329		440	489	382		22	1333
1937		115	57			195	217		126	538
1942	11				11					11
1944		9	4			13	4		9	26
1945		10	88			478	151		708	1337
1946	17	4762	130		17	5162	156		87	5422
1947	29	144	747		67	211	833			1111
1951			51				51			51
1952	15	149	10		15	174	10		40	239
1953	312	96			416	119				535
1954		38				38				38
1955	174	92	243		224	110	303		14	651
1962	9		9		9		9			18
1964		25	80	4		38	97	4		139

Table VII (Cont'd.) - Record of Pilchard Eggs, 0.5M. Net, 1941.

Station	Number of Normal Eggs				Total Number of Eggs					
	A	B	C	D	A	B	C	D	Unclass.	n
Cruise 21:										
2111		11				11				11
2113	287	649	113		395	698	124			1217
2115	23	29	691	163	374	41	1028	291	329	2063
2123		10			5	10				15
2132		9				9			9	18
2133	7	7			7	7	7			21
2134		96	102			108	114			222
2135	84	352	1027	585	111	456	1144	650	6	2367
2136		62	223	458		74	254	514		842
2137	59		12		71		12			83
2142		11				11				11
2143			17			17	17			34
2147		9	67			9	71			80
2152		44				44				44
2161		25				25				25
2162	270	31			348	31			3	382
2163	58	10			96	10				106
Cruise 23:										
2323	17	17			17	25	17			59
2344		24					24			24
2345		74				74				74
2346		12	36	48		12	36	48		96
2347		22	22		22	22	22			66
2355					10					10

Table VIII - Record of Pilchard Larvae, 1939.

Station	Midpoint of Size Class (in mm.)																	
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	Total
Cruise 8:																		
811-U[1]		2.2	15.7	49.3	22.4	1.1	1.1	1.1		1.1								94.0
811-M[2]	2.2																	2.2
812-U	1.2	2.3	2.3	2.3	2.3	3.5	2.3	3.5										19.7
813-U			1.7	1.7	1.7	0.8												5.9
814-U		1.1																1.1
814-M	1.2																	1.2
841-U		1.1																1.1
852-U			3.0		1.5		1.5											6.0
852-M		2.0																2.0
853-U	3.1	10.8	4.6				1.5		3.1	1.5								24.6
853-M		47.5	3.8					1.9										53.2
857-U											4.4	1.5						5.9
858-U															1.1			1.1
862-U		1.6														1.6		3.2
863-U			3.1	4.7	1.6					1.6								11.0
864-U	1.5	1.5	6.2	33.9	92.3	49.2	41.6	55.4	56.9	98.5	83.1	89.3	49.2	61.6	3.1	3.1		726.4
865-U				1.6					6.6	1.6	3.3	1.6	4.9	8.2				27.8
865-M											1.5					1.5		3.0
866-U									1.8									1.8
870-U								0.7	0.7	0.7	0.7							2.8
878-U										0.8								0.8
Total	9.2	70.1	40.4	93.5	121.8	54.6	48.0	62.6	69.1	105.8	93.0	92.4	54.1	69.8	4.2	6.2		994.8

1/ Upper net haul.

2/ Intermediate net haul.

Table IX - Record of Pilchard Larvae, 1940.

Station	Midpoint of Size Class (in mm.)																	
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	Total
Cruise 10:																		
1001		1.9			0.8		0.4											3.1
1003	47.5	1.9																49.4
1004	47.2			2.0														49.2
1005	2.6	20.7	18.2	5.2					1.4	0.4								48.5
1009	41.0	182.8	197.9	21.6			0.4	0.8	0.8	0.8	0.8							446.9
1010	24.0	16.0																40.0
1012	107.7	2.0																109.7
1013	4.0			1.3														5.3
1014	19.4	10.8	2.1		0.8	0.4	0.4											33.9
1015	6.0	6.1	14.2	8.1	0.4		0.8	0.4										36.0
1017	6.2						0.8											7.0
1018	2.1	19.2	2.1	2.1			0.6											26.1
1019	2.9																	2.9
1020						1.2	0.6	0.6										2.4
1021	2.4	27.0	2.4	9.8	5.6													47.2
1022	2.9				3.3			0.4										6.6
1023				2.3	3.0	8.2	9.2	5.2	2.9	0.7	0.3			0.3				32.1
1024	2.9																	2.9
1025	2.6																	2.6
1026	3.2																	3.2
1027	7.2		3.6	3.6	1.0	4.7	3.2	2.1	2.1	0.5	2.1	0.5						30.6
1028	11.8	55.9			0.4								0.4					68.5
1029		2.8				0.4												3.2
1031			2.4		0.3	1.0	0.3	0.3										4.3
1032	4.2	2.1			0.3		0.6	0.3										7.5
1033	4.0																	4.0
1034	32.2																	32.2
1035						0.4												0.4
1036	41.8	10.5																52.3
1037						1.6	0.4	0.8	0.4									3.2
1038			7.4			0.4			0.7	0.7	0.4		0.4					10.0
1039				2.6	0.4			0.4										3.4
1040	7.0		3.5															10.5
Total	432.8	359.7	253.8	58.6	16.3	18.3	17.7	11.3	8.3	3.1	3.6	0.5	0.8	0.3				1185.1

Table IX (Cont'd.) - Record of Pilchard Larvae, 1940.

Station	Midpoint of Size Class (in mm.)																	
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	Total
Cruise 11:																		
1101	6.6																	6.6
1102	2.0	4.0				0.3												6.3
1103		2.1			2.1													4.2
1104	1.7		1.7		3.6	0.7	0.2		0.2		0.2	0.2						8.5
1105			4.6	13.9	5.6	0.3												24.4
1106		4.2																4.2
1109						0.5		0.2	0.5	0.2								1.4
1110					0.2	0.5	0.2	0.2										1.1
1111				2.5														2.5
1112		5.5																5.5
1117	1.5									0.2								1.7
1119	4.0	3.6		2.2		0.9	0.3	0.3										11.3
1120	8.4	23.5	13.0	4.2														49.1
1121	5.0	7.5	7.5	10.0	8.6	3.2	0.4	0.4										42.6
1122	8.4																	8.4
1123	7.5	2.5																10.0
1124	2.4	7.3			4.1	1.0	0.3	1.0	1.3	0.3	0.3							18.0
1125		2.1	4.2		2.7	4.5	3.6	1.2	0.3	1.2			0.6	0.3				20.7
1128	3.7	22.2			0.3													26.2
1129	27.6	45.6	2.1															75.3
1131	3.2		3.2			0.5												6.9
1132	4.1	16.3	44.6	36.5	1.2	2.9	4.0	3.5	2.9	1.8				1.8				119.0
1134	26.7	24.2																50.9
1135	6.0	12.1	22.2	23.4	4.7	9.0	7.1	1.7	1.4	0.5	0.3		0.3					88.7
1136	55.8	197.6	35.4	15.2	14.5	7.9	5.1		1.4	0.7	0.7							334.3
1137	13.5	19.4																32.9
1138	10.3	7.4	10.5			0.4												28.6
1139	78.7	39.4	22.2	22.1	14.3	6.3	2.8	0.3	1.1	0.3	0.3							187.8
1140	4.5	2.0	2.0	10.2	9.8	9.9	2.3	1.3	1.9	1.0	1.2	0.6						46.7
Total	281.6	448.5	173.2	140.2	71.7	48.8	26.3	10.1	10.4	6.2	3.0	0.8	0.9	2.1				1223.8

Table Ia (Cont'd.) - Record of Pilchard Larvae, 1940.

