Serial No. 324

DEPARTMENT OF COMMERCE

U. S. COAST AND GEODETIC SURVEY

E. LESTER JONES, DIRECTOR

UNITED STATES COAST PILOT

GULF COAST

KEY WEST TO THE RIO GRANDE

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INTRODUCTORY

DEPARTMENT OF COMMERCE,
UNITED STATES COAST AND GEODETIC SURVEY,
Washington, December 15, 1925.

This publication covers the coast of the Gulf of Mexico from Key West to the Rio Grande, including the harbors and adjacent navigable inland passages, and is based mainly upon the work of the United States Coast and Geodetic Survey, including the results of special examinations in 1925.

This volume covers the territory first included in United States Coast Pilot, Part VIII, and later in United States Coast Pilot, Atlantic Coast, Section E. Three editions of the former and one of the latter were published. The first edition of the former was prepared by Lieut. Glennie Tarbox, United States Navy, and John Ross.

The present volume has been prepared by Lieut. William D. Patterson, United States Coast and Geodetic Survey. The compilation was supervised by Lieut. Commander J. H. Hawley, chief, coast pilot section.

Great courtesy has been shown by the United States Engineers, the Lighthouse Service, and local authorities in furnishing information for use in this publication.

The aids to navigation are corrected to December 11, 1925.

Navigators and others are requested to notify the Director, United States Coast and Geodetic Survey, of any errors or omissions that they may find in this publication, or of any additional matter which [redacted] should be inserted for the information of mariners.

E. LESTER JONES, *Director.*

[redacted]

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NOTE

The courses and bearings given in degrees are *true*, reading clockwise from 0° at north to 360°, and are followed by the corresponding *magnetic* course in points, in parentheses. General directions, such as northeastward, west-southwestward, etc., are magnetic.

Distances are in *nautical miles* and may be converted approximately to statute miles by adding 15 per cent to the distances given.

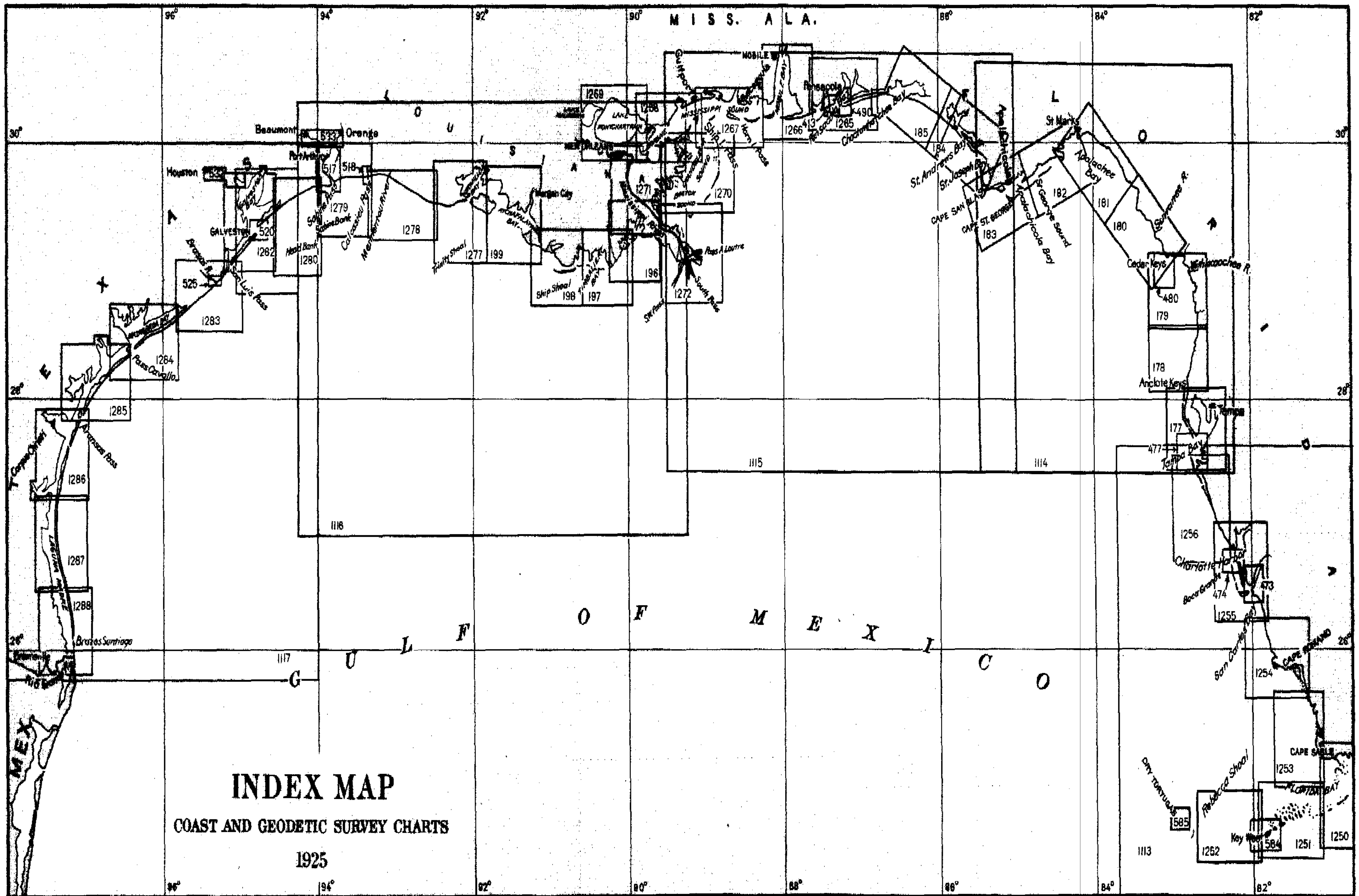
Currents are expressed in knots, which are nautical miles per hour.

Except where otherwise stated, all depths are at *mean low water*, followed, in parentheses, by the metric equivalent expressed in meters and tenths.

Heights are given in feet with metric equivalent in parentheses.

Changes and other corrections affecting all coast pilot volumes are included in the Notice to Mariners published weekly by the United States Department of Commerce. About one year after a coast pilot is published, and at approximately yearly intervals thereafter until a new edition is brought out, a supplement, giving the more important corrections and additions to its text since the date of its publication, is issued. The date of the latest supplement to each coast pilot, for which a supplement has been issued, is shown in the list of coast pilots published each week in the Notice to Mariners. Any supplement may be obtained, free of charge, upon application to the Coast and Geodetic Survey, Washington, D. C., or any of its field stations. Each supplement is complete in itself and cancels all previous supplements.

Do not use this coast pilot except with reference to the latest supplement that may have been published and Notices to Mariners issued after the date of the supplement.



INDEX MAP

COAST AND GEODETIC SURVEY CHARTS

1925

C.&G.S. Print No. 256

UNITED STATES COAST PILOT

GULF COAST—KEY WEST TO THE RIO GRANDE [1]

GENERAL INFORMATION

The information contained in this volume, United States Coast Pilot, Gulf Coast, relates to the Gulf of Mexico from Key West to the Rio Grande, including the harbors and adjacent inland waterways, and embraces the coast of a part of Florida, Alabama, Mississippi, Louisiana, and Texas.

Within the limits of this volume the general coast line has a length of 1,629 miles, and is low and generally sandy, presenting no marked natural features to the mariner approaching it from seaward. The principal points and harbor entrances are marked by lighthouses, which are the chief guides for approaching or standing along the coast.

From Key West to Apalachee Bay the bottom is largely of a coral formation, with occasional spots of less depths than the surrounding bottom.

From Mississippi Sound to Galveston Bay the bottom is sand and silt, with several shoals lying well offshore, which change to some extent with severe storms; with the variable currents which are often encountered they are a serious menace to the navigator passing near them.

From Galveston to the Rio Grande the bottom is sandy, fairly regular, and free from off-lying dangers. In about latitude 27° N., where the trend of the coast changes from southwest to southeast, a counter current is formed which attains a considerable velocity of rotation and has been called the whirlpool of the Gulf. Vessels and barges disabled or broken adrift in the waters southeastward frequently go ashore abreast of this whirlpool.

Harbors and ports.—The most important places, either commercially or as harbors of refuge, are Charlotte Harbor, Tampa Bay, Withlacoochee Anchorage, St. George Sound and Apalachicola Bay, St. Josephs Bay, St. Andrews Bay, Pensacola, Mobile, Horn Island Pass and Pascagoula, Ship Island Pass and Gulfport, South and Southwest Passes and New Orleans, Atchafalaya Bay and River, Sabine Pass, Galveston Bay, and Aransas Pass.

Harbor entrances.—The entrance of every harbor on this stretch of the coast is more or less obstructed by a shifting sand bar over which the channel depth is changeable. Most of the entrances are being improved by dredging, and in some case by jetties, to maintain

[1] The entire Gulf of Mexico and the Atlantic coast northward to Cape Romain are shown on chart No. 1007. The other charts covering that part of the coast included in this volume are indicated on the index map.

or increase the present depths. Masters of vessels bound to the harbars along this coast should, in cases where the depths given in this volume are approximately the same as the draft of their vessel, inquire of local pilots what draft is at the time being taken in and out over the bar.

On the bars the buoys are moved from time to time to indicate the channel; but they are liable to be dragged out of position and can not always be replaced immediately, so that a stranger must use the greatest caution. A stranger should, if possible, select a rising tide for entering the harbors on this coast.

The tidal currents have considerable velocity in all of the entrances, and their direction is affected by the force and direction of the wind; sailing vessels entering the harbors and sounds require a fair working breeze during the ebb.

In southerly gales the sea breaks on some of the bars, and no stranger should then attempt to enter such harbors without the assistance of a pilot.

System of buoyage.—In conformity with section 4678 of the Revised Statutes of the United States, the following order is observed in coloring and numbering buoys in United States waters, viz:

In approaching the channel, etc., from seaward, red buoys, with even numbers, will be found on the starboard side.

In approaching the channel, etc., from seaward, black buoys, with odd numbers, will be found on the port side.

Buoys painted with red and black horizontal stripes will be found on obstructions, with channel ways on either side of them, and may be left on either hand in passing in.

Buoys painted with white and black perpendicular stripes will be found in mid-channel, and must be passed close-to to avoid danger.

All other distinguishing marks to buoys will be in addition to the foregoing, and may be employed to mark particular spots.

Perches, with balls, cages, etc., will, when placed on buoys, be at turning points, the color and number indicating on what side they shall be passed.

Nun buoys, properly colored and numbered, are usually placed on the starboard side, and can buoys on the port side of channels.

Day beacons (except such as are on the sides of channels, which will be colored like buoys) are constructed and distinguished with special reference to each locality, and particularly in regard to the background upon which they are projected.

Buoys maintained by the United States Army Engineers for dredging purposes will hereafter be painted white with the top for a distance of 2 feet painted dark green.

Aids to navigation.—The lighthouses and other aids to navigation are the principal guides, and mark the approach and channels to the important ports. The buoyage accords with the system adopted in United States waters. The principal coast lights are described in the text of this volume. For a complete description of all lighted aids see the Light List. Atlantic and Gulf Coasts of the United States; and for a brief description of lights, buoys, and beacons, see Buoy List, Seventh District, Florida Reefs to Cedar Keys, and Buoy List, Eight District, Cedar Keys to the Rio Grande. These lists are published by the Lighthouse Service, and can be ob-

tained at a cost of 30 cents for the Light List and 20 cents each for the Buoy Lists.

Bridge regulations.—Regulations for lighting bridges over navigable waters, also for lights on sheer booms, piers, dams, and similar obstructions to navigation are prescribed by the Department of Commerce. A copy of these regulations will be sent free of charge to any shipmaster, pilot, or bridge owner on application to the Division of Publications, Department of Commerce, Washington, D. C. The lighthouse inspectors have immediate authority over lighting of structures in their respective districts and are charged with the enforcement of the regulations.

Regulations for the operation of drawbridges, and for the navigation of certain sections of the inland waterways, are prescribed by the Secretary of War for many places; extracts from the regulations are given in some cases under the description of the waters affected.

Regulations for passing dredges are prescribed by the Secretary of War for many channels and are given under the descriptions of the channels. Lighthouse tenders, when working on buoys in channels or other frequented waters, may display a red flag (international signal-code letter B) and a black ball at the fore, as a warning to other vessels to slow down in passing.

Supplies.—Coal, gasoline, fresh water, and some supplies can be obtained at Key West, Tampa, Apalachicola, St. Andrew, Pensacola, Mobile, Pascagoula, Gulfport, New Orleans, Morgan City, Sabine Pass, Galveston, Brazosport (limited), and Port Aransas; fuel oil is also obtainable at most of these places.

Repairs.—Mobile, New Orleans, and Galveston are the principal places at which extensive repairs to the hulls and machinery of large vessels can be made. Small vessels and motor boats can be hauled out and minor repairs to machinery can be made at many other places as mentioned under the descriptions of the different ports.

Largest dry docks and marine railways

Port	Name	Length of vessels hauled	Depth on sill at high water	Capacity
		Feet	*Feet*	*Tons*
Florida:				
Key West	Railway	[1] 180	10, 16	1, 000
Tampa	do	260	19	3, 500
Apalachicola	do	150	9	250
Pensacola	Dry dock	380	18	6, 000
	Railway	110	9, 14	300
Alabama: Mobile	Dry dock	480	23	10, 000
	Railway	[1] 300	11, 19	3, 000
Mississippi: Pascagoula	do	150	9	300
Louisiana:				
New Orleans	Dry dock	521	22	10, 000
	Dry dock (Government).	[1] 525	28	18, 000
Berwick	Railway	150	8	300
Texas:				
Orange	do	160	6, 15	[2] 1, 200
Beaumont	do	300	12, 17	2, 500
Galveston	Dry dock	525	23	10, 000
	Railway	196	12, 14	1, 200

[1] Length over blocks.

[2] Barges only. Capacity for keel vessels 300 tons.

PILOTS AND PILOTAGE

Pilots cruise off the entrances of the principal ports, while at some of the ports of less importance they keep a lookout for vessels making the pilot signals outside the bar. Pilotage is compulsory for certain vessels entering from sea, but is not compulsory for the interior waters except the Mississippi River as far as New Orleans. Pilots for the inside routes may be found at the larger cities and towns; in general, the charge for piloting in interior waters is by special agreement with the pilot.

Pilotage rates for the States of Alabama, Mississippi, and Louisiana are given under the headings of the various ports of those States.

The following are extracts from the State statutes of Florida and Texas relating to pilotage:

Florida: The board of pilot commissioners of each port may fix the rates of pilotage which shall be paid by any vessel entering their port; but in no case shall they fix the rates greater than the rates now provided by law, as follows: All steamers or vessels entering any port or leaving the same shall be subject to pay to any licensed pilot performing duty on board, or to the pilot who shall first speak to such steamer or vessel, the following rates of pilotage: For steamers or vessels drawing six feet, or less than the same, $2 per foot; for steamers or vessels drawing from six to ten feet, $3 per foot; for steamers or vessels drawing from ten to fourteen feet, $4 per foot; for steamers or vessels drawing from fourteen to twenty feet, $5 per foot; for steamers or vessels drawing over twenty feet, $6 per foot. These rates shall apply to all steamers or vessels, whether owned wholly by citizens of this State or not: *Provided*, That all steamers or vessels carrying the regular United States mails shall pay half pilotage only: *Provided further*, That all steamers or vessels drawing less than six feet of water, and having a coastwise license, shall be exempt from paying whole or half pilotage, unless they employ a pilot.

Texas: The rate of pilotage on any class of vessels shall not in any port of this State exceed $4 for each foot of water which the vessel at the time of piloting draws, and whenever a vessel, except of classes below excepted, shall decline the service of a pilot offered outside the bar, and shall enter the port without the aid of one, she shall be liable to the first pilot whose services she so declined for the payment of half pilotage; and any vessel which after being brought in by a pilot shall go out without employing one shall be liable to the payment of half pilotage to the pilot who brought her in, or if she has come in without the aid of a pilot, though offered outside, she shall in so going out be liable for the payment of half pilotage to the pilot who has first offered his services before she came in; but if she has come in without the aid of a pilot, or the offer of it outside, she shall in case of going out without a pilot not be liable to half pilotage. At any port where vessels shall receive or discharge their cargoes at an anchorage outside the bar, such vessel shall be liable for pilotage at the above rate to such anchorage, but shall not be liable for or compelled to pay pilotage from such anchorage to the open sea; and if any vessel bound from the open sea to such anchorage while under way shall decline the services of a pilot, and shall afterwards receive or discharge any portion of her cargo at such anchorage on the lighters or otherwise, she shall be liable for the payment of half pilotage at the above rates to such anchorage to the first pilot whose services shall have been tendered to and declined by her, but not liable for any pilotage from such anchorage to the open sea; and when a pilot takes charge of a vessel twenty miles outside of the bar and brings her to it, he shall be entitled to one-fourth pilotage for such offshore service, in addition to what he is entitled to recover for bringing her in; but if such offshore service be declined, no portion of such compensation shall be recovered.

The following classes of vessels shall be free from any charge for pilotage, unless for actual service, to wit: All vessels of 20 tons and under; all vessels of whatsoever burthen, owned in the State of Texas and registered and licensed in the district of Texas, when arriving from or departing to any port in the State of Texas; all vessels of 75 tons and under, owned and licensed for the coasting trade in any part of the United States, when arriving from

or departing to any port in the State of Texas; all vessels of 75 tons and under, owned in the State of Texas and licensed for the coasting trade in the district of Texas, when arriving from or departing to any port in the United States.

Towboats are stationed at Tampa, Carrabelle, Apalachicola, Millville, Pensacola, Mobile, Pascagoula, Gulfport, New Orleans, Morgan City (Atchafalaya River), Sabine Pass, and Galveston.

Harbor masters are appointed for the principal ports, and they have charge of the anchorage and berthing of vessels in their respective harbors. Harbors and anchorage regulations are given under the descriptions of the ports. The laws prohibit the dumping of ashes or other materials in the channels.

Navigation laws of the United States are published by the Bureau of Navigation, Department of Commerce, at intervals of four years, the present edition being that of 1923. A supplement is issued after every session of Congress. The volume and supplements can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., price $1 for the volume and 5 cents each for the supplements.

Rules of the road.—International and inland "Rules to prevent collisions of vessels," lines within which the inland rules apply, and "Regulation of motor boats" are published by the Bureau of Navigation, Department of Commerce, and are included in the appendix to this volume.

Pilot rules for certain inland waters of the Atlantic and Pacific coasts and of the coast of the Gulf of Mexico are published by the Steamboat Inspection Service in Form 804.

Pilot rules for the rivers whose waters flow into the Gulf of Mexico and their tributaries (Pilot rules for western rivers) are published in form 806.

Copies of these pamphlets are furnished by the officers of the Steamboat Inspection Service, and can also be had from the Division of Publications, Department of Commerce, Washington, D. C.

QUARANTINE

Quarantine for all ports within the limits of this volume is enforced in accordance with the requirements of the United States Public Health Service. At ports in the State of Texas some local requirements also have to be complied with. Quarantine regulations will be found at the stations of the service and at American consulates, and will be furnished to vessels upon application, either by officers of the service or by the bureau at Washington, D. C. Every vessel should be provided with the quarantine regulations. Port sanitary statements are issued by the United States Public Health Service and may be obtained at the stations of the service or from collectors of customs in all ports of the United States.

On account of the menace, every summer, of yellow fever to the ports on the southern coast of the United States because of the prevalence of this disease in Mexico, Central America, and South America, during the season April 1 to November 1, special restrictions are enforced. Since during the present season (1925) no authenticated cases of yellow fever have been reported from any of the Latin American countries, the special measures against the introduction of yellow

fever during the close quarantine season have been modified. However, special vigilance is exercised because of the possibility that there may be latent foci of this disease which may become manifest at any time, making it necessary to enforce close quarantine.

The Public Health Service provides special arrangements for facilitating commerce, especially as this applies to the transportation of fruit between Mexican ports and Gulf ports. These special measures comprise the detailing in the offices of the American consuls at the various Mexican ports of medical officers, who assist steamship companies in complying with any quarantine measures in the port of departure which will tend to aid the quick dispatch of vessels upon their arrival at southern United States ports. On this account it is recommended that the masters of vessels, upon arrival at any of the Mexican Gulf ports, communicate at once with the American consul in order to ascertain whether any special precautions are required.

The following are the national quarantine stations within the limits covered by this volume:

Key West, Fla.
Bocagrande, Fla.; telegraphic address Bocagrande, post office address South Bocagrande, Fla.
Tampa Bay, Fla.; telegraphic and post office address Tampa, Fla.
Cedar Keys, Fla.; post-office address Bronson, Fla.
St. George Sound, Fla.; post office and telegraphic address Carrabelle, Fla.
St. Andrew, Fla.; post office and telegraphic address Panama City, Fla.
St. Joseph, Fla.; post office and telegraphic address Port St. Joe, Fla.
Pensacola, Fla.
Mobile, Ala.
Pascagoula, Miss.
Ship Island, Miss.; post office and telegraphic address Gulfport, Miss.
New Orleans, La.; post office and telegraphic address Quarantine, La.
Galveston, Tex.
Lake Sabine District, Tex.; post-office address Port Arthur, Tex.
Port Aransas, Tex.; post office and telegraphic address Aransas Pass, Tex.
Freeport, Tex.

Medical relief.—Information with respect to medical relief furnished seamen will be found in the Regulations of the United States Public Health Service, which can be consulted at all marine hospitals and other relief stations. These stations are located at nearly all the more important Gulf ports. The following is a list of such ports and the relief stations operated by that service:

Marine Hospital No. 10, Key West, Fla. (Front and Emma Streets).
Tampa, Fla. (212 Citizen's Bank Building).
Apalachicola, Fla. (Deputy Collector of Customs).
Pensacola, Fla. (311 Blount Building).
Mobile, Ala., Marine Hospital No. 13 (St. Anthony and Bayou Streets).
Gulfport, Miss. (21 Durham Building).
New Orleans, La., Marine Hospital No. 14 (Tchoupitoulas and Henry Clay Streets).
Port Arthur, Tex. (Federal Building).
Galveston, Tex. (302 Customhouse).
Houston, Tex. (511 Kress Building).

WEATHER

Fog.—From November to April, inclusive, fog may occasionally be encountered near the coast at any point between San Carlos Bay and the Rio Grande. It is most dense in the vicinity of the harbor entrances, and the prominent points, such as Cape San Blas.

Usually southerly winds bring it in, and northerly winds clear it away. See also the meteorological tables in the Appendix.

The following table shows the number of hours per month that the fog signals were operated at the stated light stations on the Gulf coast of the United States during 1924:

Light station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Egmont Key, Fla	3	2	0	0	0	0	0	0	0	0	0	39	44
Merrill Shell Bank, Miss	57	30	48	27	0	0	0	0	0	56	89	133	440
Lake Borgne, Miss	53	7	3	11	0	0	0	0	0	24	34	90	222
New Canal, La	50	33	30	26	0	0	0	0	0	35	68	21	263
Chefuncte River, La	26	13	6	19	0	0	0	3	0	17	63	105	249
Pass Manchac, La	32	18	20	12	0	0	0	0	0	32	95	134	343
Amite River, La	36	17	34	29	0	0	0	0	16	77	79	114	402
South Pass Lightship	83	57	98	138	0	0	0	0	0	0	56	54	486
South Pass Jetty	88	99	112	175	0	0	2	2	2	2	77	64	621
Head of Passes, La	103	101	120	81	3	3	4	4	0	6	99	43	567
Cubits Gap, La	121	121	137	214	8	9	2	2	4	7	150	105	880
Bayou Villars, La	65	32	34	24	3	0	2	6	22	151	204	54	597
Timbalier, La	15	6	10	16	0	0	0	0	0	0	2	17	66
Ship Shoal, La	29	24	56	50	0	0	0	0	0	17	65	41	282
Point Au Fer Reef, La	63	40	43	21	0	0	0	2	0	5	52	61	285
Heald Bank Lightship	18	36	82	77	0	0	0	0	0	2	0	50	265
Galveston Jetty, Tex	65	32	105	100	6	7	5	8	13	182	76	85	684
Galveston Harbor, Tex	46	25	68	63	3	0	0	0	0	177	60	83	525
Red Fish Bar Cut, Tex	51	13	61	0	0	0	0	0	0	92	51	66	334

Northers.—From November to April, northers blow from northwest and north with considerable violence; their duration is from one to four days, the latter being exceptional. They occur more frequently, and are more strongly marked, along the coast of Texas than eastward; but their general characteristics are alike all over the Gulf of Mexico.

The indications of an approaching norther are invariably a slightly falling barometer, generally not more than 0.20 inch, and lowering temperature; it begins with a violent squall, during which the temperature may drop 20° in 10 minutes. After the first squall the wind gradually increases to a fresh gale, but does not reach its maximum velocity until after the barometer has begun to rise, and it will generally blow with full force for at least 24 hours. Sometimes the temperature drops to as low as 18° F. Some northers are dry—that is, unattended by precipitation—others are attended by cold rain, that may turn into sleet or snow.

Northers along the Gulf coast are not dangerous for large vessels, but small vessels are sometimes blown offshore. They affect, however, the depth of water in the harbors and on the bars by blowing the water offshore, in some cases lowering the water by as much as 4 feet. This should be borne in mind by vessels attempting to enter the harbors on the Gulf coast, during or soon after a norther. Currents in narrow channels and in the Gulf are also greatly affected by northers.

Southeast gales are dangerous to shipping along the Gulf coast of the United States, westward of Apalachee Bay. They may occur at any time of the year, but are most dangerous in winter and early spring. During a heavy southeaster, the bars at the entrances to the

harbors are made impassable for deep-draft vessels, on account of the heavy sea which breaks in depths of about 4 fathoms. The usual local indication of a southeaster is a breeze freshening at east-northeast or east, and hauling southward, accompanied by a falling barometer, a rising temperature, and an increasing swell. The lowest reading of the barometer is usually reached immediately after the wind gains its maximum velocity at southeast. When the wind hauls southward of southeast, it is an indication that the gale is breaking, which is usually followed by heavy squalls; as it hauls westward of south, first rain squalls, and then clearing weather, may be expected, unless, as is sometimes the case, the southeaster be followed by a norther. Southeast gales raise the water in the harbors along the Gulf coast, in some cases, to a height of 6 feet above the normal. Along the western coast of Florida, from Cape Romano to Apalachee Bay, southeast gales are not so dangerous to shipping; vessels can anchor in shoal water under the lee of the land and hold on until the gale abates.

STORM WARNINGS

Storm warnings are displayed by the United States Weather Bureau at numerous places on the coasts of the United States and the Great Lakes.

Small craft warning.—A red pennant indicates that moderately strong winds that will interfere with the safe operation of small craft are expected. No night display of small craft warnings is made.

Northeast storm warning.—A red pennant above a square red flag with black center displayed by day, or two red lanterns, one above the other, displayed by night, indicate the approach of a storm of marked violence with winds beginning from the northeast.

Southeast storm warning.—A red pennant below a square red flag with black center displayed by day, or one red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the southeast.

Southwest storm warning.—A white pennant below a square red flag with black center displayed by day, or a white lantern below a red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the southwest.

Northwest storm warning.—A white pennant above a square red flag with black center displayed by day, or a white lantern above a red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the northwest.

Hurricane, or whole gale warning.—Two square flags, red with black centers, one above the other, displayed by day, or two red lanterns, with a white lantern between, displayed by night, indicate the approach of a tropical hurricane, or one of the extremely severe and dangerous storms which occasionally move across the Great Lakes and Atlantic coast.

These warnings are displayed at all stations on the Atlantic and Gulf coasts of the United States and on the following islands in the Atlantic: Jamaica, Turks Island, Bermuda, Haiti, Curacao, Porto Rico, Virgin Islands of the United States, St. Kitts, Dominica, Bar-

bados, Trinidad, St. Lucia, St. Vincent, Grenada, Swan Island, and Cuba.

The following are the storm warning display stations with the limits covered by this volume:

Florida:
- Apalachicola.
- Bagdad.
- Bocagrande.
- Camp Walton.
- Carrabelle.
- Cedar Keys.
- Clearwater.
- Egmont Key.
- Fort Myers.
- Key West.[2]
- Key West, corner Caroline and Elizabeth Streets.
- Key West, 611 Front Street.
- Key West, Ruy Lopez cigar factory.
- New Valparaiso.
- Palmetto.
- Pensacola.[2]
- Port St. Joe.
- Port Tampa.
- Punta Gorda.
- Punta Rasa.
- St. Andrew.
- St. Petersburg.
- Sarasota.
- South Bocagrande.
- Tampa.[2]

Florida—Continued.
- Tampa, Sedden Island.
- Tarpon Springs.

Alabama:
- Coden.
- Fort Morgan.
- Mobile.[2]
- Mobile, Turner-Hartwell Docks.

Mississippi:
- Bay St. Louis.
- Biloxi.
- Gulfport.
- Pascagoula.
- Pass Christian.

Louisiana:
- Burrwood.
- Empire.
- Morgan City.
- New Orleans.
- New Orleans, Jahnke Dry Dock & Repair Co.
- Pilot Town.
- Salmen.
- West End.

Texas:
- Anahuac.
- Aransas Pass.
- Brazos Santiago.

Texas—Continued.
- Corpus Christi.[2]
- Freeport.
- Galveston.[2]
- Galveston, Quarantine Station.
- Harrisburg.
- Heald Bank Light Vessel.
- Laporte.
- Matagorda.
- Morgan Point.
- Orange.
- Palacios.
- Port Aransas.
- Port Arthur.
- Port Arthur, Gulf Refining Co.
- Port Lavaca.
- Port O'Connor.
- Rockport.
- Sabine Pass.
- Seabrook.
- Texas City, Ninth Street and Ninth Avenue.
- Texas City, Terminal Co's. elevator.
- Velasco.

WEST INDIA HURRICANES

These are cyclonic storms with a center of lowest barometer, around which the wind blows in a more or less circular course (spirally) in a direction contrary to the hands of a watch. At the same time the storm field advances on a straight or curved track, sometimes with great velocity, and sometimes not more than a few miles an hour, occasionally appearing to come to a pause in its onward movements. The velocity on the Atlantic coast between Hatteras and the island of Cuba is 5 to 15 miles per hour. They cover a circular area varying generally from 150 to 500 miles in diameter. At the center, the area of lowest barometer, which is from 10 to 20 miles in diameter, complete calm prevails; the seas within this center are violent and confused, and combined with the sudden shifts of wind which are encountered as the vessel passes through the center, make this the most dangerous part of the hurricane and the one to be avoided.

Hurricanes form eastward of the Windward Islands or in the western Caribbean Sea and take a westerly or northwesterly course. Some curve northward gradually, passing north of the island of Cuba and northeasterly along and eastward of the Atlantic coast of the United States. Others pass over or southward of Cuba and enter the Gulf of Mexico, and while in the Gulf usually curve north-

[2] At these stations barometers will be compared with standards.

ward or northeastward so as to strike the coast somewhere between northwest Florida and the Rio Grande. Tracks of hurricanes are shown on pilot charts of the North Atlantic Ocean, published monthly by the United States Hydrographic Office.

The months during which hurricanes are encountered are June to November, the months of their greatest frequency are August, September, and October. During these months mariners should be on the watch for indications of a hurricane and should frequently and carefully observe and record the barometer.

Signs of approach.—First, a long heavy swell, a slight rise followed by a continuous fall of the barometer; second, a strong gusty wind from some northerly point (northeast, north, or northwest), blowing with increasing force; and third, a rough, increasing sea. If one or more of these signs be wanting there is little cause for anticipating a hurricane.

The approach of a hurricane is usually indicated by a long, heavy swell, propagated to a great distance two or three days in advance, where there is no intervening land to interrupt it, and which comes from the direction in which the storm is approaching.

One of the earliest signs of a hurricane are high cirrus clouds which converge toward a point on the horizon that indicates the direction of the center of the storm. The snow-white fibrous mare's tails appear when the center of the storm is about 300 to 400 miles distant.

As the storm center approaches, the barometer continues to fall, the velocity of the wind increases and blows in heavy squalls, and the changes in its direction become more rapid. Rain in showers accompanies the squalls, and when closer to the center the rain is continuous and attended by furious gusts of wind; the air is frequently thick with rain and spume drift, making objects invisible at a short distance. A vessel on a line of the hurricane's advance will experience the above conditions, except that as the center approaches the wind will remain from the same direction, or nearly so, until the vessel is close to or in the center.

Distance from center.—The distance from the center of a hurricane can only be estimated from a consideration of the height of the barometer and the rapidity of its fall, and the velocity of the wind and rapidity of its change in direction. If the barometer falls slowly and the wind increases gradually it may be reasonably supposed that the center is distant; with a rapidly falling barometer and increasing winds the center may be supposed to be approaching dangerously near.

Practical rules.—When there are indications of a hurricane, vessels should remain in port or seek one if possible, carefully observing and recording the changes in barometer and wind, taking every precaution to avert damage by striking light spars, strengthening moorings and, if a steamer preparing steam to assist the moorings. In the ports of the Southern States hurricanes are generally accompanied by very high tides, and vessels may be endangered by overriding the wharf where lying if the position is at all exposed.

Vessels in the Straits of Florida may not have the sea room to maneuver so as to avoid the storm track, and should use every endeavor to make a harbor or stand out of the straits to obtain sea room. Vessels unable to reach port and having sea room to ma-

neuver should, in the absence of advice by radio telegraph, observe the following rules:

When there are indications of a hurricane near, sailing vessels should heave to on the starboard tack and steamers remain stationary and carefully observe and record the changes in wind and barometer so as to find the bearing of the center and ascertain by the shift of wind in which semicircle the vessel is situated. Much will often depend on heaving to in time.

Bearings of center.—Facing the wind, the storm center will be 8 to 12 points to the right; when the storm is distant it will be from 10 to 12 points, and when the barometer has fallen five or six tenths it will be about 8 points.

A line drawn through the center of a hurricane in the direction in which it is moving is called the axis or line of progression, and looking in the direction in which it is traveling the semicircle on either side of the axis is called, respectively, the right-hand, or dangerous, semicircle, and the left-hand, or navigable, semicircle.

To find in which semicircle the vessel is situated: If the wind shifts to the right, the vessel will be in the right-hand, or dangerous, semicircle, with regard to the direction in which the storm is traveling, in which case the vessel should be kept on the starboard tack and increase her distance from the center.

If the wind shifts to the left, the vessel will be in the left, or safe, semicircle. The helm should be put up and the vessel run with the wind on the starboard quarter, preserving the compass course, if possible, until the barometer rises, when the vessel may be hove to on the port tack; or, if there is not sea room to run, the vessel can be put on the port tack at once.

Should the wind remain steady and the barometer continue to fall, the vessel is in the path of the storm and should run with the wind on the starboard quarter into the safe semicircle.

In all cases act so as to increase as soon as possible the distance from the center, bearing in mind that the whole storm field is advancing.

In receding from the center of a hurricance, the barometer will rise and the wind and sea subside.

RADIO SERVICE

The supervision of radio communication in the United States, including the Hawaiian Islands, is controlled by the Bureau of Navigation, Department of Commerce. A list of the radio stations of the United States, including shore stations, merchant vessels, and Government vessels; Radio Communication Laws and Regulations of the United States; and Amateur Radio Stations of the United States are published by the bureau. Either of the first two publications can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.; price, 15 cents each; the last one, 25 cents. Changes or additions to the stations and to the laws and regulations are published in bulletins issued monthly; price, 5 cents per copy or 25 cents per year.

The International List of Radio Stations of the World (edition in English) can be procured from the International Bureau of the Telegraphic Union (Radiotelegraphic Service), Berne, Switzerland. In

addition to the information contained in the list of the United States stations published by the Bureau of Navigation, the international list shows geographical locations, normal ranges in nautical miles, radio systems, and rates. Supplements to the international list will be issued monthly and will contain new stations and tables of alterations. Inquiries as to the subscription prices of these lists should be made direct to the Berne bureau at the address given above. Remittances to Berne should be made by international postal money orders.

Time signals.—In connection with the service over the land telegraph lines, time signals by radio are sent daily, Sundays and holidays excepted, from certain United States naval coastwise radio stations. The signals begin at 5 minutes before the hour and continue for 5 minutes. During this interval every tick of the clock is transmitted except the twenty-ninth second of each minute, the last 5 seconds of each of the first 4 minutes, and finally the last 10 seconds of the last minute. The time signal is the beginning of the dash after this long break. Hydrographic information, weather reports, and other information of benefit to shipping are sent out from these stations.

Radiocompass bearings.—The increasing use of radio directional bearings for locations of ships' positions at sea, especially during foggy weather, has made it particularly desirable to be able to apply these radio bearings sent out by the shore stations directly to the nautical chart. The radio bearings sent out by radiocompass stations are the bearings of the great circles passing through those stations and the ship, and unless in the plane of the equator or of a meridian, would be represented on a Mercator chart as curved lines. Obviously it is impracticable for a navigator to plot such lines on his chart, so it is necessary to apply a correction to a radiocompass bearing to convert it into a Mercator bearing; that is, the bearing of a straight line on a Mercator chart laid off from the sending station and passing through the receiving station.

On page 14 is given a table of corrections for the conversion of a radio bearing into a Mercator bearing. It is sufficiently accurate for practical purposes for distances up to 1,000 miles.

The only data required are the latitudes and longitudes of the radiocompass stations and of the ship by dead reckoning. The latter is scaled from the chart and the former either scaled from the chart or taken from the list of radiocompass stations printed in the Coast Pilots or on the Pilot Chart published by the Hydrographic Office, United States Navy. The largest scale chart available should be used for this purpose.

The table is entered with the difference in longitude in minutes between the ship and shore station (the nearest tabulated value being used), and opposite the middle latitude between the ship and shore station (to the nearest tabulated value) the correction to be applied is read.

The sign of the **correction**, when bearings are read clockwise from north, will be as follows: In **north latitude**, the plus sign is used when the ship is **east** of the compass station; the minus sign is used when the ship is **west** of the compass station; in **south latitude**, the minus sign is used when the ship is **east** of the compass station;

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The plus sign is used when the ship is west of the compass station. If the radio bearings are observed on the ship, the signs will be reversed. The corrected bearing is then the Mercator bearing from ship to the sending station, and to facilitate plotting 180° should be added to it and the result plotted from the sending station.

Should the position by dead reckoning differ greatly from the true position of ship as determined by plotting the corrected radio bearings, a retrial should be made, using the new value as the position of the ship.

Example.—A ship in latitude 37° 20′ N., longitude 69° 20′ W., by dead reckoning receives a radio bearing of 64° from a radiocompass station located in latitude 35° 14′ N., longitude 75° 32′ W. Find the Mercator bearing of the ship from the station—

Radiocompass station latitude	35°	14′ N.,	long.	75°	32′ W.
Dead reckoning position of ship	37	20		69	20
Middle latitude	36	17	Diff.	372′	

Entering table with difference of longitude=360′, which is the nearest tabulated value to 372′ and opposite 36° middle latitude (the nearest tabulated value to 36° 17′) the correction 106′ is read. The ship being east of the station the correction is plus. The Mercator bearing will then be the radio bearing received plus the correction from the table, 64° 00′+106′=64°+1° 46′=65° 46′.

For more accurate determinations the following formula should be used and on which the table of corrections are based.

Formula for the conversion of radio bearings into Mercator bearings.—The Mercator bearing is equal to the radio bearing received, plus or minus one-half the convergence of the meridians in minutes. which expressed as a formula is

$$M=R\pm\frac{D}{2}\sin\left(\frac{B+B'}{2}\right)\text{in which}$$

M=Mercator bearing required.
R=radio bearing received from the radiocompass station.
D=difference in longitude, in minutes, between the radiocompass station and the ship's position by dead reckoning.
B=latitude of the radiocompass station.
B'=latitude of the ship's position by dead reckoning.

Example.—A ship in latitude 37° 20′ north, longitude 69° 20′ west by dead reckoning receives a radio bearing of 64° from a radio compass station located in latitude 35° 14′ north, longitude 75° 32′ west. Find the Mercator bearing of the ship from the station.