Station	Midpoint of Size Class (in mm.)																	
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	Total
Cruise 12:																		
1201					0.3					0.3								0.6
1203														0.4				0.4
1204		5.6			0.4		0.4											6.4
1207		3.6																3.6
1208		2.1																2.1
1210						0.3												0.3
1211	21.0	5.4	1.7															28.1
1215	3.5	39.0	3.5		0.5	1.5	5.5	5.0	2.0	1.5	1.0		0.5	0.5				64.0
1216						0.4	0.8	0.4		0.4								2.0
1217							1.4											1.4
1219								0.3										0.3
1220	2.1	6.5																8.6
1221		2.6			0.4	1.1	1.5	2.3	0.7	0.7	0.4							9.7
1226						1.7	0.9	0.4			0.9	0.4	0.4	0.4				5.1
1227	8.7							0.4	0.4	0.4	0.4							10.3
1228		4.5			0.3	0.3	0.6					0.3						6.0
1229		2.1						0.3	0.3	2.0	1.0	0.3		0.3				6.3
1231	9.1		18.0	6.8	3.6	2.9	0.6			0.3								41.3
1232				3.0	1.7	2.1	0.4		0.4	0.8		0.4						8.8
1233					3.0	0.3	0.3											3.6
1234	16.2	20.3		5.2	2.3	1.0	0.5			0.5								46.0
1235					0.9	0.3		0.6			0.3		0.3					2.4
1236	22.6	124.6	93.6	37.9	10.0	5.1	1.2	1.4	0.4									296.8
1237	2.6	13.8		2.8	0.4			0.4										20.0
1238		10.6	10.6		0.8													22.0
1240	8.4	5.6			0.4	0.4	0.4	1.2										16.4
Total	94.2	246.3	127.4	55.7	25.0	17.4	14.5	12.7	4.2	6.9	4.0	1.4	1.2	1.6				612.5

Table IX (Cont'd.) - Record of Pilchard Larvae, 1940.

Station	Midpoint of Size Class (in mm.)																	
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	Total
Cruise 13:																		
1301			8.2	2.1	1.1	2.1	4.6	4.2	9.0	7.1	3.6	1.7	0.3	2.0	0.8	0.4	0.4	47.6
1302						0.4		0.4	0.4									1.2
1303		3.8			0.3	0.9	0.3	0.3	0.6	0.6								6.8
1304	32.5		8.1	2.7	23.9	24.3	13.9	6.3	3.2	2.4	0.4	0.8						118.5
1305	52.3	4.6							0.3									57.2
1306									0.4									0.4
1307							0.4											0.4
1309	7.5	8.2																15.7
1310										0.3								0.3
1311	9.1					0.3	0.9	0.6	0.3	0.3								11.5
1312	5.4				1.6	0.8	0.8											8.6
1313	69.5	53.3		2.7		0.4												125.9
1314	364.4	32.7	11.6				0.4											409.1
1315	21.0	18.0	6.0		0.4	0.4	1.3											47.1
1316	749.2	121.5	8.6		0.3	1.3	0.7	0.3	0.3									882.2
1317		4.0	8.0	8.0	2.9	9.4	30.2	22.9	9.5	4.9	3.3			0.6				103.7
1318	7.5	7.5																15.0
1320		7.1	14.4	5.0	43.1	71.3	148.7	167.7	124.3	124.6	102.3	46.6	12.0	2.1				869.2
1321			5.5	5.5	6.3	0.8	1.6	0.8	0.8	7.8	2.4	1.6						33.1
1322	103.9																	103.9
1323	136.9	327.2	53.2	22.8	15.2			2.2		1.1								558.6
1324	730.4	22.8	7.6	7.6	1.1	2.2								1.1		1.1		773.9
1325			12.7	7.2	7.9	3.5	0.5	0.8	0.5									33.1
1326									0.4	0.4								0.8
1327											0.3			0.3				0.6
1328		5.8			1.1	3.8	2.0	3.0	1.4	2.0								19.1
1329	16.4	116.3	37.4	77.1	146.9	219.9	159.7	89.6	57.2	35.0	14.1	2.0	1.9					973.5
1330	14.3	4.5	9.4	9.4	6.7	5.0	2.4	2.4	0.6									54.7
1331	6.2	21.4	15.6	27.6	17.2	14.0	6.6	8.4	3.0	3.6	0.4	0.4	1.7	1.2				127.3
1332	8.3	41.2	5.4		0.4	1.2	0.4		0.8				0.4					58.1
1333	3.4					0.5	1.0	1.0	0.5		1.0							7.4
1334	36.2	75.6	33.3	6.0		0.4	0.8	0.8				0.4						153.5
1335	9.5			2.0	4.4	3.4	2.8	2.2	2.2	1.3	0.9	0.6	0.7					30.0
1336	17.9	129.2	88.1	29.7	2.5	5.7	3.3	0.7	1.1	2.4	0.4	0.3		0.7				282.0
1337		5.3	18.1		0.4	2.3	0.4											26.5
1338	25.7	97.6	28.2	2.6	0.4	2.2	1.1	0.4	0.8									159.0
1339	59.2	121.2	9.4	2.4	5.0	0.9	0.3											198.4
1340	14.9	20.9		3.0		1.3	0.9	0.9	0.4		0.4			0.4				43.1
Total	2501.6	1249.7	388.8	223.4	289.1	378.7	386.0	315.9	218.0	193.8	129.5	54.4	17.0	8.4	0.8	1.5	0.4	6357.0

Table IX (Cont'd.) - Record of Pilchard Larvae, 1940.

Station	Midpoint of Size Class (in mm.)																	
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	Total
Cruise 14:																		
1401											0.5							0.5
1402																0.4		0.4
1403														0.5				0.5
1404	5.2	19.8	2.6	11.3														38.9
1405	212.0	19.4	3.3			0.4												235.1
1406	28.3	5.8																34.1
1407									1.2	1.2	0.6	0.6	2.4	2.4				8.4
1408						0.4		0.4										0.8
1409	11.6	14.3	5.8		0.4	0.4	0.4											32.9
1410	2.5																	2.5
1411	41.1					1.2	1.2	2.6	1.9			0.6						48.6
1412	2.5		23.0	7.4	2.7	2.8	4.4	5.6	3.6	3.7	0.4	0.8				0.4		57.3
1413	2.7	2.7	2.7	2.7	3.1	0.3	1.1				0.4							15.7
1414	4.9	31.1			1.1	0.8												37.9
1415	5.2	39.8	7.7					0.4			0.4							53.5
1416	54.6	3.6							0.4		0.5		1.4	1.3				61.8
1417				5.9	3.8	12.4	31.9	60.6	79.0	63.9	37.9	11.3	4.2	2.8	0.4			314.1
1418	15.3		6.0	6.0	3.4	1.7	1.3				0.4	0.4	1.7		0.4			36.6
1419										0.8			0.4	0.4				1.6
1420												0.6		0.6				1.2
1421						0.6		0.6	0.4	0.4		0.4	0.4					2.8
1422	7.1																	7.1
1423	22.3	36.5	5.6		0.8		0.4											65.6
1424		11.5		3.8	1.2		0.6					0.6		0.6	0.6			18.9
1425													0.9	1.4	0.5			2.8
1426										0.4	0.4	1.8	1.4	1.9	0.5			6.4
1427											0.4							0.4
1428								0.4		0.4	0.8			0.4				2.0
1429									0.4									0.4
1430	4.7																	4.7
1431								1.0	4.1	3.9	2.0	1.0		2.5	1.0			15.5
1432									2.4	0.8	1.2		0.4					4.8
1434	3.2	6.4			0.5	0.5		1.0	0.5		0.5							12.6
1435		2.0			0.3	0.9	7.8	21.1	23.5	18.8	14.1	8.6	5.5	7.5	4.3	6.5	1.5	122.4
1436		2.4	5.2	7.3	19.7	16.8	22.2	34.5	43.6	48.0	22.3	12.0	4.6	4.0	0.7			243.3
1437	9.2	12.3	3.0		7.0	3.8	7.4	4.7	3.9	2.5	2.1	0.4	0.4					56.7
1438	16.7		8.7	7.2	2.2	14.3	11.9	12.7	11.0	6.0	1.8	0.7	0.7					93.9
1439	14.8	142.7	85.5	24.8	19.1	5.8	3.2	1.0	2.6	4.0	1.6	2.1	1.0	1.0				309.2
1440	6.0	54.4	27.3	5.9	10.7	9.5	7.5	3.9	6.7	2.7	2.2	2.2	1.7	0.4	0.4			141.5
1441	4.5	32.0	13.9	4.6	3.6	1.0	0.6	0.3	0.3	0.3			0.3	0.3				61.7
1442				2.4			0.5											2.9
Total	474.4	436.7	200.3	89.3	79.6	73.6	102.4	150.8	185.5	157.8	90.5	44.1	27.4	28.0	8.8	7.3	1.5	2158.0

Table IX (Cont'd.) - Record of Pilchard Larvae, 1940.

Station	Midpoint of Size Class (in mm.)																	
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	Total
Cruise 15:																		
1501										0.4								0.4
1502									0.5			0.5						1.0
1504		4.6					0.7	0.7	2.0		1.3	2.0	0.7	0.7		0.7		13.4
1505									0.8	0.8	0.8	0.8						3.2
1506									2.1	0.7	4.2							7.0
1507		0.6	5.2	2.3		0.6	0.6		0.6	0.6								10.5
1512		6.8							1.0		1.0	1.0						9.8
1513	3.1											0.4			0.4			3.9
1514		20.0		3.3									0.5					23.8
1515	10.3	13.7		3.4	0.5		1.0	4.0	2.5	1.5		0.5	1.0	0.5			0.5	39.4
1516				5.2				1.5	0.7	0.7			0.7	0.7				9.5
1522						0.4	2.4	0.8	1.6	0.4								5.6
1523			0.3	0.9			1.4	0.4		0.4								3.4
1524			3.3		0.9	1.6	2.9	4.1	3.2	1.7	1.8	0.5		0.4	0.5			20.9
1525					0.5			0.5		0.4								1.4
1527														0.6				0.6
1530												1.0		1.0				2.0
1532				0.7	0.4	1.5	1.9	2.9	3.2	4.8	6.2	3.3	3.0	2.9	0.7	0.3		31.8
1533					0.4										0.8			1.2
1534						0.4												0.4
1535																	0.4	0.4
1536				3.8	0.6	0.6		0.6		0.6			1.8		0.6	0.6		9.2
1537	2.5							0.4	0.7	1.4	1.1	0.4						6.5
1538								3.8	3.1	1.6	3.1	2.3	1.5	3.1	0.8			19.3
1539							1.5	5.2	11.0	10.0	15.2	21.5	16.3	11.4	1.0			93.1
1540					0.4			1.3	1.3	0.4	0.4	1.2	1.2	0.8		0.8		7.8
1542																0.5		0.5
Total	15.9	45.7	8.8	19.6	3.7	5.1	12.4	26.2	34.3	26.4	35.1	35.4	26.7	22.1	4.8	2.9	0.9	326.0

Table X - Record of Pilchard Larvae Taken in 1.0-Meter Net, 1941

Station	Midpoint of Size Class (in mm.)																	
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	Total
Cruise 17:																		
1711	1.2	1.2																2.4
1712	2.2	1.1		1.1														4.4
1714		1.1																1.1
1715	7.2	4.1	2.1		1.0													14.4
1716	4.2	7.4	1.1															12.7
1717	10.9	6.4	6.4	0.9	2.7						0.9							28.2
1721	2.3	6.9																9.2
1722	5.5	15.2	1.1															21.8
1723	15.6	1.3																16.9
1724	15.0	6.8																21.8
1726		1.3	1.3															2.6
1727	2.8	7.0	1.4	4.2	1.4						1.4							18.2
1728	25.4	10.3	5.8															41.5
1730	9.9																	9.9
1731	6.7	24.7	1.0															32.4
1732			1.0															1.0
1733	4.1																	4.1
1734	5.9	1.0	1.0															7.9
1735			1.4															1.4
1736	0.9	8.3	1.8															11.0
1737	9.7	10.8																20.5
1740	7.4	19.9	2.5	0.6														30.4
1741	11.6	2.9	1.4															15.9
1742	1.0	1.0																2.0
1743	4.3	5.4	4.3	5.4			1.1		1.1									21.6
1744	2.2	31.5	20.2	4.5	3.0	1.5		0.8						0.8				64.5
1745	18.0	20.0	6.6															44.6
1746	1.4	26.7	10.1	2.2	1.4	1.4												43.2
1747	10.7	8.9	5.3	1.8	2.7													29.4
1751	2.7	5.5	1.8	1.8	0.9	0.9	0.9											14.5
1752	3.3	12.0	9.8	2.2		1.1	2.2	1.1		1.1								32.8
1753	52.5	27.8	3.1	4.1		3.1	1.0	1.0	3.1	1.0	1.0							97.7
1754	2.4	1.6	3.2	3.2	4.0	0.8		3.2	0.8	0.8								20.0
1755	1.9	1.0	1.9	1.9	1.0		1.0		1.0	1.9								11.6
1760		2.0																2.0
1761	34.7	43.0	9.4	6.3	5.2	8.4	4.2	4.2	4.2	1.0								120.6
1762	9.4	48.0	28.1	15.2	5.8		1.2											107.7
1763	4.8	27.6	1.9															34.3
1764	3.0	20.0	51.0	30.0	69.0	69.0	12.0	2.0	6.0	8.0	1.0							271.0
Total	300.8	419.7	186.0	85.4	98.1	86.2	23.6	12.3	16.2	13.8	4.3			0.8				1247.2