By the formula—

$R=64°$
$D=75°\ 32'-69°\ 20'=6°\ 12'=372'$
$\frac{D}{2}=186'$

$B=37°\ 20'$
$B'=35°\ 14'$
$B+B'=72°\ 34'$
$\frac{B+B'}{2}=36°\ 17'$

sin 36° 17′=.59176 (from the table of natural sines p. 14)

Substituting these values in the formula, and observing that since the ship is in north latitude and east of the radiocompass station, the + sign is used (see p. 12 for determination of signs), we have—

$$M=64°+186'\times 0.59176=64°+110'=64°+1°\ 50'=65°\ 50'$$

Table of natural sines

Mid. L.	Sine	Mid. L.	Sine	Mid. L.	Sine	Mid. L.	Sine	Mid. L.	Sine	Mid. L.	Sine
0°	0.00000	11°	0.19081	22°	0.37461	33°	0.54464	44°	0.69466	55°	0.81915
1°	.01745	12°	.20791	23°	.39073	34°	.55919	45°	.70711	56°	.82904
2°	.03490	13°	.22495	24°	.40674	35°	.57358	46°	.71934	57°	.83867
3°	.05234	14°	.24192	25°	.42262	36°	.58779	47°	.73135	58°	.84805
4°	.06976	15°	.25882	26°	.43837	37°	.60182	48°	.74314	59°	.85717
5°	.08716	16°	.27564	27°	.45399	38°	.61566	49°	.75471	60°	.86603
6°	.10453	17°	.29237	28°	.46947	39°	.62932	50°	.76604	61°	.87462
7°	.12187	18°	.30902	29°	.48481	40°	.64279	51°	.77715	62°	.88295
8°	.13917	19°	.32557	30°	.50000	41°	.65606	52°	.78801	63°	.89101
9°	.15643	20°	.34202	31°	.51504	42°	.66913	53°	.79864	64°	.89879
10°	.17365	21°	.35837	32°	.52992	43°	.68200	54°	.80902	65°	.90631

Table of corrections, in minutes

[Difference of longitude in minutes]

Mid. L	30′	60′	90′	120′	150′	180′	210′	240′	270′	300′	330′	360′	390′	420′	450′	480′	510′	540′	570′	600′
5°	1	3	4	5	7	8	9	10	12	13	14	16	17	18	20	21	22	24	25	26
6°	2	3	5	6	8	9	11	13	14	16	17	19	20	22	23	25	27	28	30	31
7°	2	4	5	7	9	11	13	15	16	18	20	22	24	26	27	29	31	33	35	37
8°	2	4	6	8	10	13	15	17	19	22	23	25	27	29	31	33	35	38	40	42
9°	2	5	7	9	12	14	16	19	21	23	26	28	30	33	35	37	40	42	45	47
10°	3	5	8	10	13	16	18	21	23	26	29	31	34	36	39	42	44	47	49	52
11°	3	6	9	11	14	17	20	23	26	29	31	34	37	40	43	46	49	51	54	57
12°	3	6	9	12	16	19	22	25	28	31	34	37	41	44	47	50	53	56	59	62
13°	3	7	10	13	17	20	24	27	30	34	37	40	44	47	51	54	57	61	64	67
14°	4	7	11	15	18	22	25	29	33	36	40	44	47	51	54	58	62	65	69	73
15°	4	8	12	16	19	23	27	31	35	39	43	47	50	54	58	62	66	70	74	78
16°	4	8	12	17	21	25	29	33	37	41	45	50	54	58	62	66	70	74	79	83
17°	4	9	13	18	22	26	31	35	39	44	48	53	57	61	66	70	75	79	83	88
18°	5	9	14	19	23	28	32	37	42	46	51	56	60	65	70	74	79	83	88	93
19°	5	10	15	20	24	29	34	39	44	49	54	59	64	68	73	78	83	88	93	98
20°	5	10	15	21	26	31	36	41	46	51	56	62	67	72	77	82	87	92	98	103
21°	5	11	16	21	27	32	38	43	48	54	59	64	70	75	81	86	91	97	102	108
22°	6	11	17	22	28	34	39	45	51	56	62	67	73	79	84	90	96	101	107	112
23°	6	12	18	23	29	35	41	47	53	59	64	70	76	82	88	94	100	105	111	117
24°	6	12	18	24	31	37	43	49	55	61	67	73	79	85	92	98	104	110	116	122
25°	6	13	19	25	32	38	44	51	57	63	70	76	82	89	95	101	108	114	120	127
26°	7	13	20	26	33	39	46	53	59	66	72	79	85	92	99	105	112	118	125	131
27°	7	14	20	27	34	41	48	54	61	68	75	82	89	95	102	109	116	123	129	136
28°	7	14	21	28	35	42	49	56	63	70	77	84	92	99	106	113	120	127	134	141
29°	7	15	22	29	36	44	51	58	65	73	80	87	95	102	109	116	124	131	138	145
30°	7	15	22	30	38	45	53	60	68	75	83	90	98	105	113	120	127	135	143	150
31°	8	15	23	31	39	46	54	62	70	77	85	93	100	108	116	124	131	139	147	155
32°	8	16	24	32	40	48	56	64	72	79	87	95	103	111	119	127	135	143	151	159
33°	8	16	25	33	41	49	57	65	74	82	90	98	106	114	123	131	139	147	155	163
34°	8	17	25	34	42	50	59	67	75	84	92	101	109	117	126	134	143	151	159	168
35°	9	17	26	34	43	52	60	69	77	86	95	103	112	120	129	138	146	155	163	172
36°	9	18	26	35	44	53	62	71	79	88	97	106	115	123	132	141	150	159	168	176
37°	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	163	172	181
38°	9	18	28	37	46	55	65	74	83	92	102	111	120	129	139	148	157	166	175	185
39°	9	19	28	38	47	57	66	75	85	94	104	113	123	132	142	151	160	170	179	189
40°	10	19	29	39	48	58	68	77	87	96	106	116	125	135	145	154	164	174	183	193
41°	10	20	30	39	49	59	69	79	89	98	108	118	128	138	148	157	167	177	187	197
42°	10	20	30	40	50	60	70	80	90	100	110	120	130	140	151	161	171	181	191	201
43°	10	20	31	41	51	61	72	82	92	102	113	123	133	143	153	164	174	184	194	205
44°	10	21	31	42	52	63	73	83	94	104	115	125	135	146	156	167	177	188	198	208

The Naval Communication Service will furnish radio bearings to mariners of all vessels equipped with radiotelegraph transmitters. While the use of these bearings should not lead a mariner to neglect other precautions, such as the use of the lead, etc., during a fog, these bearings will greatly reduce the dangers to navigation for mariners who are compelled for any reason to proceed during foggy or misty weather.

These radiocompass stations are provided, primarily, to assist the mariner in closing the land during fog or poor visibility, but they may also be used to obtain the positions of vessels at sea in radio compass range, about 150 miles, when for any reason positions can not be obtained by other means. The maximum distance for which bearings from these stations are accurate is 150 miles. (See preceding pages for reduction of observed bearings to Mercator bearings.)

Radiocompass stations are divided into two classes: (*a*) Single stations, operating independently and furnishing a single bearing. These stations are located with the view of giving service to ships at a distance of not over 150 miles from the station. (*b*) Harbor entrance groups. All stations in harbor entrance groups are connected to and controlled by the master station. All stations of the group take bearings simultaneously and these bearings are transmitted to the ship requesting them by the control station. The purpose of these stations is to lead mariners to the light vessels off harbor entrances.

Where only one radiocompass station is available, the mariner may fix his position by two or more bearings from the station with the distance run between, or may use the bearings as a line of position, or as a danger bearing. Or the bearing may be crossed with a line of position obtained from an observation of an astronomical body to establish a fix.

Wave lengths.—All independent and group radiocompass stations keep watch on 375 kilocycles (800 meters). Only this wave should be used to call and work with these stations.

During the first 10 minutes of each hour during clear weather radiocompass stations ordinarily will not be guarding this wave. Ships are requested to confine their requests to bearings during clear weather to the remaining 50 minutes of the hour, as far as is practicable. Should a station chance to hear a request for a bearing during the first 10 minutes of the hour, the required bearing will be given. During the remaining 50 minutes, and at all times during inclement weather, all radiocompass stations will be continuously guarding the 375-kilocycle (800-meter) wave.

Calling a radiocompass station.—To obtain a bearing from independent radiocompass stations, call the station from which the bearing is desired in the usual manner and request bearings by means of the conventional signal given hereafter. Simultaneous bearings from two or more compass stations can be obtained by making the call include the other compass stations desired. To obtain bearings from the harbor entrance compass stations, carry out the procedure previously given. The compass control station only will answer.

Conventional signals.—The following abbreviated signals will be used:

Signal	Meaning
QTE?	What is my true bearing?
QTE	Your true bearing from _____ radio compass station was _____ degrees.

The following radio compass stations will be of use for vessels navigating within the approximate limits of this volume:

Stations	Call letters	Position	Arc of calibration
			Degrees
Jupiter, Fla	NAQ	Lat. 26° 56′ 59″ N., long. 80° 04′ 56″ W.	0–160
South Pass, La	NBX	Lat. 29° 00′ 43″ N., long. 89° 09′ 32″ W.	60–240
Galveston, Tex	NKB	Lat. 29° 20′ 01″ N., long. 94° 45′ 13″ W.	25–210
Toro Point, C. Z	NAX	Lat. 9° 22′ 31″ N., long. 79° 56′ 58″ W.	_____

Procedure in detail.—(*a*) A ship calling the radiocompass station or compass control station should make the abbreviation "QTE?" ("What is my true bearing?"). This request will be answered by the radiocompass station or control station, and when ready to observe the radio bearing it will send the signal "K," indicating to the ship to commence "testing"; that is, repeating its distinguishing signal for a period of 50 seconds. The signal should be made slowly, with the dashes considerably prolonged.

(*b*) The testing should be made on 800 meters, upon the completion of which the ship should await reply from the radiocompass station.

(*c*) The radiocompass station or control station will then reply, repeating the abbreviation "QTE" ("Your true bearing from _____ was _____ degrees"), followed by the bearing in degrees given by a group of three figures 000 to 360, indicating the true bearing in degrees of the ship station from the radiocompass station, and then the time group, giving the time of observations in local standard time. In the case of more than one radiocompass connected by land line, only the station originally called will answer. This station will combine all the bearings taken by itself and associated stations into one message, which gives each bearing observed immediately after the name of the station making the observation. *All compass stations transmit on 800 meters.*

Danger from reciprocal bearings.—Attention is invited to the fact that when a single bearing is furnished there is a possibility of an error of approximately 180°, as the operator at the compass station can not always determine on which side of the station the vessel lies. Certain radiocompass stations, particularly those on islands or ex-

tended capes, are equipped to furnish two corrected true bearings for any observation. Such bearings when furnished vessels may differ by approximately 180°, and whichever bearing is suitable should be used.

Caution.—Mariners receiving bearings which are evidently the approximate reciprocal of the correct bearing should never attempt to correct these bearings by applying a correction of 180°, as such correction would not include the correction necessary on account of deviation at the compass station. An error of as large as 30° may be introduced by mariners applying an arbitrary correction of 180° to such bearings. Vessels receiving bearings manifestly requiring an approximate 180° correction should request the other bearing from the radiocompass station if not previously furnished.

Bearings, except in the case of approximate reciprocal bearings, should be accurate within 2° of arc, provided the transmitting equipment on board vessels is tuned sharply to 800 meters. Operators should use sufficiently wide coupling to obtain low decrement. If radio transmitters are not tuned sharply, it is difficult to obtain bearings that are sufficiently accurate for navigational purposes.

When bearings from three or more compass stations are not over 2° of arc in error, but do not meet at a fixed point, the geometric center of the triangle formed by the bearings can generally be taken as the approximate position of the vessel. Mariners, until thoroughly familiar with the system, are advised to use radiocompass stations frequently, especially in clear weather, when positions of vessels can be accurately fixed in order to accustom operators to the procedure and to acquaint themselves with the degree of accuracy and dependability of bearings furnished by the radiocompass stations.

Reports.—In order that the operation of shore radiocompass stations may be checked, mariners obtaining bearings are requested to forward a brief report to the Director Naval Communications, Navy D partment, Washington, D. C., containing the following particulars:

1. Name of ship.
2. Name of radiocompass station.
3. Date and local standard time at which radio bearing was taken.
4. Bearings given by radio station.
5. Estimated position of ship at above time and dates by methods other than radio.
6. The probable degree of accuracy of the estimated position.
7. Weather conditions at above time.
8. Remarks, if any.
9. Signature of master or responsible navigating officer.

There is no charge for bearings furnished by the United States Naval Radio Compass Stations.

Radio fog signals.—The following radio fog signals are operated on the Atlantic coast by the United States Lighthouse Service:

Boston Lightship, Mass.:	
Group of 1 dash and 1 dot	**55 seconds**
Silent	**20 seconds**
Nantucket Shoals Lightship, Mass. (call letters WWAH):	
Group of 4 dashes	**60 seconds**
Silent	**30 seconds**

Fire Island Lightship, N. Y. (call letters WWAN):	
Group of 2 dashes	50 seconds
Silent	15 seconds
Ambrose Channel Lightship, N. J. (call letters WWAT):	
Single dashes	65 seconds
Silent	25 seconds
Seagirt Light Station, N. J.:	
Groups of 3 dashes	30 seconds
Silent	3 minutes
Five Fathom Bank Lightship (call letters WWAR):	
Group of 1 dash and 3 dots	40 seconds
Silent	25 seconds
Cape Henry Light Station, Va.:	
Groups of 2 dots and 1 dash	60 seconds
Silent	120 seconds
Diamond Shoal Lightship, N. C. (call letters WWAZ):	
Group of 2 dashes	30 seconds
Silent	30 seconds
Mississippi River South Pass West Jetty Range Front Light Station, La.:	
Group of 2 dashes	60 seconds
Silent	60 seconds
Galveston Jetty Light Station, Tex.:	
Single dashes	60 seconds
Silent	90 seconds

These radio fog signals are intended for the use of vessels equipped with radiocompass. By reason of this radiocompass (also termed radio direction finder) the bearing of the radio fog-signal station may be determined with an accuracy of approximately 2° and at distances considerably in excess of the range of visibility of the most powerful coast lights. The apparatus is simple and may be operated by the navigator without the assistance of a radio operator or without knowledge of the telegraph code. The radio direction-finding apparatus consists of a radio receiving set, similar in operation to those used for radio telegraph or telephone reception, and a rotatable coil of wire in place of the usual antenna. By rotating the coil the intensity of the signal received from the transmitting station is caused to vary, and by noting the position of the coil when the signal is heard at its minimum intensity the bearing of the transmitting station is readily obtained.

It is important to note that the bearing of an incoming radio wave is subject to errors not unlike the deviation of a magnetic compass. Those using radio direction finding on shipboard are cautioned to bear these errors in mind and to keep radiocompasses calibrated at all times. This may be done during clear weather by comparing the bearing obtained with the radiocompass with the bearing as given by other methods in general use. All radiocompasses are subject to what is called "night effect," an indeterminate error sometimes experienced near nightfall and sunrise.

The signals from the lightships have definite characteristics for identifying the stations, as have the flashing lights and sound fog signals, and bearings may be obtained with even greater facility than sight bearings on visible objects. The radio fog signals are transmitted on a wave length of 1,000 meters, which is exclusively reserved for this purpose to avoid interference.

NOTE.—Ships and stations for which no call letters are given do not maintain radio communication.

With the exception of *Nantucket Shoals Lightship*, as noted below, the lightships and stations transmit continuously during thick or foggy weather. With the exception of *Nantucket Shoals Lightship*, the lightships and stations sound the signal daily in clear weather from 9 to 9.30 a. m. and from 3 to 3.30 p. m. (seventy-fifth meridian time except stations on the Gulf Coast, which keep ninetieth meridian time).

With the exceptions of *Nantucket Shoals Lightship* and *Boston Lightship*, operators on lightships maintain watch on 600-meter wave length for the first 15 minutes of each hour from 8 a. m. to 9.15 p. m., local standard time, except when radio fog signal is in operation. Requests by radio for special transmission of signals for testing or calibrating should be made during such watch periods, using 600-meter wave length.

In clear weather *Nantucket Shoals Lightship* (call letters WWAH) transmits signals day and night during the second 15 minutes of each hour, and the operator stands watch during the first 15 minutes of each hour from 8 a. m. to 10.15 p. m. (seventy-fifth meridian time). During fog the radio fog signal will be silent from 10 a. m. to 10.15 a. m. and from 4 p. m. to 4.15 p. m. for listening in.

Nantucket Shoals Lightship sounds radio fog signal and submarine signal at the same time. The submarine signal sounds 2 groups of 6 blasts every 90 seconds, thus, six 1-second blasts, 3½ seconds apart, 12 seconds silence, six 1-second blasts, 3½ seconds apart, 31 seconds silence. In each repetition the first dash of the radio signal and the first blast of the submarine signal are sounded at the same time. The difference in time in seconds between the reception of the first dash of the radio signal and the first blast of the submarine signal multiplied by 1,600 will give the distance in yards of the observer from the lightship.

Vessels are requested to forward reports to the Commissioner of Lighthouses, Washington, D. C., or Superintendent of Lighthouses, Boston, Mass., as to the effectiveness of this signal.

A general description of this method of navigation and the instruments required may be obtained from the Commissioner of Lighthouses, Washington, D. C., upon request. The Bureau of Standards Scientific Paper No. 428, the Radio Direction Finder and Its Application to Navigation, may be obtained from the Superintendent of Documents, Washington, D. C., for 15 cents.

Radio telegraphic broadcasts of weather information issued by the United States Weather Bureau for the benefit of marine interests are made daily on regular schedules along the Gulf coast.

The programs which are broadcast from each radio station are of the same character and are similarly transmitted. They are based upon observations taken in the United States at 8 a. m. and 8 p. m., seventy-fifth meridian time, and one hour earlier at stations in the Gulf of Mexico and Caribbean Sea, of the date of distribution, as indicated.

The bulletins are divided into two parts. The first contains reports of barometric pressure, wind direction, and velocity at certain stations, each of which is indicated by one or more "key letters," and using a group of five figures to represent the data contained in

the report. The second part consists of wind and weather forecasts and warnings of storms and hurricanes.

These weather reports contained in the first part of the bulletins and supplemented by others picked up from vessels can be used in the production of weather maps, which will be of much value to navigating officers, and charts prepared for this purpose, which show the reporting station and their key letters, will be forwarded upon application.

Following is a list of radio broadcasting stations, from which broadcasts are made in cooperation with the United States Weather Bureau:

Key West, Fla. (NAR); U. S. Navy. 10 p. m. Wave length 5,657 meters CW and 1,463 meters ACW, simultaneously.

Port Arthur, Tex. (WPA); Gulf Refining Co. 11.45 a. m., wave length 925 meters spark.

Brownsville, Tex. (NAY); U. S. Navy. 12 midnight. Wave length 4,997 meters CW and 2,255 meters spark, simultaneously.

San Juan, P. R. (NAU); U. S. Navy. 7.45 p. m., wave length 4,836 meters CW and 9 p. m., 4,836 meters CW. Note: This broadcast is retransmitted by station NAW at Guantanamo, Cuba, at few minutes past 9 p. m. on a wave length of 4,543 meters CW. Both of the broadcasts are made during the hurricane season from July 1 to November 15, inclusive.

Almirante, Panama (UB); United Fruit Co. 12.30 p. m. and 11.45 p. m. Wave length 4,075 meters CW. Note: The daily bulletins are transmitted to Almirante, Panama, as well as Swan Island (US) from the Tropical Radio station (WNU) at New Orleans, La., on 3,331 meters CW wave length, at 11.30 a. m. and 11.30 p. m. Any ship or shore station is at liberty to pick up these messages and repeat them to other ships, should it desire to do so. No broadcasts are made from Swan Island, but ships may call that station to obtain a copy of the Almirante broadcast if they have been unable to receive it.

Local bulletins are broadcast daily from other radio stations in this district as named below. These bulletins consist of wind and weather forecasts for ocean areas contiguous to the station, storm, and hurricane warnings and advices and current weather conditions such as, barometric pressure, wind direction and velocity, and state of weather.

Key West, Fla. (NAR); U. S. Navy. 12 noon. Wave length, 1,463 meters ACW.

Pensacola, Fla. (NAS); U. S. Navy. 11.45 a. m. Wave length 1,333 meters spark. Storm warnings issued in the afternoon are broadcast at 6 p. m.

New Orleans, La. (NAT); U. S. Navy. 10 a. m., 11 a. m., and 5 p. m. Wave length 2,607 meters spark.

New Orleans, La. (WNU); Tropical Radio Co. 10 p. m. Wave length 3,331 meters CW.

Galveston, Tex. (WGV); Radio Corporation of America. 11.30 a. m., and 6 p. m. Wave length 830 meters ICW.

Brownsville, Tex. (NAY); U. S. Navy. 12 noon and 7 p. m. Wave lengths 4,997 meters CW and 2,255 meters spark simultaneously.

All hurricane warnings and advisory messages relating thereto are broadcast when issued and repeated at about four-hour intervals.

San Juan, P. R. (NAU). Wave length 4,836 meters CW.
Guantanamo, Cuba. (NAW). Wave length 4,543 meters CW.
Port au Prince, Haiti. (NSC). Wave length 2,255 meters spark.
St. Thomas, V. I. (NBB). Wave length 1,685 meters spark.
St. Croix, V. I. (NNI). Wave length 425 meters spark.
St. John, V. I. (NBO). Wave length 347 meters spark.
Santo Domingo, D. R. (HIA). Wave length 600 meters spark.
Ensenada, P. R. (WPR). Wave length 600 meters spark.

Complete details relative to the above service and method of decoding the major bulletins are published in circulars (Nos. 13 and 14, Radio) issued by the United States Weather Bureau. Copies of these circulars and card descriptive of storm warnings may be obtained upon application to any United States Weather Bureau office on the Atlantic or Gulf coasts. A new edition of the Radio Weather Code for Vessel Weather Observers (W. B. 860, 1925) has been published recently.

Free medical advice to seamen by radio.—The Seamen's Church Institute, of New York, announces that, through the cooperation of the Seamen's Church Institute with the United States Public Health Service, free medical advice for ships at sea is now available through the coastal radio stations operated on the Atlantic and Pacific coasts of the United States.

The Marine Hospitals and Relief Stations of the United States Public Health Service designated to furnish the service in question are as follows:

Atlantic coast: New York, N. Y., United States Marine Hospital No. 70. Alternate.
Stapleton, N. Y., United States Marine Hospital No. 21.
Key West, Fla., United States Marine Hospital No. 10.
Gulf coast: New Orleans, La., United States Marine Hospital No. 14.

While the Panama Canal was not included in the original scheme, several requests for medical service have been received here from ships at sea and have been given prompt attention.

Ships desiring medical advice can secure prompt service by addressing radiograms through any radio station with which communication is established, such radiograms to be signed by the master addressed to the nearest marine hospital or relief station and briefly stating symptoms of the person afflicted. The advice given by the above-mentioned hospitals will be phrased in language (English) intelligible to a layman. This free medical service has been established primarily for the benefit of ships not carrying physicians. However, should occasion require, consultation may be held by radio by ships' physicians with the hospital staffs.

The United Fruit Co. announces that the free medical radio service, which it inaugurated on August 1, 1922, from its hospitals in the various countries of Central America and from the passenger ships in its service, is now made available for ships at sea through an additional number of stations. The following is a list of radio stations of the United Fruit Co. and of the Tropical Radio Telegraph Co. through which this service may hereafter be obtained without charge, so far as these companies are concerned, by ships of all nationalities:

Radio station	Call letters	Radio station	Call letters
Boston, Mass	WBF	Tegucigalpa, Honduras	UG
Miami, Fla	WAX	Puerto Barrios, Guatemala	UF
New Orleans, La	WNU	Managua, Nicaragua	UL
Burrwood, La	WBW	Bluefields, Nicaragua	UQ
Fort Morgan, Ala	WIO	Cape Gracias, Nicaragua	UW
Mobile, Ala	WNN	Puerto Limon, Costa Rica	UX
Swan Island, Caribbean Sea	US	Almirante, Panama	UB
Santa Marta, Colombia	UJ		

Free medical radio service is also available through the Tela Railroad Co.'s radio station, call letters UC, Tela, Honduras, and through the Truxillo Railroad Co.'s radio station, call letters UA, Puerto Castilla, Honduras. Both of these stations may be reached through any station of the United Fruit Co. or of the Tropical Radio Telegraph Co. listed above.

The following information is taken from a circular issued by the United Fruit Co.:

Radiograms requesting medical advice should be signed by the captain of the ship and should state briefly but clearly the symptoms of the person afflicted. Such radiograms, if intended for a United Fruit Co. hospital, should be addressed "Unifruitcó" followed by the name of the place where the hospital is located. United Fruit Co. hospitals giving this service are located at the following places, and also may be reached through any of the above-mentioned radio stations: Santa Maria, Colombia; Puerto Limon, Costa Rica; Almirante, Panama; and Puerto Barrios, Guatemala.

This service may also be obtained at the hospital of the Tela Railroad Co., Tela, Honduras, and at the hospital of the Truxillo Railroad Co., Puerto Castilla, Honduras. Radiograms for these hospitals should be addressed "Telarailco" and "Trurailco," respectively.

All United Fruit Co. passenger steamships carry doctors and free medical advice may be secured by radio from any of them by a radiogram addressed "Ship's Doctor," followed by name of the steamship. This free medical service is established primarily for the benefit of ships not carrying doctors; however, should occasion require, ships' doctors may hold consultation by radio with the United Fruit Co. ships' doctors and hospital staffs.

The physicians and surgeons comprising the medical staff of the United Fruit Co. and its associated companies are thoroughly qualified, but in view of the fact that radio medical advice to ships at sea is given free and without an opportunity for a personal examination of the patients, no responsibility will be assumed by either the company and its associated companies or the physicians or surgeons giving the advice as to its accuracy, or for error or delay in the receipt or transmission of any message sent or received in connection therewith.

It is requested that when sending medical-advice radiograms, radio operators check them "(number of words) DH Medico." "DH Medico" radiograms will be given preference over all other radiograms, excepting S O S calls, throughout the radio service of the United Fruit Co. and Tropical Radio Telegraph Co.

UNITED STATES COAST GUARD STATIONS

Coast Guard stations are maintained at the places named in the following table. The stations are manned throughout the year, and are supplied with boats, wreck guns, beach apparatus, and all other appliances for affording assistance in case of shipwreck. Instructions to enable mariners to avail themselves fully of the assistance thus afforded will be sent free of charge upon application to the United States Coast Guard, Washington, D. C.

The Coast Guard stations are provided with the International Code Signals, and are prepared to send or receive signals in that code or by means of the Semaphone Code, the Occulting or Flashing-light Code, or the International Morse Wigwag Code. Telephone facilities are available at the stations for the summoning of Coast Guard cutters, tugs, or other assistance.

Signals.—The following signals have been adopted by the United States Coast Guard:

Upon the discovery of a wreck by night, the Coast Guard force will burn a red pyrotechnic light or a red rocket to signify—" You are seen; assistance will be given as soon as possible."

A red flag waved on shore by day, or a red light, red rocket, or red Roman candle displayed by night, will signify—" Haul away."

A white flag waved on shore by day, or a white light slowly swung back and forth, or a white rocket, or white Roman candle fired by night will signify—" Slack away."

Two flags, a white and a red, waved at the same time on shore by day, or two lights, a white and a red, slowly swung at the same time, or a blue pyrotechnic light burned by night, will signify—" Do not attempt to land in your own boats; it is impossible."

A man on shore beckoning by day, or two torches burning near together by night, will signify—" This is the best place to land."

Any of these signals may be answered from the vessels as follows: In the daytime, by waving a flag, a handkerchief, a hat, or even the hand; at night, by firing a rocket, a blue light, or a gun, or by showing a light over the ship's rail for a short time, and then concealing it.

Cautions.—Masters are particularly cautioned, if they should be driven ashore anywhere in the neighborhood of the stations, to remain on board until assistance arrives, and under no circumstances should they attempt to land through the surf in their own boats, until the last hope of assistance from the shore has vanished. Often when comparatively smooth at sea a dangerous surf is running which is not perceptible 400 yards offshore, and the surf when viewed from a vessel never appears as dangerous as it is. Many lives have been lost unnecessarily by the crews of stranded vessels being thus deceived and attempting to land in the ship's boats.

Name of station	State	Location	Former number and designation for aviation purposes only
Santa Rosa	Florida	Santa Rosa Island, 2 miles east of Fort Pickens	212
Barataria	Louisiana	On Grand Isle, 1½ miles southwest of Grand Pass	214
Sabine Pass	Texas	West side of Sabine Pass, three-fourths of a mile south of Sabine Pass Light.	216
Galveston	do	On Pelican Spit, west side of channel entrance to Galveston, Tex.	217
San Luis	do	Near west end of Galveston Island	218
Velasco	do	North side entrance Brazos River, one-half mile east-southeast of Brazos River Light.	219
Saluria	do	Northeast end Matagorda Island, 1½ miles north-northeast Matagorda Light.	220
Aransas	do	Northeast end Mustang Island, at Port Aransas	221
Brazos	do	South end Padre Island, about 1 mile north of Brazos Santiago; near Brazos Santiago Light.	222

VARIATION OF THE COMPASS

The magnetic variations for 1927 and annual increase at points mentioned are as follows:

Locality	Variation	Annual increase
	° ′	′
Key West	2 35 E.	0
Tampa Bay Entrance	2 20	0
Cedar Keys	2 35	0
Cape San Blas	3 45	0
Pensacola Bay Entrance	4 45	0
Mobile Bay Entrance	5 00	0
Mississippi River Entrance	5 35	1
Ship Shoal Lighthouse	6 30	1
Trinity Shoal	7 10	1
Sabine Bank Lighthouse	7 45	1
Galveston Bay Entrance	8 15	1
Brazos River Entrance	8 25	1
Aransas Pass	9 05	1
Brazos Santiago	8 50	1

TIDES

In the Gulf of Mexico the periodic tides are usually very small and may, therefore, be greatly modified and sometimes entirely obliterated by fluctuations in the water surface due to the winds or other meteorological conditions.

At Key West the mean rise of the tide is less than 1½ feet, with high water occurring about 10 hours after the moon's meridian passage. Extreme variations in the level from 2 feet below the plane of reference to 3 feet above may occur in this locality.

Along the western coast of the peninsula of Florida from Cape Sable to Apalachee Bay the mean rise of the tide varies from 2 to 3 feet, with high water from 3 to 4 hours later than at Key West. Extreme tides from 3 feet below to 6 feet above the plane of reference have been observed on this coast.

Along the northern shore of the Gulf of Mexico from St. George Sound to the Rio Grande the tide is very irregular and generally diurnal—that is, during a large part of each month only one high and one low water will occur each day, especially near the time of the greatest north and south declination of the moon. When the moon is near the Equator two high and two low waters each day will generally occur, but the range of tide will be smaller at this time.

The mean rise of the tide along this shore is less than 2 feet, but fluctuations due to the wind from 3½ feet below to 4 feet above the plane of reference are not uncommon. During the severe storms that occasionally visit this region, high waters from 10 to 15 feet above the plane of reference have been reported at Galveston, Tex.

The periodic or astronomical tide, small at the mouth of the Mississippi River, gradually diminishes as it ascends the river until it finally becomes completely masked by the larger fluctuations resulting from meteorological conditions. At New Orleans the astronom-

ical tide is so small as to be of no practical importance, although on some days during a month periodic fluctuations amounting to several tenths of a foot have been noted. There is, however, a large fluctuation in the level due to the condition of the river. The mean annual fluctuation at New Orleans is about 14 feet, the water being highest in the spring months and lowest during the autumn and early part of the winter. An extreme fluctuation of 21 feet in the river level at this city has been reported.

For more detailed information concerning the tides in the Gulf of Mexico the General or Atlantic Coast Tide Tables should be consulted. These are published annually in advance by the United States Coast and Geodetic Survey and may be obtained from the office or from any of the agencies of this bureau on receipt of price, which is 75 cents for the general tables and 15 cents for the Atlantic coast reprint.

CURRENTS

Current tables and information heretofore published in the Tide Tables are now issued separately as Current Tables of the Atlantic Coast of the United States and Current Tables of the Pacific Coast of the United States. They are for sale at the agencies. Price, 10 cents each.

Gulf of Mexico.—Under normal conditions, and at all seasons of the year, the waters passing northward through Yucatan Channel into the Gulf of Mexico spread out in various directions, westerly, northerly, and easterly. Taking the Gulf as a whole, the winter winds are northeasterly and the summer winds southeasterly; as a consequence, during the winter season, the west-going branch or portion of the inflowing waters is driven southward upon Campeche Bank, and the northward flow, usually found in the deeper waters lying between Campeche Bank and the Mississippi Passes, practically disappears.

During most seasons of the year, there is a fairly definite current setting from Yucatan Channel toward the Mississippi Passes and extending over about one-half of this distance; also a southeasterly current extending from near the Passes to the western end of Florida Strait.

The currents in the western end of the Gulf, from Vera Cruz to Galveston, are weak and uncertain. The currents in the deeper portions of the Gulf are due largely to prevailing winds.

Counter currents occur along the northern and western coasts of Cuba, in the Bay of Campeche, along the coast west of the Mississippi Passes, and probably off nearly the entire Gulf coast of Florida. The current along the Florida Keys is variable and uncertain.

The **Gulf Stream** sets eastward and northward through the Straits of Florida, and after passing between Fowey Rocks and Little Bahama Bank it continues for some distance northward and then northeastward, its axis following the general direction of the 100-fathom curve and from 10 to 20 miles eastward of it.

Passing through the Straits of Florida, the axis of the stream off Habana is nearest the southern edge of the current prism, but after making the bend between Salt Key Bank and Florida Reefs the axis is from 4 to 11 miles outside the 100-fathom curve on the west side.

There is another body of water northward of the West India Islands, which, driven by the trade winds, is moving westward. This is a slow current, but when it joins the Gulf Stream proper off the southern Atlantic coast of the United States it materially adds to the latter on its way toward the northern seas.

The width of the Gulf Stream off Cape Hatteras is about the same as when it leaves the Straits of Florida. It is, however, liable to more fluctuations in direction, particularly along the edges; and in its progress eastward, by the time the Newfoundland banks are reached it is probable that these fluctuations entirely obliterate the stream as a body distinguishable from its mate which has come by the outside passage from the trade region. In these latitudes, however (about 40° N.), the whole surface is slowly moving eastward, driven by the prevailing westerly winds. Approaching the shore of Europe, it meets the obstruction of the continent and escapes laterally, one branch southward from the Azores toward the coast of Africa, the other branch into the Arctic.

The investigations of the Gulf Stream indicate that there is no way of utilizing the thermometer to determine with certainty the direction of the current.

A steamer bound from Cape Hatteras to Habana or the Gulf ports crosses the stream off Cape Hatteras. A fair allowance to make in crossing the stream is 1½ knots in a northeasterly direction for a distance of 40 miles from the 100-fathom curve. In the run from the southern edge of the stream to Matanilla Shoal no allowance for current can be given.

Crossing the Gulf Stream at Jupiter or Fowey Rocks, an average allowance of 2½ knots in a northerly direction should be made for the set of the current. The weakest current will be experienced about 3 hours before the transit of the moon.

Crossing the stream from Habana, a fair allowance for the average current between 100-fathom curves is 1.1 knots in an east-northeasterly direction.

In the Straits of Florida the velocity of the stream is affected by the winds, by differences in barometric pressure inside the Gulf of Mexico and outside, and by the tides. The first two causes produce the largest changes, and are difficult, if not impossible, to estimate. The semidiurnal effect of the tides on the stream amounts to about 0.5 knot, the maximum current of the Gulf Stream occurring 3 hours after the moon's meridian transit (upper or lower), and the minimum current 3 hours before the moon's transit. Outside of the Straits of Florida the velocity of the stream is affected principally by the winds.

The following is the distance of the axis of the Gulf Stream, or the point where the greatest velocity may be found, from various points:

	Miles
East of Contoy Island, Yucatan	35
North of Habana	25
East of Fowey Rocks	11
East of Jupiter Inlet lighthouse	19
Southeast of Cape Hatteras lighthouse	31

The following tables show the mean velocity of the surface flow and the maximum daily variation observed at various stations:

Between Fowey Rocks and Gun Key

Station	Distance east of Fowey Rocks	Mean surface velocity observed	Maximum daily variation observed
	Miles	*Knots*	*Knots*
1	8	2. 7	2. 4
1½	11½	3. 5	1. 8
2	15	3. 2	1. 7
3	22	2. 7	. 6
4	29	2. 1	. 6
5	36	1. 7	1. 0

Between Rebecca Shoal and Cuba

Station	Distance south of Rebecca Shoal	Mean surface velocity observed	Greatest daily variation observed
	Miles	*Knots*	*Knots*
1	20	0. 3	0. 6
2	35	. 7	1. 2
3	50	2. 2	. 6
4	68	2. 2	. 8
5	86	. 8	. 8

Along the Florida Reefs between Alligator Reef and Dry Tortugas the distance of the northerly edge of the Gulf Stream from the edge of the reefs gradually increases toward the westward. Off Alligator Reef it is quite close inshore, while off Rebecca Shoal and Dry Tortugas it is possibly 15 to 20 miles south of the 100-fathom curve. Between the reefs and the northern edge of the Gulf Stream the currents are ordinarily tidal, and are subject at all times to considerable modification by local winds and barometric conditions. This neutral zone varies in both length and breadth; it may extend along the reefs a greater or less distance than stated, and its width varies as the northern edge of the Gulf Stream approaches or recedes from the reefs.

Straits of Florida—Caution as to currents.—The attention of navigators is called to the fact that most of the wrecks on Florida Reefs occur in the case of vessels bound southward, especially at night; they generally occur on reefs lying about halfway between the lights; and the region of maximum frequency of wrecks is between Carysfort Reef and Alligator Reef, and to a less extent between Fowey Rocks and Carysfort Reef and between Alligator Reef and Sombrero Key.

From a consideration of the data it can be stated that nearly all casualties are due to one cause—an underestimate of the strength of the Gulf Stream against the vessel. This leads to two errors in navigation: First, the distance made good over the bottom is less than assumed or indicated by the log, and when skirting the reefs the course is changed too soon for the next light and before sighting it; second, the vessel underrunning her log is closer to the reefs than indicated by the four-point bearing, and this error is greater for slow vessels than for fast ones.

At night, when bound southward and navigating at a safe distance from the reefs between Fowey Rocks and Sombrero Key, it is on the side of safety to assume that the vessel is steaming against a 3 or 4 knot current, and from one light to hold a course that will insure clearing the reefs until the next light is sighted. It is also well to remember that near the reefs there is a tidal current, possibly as much as 0.5 knot in places directly on and off the reefs on the rising and falling tides, respectively.

On the other hand when bound northward and following Florida Reefs between Sombrero Key and Fowey Rocks it is on the side of safety to underestimate the velocity of the Gulf Stream with the vessel; the courses should be laid well clear of the reefs, which is the usual practice. Vessels are rarely lost on Florida Reefs when bound northward, except when crossing the Stream from Habana and making the reefs in misty or rainy weather.

The following are extracts from a report of a stranding:

Rounded Great Isaac Light at a distance of 2¼ miles, steered by compass and log 227° true for 20 miles, and then steered 224° true. By bow and beam bearing Fowey Rocks Light was 12 miles distant when abeam, but on account of the northerly current it was probably about 7 miles. The vessel stranded on the north end of Long Reef, having had a northerly set of 17 miles, or an average of about 2¼ knots for the crossing from Great Isaac Light to Florida Reefs.

Along the keys there is a slight tidal drift, of not more than 0.5 knot, setting on and off the reefs. This current will probably not be noticeable at a greater distance from the reefs than 1 mile. Between the keys, in the passes connecting Hawk Channel and Florida Bay, the current has considerable velocity (3 to 4 knots) in the immediate vicinity of the openings, and is felt to some extent, probably, on and beyond the usual sailing line in Hawk Channel. When not influenced by winds the maximum current northwestward into Florida Bay and southeastward into Hawk Channel through the openings between the keys occurs about 1 hour before high and low waters, respectively, in the straits. The northwesterly current is increased by easterly winds and the southeasterly current by westerly winds, due to the effect of these winds in driving out or piling up, respectively, the water in Florida Bay.

Straits of Florida to Cape Hatteras.—On the eastern side of the Gulf of Mexico for a distance of possibly 100 miles outside the 100-fathom curve, southeasterly currents prevail and velocities as high as 2.5 knots have been reported. The Gulf Stream investigations indicated that the strongest current into the Straits of Florida is found near the 1,000-fathom curve westward of Dry Tortugas, and that velocities of 1.5 to 2 knots are frequent in that locality. Approaching Dry Tortugas from the Gulf should therefore be regarded as a difficult run, as a vessel will overrun her log, and observations are the principal guide; currents may be expected at all times, but variations occur both in direction and velocity, due to the season of the year and the winds. Approaching the passage westward of Rebecca Shoal from northward, a number of vessels have stranded on New Ground Shoal.

From Florida Straits to Cape Hatteras, vessels follow the Gulf Stream, passing about 12 miles southwestward of Dry Tortugas lighthouse, about 14 miles southward of Rebecca Shoal lighthouse.

then following Florida Reefs about 8 miles off, and passing Fowey Rocks at a distance of 10 to 12 miles and Jupiter Inlet lighthouse 15 miles. The velocity of the current varies greatly in different localities, and is also subject to sudden changes, due to wind, differences in barometic pressure, and the like, so that no fixed hourly rate can be given. Frequently, high velocities will be carried between certain points and suddenly dropping off between others. The position should therefore be checked whenever possible by bearings. The ship speed plus supposed rate of current should not be assumed to fix the position. The greatest velocity will be found between Carysfort Reef and Jupiter Inlet, ranging from 2 to 4½ knots.

From 15 miles off Jupiter Inlet Lighthouse make good the course 1° 30′ true (N. ⅛ E. mag.) for 208 miles to latitude 30° 25′ N., longitude 79° 40′ W. This should lead from 12 to 18 miles outside the 100-fathom curve, and should give a current nearly equal to the average made between Fowey Rocks and Jupiter.

When approaching Diamond Shoal great care must be taken to have a correct location for the vessel. The currents are subject to wide variations, as indicated by the observations on the light vessels. At times during both summer and winter the Gulf Stream has great velocity; at other times none will be found, or a southerly set may be experienced with northerly winds. The general direction of the stream is northeast with a velocity of 1 to 2 knots, but on nearing Diamond Shoal light vessel the current is said to set well to the east-northeast and at other times nearly north. Overallowance and this northerly set have been fatal to many vessels. If a northerly gale is encountered between Jupiter and Cape Hatteras, some navigators keep closer inshore to get on soundings before reaching Diamond Shoal.

INLAND WATERWAYS

Key West to New Orleans.—There are several detached stretches of inside waters, available for drafts of 4 to 5 feet (1.2 to 1.5 m.), and a partially sheltered route, with frequent harbors for small craft, along the entire coast from Key West to New Orleans. Brief descriptions are given under various headings elsewhere in this volume, and are also given, in detail, with maps, in the Inside Route Pilot, Key West to the Rio Grande, published by the Coast and Geodetic Survey. The routes offering the greatest amount of protection for small craft, their approximate distances in nautical miles, and the limiting depths are as follows:

	Nautical	Depth
	Miles	*Feet*
Key West, via Hawk and Moser Channels, past Cape Sable to Coon Key, partly outside	119	7
Coon Key, via Big Marco River and Pass, inside	11	3–5
Big Marco Pass to San Carlos Bay entrance, outside	28	--------
San Carlos Bay, via Pine Island Sound to Boca Grande entrance, inside	31	6
Boca Grande entrance to Venice Inlet outside	26	--------
Venice Inlet to Anclote Keys, inside	84	3 7

	Nautical	Depth
	Miles	*Feet*
Anclote Keys to Cedar Keys entrance, following the coast at a distance of 7 miles, outside	63	4
Cedar Keys entrance to St. Marks entrance	88	5
St. Marks entrance. via Crooked River, to Carrabelle, inside	47	3
Carrabelle to Apalachicola, inside	28	8
Apalachicola, via canal to St. Andrews Bay entrance, inside	62	5
St. Andrews Bay entrance to Choctawhatchee Bay entrance, outside	50	--------
Choctawhatchee Bay entrance, via Santa Rosa Sound to Pensacola Bay entrance, inside	40	6
Pensacola Bay entrance to Mobile Bay entrance, outside	40	--------
Mobile Bay entrance, via Pass aux Herons, Mississippi Sound, Lake Pontchartrain. and Navigation Canal, to New Orleans, inside	123	6

Louisiana.—From New Orleans westward through Louisiana there is a network of inside waters, affording a through passage to Sabine Pass for drafts of 3 to 5 feet (0.9 to 1.5 m.). These are briefly described under the heading, Intracoastal Waterway, New Orleans to Sabine Pass, on page 153, and are described in detail in the Inside Route Pilot, Key West to the Rio Grande.

Texas.—From Sabine Pass to Galveston, 52 miles, there is no inside route. From Galveston southwestward to Corpus Christi there is an inside route for a draft of about 4 feet (1.2 m.), by way of several extensive bays and dredged canals connecting them. It is briefly described under the heading, Inside Route, Galveston to Corpus Christi, on page 197, and is described in detail in the Inside Route Pilot, Key West to the Rio Grande. Beyond Corpus Christi there is no inside route.

Mississippi River and Great Lakes.—A draft of 4 feet (1.2 m.), at ordinary low river stages, can be taken from New Orleans to Chicago, and thence to the Atlantic Ocean, by way of the Mississippi River and its tributaries and the Great Lakes. For distances and a brief description of the route, see page 138.

The following data about the inland waterway from **New York to Florida** is included for ready reference:

Vessels of 7 feet (2.1 m.) draft can pass inside from New York Bay to Delaware River through the Delaware & Raritan Canal. Masted vessels are limited to a height of 50 feet above canal level by a bridge without draw at New Brunswick, N. J.

Vessels of 9 feet (2.7 m.) draft can pass inside from Delaware River to Beaufort, N. C., through the Chesapeake & Delaware Canal, Chesapeake Bay, Elizabeth River, Dismal Swamp Canal or Albemarle & Chesapeake Canal, Albemarle and Pamlico Sounds, Neuse River, Adams Creek, canal to Core Creek, and Newport River. A draft of 3 feet (0.9 m.) can be taken inside about 40 miles southward from Beaufort, N. C., to New River Inlet. All bridges have draw openings.

There is no inside passage from Beaufort, N. C., to Winyah Bay, a distance of about 160 nautical miles, and vessels must pass outside between these points. Cape Fear River, halfway between them, is available as a harbor.

Vessels of 5 feet (1.5 m.) draft can pass inside from Winyah Bay, S. C., to St. Johns River, Fla. All bridges have draw openings.

Vessels of 4 feet (1.2 m.) draft can pass inside from St. Johns River to Miami, Fla., through Pablo Creek, North, Matanzas, Halifax, and Hillsborough Rivers, Mosquito Lagoon, Indian River, South Jupiter Narrows, Hobe, and Jupiter Sounds, Lake Worth, Key Biscayne Bay, and the canals connecting them. All bridges have draw openings.

From Miami to Key West, Fla., there is practically an inside route through the Hawk Channel that can be used by vessels of 10 feet (3.0 m.) draft. Cuts with a depth of 5 feet (1.5 m.) have been made in places so that vessels of 4 feet (1.2 m.) draft can go from Miami through Key Biscayne Bay, Card Sound, Barnes Sound, railroad drawbridge at Cross Key, Blackwater Sound, Tarpon Basin, Florida Bay along the north side of the keys to Long Key, and thence northwestward into the Gulf of Mexico at Cape Sable, or can continue in Florida Bay along the north side of the keys, through Big Spanish Key Channel, and thence in the Gulf of Mexico to Key West.

Boats of 3 feet (0.9 m.) draft can be taken across Florida by way of some of the drainage canals, Lake Okeechobee, and Caloosahatchee River.

A catalogue showing the charts of the route can be obtained free of charge on application to the Coast and Geodetic Survey, Washington, D. C., or to any of its agents. A list of agents for the sale of charts and other publications of the Coast and Geodetic Survey is given in the catalogue and in the first notice each month of the Notice to Mariners, published weekly by the Bureau of Lighthouses and the Coast and Geodetic Survey.

The route is covered in the following publications of the Coast and Geodetic Survey:

United States Coast Pilot, Section C, Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays.

United States Coast Pilot, Section D, Cape Henry to Key West.

Inside Route Pilot, Coast of New Jersey.

Inside Route Pilot, New York to Key West.

Tide Tables, Atlantic coast ports of the United States.

Current Tables, Atlantic Coast of North America.

DESCRIPTIONS AND SAILING DIRECTIONS

KEY WEST HARBOR (CHART 584)

This harbor is large and commodious, and one of the best anchorages for large vessels south of Chesapeake Bay. It lies northward of a broken line of the Florida Reefs in latitude 24° 33′ N. and longitude 81° 49′ 30″ W. The harbor proper lies in front of the city of Key West, protected on the eastern side by the island and on the other sides by submerged reefs and sand flats. It has a length of 2 miles and a width of about one-fourth mile. Southwest of the harbor proper there is a large anchorage area protected by the reef. The harbor is entered through breaks in the reef, there being five main and several minor channels.

Sand Key Lighthouse is a brown, pyramidal, skeleton tower, on pile foundation, inclosing dwelling and stair cylinder. The light is group flashing white (flash 0.5 second, eclipse 1.5 seconds, flash 0.5 second, eclipse 7.5 seconds), with four red sectors, 109 feet (33 m.) above the water, and visible 16 miles.

Key West Lighthouse is a white conical tower. The light is occulating white (light 6 seconds, eclipse 6 seconds), with 3 red sectors, 91 feet (27.7 m.) above the water, and visible 15 miles.

Northwest Passage Unused Lighthouse (Old Tower) is a white dwelling on brown pile foundation, standing in 4 feet of water, at the northwesterly entrance to Northwest Channel. The light is discontinued.

Channels.—There are several channels or approaches to the harbor, leading between the reefs and coral banks which surround it; they have been examined by means of a wire drag, and the dangers are shown on the chart. These channels are easy to follow in a sailing vessel in the daytime with a fair wind, but it is not safe for a stranger to attempt to beat into the harbor.

Southeast Channel is marked by buoys and at night by the easterly edge of a red sector in Key West Light; it leads over lumpy bottom with 14 to 18 feet (4.3 to 5.5 m.) over the coral heads, and it is not recommended for vessels of over 13 feet (4.0 m.) draft. The course through the channel is 321° true (NW. ⅜ N. mag.) for Key West Lighthouse.

Main Ship Channel has an improved depth of 30 feet (9.1 m.) for a width of 300 feet and is well marked by buoys and lights. This channel is used by the deeper-draft vessels and by strangers.

Southwest Channel is convenient for vessels approaching from southwestward; it has a navigable depth of 24 feet (7.3 m.) if closely followed, and is marked by several buoys. Vessels of 16 feet (4.9 m.) draft can make one course nearly to the anchorage by heading for Key West Lighthouse bearing 55° true (NE. ⅝ E. mag.) in the daytime, and by standing on the edge of a red sector of that light at night, and this is about the deepest draft of the vessels using the channel. Strangers should not attempt it at night.

Northwest Channel has been improved and in January, 1925, had a depth of 18 feet (5.5 m.) and a width of 200 feet; it can be used by vessels of 16 feet (4.9 m.) draft. This channel affords a short cut from Key West Harbor to the Gulf of Mexico and is well marked.

Key West, on Key West Island, is the only city of any size on the west and north shores of the Straits of Florida. It is the terminus of the Florida East Coast Railroad, and has steamship communication with New York, Habana, Tampa, Mobile, and Galveston, and in the winter season with Colon and Nassau. A number of steamers and small sailing vessels enter and clear from the port, over half of which are from or for foreign ports. The commerce consists of canned goods, cedar, cigars, coal, fish, flour, fruits, grain, crude and refined oils, tobacco, and general merchandise. The greatest draft of vessels coming to the port is 26½ feet and the average draft is 14 feet.

Terminal facilities.—The depth at the wharves ranges from 10 to 26 feet (3.0 to 7.9 m.), according to locality. These consist of four wharves and six piers, used for general freight, etc., having berthing space of 11,744 feet. All have connection with city streets, two piers having rail connections. These terminals with the exception of one wharf are open to the public. In addition to the above there are four Government piers, having a berthing space of 4,138 feet.

Prominent features.—When standing along about 6 miles southward of the Florida Keys, as the entrances from the southward are approached, the city and Key West Lighthouse will be seen near the western end of Key West Island, and Fort Taylor will show prominently a little westward of the island. The naval coal wharf and radio poles are conspicuous north of the fort. Sand Key Lighthouse will be seen about 7 miles southwestward of Key West Lighthouse.

Eastern Triangle Light (flashing white), a black tankhouse on a red, triangular, pyramidal, skeleton structure, on piles, is midway between the entrance buoys of the Main Ship Channel and Key West Lighthouse, and can be readily distinguished from outside the reefs.

Anchorage.—The best anchorage is in the inner or Man-of-War Harbor, where the depth is 3½ to 4½ fathoms (6.5 to 8 m.); this anchorage is northward of the city between coral banks, which prevent a heavy sea. Vessels can anchor anywhere off the city northward of Fort Taylor, or in the entrance to the Northwest Channel abreast of the city in 3½ to 5 fathoms (6.5 to 9 m.), taking care, however, not to get too close to the reefs, which in some places rise abruptly at the edge of the channels. The outer anchorage, about 1 mile from Fort Taylor, with the fort bearing between 36° true (NE. by N. mag.) and 328° true (NW. by N. mag.), has depths of 4½ to 6 fathoms (8 to 11 m.) and is somewhat exposed, but is safe for vessels with good ground tackle. Small craft generally anchor in the cove on the north side of the city southward of the railroad wharf.

Quarantine.—The boarding station is near Fort Taylor; no vessel is permitted to pass above this before obtaining pratique. The

quarantine anchorage is in Man-of-War Harbor northward of Fleming Key.

A marine hospital is located at Key West. It is open to foreign as well as American seamen.

Pilots can always be had by making signal while outside the reefs. Pilot boats are usually cruising outside and a good lookout is kept for approaching vessels. Pilotage is compulsory for certain vessels. Pilots for Hawk Channel can be had at Key West. See the extracts from the laws of Florida relative to pilotage on page 4.

Extracts from the Rules and Regulations for the Port of Key West.—The master of any vessel entering the port of Key West, who does not accept the services of a pilot shall be compelled to pay the full legal rates of pilotage, provided the vessels be spoken outside the following limits:

If she be entering by Main Ship Channel she must be spoken outside the Western Head Buoy. If by Hawk Channel, she must be spoken east of mid-channel buoy, intersecting Southeast Channel and Hawk Channel, Key West Light bearing NW. ¼ N.

If entering by Southeast Channel, must be spoken outside of No. 4 red buoy, Sand Key bearing SW. by W. ¾ W.

If entering by Southwest Channel or Sand Key, she shall be spoken southwest of a line of No. 7 black buoy and No. 8 red buoy in Southwest Channel. If entering Northwest Channel she must be spoken outside of No. 1 or Bar Buoy.

Should a vessel enter the port of Key West without being spoken by a licensed pilot outside the foregoing limits, the first pilot speaking her thereafter shall be entitled to full outward pilotage.

SEC. 13. The rates of pilotage as now established by law are as follows: For steamers or vessels drawing 6 feet, or less than the same, $2 per foot; for steamers or vessels drawing from 6 to 10 feet, $3 per foot; for steamers or vessels drawing from 10 to 14 feet, $4 per foot; for steamers or vessels drawing from 14 to 20 feet, $5 per foot; for steamers or vessels drawing over 20 feet, $6 per foot. These rates shall apply to all steamers or vessels, whether owned wholly by citizens of this State or not: *Provided*, That all steamers or vessels carrying the regular United States mails shall pay half pilotage only: *Provided further*, That all steamers or vessels drawing less than 6 feet of water, and having a coastwise license, shall be exempt from paying whole or half pilotage, unless they employ a pilot.

And all vessels drawing 14 feet or less shall pay the sum of $10 for dropping from one anchorage to another and those drawing over 14 feet shall pay the sum of $20.

Supplies.—A large supply of bituminous coal is always kept on hand, and anthracite coal can be had in limited quantities. Water can be obtained, but the supply is limited at times. Provisions and ship chandler's stores can be obtained in the city.

Repairs.—There is a small marine railway, 180 feet long, with a lifting capacity of about 1,000 tons. Vessels of 10 feet draft forward and 16 feet aft can be hauled out. Repairs to the hulls of wooden vessels can be made, and there is a machine shop where ordinary repairs can be made.

Storm warnings are displayed at Key West.

Tides.—The mean rise and fall of the tide is 1.2 feet.

Currents.—The tidal currents in Key West Harbor and Northwest Channel set fair with the channels and the times of maximum current at these places are nearly simultaneous, the strength of the flood (north flowing) occurring 1 hour 46 minutes before high water, and the ebb 1 hour 14 minutes before low water, at Key West. Slack water occurs 1 hour 20 minutes and 1 hour 52 minutes, respectively, after high and low water at Key West. The average velocity at strength of both flood and ebb is 1 knot between Whitehead Spit and

Kingfish Shoals, 1 knot in Man of War Harbor, and 1.7 knots at its entrance, and 1.4 knots in Northwest Channel abreast of Middle Ground. These normal conditions are greatly modified by winds.

Winds.—The prevailing winds are easterly, the strongest north in winter and easterly during the hurricane months. See also the meteorological tables in the appendix.

DIRECTIONS, KEY WEST HARBOR

The approaches to Key West Harbor have been examined by means of a wire drag, and the dangers are shown on the chart.

Main Ship Channel.—This approach is used by all deep-draft vessels entering Key West. A channel 300 feet wide and 30½ feet 9.3 m.) deep has been cleared of shoals.

Key West Entrance gas and whistling buoy is moored in about 15 fathoms (27.4 m.) on the Main Ship Channel range, 4¼ miles eastward of Sand Key Lighthouse. Buoys Nos. 1 and 2 mark the 24-foot (7.3 m.) curves at the sides of the channel, about ¼ mile northward of the gas buoy.

Main Ship Channel range marks the axis of the channel up to Eastern Triangle Light. The front light of the range is mounted on a small, white, pyramidal beacon on the shore end of the causeway leading to Fort Taylor; the rear light of the range is mounted on an iron mast near the southeast corner of the Navy coal shed, color white, with vertical stripe down roof and side of buoy shed. Each of these beacons shows a red light at night.

From the entrance gas buoy steer 356° true (N. ⅝ W. mag.), with Key West Main Ship Channel range lights in line ahead. When up to Eastern Triangle Light steer 339° true (NNW. ⅛ W. mag.), with **Whitehead Point Spit buoy** a little on the starboard bow. Pass 200 yards westward of this buoy and steer 2° true (N. mag.), passing between buoys Nos. 11 and 8 at distances of about 200 yards from each. When abreast of buoy No. 8 steer 10° true (N. ⅝ E. mag.) for ⅜ mile and anchor in 4 to 5 fathoms (7.3 to 9.1 m.). Or, if bound for the wharves or Man of War Harbor, from abreast of nun buoy No. 8, steer 24° true (N. by E. ⅞ E. mag.) on the Key West Harbor range, and give the breakwater at the naval station and the wharves a berth of about 100 yards.

Northwest Channel.—Northwest Channel has been examined by means of a wire drag, and the dangers are shown on the chart. The following courses lead in a least depth of about 18 feet (5.5 m.):

When Northwest Passage unused lighthouse is distant 7 or 8 miles, bring it to bear 182° true (S. mag.) and steer for it, passing about 1¼ miles eastward of **Smith Shoal gas and whistling buoy,** and until up to the entrance gas and bell buoy. **Northwest Bar Light** will then be on range with Sand Key Lighthouse, the latter barely showing over Snipe Key.

Leaving the gas and bell buoy 200 yards to eastward, steer 171° true (S. by E. mag.), heading for Northwest Bar Light in range with Northwest Channel entrance range rear light until abreast of can buoy No. 3. Then haul gradually to eastward, passing between Northwest Bar Light and can buoy No. 5, and bring Northwest Bar Light astern and in range with Northwest Channel turn range rear light, course 118° true (SE. by E. ¾ E. mag.). Continue this

course, leaving three can buoys to port and up to nun buoy No. 6. Then bring Northwest Channel inner range on ahead, on course 139° true (SE. ⅛ S. mag.) and continue this course until one-fourth mile from the front object of the range. Then steer 155° true (SSE. ⅜ E. mag.), heading for **Inner Midchannel gas buoy** (flashing white). Vessels drawing 14 feet or less can cross the **Middle Ground** by passing about 400 feet south of Northwest Channel Inner Rear Light.

Vessels of the limiting draft of Northwest Channel should pass southward of the Middle Ground. From Inner Midchannel gas buoy steer 148° true (SE. by S. mag.) to a position 100 yards eastward of Kingfish Shoal Light. Then steer 171° true (S. by E. mag.) for 1 mile until Key West Lighthouse bears 70° true (ENE. ⅛ E. mag.) or at night in the red sector of the light. Then head for the lighthouse until Key West Harbor range comes on. Then steer for it on course 24° true (N. by E. ⅞ E. mag.) and give the breakwater at the naval station and the wharves a berth of 100 yards.

FLORIDA KEYS, WESTWARD OF KEY WEST

This section is the western end of the remarkable chain of low islands, with intervening reefs and shoals, beginning with Virginia Key, in about latitude 25° 45′ N., longitude 80° 09′ W., and extending in a circular sweep to the Dry Tortugas, in latitude 24° 38′ N., longitude 82° 55′ W. From Florida Bay westward to Dry Tortugas they separate the waters of the Straits of Florida from the Gulf of Mexico.

Westward of Key West there is a succession of shoals, reefs, and keys, mostly of a coral formation and very irregular in outline. The keys are low, small in extent, and, except for the Dry Tortugas, largely covered with a dense growth of mangrove. Fresh water in limited quantities is found on Marquesas Key and some rain water is caught and stored at Dry Tortugas.

About 5½ miles south of the main chain of keys and reefs, and extending westward from Sand Key Lighthouse for a distance of 40 miles or more, is a line of reefs, shoals, and generally broken ground, which rises abruptly from the deep water of the Straits of Florida. **Satan Shoal, Vestal Shoal, Coalbin Rock, Cosgrove Shoal, Marquesas Rock,** and a 17-foot (5.2 m.) spot 2¼ miles westward of Marquesas Rock are the most dangerous of those known at present. As a measure of safety, when standing westward of Key West and bound into the Gulf of Mexico, vessels of the deepest draft should avoid this broken ground, including the areas with depths less than 10 or 12 fathoms lying southward and westward of Rebecca Shoal and Dry Tortugas. A course which leads 1 to 2 miles south of the buoys, 12 miles south of Rebecca Shoal Lighthouse, and 8 miles south of Dry Tortugas Lighthouse on Loggerhead Key is as close as this broken ground should be approached when skirting it. The hand lead can not be depended upon to insure clearing the dangers.

The currents near the edge of the bank in this locality are variable, being influenced by the winds, by differences of barometric pressure in the Gulf and outside, and by the tides. There are strong

tidal currents through the passage westward of Rebecca Shoal. A velocity of 1½ knots has been observed in the passage and 1 knot (north and south) on the edge of the bank southward of the passage. The tidal current on and off the edge of the reef should also be taken into consideration by vessels in these waters.

For about 11 miles westward of Key West Harbor there is an extensive shoal area with a number of small scattered keys on it. White sand beaches make the three southernmost keys easily distinguishable from the southward.

Bocagrande Channel, lying about 15 miles westward of Key West, between Bocagrande Key and Marquesa Keys, affords a short cut across the shoals from the Straits of Florida to the Gulf of Mexico; but it is seldom used, as the Northwest Channel from Key West has deeper water, is better marked, and cuts off more distance for vessels coming from or bound to points northward or eastward. Bocagrande Channel is good for a depth of about 11 feet (3.5 m.) and is buoyed, but it is used only by local boats of about 6 feet or less draft. A 2° (north mag.) course will lead through the buoyed channel.

Marquesas Keys are a number of keys, roughly circular in outline, lying westward of Bocagrande Channel; they are about 4 miles long and 3 miles broad and surrounded by an extensive shoal area.

Extending in a westerly direction for a distance of 18 miles from Marquesas Keys is an extensive shoal, the western part of which is known as **The Quicksands.** The general width of the shoal between the 18-foot (5.5 m.) curves is about 4½ miles, with depths of only 2 to 6 feet (0.6 to 1.8 m.) over it in spots. At the western end of The Quicksands is **Half Moon Shoal,** with a least depth of 10 feet (3.0 m.) on it. A red buoy, No. 4A, marks the location of a wreck.

About 5 miles north of The Quicksands is **New Ground,** a narrow ridge 5½ miles long in a general east and west direction, ⅜ mile wide, and with a least depth of 4 feet (1.2 m.). Its western extremity is marked by a gas and whistling buoy. On the northern side of New Ground the water shoals abruptly, and vessels should keep in not less than 13 fathoms (23.8 m.) to insure clearing the shoal.

On the southern side of New Ground, and between it and The Quicksands, is a questionable channel, 2¼ miles wide, with depths of 28 to 35 feet (8.5 to 10.7 m.). Spots having 19 to 22 feet (5.8 to 6.7 m.) over them are found 7 miles eastward of New Ground, and the bottom inside of the 10-fathom (18.3 m.) curve is generally broken. There are indications of a ridge, of which New Ground is the western end, extending eastward to **Smith Shoal,** and the locality should be approached with caution by all except light-draft vessels. A shoal, with 2½ fathoms (4.6 m.) of water over it, lies 3⅜ miles 255° true from Smith Shoal, partly verifying the existence of the ridge mentioned.

Between Half Moon Shoal and Rebecca Shoal is a channel used by steamers with local knowledge drawing as much as 18 feet (5.5 m.), but it is not recommended for a stranger because of the broken nature of the bottom. Within a radius of 2¾ miles from the buoy on Half Moon Shoal, and between southeast and west of it, are a

number of spots, with least found depths of 20 to 22 feet (6.1 to 6.7 m.), rising abruptly from depths of 6 to 7 fathoms (11 to 12.8 m.). Another spot, known as **Isaac Shoal**, lies nearly 2 miles southeast by east from Rebecca Shoal and has a least depth of 14 feet (4.3 m.). The shoals are of the nature of coral heads, rising very abruptly from the deep water surrounding them, and there are probably other shoals not found by the survey. It is also probable that there are less depths than found by the survey on the charted shoals.

Currents.—In the channel between Half Moon Shoal and Rebecca Shoal slack water before the flood (northerly) occurs two hours after the time of low water at Key West, and slack water before the ebb (southerly) occurs two hours after the time of high water at Key West. The average velocity of the current at strength is three-fourths knot. The times of slack water and the velocity of the current are considerably influenced by the winds.

Rebecca Shoal, a coral bank quite small in extent and with a least depth of 9 feet (2.7 m.) over it, lies about 7 miles westward of Half Moon Shoal.

Rebecca Shoal Lighthouse is a white dwelling on a brown pile foundation on the southerly edge of the shoal. The light is group flashing white (3 flashes every 15 seconds), 66 feet (20.1 m.) above the water, and visible 14 miles. A sector, in which the flashes are red, covers Isaac and Half Moon Shoals and The Quicksands.

So far as is now known the passage between Rebecca Shoal and Dry Tortugas is clear. The lower part of the passage, south of a line from Rebecca Shoal Lighthouse to Tortugas Harbor unused lighthouse and west of a line extending NNE. and SSW., and passing 1 mile west of Rebecca Shoal Lighthouse, has been examined with the wire drag. Included in the dragged area are the three 10-fathom (18.3 m.) spots on a line about 9 miles south of the northern limit of the drag work. Until more detailed surveys have been made of the remainder of this locality, vessels of the deepest draft should use this passage with great caution, as there are probably undiscovered spots with less depths than those now charted. A vessel is reported to have struck an obstruction 2 miles, 285° true (WNW. 7/8 W. mag.) from Rebecca Shoal Lighthouse. No obstruction was found here with the drag set to a depth of 33 feet (10 m.) or over. A vessel is also reported to have struck an obstruction with about 18 feet over it 11 miles 147° true (SE. 7/8 S. mag.) from Rebecca Shoal Lighthouse.

Dry Tortugas is a group of small sandy reefs and keys about 10 miles long in a northeast and southwest direction and about 5 miles wide, lying 58 miles westward of Key West. **Pulaski Shoal,** the northeastern end of this group, is 12 miles northwestward of Rebecca Shoal and is marked by a whistling buoy. The keys are irregular in form, and in general rise abruptly from deep water, with fairly good channels between them. As the keys are low and generally barren of vegetation, with only seven of them showing above high water, they are not readily distinguished; but **Fort Jefferson** and Tortugas Harbor unused lighthouse on **Garden Key,** and Dry Tortugas Lighthouse, on **Loggerhead Key,** are good landmarks. On a clear day they may be seen at a distance of 10 or 12 miles, Garden Key having the appearance of a bare rocky island. **Bird Key,** a

small key lying three-fourths mile southwestward of Fort Jefferson, is a national bird reservation.

When approaching Dry Tortugas from eastward or southeastward, the lead is of little use to give warning of danger, as 10 to 15 fathoms is found close to the reefs in many places. Approaching from northwestward or southwestward, the water shoals more gradually; but in thick weather a depth of 10 fathoms (18.3 m.) is as close as any vessel should approach, unless sure of her position.

Tortugas Harbor unused lighthouse on Garden Key is a brown, hexagonal, pyramidal tower, 67 feet (20.4 m.) high.

Dry Tortugas Lighthouse on Loggerhead Key is a conical tower, lower half white, upper half black. The light is flashing white (light 1 second, eclipse 19 seconds), 151 feet (46 m.) above the water and visible 19 miles.

There are two buoyed channels known as Southeast and Southwest, which lead to the anchorages among the reefs, and on a clear day no difficulty need be experienced by a medium-draft vessel in entering, as the shoals are readily distinguishable by the difference in color of the water. All of the channels, except that part of Southwest Channel southward and westward of buoy No. 2, have been closely developed by survey with lead, but have not been dragged to develop the least depths. The bottom is so rocky and broken and the rocky heads are so small in extent that vessels should exercise the greatest caution, even in the buoyed channels, where the depths are not more than about 10 or 12 feet (3 or 3.6 m.) greater than the draft.

Southeast Channel leads between the reefs making off eastward from Long and Bush Keys and those making off westward from East, Middle, and Sand Keys. This channel has depths of 30 feet (9.1 m.) or more, but it should be used with caution by vessels drawing over 18 feet (5.5 m.).

Southwest Channel leads between the reefs making off southwestward and westward from Garden and Bird Keys and those extending southwestward from Loggerhead Key. The least found depth on the usual course is 6 fathoms (11 m.), but it has not been closely developed outside of buoy No. 2.

Northwest Channel has been abandoned and the buoys have been discontinued.

There are numerous places among the reefs where vessels can anchor and find shelter from winds from different quarters, according to circumstances. The **anchorage** affording best shelter from all winds, although somewhat open to the northward, is northward and northwestward of Garden Key. It has good holding ground, and the depths range from 8 to 10 fathoms (14.6 to 18.3 m.). Excellent anchorage for small vessels and boats is found in the deep water known as **Bird Key Harbor,** close eastward of Bird Key, and also in what is known as Tortugas Harbor, the narrow channel leading to the wharf at Fort Jefferson through the reefs that surround Garden Key. **Fort Jefferson** has been abandoned, but the channel is well marked with beacons and buoys. These two anchorages are entered from northward and are used principally by the fishermen who frequent these waters.

Currents.—In the Southwest Channel slack water before the flood (northerly) occurs about 20 minutes before the time of low water

at Key West, and slack water before the ebb (southerly) occurs about 20 minutes after the time of high water at Key West. The currents are nearly simultaneous in all the channels of these islands, and follow the general directions of them. The average velocity of the current between Loggerhead Key and **White Shoal** is 1.3 knots at strength. The velocities, as well as the times of slack water, are considerably influenced by the winds.

There are no regular **pilots** for Tortugas Harbor, but a competent fisherman or lighthouse keeper will usually come out and assist vessels to enter.

For 10 miles westward of Dry Tortugas the bottom is broken and irregular, and consists of coral rock with patches of sand and broken shell. The shoalest part of this area, known as **Tortugas Bank,** lies 7 miles west of Loggerhead Key, and has a least found depth of 38 feet (11.6 m.), but it has not been closely developed. Depths of less than 10 fathoms (18.3 m.) are found for a distance of 2½ miles in all directions. Between Tortugas Bank and Dry Tortugas the depths range from 10 to 19 fathoms (18.3 to 34.7 m.). Tortugas Bank should be avoided by deep-draft vessels, especially during heavy weather.

KEY WEST TO SAN CARLOS BAY

From Cape Sable to San Carlos Bay the coast is low, sandy, and generally wooded, with few distinguishing features. Back of the coast is an extensive swampy region, practically uninhabited, known in the southern part as **The Everglades.** Off the coast the water is generally shoal, and the 10-fathom (18.3 m.) curve roughly approaches a line drawn north-northwestward from Key West to Tampa Bay Entrance. This part of the coast is seldom approached by deep-draft vessels.

Vessels of moderate draft, bound from Key West up the west coast of Florida, can lay a straight course from Northwest Channel to Sanibel Island Lighthouse, at the entrance to San Carlos Bay, a distance from Key West of 118 miles. This course lies well clear of all dangers, and the lighthouse on Sanibel Island is a good landfall during the day or night. However, on account of the frequency of northers during the winter months, this track is not recommended for small power boats, and the route across Florida Bay is to be preferred.

Calda Channel, leading northward from Man-of-War Harbor, Key West, is a narrow, crooked channel, good for a draft of about 5 feet (1.5 m.), and, although not marked, is easily followed by day. The northerly entrance may be found by following the edge of the bank, 5 miles northward of Key West, until a large wreck is in range with the square, concrete tower of the Havana-American Tobacco Co., bearing 151° true (SSE. ¾ E. mag.).

Florida Bay, lying northward of Florida Keys, and between them and the south coast of the mainland of Florida, is a triangular-shaped body of water extending in a general east and west direction from Barnes Sound to Cape Sable. The depths are shallow and irregular, and the bottom is mostly coral, with a thin covering of silt in the eastern part. From April to October the waters of the

bay are clear and the shoals plainly discernible, but during the winter months the water is milky and the shoals indistinguishable.

In the eastern part of the bay there are numerous ridges and reefs, which show bare or nearly bare, and there is also a large number of small wooded keys. This part is navigable only for small craft, and is mostly frequented by small motor yachts, spongers, fishermen, and the inhabitants of the keys, who generally use flat-bottomed boats of 3 to 4 feet (0.9 to 1.2 m.) draft. The western part of the bay is comparatively clear, with depths ranging from 7 to 13 feet (2.1 to 4.0 m.), and the bottom is covered with loggerhead sponges and small coral heads.

Moser Channel, 39 miles eastward of Key West, affords a passage between the Florida Keys from Hawk Channel to Florida Bay, which is used by vessels of 6 to 7 feet (1.8 to 2.1 m.) draft, coming either from Key West or from the east coast of Florida, and bound to points on the west coast. By this route small craft find comparative shelter in the shallow waters of Florida Bay, and protected anchorages are at no great distance apart. Moser Channel is crossed at its southerly end by a drawbridge with an opening 106 feet wide on each side of the central pier.

A strong tidal **current** is always found, except at slack water, in Moser Channel in the vicinity of the bridge, and during spring tides there are overfalls which may swamp a small boat. This tidal current is caused by the differences in the range and in the time of tides on the south and north sides of the keys. On the south side the extreme rise and fall is about 1½ feet and on the north side about 3½ feet. High and low water may occur on the south side as much as three to four hours before they occur on the north side. Winds also affect the currents very noticeably. The northerly current is increased by easterly winds and the southerly current by westerly winds, due to the effect of these winds in driving out or piling up, respectively, the waters in Florida Bay. The flood current runs northward and the ebb current southward through the draw of the bridge.

From the drawbridge crossing Moser Channel a 356° true (N. ½ W. mag.) course for 3¼ miles leads to a position 250 yards westward of a beacon No. 2. Then steer 19° true (N. by E. ½ E. mag.) for 3 miles, then change course to 354° true (N. ¾ W. mag.) for three-fourths mile, which will lead 400 yards westward of beacon No. 1, which marks the northern edge of a 3-foot shoal. Continuing on this course for 25 miles leads 1½ miles off Cape Sable, Northwest Cape.

Cape Sable, on the north side of Florida Bay, is the southwestern point of the mainland of Florida. It is low and wooded and has three points known, respectively, as **East Cape, Middle Cape,** and **Northwest Cape.**

From Northwest Cape the coast trends about north for 20 miles, and then northwestward for 30 miles to Cape Romano. For the greater part of this distance it is broken by innumerable small islands and keys, known as the **Ten Thousand Islands,** among which is a network of small rivers and bayous leading to the interior. The islands and keys are generally lumps of mud, low and densely wooded, and nearly impossible of identification by a stranger. They

are small in size, mostly awash at high water, and fringed with oyster reefs.

The depths for a distance of 10 miles from the coast are shallow, and for 2½ miles from the coast there is found a depth of 7 feet (2.1 m.) or less. With local knowledge 3 to 7 feet (0.9 to 2.1 m.) can be carried into many of the rivers, but this part of the coast is visited only occasionally by light-draft motor yachts and small craft from Key West and Marco. These vessels seek shelter from gales by entering the rivers or bayous, or by running inshore as close as their draft will permit and anchoring where they find soft bottom.

Ponce de Leon Bay is a nearly rectangular bight, 2 miles wide by 1½ miles long, in the west coast of Florida, 7 miles north of Cape Sable Northwest Cape. **Shark Point**, on the north side of the entrance, and the point on the south side are heavily wooded to the water's edge, and stand out in bold relief against the tree line at the head of the bay. The head and the northern part of the bay are shallow, but there is a good and convenient anchorage for vessels of 6 feet (1.8 m.) draft in the southern half of the entrance, from one-fourth to one-half mile northwestward of the southern shore. Several narrow streams empty into the head of the bay.

Shark River discharges into Ponce de Leon Bay at its head, through two mouths, close together and about east-northeast from the south side of the entrance. These mouths are not easily distinguished from the other passages through this mangrove-fringed shore. The two branches of Shark River meet at a point about 2 miles inland, where there is an old wharf and abandoned mill. They are navigable for a draft of 6 feet (1.8 m.) to this point. Many yachts and small craft come to Shark River during the winter season for the fishing and hunting, and usually take a guide at Fort Myers or at Marco. The river, because of its intersection by many creeks and bayous, is difficult for a stranger.

Directions, Ponce de Leon Bay.—The shore from Northwest Cape to Ponce de Leon Bay can be followed at a distance of 1 mile until the south side of the entrance bears northeast. Then follow this shore at a distance of three-eighths to one-half mile, and when the coast south of the little river (1 mile south of the bay) is shut out, anchor in 7 to 10 feet (2.1 to 3 m.). Approaching from northward, keep at least 3 miles off shore until a northeast course will clear the south shore of the bay from three-eighths to one-half mile, and then stand in on this course until the coast south of the little river is just shut out. Here there will be shelter from winds east of north or south, and the shoal northwest of the position will afford considerable protection from that direction. Boats drawing over 4 feet (1.2 m.) should not proceed farther into the bay until an examination has been made. On account of the absence of any distinguishing marks, no directions that would be of use to a stranger can be given.

Seminole Point (locally known as **Plover Point**) and **Pavilion Key**, 24 and 30 miles, respectively, northward of Northwest Cape, are fairly prominent when coming up the coast at a distance of 2 or 3 miles from it. Seminole Point is the southwest end of the southern one of two small keys lying 1½ miles from the mainland, and is the most westerly land seen until Pavilion Key is picked up. After

leaving Seminole Point two long, low islands will be seen standing off the coast, the distance between them apparently four or five times the distance from the inner island to the mainland. On nearer approach, when the outer island, which is Pavilion Key, bears about north-northwest, a small key will be seen between the other two, and the gap between the inner island and the mainland will have closed.

Jewel Key, 6 miles northward of Pavilion Key, and 1 mile east-southeastward of **Pelican Key,** marks the entrance of the main channel to Chokoloskee. Jewel Key is a small flat island with a clump of mangroves on the northern end.

Chokoloskee is a post office and small settlement about 3 miles east-northeast of Jewel Key. Gasoline, oil, water, ice, and some general supplies can be bought here. **Jewel Key Pass** (or **Chokoloskee Pass)** is the main channel to the town and is good for a draft of 5 feet (1.5 m.) at low tide. However, the channel is only marked at the upper end, and is narrow and crooked and is obstructed by numerous oyster bars so that strangers will find difficulty in carrying this depth of water.

Indian Key Light No. 1 is a flashing white light on a white, triangular, pyramidal structure and pointer on piles, 20 feet (6.1 m.) high, and located in 9 feet (2.7 m.) of water, off the southern end of **Indian Key.**

Indian Key Anchorage, 30 miles northwestward of Shark Point and 10 miles below Big Marco River, is well protected from all winds and is good for drafts under 7 feet (2.1 m.) The anchorage is easily entered during daylight or dark and presents no difficulties after Indian Key and Indian Key Light have been made out. **Indian Key** is about 1,000 yards long and 200 yards wide and lies with its major axis in a north-northeast and south-southwest direction; it is wooded and resembles, except for its shape, all neighboring keys. The anchorage is northeast of the key and is more easily reached by the passage east of the key as on this side depths of 7 to 13 feet (2.1 to 4 m.) extend close to the key. A red nun buoy (No. 2) lies 3½ miles 206° true (SSW. ⅛ W. mag.) from Indian Key and 9½ miles 61° true (NE. by E. ¼ E. mag.) from Cape Romano Shoals whistle buoy, and serves as a guide to the anchorage.

Everglade is a small town, and county seat of Collier County, about 6 miles northeastward of Indian Key. There is a post office, sawmill, various stores, and an ice and power plant here. There is a small slipways located here that can haul out vessels up to 6 feet draft and 60 feet long. Some machine repairs can also be made. Fresh water, gasoline, distillate, ice, and general stores can be obtained. There is telephone communication with Fort Myers, where connection can be made with telegraph. A road has been built to Fort Myers and one is under construction to Miami **(Tamiami Trail).** There is regular semiweekly steamship communication with Fort Myers and Tampa. The best channel leading to Everglade is **Indian Key Pass,** or Ship Channel. Five feet (1.5 m.) of water can be carried through this pass at low tide and 6½ feet (2.0 m.) at high tide. A vessel drawing 6½ feet makes regular trips to this port, but enters at high tide.