Table X (Cont'd.) - Record of Pilchard Larvae Taken in 1.0-Meter Net, 1941

Station	Midpoint of Size Class (in mm.)																
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	Total
Cruise 19:																		
1911				3.1	1.5													4.6
1912		1.1	2.2	1.1	3.4	2.2												10.0
1913														1.4				1.4
1916	14.8	8.4	10.6	3.2			1.1	-										38.1
1917	25.9	41.8	14.4	1.4							2.9	1.4						87.8
1921	2.7	6.7	31.9	9.3	9.3	4.0	4.0	5.3	1.3	13.3	13.3	4.0		1.3				106.4
1922		1.7	3.4	1.7		1.7		3.4			1.7							13.6
1923	7.9	4.7	1.6	1.6														15.8
1924	1.1																	1.1
1925	1.5	1.5	4.5															7.5
1926	2.1	2.1	2.1	2.1				2.1		2.1								12.6
1927	4.8	7.3	2.4		4.8	1.2	2.4	4.8	2.4			1.2						31.3
1928	4.0	10.7	5.3	1.3	1.3													22.6
1930							1.3			1.3	1.3			1.3				5.2
1931		9.4	4.0	1.3		1.3												16.0
1932	3.3	1.1	5.6	6.7	1.1	3.3	1.1	10.0	4.4	2.2	1.1							39.9
1933		45.8	32.9	11.5	1.4	5.7	8.6	4.3	2.9	2.9	1.4							117.4
1934	35.8	39.7	2.6	1.3	1.3			1.3	1.3									83.2
1935	17.1																	17.1
1936	51.8	4.2																56.0
1937		1.4		2.8		2.8	1.4	4.1	2.8			1.4						16.7
1940							1.0											1.0
1942	12.0	2.7	2.7		1.3	5.3	4.0	9.3	6.7	1.3								45.3
1943	2.5	8.8	7.6	3.8	11.3	18.9	8.8	6.3	1.3	5.0	1.3	5.0	6.3	5.0				91.9
1944	1.3	4.0				1.3		2.6	4.0		1.3	1.3						15.8
1945	11.5	6.6	1.6	3.3	1.6	3.3												27.9
1946	6.6	11.8	1.3															19.7
1947	23.8	27.3	2.4					1.2	2.4	1.2								58.3
1951	7.3	309.9	78.0	2.1	6.2	1.0	4.2	5.2	8.3	7.3	2.1	1.0		2.1				434.7
1952	2.4	23.6	31.8	21.2	11.8	21.2	29.4	33.0	26.0	20.0	4.7							225.1
1953	15.4	49.5	108.9	36.3	27.5	28.6	34.1	18.7	11.0	4.4	3.3							337.7
1954	1.4	14.2	7.1	2.8	7.1	11.4	8.5	7.1		1.4		1.4						62.4
1955	26.6	86.4	9.3	2.7	5.3	2.7			1.3									134.3
1960			6.3	0.8	4.0	2.4	1.6	0.8	1.6		1.6			0.8				19.9
1961	2.1	132.9	268.8	30.9	13.4	6.2	1.0	4.1		4.1			1.0		1.0			465.5
1962		11.2	6.7	10.1	17.9	6.7	4.5	4.5	3.4		1.1							66.1
1963		5.8	16.0	5.8	7.2	16.0	5.8	10.2	2.9		1.4		1.4	1.4				73.9
1964	3.1	14.6	41.6	51.0	66.5	75.9	78.0	23.9	2.1	4.2	2.1	1.0	5.2	2.1				371.3
Total	288.8	896.9	713.6	219.2	205.2	223.1	200.8	162.2	86.1	70.7	40.6	17.7	13.9	15.4	1.0			3155.2

Table X (Cont'd.) - Record of Pilchard Larvae Taken in 1.0-Meter Net, 1941

Station	Midpoint of Size Class (in mm.)																	
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	Total
Cruise 21:																		
2111								1.1	1.1			1.1	1.1					4.4
2112		1.0							1.0									2.0
2113	8.0	1.1																9.1
2114	7.2	7.2	2.4		1.2	1.2	1.2	1.2										21.6
2115	12.5		1.0		2.1	1.0	2.1			3.2								21.9
2116	12.1	53.9	26.4	9.9	5.5	3.3	3.3			1.1		1.1						116.6
2117		2.2			1.1	4.4	1.1	3.3	3.3	3.3								18.7
2121		0.9			2.7	1.8	5.5	10.0	9.1	15.5	3.6	3.6	4.6	9.1	0.9	2.7	0.9	70.9
2122										2.1			1.1					3.2
2123		2.0			1.0	1.0					1.0							5.0
2124	4.9	1.2	2.5	1.2	2.5	1.2	2.5	2.5										18.5
2125	1.2			2.4	1.2	2.4	5.9	3.5	1.2	10.7	4.7	9.5	3.5	1.2	1.2			48.6
2126									3.6	1.2	2.4	1.2	1.2					9.6
2128							1.1				1.1	1.1	1.1	1.1				5.5
2130			1.2								1.2	1.2						3.6
2131	1.2	12.9		1.2								4.7	1.2	1.2				22.4
2132			0.8				0.8		0.8			1.7						4.1
2133		0.8	3.8	1.5	3.0	3.0	1.5	2.2	0.8	3.8	2.2			0.8				23.4
2134	1.8	3.6		1.8				0.9		0.9								9.0
2135	70.0	6.2			1.0	1.0												78.2
2136	21.0	40.0	14.0	19.0	9.0	8.0	5.0	2.0	2.0	7.0	3.0	2.0	2.0	3.0				137.0
2137		11.9	17.8						4.0	3.0	2.0							38.7
2140		1.1		1.1	1.1	9.1	12.6	10.3	5.7	9.1	2.3	2.3	2.3	3.4				60.4
2141		2.6	1.7	10.3	14.6	14.6	9.5	12.0	10.3	11.2	5.2	7.7	2.6	5.2	3.4			110.9
2142	6.3	12.6	1.0		1.0	1.0		1.0	2.1	1.0	1.0		1.0		1.0			29.0
2143	7.0	34.0	1.7	1.7		2.6	2.6	7.0	7.9	6.1	4.4	3.5	3.5	3.5				85.5
2144					3.8	33.3	56.0	81.6	83.6	60.8	36.1	18.1	5.7	3.8	2.9			385.7
2145			2.9	7.8	16.5	33.0	61.2	103.8	96.0	93.1	69.8	39.8	35.9	44.6	18.4	7.8		630.6
2146			0.7	0.7	0.7	2.8	2.8	6.4	5.7	5.7	6.4		2.1					34.0
2147	1.6	17.9	8.6	2.3	3.1	0.8	0.8	0.8	0.8	2.3	1.6	1.6	1.6		0.8			44.6
2151		0.8	12.1	15.4	13.8	23.5	18.6	24.3	9.7	3.2	4.0	2.4		0.8		0.8		129.4
2152	1.1	11.4	1.1	1.1	2.3	2.3			1.1									20.4
2153					1.5	1.5	1.5	5.3	1.5		0.8	0.8						12.9
2154					7.4	8.6	11.1	9.9	9.9	3.7	6.1							56.7
2155						3.8	5.6	10.4	9.4	9.4	5.6	3.8	0.9	2.8	0.9			52.6
2161	3.3	25.0		3.3	9.8	8.7	9.8	10.9	9.8	10.9	3.3	1.1						95.9
2162	23.0	54.3	18.4	28.6	25.8	11.9	1.8	0.9			0.9							165.6
2163	1.0		2.1	1.0		2.1	1.0	4.1	2.1									13.4
2164					10.7	17.4	5.8	8.7	10.7	6.8	1.9	1.0		1.0				64.0
Total	183.2	304.6	120.2	110.3	142.4	205.3	230.7	324.1	293.2	275.1	170.6	109.3	71.4	81.5	29.5	11.3	0.9	2663.6