Directions for Indian Key Anchorage and Pass (Ship Channel).—From the red buoy off Indian Key, steer 30° true

(NNE. ½ E. mag.), leaving Indian Key Light 100 yards on the port hand. Good anchorage can be found about 400 yards northeast of Indian Key in 8 to 10 feet (2.4 to 3.0 m.) of water, or about 1 mile northeast of the Key south of beacon No. 3, in 14 feet (4.3 m.), gravel bottom. The channel beyond beacon No. 3 extends in an east-northeast direction to beacon No. 7, and thence east-by-south for about 1 mile. From here the channel turns northeast and is very crooked, but is well marked by stakes with pointers. There is a straight dredged channel across **Chokoloskee Bay** into **Allen River** (locally known as **Barron River**) with a depth of 5 feet (1.5 m.) at low tide. The town of **Everglade** is about 1 mile from the entrance to Allen River.

Sandfly Pass, with entrance north of Pelican Key, and **West Pass,** with entrance north of **Tiger Key,** are used by local boats with shallow draft. They are not marked.

Cape Romano is the southern point of a large island which lies 75 miles northward from Northwest Passage Lighthouse. Here the coast changes its trend from northwest by west to north-northwest. Northward of Cape Romano the deep water approaches the coast much more closely than it does southward of the cape.

Cape Romano Shoals, extending 10 miles in a general southerly direction from the cape, consist of a number of irregular patches with 2 to 11 feet (0.6 to 3.4 m.) over them. These shoals are marked by a whistling buoy moored in about 4 fathoms off their southern end. There is a strong tidal current around the shoals, particularly during spring tides, and on the seaward side of the shoals. The flood current sets southward and the ebb northward.

Cape Romano Anchorage is eastward of Cape Romano Shoals and affords fair anchorage in 12 feet (3.7 m.); vessels of less draft can stand well up and anchor in 7 to 8 feet (2.1 to 2.4 m.), southeastward of the cape.

Coon Key marks the southern Caximba approach to Big Marco River and also to the route through Caximba Pass. A flashing white light mounted on a white, square, pyramidal, slatted structure is located off the southern end of the shoal making southeast from Coon Key. Approaching from southeastward, Coon Key can be seen from the deck of a launch at a distance of 7 miles. At that distance it shows clear of all adjacent keys, and Cape Romano can be seen only in a few detached spots near its western end. As the key is approached the land back of it becomes visible on each side, but Coon Key always stands well above all land in that vicinity. When near to the key it can be recognized by the light and the large quantity of high, dead timber, it appearing to carry higher and a greater percentage of dead trees than any of the neighboring keys. At low tide an extensive reef can be seen west of the key and a short stretch of yellow-sand beach east of the key. When nearly up to Coon Key a narrow gap can be seen east of it between the back keys; this is the entrance to Big Marco River.

Caximba Pass, about 5½ miles northwestward of Cape Romano, extends in a general east and west direction for about 4 miles and affords a passage for small craft inside of Cape Romano. The western entrance, marked by a buoy, is obstructed by a shifting bar, over which the channel depth is about 5 feet (1.5 m.). Persons acquainted

with Caximba Pass can be found at Key West, Punta Rasa, and the intervening settlements.

Directions for Caximba Pass.—Approach Coon Key Light from the southeast and pass about 300 feet southwest of it. When this light is abeam, change course to 287° true (WNW. 5/8 W. mag.) for three-fourths mile to beacon No. 2, which leave about 100 feet to starboard; continue this course for about one-eighth mile (to clear 4-foot mud bank on starboard hand), then change course to 303° true (NW. by W. 1/4 W. mag.) for red beacon No. 4, which leave close to on starboard hand. (From Coon Key Light to red beacon No. 4 there are shallow oyster bars on the port hand and a mud spit with about 4 feet (1.2 m.) at mean low water on the starboard hand between beacons Nos. 2 and 4.) From beacon No. 4 steer 329° true (NNW. 7/8 W. mag.) three-fourths mile to beacon No. 1, near point of key on the port hand, and after rounding this point steer 268° true (W. 3/8 S. mag.), keeping about midway between the keys on the starboard and beacons Nos. 3 and 5 on the port until up to beacons Nos. 6 and 7. Pass between the beacons Nos. 6 and 7 (there is a shallow bar, with about 4 feet (1.2 m.) at mean low water here), then haul up sharply to port, passing beacons Nos. 7 to 19 close-to on port hand and Horrs Island and beacons Nos. 8 and 10 on the starboard, in an inverted S-shaped curve. From beacon No. 10 head for wharves at Caxambas, avoiding the oyster bars on the port hand.

After leaving Caxambas steer about west, keeping midway between the oyster bars and the keys, and leave beacon No. 6 on the port about 100 yards. Between beacon No. 6 and the next beacon, No. 4, there is a sand spit that makes out toward the channel from the south side. When nearly opposite beacon No. 4, haul around to port, passing between beacon No. 4 on the port and the point of key on the starboard, and then haul sharply to starboard; keep in mid-channel, about 50 feet from the sand beach of the Key, passing midway between the beach on the starboard and beacon No. 6 and Caximba Pass Light on the port.

When past the light, head up for the mid-channel buoy and then for the red buoy, No. 4 (which leave on port hand), keeping a sharp lookout for breakers and shoal waters. The channel on the outside is shifting constantly.

Caxambas (meaning "place of wells") is a small town on the north shore of **Caximba Bay.** It has a store, where small quantities of supplies may be obtained, telephone and auto line connection with Fort Myers by way of Marco, a post office, and clam cannery. Fresh water, gasoline, and oil may also be obtained. An auxiliary schooner carrying general freight makes weekly trips to Marco and Key West. A launch carrying gasoline and freight makes weekly trips to Punta Gorda and Everglade. Telegraph messages can be telephoned to Fort Myers.

Big Marco Pass and River afford at high water a safe passage inside of Cape Romano for small vessels of about 5 feet (1.5 m.) draft and are considerably used by yachts and small craft with local knowledge. Big Marco Pass, 8 miles northward of Cape Romano and 33 miles southward of San Carlos Bay, is marked by a light.

The channel across the bar is marked by buoys which are shifted as often as practicable to conform to changes in the channel. Shoals extend 1 to 1½ miles seaward on each side of the channel and are usually indicated by breakers or by discolored water.

Big Marco River trends eastward and then southward from Big Marco Pass to the Gulf at **Gullivan Bay**, 4 miles northeastward of Cape Romano. The river is about 8 miles long and affords a through passage for a draft of 4 feet (1.2 m.) at mean low water. The channel is very narrow and crooked but is well marked by beacons. The southern approach is across a shoal having a least depth of 4 feet (1.2 m.) at mean low tide and is marked by a light on a white beacon off the southeast end of Coon Key. It is protected from all directions except between southeast and southwest, and a wide expanse of gradually shoaling depths greatly reduces any possible sea from these directions. At high tide a draft of 6 feet (1.8 m.) can be taken through the river, but good local knowledge is necessary.

Marco is a post office and small settlement on the south bank of Big Marco River 1 mile in from the light. It is a distributing point for this vicinity and has a small hotel and a general store where gasoline, water, and some supplies, including ship chandlery, can be obtained. There is a clam cannery and tourists' camp here. A road and telephone line leads to Fort Myers and Caxambas. There is no bridge across the river, and passengers and vehicles are ferried across. Telegraph messages can be telephoned to Marco. There is a small machine shop and a marine railway of about 50 tons capacity; vessels 70 feet long drawing 6 feet can be hauled out. The wharf and marine railway are on the east bank of **Collier Creek** and can be reached with a draft of 6 feet (1.8 m.). **Pilots** can be found at Marco.

Directions Big Marco River and Pass.—From a position 1 mile southeastward of Coon Key Light steer 324° true (NW. ⅝ N. mag.), heading for the northern end of Coon Key and leaving Coon Key Light 400 yards on the port hand. Proceed slowly across the bar here, sounding continuously until past the south end of the key and in deeper water.

Pass nearly 500 yards east of the south end of the key, and then gradually reduce the distance to 100 yards when the middle length of the key has been passed. From the north end of Coon Key swing to the east bank of the channel and follow it until 25 yards west of beacon No. 2, then head northwestward to the west bank, keeping about 100 yards off the bank to beacon No. 1. Leave beacon No. 1 100 yards to port and beacon No. 4, 100 yards to starboard. Pass midway between beacon No. 6 and the point, continuing around the point at a distance of 20 yards, leaving beacon No. 8, 25 yards to starboard; then head for the point west of beacon No. 10. Pass midway between beacon No. 10 and the point to westward, and then head northeastward for the north end of the small island east of beacon No. 10 (proceed carefully here for there is a shoal to port), passing about 15 yards off the northwest end; then head straight up the middle of the channel, 354° true (N. ¾ W. mag.).

Continue in the middle of the channel leaving beacon No. 12 to starboard and beacon No. 5 to port, until past beacon No. 5, then favor the west bank to and around the turn in the channel. Then gradually work to the north side of the channel leaving beacon No.

16 to starboard. Just before arriving at beacon No. 16, watch for beacon No. 18 around the point to southward, and as soon as it appears head for it, keeping it in range with the point, leaving a bare shoal close-to on the port hand. (There is a shoal bar here and boats should proceed carefully.) When about 40 yards off the point alter course and leave it 20 yards to port. Continue close to this shore until beacon No. 18 is on range with beacon No. 20, then head midway between beacon No. 18 and the south bank, keeping about 25 yards off the bank. Pass 50 yards south of beacon No. 20, 25 yards south of beacon No. 22, and 75 yards north of beacon No. 7. Continue on course until about 100 yards from the north bank then head for beacon No. 9 leaving it 25 yards on the port hand. Leave beacon No. 24, 15 yards on the starboard and head north-northwest into deep water, then alter course to westward passing 200 yards off the south bank heading for Marco cannery smokestack, carrying deep water to the wharves.

When leaving Marco, leave beacon No. 6, at the entrance to Collier Creek, on the port hand and leave beacon No. 4 50 yards to port. Follow the southern bank closely when past beacon No. 4, leaving the light (flashing white) and beacon No. 1 well to starboard. Pass 25 yards north of beacon No. 2, head for the channel buoy and continue from the channel buoy to the black-and-white entrance buoy. There is only about 3 feet (0.9 m.) of water across the bar here at low tide and the channel frequently changes. The buoys are shifted when necessary to indicate the best water.

Naples is a small town 10 miles north of Big Marco Pass. A dock 1,000 feet long, with 16 feet (4.9 m.) of water at the end extends into the open Gulf off the town. There is a hotel, some general stores, and an ice and a power plant here. Gasoline, distillate, fresh water, ice, and general supplies can be obtained. There is a road to Marco and Fort Myers, with passenger busses making two trips each way daily. A telephone line extends to Marco and Fort Myers. Telegraph messages can be telephoned to Fort Myers. Minor machine repairs can be obtained at the Naples Power Co.

Gordon Pass is the northern entrance to the dredged channel leading from Marco to Naples. It is good for a draft of 4½ feet (1.4 m.) at high tide, and this draft can also be carried at high tide to **Naples Back Bay,** which is a good anchorage for small boats behind the town of Naples.

Big Hickory and **Big Carlos Passes,** 9 and 6 miles, respectively, southward of San Carlos Bay, are used to some extent by small local boats, but are shallow and subject to frequent changes. They are not marked and should not be attempted by a stranger.

Matanzas Pass, also known locally as **Estero Pass,** opens into the eastern end of San Carlos Bay, 3 miles east of Sanibel Island Lighthouse. Small vessels can find secure anchorage just inside the pass. The channel, although narrow, is not difficult, and it is said to change very little. It is marked on the north side of the entrance by a flashing white light. A draft of 9 feet (2.7 m.) can be taken to a safe anchorage inside the entrance; 5 feet (1.5 m.) can be taken to the settlement of **Carlos,** 2¾ miles from the mouth; and 4 feet (1.2 m.) through **Estero Bay** and out Big Carlos Pass, but strangers are advised not to go beyond Carlos. From inside the entrance to

Carlos the channel is narrow, but the deepest water is shown by the line of soundings on the chart.

Sanibel Island Lighthouse is a brown skeleton tower inclosing a stair cylinder, on **Point Ybel,** at the westerly side of the entrance to San Carlos Bay. The light is a group flashing white (2 flashes every 10 seconds), 98 feet (29.9 m.) above the water, and visible 16 miles.

SAN CARLOS BAY (CHART 473)

is 110 miles 356° true (N. 5/8 W. mag.) from Northwest Passage Lighthouse and about 20 miles southward of Charlotte Harbor. It is connected with the latter by two shallow bodies of water known as Pine Island Sound and Matlacha Pass. It is largely filled with shoals, on which the depths vary between 1 and 6 feet (0.3 and 1.8 m.), and is of commercial importance chiefly as the approach to Caloosahatchee River. San Carlos Bay and adjacent waters are the resort of tourists and fishermen during the winter months, and are frequented principally by small local vessels and yachts.

The eastern part of the bay can be entered from the Gulf by a dredged channel, 200 feet wide and 12 feet (3.7 m.) deep, which leads to Punta Rasa and the mouth of the Caloosahatchee River. The channel is subject to gradual shoaling, and is redredged from time to time. Several beacons and Punta Rasa range lights mark its axis. The range beacons are white, square, pyramidal, structures on piles. The front range light is fixed red, and the rear light fixed white.

A swash channel, with depths of 4 to 7 feet (1.2 to 2.1 m.), leads close around the south side of the eastern point of Sanibel Island, but it is unmarked and continually shifting.

There is a narrow channel, marked by beacons, with a least depth of 11 feet (3.4 m.), leading along the northeast side of Sanibel Island to the wharf at St. James City.

Punta Rasa is a post office and settlement of a few houses on the point 2 miles northward of Sanibel Island Lighthouse. There is a telephone and a telegraph station here, and roads lead to Fort Myers and to points southward. Gasoline, oil, ice, and some general supplies can be obtained. The fresh water is poor and can not be used for boiler purposes. A draft of 12 feet (3.7 m.) can be taken to the wharf. **Pilots** (not licensed) can be found here. There is daily boat service with Fort Myers and the settlements in Pine Island Sound.

Matthews Wharf, on the northeast side of Sanibel Island, about 1½ miles west of the light, is a small settlement and winter resort. It is the outlet for the fruit and gardens produce grown in this vicinity. There is a hotel, post office, and general store here. Gasoline, oil, supplies, and water in small quantities can be obtained. A telephone line connects with Punta Rasa and Fort Myers. There is daily boat service with Fort Myers and the settlements in Pine Island Sound.

Sanibel is located on the northeast side of Sanibel Island, 2 miles westward of the light. There is a hotel, post office, and daily boat service here, but no supplies can be had. A draft is 6 feet (1.8 m.) can be carried to the wharf.

St. James City is a post office and small fishing town on the southern end of Pine Island. Gasoline, oil, ice, and general supplies

can be obtained. The fresh water is poor. A draft of 11 feet (3.6 m.) can be carried here through the channel, but there is a depth of only about 9 feet (2.7 m.) at the face of the dock. A road leads to the northern end of the island and connects with the county road under construction across Little Pine Island and Matlacha Pass to Fort Myers. There is daily boat service to Fort Myers and the settlements in Pine Island Sound.

Anchorage.—Good anchorage for vessels of too great a draft to enter the bay can be found in 15 to 25 feet (4.6 to 7.6 m.), sticky bottom, from 3 to 4 miles southeastward of Sanibel Island Lighthouse and near buoy No. 1. With northerly winds there is good anchorage under the southern end of Sanibel Island in 16 to 24 feet (4.9 to 7.3 m.), with the lighthouse bearing anywhere between northeast and north by west. The anchorage off Punta Rasa is good, but the tidal currents at times have considerable velocity. There is a good anchorage along the shore of Sanibel Island inside the lighthouse. The currents have considerable velocity, but bottom with spots of good holding ground can be found. Off St. James City there is an excellent anchorage in 12 to 18 feet (3.7 to 5.5 m.) with good holding ground. At this point the tidal currents have less velocity than at any of the other anchorages in San Carlos Bay.

Pilotage is not compulsory and there are no licensed pilots. Some competent person generally can be found at Punta Rasa to pilot vessels into the bay or up the Caloosahatchee River.

Currents.—Slack water before the flood occurs 1 hour 40 minutes before the time of high water at Key West, and slack water before the ebb occurs 1 hour 40 minutes before the time of low water at Key West. The mean velocity of the current at strength is 0.7 knot.

Storm warnings are displayed at Punta Rasa and Fort Myers.

Directions, San Carlos Bay.—To enter San Carlos Bay from southward keep at least 1½ miles off the coast southward of Sanibel Island Lighthouse until up to the bell buoy or until on the Punta Rasa range. Then steer 317° true (NW. mag.), keeping Punta Rasa range lights in line ahead, which leads along the axis of the dredged cut. The cut is also marked by beacons. The bank on the northeast side of the channel is very shallow and bares between beacons Nos. 8 and 10. There is a small shed on its northern end east of beacon No. 10.

To go to Caloosahatchee River.—Hold Punta Rasa range until abeam of beacon No. 12, then steer 7° true (N. ½ E. mag.) passing close to the wharves at Punta Rasa.

To go to Pine Island Sound.—Leave Punta Rasa range at red beacon No. 6 and steer about 262° true (W. ⅞ S. mag.) to clear the north shore of **Point Ybel** (east end of Sanibel Island, on which is the lighthouse of that name) about 200 yards. Then see directions for Pine Island Sound on page 54.

CALOOSAHATCHEE RIVER (CHART 473)

rises in Lake Okeechobee and flows 73 miles in a westerly direction, emptying into San Carlos Bay near Punta Rasa. For a distance of 17 miles from the mouth the river has an average width of about 1 mile, but above that point it is a narrow, crooked stream, only 50 to 100 feet wide in many places during the dry season.

From the mouth a dredged channel 100 feet wide and 10 feet (3.0 m.) deep extends to a turning basin at Fort Myers, a distance of 14 miles. The channel is subject to change and is redredged from time to time. In 1925 it had a least depth of 12 feet (3.6 m.) over the bar and 10 feet (3 m.) to Fort Myers. For 6 miles above Fort Myers the depth at low water is 5 feet (1.5 m.), but above that point the depth varies greatly with the seasons. At the close of the dry season, usually in March, but sometimes as late as May, the river has a depth of but 2½ feet (0.8 m.) at several places in its upper reaches.

The Caloosahatchee River is tidal as far as Labelle. The tide which has a mean range of about 1.7 feet at its mouth gradually diminishes as it ascends the river. Freshets, lasting usually about 2 weeks, occur during the summer and early fall months and raise the river from 4 to 17 feet (1.2 to 5.2 m.), depending upon the locality. Strong currents are prevalent in the upper reaches, especially during high river stages. Below Fort Myers there are strong ebb currents in the cuts at **Shell** and **Mangrove Points,** 2 and 2½ miles, respectively, above Punta Rasa.

Fort Myers, on the south bank of Caloosahatchee River 14 miles above its mouth, is the commercial center for the country east and south of Charlotte Harbor, as far east as Lake Okeechobee and south to Cape Sable. It is the terminus of a railroad, and is connected with Tampa, Everglade, and Key West by steamship giving weekly service. Steamboats and launches ply daily between Fort Myers and the villages and landings on Caloosahatchee River, Pine Island Sound, and the inland waters south of the river. When navigation is possible in the upper reaches of Caloosahatchee River and across Lake Okeechobee there is communication with Fort Lauderdale, on the Atlantic coast. Drafts of from 5 to 8 feet (1.5 to 2.4 m.) can be taken to the various wharves at Fort Myers.

Fresh water, provisions, gasoline, and some ship chandlery can be obtained. Bituminous coal in small quantities can be obtained by arrangements with the railroad, but no large supply is kept on hand. The facilities for making repairs to gas engines and to the machinery and hulls of small vessels are fair. Vessels of about 90 tons, of a length of 80 feet and draft of 5 feet, can be hauled out. There is a small shipyard on Orange River, about 6 miles above Fort Myers, to which a draft of 5 feet (1.5 m.) (6 feet (1.8 m.) at extreme high tide) can be taken. Repairs to machinery can be made there, and the marine railway is of sufficient capacity to haul out any vessel not over 110 feet in length that can reach the yard.

Orange River empties into the Caloosahatchee River from southeastward at a point about 6 miles above Fort Myers. It is navigable for a draft of 4 feet (1.2 m.) for 5 miles to a closed bridge at Buckingham.

Alva, Fort Denaud, Labelle, and **Fort Thompson,** 19, 27, 32, and 37 miles, respectively, above Fort Myers, are the most important of several villages and boat landings along the river. Six drawbridges cross the stream, the first at a point 1 mile above Fort Myers, the second 4 miles above Fort Myers, and the others at Olga, Alva, Fort Denaud, and Labelle. All have draw openings 50 feet or more in width.

Directions, Caloosahatchee River to Fort Myers.—After leaving Punta Rasa Range, steer 7° true (N. ½ E. mag.) for 1 mile, until the shed eastward of **Kitchel Key** is on range with the northeastern tangent of the Key. Then steer 328° true (NW. by N. mag.), leaving the shed 150 yards to westward. When this shed is on range with the eastern tangent of Kitchel Key (it will then be about broad on the port quarter) steer 343° true (N. by W. ¾ W.) heading a little to westward of beacon No. 5, at the entrance of the first river cut, Cut D.

Leave beacon No. 5, 50 feet on the port hand and steer 24° true (N. by E. ⅞ E. mag.) on Cut D range, the front is a white light over a square, white, day mark, and the rear a red light over a circular, white, day mark. When nearly up to the front light, No. 7, steer 45° true (NE. ⅛ N. mag.) on Cut E range; the front is No. 11, a square, white, day mark, and the rear is a circular, white, day mark. When beacon No. 9 (white light over a square, white, day mark) closes on the rear beacon of Cut D range, steer 67° true (NE. by E. ¾ E. mag.) into Cut F, with these lights on range astern. Hold this range past beacon No. 13, which is 300 yards northward of Shell Point, and then steer to leave beacons Nos. 15 and 17 on the port hand and to enter Cut G on a 81° true (E. by N. mag.) course, with the beacons of this range on line ahead. The front beacon of the range shows a red light over a diamond-shaped, white, day mark and the rear a white light over a triangular, pyramidal, white, day mark. These beacons are sometimes difficult to pick up, especially during rainy or misty weather, and unless exactly on range after leaving beacon No. 17, about 1 mile east of Shell Point, there is danger of striking submerged rocks on either side of the cut. Some of the rock excavated from this cut (it was dumped on each side) is visible at certain stages of the tide, but as there is also a spoil bank of earth about 100 feet north of the cut, strangers, having missed the range, are liable to get between this earth bank and the northern rock pile.

Leave Cut G range, passing 100 feet westward of the red beacon No. 18, which is just west of the front range light, and steer to bring this light in line with a white light over a triangular, pyramidal, white, day mark southwest of it, Cut H. I. J. Steer 51° true (NE. ⅜ E. mag.) on this range, the beacons in line astern, and leave beacons Nos. 19 and 19A, both white, square, day marks, 50 feet on the port hand. Care should be taken not to get off the range here, as there is a 5 feet (1.5 m.) shoal close-to on the starboard hand between beacons Nos. 19 and 19A.

Then gradually change course to 22° true (N. by E. ¾ E. mag.) to leave beacon No. 21, square, white, day mark, 50 to 75 feet on the port hand. Then steer 14° true (N. by E. mag.) to beacon No. 23, leave it 50 yards on the port hand, and steer 42° true (NE. ½ N. mag.) to pass 25 yards southeast of beacon No. 25. There is a 5-foot (1.5 m.) shoal on the north side of the channel between beacons Nos. 23 and 25, extending about 15 yards into the channel. Vessels should not get too close to the north side of the channel here.

When past beacon No. 25, alter the course about 4° northward, heading for beacon No. 27, and when up to it steer 42° true (NE. ½ N. mag.) on Cut P range, the lights for which are No. 28, a red

light on red lantern box with white pointer, and a rear white light with a triangular, pyramidal, white, day mark. Leave light No. 28 on the starboard hand, beacon No. 29 (white) 100 yards on the port hand, and No. 30 (red) close-to on the starboard hand. When past No. 29 steer 13° true (N. by E. mag.) on Cut Q range, the beacons for which are light No. 33, a fixed white light on a square, white, day mark, and a rear beacon with a circular, white, day mark. Leave all beacons hereafter on the port hand and steer as follows: 27° true (NNE. ¼ E. mag.) on Cut R range, then 44° true (NE. ¼ N. mag.) on Cut S range, and finally 57° true (NE. ⅞ E. mag.) to the turning basin at Fort Myers. Pass close to the ends of the wharves, as there is a shoal on the north side of the channel here. The beacons for the last two ranges are similar to those for Cut Q, except that none of them are lighted. There is no range for the last course. The **turning basin** is 10 feet (3.0 m.) deep and is between beacons Nos. 39, 41, 43, and the wharves. Outside of this dredged area the depth is 7 feet (2.1 m.) or less.

INLAND ROUTE ACROSS SOUTH FLORIDA

The opening of the State drainage canals from Lake Okeechobee to the Atlantic coast has created a waterway, navigable for shallow-draft vessels, between the Atlantic Ocean at Fort Lauderdale, West Palm Beach, and St. Lucie River, and the Gulf at San Carlos Bay. When the stage of the water permits, one steamboat and several gasoline launches, carrying passengers and freight, operate over this route between Fort Myers and Fort Lauderdale and West Palm Beach. The Caloosahatchee River is connected by canal with **Lake Hicpochee,** which is connected with the southwest corner of Lake Okeechobee by a similar canal. Lake Okeechobee is connected with the Atlantic Ocean at St. Lucie River by the **St. Lucie Canal,** at West Palm Beach by the **West Palm Beach Canal,** and at Fort Lauderdale by the **North New River Canal.** The controlling depth for this route is from 2 to 4 feet (0.6 to 1.2 m.), depending on the water level in the lake.

MATLACHA PASS AND PINE ISLAND SOUND

Matlacha Pass is a shallow body of water, extending northward from San Carlos Bay to Charlotte Harbor, between **Pine Island** and the mainland. It is navigable for a draft of 4 feet (1.2 m.), but the channel is narrow, crooked, and not marked. It is used only by small craft with local knowledge, and strangers should not attempt it.

Pine Island Sound, west of Pine Island, is the main thoroughfare between San Carlos Bay and Charlotte Harbor, a distance of about 15 miles. It is full of shoals and low islands, through which there is a crooked but well-marked channel, good for a draft of about 7 feet (2.1 m.) at high tide. With the aid of the chart, a stranger should have no great difficulty in getting through with a draft of 5 feet (1.5 m.), but for a greater draft he should take a pilot.

Wulfert is a store and post office on the northern end of Sanibel Island. There is a small wharf here with 5 feet (1.5 m.) of water

at the end. The inside channel behind **Buck Key** passes by this wharf and the steamer making daily trips to and from Fort Myers stops here. Gasoline and some provisions can be obtained.

Blind Pass separates Sanibel Island from **Captiva Island.** It is not marked and is only good for a draft of about 2 feet (0.6 m.) at low tide. A bridge crosses this pass, having a 16-foot span and 14-foot clearance.

Captiva is located on Captiva Island, 5½ miles south of Captiva Pass. It is a fishing town and winter resort, and has a hotel, store, post office, and large outdoor school. Gasoline, oil, ice, and some general supplies can be obtained. Fresh water can be had in very limited quantities. A daily steamer from Fort Myers stops here, and a boat from Punta Gorda calls three times a week. There are two wharves here, each with 6 feet (1.8 m.) of water at the end.

Captiva Pass, leading from the Gulf into Pine Island Sound at a point 6 miles southward of Bocagrande, is good for a draft of 6 feet (1.8 m.), and is used to some extent by yachts and small fishing boats. The channel lies between shoals extending nearly 1 mile into the Gulf and is quite narrow at the bar. According to the latest available information, it trended northeast by north to the point on the north side of the entrance, and was quite easily followed. It is unmarked. There is a fair anchorage for small boats in a basin about 200 feet across and from 7 to 8 feet (2.1 to 2.4 m.) deep, south of a small point in Pine Island Sound, one-half mile south of Captiva Pass. The holding ground is said to be good and the anchorage is well protected from all directions except east to southeast. This anchorage is reached from Captiva Pass by following the shore southeastward at a distance varying from 150 feet at the pass to 50 feet at the point one-half mile southeast of the pass, passing inside of the shoals, nearly bare at low tide, and between the point and some stakes. At the point the channel bends sharply westward to the anchorage, which is close to the point and between it and a shoal that uncovers at low tide.

Redfish Pass, about 3½ miles south of Captiva Pass, is a new cut through Captiva Island. It has rapidly increased in width and in 1925 was about one-fourth mile wide. There is a depth of about 5 feet (1.5 m.) of water through here, but the channel is not marked and is winding and difficult.

Useppa Island is a winter resort and is of no importance except during the winter months. There is a large hotel here (open only during the winter), several houses, and a golf course. There is a landing on the northwest side of the island and a yacht anchorage off the landing. There is also a landing on the eastern side of the island. A prominent tank is located in the center of the island.

Horn Passage is a good 5-foot (1.5 m.) channel westward of **Buck Key.** The southern approach is through **Wulfert Channel,** good for 5 feet (1.5 m.) draft, and the northern approach is through Captiva Channel, also good for 5 feet (1.5 m.) The passage and channels are all well marked by beacons and stakes, and are easy to follow during daylight. This route leads past the towns of Wulfert and Captiva and is well protected in all weather.

Punta Blanca, on the eastern point of **Lacosta Island,** 2½ miles south of Bocagrande, is a small settlement with a store and boat-

building shop. There is a small dock here with 9 feet (2.7 m.) of water at the end. Gasoline, fresh water, provisions, and some yacht supplies can be obtained. There is a slipway here capable of hauling out boats up to 8 feet (2.4 m.) draft. Machine repairs can also be made and yachts can be stored.

Pelican Bay anchorage is in Pelican Bay northwest of Punta Blanca. It affords a well-protected anchorage in 6 to 7 feet (1.8 to 2.1 m.) of water. The entrance is about one-half mile south of the quarantine station and is said to be good for 5 feet (1.5 m.) at low tide. Boats of shallow draft can enter the anchorage from the southward by passing about one-fourth mile southward of Punta Blanca.

Supplies and repairs.—Provisions and some boat supplies can be obtained at most any of the settlements described above. The fresh water in this vicinity is poor for boiler purposes, being artesian and full of impurities. The water at Punta Blanca is claimed to be good, although it too is artesian. Ice can be obtained at the settlements and at the fish houses located in the open sound. Punta Blanca is the only place in the sound where repairs can be had. Fort Myers, South Bocagrande, and Punta Gorda are the only other places where repairs can be had in the vicinity.

SAILING DIRECTIONS FOR PINE ISLAND SOUND

Entering the channel north of Point Ybel in San Carlos Bay, about 300 yards offshore, steer 268° true (W. ½ S. mag.) heading for Matthews Wharf. Leave beacon No. 2 about 100 yards on the starboard hand and if going to Matthews Wharf continue on course to the wharf.

To continue into Pine Island Sound, leave the next beacon, No. 1, close-to on the port hand, and the next beacon No. 4, close-to on the starboard. From beacon No. 4 a straight course can be laid to Sanibel Wharf.

When past beacon No. 4, steer 325° true (NW. ⅝ N. mag.) for beacon No. 3, leave it close-to on the port hand, and steer 290° true (WNW. ½ W. mag.) heading a little to northward of beacon No. 5. If going to St. James City, head straight for the wharf from beacon No. 5.

Leave beacon No. 5 about 50 yards to port and hold course for about 300 yards past the beacon, then steer 247° true (SW. by W. ¾ W. mag.), heading for beacon No. 2. Leave beacon No. 2 and light No. 4 (fixed red) close-to on starboard hand, and change course to leave beacon No. 4A about 100 yards to starboard. When abeam of 4A, steer about 314° true (NW. ¼ W. mag.), leaving beacon No. 6, 200 yards to starboard and passing about 50 yards eastward of new beacon No. 1, a white pile with pointer. There is a shoal spot between beacons Nos. 4A and 6 and vessels should stand well to westward of these beacons. Old beacon No. 1 (square, white, slated structure) is in shoal water and it is shoal between the old and new beacons. The old beacon should be ignored.

From a position 50 yards north of beacon No. 1 (new), steer 281° true (W. ¾ N. mag.) passing well to southward of light No. 8 (red lantern box and white pointer on five-pile structure, red light),

and heading toward the Wulfert Channel beacons. The channel forks here, one fork leading westward and northward through Wulfert Channel, Horn Passage, and Captiva Channel, and the other leading northward up through the central part of the sound.

To go through Horn Passage, continue on course leaving Wulfert Channel beacons Nos. 1 and 3 close-to on port hand, and keeping the range beacons (front beacon No. 2 and a rear beacon) in line ahead. The channel is very narrow here but the edges of the cut are well marked with stakes. When up to front beacon No. 2, change course southwestward to beacon No. 5 and then northwestward to beacon No. 7, from which the channel leads to the wharf at Wulfert.

After leaving Wulfert the channel leads around the northern end of Sanibel Island into Horn Passage. Leave beacons Nos. 2 and 2A, close-to on the starboard, and beacons Nos. 1 and 3 close-to on the port. From beacon No. 3 the channel leads northward, passing westward of Buck Key and the small keys to southward, and close to the eastern shore of Captiva Island. Leave beacon Nos. 4, 4A, and 6, close-to on the starboard hand, keeping to the west side of the channel. From beacon No. 6 cross to the east side of the channel passing between the bare sand bars on either side and leaving beacon No. 5 to port. Leave beacons Nos. 8 and 10 to starboard and steer along the west side of the wharves at Captiva.

After leaving Captiva, head for the Captiva Channel front range beacon and leave it close-to on the port hand. Steer 42° true (NE. ½ N. mag.) keeping the range beacons in line astern. Leave beacons Nos. 6, 4, and 2, close-to on the port hand. Continue past beacon No. 2 for 300 yards and then steer 351° true (N. by W. mag.) for 3 miles to beacon No. 16.

To go northward through the main channel.—From a position 100 yards westward of light No. 8, steer 349° true (N. by W. ¼ W. mag.) for 1.6 miles to beacon No. 10. Leave beacon No. 10 close-to on the starboard and head for beacon No. 12. There is a shoal spit between beacon No. 10 and light No. 14 (red lantern box and white pointer on five-pile dolphin, red light), so all except very shallow draft boats must head over to beacon No. 12 and pass through the dredged cut between beacon No. 12 and light No. 14. Leave these close-to on the starboard hand and continue on course for 350 yards past light No. 14, then change course northward for one-half mile through the dredged cut. From here a course 326° true (NW. ¾ N. mag.) for 3¼ miles will lead southwestward of beacon No. 16.

Leave beacon No. 16 about 400 yards northeastward on a northwest course and continue for about three-fourths mile until light No. 3 (white lantern box and pointer on five-pile dolphin, white light) is on range with beacon No. 5 (white pointer and square day mark). Then change course to leave light No. 3 close-to on the port hand and head for beacon No. 5. When about one-fourth mile from beacon No. 5, head north-northeast for four-tenths mile and then steer 0° true (N. ¼ W. mag.) leaving beacon No. 7 about 250 yards to port and heading a little eastward of light No. 9 (white lantern box and pointer on five-pile dolphin, white light).

A depth of 6 feet (1.8 m.) can be carried to the wharf on the eastern side of Useppa Island. Two passages lead from here to Char-

lotte Harbor, one along the shore of Lacosta Island to Bocagrande, and the other through a dredged channel north of Pine Island. The former is more convenient if bound for Punta Blanca or out to the Gulf, and the latter if bound up the harbor; both are good for about 7 feet (2.1 m.) at mean low tide.

To leave by the western passage.—When nearly up to the hotel on Useppa Island, bring the south end of **Mondongo Island,** which is north of Useppa and west of **Patricio Island,** to bear 323° true (NW. ½ N. mag.) and steer for it leaving light No. 9 (white, five-pile dolphin) well to starboard until up to a beacon (white day mark) that marks the northeast end of the shoal surrounding Useppa Island. The beacon is little less than halfway from Useppa to Mondongo Island. Leave this beacon close-to on the port hand, and then haul gradually for Punta Blanca, favoring light No. 13 W. (white) on the port hand. When northward of light No. 13 W. steer 333° true (NNW. ⅝ W. mag.) passing 150 yards off the wharf at Punta Blanca (there is 9 feet (2.7 m.) of water at the end of wharf) and about 150 yards eastward of beacon 15 W. From here steer 325° true (NW. ⅝ N. mag.) leaving beacon No. 18 W. about 100 yards to starboard and the quarantine station wharf about 200 yards to port.

To leave by the eastern passage.—When abreast the middle of Useppa Island, haul in slightly toward this island, so as to be one-fourth mile off when up to the north end. Then steer 29° true (NNE. ⅜ E. mag.) to pass light No. 9 (white, five-pile dolphin) to port, beacon No. 18 (red day mark) to starboard and close to beacon No. 11 (white day mark). Leave this beacon to port and steer 24° true (NNE. mag.) to leave beacon No. 20 (red day mark) to starboard. Then be guided through the cut channel by the aids as found.

CHARLOTTE HARBOR (CHART 474)

lies 126 miles 349° true (N. by W. ⅛ W. mag.) from Key West Northwest Channel and 63 miles 152° true (SSE. ¾ E. mag.) from Tampa Bay. It is the approach to the towns of South Bocagrande, Bocagrande, Punta Gorda, Cleveland, and numerous smaller settlements, and to Miakka and Peace Rivers. On the south side it opens into Pine Island Sound and Matlacha Pass, either of which affords an inside route for light-draft vessels to San Carlos Bay. On the north side it opens into Gasparilla Sound.

Charlotte Harbor is entered from the Gulf by **Boca Grande Channel,** which has been improved by dredging a cut 300 feet wide and 24 feet (7.3 m.) deep, and vessels of about 24 feet draft have been taken out.

A channel, originally 200 feet wide and 12 feet (3.7 m.) deep, has been dredged across the shoals in Charlotte Harbor to Punta Gorda, near the mouth of Peace River. The channel is subject to change, and in 1925 a draft of 11 feet (3.4 m.) could be taken to the mouth of the river and 9 feet (2.7 m.) to the anchorage off the wharves at Punta Gorda.

South Bocagrande, on the south end of Gasparilla Island, inside the entrance, is a phosphate shipping port of considerable importance. It has excellent facilities for loading cargoes of phosphate

rock, which is brought by rail from the interior of the State. There is a natural depth of 25 feet (7.6 m.) or more along the face of the south dock (No. 1), a dredged depth of 21 feet (6.4 m.) along the south side of the north dock (No. 2) (which has been abandoned and consists of piles only), and 12 feet (3.7 m.) along its face and north side. There is a small dock between the long docks which affords more protection for small vessels. This dock has 16 feet (4.9 m.) of water at its end. There are fresh-water connections on Dock No. 1, and the water is good for boiler purposes. Gasoline, provisions, and some yacht supplies can be obtained. Coal can be had by arrangement with the railroad company, but no supply is kept on hand.

Bocagrande is a winter resort and fishing station on the railroad 2 miles north of South Bocagrande. A small wharf, extending into Charlotte Harbor 2 miles north of the wharf at South Bocagrande, leads to the town. South of this wharf at Bocagrande is a small landlocked lagoon, in which small craft can find anchorage in depths of 4 to 5 feet (1.2 to 1.5 m.), mud bottom. It is reached by a dredged channel, about 20 feet wide and 6 to 7 feet (1.8 to 2.1 m.) deep, running east and west, about 200 yards south of the wharf. The outer end is marked by a beacon on the south side of the channel. Gasoline, provisions, and some supplies can be bought here, and there is telephone and telegraph communication.

Matlacha Pass and Pine Island Sound are described under a separate heading preceding.

Gasparilla Sound extends northward from Charlotte Harbor for about 7½ miles, between **Gasparilla** and **Little Gasparilla Islands** and the mainland; it is navigable for vessels of 4 to 5 feet (1.2 to 1.5 m.) draft having local knowledge, but there is no through channel to Lemon Bay. A railroad trestle with two draw openings, each 45 feet wide, crosses the sound north of Gasparilla Island.

Gasparilla Pass, through which passage may be made to or from the Gulf, usually has a depth of 6 feet (1.8 m.), but it is unmarked. Both the depth and position of the channel are subject to frequent change. Gasparilla Sound and Pass are frequented only by fishermen and small coasters who have local knowledge.

Miakka River empties into the northern end of Charlotte Harbor from northward. A depth of 9 feet (2.7 m.) can be taken into the mouth. There are no towns along the river, and it is used only occasionally by small vessels of 4 to 5 feet (1.2 to 1.5 m.) draft, carrying freight to settlers scattered along its banks. A railroad bridge crosses the river about 3 miles above its mouth.

Peace River empties into the northeastern corner of Charlotte Harbor from northeastward. It is navigable for vessels of 6 feet (1.8 m.) draft for a distance of 12 miles above its mouth.

Bokeelia is a post office and small settlement on the northern end of Pine Island. There is a wharf, to which a draft of 7 feet (2.1 m.) can be taken. Gasoline, oil, and some supplies can be obtained, but there is no fresh water available. A road connects with the southern end of Pine Island, and there is boat service to Punta Gorda and the settlements on Pine Island Sound three times a week.

Punta Gorda is a town on the south bank of Peace River near the head of Charlotte Harbor and is second in size to Fort Myers. It has railroad connections with the interior of the State and with Fort

Myers. A draft of 9 feet (2.7 m.) can be taken to the anchorage off the wharves. The Gulf Oil Dock, the longest dock here, has 5½ feet (1.7 m.) of water at the end, and there is also 5½ feet (1.7 m.) of water at the end of the railroad dock. A bridge with draw crosses the river about 600 feet above the docks. Good anchorage, in depths ranging from 6 to 9 feet (1.8 to 2.7 m.) can be found off the town. Fresh water, gasoline, and some supplies can be had here, and there is telegraph and telephone communication. Storm-warning signals are displayed from a tower on the water front. Minor repairs to engines and machinery can be made, and there are slipways of about 30 tons capacity, but limited to drafts of 4 feet. At **Cleveland,** 3 miles above Punta Gorda, on the same bank, is a marine railway of about 100 tons capacity, on which vessels of 6 feet draft can be hauled. Single-pile beacons, with pointers, mark the best water in Peace River from Punta Gorda to Cleveland.

Prominent features.—In approaching the entrance to Charlotte Harbor from the southward or southwestward a water tank, 136 feet (41.6 m.) high, and a yellow chimney, 125 feet (38.1 m.) high, three-eighths mile north of the entrance, will be the first objects sighted in the daytime. At night the entrance gas buoy and Gasparilla Island Lighthouse will be recognized first. Coming from northward a vessel will first sight a high water tank (103 feet (31.4 m.)), 1¾ miles north of the entrance. At night this tank has a small light on the side.

Gasparilla Island Lighthouse is a white frame dwelling on the south end of the island. The light is flashing white (flash 0.5 second, eclipse 9.5 seconds), 41 feet (12.5 m.) above the water, and visible 12 miles.

Pilots will board vessels near the entrance buoy. Pilotage is compulsory for most vessels. (See the extracts from the laws of Florida relative to pilotage on p. 4.) Pilotage rates for the port of Bocagrande, effective after November 1, 1923, are as follows:

From sea to anchorage, or from anchorage to sea

	Per foot
6 to 8 feet	$2.50
8 to 15 feet	3.00
15½ to 20 feet	4.50
20½ and over	5.50

Dockage rate

To dock	10.00
From dock	10.00
Boat, running lines	15.00
Boat waiting on ship in stream—daylight service—per day	5.00
Changing anchorage	10.00
Boat transferring laborers to and from ship in stream for leveling cargo, daylight service	10.00
To quarantine ground	10.00
To delivering orders at sea	25.00

Anchorage.—The best anchorage for large vessels is in deep water at the inner end of the entrance channel. This is the anchorage used by vessels while waiting for a loading berth at the phosphate elevators. It affords excellent shelter from all winds, and is also used as a harbor of refuge by coasters and other vessels. Small vessels can anchor almost anywhere in Charlotte Harbor that suit-

able depth can be found. Good depths for small craft close inshore can be found anywhere within 1½ miles northward of the entrance and one-half mile off the east side of Gasparilla Island. Small craft can also use the lagoon at Bocagrande.

The **harbor master** has control of the anchorage and berthing of vessels at South Bocagrande. Masters should report to him immediately after anchoring or docking. The following is an extract from the regulations relating to South Bocagrande:

No steamers shall, while passing along the line of the wharves of this city, exceed in speed 4 miles an hour; and where two or more vessels are moored abreast of any of said wharves the steamer passing will stop her engines and turn "over slow," using every precaution to avoid unnecessary suction until the vessels in her immediate vicinity are passed by.

Quarantine.—The quarantine station is inside the point on the south side of the entrance. Vessels subject to visitation will be boarded at the anchorage at the inner end of the entrance channel.

Hospital.—The nearest marine hospital is at Key West.

Supplies.—Ship chandlery and provisions can be obtained at South Bocagrande and Punta Gorda. There is no supply of coal, but it can be brought by rail from the town of **Arcadia** on short notice. Good water can be had at South Bocagrande.

Minor repairs only to machinery and hulls of small craft can be made at South Bocagrande, Punta Gorda, and Cleveland. (See also Punta Blanca on page 53.)

Storm warnings are displayed at South Bocagrande, Bocagrande, and Punta Gorda.

Tides and currents.—The mean rise and fall of the tide is 1.4 feet, but the variations in the water surface due to the force and direction of the wind are as much as 4 or 5 feet at times, obliterating all traces of the normal tidal action.

The tidal currents in the entrance channel have considerable strength, especially the ebb current, which is said to attain occasionally an extreme velocity of 3 to 4 knots, dependent also upon the force and direction of the wind. Slack water before the flood occurs at about the time of high water at Key West and slack water before the ebb occurs about 1 hour 45 minutes before the time of low water at Key West.

DIRECTIONS, CHARLOTTE HARBOR

On both sides of the entrance there are shifting shoals extending in a general southwesterly direction for 3½ miles. Their shoaler parts, locally known as "sand bores," are usually marked by breakers. Near their western edges the shoals rise abruptly from 4 and 5 fathoms (7 and 9 m.) of water, and the lead gives but poor warning of their proximity in approaching them.

Bocagrande, the main channel, has an improved depth of 18 feet (5.5 m.) for a width of nearly three-eighths mile, and a depth of 24 feet (7.3 m.) in a dredged channel 300 feet wide. It is marked by buoys and range beacons. A draft of 15 feet (4.6 m.) can be taken in through Bocagrande when there is a moderately heavy sea running, but strangers of a greater draft should not attempt to enter under such conditions without a pilot.

It is well to keep at least 4 miles offshore until the gas and gas bell buoy is sighted, or steer for the lighthouse, or the chimney and

water tank at South Bocagrande, bearing 47° true (NE. mag.), and stand in on this course until up with the gas and bell buoy. Then steer 36° true (NE. by N. mag.) for 2½ miles from the gas buoy with two beacons on the shoals west of the lighthouse in range, and leave the buoys on the sides indicated by their color. The shoal on the northwest side of the channel has built out so that it extends into the channel between buoys Nos. 2 and 3. Vessels of over 16 feet (4.9 m.) draft should keep well to eastward of the range between these buoys. From buoy No. 4 steer 67° true (NE. by E. ¾ E. mag.), being guided by the buoys, and pass a little over one-fourth mile southward of Gasparilla Island Lighthouse.

Vessels of less than 18 feet (5.5 m.) draft could formerly enter the harbor on the lighted range; but due to shoaling on the bar from the northward, this range should not be used to cross the bar by vessels of over 8 feet (2.4 m.) draft.

A break in the shoal along the north side of the Bocagrande Channel forms what is known as the **Swash Channel,** a narrow passage 5 feet (1.5 m.) deep, close to the southern end of Gasparilla Island. This channel is used to a considerable extent by small local craft and is said to change but little. However, a stranger should attempt it only when the sea is so smooth that the shoals can be clearly seen.

To go to Punta Gorda.—Steer 72° true (ENE. ⅛ E. mag.) with Charlotte Harbor Light a little on the port bow, passing 150 yards north of beacons Nos. 8 and 10. When beacon No. 10 is abeam steer 75° true (ENE. ½ E. mag.) until Charlotte Harbor Light bears 13° true (N. by E. mag.), and then steer 44° true (NE. ¼ N. mag.) to a position 100 yards east of black beacon No. 7. Then steer 355° true (N. ⅝ W. mag.) for Mangrove Point beacon (flashing white light), leave it 100 yards on the port hand, and steer 16° true (N. by E. ¼ E. mag.), so as to leave Peace River beacon (flashing red light) 100 yards on the starboard hand. From a position 200 yards north of the last beacon steer 69° true (ENE. mag.) for seven-eighths mile, and then steer 92° true (E. mag.) so as to leave beacon No. 2 about 25 yards on the starboard hand. From there steer 67° true (NE. by E. ¾ E. mag.) to the anchorage westward of beacon No. 4. A depth of 5½ feet (1.7 m.) can be carried to the wharves at low tide.

CHARLOTTE HARBOR TO TAMPA BAY

From Charlotte Harbor to Tampa Bay the coast trends about northwest by north, and is a nearly straight sand beach, broken at a few places by small inlets. The shore is low, and wooded nearly to the water's edge, and has but few prominent features that can be recognized from offshore. The buildings at Bocagrande, at Sarasota, and at several of the inlets can be made out, and the water tower at Sarasota can be seen from some distance offshore. Some tall palmettoes, with a hotel and several buildings at Maria, near the northwesterly end of Anna Maria Key, are also good landmarks. The coast is clear, except in the vicinity of the entrances to Charlotte Harbor and Tampa Bay.

Back of the coast line are shallow bays and lagoons which can be entered with light-draft vessels by the various passes and inlets, but there is no continuous inside passage even for the lightest draft.

Bocilla Pass and **Knight Pass,** 10 and 11 miles, respectively, above the entrance to Charlotte Harbor, are small and difficult entrances to **Lemon Bay,** a comparatively unimportant body of water, filled with shoals.

Venice Inlet has a depth of 3½ feet (1.1 m.), but is crooked and difficult for a stranger. The towns of **Venice** and **Nakomis** are located inside the inlet. A depth of 3 feet (0.9 m.) can be carried to the landings off these towns. This inlet is the southern entrance to Little Sarasota Bay.

Little Sarasota Bay, Sarasota Bay, and **Sarasota Pass** are connecting bodies of water, or lagoons, extending from Venice Inlet to the lower part of Tampa Bay, and are separated from the Gulf by a line of narrow keys. These waters vary in width from a few hundred feet to 3 miles and are very shallow. Cuts have been dredged through the shoals to give a depth of 3 feet (0.9 m.) from Venice Inlet to Sarasota, and 7 feet (2.1 m.) from Sarasota to Tampa Bay. The channel is well marked by beacons and is easily followed.

Musketeers Pass, locally known as **Midnight Pass,** is a 4-foot (1.2 m.) pass between Little Sarasota Bay and the Gulf, about 6½ miles northwestward of Venice Inlet. This pass is reported to be gradually shifting northward.

Osprey is a post office and store on the eastern side of Little Sarasota Bay, 5½ miles north of Venice Inlet. There is a small landing here, and gasoline and some supplies may be had. **Vamo** is a new settlement 1¾ miles north of Osprey, on the same side of the bay.

Big Sarasota Pass leads into Sarasota Bay 38 miles northwestward of Gasparilla Island Light and 20 miles southeastward of Tampa Bay Southwest Channel entrance buoy. It lies between Sarasota Key and the small islets north of this key and can be recognized, coming up the coast, when nearly up to Sarasota Point, by the low sandy west end of Sarasota Key. A high water tower at Sarasota and a hotel and windmill on a tank on **Bird Key** will be seen as the pass opens. This pass is the southern entrance to Sarasota Bay and is good for 7 feet (2.1 m.) at low tide. The **entrance** to the pass is marked by Sarasota Pass Light No. 1, flashing white every 5 seconds. The structure is a white, square, pyramidal, skeleton superstructure, with tank house, on 5 piles, with light 47 feet (14.3 m.) above the water. The channel across the bar is marked by two buoys.

New Pass, 2½ miles north of Sarasota Pass, has a depth of about 3 feet (0.9 m.) but is little used. Breakers obstruct the pass westward of the opening, and boats entering here must approach the shore about 1 mile south of the pass and then head northward along the shore, keeping behind the breakers, to the pass. A drawbridge is being built across New Pass.

Sarasota, a town of 5,000 inhabitants, is a winter resort on the easterly shore at the southern end of Sarasota Bay, and has railroad and steamer connection with Tampa. A draft of 7.5 feet (2.3 m.) can be taken to the wharf. Fresh water, gasoline, and all supplies can be obtained. There is a repair shop for small boats and a

marine railway of 25 tons capacity which can haul out boats up to 45 feet in length and 4 feet draft. Anchorage for boats may be had in either of two artificial basins, where there are available depths of 7 to 8 feet (2.1 to 2.4 m.), or in a dredged area in the vicinity of the concrete dock. Dredging operations have removed part of the shoal in front of the town, and the shore line has been filled in and extended. A dredged channel 6 feet (1.8 m.) deep and 100 feet wide leads to Bird Key, on which a large white residence and a prominent tank are located. The entrance to this channel is marked by beacon No. 9. Storm warnings are displayed at Sarasota.

There is a 6-foot (1.8 m.) dredged channel into **Hudson Bayou** which is a good harbor for small boats. The entrance to the bayou is marked by single piles.

Hog Creek, on the north side of Sarasota, is the location of the slipways and machine shop. The Gulf Refining filling station is also located here. The entrance is through a 7-foot (2.1 m.) dredged channel.

There is a good channel extending north and south between Bird Key and Coon Key. This channel is good for about 7 feet (2.1 m.) draft, but is not marked. A causeway is being built from **Cedar Point** to **Coon Key,** with drawbridges over this channel, and over the channel near Cedar Point.

Longboat Inlet, 11 miles northward of Big Sarasota Pass, leads to Sarasota Bay. It has a depth of only 5 feet (1.5 m.) on the bar, but the channel is straight and is an easy entrance. On the north side are several unpainted buildings on the beach. The channel bears seaward in a south-southwest direction from the opening and is well defined by prominent shoals on each side. After entering the inlet turn northward and keep close to the shore until abreast of the wharf, then steer 22° true (N. by E. ¾ E. mag.), with Longboat Inlet range beacons in line ahead. When about 100 yards from the front beacon haul northwestward and follow the channel.

Longbeach, on the northern end of **Longboat Key,** is a small fishing village. **Ilexhurst** is a small settlement on the southern end of Anna Maria Key. Some supplies can be had at Ilexhurst where there is a small wharf.

Cortez is a post office and small fishing village 1¾ miles north of Longboat Inlet, on the eastern side of Sarasota Pass. Gasoline, oil, fresh water, and general supplies can be had. There is telephone connection to **Bradentown,** where there is a telegraph. A bridge with draw connects the town of Cortez with **Cortez Beach** on Anna Maria Key. A draft of 5 to 7 feet (1.5 to 2.1 m.) can be carried to the wharves at Cortez south of the bridge.

Directions, Big Sarasota Pass to Sarasota.—Approaching this pass a vessel should keep at least 2 miles offshore until a water tank and power-house chimneys in Sarasota are in line with the northwest point of Sarasota Key. Head in for the shore, passing close to the entrance buoy No. 2 and the channel buoy, and steer 28° true (NNE. ¼ E. mag.) until about 100 yards from the shoal ahead, which is northerly of the point of the key. Then steer 59° true (NE. by E. mag.) passing the shoal fairly close to port, and leaving beacon No. 1 (flashing white light) about 150 yards to port. When about 100 yards off the starboard shore, follow it at this

distance to the northerly end of Sarasota Key, leaving beacons Nos. 1A and 3 to port. Then be guided around the edge of the flats off Bird Key by the beacons which are left to port. When up to the Middle Ground beacon No. 4, leave it well to starboard, passing about 75 yards south of Cedar Point, and head for the concrete dock at Sarasota.

Directions, Sarasota Bay and Pass to Tampa Bay.—From a position about 300 yards northwest of beacon No. 4, south of Cedar Point, steer 330° true (NNW. ⅞ W. mag.), passing 150 yards westward of beacon No. 15. Then steer 343° true (N. by W. ¾ W. mag.) until beacon No. 28 is abeam (about ¼ mile to port), and then steer 320° true (NW. ¼ N. mag.) for 4¼ miles, passing eastward of beacon No. 26. Steer around beacon No. 26 at a distance of about 150 yards and head westward for beacon No. 24, passing 150 yards south of beacon No. 13, and keeping two square range targets in line ahead. When up to beacon No. 24, change course to leave it to port, and steer 310° true (NW. ⅝ W. mag.) through the 7-foot (2.1 m.) dredged channel, leaving beacons Nos. 22, 20, 18, 16, 14, and 12, close-to on the port hand.

Steer around the northern end of Longboat Key, keeping close to the beach, and then head over to the southern end of Anna Maria Key, leaving beacon No. 9 well to eastward. Keep close to the shore until abreast of the wharf at Ilexhurst. Then steer 22° true (N. by E. ¾ E. mag.), with the Longboat Inlet range beacons in line ahead. When about 150 yards from the front beacon haul northwestward, leaving an unnumbered beacon and beacon No. 5 to starboard, and head for the draw in the bridge. Or, if going to Cortez, round beacon No. 5 and head for the wharves.

After passing through the bridge at Cortez, steer 337° true (NNW. ¼ W. mag.) passing 100 yards east of beacon No. 10; then steer northward, leaving beacon No. 3 to eastward, and head for beacon No. 8 at the entrance to the dredged channel. Follow this cut, heading northward to beacon No. 6 and northwestward to beacon No. 4, leaving all beacons to port. After leaving beacon No. 4, follow the channel northward, then westward, leaving beacon No. 2 about 200 yards to port, and beacon No. 1 about 100 yards to starboard. (Then see Directions for Tampa Bay.)

TAMPA BAY (CHARTS 477 AND 177)

is about 20 miles long to the entrance of Hillsboro and Old Tampa Bays, and 6 to 7 miles wide. It is the approach to Hillsboro, Old Tampa, Sarasota, and several smaller bays, and to the cities of St. Petersburg, Port Tampa, and Tampa. It is easy of access either day or night and is the largest deep-water harbor in the State of Florida. It is one of the important harbors on the Gulf coast of the United States, having a considerable foreign and coastwise trade in phosphate rock, lumber, naval stores, tobacco, and general merchandise.

For a distance of 15 miles above the entrance Tampa Bay has a least depth of 22 feet (6.7 m.) along its axis, between broad shoals that extend from the shores on both sides. It has a depth of 25 feet (7.6 m.) in the dredged channel, 300 feet wide, up to cut F range, and 27 feet (8.2 m.) from there to Tampa and Port Tampa, and a

draft of 26 feet (7.9 m.) has been taken out from there at high water. It can be entered by any one of three channels which lead between shoals extending about 5 miles from the shore.

North Channel, the northernmost of these channels, and the most important one commercially, has a depth of 26 feet (7.9 m.) in an improved channel, 500 feet wide, and is well marked by buoys, some of them lighted, and by Egmont Key range lights. **Palatine Shoal,** lying 5 miles westward of Egmont Key Lighthouse, on the south side of the North Channel, consists of several small lumps having 17 to 21 feet (5.2 to 6.4 m.) over them. It is marked by a horizontally striped buoy, which should be given a berth of one-fourth mile or more.

Southwest Channel has a depth of about 16 feet (4.9 m.) and is marked by buoys. Egmont Key, 1½ miles long, lies between North and Southwest Channels, and the shoals making westward from it separate the two channels.

Passage Key Inlet, the opening between the northern end of Anna Maria Key and the small key northward, known as **Passage Key,** has a depth of 9 feet (2.7 m.) in an unmarked, shifting channel, and is used only by small local vessels. Passage Key has washed away and there is now only a long sand spit left.

Prominent features.—Approaching Tampa Bay entrance on a clear day a water tank, 130 feet (39.6 m.) high, located on Egmont Key, three-eighths mile south of the lighthouse, is usually the first object sighted. The tall water tank and houses near the southern end of Mullet Key, and a hotel and two tall tanks at Pass-a-Grille, can also be recognized when a little closer in. **Egmont, Mullet,** and **Anna Maria Keys** are low and wooded, and Egmont Key has a number of houses southward of the lighthouse. In thick or hazy weather nothing can be seen, and it is then advisable for vessels not sure of their position to anchor until the weather clears.

Egmont Key Lighthouse is a white tower, the top of which shows over the tops of the trees. The light is group occulting white, 85 feet (25.9 m.) above the water, and visible 15 miles. It has a red sector covering the bar gas and bell buoy at Southwest Channel. The fog signal is a bell striking a group of 2 strokes every 10 seconds.

Sarasota Pass and Bay are described on page 61.

Anna Maria is a post office and small village on the northern end of Anna Maria Key. There is a wharf on the northeastern side of the key, with 9 feet (2.7 m.) of water at the end, and there is daily boat service to points on Tampa Bay. A road extends from Anna Maria to Bradentown by way of Cortez, and there is telephone connection also. Gasoline, water, ice, and some general supplies can be had here.

Manatee River is on the south side of Tampa Bay, 7 miles southeastward of Egmont Key Lighthouse. For a distance of 11 miles above the mouth the river is a tidal estuary from one-half mile to nearly 1 mile in width; for the next 9 miles, to **Rye,** it varies in width from 80 to 600 feet. It has been improved by dredging where necessary, so that a draft of 12 feet (3.7 m.) can be carried to **Hooker Point,** 10 feet (3 m.) to **Rocky Bluff,** 9 miles above the mouth, and 3 feet (0.9 m.) to **Rye,** the head of navigation, 20 miles

above the mouth. A draft of 3 feet (0.9 m.) can also be carried for 3 miles up Braden River to **Elwood Park.** The entrance of Manatee River, and also the channel as far as Rocky Bluff, is marked by buoys and beacons, some of which are lighted. The river is well protected from all directions and forms a good storm anchorage for small boats.

Manatee River is well settled along its banks, the largest towns and their distances above the mouth being **Palmetto** on the north bank, and **Bradentown** on the south bank, both 5 miles; **Manatee** on the south bank, 6½ miles; and **Ellenton** on the north bank, 8 miles. These towns have steamer and railroad communication with Tampa. Railroad and highway drawbridges cross the river above Bradentown. The commerce on the river consists of fuller's earth, naval stores, citrus fruits, and truck, and is shipped in small vessels to Tampa. Bradentown is the county seat and is the largest town on the river. Ten feet (3 m.) of water can be carried to the face of the wharf here, and supplies of all kinds can be obtained. Some supplies can also be had at Manatee, Palmetto, and Ellenton. **Storm warnings** are displayed at Palmetto. **Repairs** to small vessels can be had at **McKay Point** where there is a machine shop and two ways that can haul vessels up to 6-foot draft and to a length of 72 feet. **Supplies** can also be had here, and there is road and telephone connections with the larger towns on the river.

To enter Manatee River, approach the entrance buoy No. 2 from a northwesterly direction and leave it close-to to westward, with cut A range lights in line ahead, course 139° true (SE. ¼ S. mag.). When nearly up to cut A front light, change course to 115° true (ESE. mag.) leaving this light and cut C front light close-to on the starboard hand. When up to cut C front light, steer 99° true (E. ⅝ S. mag.) with the range lights in line astern, and leave a beacon to starboard. Continue on course past this beacon until cut D range lights are nearly in line on the port quarter, and then steer 118° true (SE. by E. ¾ E. mag.) with these range lights in line astern, and leave beacons Nos. 3 and 5 to port and beacons Nos. 8 and 10 to starboard. From beacon No. 10 the channel is easily followed up the river, by passing the lights and beacons as indicated by their pointers.

Terraceia Bay is on the southeastern side of Tampa Bay, northeastward of the lower part of Manatee River. It is entered from Tampa Bay through a narrow channel marked by beacons, some of which are lighted. The least depth in the channel is 4 feet (1.2 m.). The bay is also entered from Manatee River, opposite the village of Palma Sola, through a dredged cut about 100 feet wide and 6 feet (1.8 m.) deep; this cut is marked at both ends by beacons. **Terra Ceia,** a small village and post office on the north shore of the bay, is the terminus of a branch line of railroad.

Little Manatee River is on the southeast side of Tampa Bay, 16 miles above Egmont Key Lighthouse. It is good for a draft of 3½ to 4 feet (1 to 1.2 m.) for a distance of 8 miles above its mouth, and 3 feet (0.9 m.) to **Riverhead,** a mile farther on. At the entrance to the river there is a bar, crossed by a tortuous channel, which affords a depth of 4 feet (1.2 m.). This entrance is marked by beacons and lights.

Boca Ciega Bay, on the north side of the lower part of Tampa Bay, is described on page 71.

St. Petersburg, a large winter resort on the west shore of Tampa Bay, is the terminus of two railroads, and has steamer communication with Tampa and the towns on the bay. A draft of 10 feet (3.0 m.) can be taken from Tampa Bay entrance to a point abreast the city by following the west channel from near buoy No. 4B in Cut B, and a draft of 24 feet (7.3 m.) by following the improved channel to Port Tampa as far as Cut J. A draft of 15 feet (4.6 m.) can be taken to the railroad wharf, and 9 feet (2.7 m.) to the Municipal Pier, the end of which is marked by two fixed red lights. Nine feet (2.7 m.) can be carried into the yacht basin between these two wharves, and there is from 10 to 14 feet (3.0 to 4.3 m.) of water in the basin. The entrance to the basin is marked by a lighted range (this range is very difficult to pick up) and with lights at the ends of the north and south moles. Small craft can find the best anchorage in Bayboro Harbor, an artificial basin, 1,360 feet long, 450 feet wide, and 10 feet (3.0 m.) deep, one-half mile south of the center of the city. The basin is reached by a dredged channel, 200 feet wide and 10 feet (3.0 m.) deep, running east and west, close to the north side of a stone jetty, three-fourths mile south of the railroad wharf. A lighted range ahead, one astern, and beacons mark the dredged channel. Fresh water, gasoline, provisions, and yacht supplies can be had at St. Petersburg, and there are facilities for making repairs to small machinery. Vessels of about 100 tons can be hauled out here. **Storm-warning signals** are displayed from a tower near the wharves.

Coffeepot Bayou, 1 mile north of the Municipal Pier, makes a good yacht anchorage, in a fast developing residential section of St. Petersburg. A draft of 5 feet (1.5 m.) can be carried through a dredged channel leading into this bayou.

Old Tampa Bay, an arm of Tampa Bay extending northwestward, is about 12 miles in length and averages 6 miles in width. Its narrowest part is at its junction with Tampa Bay, where the width is only 2½ miles. A highway bridge, known as the **Gandy Bridge,** crosses the bay about 1½ miles above Port Tampa. It is partly fill and partly concrete construction, and the draw, 2,333 yards from the eastern shore of the bay along the center line of the bridge, has a width of 75 feet. The bay is generally shallow, with depths of 5 to 15 feet (1.5 to 4.8 m.), except at its southern end, where there is a deep channel leading along the eastern side at a distance of three-fourths mile from the shore. Between the deep water in Tampa Bay and this channel in Old Tampa Bay are two shoals which have been improved by dredging a channel across them 300 feet wide and 27 feet (8.2 m.) deep. The channel is well marked by buoys, lights, and range beacons. A dangerous rock with 20 feet (6.1 m.) over it lies 350 yards westward of the end of the upper wharf at Port Tampa; it is marked by a horizontally striped buoy.

Port Tampa is an important shipping port on the easterly shore of Old Tampa Bay just inside the entrance. The long docks and buildings of the railroad are conspicuous marks from Tampa Bay. A railroad and electric car line connect Port Tampa with Tampa,

There is a depth of 27 feet (8.2 m.) alongside the docks and in the slips. The slip at which vessels usually load is 2,600 feet long. Phosphate rock is the principal article of export. There is a passenger line from Port Tampa to Habana via Key West making semiweekly sailings.

Beach Park is a new residential section on **Cuthbert Bayou,** 4½ miles north of Port Tampa. No supplies can be had here, and only small boats can enter the bayou.

Safety Harbor is a health resort on the western shore of Old Tampa Bay, 1 mile north of **Cooper Point.** A prominent tank 219 feet (67 m.) high is located here, and is a good landmark for vessels navigating the bay. Gasoline, ice, water, and some supplies can be had here, and there is railroad, telegraph, and telephone communication with Tampa and St. Petersburg.

Oldsmar is a small town on the north and east shore of **De Soto Bayou.** A 6-foot (1.8 m.) channel marked by beacons leads from Old Tampa Bay to the municipal pier and the yacht basin. Gasoline, ice, water, and some general supplies can be obtained, and there is railroad, telegraph, and telephone communication.

Hillsboro Bay, the northeastern arm at the head of Tampa Bay, is 8 miles long and 4 miles wide and has a natural channel depth of 12 feet (3.7 m.) to within 2 miles of its head. A channel 200 feet wide and 27 feet (8.2 m.) deep has been dredged from the deep water of Tampa Bay through Hillsboro Bay to a turning basin at the mouth of Hillsboro River; the channel is well marked by buoys and lights.

Hillsboro River is a narrow stream which flows through the middle of the city of Tampa. A channel 200 feet wide and 12 feet (3.7 m.) deep extends upriver from the turning basin to within 100 feet of the first bridge. A draft of 10 feet (3 m.) (11½ feet (3.5 m.) at high water) can be taken to the shipyard above the third bridge. Above Tampa the stream is narrow and, in general, quite deep as far as **Sulphur Springs,** 8 miles above the first bridge, but at several places shoals extend nearly or entirely across, on which the controlling depth is 4½ to 5 feet (1.3 to 1.5 m.). Above Sulphur Springs the depth decreases rapidly and there is a dam across the stream.

From the turning basin at the mouth of the river a channel 300 feet wide and 27 feet (8.2 m.) deep has been dredged eastward along the south water front of Tampa, and between it and Sedden Island through the railroad bridge into **Ybor Estuary.** The ocean steamship docks are along the south water front of the city and in Ybor Estuary, and the docks for bay steamers and small vessels are along the east bank of Hillsboro River below the first bridge. The Municipal Slip, 300 feet wide, 980 feet long, and 27 feet (8.2 m.) deep, is located on the western side of Ybor Estuary. A 27-foot (8.2 m.) channel, marked by ranges, has been dredged across **Sparkman Bay** to Ybor Estuary. Five drawbridges (width of openings, 75 feet) cross the river at Tampa and a little above. The signal for opening any of the draws is four blasts of the whistle.

Tampa is an important manufacturing city and shipping port at the head of Hillsboro Bay and has communication by several lines of railroad. There are depths of 12 to 27 feet (3.7 to 8.2 m.) along-

side the docks. There are good facilities for loading cargo, especially phosphate rock, a considerable part of which is shipped to foreign ports. The phosphate elevators are on **Sedden Island.** Several lines of steamers afford regular service to New York, Key West, Habana, Mobile, and New Orleans, and small steamers make regular trips to the towns in Tampa Bay, Manatee River, Charlotte Harbor, and to Fort Myers and Everglade. Gasoline, oil, water, coal, and all ship supplies can be obtained. There is a foundry, machine shop, and marine railway.

Alafia River empties into Hillsboro Bay from eastward. The river has considerable depth inside, but its mouth is obstructed by a bar with from 2½ to 4 feet (0.8 to 1.2 m.) upon it. The deepest draft of vessels entering is 4 feet (1.2 m.). A light, in about 4 feet (1.2 m.) of water, marks the northwesterly side of the south entrance to the river.

Pilots and pilotage.—At the North Channel entrance pilots board vessels near the gas and whistling buoy, or between it and buoy No. 2; at the Southwest Channel they board vessels outside the bell buoy.

Pilotage is compulsory for most vessels. (See the extracts from the laws of Florida relative to pilotage on p. 4.) The rates of pilotage in Old Tampa Bay, Tampa Bay, and Hillsboro Bay are as follows:

	Per foot
Vessels drawing 6 feet and under	$2.00
Vessels drawing over 6 to 8 feet	2.50
Vessels drawing over 8 to 15 feet	3.00
Vessels drawing over 15 feet	3.50

Vessels employing services of pilot to shift from Tampa to Port Tampa, or vice versa, or from Tampa to **Gadsdens Point,** or vice versa, shall pay $20. Those employing services of pilot to put them in or out of dock, or to shift from one dock to another, shall pay $10 each way.

Towboats are used by the deeper-draft sailing vessels bound to Tampa and Port Tampa, and by some deeply laden steamers bound out. Towboats are sent out by the railroad company to meet expected sailing vessels.

Anchorage—Outside the bar vessels with good ground tackle can anchor anywhere offshore in 6 to 8 fathoms (11 to 15 m.), and ride out any gale except a hurricane. Inside the entrance the usual anchorages are as follows: Southward of the quarantine station on Mullet Key, in 5 to 6 fathoms (9 to 11 m.); about 4 miles south of Port Tampa, between Buoys 3F and 2G, on the south, and the front range beacons of cut E and cut F, on the north; below and above the docks at Port Tampa; and near the dredged channel in Hillsboro Bay, between beacon No. 3 and beacon No. 9.

Terminal facilities.—At Tampa these consist of 14 wharves, of which the greater number are of the combined freight and passenger type with a total water frontage of 7,300 feet, and with railway and highway connections. All but 8 of the wharves are open to the public on payment of wharfage charges. The municipal terminals consist of two concrete piers 980 feet long, located on the western side of Ybor Estuary.

At Port Tampa terminal facilities consist of 2 combined freight and passenger piers affording a total berthing space of 6,560 feet and having railway connections. These terminals are open to the public upon the payment of published tariff charges.

Quarantine.—The quarantine station is on the south side of Mullet Key. Vessels subject to visitation by the health officer are boarded while lying at anchor anywhere within three-fourths mile off the station. There is also a hospital and fumigation station located here.

Hospital.—A relief station of the United States Public Health Service is located at Port Tampa. The nearest marine hospital is at Key West.

Supplies.—Anthracite and bituminous coal can be had at Port Tampa and Tampa. Fuel oil and gasoline can be had at Tampa. Fresh water and provisions can be had at Tampa, Port Tampa, and St. Petersburg, but the fresh water is poor for boiler purposes. The best water for boiler purposes can be bought at Tampa. Ship chandlers' stores can also be had at Tampa.

Repairs to hulls and machinery of vessels can be made at Tampa. The largest marine railway can haul out vessels of 3,500 tons, 260 feet in length and 19 feet draft. Repairs to small boats can also be made at St. Petersburg and at McKay Point in Manatee River.

Storm warnings are displayed at Tampa, Sedden Island, Port Tampa, St. Petersburg, and Egmont Key.

Tides.—The mean rise and fall of tides at Egmont Key is 1.4 feet and in Hillsboro Bay 2.2 feet. Strong winds may obliterate all traces of normal tidal action. A strong offshore wind sometimes lowers the water surface at Tampa and in the dredged channels as much as 4 feet, and a continued southwest wind raises it by nearly the same amount.

Currents.—The tidal currents in the North Channel entrance usually have considerable velocity, and vessels should take care not to be set off the course. On the flood the current sets northeastward across the bar; on the ebb it sets straight out. Inside the bar a current of 1½ knots is often encountered.

DIRECTIONS, TAMPA BAY

The following are courses and distances to Tampa Bay North Channel entrance gas and whistling buoy:

From Northwest Channel entrance, Key West, 343° true (N. by W. ⅝ W. mag.), 187 miles.

From Rebecca Shoal Lighthouse, 355° true (N. ⅝ W. mag.), 183 miles.

From Mobile Bay entrance, 119° true (SE. by E. ¾ E. mag.), 312 miles.

From South Pass, Mississippi River, 104° true (E. ⅞ S. mag.), 340 miles.

In approaching Tampa Bay it is well to keep in at least 6 fathoms and over 5½ miles offshore until the entrance gas and whistling buoy is sighted, and then head for it. From the buoy the following courses and distances lead in the improved channels to Port Tampa and Tampa. For dimensions of these channels see description preceding.

	Course		Distance in nautical miles
	True	Magnetic	
	°		
1. On Egmont Key range until past buoy No. 3 Egmont Key range is formed by Egmont Key lighthouse and a white pyramidal structure ¾ mile in front of it, showing a flashing white light.	98	E. ½ S	3¾
2. To a PS gas and bell buoy	81	E. by N	1¼
3. To the PS gas and bell buoy 1 mile off the quarantine station (Mullet Key).	98	E. ½ S	4½
4. To gas and bell buoy No. 2B	68	NE. by E. ⅞ E	5
5. Through Cut B to gas bell and buoy No. 6	37	NE. ⅞ N	3⅝
6. On Cut C range to buoy No. 3C	61	NE. by E. ¼ E	2
7. Through Cut D until Cut E range closes	27	NNE. ¼ E	2½
8. On Cut E range to buoy No. 1F	17	N. by E. ⅜ E	1½
9. On Cut F range to buoy No. 5F	0	N. ⅛ W	1½
To Port Tampa			
10. On Cut G range until past buoy No. 4G	281	W. ¾ N	2¾
11. On Cut J range until past Cut K range, Front Beacon.	359	N. ¼ W	1½
12. On Cut K range to buoy No. 4K	22	N. by E. ¾ E	1¾
13. To anchorage off docks at Port Tampa	13	N. by E	1
To Tampa from buoy No. 3F			
14. To beacon No. 2, passing north of buoy No. 10.	68	NE. by E. ⅞ E	3¼
15. To beacon No. 4, with lights on range	65	NE. by E. ⅝ E	¾
16. To beacon No. 6	47	NE	⅜
17. Until past beacon No. 9	5	N. ¼ E	5½
18. On Hillsboro River range astern, two tall stacks ahead, to the turning basin off Tampa.	333	NNW. ½ W	2¼

In order to distinguish the dredged cuts the numbers on the buoys marking them are followed by a letter which designates the cut.

From gas and bell buoy No. 2B to St. Petersburg by the West Channel (for a draft of 10 feet (3 m.) or less).—Steer 37° true (NE. ⅞ N. mag.) for 2 miles to buoy No. 4B. Then steer 355° true (N. ⅝ W. mag.) for 6½ miles, passing between **Point Pinelos light** (black pyramidal structure) and a red buoy northeastward of it, and passing ¼ mile westward of a single, slatted pile. The course leads to a perpendicularly striped buoy off St. Petersburg.

From the northern part of Tampa Bay to St. Petersburg.—If drawing 10 feet (3 m.) or less, steer for the standpipe on the hill at St. Petersburg when it bears between 278° true (W. ½ N. mag.) and 255° true (WSW. ½ W. mag.), unless eastward of Cut E beacons.

If coming from Hillsboro Bay a draft of 20 feet (6.1 m.) can be carried by steering 260° true (W. by S. mag.) from a position 50 yards north of buoy No. 10. The standpipe on the hill at St. Petersburg should be right ahead, two horizontally striped buoys should be left on the port hand and buoy No. 2G on the starboard hand.

When 2 miles from St. Petersburg steer for the perpendicularly striped buoy off the wharves, or steer for the longest wharf.

Southwest Channel entrance to Tampa Bay.—It is well to keep more than 3 miles off the coast until Egmont Key Lighthouse bears 43° true (NE. 3/8 N. mag.) and then steer for it until up to Southwest Channel entrance gas and bell buoy (flashing red). At night a vessel on this course should be in the narrow, faint-red sector of the light. From the gas and bell buoy steer 102° true (E. 7/8 S. mag.) for 1½ miles to Southwest Channel Turn gas buoy (black and white, flashing white), leaving a nun buoy to starboard and a can buoy to port. Then steer 55° true (NE. ¾ E. mag.) for 2¼ miles to a position midway between Southwest Channel Light and a nun buoy southward of it. When the light is abeam, a 61° true (NE. by E. ¼ E. mag.) course for 7¼ miles leads to gas and bell buoy No. 2B at the southwestern end of Cut B.

A 16-foot (4.9 m.) sounding has been located about midway between Southwest Channel gas and bell buoy and Turn gas buoy.

TAMPA BAY TO CEDAR KEYS

At the entrance to Tampa Bay and in spots for 30 miles northward of it, depths of less than 18 feet (5.5 m.) are found for nearly 5 miles offshore and the bottom is generally broken. The coast is bordered by a line of long, narrow islands which, for the most part, overlap at their ends. The Gulf sides of these islands are straight or gently curving sand beaches, backed by dense growths of small pine and semitropical shrubs and timber. Between the chain of islands and the mainland there is a continuous waterway of shallow bays and passages, having a least depth of 3 feet (0.9 m.) (1925), the southern part of which is formed by Boca Ciega Bay and the northern parts by Clearwater Harbor and St. Joseph Sound. This inside channel is well marked for the entire distance with beacons.

Boca Ciega Bay extends 13 miles northwestward from the lower part of Tampa Bay to the **Narrows,** a narrow passage 4 miles long, connecting with Clearwater Harbor. The bay is generally shoal, but a channel 100 feet wide and 4 feet (1.2 m.) deep has been dredged where necessary so that a least depth of 4 feet (1.2 m.) can be taken from Tampa Bay to near the head of Boca Ciega Bay. This connects with a dredged channel 50 feet wide and 3 feet (0.9 m.) deep through the Narrows to Clearwater Harbor. The cuts in Boca Ciega Bay and the Narrows have been marked with beacons with pointers, indicating the side on which they should be passed, but the channel is difficult to follow without local knowledge. **Tidal currents** is Boca Ciega Bay seldom exceed one-half knot.

An 8-foot (2.4 m.) dredged **channel** leads from Tampa Bay to Boca Ciega Bay, extending westward from Point Pinelos Light, and is well marked by beacons. This depth can be carried to the wharf at Pass a Grille by following the beaconed channel.