Table X (Cont'd.) - Record of Pilchard Larvae Taken in 1.0-Meter Net, 1941

Station	Midpoint of Size Class (in mm.)																	
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	Total
Cruise 23:																		
2312											1.4							1.4
2314	1.4																	1.4
2315								1.4						1.4				2.8
2322	11.5	1.3	1.3						1.3	1.3								16.7
2323	1.6		0.8															2.4
2324									1.1									1.1
2325		3.7																3.7
2326			3.8	2.5	2.5	1.3		2.5	3.8	8.8	5.1	1.3	2.5	1.3				35.4
2327					1.4	4.1	2.7	13.7	2.7	6.8	9.6	2.7	1.4	1.4	1.4			47.9
2332		1.3																1.3
2333						1.3					2.6		1.3	1.3				6.5
2334	9.2	25.3		1.3														35.8
2335	14.4		2.6									1.3	1.3		2.6			22.2
2336		1.3	1.3							1.3								3.9
2337										1.3				1.3				2.6
2340					0.8		0.8	0.8			1.7	5.9	1.7	0.8				12.5
2341							2.3	4.5	2.3		2.3							11.4
2342								1.0										1.0
2345	23.2	32.0	8.7	8.7	1.4	7.2	2.8											84.0
2346	1.5	19.5			1.5		3.0	1.5	4.5	3.0	1.5	1.5		3.0	1.5			42.0
2347		6.4				1.3	1.3			1.3								10.3
2351														1.0	2.1			3.1
2352							2.1	7.3	9.4	3.1	4.2	4.2	5.2					35.5
2353									1.0		1.0	1.0						3.0
2354		4.4	2.2		2.2					1.1	2.2			2.2				14.3
2355		1.2	2.5	2.5			2.5	4.9		1.2		1.2	1.2					17.2
2362				1.1														1.1
2363				1.2	2.4		3.7	2.4	3.7	3.7	1.2	3.7	1.2	1.2		1.2		25.6
2364	1.1													4.4	1.1	2.2		8.8
Total	63.9	96.4	23.2	17.3	12.2	15.2	21.2	40.0	29.8	32.9	32.8	22.8	15.8	19.3	8.7	3.4		454.9

Table X (Cont'd.) - Record of Pilchard Larvae Taken in 1.0-Meter Net, 1941

Station	Midpoint of Size Class (in mm.)																	
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	27.25	Total
Cruise 25:																			
2515	1.2																		1.2
2517	1.4							4.1	1.4										6,9
2527											2.5			3.7					6.2
2530																	2.5		2.5
2536										1.4	1.4	2.8	2.8	1.4					9.8
2537									1.2	1.2									2.4
2545																1.4			1.4
2547										1.3									1.3
2551			0.9																0.9
2552															1.1				1.1
2553													1.2	1.2	1.2				3.6
2554		1.4																	1.4
Total	2.6	1.4	0.9					4.1	2.6	3.9	3.9	2.8	4.0	6.3	2.3	1.4	2.5		38.7
Cruise 27:																			
2716		1.0															1.0	2.0	4.0
Total		1.0															1.0	2.0	4.0

Table XI - Record of Pilchard Larvae Taken in 0.5M Net, 1941.

Station	Midpoint of Size Class (in mm.)																	
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	Total
Cruise 17:																		
1711	4.3																	4.3
1715	25.3	16.8		4.2	8.4													54.7
1716	12.0	32.0																44.0
1721	12.4	33.0	4.1															49.5
1731	42.9	46.8																89.7
1732	4.8																	4.8
1733	7.2																	7.2
1734	5.0	5.0																10.0
1735	4.9	9.9																14.8
1736	7.6	34.2	3.8															45.6
1737	27.2	95.2	13.6															136.0
1741	59.9	29.9	15.0															104.8
1743	12.0	27.6	4.0															43.6
1744	12.7	44.6	28.6	3.2	15.9	9.5				3.2								117.7
1745	56.3	51.6	9.4															117.3
1747	46.3	23.2	19.3	7.7	3.9													100.4
1751	9.7	38.8	12.9	3.2	3.2		3.2											71.0
1752	33.6	38.4	14.4	4.8														91.2
1753	225.9	133.7	46.1	4.6	13.8			4.6										428.7
1754	8.1	4.1	4.1	8.1	8.1		4.1											36.6
1755	13.5	18.0	9.0	31.4			9.0							4.5				85.4
1761	80.7	161.2	65.3	30.7	11.5	19.2	7.7											376.3
1762	30.7	175.2	21.9	17.5				4.4										249.7
1763	68.2	257.7	34.1															360.0
1764	4.1	82.0	82.0	45.1	94.3	69.7	32.8	8.2		4.1	4.1							426.4
Cruise 19:																		
1911			4.6	4.6	4.6		4.6					4.6						23.0
1912	3.8	7.7		3.8			3.8											19.1
1916	66.1	23.3	31.1	11.7									3.9					136.1
1917	48.6	68.0	19.4															136.0
1921	68.9	38.3	206.8	38.3	61.3	38.3	15.3	15.3	3.8	11.5	11.5	3.8						513.1
1922	11.3	34.0	5.7	5.7	5.7		5.7	5.7										73.8
1923	116.6	177.6	77.7	5.6	5.6													383.1
1925	66.1	23.6	4.7															94.4
1926	24.3				6.1													30.4

Table XI (Cont'd.) - Record of Pilchard Larvae Taken in 0.5M Net, 1941.

Station	Midpoint of Size Class (in mm.)																	
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	Total
Cruise 19 Cont'd.																		
1927	34.6	34.6	4.3		4.3	4.3	4.3											86.4
1928	34.3	49.0	9.8	4.9	9.8		4.9											112.7
1931	5.1	71.8	82.1	5.1														164.1
1932		15.7	47.0	54.9	19.6	7.8			3.9	3.9								152.8
1934	142.1	188.1	8.4	8.4														347.0
1935	204.2	5.7																209.9
1936	80.0	17.8																97.8
1937	38.5	5.5	16.5	11.0			5.5	16.5	5.5									99.0
1941	8.4	4.2				8.4												21.0
1942	181.3	26.6	5.3															213.2
1943	8.9	31.3	26.8	13.4	13.4	4.5	13.4	8.9			4.5	4.5	8.9					138.5
1944	4.4	40.0	13.3		4.4			4.4										66.5
1945	4.9	14.6	34.2	14.6	4.9	4.9												78.1
1946	125.3	29.3	4.2															158.8
1947	124.2	234.6	9.2															368.0
1951	37.3	674.9	140.8	8.3		4.1		4.1	4.1		8.3		4.1					886.0
1952	39.7	228.2	297.6	84.3	24.8	39.7	74.4	64.5	49.6	34.7	14.9	9.9						962.3
1953	77.0	149.5	185.7	49.8	27.2	22.6	27.2	4.5	4.5									548.0
1954	30.2	78.7	12.1	6.0	18.2	6.0	12.1		6.0									169.3
1955	132.9	284.0	50.4	13.8	9.2	4.6												494.9
1961	42.0	865.2	688.8	88.2	29.4	4.2			12.6									1730.4
1962		24.7	12.4	16.5	37.1	16.5	4.1											111.3
1963		22.0	16.5	60.6	22.0	22.0	5.5	5.5										154.1
1964	25.3	21.1	105.5	135.0	118.2	118.2	76.0	16.9		4.2								620.4
Cruise 21:																		
2112	5.2	5.2																10.4
2113	21.6																	21.6
2115	383.5	168.5	5.8	5.8		11.6												575.2
2121					5.5					11.0		5.5						22.0
2123	10.0	14.9																24.9
2131		34.6	5.8		5.8													46.2
2132	84.7	13.4					4.5											102.6
2133			3.4	6.7	6.7	3.4					3.4							23.6
2134	78.1	48.1	6.0	12.0				6.0										150.2
2135	143.0	78.0																221.0

Table XI (Cont'd.) - Record of Pilchard Larvae Taken in 0.5M Net, 1941.

Station	Midpoint of Size Class (in mm.)																	
	3.25	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.75	Total
Cruise 21 Cont'd.																		
2136	198.4	223.2	24.8	12.4	18.6	12.4	6.2											496.0
2137		79.3	17.0			5.7					5.7			5.7				113.4
2141	4.9	4.9	4.9	24.4	9.8	19.5	14.6	9.8		9.8	4.9			9.8				117.3
2142	10.9	32.6							5.4				5.4					54.3
2143	28.2	56.4		8.0				4.0		12.1	4.0							112.7
2144					4.4	30.6	61.0	82.9	78.5	78.5	39.2	17.4	4.4					396.9
2145		4.9	9.9	9.9	34.5	44.4	93.7	98.6	133.2	143.0	74.0	64.1	29.6	59.2	4.9		4.9	808.8
2146		4.2				4.2	8.4	16.8	8.4	8.4		16.8	8.4	4.2		4.2		84.0
2147		134.1	49.2	9.0	4.5							4.5						201.3
2151		7.0	14.0	45.5	21.0	21.0	10.5	21.0	3.5	3.5		3.5		3.5	3.5	3.5		161.0
2152	26.5	26.5		5.3	10.6													68.9
2153						3.5												3.5
2154						4.3	4.3	17.4				8.7						34.7
2155							4.4	17.6	13.2	4.4	4.4	4.4		13.2				61.6
2161	24.1	151.0	6.0						6.0	24.1		12.0						223.2
2162	74.9	139.9	17.0	30.7	17.0	23.8	13.6											316.9
2163	19.2	9.6						9.6										38.4
2164				13.7	13.7	22.8	27.3	31.9	13.7	4.6								127.7
Cruise 23:																		
2311		5.1																5.1
2321	4.7	9.3																14.0
2323		4.0																4.0
2341								4.6										4.6
2343	4.5	4.5																9.0
2344		57.9	11.6															69.5
2345	382.7	334.9	101.7	17.9	17.9	17.9												873.0
2346	5.7	68.8	17.2															91.7
2347	10.5	10.5	5.3															26.3
2351												4.2						4.2
2352									13.1	8.7	4.4							26.2
2354		13.9	9.2	9.2	4.6	9.2	9.2											55.3
2355		10.1		5.0														15.1
2362						4.2												4.2
2363		4.6							13.6	9.1			4.6					31.9