Pass a Grille is the name of a passage that leads from the Gulf to the lower part of Boca Ciega Bay, between Pine and Long Keys. It is also the name of the **town** on the southern end of Long Key. Two tall tanks are located in the center of the town and are prominent objects from off the coast. The channel across the bar

extends in an east and west direction from the south end of Long Key, and is marked by beacons. The depth on the bar at mean low tide is from 5 to 7 feet (1.5 to 2.1 m.), but the channel and depths change frequently.

The town of **Pass a Grille** is a winter resort on the southern end of **Long Key.** The wharf is located on the eastern side of the key, on the pass, and has a depth of 10 feet (3.0 m.) at the end. There is regular boat service to Gulfport where bus connection can be made with St. Petersburg. There are hotels and stores here, and gasoline, water, ice, and some yacht supplies can be obtained. Repairs can be made to small machinery and there is a slipways that can haul vessels up to 40 feet in length and 4-foot (1.2 m.) draft.

Gulfport is a small resort on the north shore, nearly north of Pass a Grille, and is connected by electric car line with St. Petersburg. A power boat makes frequent trips between here and Pass a Grille.

John Pass leads from the Gulf to Boca Ciega Bay, 4 miles below its head, and 7 miles northward of Pass a Grille. A two-story white house, on the north side of the pass, is a conspicuous mark from a few miles offshore, and serves as a guide to the pass. This pass is much used by small local boats and is not difficult when the sea is smooth. There are several small detached shoals, between which the channel winds. The shoals are dark in color and usually can be seen in time to sheer off, if moving slowly. The entrance to the channel is marked by a black can buoy, and the channel is marked by beacons. The channel shifts frequently and the buoy is moved accordingly. A depth of 4 to 6 feet (1.2 to 1.8 m.) can be carried across the bar at low tide.

Blind and **Indian Passes,** the former south of John Pass and the latter at the north end of Boca Ciega Bay, are very shallow and are not used.

Clearwater Harbor extends for about 7 miles from the Narrows, north of Boca Ciega Bay, to Big Pass. It has an average width of about 1 mile, but is mostly filled with shoals, between which there are narrow natural channels varying in depth from 6 to 20 feet (1.8 to 6.1 m.). Cuts 50 to 100 feet wide and 5 feet (1.5 m.) deep connecting with these natural channels have been dredged from the Narrows through the shoals at the south end of the harbor. The channel is well marked by beacons with pointers.

Clearwater is a town on the east shore of Clearwater Harbor opposite Little Pass. It is connected by railroad with St. Petersburg and the towns northward. A draft of 6 feet (1.8 m.) can be taken to the public wharf, from which a road leads to the center of the town. Gasoline, provisions, and some yacht supplies can be obtained there. A drawbridge connects **Blind Key** with the mainland and the outer island. **Storm warnings** are displayed at Clearwater.

Dunedin is also on the east shore, 3 miles north of Clearwater and about opposite Big Pass; it is on the railroad. A draft of about 3 feet (0.9 m.) can be taken to the wharves. Gasoline, provisions, and some yacht supplies can be had here. The water is very shoal from Dunedin southwestward for 2 miles to the channel leading to Big Pass, and although the best water is marked by beacons it is difficult to navigate even with small boats.

Little Pass and **Big Pass** lead into Clearwater Harbor from the Gulf. Little Pass is 12 miles northward of John Pass, 12 miles southward of Anclote Keys Lighthouse and 1½ miles westward of the town of Clearwater. It may be recognized by a small pavilion on the beach on the north side of the entrance, and by beacon No. 2. Big Pass, 3 miles northward of Little Pass, is marked by a buoy, which does not always indicate the best water, and by beacons. At times as much as 9 feet (2.7 m.) is found in the channels of these passes, and a depth of 6 feet (1.8 m.) can usually be depended upon, with Big Pass having the better depth of the two. On the bars the channels are subject to change, and the chart can not be relied upon to show the latest condition. Inside the entrance the channels are fairly stable, and the chart is a good guide. Usually, when the sea is smooth, which is the only time that a stranger can enter safely, the channels can be discerned by the difference in color of the water.

St. Joseph Sound extends northward from the northern end of Clearwater Harbor nearly to Anclote Keys, and is separated from the Gulf for a part of the distance by a narrow strip of beach, known as **Hog Island.** With a favorable tide a draft of a little more than 3 feet (0.9 m.) can be carried through the sound, but in its present condition 3 feet (0.9 m.) is all that a stranger should attempt to carry, and that on a rising tide. The best water is marked by beacons with pointers; but shoaling has occurred so that local knowledge is necessary to find the best water between beacons, especially southwestward of Dunedin.

Anclote Keys Lighthouse is a brown skeleton tower on the south end of Anclote Keys. The light is flashing white (light 1 second, eclipse 4 seconds), 101 feet (31 m.) above the water, and visible 16 miles. A clump of tall trees near the lighthouse forms a conspicuous landmark for vessels standing along the coast and well offshore.

Anclote Anchorage, between Anclote Keys and the mainland, is well protected from westerly gales and is considerably used. It is good for vessels of 7 feet (2.1 m.) or less draft, and can be reached by passing either northward or southward of the keys. Both passages are marked by beacons. Vessels of a greater draft than 7 feet (2.1 m.) can find anchorage westward of the keys; here they are exposed to westerly winds; but as the water shoals very gradually, there is never a very heavy sea, and vessels with good ground tackle can ride out anything but a hurricane.

To enter the anchorage from south of the keys, bring Anclote Keys Lighthouse to bear 33° true (NNE. ¾ E. mag.) and steer for it on this course until up to beacon No. 1. From this beacon head 56° true (NE. ¾ E. mag.) so as to leave beacon No. 2 to starboard and beacons Nos. 1, 3, and 5 on the port hand. When one-fourth to three-eighths mile eastward of beacon No. 5, head about 13° true (N. by E. mag.) and select anchorage as desired anywhere within the next 3 miles.

Approaching from northward, keep outside the 12-foot (3.7 m.) curve and steer for Anclote Keys lighthouse on any bearing eastward of 160° true (SSE. mag.) until beacon No. 2, lying 5½ miles north-northwestward of the lighthouse, is sighted. From this beacon steer 92° true (E. mag.) to beacon No. 4. Then steer 132°

true (SE. ½ E. mag.) for a small black beacon, No. 1. Pass nearly ½ mile westward of this beacon and steer 185° true (S. ¼ W. mag.) for a red, pyramidal beacon in range with a similar black beacon (white light on the latter) until a red beacon is one-half mile distant on the starboard beam. Then steer about 205° true (SSW. mag.) and select anchorage as desired anywhere within the next 3 miles.

Anclote River discharges over a broad shoal east of Anclote Keys. A channel 100 feet wide and 5½ feet (1.7 m.) deep has been dredged from Anclote Anchorage into the river and up to Anclote post office, a distance of 2¼ miles, and a channel 4 feet (1.2 m.) deep from there to the county bridge at Tarpon Springs, 1½ miles farther up the river. In 1925, 5 feet (1.5 m.) could be carried to Anclote and 3½ feet (1.1 m.) to the county bridge, but the sides of some of the cuts had caved, leaving a clear channel not over 50 feet wide at several places. The river, outside of the channel, is but a foot or two deep, and above the bridge it is navigable only for boats. The channel is well marked by lights and beacons as far as Tarpon Springs. A pilot for the river may be found at Tarpon Springs.

Anclote is a small settlement on the north bank of Anclote River. No supplies can be had here, but there is telephone connection with Tarpon Springs, and supplies or a pilot can be telephoned for.

There is a slipways and small machine shop above Anclote, on the same side of the river, opposite Kramer Bayou. Boats up to 40 feet in length and 4-foot (1.2 m.) draft can be hauled, and some machine repairs can be made. There is also space for yachts to be stored here.

Tarpon Bayou, the bayou next eastward of Kramer Bayou, extends southward from the river at an opening one-half mile above the island that is opposite Anclote. On the eastern arm of this bayou there is a little concrete-faced basin. A draft of 4 feet (1.2 m.) can be taken into the basin and to the public wharf at its head, but a favorable tide is necessary.

Tarpon Springs is a winter resort and town on the south bank of Anclote River. It is the headquarters for the sponge-fishing fleet of this section of the coast and is often visited by small yachts. A railroad connects with the towns southward along the coast to St. Petersburg and with the interior. A draft of 5 feet (1.5 m.) can be taken at high tide to the **Sponge Exchange,** just below the county bridge, but the depth at the dock there is less than 3 feet (0.9 m.). The most convenient approach to the town for small boats is through the bayou and basin described in the preceding paragraph. Fresh water, gasoline, provisions, and boat supplies can be had at Tarpon Springs. There are facilities for making repairs to launches, and there are marine railways of about 60 tons capacity. The limits of length and draft that can be hauled out here are 85 feet and 6 feet, respectively. **Storm warnings** are displayed from a tower at the Sponge Exchange.

Directions, Anclote River.—Enter Anclote River on a 71° true (ENE. ⅛ E. mag.) course with two lights in range ahead and the lighthouse astern, leaving beacon No. 4 to starboard and lighted beacon No. 1 to port. When nearly up to the front range beacon,

turn eastward passing 25 yards off beacon No. 2, and then bring the range beacons in line astern on course 108° true (ESE. 5/8 E. mag.). Leave beacon No. 4 about 15 yards to starboard and steer around beacon No. 6 (red light) and head between beacons Nos. 5 and 8 for the dredged cut between two small islands. Pass through this cut to beacon No. 7 (white light) and pass midway between this beacon and beacon No. 10, and swing eastward to leave beacon No. 12 to starboard. Leave beacons Nos. 14, 16, and 18, close to starboard, and pass midway between beacons Nos. 20 and 9 (white light). From beacon No. 9, head eastward around the bend, leaving beacon No. 22 to starboard, and favor the north and west shore leaving beacons Nos. 24 and 26 to starboard, then along the right bank leaving beacons Nos. 28, 30, and 32, close-to on the starboard hand. Pass midway between beacon No. 11 (white light) and beacon No. 34, and proceed in midchannel to the wharves. The channel is said to have shoaled to a depth of 3 feet (0.9 m.) at low tide in the cut east of the island at the mouth of Kramer Bayou between beacons Nos. 28 to 32, and strangers are advised to navigate cautiously after leaving Anclote.

To go to the basin in the eastern part of Tarpon Springs, leave the river at **Kramer Bayou,** the first opening on the south side above Anclote post office, and follow the marked channel past a marine railway. Then favor the eastern and northern banks, passing a small bayou on the port hand, and turn into the second passage on the north side. Keep about in the middle of this passage and look out for submerged rocks. The public landing is on the north side, nearly at the head of this arm.

Northward of Anclote Keys, for 60 miles, to Cedar Keys, the coast is low and fringed with marshes averaging a mile in width. The coast line is broken by a number of shallow creeks and rivers, which can be entered only by small boats. Innumerable small keys and islets lie near the coast, and broken ground extends as much as 15 miles offshore in places. As a general rule, the depths decrease gradually as the coast is approached, but there are many shallow spots and rocks with deeper water inside. These extend for a distance of 40 miles northward from Anclote Keys, 7 miles offshore, and are known under the general name of **St. Martin Reef.** The outer limit of shallow water and detached shoals is marked by St. Martin Outer Shoal Beacon No. 22, a five-pile dolphin, with red triangular double day mark and white pointer, in a depth of 13 feet (4.0 m.), at a position 16 miles 343° true (N. by W. 3/4 W. mag.) from Anclote Keys Lighthouse.

Strangers should approach the coast with great care, and vessels of deep draft should keep in 5 to 6 fathoms (9.1 to 11.0 m.) Small vessels of 3 to 4 feet (0.9 to 1.2 m.) draft usually follow the coast more closely, especially during windy weather, and by keeping about 7 miles off find comparatively smooth water. This section of the coast is frequently obscured by a hazy atmosphere, and the vessels standing inshore close enough to sight land are mostly spongers and fishermen; these sometimes anchor in shoal water behind shell reefs, in places where the bottom is soft, and ride out the heaviest gales. Vessels of moderate draft can anchor in from 3 to 5 fathoms (5.5 to 9.1 m.) anywhere between Anclote Keys and Cedar Keys, and, as there is but little sea, they can ride out anything except a hurricane.

Bird Roosts, or **Racks,** have been built on the outermost shoals all along this coast between Tampa Bay and St. Marks River. They consist of a square platform on piles about 10 feet above the water, and make good landmarks. Since these racks are usually built on the outermost shoals, small boats can be assured of fairly good water by keeping outside of them.

New Port Richie is a small village on **Pithlochascootie River,** about 2½ miles from the entrance. It is located on the Dixie Highway and has telephone connection with Tarpon Springs and other towns. A draft of about 3½ feet (1.1 m.) can be carried across the bar at high water, and there is fairly deep water in the river. Gasoline, oil, and provisions can be obtained here. **Port Richie,** at the entrance of the river, consists of a few houses and post office.

Hudson, about 14 miles north of Tarpon Springs, is a post office and fish house on Hudson Creek. A draft of 3 to 4 feet (0.9 to 1.2 m.) can be carried into the creek on a favorable tide, but the entrance is difficult.

Aripeka is a post office and small settlement of a few houses, including an old sawmill on **Indian Bay.**

Bayport is a small village and post office on **Wekiwoochee River,** 24 miles north of Tarpon Springs. There is a hotel and general store, and gasoline, oil, and provisions can be obtained. There is road and telephone connection to **Brookville,** 18 miles away. A draft of about 4 feet (1.2 m.) can be carried by **Bayport** on a favorable tide. The channel begins close to southward of **Beacon Rock,** a prominent rock bare at high tide lying 2¼ miles offshore, and continues in a generally west by south direction among the oyster reefs into Wekiwoochee River. The channel is staked.

Chassahowitzka River empties into **Chassahowitzka Bay,** 33 miles north of Anclote Keys Lighthouse. A draft of 3 to 4 feet (0.9 to 1.2 m.) can be carried, on a favorable tide, to a small fishing settlement on the river. The channel is only partly staked and would be difficult for strangers. **Black Rock,** 2½ miles offshore from the entrance to the river, shows above water at all stages of the tide. **Chassahowitzka Point** on the north side of the bay, is a prominent high mangrove island.

Homosassa is a small village on **Homosassa River,** about 4½ miles from the entrance. It has railroad, telephone, and telegraph connection with Crystal River. There are four fish houses, a hotel, post office, and general store here. Gasoline, oil, ice, and provisions can be obtained. A draft of 4 feet (1.2 m.) can be carried to the village on a favorable tide, but the channel is not staked. To enter the river, pass about 2¼ miles northwestward of Chassahowitzka Point and head in a generally northeasterly direction, keeping in dark water, as the shoals on each side will show light colored. The course leads about 1½ miles southward and southeastward of Homosassa Islands. When close to the shore the course turns eastward, then southward, and passes close to northward of Shell Island. Chart No. 179 is the guide.

Homosassa Islands are prominent mangrove islands located about 2 miles offshore on the north side of **Homosassa Bay.**

Crystal River enters the Gulf 46 miles northward of Anclote Keys Lighthouse and 23 miles east-southeastward of Cedar Keys.

The approach to the river is across a shoal and **Crystal Reefs,** through which a channel, 6 feet (1.8 m.) deep and 60 feet wide, has been dredged; this channel is subject to shoaling and in 1925 there was a least depth of about 4 feet (1.2 m.) at low water. Inside the mouth there is ample depth and 6 feet (1.8 m.) can be carried to the **Cedar Mill** wharf, and 4 feet (1.2 m.) to the fish wharf, at the town of Crystal River, 6 miles up the river. The channel is easily followed. The outer dredged channel through the reefs is marked by single pile beacons with white pointers. The commerce on the river consists of fish, oysters, and cedar logs, and is carried on by means of shallow-draft motor boats. The town of **Crystal River** has railroad, telephone, and telegraph connection with the interior of the State. Gasoline, oil, and provisions can be obtained, and some repairs to small boats can be made here. The mean tidal range at the mouth of the river is 1.5 feet.

To enter Crystal River, keep at least 5 miles offshore until beacon No. 1, a single-pile with white square day mark and pointer, and beacon No. 2, a single pile with white pointer, bear about east by north, and then steer for these beacons. Pass between beacons Nos. 1 and 2 and steer 55° true (NE. ¾ E. mag.) passing to southward of beacon No. 3 and to northward of beacon No. 4. Pass between beacons Nos. 5 and 6 and steer 86° true (E. ½ N. mag.) through a dredged channel marked on both sides by beacons, into the entrance of the river. No directions for the river can be given other than to keep about in midstream.

WITHLACOOCHEE ANCHORAGE AND RIVER

Withlacoochee Anchorage lies 46 miles northward of Anclote Keys Lighthouse, 14 miles southeastward of Cedar Keys, and 7½ miles offshore. The approach to the anchorage from deep water of the Gulf is marked by Withlacoochee Entrance Beacon No. 1, a five-pile dolphin with double white square day mark and pointer. Beacon No. 3, a three-pile dolphin with white square day mark and pointer, is located on the northeastern side of the anchorage and marks the channel leading to Port Inglis. The anchorage consists of a small basin among the shoals, locally known as the **Loading Pool,** which has been used by ocean-going vessels while loading cargoes brought out in lighters from Port Inglis. There is room in the pool for five vessels of not more than 16 feet (4.9 m.) draft.

Withlacoochee River empties into the Gulf 7½ miles northeastward of Withlacoochee anchorage, from which a channel 85 feet wide and 10 feet (3.0 m.) deep has been dredged through the reefs and shoals to Port Inglis at the mouth of the river. This channel has shoaled considerable and in 1925 the limiting depth was 7 feet (2.1 m.) at low water. Above Port Inglis the limiting depths are 8 feet (2.4 m.) to Inglis about 7 miles from the mouth of the river; from Inglis to the lock in Florida Power Co.'s dam, 10 miles above the mouth, 5 feet (1.5 m.); from the lock to **Stocktons Ferry,** 34 miles above the mouth, 4 feet (1.2 m.); from Stocktons Ferry to the head of navigation at **Istachatta,** 66 miles above the mouth, 2 feet (0.6 m.) during half the year and 1 foot (0.3 m.)

during low stages. Navigation is more or less continually obstructed by water hyacinths. A lock 134 feet long and 36 feet wide has been built at the Florida Power Co.'s dam.

The commerce on the river formerly consisted chiefly of phosphate rock, but the rock is now shipped by rail to the east coast, and the main commerce is in fish, oysters, farm products and lumber. No licensed pilots are stationed here, but local pilots not licensed can usually be found at Inglis or Cedar Keys.

Port Inglis has been nearly abandoned since shipment of phosphate rock by water has ceased, and there are only one or two families left here.

Yankeetown, 3 miles above Port Inglis, is a small winter resort and fishing village. There is a hotel and store here and gasoline, oil, and provisions can be obtained.

Inglis, 7 miles from the mouth of the river, is a post office and railroad terminal. A phosphate plant is located here. Gasoline, oil, fresh water, and provisions can be obtained, and some repairs to small boats can be made here.

Tides and currents.—The mean rise and fall of tide is 2.4 feet. A tidal current sets easterly from the loading pool during flood and westerly during ebb. The latter is said sometimes to attain a velocity of 3 knots and must be taken into account by vessels coming in from the gas buoy. A strong northeasterly wind may increase the velocity of the ebb current and a southwesterly wind may decrease it.

Directions, Withlacoochee Anchorage and River.—From beacon No. 1, steer 65° true (NE. by E. 5/8 E. mag.), passing about 200 yards south of beacon No. 3. When the light (a white, square, pyramidal structure on piles, flashing white every 3 seconds) bears 46° true (NE. 1/8 N. mag.), steer for it, leaving the rock dump, the outer end of which is 700 yards southwestward of the light, 50 feet on the port side. Pass 125 feet southeastward of the light and continue about 50 feet southward of the rock dump, which for the next three-fourths mile is entirely on the north side of the channel. Then be guided by the channel stakes and spoil banks, which will be found on both sides of the channel. Strangers should proceed very carefully here as the channel is crooked and there are some rocks on the edges of the channel covered at half tide.

CEDAR KEYS

(Chart 480) is a group of keys and islets, 90 miles northward of Tampa Bay. They are low, sandy, and covered with a growth of mangrove trees. **Seahorse Key,** the southernmost key of the group, is 45 feet (13.7 m.) high, and may be distinguished by the tower of an unused lighthouse showing over the tops of the trees.

Seahorse Reef is a dangerous shoal with little depths over it, extending 11 miles southwestward from Seahorse Key. It is marked by a bell buoy off its outer end, and by a tall, white, skeleton steel, lighted beacon about 2 miles northeastward of the end.

Cedar Keys is a small town on **Way Key** and the terminus of a branch railroad line. A draft of 7 feet (2.1 m.) can be taken to the railroad wharf. Gasoline, fresh water, and some provisions and launch supplies can be had. Boats up to 50 feet in length and 4 feet

(1.2 m) draft can be hauled out, and some repairs to small machinery can be made.

Storm warnings are displayed at Cedar Keys.

Main Ship Channel, east of Seahorse Key, has a depth of 10 feet (3.0 m.), is well marked, and, although narrow and crooked, is easily followed in the daytime with clear weather. The deepest draft now using the channel is about 7 feet (2.1 m.).

Northwest Channel, north of **North** and **Middle Keys,** is marked by a light at the entrance and by occasional piles inside; with careful navigation it is good for a draft of 5 feet (1.5 m.) on a favorable tide. Small craft bound up the coast, if their draft will permit, should enter by the Main Ship Channel and leave by the Northwest Channel, rather than cross Seahorse Reef.

South Bar Channel, north of **Depot Key,** has a least depth of 5 feet (1.5 m.), but is poorly marked and difficult for strangers. It is used chiefly by local boats.

Anchorage.—Cedar Keys Harbor is protected on all sides by keys and shoals, and affords a safe anchorage for small vessels in all weathers. The best anchorages are off the town and off the northwest side of Depot Key; these anchorages are used by the smaller vessels. Good anchorage in 12 feet (3.7 m.) is found in the channel just above **Turning Point light,** northeastward of Seahorse Key. Shoals on both sides prevent a heavy sea, and the holding ground is good. Vessels waiting to enter the Main Ship Channel can anchor in 14 feet (4.3 m.), with Seahorse Key bearing 13° true (N. by E. mag.), distant 2½ miles.

Fog.—There is considerable fog in this locality during the winter months; southerly winds bring it in and northerly winds clear it away.

Tides and currents.—The mean rise and fall of tides at Cedar Keys is 2.4 feet. Outside the entrance, the current sets eastward on the flood and westward on the ebb. Inside, the currents in general follow the channels.

Directions, Main Ship Channel.—Pass southward and well eastward of the bell buoy at the south end of Seahorse Reef; steer northeastward until Sea Horse Key Old Tower bears 15° true (N. by E. ⅛ E. mag.) and then head for it. Pass 100 yards eastward of Main Entrance Light No. 1 (flashing white every 5 seconds) and steer 28° true (NNE. ¼ E. mag.) passing 75 yards to eastward of beacon No. 3, to a position 200 yards southeastward of beacon No. 5. From here head northeastward toward beacon No. 2; then turn northward so as to pass about 50 yards westward of beacons Nos. 2, 4, 6, and Turning Point Light No. 8 (fixed white). Swing around this light at a distance of about 50 yards and steer 57° true (NE. ⅞ E. mag.), passing 50 yards northward of beacon No. 10. When nearly up to beacon No. 12, haul northward, passing 100 yards northwestward of beacon No. 12 and 50 yards eastward of beacons Nos. 7 and 9. Haul around beacon No. 9 at a distance of about 50 yards and steer a little south of west to pass 50 yards south of beacon No. 14. Haul around beacon No. 14 at a distance of about 50 yards and steer northeastward for the wharves at Cedar Keys, passing 100 yards southeast of beacon No. 13 and 150 yards north-

west of the Dredged Cut Beacon, a large red, slatted structure on piles.

Boats of less than 5-foot (1.5 m.) draft can cross the Middle Ground northwest of Depot Key, through the Dredged Cut, which extends north and south about 50 yards eastward of the Dredged Cut beacon. From beacon No. 9 head about northeast by north until a north course will lead about 50 yards to eastward of the Dredged Cut beacon. Two piles on the north shore form a range for this cut, and when on range they will be seen slightly to westward of a prominent windmill at Cedar Keys. Continue on a northerly course until fully 200 yards past the Dredged Cut beacon before heading for the wharves at Cedar Keys.

To leave by the Northwest Channel.—Pass about 100 yards southeast of beacons Nos. 13 and 11, and pass close to northward of beacons Nos. 14 and 12. The shoalest water in this channel is at beacon No. 12, and boats should proceed carefully here. From beacon No. 12 head northwestward, passing 50 yards west of beacon No. 3 and close to eastward of beacon No. 10. Haul around beacon No. 10 close-to, and steer a little north of west, passing 75 yards north of beacon No. 8 and about 100 yards northward of beacons Nos. 6, 4, and 2, and about 100 yards southward of North Bank Light No. 1 (group flashing white, two flashes every 10 seconds).

To enter by South Bar Channel.—From a position 1 mile southwestward of Withlacoochee River Light, a course 318° true (NW. mag.) for 12½ miles leads to South Bar Light No. 2 (red, triangular, pyramidal, wooden structure on piles). Or, from Withlacoochee East Shoal Beacon No. 3, a course of 334° true (NNW. ½ W. mag.) for 11¾ miles leads to South Bar Light No. 2. Pass close to southwestward of South Bar Light No. 2, and steer 299° true (NW. by W. ⅝ W. mag.) with the south tangent of Dog Island nearly dead ahead. When beacon No. 1 comes on range with Dredged Cut beacon, steer about west by south, passing 50 yards north of beacon No. 1. Continue on course for nearly one-half mile past this beacon and then haul about three points to northward to pass about 50 yards southwest of beacon No. 3, and continue on course to the wharves at Cedar Keys.

CEDAR KEYS TO ST. MARKS RIVER

From Cedar Keys the coast extends in a general northwesterly direction for about 75 miles, and then westerly for 10 miles to St. Marks River. Inland for 1 or 2 miles it is low and marshy and backed by pine forests. The shore line is broken by a number of unimportant creeks and rivers, some of which are navigable for a draft of 4 to 5 feet (1.2 to 1.5 m.). Offshore for a distance of 10 miles the bottom is exceedingly irregular and broken, with coral heads and reefs everywhere in evidence. For light-draft vessels this shoal water affords fair anchorage, with considerable protection from heavy seas. This stretch of the coast is frequented mostly by spongers and fishermen, and strangers desiring to enter any of the rivers or creeks should employ one of them who is familiar with the route.

Suwanee Sound, beginning 4 miles north of Cedar Keys, is bounded on the west by a long line of narrow reefs known as

Suwanee Reef, and on the east by the mainland. It is about 8 miles long and has an average width of about 3 miles. There are several entrances to the sound, the main one being **Derrick Key Gap,** through which a channel 6 feet (1.8 m.) deep and 70 feet wide has been dredged. This channel is subject to shoaling, and in 1925 the controlling depth was 5 feet (1.5 m.). Single-pile beacons with slatted day marks, mark the channel. **Ranch Bar Gap,** 3½ miles northwest of Derrick Key, is good for a 5-foot (1.5 m.) draft through an unmarked channel. **West Gap,** 6¼ miles northwest of Derrick Key, is also good for a 5-foot (1.5 m.) draft through an unmarked channel. West Gap is used considerably by local boats, but is somewhat difficult for a stranger.

Suwanee River empties into Suwanee Sound through two mouths, known as **East Pass** and **West Pass.** A branch of West Pass is known as **Northwest Pass.** A channel 5 feet (1.5 m.) deep has been dredged through the shoals at the entrance to East Pass. This channel is marked by beacons and is the main entrance to the river. West Pass is little used and is good for only shallow draft boats. At high tide a draft of 3 feet (0.9 m.) can be taken out Northwest Pass through an opening in the reefs to the Gulf, but the channel is not marked and should not be attempted by strangers.

A draft of 5 feet (1.5 m.) can be carried from the Gulf up Suwanee River to **Rolands Bluff,** 65 miles above the mouth; 4 feet (1.2 m.) can be carried to **Ellaville,** 117 miles above the mouth; and at high stages small boats can go to **White Springs,** 150 miles above the mouth. The river is tidal for 21 miles above the mouth. Above the tidal section the slope is steep and the current rapid. Extreme fluctuations occur due to freshets. Low water usually occurs in the winter and high water in the fall months. The main commerce on the river consists of logs.

Directions, Derrick Key Gap to Suwanee River.—From a position 300 yards westward of North Bank Light No. 1, steer 8° true (N. ½ E. mag.) for 1 mile and then steer 19° true (N. by E. ½ E. mag.) heading for a bird rack. Run this course for 1 mile, or to within one-fourth mile of this rack, then haul slowly eastward, passing southeastward of the rack and several stakes that are south of Derrick Key. Then haul northward to pass westward of red beacon No. 2, and to eastward of black beacons Nos. 1 and 3, and 5. From here haul westward to pass to southward of beacons Nos. 4 and 6. From beacon No. 6, a course 331° true (NNW. ¾ W. mag.) for 4 miles leads to East Pass beacon No. 2. Pass to westward of beacons Nos. 2, 4, and 6, and to eastward of beacons Nos. 1 and 3. Beyond beacon No. 3, a few stakes mark the channel into the river.

Pepperfish Keys are the only objects between Cedar Keys and St. Marks Lighthouse that a stranger can recognize. They lie from one-fourth to 1 mile off the mainland and on account of their separation from the general coast line can be made out at a distance of from 5 to 6 miles. Four bird racks have been built off Pepperfish Keys, the northernmost lying 1¼ miles west by north of the keys, and the others 2, 3, and 3½ miles south of this one. A white sand beach on the north end of Pepperfish Keys can be easily identified. A tall clump of trees on **Pine Point** is also prominent.

Good, protected **anchorage** for small boats can be found northeast of the westernmost Pepperfish Keys. There is 6 to 8 feet

(1.8 to 2.4 m.) of water here and the bottom is sand with patches of bowlders. The approach to the anchorage is from the westward and extends in a generally east by south direction through an unmarked channel. Boats of less than 4 feet (1.2 m.) draft can enter by passing to northward of the northernmost bird rack, and by keeping in dark water, as the shoals show light colored.

Steinhatchee River discharges into **Deadman Bay,** 38 miles northwestward of Cedar Keys. A draft of 4 feet can be taken into the river on a favorable tide, and good depths will be found inside, but the approach is obstructed by shoals and oyster bars. There are no marks that could be recognized by a stranger.

Fenholloway River empties into the Gulf 64 miles northwestward of Cedar Keys, and eastward of Apalachee Bay. It can be entered with a draft of 4 feet (1.2 m) on a favorable tide, but local knowledge is necessary. It is navigable for only a few miles from the mouth.

Aucilla River empties into Apalachee Bay at the bend in the coast line 10 miles eastward of St. Marks Lighthouse. A draft of 5 feet (1.5 m.) can be taken into the river on a favorable tide, but the approach for a distance of 3 miles is a narrow winding channel, unmarked and difficult for a stranger.

St. Marks River empties into the head of **Apalachee Bay,** 83 miles northwestward of Cedar Keys and 54 miles northeastward of Cape St. George. A narrow channel, marked by buoys, leads between shoals to an anchorage known as **Spanish Hole,** which lies between oyster bars in the mouth of the river, one-half mile northwestward of the lighthouse. The depths are from 8 to 19 feet (2.4 to 5.8 m), with very shallow water close-to on all sides. Vessels of 7 feet (2.1 m) draft can enter the anchorage and continue up the river for about 5 miles to the village of St. Marks, but for a distance of 3 miles above the anchorage the channel is so narrow and crooked that a stranger will have much difficulty in getting through with over half that draft. The channel is well marked by beacons, but strangers must proceed carefully to keep off the oyster bars. The anchorage is easily reached during daylight and is well protected on all sides.

St. Marks Lighthouse is a white, conical tower, with a 1-story dwelling attached. The light is fixed white, 82 feet (25 m.) above the water, and visible 12 miles.

St. Marks is a small village on the north bank of St. Marks River, one-half mile above the junction with **Wakulla River,** a narrow stream which empties into St. Marks River from northwestward, at a point 5 miles above the lighthouse. The principal industries are logging and fishing. There is a sawmill, general store, and post office here. Gasoline, oil, ice, provisions, and fresh water in small quantities can be obtained. Coal can be shipped on order from Tallahassee, 19 miles away. There are two small ways here capable of hauling vessels up to 50 feet in length and 4½ feet (1.3 m) draft, and some repairs to small machinery can be made. There are railroad, telephone, and telegraph connections with Tallahassee.

Caution.—A rock pile, with 1 foot (0.3 m.) of water over it at low tide, lies in the middle of the river off the fish wharf, at St.

Marks. The rock pile is small in area and vessels can pass on either side.

Directions to the Anchorage.—Pass close either side of the perpendicularly striped buoy at the entrance and leave the red buoy to starboard, and steer 346° true (N. by W. ½ W. mag.) until 1 mile past the red buoy. Then haul westward about 10° so as to leave the second red buoy 75 yards on the starboard hand. Leave the third red buoy 100 yards on the starboard hand, steering about 351° true (N. by W. mag.), and then steer north-northeastward to the anchorage, keeping a sharp lookout for shoals. The **anchorage** is about northwest from the lighthouse, between oyster bars, and should be approached cautiously after rounding the inner buoy. Depths of from 8 to 19 feet (2.4 to 5.8 m.) are found in the channel and at the anchorage, with very shallow water (1 foot (0.3 m.) or less) close-to on all sides.

ST. MARKS RIVER TO CAPE SAN BLAS

From St. Marks River the general trend of the coast is about southwest by west for a distance of 54 miles to Cape St. George, and thence about west by north for a distance of 17 miles to Cape San Blas; but the coast line is very irregular and broken by numerous bays and entrances. The outer coast line is formed by a chain of narrow, wooded, sand islands, of which the most important are St. James, Dog, St. George, and St. Vincent. Cape San Blas is low and wooded. Between Dog and St. George Islands and the mainland are two important bodies of water, known as St. George Sound and Apalachicola Bay. The coral formation, which characterizes the coast of Florida from the Florida Keys to Apalachee Bay, gives way to a sand formation to the westward.

Shoals, with depths of as little as 3 feet (0.9 m.) on them, extend several miles offshore from the eastern end of St. James Island, from Cape St. George, and from Cape San Blas; they shift frequently during storms and are dangerous to navigation, but are marked at their outer ends by buoys.

Ochlockonee Shoal extends 8½ miles eastward of St. James Island, and, although separated from the mainland by lanes of moderate depths, there is no safe passage inside of it, except for small boats. Ochlockonee Shoals Sea Buoy No. 24, a first-class red nun, lies about 1 mile southeast of the shoal.

St. James Island extends westward from Apalachee Bay for a distance of 20 miles, and is separated from the mainland by Ochlockonee Bay and by three narrow connecting streams, known as Ochlockonee River, Crooked River, and Carrabelle River. **Lighthouse Point,** the southeastern end of St. James Island, may be seen from well offshore.

Ochlockonee Bay, Ochlockonee River, Crooked River, and Carrabelle River form an **inside passage,** about 38 miles long and 3 feet (0.9 m.) deep at low tide, from Apalachee Bay to St. George Sound. A draft of 4½ feet (1.4 m.) can be taken through on a favorable tide, but passage for all but open boats is obstructed by the railroad bridge mentioned under Ochlockonee River.

Ochlockonee Bay is a shallow bay 5 miles long in an east and west direction and 1 mile wide. The approach to the bay is ob-

structed by shoals that probably shift from time to time, and the southern half of the mouth is entirely closed by oyster bars, but there is a narrow channel into the bay and to its head, good for about 4 feet (1.2 m.) at low tide.

From Apalachee Bay the best water leads in a general west-northwesterly direction toward the south side of Ochlockonee Point, follows the point, at a distance offshore of about 150 yards, for three-fourths mile, and then leads in the middle of the bay until about 2 miles west of the point. Thence it follows close to the south shore until nearly up to some large buildings, and from there it leads through a channel, generally marked by bush stakes, to the mouth of the Ochlockonee River, favoring the north side in entering.

Ochlockonee River empties into the head of Ochlockonee Bay. It trends westward for a distance of 7 miles to Crooked River, then turns northward, and finally eastward. It has a low-water depth of 5 feet (1.5 m.) or more for a distance of 29 miles, and at least 3 feet (0.9 m.) for a distance of 100 miles. A railroad bridge, with fixed spans, crosses the river just below the junction with Crooked River, at a place known as **McIntyre.** This bridge has a clear span of 32 feet, with headroom of 6⅓ feet at low tide, but bolts spaced 9 feet apart project 8 inches below the girder.

Crooked River is a narrow, crooked, tidal stream 22 miles long, connecting Ochlockonee and Carrabelle Rivers. It is from 5 to 20 feet (1.5 to 6.1 m.) deep, except in a few short stretches where the depth is but 3½ feet (1.1 m.) at low water.

South Shoal extends southward from the east end of St. James Island for about 6 miles. The sea breaks on portions of the shoal even in good weather. South Shoal Whistle Buoy No. 26 lies ½ mile off the southern end of the shoal.

Dog Island Reef, lying 4 to 6 miles off the shore of St. James Island, extends from a point about 5 miles west-southwestward of Lighthouse Point to the eastern end of Dog Island, and has depths of 2 to 6 feet (0.6 to 1.8 m.) over a considerable part of it.

ST. GEORGE SOUND AND APALACHICOLA BAY

are adjoining bodies of water, 40 miles long and 3 to 6 miles wide, separated from the Gulf by Dog, St. George, and St. Vincent Islands. These bodies of water are generally shallow with numerous oyster reefs and shoals, all of which are dangerous to vessels striking them. A line of shoals, known as the **Bulkhead,** extends in a northerly direction from St. George Island to the mainland and forms the dividing line between St. George Sound and Apalachicola Bay. A channel 8 feet (2.4 m.) deep has been dredged across the Bulkhead; it is well marked by a lighted range and buoys and with the aid of the chart can be readily followed by a stranger if the weather is clear.

Except in the vicinity of East Pass, St. George Sound and Apalachicola Bay are navigated only by local oystermen, fishermen, towboats, and small craft of less than 7 feet (2.1 m.) draft. The principal commerce consists of lumber, oysters, and fish. St. George Sound can be entered from the Gulf by Duer Channel and by East Pass. It can also be entered by open launches of 3 feet (0.9 m.) draft coming

from Ochlockonee Bay by way of Carrabelle River. Apalachicola Bay can be entered from the Gulf by way of West Pass, and also with a draft of about 5 feet (1.5 m.) by an inside passage from St. Andrews Bay.

Duer Channel lies at the eastern end of St. George Sound between South Shoal and Dog Island Reef. It is subject to frequent change and is unmarked. It is occasionally used during stormy weather by light-draft vessels with local knowledge, as it gives access to the sheltered waters of St. George Sound, but it is difficult for a stranger. Local fishermen sometimes enter St. George Sound through the shoals close eastward of Dog Island.

Alligator Harbor is a shallow, unimportant body of water at the easterly end of St. George Sound, formed by a long narrow spit of land which extends westward from Lighthouse Point. There is a good anchorage east of **Peninsula Point** in 5 to 7 feet (1.5 to 2.1 m.) of water, hard sand bottom. There is a narrow, crooked channel, with a depth of 7 feet (2.1 m.), leading to it from Duer Channel, but for a stranger drawing over 5 feet (1.5 m.) it is difficult to follow, as there are no marks.

Dog Island is a narrow, wooded island 5 miles long, and the first land sighted in approaching from southeastward. The western end is a low barren sand spit which is reported to be gradually shifting northward.

East Pass, the principal entrance to St. George Sound, lies between Dog and St. George Islands, 23 miles eastward of St. George Lighthouse. The channel is dredged to a width of 150 feet and a depth of 17 feet (5.2 m.) (project depth 20½ feet) between shoals extending offshore for 2 miles. The channel is subject to change, and although it is well marked by buoys and a lighted range, it is a little difficult for a stranger. **A Swash Channel,** good for a draft of about 12 feet (3.7 m.), leads west-northwestward from buoy No. 5 to can buoy No. 1.

Carrabelle River empties into St. George Sound, 5 miles northward of East Pass. A channel 100 feet wide and 10 feet (3 m.) deep, marked by a range, has been dredged from the sound into the river and to the wharves at Carrabelle. Another channel, 100 feet wide and 18 feet (5.5 m.) deep, has been dredged in an 18° true (N. by E. ⅜ E. mag.) direction to the lower end of the dredged channel into the river. The dredged channels are subject to change; in 1925 a depth of 9½ feet (2.8 m.) could be taken to the wharves, and the channel leading to the river was good for a depth of only 14 feet (4.2 m.).

Carrabelle is a small town and lumber shipping port on the east bank of the Carrabelle River, one-half mile above its mouth. It is the terminus of a railroad and has steamer communication with Apalachicola (daily), St. Andrews Bay ports, Pensacola, and Mobile. Gasoline, fresh water, and some supplies can be had. Vessels of 50 tons can be hauled out and repaired.

St. George Island extends about 21 miles westward from East Pass and is densely wooded except its eastern end, which, like the western end of Dog Island, is a low barren spit.

Cape St. George Shoal extends 7 miles southward from the cape and consists of several detached spots with moderate depths between them.

Cape St. George Lighthouse is a white conical tower on the west end of St. George Island. The light is fixed white, 72 feet (22 m.) above the water, and visible 14 miles.

Cape San Blas Shoals, with depths of 3 fathoms (5.5 m.) or less, extend 4 miles southward from the cape, and spots with 4 to 5 fathoms (7.3 to 9.1 m.) over them are found 10 miles southward and southwestward from the cape. Deep-draft vessels should not approach the cape closer than 11 or 12 miles in these directions. Cape San Blas gas and bell buoy lies 6½ miles southward of the cape. An area of broken ground extends from 7 miles southwestward to 5 miles westward of the gas buoy and should be avoided by all except light-draft vessels.

A **swash channel** with a depth of about 8 feet (2.4 m.) lies about 1¼ miles offshore from Cape San Blas Lighthouse, and another channel, with a depth of 5 feet (1.5 m.), lies within 300 yards of the shore and inside the foundation of an old lighthouse, which is barely visible at low tide. Both channels are used by small local boats when the sea is smooth, but they are not recommended for a stranger. With a fresh breeze from any quarter south of east and northwest, rough water may be expected at the cape, and a breaking sea may extend far offshore. Between December and March **fog** is frequently encountered off Cape San Blas.

Cape San Blas Lighthouse is a brown, pyramidal, skeleton structure inclosing a cylinder. The sea is rapidly encroaching upon the base of the structure. The light is flashing white (flash 1 second, eclipse 19 seconds), 101 feet (31 m.) above the water, and visible 16 miles.

St. Vincent Sound is a shallow and unimportant extension northwestward of Apalachicola Bay. It can be entered from Apalachicola Bay from eastward and through Indian Pass from westward. **Indian Pass** has a narrow shifting channel and is not marked. It is used only by small local fishing craft, and should not be attempted by a stranger.

West Pass, entrance to Apalachicola Bay, is subject to frequent change and is but little used. The channel leads through the shoals, extending 3 miles southward from **St. Vincent** and **Sand Islands,** on the northerly and southeasterly sides, respectively. The bell buoy marking the entrance is 11 miles 75° true (ENE. ⅜ E. mag.) from Cape San Blas gas and bell buoy and 6 miles westward of Cape St. George Lighthouse. The project depth through West Pass is 18 feet (5.5 m.), but **East Bank** has built out and encroached on the channel so that in 1925 the controlling depth was 12 feet (3.6 m.). The channel across the bar is marked by buoys and a lighted range.

Link Channel is a dredged cut connecting West Pass with the Lower Anchorage. The project depth is 18 feet (5.5 m.), and in 1925 the controlling depth was 17 feet (5.2 m.). This cut is marked by a lighted range.

Apalachicola is a town on the north shore of the bay and west bank of the river of that name. It has communication by railroad with the interior, and by steamboat with Carrabelle, St. Andrews Bay ports, Pensacola, Mobile, and the river towns. A river steamboat makes weekly trips to Columbus, Ga., and intervening towns. There are shipped from Apalachicola considerable lumber, fish, and

oysters. The town is easily reached by a dredged channel of about 8 feet (2.4 m.) depth.

A channel less than 100 yards wide, but with ample depth, leads along the wharves and is separated from the main river channel by a shoal that extends from northward down to a point abreast of the lower wharves. The depths at the wharves range from 3 to 10 feet (0.9 to 3 m.).

Coal, gasoline, fresh water, provisions, and some ship chandlery can be had at Apalachicola. The facilities for making repairs to small vessels are good, and there is 1 marine railway that can haul out a vessel 150 feet long drawing 9 feet.

Apalachicola River, emptying into the northern part of Apalachicola Bay, is formed by the junction of the **Flint** and **Chattahoochee Rivers,** 92 miles northward of Apalachicola. Its mouth is obstructed by a broad shoal, which has been improved by a dredged channel 100 feet wide and 10 feet (3 m.) deep. This channel has shoaled, and in 1925 the controlling depth was 7½ feet (2.3 m.). About 35 miles above the mouth of the river a cut-off 1⅘ miles long leaves the river and joins **Lee Slough,** 6½ miles long, and lower **Chipola River,** 8½ miles long, and reenters Apalachicola River about 25 miles above its mouth. In 1924 a draft of 6 feet (1.8 m.) could be carried up Apalachicola River for 92 miles to the junction of Flint and Chattahoochee Rivers; 5 feet (1.5 m.) through the cut-off, Lee Slough, and Lower Chipola River; 3 feet (0.9 m.) through Upper Chipola River to **Look** and **Tremble Shoals;** 2 feet (0.6 m.) up Flint River to **Albany, Ga.,** 90 miles, and 2½ feet (0.8 m.) up Chattachoochee River to **Columbus, Ga.,** 143 miles. The distances given are approximate, and the available depths are at ordinary river stages. The high-water stage occurs between February and April, inclusive, and the low water between September and November, inclusive. The river is tidal in its lower reach, the effect of the tide being felt for approximately 25 miles above its mouth. A railroad drawbridge having an opening of ample width spans the river about 3 miles above its mouth.

Pilots.—Pilotage is compulsory. (See the extracts from the laws of Florida relative to pilotage on p. 4.) At East Pass regularly licensed pilots will be found on, or just inside, the bar. Rates for pilotage from sea to the quarantine anchorage are, for vessels less than 6 feet draft, $2 per foot; from 6 to 10 feet, $3 per foot; 10 to 14 feet, $4 per foot; 14 to 20 feet, $5 per foot. An additional charge of $10 is made for shifting a vessel from quarantine anchorage to loading anchorage.

At West Pass there are no pilots, but a regularly licensed pilot for the waters can be found at Apalachicola. Rules and rates are the same as for East Pass.

Towboats.—At East Pass sailing vessels usually enter under sail and tow out when loaded. The towboats belonging to the mills from which vessels load usually do the towing, but a towboat can be had by making signal off the entrance, although a vessel may have to wait until one is disengaged.

Towboats for West Pass can usually be found at Apalachicola.

Anchorage.—In St. George Sound vessels of over 14 feet (4.3 m.) draft anchor inside the western end of Dog Island, to which point lumber is brought in lighters from Apalachicola and Carrabelle.

Ballast is discharged 1 mile eastward of this anchorage. The upper anchorage, sometimes used for loading part cargoes, is between 2 and 4 miles westward of the northeastern end of St. George Island, and south of a line between a black beacon and a red beacon which mark the channel to Apalachicola Bay. The quarantine anchorage is between one-half and 1 mile south of the beacons at the entrance to the Carrabelle River, and has depths of 16 to 19 feet (4.9 m. to 5.8 m.). At all these anchorages vessels can ride out any gale in safety.

In Apalachicola Bay vessels can anchor anywhere after passing inside of Sand Island. Light-draft vessels find very good anchorage about 1 mile south of the entrance to the dredged channel leading into the mouth of Apalachicola River.

Quarantine.—The quarantine officer is stationed at Carrabelle. Vessels subject to visitation are boarded at the quarantine anchorage south of the town.

Hospital.—A relief station of the United States Public Health Service is located at Apalachicola. The nearest marine hospital is at Mobile.

Customs officers are stationed at Apalachicola.

Storm warnings are displayed at Carrabelle and Apalachicola.

Tides and currents.—At East Pass the mean tidal range is about 1.7 feet. The tidal currents are strong, sometimes having a velocity of 3 to 4 knots, and ordinarily at least 1 knot. They usually set across the shoals at an angle with the channel, and great care should therefore be taken not to be set toward the shoals on either hand.

The mean range of tide at West Pass and in Apalachicola Bay is about 1.5 feet. The currents are influenced by the winds and by freshets, and at times are very strong, especially the ebb; at flood they are generally weak. A velocity of 3 knots has been observed in the channel at a point inside the bar about 1¼ miles eastward of the bell buoy.

The ebb current runs out through West Pass and divides, part going to the southward over the breakers and part following the deeper water to the bar, the latter being the stronger.

DIRECTIONS, ST. GEORGE SOUND AND APALACHICOLA BAY

East Pass.—Coming from eastward on a clear day the trees on Lighthouse Point will be seen from southward of South Shoal buoy, and shortly afterwards the trees on the eastern end of Dog Island will be made out on the starboard bow. In a heavy sea a deep-draft vessel should keep in 5 to 7 fathoms (9 to 13 m.) until the bell buoy marking the entrance to East Pass is about in range with the lighthouse of Crooked River range, on the northwest side of the sound, bearing about 332° true (NNW. ¾ W. mag.). Enter the dredged channel on this course and pass the buoys close-to. If Crooked River range can be picked up, it is of great assistance in keeping in the channel, but it does not show well from outside the bar. The channel through East Pass is narrow and subject to change, and has shoals, with as little depth as 5 feet (1.5 m.) over them, close-to on both sides. Inside the pass the chart and the buoys are the guides.

Directions to Carrabelle.—After entering St. George Sound by East Pass and when past the west end of Dog Island, steer 23° true

(N. by E. ¾ E. mag.) so as to pass 350 yards westward of the island and 200 yards westward of can buoy No. 11. When this buoy is abeam steer 15° true (N. by E. ⅛ E. mag.) with Carrabelle River Entrance Light No. 2 (fixed red) slightly on the starboard bow. The shoal westward of the Turn Buoy No. 2 makes out well to southwestward of Carrabelle River beacon (black, day mark on single pile) and should be carefully avoided. Pass about 100 yards to westward of Turn Buoy No. 2 and when nearly up to the Entrance Light, the Carrabelle River range, two lighted beacons in the mouth of the river, the front a black structure showing a red light and the rear a white structure showing a white light, will close, bearing about 330° true (NNW. ⅞ W. mag.). Steer this range and leave the front range beacon 50 feet on the port hand and follow the trend of the east bank, keeping in mid river to the first wharves and then less than 100 feet off the wharves.

St. George Sound to Apalachicola.—Make Royal Bluff Shoals buoy No. 2 and head for the Turn Light (red, square, pyramidal, slatted structure on piles, white light) on course 243° true (SW. by W. ¼ W. mag.) passing 250 yards north of Mud Island Flats beacon and 100 yards south of the channel beacon. When up to the Turn Light, steer 203° true (S. by W. ¾ W. mag.) passing close to eastward of this light and about 100 yards to eastward of Porter Bar Light (red, square, pyramidal, slatted structure on piles, red light). When about 300 yards past Porter Bar Light, change course to 268° true (W. ½ S. mag.) and continue for 1¾ miles until the lighted range marking the dredged channel through Bulkhead Shoals comes on range. This cut is 100 feet wide and 8 feet (2.4 m.) deep, but strong currents often set across the channel and care must be taken to keep on the range. Steer this range passing to southwestward of red buoys Nos. 4 and 6. When about 300 yards past buoy No. 6, change course to 252° true (WSW. ⅛ W. mag.) with the light (fixed white), marking the entrance to the dredged cut leading to Apalachicola River, slightly on the starboard bow. Rounding this light sharply, head 351° true (N. by W. mag.) on Apalachicola range, with the bulkhead 25 yards on the starboard hand. This range is low and does not show well because of the vapor rising from the river. In 1925 the dredged channel was 100 feet wide and 7½ feet (2.3 m.) deep, but it is subject to rapid shoaling.

West Pass to Apalachicola.—The channel across the bar is subject to such frequent and marked changes that no definite courses can be given, and strangers are advised not to attempt to enter without a pilot. The best water across the bar is indicated by one black and three red buoys, which are shifted frequently to conform to changes in the channel. Pass to southward of the black buoy and to northward of the red buoys, and then steer 68½° true (NE. by E. ¾ E. mag.) on West Pass range, the lights of which are on pyramidal structures on piles, the front, a red light on a red day mark and the rear, a white light on a white day mark. When up to the black buoy just inside of Sand Island, haul southward and bring the lights of Sand Island Cut range in line, bearing 130° true (SE. ¾ E. mag.). These lights are of the same type as those of the first range and are close inshore. Steer this range until nearly up with the front light, and then steer so as to leave it 100 yards on the

starboard hand and to leave the second white light (white beacon), which is eastward of the rear range light, about ¼ mile on the starboard hand. Bring this last light on range with Cape George Lighthouse (showing over the trees) and steer 31° true (NNE. ½ E. mag.). This range leads to the dredged channel into Apalachicola River.

INLAND WATERWAY BETWEEN APALACHICOLA BAY AND ST. ANDREW BAY

The completion of that section of the intracoastal waterway which lies between Apalachicola Bay and St. Andrew Bay has made available a safe inland passage for small craft inside of Cape San Blas. This passage was dredged to a depth of 6 feet (1.8 m.) (project depth 5 feet (1.5 m.) and width 65 feet), but shoaling has occurred at the entrance to Wetappo River with a least depth in 1925 of 3½ feet (1.1 m.). One drawbridge and 2 ferries cross the channel, the bridge 18 miles and the ferries 20 and 30 miles above Apalachicola. The canal is free of tolls and has no locks. The distance from the town of Apalachicola to Panama City, on St. Andrew Bay, is about 53 miles by this passage, of which about 24 miles is through the canal and improved creeks.

The route follows Apalachicola River for 5 miles, until 1¾ miles above the railroad bridge, **Jackson River** for 4 miles, **Lake Wimico, Searcy Creek, South Prong, Wetappo River,** and East Bay, an arm of St. Andrew Bay. The channel through Wetappo River and the eastern part of East Bay has been dredged to a depth of 6 feet (1.8 m.), but shoaling has occurred to a least depth of 3½ feet (1.1 m.) at the entrance to Wetappo River. The dredged channel across Lake Wimico and at the entrance to Wetappo River is marked by stakes. The channel is tidal throughout.

ST. JOSEPH BAY

lies northward of Cape San Blas and is separated from the Gulf by a long narrow strip of land and succession of low sand hills, wooded in places, extending northward from the cape. The bay is 11½ miles long and varies in width from 2 miles at its entrance to 5½ miles at its widest part. It is one of the best harbors on the Gulf coast and is easily entered at any time by vessels of a moderate draft. The entrance is across shoals varying in depth from 15 to 19 feet (4.6 to 5.8 m.), and has an improved channel 300 feet wide and 24 feet (7.3 m.) deep. The dredged channel is subject to little change and is well marked by buoys and a slow range. The course from the entrance whistling buoy on the range is 60° true (NE. by E. mag.). A swash channel having a depth of 14 feet (4.3 m.), follows the shore of **St. Joseph Point** at a distance of one-fourth mile and passes between the shore and a shoal of about 8 feet (2.4 m.) depth. The entire bay, except for the southern third and a narrow shelf along the sides, is free from shoals and is from 24 to 36 feet (7.3 to 11 m.) deep. Small craft can find protected anchorages in **Eagle Harbor,** a small bight in the west shore 6 miles south of St. Joseph Point, and in the narrow sloughs in the south end of the bay.

The wreck of the barge Avio is located off the wharf at Port St. Joe. The wreck lies in a northeast and southwest direction, and has

a least depth over it of 8 feet (2.4 m.). A red and black nun buoy is located 20 yards from the northeast end of the wreck. The buoy is in 24 feet (7.3 m.) of water and lies 188 yards 258° from the end of the wharf of Port St. Joe.

Port St. Joe is a small mill town and lumber shipping port on the east shore; it has railroad communication with Apalachicola. The wharf at Port St. Joe has a depth of 22 feet (6.7 m.) and has fresh water piped throughout. The water is taken from deep wells and is charged with minerals that render it unpleasant for drinking. Coal in limited quantities can be had. Pilots are stationed at Port St. Joe.

The nearest customs officer is at Apalachicola. **Storm warnings** are displayed at Port St. Joe. Vessels going to Port St. Joe notify the customs officer at Apalachicola of their arrival, and he comes to the vessel at the first opportunity. Vessels in ballast may begin loading at once, if desirable, without awaiting the arrival of the customs officer. To clear, the master goes by rail to the customs office at Apalachicola.

The broken ground from the dredged channel into St. Joseph Bay northwestward to **St. Andrew Point** is known as **Bell Shoal.** It has depths of 16 feet (4.9 m.) near the dredged channel, but much shoaler depths approaching St. Andrew Point. The point should be given a berth of 3 miles. **Crooked Island** is a long, narrow island extending northwestward from St. Andrew Point to the entrance to St. Andrew Bay. It incloses a shallow, unimportant body of water known as **St. Andrew Sound.**

ST. ANDREW BAY

is a narrow, irregularly shaped, landlocked harbor of moderate depth, lying 27 miles northwestward of Cape San Blas. The entrance, southeastward of **Hurricane Island,** is obstructed by a shifting bar, which has been improved by dredging a channel 200 feet wide and 22 feet (6.7 m.) deep. St. Andrew Bay is the approach to the tributary inlets of East, West, and North Bays and to several towns and villages. The bay has some little commerce in lumber and naval stores.

East Bay is an arm of St. Andrew Bay, extending in a general east-southeasterly direction for about 18 miles. It is from three-eighth mile to 2¼ miles wide, and has a channel depth of 20 to 40 feet (6.1 to 12.2 m.) for 9 miles, and 12 feet (3.7 m.) for a farther distance of 3 miles. The inland waterway from Apalachicola Bay reaches the head of East Bay by way of Wetappo River. Daily mail and passenger boats run from the small settlements at the head of East Bay to Panama City and St. Andrew.

North Bay, extending in a northeasterly direction from St. Andrew Bay, is from three-eighths mile to 2¼ miles wide, and has a channel depth of 12 feet (3.7 m.) for 5 miles, and 5 feet (1.5 m.) to **Bayhead,** a village at the head of the bay. Several small, unimportant streams enter the bay at its head. **Southport,** on **Fanning Bayou,** is a post office and railroad terminal. A draft of 6 feet (1.8 m.) can be taken to the end of the wharf here. Gasoline, oil, and provisions can be obtained. **Lynn Haven** is a summer resort on the east shore of North Bay. A small yacht basin is formed by a bulkhead to which a draft of 6 feet (1.8 m.) can be carried. Pass

close to westward of the bulkhead. It has telephone and road connections with the other towns on St. Andrew Bay. Gasoline, oil, and provisions can be obtained. Daily boat service is maintained between Southport, Lynn Haven, and Bayhead. A drawbridge, with span of ample width, crosses North Bay about one-half mile above Lynn Haven.

West Bay, extending in a northwesterly direction from St. Andrew Bay, is 2 miles wide, and has a depth of 12 feet (3.7 m.) for 5 miles, and 8 feet (2.4 m.) for a farther distance of 3 miles, to near its head.

In East, West, and North Bays the deepest water is generally found near the middle of the bay, and, in the absence of marks or definite information, strangers should keep about midway between the shores.

St. Andrew is a town of about 1,500 inhabitants on St. Andrew Bay. Drafts of 14 to 16 feet (4.3 to 4.9 m.) can be taken to the wharves here. Gasoline, oil, provisions, and fresh water can be obtained. **Storm warning signals** are displayed here.

Panama City is a town of about 2,000 inhabitants. Drafts of 7 to 10 feet (2.1 to 3 m.) can be carried to the wharves, and 10 feet (3 m.) can be carried through a dredged cut into the yacht harbor in **Panama Bayou,** east of the town. This cut is marked by a row of piles which are placed about 10 yards to westward of the center of the channel. A drawbridge crosses the bayou near its mouth. Gasoline, provisions, fresh water, and some ship chandlery can be obtained here. There is a marine railway in Panama Bayou capable of hauling boats up to 7 feet draft and 60 tons. Some machine repairs can also be made.

Millville, on **Watson Bayou,** is a town of about 2,000 inhabitants, and is a lumber shipping port of some importance. A draft of 13 feet (4 m.) can be carried to the wharves, where there are depths of 12 to 15 feet (3.7 to 4.6 m.). Lumber schooners come to Millville to load, but large ships go to Bay Harbor. There are ways of 800 tons capacity here capable of hauling vessels up to a draft of 9 feet (2.7 m.) forward and 12 feet (3.6 m) aft and a length of 200 feet. Coal, gasoline, and provisions can be obtained.

Bay Harbor is the principal loading port for large steamers. A draft of 21 feet (6.4 m.) can be carried to the wharf here. The town has a population of only about 300, and few supplies can be obtained, but these can be had at Millville or Panama City. A wreck of a large steamer with most of it showing above water, lies southwestward of the wharf.

These four towns all have railroad communication with the interior of the State, and steamer communication with Apalachicola, Pensacola, and Mobile. Mail and passenger boats also make regular trips between these towns and the small villages on the other arms of the bay.

Prominent features.—Approaching the entrance to St. Andrew Bay from seaward, the shore at first appears as a low, unbroken line of woods. Upon nearer approach the sand beach shows in an unbroken, white line, with the exception of the entrances through East and West Passes, which show as dark breaks in the white expanse. These breaks, together with the range beacons, are the

marks by which the entrance can be identified. At times the smoke from the sawmills on the shores of the bay will be an aid to picking up the entrance. The water in the vicinity of the entrance is remarkably clear, and even in rough weather the outlines of the channels and spits can be distinguished by the difference in color of the water—deepest where it is darkest.

Channels.—East Pass, lying southeastward of Hurricane Island, is the main entrance to St. Andrew Bay from the Gulf and has been improved by dredging a channel 200 feet wide and 22 feet (6.7 m.) deep, which is marked by range lights and buoys. The pass is subject to considerable change, there being a general movement to the eastward, and the buoys may be displaced by storm action, so that the aids can not be depended upon to mark the best water, and it is inadvisable for a stranger to enter without a pilot. It is even customary for the pilots to sound and place markers before bringing in a large ship. The wreck of a schooner lies on the north side of the channel at the first turn. A fixed red light has been placed on this wreck. The light is 50 yards southwest of the front range light (Bar Range). Shoaling has occurred in the channel northwest of **Davis Point.** In March, 1925, the controlling depth through here was 21 feet (6.4 m.).

West Pass, west of Hurricane Island, has nearly filled up, is not marked, and is little used.

Pilots.—Licensed pilots are stationed at the northeasterly end of Hurricane Island during the hours of daylight and will come out in answer to signal. Pilotage is compulsory for most vessels. (See the extracts from the laws of Florida relating to pilotage on p. 4.) Rates of pilotage are, for vessels drawing less than 6 feet, $2 per foot; from 6 to 10 feet, $3 per foot; 10 to 14 feet, $4 per foot; 14 to 20 feet, $5 per foot; over 20 feet, $6 per foot.

Towboats may be had at Millville.

Anchorage.—Excellent anchorage can be found almost anywhere inside the bay where the depth is suitable. The usual anchorages are abreast the town of St. Andrew, between **Buena Vista** and **Dyers Point,** in mid-channel between **Dyers** and **Sulphur Points,** and off the wharves at Panama City. The quarantine anchorage is about midway between **Red Fish Point** and the beacon on **Courtney Point Shoal.**

Harbor master.—The harbor master assigns anchorages and berths to vessels and enforces the rules and regulations of the port. A charge of 1 cent per ton is placed upon all vessels entering the port to discharge or load cargo, and one-half cent per ton for each steamer entering for bunker coal. The harbor master is stationed at St. Andrew.

Quarantine.—The quarantine officer is stationed at Panama City. Vessels subject to visitation are boarded at the anchorage midway between Red Fish Point and the beacons on Courtney Shoal.

Hospital.—The nearest marine hospital is at Mobile.

A customs officer is stationed at Panama City.

Supplies.—Gasoline, fresh water, provisions, and some ship chandlery can be had at St. Andrew, Panama City, and Millville. Coal in small quantities can be had at Millville.

Repairs.—Minor repairs to small vessels can be made at Panama City where there are marine ways of about 60 tons capacity. At Millville there are ways capable of hauling vessels up to 200 feet in length and a draft of 9 feet (2.7 m.) forward and 12 feet (3.6 m.) aft. Some machine repairs can also be made.

Storm warnings are displayed at St. Andrew.

Tides.—The mean rise and fall of the tide is 1.4 feet. Winds affect the tide to such an extent that heights and times of tide are variable, and frequently all traces of normal tidal action are obliterated. Long-continued southerly winds raise the water level in the bay and northerly winds lower it.

Currents.—A strong ebb current sets outward through the dredged cuts and causes heavy tide rips in the exposed parts of the channels if the wind is on shore and of moderate strength. Small vessels bound in or out, when there is more than a moderate southerly or westerly breeze, should endeavor to reach the bar during flood current.

Directions, St. Andrew Bay.—Coming from eastward a course of 334° true (NNW. ⅝ W. mag.) for 32½ miles from Cape San Blas gas and bell buoy, or a course of 347° true (N. by W. ½ W. mag.) for 30 miles from a position 10 miles southwest of Cape San Blas lighthouse, will lead to the entrance buoy at St. Andrew Bay. Coming from westward it is well to keep 1 mile or more from the beach and in at least 4 fathoms (7.3 m.), on about a 127° true (SE. by E. mag.) course, until the entrance buoy is sighted.

The channel across the bar is subject to frequent change and the range can not be depended upon to lead in the best water. In March, 1925, the range was good until up to buoy No. 2A, and then the best water led to eastward of the range. The buoys are the best guides as they are frequently shifted to conform to the changes in the channel, also the breakers and the difference in the color of the water—deepest where it is darkest. Inside the entrance, the chart is the guide.

ST. ANDREW BAY TO PENSACOLA BAY

For 94 miles westward of St. Andrew Bay to Pensacola Bay the shore line is a gently curving sand beach, unbroken except at the entrance to Choctawhatchee Bay, 50 miles westward of St. Andrew Bay entrance. Except at the entrances to the bays the beach is steep-to and can be approached closely, and there are no outlying dangers. A slightly elevated wooded knoll, locally known as **Topsail Bluff**, stands 8 miles eastward of the entrance to Choctawhatchee Bay and can be seen for several miles, especially by vessels near the coast.

Choctawhatchee Bay is 25 miles long and averages 3 miles in width. It lies nearly parallel to the coast line, and is separated from the Gulf by land varying in width from one-fourth mile to about 4 miles. The depths of water in the bay decrease gradually from west to east, there being 18 to 25 feet (5.5 to 7.6 m.) over the western two-thirds, except near the shores, and a depth of 9 feet (2.7 m.) at the eastern limit of the bay. The bay and its tributaries have considerable traffic with Pensacola in lumber and naval stores.

East Pass is a narrow passage, barely visible at any distance offshore, affording entrance from the Gulf to the western part of Choc-

tawhatchee Bay. It is obstructed by a shifting bar, on which the depth is said to vary between 4 and 10 feet (1.2 to 3.0 m.) the least depth occurring after a southerly storm. Range lights have been placed to indicate the channel across the bar, but on account of frequent changes in the channel the range is unreliable. There is a fishing station on the north shore of the pass inside the entrance, and if the bar is passable some one acquainted with the channel will usually come out in answer to a signal. The best time for entering is with a rising tide, and it should never be attempted when the sea is rough and the tide is falling.

In entering East Pass without assistance, stand in to a distance of about one-fourth mile from the shore and examine the entrance carefully. Pay no attention to the range lights, but determine by inspection how the channel lies. The only guides for entering the pass will be the breakers on the shoals on each side of the channel, and the color of the water—deepest where it is darkest. In March, 1925, there was a shoal on the range with a channel on either side. The best channel was to westward of the range, and had a depth of 5 feet (1.5 m.) at low water. After crossing the bar the best water generally favors the north shore from the range lights to the point of **Santa Rosa Island,** and thence nearer the south shore until nearly up to the fishing village.

If going to the northern or eastern part of Choctawhatchee Bay, continue close to the southerly shore until the western end of **Moreno Point** bears north, then head about north by west through **North Channel,** which is unmarked but can be easily followed by the dark color of the water. This channel has a depth of about 5½ feet (1.7 m.) at low water.

If going to Garnier Bayou or Santa Rosa Sound, continue close to the southerly shore up to East Beacon. Pass to southward of this beacon and about 200 yards to northward of West Beacon. Then see directions for Santa Rosa Sound on page 97.

Choctawhatchee River, emptying into the eastern end of Choctawhatchee Bay, has a depth at ordinary low water of 4½ feet (1.4 m.) for 24 miles to the entrance of Holmes River, and then 2½ feet (0.8 m.) for the next 59½ miles, thence 2 feet (0.6 m.) to **Newton, Ala.,** 122 miles above the mouth. The entrance to the river is through **Cypress River,** which is about 1 mile long. The approach is through a dredged channel 60 feet wide and 6 feet (1.8 m.) deep, which is protected by a jetty built on the south side of the channel, the end of which is marked by a fixed white light. **Holmes River** has been improved by snagging in the channel, and is navigable for a draft of 4 feet (1.2 m.) to **Parish Landing** and 3 feet (0.9 m.) to **Vernon,** 24½ miles above its entrance into Choctawhatchee River. Two steamers make regular trips from Pensasola to Vernon, stopping at the towns on Santa Rosa Sound and Choctawhatchee Bay.

Freeport, on **Fourmile Creek** which empties into **La Grange Bayou,** is a post office and saw mill town of about 900 inhabitants. It has railroad communication with the interior of the State and steamboat communication with Pensacola and the towns on Choctawhatchee Bay and River. A draft of 4½ feet (1.4 m.) can be carried through a staked channel in La Grange Bayou to Fourmile

Creek where the water deepens. Gasoline, fresh water, and provisions can be obtained here. A ferry makes regular daily trips to Port Washington, at the head of Choctawhatchee Bay, carrying automobiles, passengers, and mail.

Valparaiso is a small town at the head of **Boggy Bayou.** The entrance to the bayou is marked by a fixed white light on the west side of the channel off **Boggy Point.** The bayou is deep and a draft of 8 feet (2.4 m.) can be easily carried through the middle of the bayou to the wharves at Valparaiso. Gasoline, fresh water, ice, and provisions can be obtained here. There are facilities for repairing vessels of 5-foot (1.5 m.) draft or less and length up to 50 feet. There is telephone connection with **Crestview,** where connection can be made with telegraph. There is daily boat service with Pensacola and the small towns in between.

New Valparaiso, on **Tom Bayou** which is a branch of Boggy Bayou, is a post office and summer resort. Gasoline, fresh water, provisions, and some yacht supplies can be obtained. There is a marine ways capable of hauling out boats up to 9 feet (2.7 m.) in draft and 75 feet in length. Some machine repairs can also be made. There is daily boat service with Valparaiso and Pensacola. A draft of 10 to 12 feet (3.0 to 3.7 m.) can be taken to the wharves here. **Storm warnings** are displayed.

Port Washington, at the head of Choctawhatchee Bay, **Portland** on **Alaqua Bayou, Santa Rosa** on **Hogtown Bayou, Bolton** on **Rocky Bayou, Destin** on Moreno Point, and **Garnier** on Garnier Bayou are post offices and small fishing villages. Daily mail and passenger boats stop at some of these villages.

Santa Rosa Sound is 33 miles long and from 250 yards to 1¾ miles wide. It lies parallel to the coast westward of Choctawhatchee Bay, and affords an inside passage for light-draft vessels between Choctawhatchee and Pensacola Bays. The approach from Choctawhatchee Bay and the eastern part of the sound, known as the **Narrows,** have been dredged where necessary to a depth of 6 feet (1.8 m.), but owing to gradual shoaling the controlling depth in 1925 was about 5½ feet (1.7 m.). The western part of the sound and the approach from Pensacola Bay have channel depths of 15 feet (4.6 m.) or more. In the western part of the sound, lying from one-half to 1½ miles northeastward of the quarantine station, and in **English Navy Cove** there are several submerged ballast dumps, all of which have very little water over them and are dangerous to small craft. The channel through the sound is marked by lights and lighted ranges and by careful attention to the sailing directions and a sharp lookout for indications of shoals, a stranger should be able to take a draft of 5½ feet (1.7 m.) through. Two steamers and four motor launches make regular trips through the sound.

Camp Walton is a post office and summer resort. There is a hotel and general store here. Gasoline, fresh water, and provisions can be obtained. About one-half mile eastward of the town is a slipways where small launches can be hauled out. There is daily boat service to Pensacola and Valparaiso, and boats three times a week to Freeport and Choctawhatchee River towns. **Storm warnings** are displayed here.

Mary Esther, Florrosa, and **Harris** are post offices and summer resorts on the north shore of the **Narrows.**

Directions, Santa Rosa Sound.—From a position 200 yards northward of Choctawhatchee Bay west beacon, steer 269° true (W. ½ S. mag.) with Santa Rosa Sound range lights in line ahead. After entering The Narrows favor the north shore for about 1½ miles, and when about one-fourth mile past Camp Walton cross The Narrows on the Hurricane Crossing Lighted Range, course 244° true (SW. by W. ¼ W. mag.), and then follow closely the south shore for 1½ miles to a cut. Leave the spoil bank here, a round grassy island, on the starboard hand and cross to the north side, leaving the eastern side of the point, on which are several tall pine trees, close-to but avoiding the north side of the point. Favor the north shore, passing to northward of Circle Crossing Range Lights. Bring these range lights in line astern, course 270° true (W. ⅜ S. mag.), and pass to northward of the spoil bank, a low grassy island. When 1¾ miles past the front light, steer 291° true (WNW. ½ W. mag.) for a white house on the north shore, go slowly, and feel the way carefully between the shoals on each side.

When about 200 yards from the north shore steer about southwest to the south side of The Narrows. Then favor the south shore for 3 miles, giving the points on that side a berth of between 50 and 100 yards. Pass 100 yards to southward of Upper Pritchard Long Point Light, white light on red beacon, and steer 270° true (W. ⅜ S. mag.), passing 100 yards to southward of Lower Pritchard Long Point Light, white light on red beacon.

From Lower Pritchard Long Point Light favor the north shore until up to Bunch Timber Front Light. This range, the front light red on a white beacon and the rear light white on a black beacon, marks the channel across the middle ground on a 223° true (SW. ½ S. mag.) course. Steer this range, with the spoil bank showing on the western side of the channel, until a little more than halfway across the sound, then steer 294° true (WNW. ¼ W. mag.) until about one-fourth mile off the northerly shore. Then keep between one-fourth and one-half mile off that shore until up with the light at the west end of the sound. Leave Deer Point Light (white), at the west end of the sound, 200 yards on the starboard hand and steer west-northwestward into Pensacola Bay.

PENSACOLA BAY

(Charts 413 and 490) is about 12½ miles long, 2½ miles wide, and easy of access either day or night. It is the approach to several towns and the city of Pensacola; to Escambia and East Bays, making northward and eastward, respectively, from its eastern end; and to Santa Rosa Sound. Pensacola Bay is one of the important harbors on the Gulf coast, having a considerable foreign and coastwise trade in cotton, lumber, naval stores, and general merchandise; steamers also call here for bunker coal. It affords excellent shelter and anchorage, and in winter is frequently used by coasting vessels as a harbor of refuge.

The entrance to Pensacola Bay is three-fourths mile wide and partly obstructed by shoals extending 1½ miles seaward. **East Bank,** with 13 to 18 feet (4.0 to 5.5 m.) over it, extends 1 mile southward of the western part of Santa Rosa Island. **Caucus Shoal,** with depths of 2 to 18 feet (0.6 to 5.5 m.), extends 1½ miles from the point on the western side of the entrance. **Middle Ground**

is between the two and has depths of 10 to 18 feet (3.0 to 5.5 m.) over it. All the shoals are shown on the charts.

Across the bar formed by these shoals there is a well-marked channel 400 feet wide, 30 feet (9.1 m.) deep (in 1924), and maintained by dredging to a depth of at least 30 feet (9.1 m.). A **Swash Channel** leads eastward of the middle ground and close to the western extremity of Santa Rosa Island. It has a depth of about 10 feet (3.0 m.), and is used only by small local vessels. Inside the entrance a depth of 30 feet (9.1 m.) can be taken up Pensacola Bay 7½ miles to the city of Pensacola, and about 18 feet (5.5 m.) to the junction with Escambia and East Bays. The lower part of the bay is free from shoals, except close to the shores, and the depths range from 20 to 40 feet (6.1 to 12.2 m.).

Pensacola Lighthouse is a conical brick tower, lower third white, upper two-thirds black, on the north side of the west end of the bay. The light is flashing white (flash 4.3 seconds, eclipse 55.7 seconds), 191 feet (58 m.) above the water, and visible 20 miles.

Warrington is a small town on the north shore of the bay about 2 miles above the entrance. It has electric railway communication with Pensacola. The depth at the wharf is 12 to 15 feet (4.6 to 5.5 m.). On the point east of the town is a **United States naval station** and a **naval radio station,** call letters NAS.

Bayou Chico empties into Pensacola Bay about 1 mile west of Pensacola. Two drawbridges cross the bayou just inside the entrance. A shipyard is located above the bridges on the north bank. The entrance to the bayou is through a dredged channel 10 feet (3.0 m.) deep, marked by a lighted range, the front light red and the rear white, and by rows of piles on each side of the channel. Two beacons form a range to mark the dredged cut through the drawbridges. Above the bridges a draft of 10 feet (3.0 m.) can be carried along the north shore for a distance of nearly 1 mile.

Pensacola is an important commercial city on the north shore of the bay 7½ miles above the entrance. It has railroad communication with Gulf points and with the north and steamer communication with Mobile, St. Andrew Bay, and Apalachicola, and there are three steamers making regular trips to Atlantic coast ports. Small steamers and motor launches carrying passengers and freight make regular trips to **Bagdad** and **Milton,** on Blackwater River, and to the towns on Santa Rosa Sound, Choctawhatchee Bay and River. The principal articles of export are resin, turpentine, pitch, tobacco, cotton, lumber, timber, fuel oil, and sulphate of ammonia. Supplies of all kinds can be obtained here, and there are facilities for making repairs to vessels. (See Repairs.)

The **terminal facilities** are excellent, having ample berthing space and depths at the wharves of 10 to 30 feet (3.0 to 9.1 m.), soft mud bottom. The coaling pier, 2,240 by 120 feet at outer end, has a depth of 28 feet (8.5 m.), berthing space 2,325 feet. It is approached by a dredged channel 28 feet (8.5 m.) deep, marked by a range; front, a white barrel on black pole, red light; and the rear a white barrel on white pole, red light; course, 8° true (N. ¼ E. mag.). The Louisville & Nashville Railroad Co. have three more piers, with depths of 28 feet (8.5 m.) and with a total berthing space of 5,010 feet, open to all carriers not competing on equal terms. These piers are approached through a dredged channel 28 feet (8.5 m.) deep.

The Gulf, Florida & Alabama Railway terminals consist of three piers, with a total berthing space of 3,800 feet, open to all carriers not competing on equal terms. Depth of water available at each of these piers is from 18 to 30 feet (5.5 to 9.1 m.) The approaches are through channels dredged to 30 feet (9.1 m.) or less, marked by range beacons. The Palafox and Baylen Street wharves have an available depth of from 10 to 18 feet (3.0 to 5.5 m.) and are used almost exclusively by the owners, and also to some extent as landings for river and small coastwise craft.

Escambia Bay extends 9 miles northward from Pensacola Bay. A little over 5 miles above its mouth it is crossed by a railroad bridge with a draw opening 85 feet wide on each side of a central pier. The depths in the bay shoal gradually from 15 feet (4.6 m.) at the mouth to 7 feet (2.1 m.) 2 miles above the bridge. **Mulat** is a small town on the east shore of the bay above the bridge. **Escambia** is a small settlement on the west shore of the bay above the bridge. Ferries, carrying automobiles and passengers, make regular trips across the bay between these two towns.

Escambia River empties into the bay through several mouths. A channel 5½ feet (1.7 m.) deep and 150 feet wide has been dredged to the easterly branch of **East River,** which is the main entrance to Escambia River. This channel has shoaled considerably, and in 1924 the controlling depth was 4½ (1.4 m.) feet in a channel 40 feet wide. A white light, on a black pile with arm and topmast, is located on the south side of the entrance to the channel. A draft of 4½ feet (1.4 m.) can be carried to Moline, 18 miles above the mouth, and thence 3 feet (0.9 m.) to the State line. From December to May, high water increases the depth of the river 2 feet (0.6 m.) or more. The main commerce is in cypress logs.

East Bay is an eastward extension of Pensacola Bay, with which it is connected by a passage three-fourths mile wide between shoals. It varies in depth from 8 to 12 feet (2.4 to 3.7 m.), but there are several small shoals of less than 5 feet (1.5 m.) depth scattered over the bay and a submerged rock pile a little over 1 mile southeastward from **White Point.** A black buoy No. 3 marks this rock pile. Middle beacon is located on a 5-foot (1.5 m.) shoal on the west side of East Bay Channel. Three naval air station beacons, A, B, and C, are located in the bay.

Blackwater River empties into **Blackwater Bay,** the northern arm of East Bay. A channel 9 feet (2.7 m.) deep and 100 feet wide has been dredged through Blackwater Bay and River to the town of **Milton,** 4 miles above the river mouth and 21 miles from Pensacola. This channel is subject to shoaling and in 1924 the controlling depth was 6½ feet (2.0 m.).