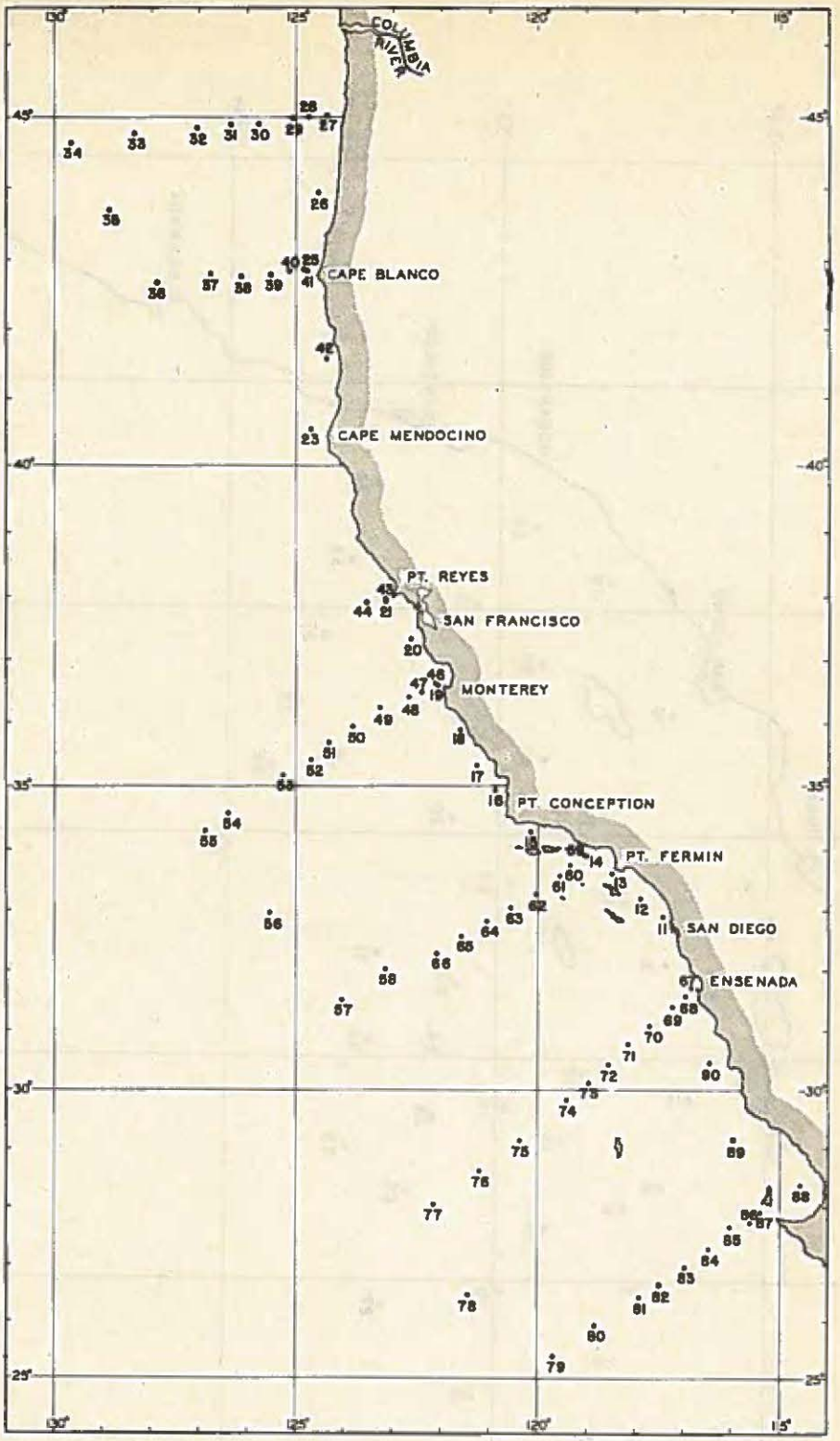

Figure 1. Station chart, cruise VIII, 1939

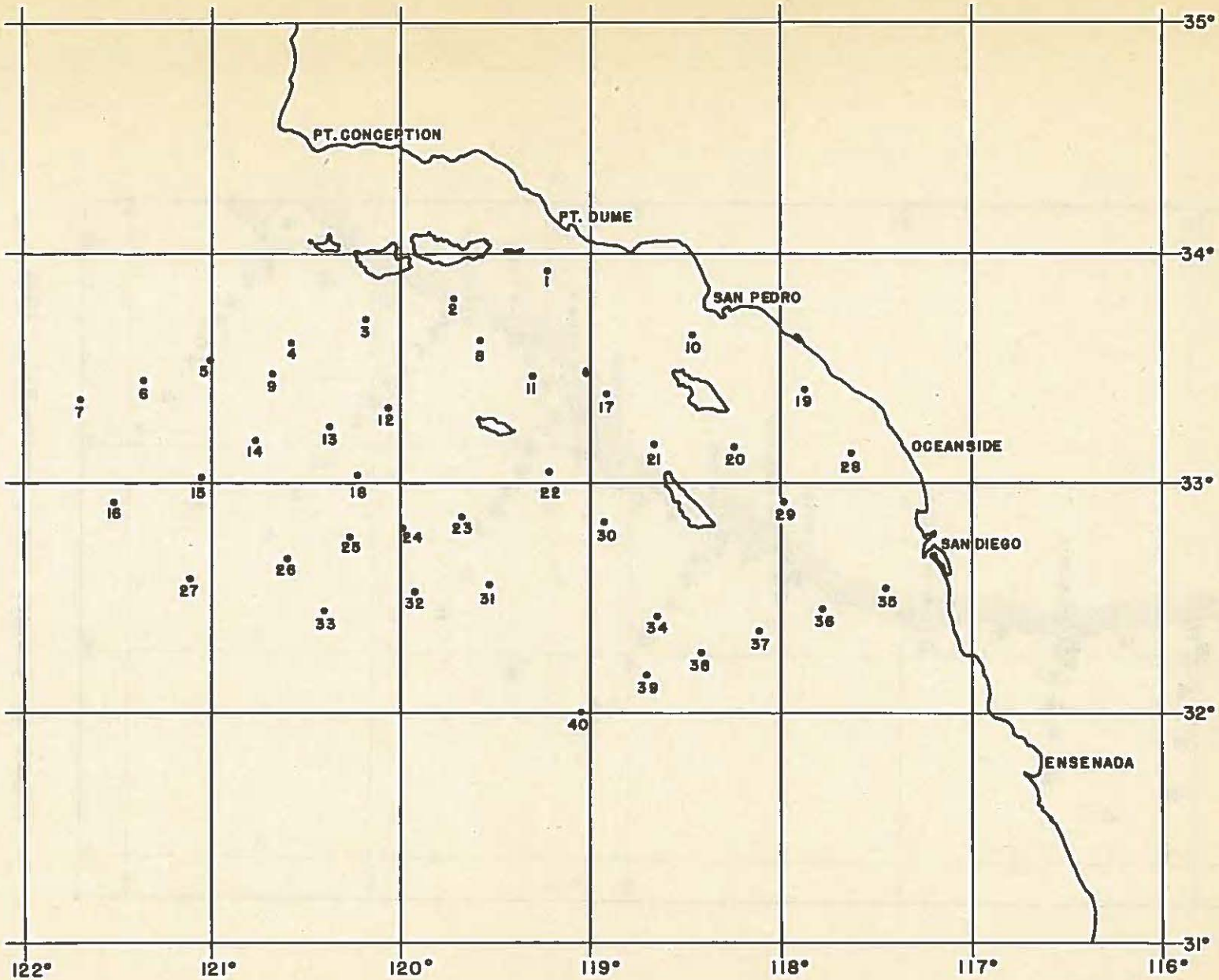

Figure 2. Station chart, cruise XIII, 1940, showing the station plan followed during the 1940 season.

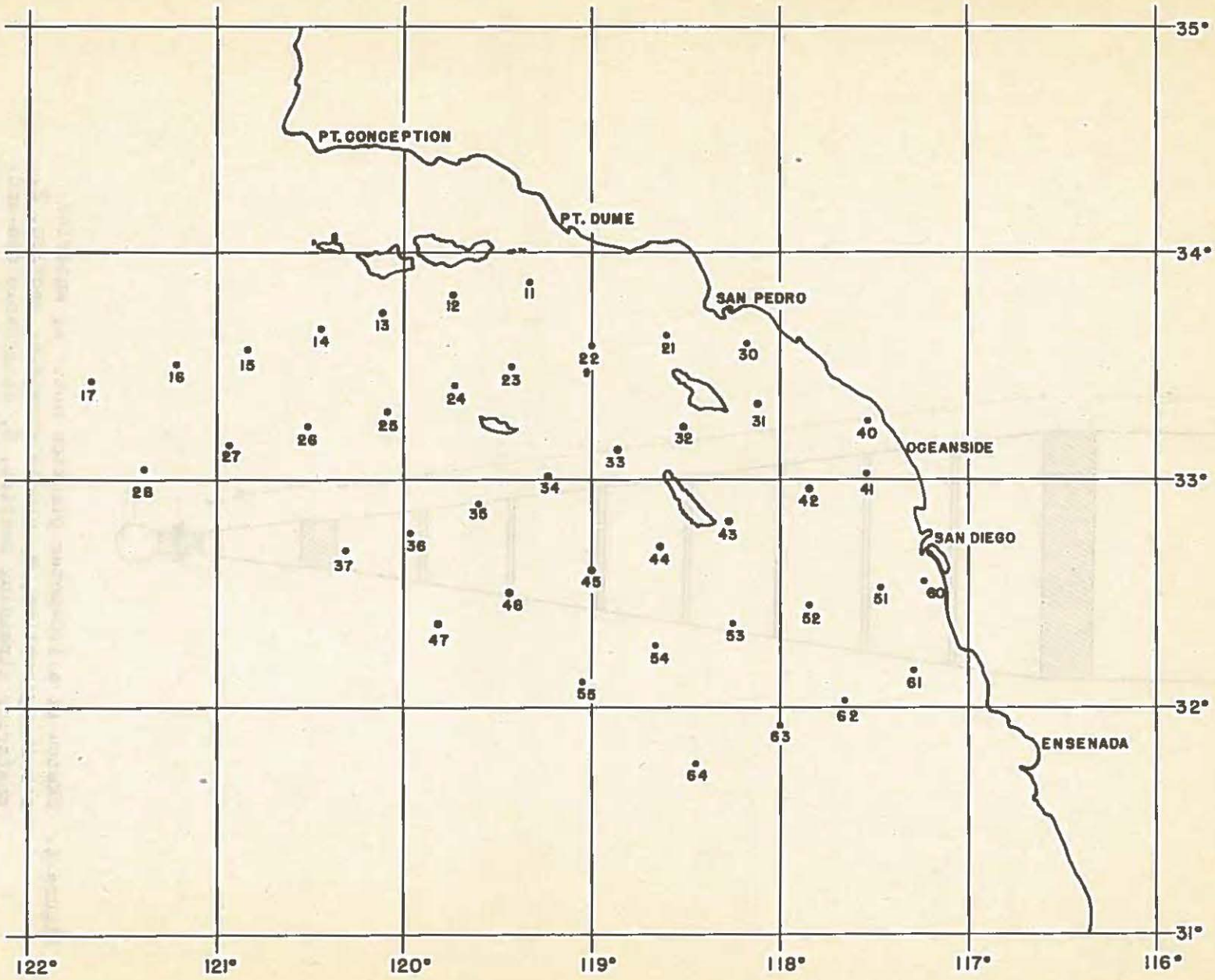

Figure 3. Station plan of the 1941 cruises. The indicated position of each station is the average position of occupancy during the season.

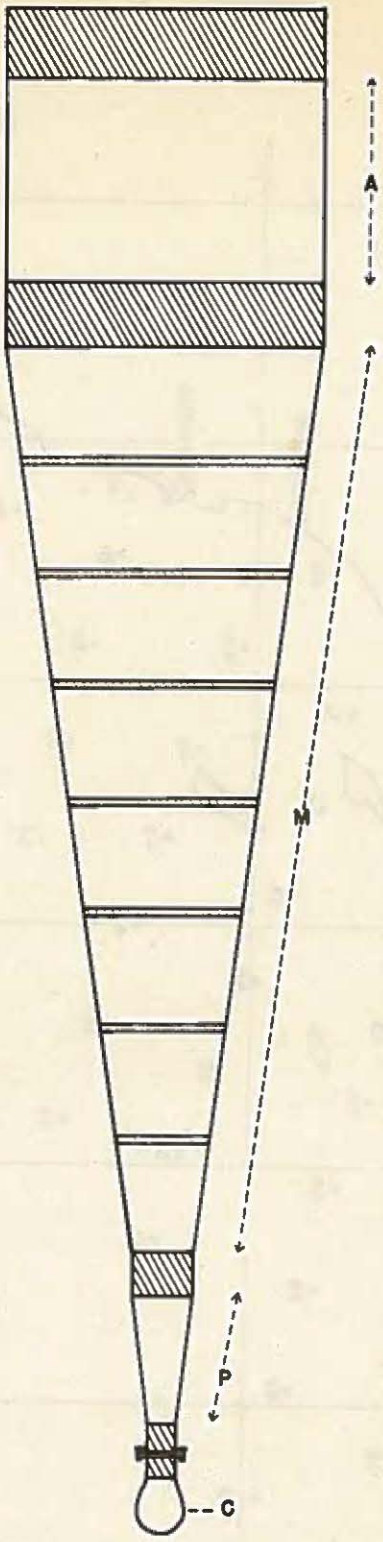

Figure 4. Sketch of a 1.0-meter plankton net. A, anterior straining section, M, middle straining section, P, posterior straining section, C, detachable cod-end. Canvas bands are indicated by cross-hatching, except the narrow canvas bands used in the middle straining section for strengthening purposes. For details concerning the size of each section and the materials used in construction refer to table 1.

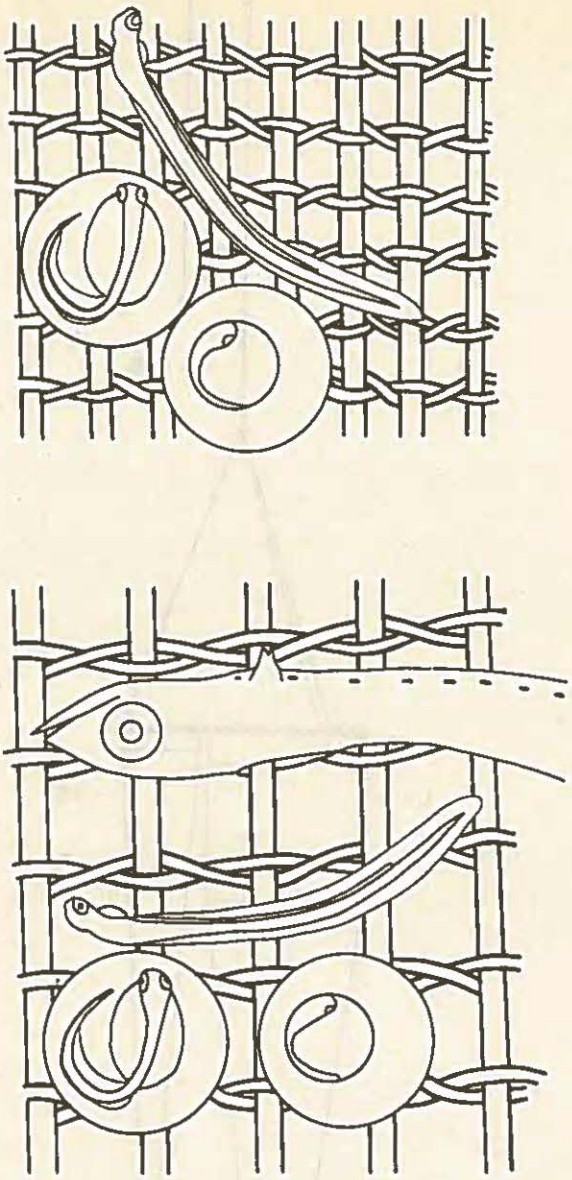

Figure 5. Enlarged camera lucida drawings showing aperture size of silk grit gauze as compared with pilchard eggs and larvae. The left hand sketch shows the aperture size of no. 24xxx grit gauze used in the construction of 1.0-meter nets, the right hand sketch shows the aperture size of no. 40xxx grit gauze used in the construction of 0.5-meter nets. The pilchard eggs are approximately 1.7mm. in diameter, the smaller larvae about 4.0mm. in length, the larger larva shown in part, about 15.0mm. in standard length.

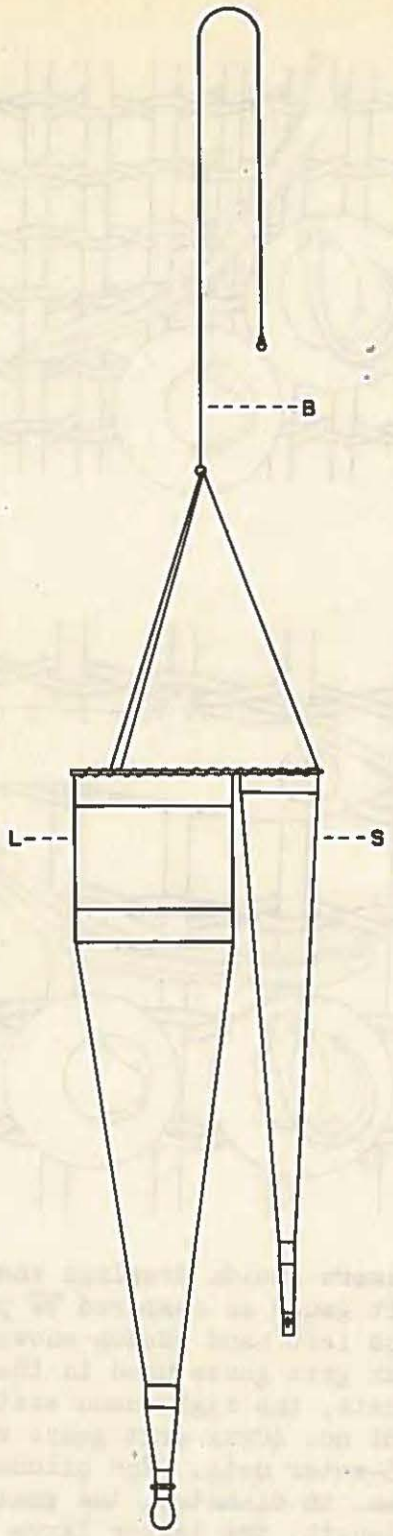

Figure 6. Sketch showing gear used during the 1941 survey—an assembly combining a 1.0-meter and a 0.5-meter net together for towing side by side. B, common bridle, L, 1.0-meter net, S, 0.5-meter net.