Pinewood is a village at the mouth of Blackwater River, on the west bank. **Bagdad** and **Milton** are towns 2½ and 4 miles, respectively, above the mouth of the river, on the west bank. Milton is considered the head of navigation. Lumber is loaded on lighters here and towed to Pensacola for shipment. The railroad bridge at Milton has a draw opening 80 feet wide. There is a small marine railway here. Milton has railroad communication with Pensacola and the interior of the State and steamboat communication with Pensacola three times a week. Gasoline, fresh water, and provisions can be obtained at Bagdad and Milton.

Directions, East Bay, Blackwater Bay and River.—The channel through East and Blackwater Bays is marked by beacons and lights, but requires local knowledge for drafts of more than 5 feet (1.5 m.). The chart of these waters can not be depended upon to show the latest conditions. Vessels of more than 5 feet (1.5 m.) draft usually pass one-half mile eastward of the light that is 1½ miles southeastward of White Point. Then they round somewhat to the eastward for 2½ miles to avoid oyster reefs, pass one-fourth mile east of the beacon in the upper part of the bay, and then bring the lights of East Bay Channel range in line when about one-fourth mile north of the beacon.

The front light of this range is a black, square, pyramidal, slatted structure, red light, and the rear light is a white, square, pyramidal, slatted structure, white light. Escribano Point beacon, red beacon of same structure as the lights, will be seen slightly to starboard of the range. Haul around this beacon and bring Blackwater Bay Channel range lights in line astern, course 27° true (NNE. mag.). These lights are the same type as the East Bay range. Hold this range until up to Bay Point light (red light) and haul northwestward, passing close to westward of this light.

Pass close to eastward of the next point on the west shore, and head for Shield Point Light (white light) passing to westward of a shoal in mid-river which can be easily seen. Pass 100 yards off Shield Point Light and haul slowly northward to the other bank of the river and enter the narrow channel. About one-half mile farther the river branches; take west branch avoiding shoals on the port hand and passing close to the point of the island on the starboard hand. If going to Bagdad, take the next branch to the west which will lead to the wharves at Bagdad. If going to Milton, continue in main channel, keeping about in midstream, to the wharves above the drawbridge.

East Bay River is a shallow unimportant stream emptying into the eastern end of East Bay.

Santa Rosa Sound is described on page 96.

Big Lagoon is a shallow, unimportant body of water about 5 miles long and from one-fourth to 1 mile wide, extending westward from Pensacola Bay at the entrance. It has a low-water depth of only a few inches at the entrance, and is separated from the Gulf by a narrow strip of sand beach, so low in places that the sea washes over it during strong southerly winds.

Prominent features.—In the vicinity of Pensacola Bay entrance there are a few prominent objects, consisting of buldings, chimneys, radio towers, fortifications, and Pensacola lighthouse. Eight miles eastward of the entrance a water tank shows over the tops of the trees. A prominent clump of trees and a wreck on the beach, 20 and 27½ miles, respectively, eastward of the entrance, can frequently be made out if in their vicinity. The wreck of the battleship *Massachusettes* lies on the point of Caucus Shoal west of the entrance and can be seen when several miles distant.

Pilots for Pensacola Bay will be found near the entrance between sunrise and sunset. They board vessels in the vicinity of the whistling buoy. Pilotage is compulsory for most vessels. (See extracts from the laws of Florida relating to pilotage on p. 4.) The rates are, for steamers or vessels drawing less than 6 feet, $1 per one-half

foot of draft; for vessels drawing 6 feet and less than 10 feet, $1.50 per one-half foot of draft; vessels drawing 10 feet and less than 14 feet, $2 per one-half foot of draft; vessels drawing 14 feet and less than 20 feet, $2.50 per one-half foot of draft; vessels drawing 20 feet and upward, $3 per one-half foot of draft. Pilots for East and Escambia Bays can be gotten from the towboats.

Towboats sometimes cruise outside the bar, and they can always be found at Pensacola for towing over the bar or up any of the bays. With a fair wind sailing vessels sometimes enter Pensacola Bay without their assistance.

Anchorage.—Good anchorage can be found in all parts of the bay except southward of the naval station. The usual anchorage is off the city of Pensacola, where the holding ground is good and vessels can ride out any gale.

The **harbor master** assigns anchorage and berths and enforces the rules and regulations for the port. A charge of 1 cent per ton is placed upon every vessel entering the port to discharge or load cargo and one-half cent per ton for each steamer entering for bunker coal. The harbor master pilots vessels from Pensacola to the quarantine station or vice versa for a uniform charge of $10. The charge for shifting a vessel from anchorage to dock, dock to anchorage, or dock to dock is $10 and $5.

Quarantine.—Vessels subject to visitation by the quarantine officer are boarded between sunrise and sunset at anchor anywhere south of the wharves at Pensacola. The quarantine station southeastward of **Deer Point,** at the entrance to Santa Rosa Sound, has been abandoned. If fumigation is necessary, the work will be done at Pensacola.

Hospital.—A relief station of the United States Public Health Service is located at Pensacola. The nearest marine hospital is at Mobile.

A **Coast Guard Station** is established on the south side of Santa Rosa Island, 2½ miles eastward of the entrance to the bay.

Supplies.—Bituminous coal, fresh water, gasoline, provisions, and ship chandler's stores can be had at Pensacola and, in limited quantities, at Warrington, Bagdad, and Milton.

Repairs.—There is a floating dry dock at Pensacola of the following general dimensions: 380 feet over keel blocks, 74 feet between wings, and 18 feet of water over the blocks. The largest marine railway can haul out a vessel of 300 tons, 110 feet long, drawing 9 feet forward and 14 feet 8 inches aft. There are also marine railways for small boats at Pensacola and Milton.

Storm warnings are displayed from the American National Bank Building, at Pensacola, where they can be seen from the harbor; and at Bagdad.

Tides.—The mean rise and fall of the tide at the entrance and in the bay is 1.3 feet, but it is greatly affected by the force and direction of the wind. Northerly winds sometimes lower the water surface 1½ feet, and abnormal southerly winds raise it the same amount.

Currents.—The currents have considerable velocity on the bar at the entrance. In **Caucus Cut,** for two hours at the strongest of the ebb, the normal current has a velocity of 2 to 2½ knots, setting southwestward diagonally across the channel. The flood has less velocity and sets northeastward. Elsewhere the currents follow the

general direction of the channel. The flood has greater velocity following a norther than at other times.

Winds.—Northers occur occasionally during the winter. They have little effect on the shipping at anchor in the harbor, except to lower the water.

Fog.—From January to April there is considerable hazy or misty weather; usually southerly winds bring it in and northerly winds clear it away.

DIRECTIONS, PENSACOLA BAY

Vessels approaching Pensacola Bay by day and not sure of their position can easily tell by the appearance of the land, when about 4 miles off, whether they are eastward or westward of the entrance. Eastward for a distance of 40 miles **Santa Rosa Island** presents a white sand beach and low, white sand hills with scattered clumps of trees and bushes; back of this, on the mainland, are thick woods. Westward of the entrance, for a distance of 40 miles, the shore is low and thickly wooded nearly to the water, showing no breaks and very few hillocks. The lead, too, will indicate whether a vessel is east or west of the entrance, the 10-fathom (18.3 m.) curve approaching the coast very much more closely eastward than it does westward of the entrance. Depths of 10 fathoms (18.3 m.) or less, 3 miles or more from the beach, indicate that a vessel is off the entrance or westward of it.

At night or in thick weather it is well for a vessel not sure of her position to keep in at least 12 fathoms (22 m.) until the lighthouse is sighted or the position is otherwise determined.

The following courses and distances lead to Caucus Cup buoy off the entrance to Pensacola Bay:

From a position 12 miles south-southwest of Cape San Blas lighthouse, 296° true (WNW. mag.), 109 miles.

From a position 1 mile south of Mobile Entrance buoy (for moderate draft), 77° true (ENE. ½ E. mag.), 41 miles.

From South Pass, Mississippi River, 51° true (NE. ⅛ E. mag.), 125 miles.

From the entrance buoy the **courses and distances to** the anchorage off the wharves at Pensacola are as follows:

	Course		Distance in nautical miles
	True	Magnetic	
	°		
1. On Caucus Cut range to gas buoy No. 8	341	NNW	2
2. On Fort Barrancas range past buoy No. 12. Shoaling has occurred on this range. Keep to westward of buoy No. 10A.	11	N. ⅝ E	¾
3. On Fort McRee range astern	57	NE. ¾ E	½
4. On Pensacola Bay range astern to gas and bell buoy No. 19.	102	E. ¾ S	1½
This course leads about ¼ mile off the north shore of Santa Rosa Island when abreast of Fort Pickens and care should be taken not to get southward of the range.			
5. Crossing Pensacola Bay	42	NE. ⅝ N	4½
6. To anchorage off wharves	4	N	½ to 1

PERDIDO BAY

Perdido Bay is an irregular shaped body of water of from 7 to 12 feet (2.1 to 3.7 m.) depth, connected by **Bay La Launch** with **Wolf Bay**, a narrow tributary extending westward. Perdido Bay and **Perdido River**, entering the bay from northward, form part of the boundary between the States of Florida and Alabama. Perdido Bay is connected with the Gulf by a narrow inlet 11½ miles westward of Pensacola Bay entrance and 28½ miles eastward of Mobile Bay entrance. At a distance of 1 mile from the shore the entrance is not easily distinguished, and there are no marks which a stranger would recognize. With local knowledge about 4 feet (1.2 m.) can be taken into the bay from the Gulf at mean low tide, but the channel is narrow and tortuous and subject to frequent changes.

There are seven small settlements and post offices on the shores of the bay and its tributaries, of which the most important is **Millview**, a sawmill village at the northeast end of the bay, which has railroad communication with Pensacola and launch communication with the other settlements on the bay.

MOBILE BAY

Mobile Bay lies 40 miles westward of Pensacola Bay entrance and 90 miles northeastward of the South Pass of the Mississippi River. It is the approach to the city of Mobile and to the Alabama and Tombigbee Rivers, the two most important streams in the State of Alabama. The lower part of the bay is a good anchorage and harbor of refuge and is easy of access either day or night when the sea is not breaking on the bar. The entrance to the bay has a width of 2¾ miles between Mobile Point on the east and the eastern extremity of **Dauphin Island** on the west, but it is largely filled with shoals extending 2 to 4 miles offshore and terminating in two low, shifting islands, known as **West Sand Island** and **Pelican Island.**

Main Ship Channel, with a depth of 33 feet (10.1 m.), leads between **Southeast Shoal** and **Mobile Point** on the east, and **Sand Island Shoal** and **West Bank** on the west, up to the lower anchorage. Across the bar it has a depth of 21 feet (6.4 m.) or more in a channel width of one-half mile, and a depth of 33 feet (10.1 m.) in a dredged channel 350 feet wide. For several years this channel has been slowly shifting to the westward, but it is now believed to have reached about the limit of its westward movement. Inside the bar the depths in the channel increase to as much as 60 feet in places, with a least width of three-eighths mile between the shoals which rise abruptly from the deep water of the channel. The channel is marked by Sand Island lighthouse, Mobile Point range, and by buoys.

A **swash channel,** with a depth of 7 feet (2.1 m.), leads from eastward, close around Mobile Point into the upper end of Main Ship Channel. Another channel, depth 6 feet (1.8 m.), known as **Pelican Passage,** leads from westward, south of Dauphin Island and across **Pelican Bay,** to the Main Ship Channel. These channels shift frequently and are not marked.

Mobile Bay Channel extends from the lower anchorage to the mouth of Mobile River, a distance of 25 miles, and has a project

depth of 30 feet (9.1 m.) and a width of 300 feet. This channel is subject to shoaling, but an average depth of 29 feet (8.8 m.) is maintained for a width of 220 feet. The bottom of the channel is formed of such soft material that a draft of 30 feet (9.1 m.) can usually be carried through it. This channel is marked by lights (square houses painted red, on pile foundation) on the eastern side at intervals of about 1¼ miles, and by black spar buoys on the western side. A spoil bank with about 7½ feet (2.3 m.) of water over it is located along the western side of the channel, about 1,000 feet from the center. This bank is open abreast of beacon No. 22, and vessels bound to or from Pass aux Herons can enter or leave the channel here. A buoyed channel is used by boats approaching the dredged channel from the eastern shore. It enters the main channel between lights Nos. 36 and 38.

Mobile River Channel extends from the mouth of the river where it joins Mobile Bay Channel, for 4½ miles up the river to the entrance to Chickasaw Creek. It has a depth of 30 feet (9.1 m.) and a width of 300 feet from the mouth of the river to Coffee Bayou, 3 miles, and thence 28 feet (8.5 m.) to the mouth of Chickasaw Creek.

Sand Island Lighthouse is a black conical tower on the west side of the southerly part of the Main Ship Channel. The light is fixed white, 131 feet (40 m.) above the water, and visible 18 miles.

Middle Ground, a tongue-shaped shoal with a least depth of about 12 feet, extends into the channel from eastward at a point 1½ miles northward of **Fort Morgan.** It is marked by a gas buoy, well off its outer end. There is a rock pile with a least depth of 8 feet (2.4 m.) over it, located 125 feet off the boathouse wharf, Quarantine Station, Mobile Point. Some old piling project above the water to the northward and eastward of this rock pile. Vessels should keep close to the end of the wharf here.

Bon Secours Bay is a large indentation of Mobile Bay, extending 14 miles eastward from inside Mobile entrance. It has an average depth of 8 to 10 feet (2.4 to 3 m.), but is of little importance commercially. **Bon Secours River** empties into the bay at the eastern end. The entrance to the river is through a staked channel (pass to northward of stakes) 5 feet (1.5 m.) deep, mud bottom. The town of **Bon Secours** is located on the north bank of the river, about one-half mile inside the mouth. There is a sawmill, post office, and general store here, and gasoline, fresh water, and provisions can be obtained. A mail and passenger boat makes trips to Mobile three times a week. A small marine ways capable of hauling out boats up to 5 feet draft is located on the bayou leading to Oyster Bay. Oyster Bay is shoal, but a draft of 5 feet (1.5 m.) can be carried to the entrance to the bay.

Weeks Bay has an average depth of 2 to 4 feet (0.6 to 1.2 m.). The entrance to the bay is through a staked channel with a depth of about 4 feet (1.2 m.). A barrel on a pile marks the entrance; pass to southward of this beacon and to northward of the next stake. A staked channel leads across the bay to **Fish River, east mouth,** and **Fish River, north mouth.** Small boats can go to **Marlow** on Fish River north mouth, and to **Magnolia Springs** on Fish River east mouth. The village of **Bayside** is located on the east shore of the bay between the mouths of Fish River. Gasoline, fresh

water, and provisions can be obtained here, and there is regular boat service from here to Mobile three times a week.

Fairhope is a single-tax colony of about 1,000 inhabitants, located on the eastern shore of Mobile Bay. Gasoline can be obtained at the Magnolia Beach wharf south of the town, and there is a small marine ways here that can haul vessels up to 3½ feet draft. Provisions and some yacht supplies can be obtained at Fairhope. There is steamboat service between here and Mobile three times a day. A bright white light on a tall tank at Fairhope is visible from all points in Mobile Bay.

Point Clear, Montrose, and **Daphne** are summer resorts on the eastern shore of Mobile Bay. Some supplies may be obtained at Daphne, which also has daily steamboat communication with Mobile.

Dog River, emptying into Mobile Bay from the west, is the site of several sawmills. A private dredged channel with a depth of 5½ feet (1.7 m.) leads from the bay to the mouth of the river. To enter, pass 100 feet southward of the stakes which mark the channel, on course 79° true (ENE. ½ E. mag.).

Mobile is one of the largest and most important cities on the Gulf coast, having an extensive foreign and coastwise trade, export and import, in cotton, lumber, naval stores, fruits, and foodstuffs. The depth of water at the wharves ranges from 12 to 28 feet (3.7 to 8.5 m.), and the facilities for handling cargo are good. There is regular steamer communication with New Orleans, Pensacola, Tampa, Key West, New York, Porto Rico, and European ports. Several railroad lines afford through communication with all parts of the United States.

Terminal facilities.—Along the western shore of Mobile River, from its mouth to One Mile Creek, a distance of about 14,000 feet, there is practically a continuous series of timber wharves and piers, the greater number of which are served by rail connections. One of these wharves having a frontage of 1,500 feet, on which is a steel shed 1,240 feet long by 100 feet wide, is owned by the city of Mobile, and is served by rail connections. In addition to the above, there are three terminals below Chickasaw Creek in Mobile River. Practically all these terminals are open to use by the general public, more or less restrictions being imposed. On **Blakeley Island,** about 1 mile north of Mobile on the east side of Mobile River, a modern coal and ore handling plant, having a storage capacity of 40,000 tons of coal and ore and a dock frontage of 500 feet, is in operation. Adjacent to and south of it a fuel-oil station, having a capacity of 110,000 barrels and a dock frontage of 500 feet, was constructed by the United States Shipping Board. The construction of new modern port facilities between **One** and **Three Mile Creeks,** involving the ultimate expenditure of $10,000,000, was begun in 1925.

Mobile and **Apalachee Rivers** are crooked streams with many ramifications, flowing in a general southerly direction from the junction of the Alabama and Tombigbee Rivers, 39 miles above the head of Mobile Bay, and emptying into the head of the bay through several mouths. Mobile River, the deeper and more important of the two streams, empties into the northwest corner of Mobile Bay at the city of Mobile. It has a depth of 28 feet (8.5 m.) to **Chickasaw Creek,** 4½ miles above the mouth, and 14 feet (4.3 m.) to its head.

The deepest draft navigating Mobile River above Chickasaw Creek is 9 feet (2.7 m.). There are no towns of importance on the river. A draft of 4½ feet (1.4 m.) can be taken into Apalachee River directly from the bay, but by a roundabout route, leading up Mobile River, down **Spanish River,** up **Tensaw River,** and then into Apalachee River, a draft of 10½ feet (3.2 m.) can be taken to the landing of **Stockton.** The vessels navigating Apalachee River are scow-built steamers of 4 feet (1.2 m.) or less draft.

Alabama River is formed by the junction of the **Coosa** and **Tallapoosa Rivers,** and is navigable throughout its length to a point 312 miles above Mobile. At ordinary low river stages a draft of 3 feet (0.9 m.) can be taken to **Montgomery,** 293 miles above Mobile, and at higher river stages greater drafts in proportion. A draft of 3 feet (0.9 m.) can be carried at low water to the head of the river, and to **Wetumpka** on Coosa River, 10 miles above its mouth. This is the head of low-water navigation. Several drawbridges, with openings of about 110 feet, cross the river. Freshets usually occur in the river from January to May.

Tombigbee River is navigable at ordinary low river stages for a draft of 6 feet (1.8 m.) to **Demopolis,** Ala., a distance of 200 miles from Mobile. Except during the period of extreme low water it is navigable for small boats as far as **Aberdeen,** Miss., 375 miles from Mobile.

Warrior River, emptying into the Tombigbee at Demopolis, extends 114 miles northward to **Tuscaloosa,** beyond which point it is known as the **Black Warrior.** A depth of 6 feet (1.8 m.) can be taken through improved channels up Warrior and Black Warrior Rivers from the Tombigbee to a point 385 miles above Mobile. There are 17 locks on the river, with limiting dimensions of 282 feet length, 51½ feet width, and 8½ feet (2.6 m.) depth. Several drawbridges with openings of about 75 feet cross the river. Freshets usually occur in the river from January to June.

Bituminous coal in quantities is brought down the river in barges to Mobile from the coal fields in the interior of the State.

Chickasaw Creek empties into Mobile River about 4½ miles above its mouth. A channel 15 feet (4.6 m.) deep has been dredged from the mouth to Chickasaw Shipbuilding Co.'s plant. A drawbridge with opening of ample width crosses the river at its mouth.

Prominent features.—The general appearance of the land is a guide to finding the entrance to Mobile Bay. For a distance of 40 miles eastward of the entrance the shore, although low, is wooded and unbroken. For 50 miles westward of the entrance there is a chain of islands which, although wooded in places, are generally low and bare. A water tank 135 feet (41 m.) high on Mobile Point and Sand Island Lighthouse are the most conspicuous objects in approaching the entrance.

Pilots will be found cruising outside the bar day and night or at anchor near the entrance buoy. Pilotage is compulsory for all vessels except those engaged in coastwise and Porto Rican trade and plying between ports on the Atlantic or Gulf coasts and the city of Mobile. The rates are, for every vessel crossing the outer bar of Mobile Bay with a draft of not more than 9 feet, $2.50 per foot of draft; for a draft of more than 9 feet and less than 11 feet, $3 a foot;

for a draft of 11 feet and not exceeding 12 feet, $3.25 a foot; for a draft of 12 feet and not exceeding 14 feet, $3.50 a foot; for a draft of 14 feet and not exceeding 20 feet, $5 a foot; and for a draft of more than 20 feet, $6 per foot. These rates are for pilotage from outside the bar to the docks at Mobile, or vice versa. Steamers entering for bunker coal only are at present required to pay single pilotage only.

Towboats can always be had at Mobile.

Anchorage.—There is good anchorage inside the entrance to the bay near the lower end of the dredged channel to Mobile and northwestward of the Middle Ground. The depths are from 20 to 25 feet (6.1 to 7.6 m.) and the bottom is soft mud. The best anchorage with good holding ground for deeper-draft vessels is northward and northwestward of Fort Morgan (on Mobile Point) and southward of the Middle Ground in depths ranging from 30 to 40 feet (9.1 to 12.2 m.). Vessels also anchor in the stream abreast the city of Mobile.

Fogs.—There is considerable fog during the early spring months with southerly breezes; northerly breezes clear it away.

Winds.—The prevailing winds are southerly and southeasterly in spring, southerly in summer, northerly in fall, and northerly and easterly in winter. The strongest winds are southerly in summer and northerly in winter. Severe northers occur occasionally during the winter; they lower the water in the bay so as to interfere with the deeper-draft vessels bound through the dredged channel. During heavy southerly gales it is not always safe for vessels of over 18 feet (5.5 m.) draft to attempt to cross the bar.

Tides.—The mean rise and fall of the tide at the entrance is about 1.2 feet.

Currents.—The currents vary with the force and direction of the wind. The main body of the flood enters the bay through the Main Ship Channel and has a velocity of about 2 knots. It has a tendency to set toward Sand Island. The ebb has about the same velocity and the set is diagonally toward the shoal on the east side of the Main Ship Channel. During the ebb current, with a strong southerly breeze, the sea on the bar is dangerous for small craft. In the dredged channel the velocity of the currents is about one-half knot, the flood setting up the bay and the ebb down the bay, but the force and direction of the wind have a very marked effect on the set and drift.

Regulations for the Port of Mobile, established in 1923

RULE 1. Masters of sailing vessels entering the Port of Mobile must, on arriving in the river, rig in the jib booms and other outriggers, cockbill their yards, and take their anchors in on deck when not in use. When permission is given by the chief wharfinger or deputy, to allow a vessel to keep the jib boom and other outriggers out, the vessel having such permission will be held responsible for all damage done to other vessels.

RULE 2. The arrival of all vessels into the Port of Mobile shall be immediately reported either by the master or ship agent to the chief wharfinger's office and to the State docks commission office.

RULE 3. The chief wharfinger is charged with the duty of selecting and changing anchorages for ships, with the movements of vessels into and out of slips or berths, and with all other ship movements that affect a fair joint use of the facilities of the port, and his instructions will be obeyed accordingly.

RULE 4. All vessels mooring in the river above One Mile Creek, either to receive or to discharge cargo or ballast, must be moored on a line parallel to

the channel of the river. If more than one vessel is so moored in the same vicinity, they must be moored on the same line.

RULE 5. All vessels loading or discharging in the stream are required to moor at both ends with anchors sufficiently heavy to hold them on the line as specified in Rule 4.

RULE 6. Lighters, barges, timber rafts, etc., placed alongside vessels, wharves, piling, etc., must be placed so as to give free passageway up and down the river to all water craft and must be made fast securely at both ends to prevent swinging with the tides. All such crafts shall display conspicuously suitable lights at night.

RULE 7. No vessel in the channel shall be allowed to make fast a line ashore, except in emergency, and then only for the shortest possible time.

RULE 8. No vessel will be allowed to receive or discharge cargo in the river below One Mile Creek without written permission from the chief wharfinger.

RULE 9. Masters requiring anchor berths for the purpose of laying up their vessels will apply to the chief wharfinger who will designate a berth where the vessel can be anchored.

RULE 10. When vessels are ready to proceed down the channel, and they find themselves blocked by other vessels to the extent that they can not get under way, the officer in charge must report the same to the chief wharfinger at once.

RULE 11. Vessels of all descriptions desiring to discharge any kind of material, such as garbage, ashes, or rubbish of any kind, into the waters of, or any of the water courses emptying into Mobile Bay, must obtain a permit from the United States Engineer's Office.

RULE 12. Vessels are not allowed to anchor in the river below Madison Street.

RULE 13. The maximum rate of speed of vessels from Chickasaw Creek to the mouth of Mobile River shall be as follows: All vessels of 500 tons gross and under (except launches), 6 miles per hour, and all vessels over 500 tons gross, 4 miles per hour.

RULE 14. The chief wharfinger will inform masters of vessels as to the maximum draft to which vessels can be safely loaded for passage through the channel.

RULE 15. The discharging of oil into the waters of Mobile River is prohibited both by the State Docks Commission and the city of Mobile.

Wharfage.—Cargoes are subject to a wharfage charge, but ordinarily vessels are not. The following **Harbor Fees** are imposed on all vessels arriving on and after March 1, 1924:

Tugs engaged in coastwise towing, per trip	$2.50
Vessels under 500 tons, making weekly trips	2.50
Vessels under 500 tons	5.00
Vessels 500 tons and over	7.50
Shifting vessels in the harbor, under 1,000 tons	5.00
Shifting vessels in the harbor, 1,000 tons and over	10.00
Shifting vessels to or from Twelve Mile Island	20.00
Shifting vessels to or from Chickasaw Creek (inside L. & N. bridge)	15.00
Mooring vessels, under 1,000 tons	5.00
Mooring vessels, 1,000 tons or over	10.00

Quarantine.—Vessels subject to visitation by the health officer are boarded at Mobile. The quarantine station on Mobile Point has been abandoned. A new quarantine station is being constructed on Sand Island, at the mouth of Mobile River, to be completed in 1927.

A **marine hospital** is located at Mobile. The office of the surgeon in charge is at the hospital.

Supplies.—Bituminous coal, gasoline, water, ship chandlery, and supplies of all kinds can be had in unlimited quantities at Mobile. Limited quantities of anthracite coal and fuel oil can also be obtained. The water is said to be very good for use in boilers.

Repairs.—Facilities for making repairs to hulls and machinery are good. There are floating docks and marine ways, the largest dry dock having a capacity of 10,000 tons, length 480 feet, width

90 feet, and depth over sill 23 feet 3 inches; and the largest marine ways a capacity for a vessel of 3,000 tons, 300 feet long, and draft of 11 feet forward and 19 feet aft. There are also shears for lifting weights up to 50 tons.

Storm warnings are displayed at Mobile and Fort Morgan.

DIRECTIONS, MOBILE BAY

The following courses and distances, made good, lead to the entrance to Mobile Bay:

From a position 10 miles southwestward of Dry Tortugas Lighthouse, 322° true (NW. ¼ N. mag.), 430 miles.

From Tampa Bay entrance, 299° true (NW. by W. ¾ W. mag.), 312 miles.

From a position 1 mile south of Pensacola entrance (for moderate draft), 260° true (WSW. ¾ W. mag.), 41 miles.

From a position 2 miles southeastward of the entrance buoy at South Pass, Mississippi River, 38° true (NE. by N. mag.), 90 miles.

The bar has a depth of 33 feet (10.1 m.) in the recently dredged channel. After making the gas and whistling buoy off entrance, steer 19° true (N. by E. ¼ E. mag.) with Mobile Point range ahead. When nearly abeam of Sand Island Light haul to 9° true (N. ⅜ E. mag.) for about 3 miles, passing to westward of gas buoy No. 10, until Fort Morgan is abeam; then steer 351° true (N. by W. ¼ W. mag.) for 1½ miles to the gas buoy off the Middle Ground. Thence the chart and the lights marking the channel are the guides; pass the lights at a distance of about 50 yards.

MISSISSIPPI SOUND, LAKE BORGNE, AND LAKE PONTCHARTRAIN

For courses and distances of the through inside route from Mobile Bay to New Orleans or the Mississippi River see page 121.

Mississippi Sound extends 70 miles west of Mobile Bay between a chain of long and narrow, low, sand islands and the mainland, and affords a sheltered inland waterway from Mobile to Lake Borgne and Lake Pontchartrain. The depths are generally shoal, but the route is good for a draft of 10 feet (3 m.) from Mobile Bay nearly to its western end, where the depth is but 7½ feet (2.3 m.). Mississippi Sound is invariably used by light-draft vessels (5 to 6 feet) bound to New Orleans or the Mississippi River, in preference to the outside route to the mouth of the Mississippi and thence up river. The eastern end of the sound is separated from Mobile Bay by an extensive oyster reef, 1 mile wide, across which there are two channels, Pass aux Herons and Grants Pass. The sound may also be entered from the Gulf by Petit Bois, Horn Island, Dog Keys, and Ship Island Passes, and Cat Island Channel.

Pass aux Herons, connecting the southwestern corner of Mobile Bay with the eastern end of Mississippi Sound, is a dredged channel 100 feet wide and 10 feet (3.0 m.) deep, completed in 1915. It is subject to some shoaling near its ends. Tidal currents run through the pass with considerable velocity. The channel is marked on the north side by lights and beacons, about 50 yards from the axis, and by black spar buoys on the south side. The bottom, in the channel

and at the Mississippi Sound end, is very soft and although the dredged channel only extends to the 8½ foot (2.6 m.) curve in Mississippi Sound, a draft of 10 feet (3.0 m.) can be taken through.

Grants Pass, one-fourth mile north of Pass aux Herons, is a toll pass dredged by private interests. The pass is marked on the north side by single-pile beacons. The pass formerly had a depth of 7 feet (2.1 m.) but has shoaled considerably, and is now used only by a few shallow-draft boats.

Dauphin is a small fishing village and post office on the north shore of **Dauphin Island,** east of **Point Isabel.** A draft of 4 feet (1.2 m.) can be carried to the landing here. Gasoline, oil, and some provisions can be obtained here.

Coden is a fishing village on the north shore of Mississippi Sound, northeast of **Isle aux Herbes.** A draft of 4 feet (1.2 m.) can be carried to the wharves here by passing west and north of Isle aux Herbes. There is a hotel, post office, express office, and general store, and gasoline, fresh water, and provisions can be obtained. **Storm warnings** are displayed at Coden.

Bayou Labatre empties into Mississippi Sound at the northeastern end. A draft of about 5 feet (1.5 m.) can be carried to the **town** of Bayou Labatre, 1½ miles above the mouth. The entrance to the river is marked by two red lights on single-pile beacons with red daymarks, and a private beacon. A marine railway capable of hauling out small boats up to 4 feet draft is located at the town of Bayou Labatre. There is a post office, general store, and express office here.

Petit Bois Pass, an entrance from the Gulf, between Dauphin and Petit Bois Islands, has a depth of 14 feet (4.3 m.) in an unstable channel. It is not marked and is seldom used.

Dog Keys Pass, lying about midway between Horn Island and Ship Island, is good for a draft of at least 12 feet (3.7 m.), and is marked by buoys. It is used by small local craft, and has been used by three-masted schooners when it was not desirable to go to Horn Island Pass or Ship Island Pass.

HORN ISLAND PASS,

the approach to the city of Pascagoula, leads between **Petit Bois Island** and **Horn Island.** A channel 21 feet (6.4 m.) deep has been dredged across the bay, and is marked by buoys which are shifted from time to time to conform to changes in the channel. The United States Engineers reported a controlling depth of 20 feet (6.1 m.) in June, 1924, but in March, 1925, local pilots reported that a depth of 22 feet (6.7 m.) could be carried across the bar by passing southward of the channel buoy. A draft of 23 feet (7.0 m.) has been taken out over the bar. It is advisable for strangers of over 15 feet (4.6 m.) draft to take a pilot. Petit Bois Spit, on the eastern side of the pass, is making out slowly in a direction parallel to the channel.

Horn Island Lighthouse is a white wooden house on pile foundation. The light is fixed white, varied by a red flash of 2 seconds duration every 30 seconds, 47 feet (14.3 m.) above the water and visible 12 miles.

Pascagoula River Approach is a channel which has been dredged to a depth of 22 feet (6.7 m.) and a width of 150 feet. This channel is subject to gradual shoaling and in June, 1925, had a controlling depth of 17 feet (5.2 m.) and width of 150 feet. The channel is marked by lights, beacons, and a lighted range, but requires some local knowledge to carry the best water.

Pascagoula River and its tributary **Dog River** are navigable for a draft of 13 feet (4 m.) for 9 miles above Pascagoula, to a large paper mill near Moss Point. Pascagoula River is navigable for 7 feet (2.1 m.) draft for 34 miles, to Dead Lake, and for 3 feet (0.9 m.) draft to the head of the river, 77 miles. **Leaf River,** which unites with **Chickasahay River** to form the Pascagoula, is navigable for a draft of 2 feet (0.6 m.) at mean low water for 67 miles above the head of Pascagoula River. Chickasahay River is navigable only at high river stages. Pascagoula River and tributaries are important chiefly as waterways for logs, timber, and forest products. The river is crossed at Pascagoula by a drawbridge, with an opening 80 feet wide, on the easterly side of the central pier.

Pascagoula is a lumber-shipping port on the north shore of Mississippi Sound and the east bank of Pascagoula River, 9 miles north-northwestward of Horn Island Pass. Pascagoula has railroad communication with Mobile, New Orleans, and intermediate points. Coal, gasoline, provisions, and some ship chandlery can be obtained. There is a public landing below the railroad bridge, with 14½ feet (4.5 m.) depth, where fresh water can be taken. Fresh water can also be obtained from the towboats at moderate prices. There are facilties for making minor repairs to vessels at the shipyard above the bridge. Vessels of 300 tons and a draft of 9 feet can be hauled out, and there are facilties for making repairs to machinery.

Moss Point is located on Dog River about 2 miles above its junction with Pascagoula River and 8 miles from the mouth of the latter. A draft of 13 feet (4.0 m.) can be taken there at low water. It has a number of sawmills and is an important lumber-shipping point. Coal, water, gasoline, and provisions of all kinds are obtainable.

Pilots come out to approaching vessels from the station inside the western end of Petit Bois Island. Pilotage is compulsory for foreign vessels, and for United States vessels of over 150 tons. The rates are $4 per foot of draft, if the services of a pilot are tendered to the westward of the sea buoy of Horn Island Pass.

Towboats are usually on the lookout for vessels approaching Horn Island Pass, or they can be found at Pascagoula.

Anchorage for vessels of over 17 feet (5.2 m.) draft while loading is found on the north side of the eastern end of Horn Island, which anchorage is well marked by buoys. Vessels of less than 17 feet (5.2 m.) draft go to Pascagoula or to the anchorage south of beacon A to load. Small vessels anchor in the river abreast of Pascagoula. The quarantine anchorage is at Pascagoula south of the bridge. The **harbor master** has control of vessels at the anchorages.

Quarantine.—Vessels subject to inspection by the health officer are boarded at the quarantine anchorage at Pascagoula.

Marine Hospital.—The nearest marine hospital is at Mobile, but there is a marine doctor at Pascagoula.

Customs officers are stationed at Pascagoula.

Storm warnings are displayed at Pascagoula.

Tides and currents.—The mean rise and fall of tide at Horn Island Pass is 1.7 feet, and at the mouth of the river, 1.8 feet. In the pass the ebb current generally sets southeastward, and the flood northward and westward, across the shoals. In the dredged cut across the bar the ebb and flood follow the directions of the cut. Winds greatly affect the velocity and direction of the currents, as well as the rise and fall of the tides.

Winds.—Northers occur occasionally during the winter months. They do not greatly affect vessels at the anchorages if provided with good ground tackle, except that they may prevent vessels at the Horn Island anchorage from loading for short periods.

Bridge regulations.—The following are the regulations prescribed by the Secretary of War to govern the opening of the drawbridge crossing the Pascagoula River at Pascagoula:

1. When at any time during the day or night a vessel unable to pass under the closed draw of the bridge aproaches it from a distance of over half a mile, the person in command of such vessel shall cause to be sounded, when said vessel shall be at a distance of not less than half a mile of the bridge, but within signal distance thereof, four blasts of the steam whistle or horn or megaphone, and shall repeat this signal until it is heard and understood at the bridge.

2. When a vessel is about to leave a landing one-half mile or less from the drawbridge, with the intention of passing through the draw, the person in command of such vessel shall cause the required signal to be sounded as above at such interval before leaving the landing that the draw may be opened in time for the boat to pass.

3. Upon hearing or perceiving the signals hereinbefore prescribed the tender of the drawbridge shall immediately open the draw for the prompt passage of said vessel, tug, or other boat: *Provided,* That the draw shall not be opened when there is a train upon or approaching the bridge so closely that it can not be stopped, or within 10 minutes before the time of the known arrival of any mail or passenger train; but that in no event, except for necessary repairs, shall the opening of the draw be delayed more than 15 minutes: *And provided further,* That the draw need not be opened for the passage of a tug or other craft equipped with a movable stack or mast which can readily be so lowered as to permit its passage under the closed draw unless such craft has in tow a vessel which is unable to pass under the closed draw, or by reason of unusual stress of weather it is unsafe to lower such stack or mast.

4. Upon hearing or perceiving the signals hereinbefore prescribed, if the draw of the bridge is open or ready to be immediately opened, the tender of the draw shall so indicate by sounding on the draw four blasts of a whistle, horn, or megaphone, but if it is not to be opened immediately he shall so indicate by sounding two blasts upon such whistle, horn, or megaphone.

5. Trains shall not be stopped on the draw of the bridge except in cases of urgent necessity, nor shall vessels be so manipulated as unnecessarily to hinder or delay the closing of the draw.

SHIP ISLAND PASS

lies immediately westward of Ship Island, 47 miles westward of Sand Island Lighthouse and 11 miles northward of the northernmost of the Chandeleur Islands. It is the approach to Ship Island Harbor and the towns of Biloxi, Gulfport, Pass Christian, Bay St. Louis, and several smaller places. Across the bar there is a dredged depth of 24 feet (7.3 m.) (project depth, 26) for a width of 300 feet, and greater depths inside. The channel, although winding, is marked by buoys and a lighted range. On the bar the channel shifts some-

what in heavy gales, but is fairly stable. A 11° true (N. ½ E. mag.) course with the range lights westward of Ship Island Lighthouse on line ahead leads across the bar; thence the deepest water follows around the westerly end of Ship Island, about one-fourth mile from the beach.

Ship Island Harbor, northward of Ship Island, is one of the best natural harbors on the Gulf coast, and is easy of access for a draft of 17 feet (5.2 m.) or less at all times, and for a draft of 24 feet (7.3 m.) when the sea is smooth. The depths in the harbor range from 20 to 30 feet (6.1 to 9.1 m.), soft bottom.

Gulfport Channel leads from Ship Island Harbor to Gulfport Harbor and is maintained to a depth of 22 feet (6.7 m.) and a width of 300 feet. The bottom is very soft ooze, and a greater draft can usually be taken through. The channel is marked by lights and buoys and by a private lighted range. This range consists of a horizontally slatted day mark (white light) on a pole 65 feet high, near the outer end of the pier, and a staff (white light) on the south end of the grain elevator at Gulfport. This range leads along the axis of the dredged channel on a 324° true (NW. ¼ N. mag.) course, but usually can not be identified until past beacon No. 8.

Gulfport Harbor is a dredged rectangular basin, protected by breakwaters, nearly one-fourth by one-half mile in extent, with depth of 23 feet (7 m.), ooze bottom. A long railroad pier extends along the northeasterly side of the basin, on which there are steam and electric railway tracks, warehouses, and facilities for loading vessels. There are no wharfage charges against vessels, but on account of the congested condition of the harbor there is usually no room except for vessels loading cargo.

Gulfport is a lumber shipping port on the north shore of Mississippi Sound, 11¼ miles northwestward of Ship Island Lighthouse and about midway, by rail, between Mobile and New Orleans. Gulfport is also the terminus of a railroad to the interior of the State. Coal, gasoline, fresh water, provisions, and some ship chandlery can be obtained. There is a marine railway capable of hauling out vessels up to 7 feet draft, and some repairs to machinery can also be made. Lumber is towed here in lighters from Wolf and Jordan Rivers for shipment by water.

Biloxi is a small city on the north shore of Mississippi Sound, about 40 miles west of Mobile Bay, and 11½ miles 19° true (N. by E. ¼ E. mag.) from Ship Island Lighthouse. It is on the railroad which lies close to the north shore of the sound and connects Mobile with New Orleans. A dredged channel 150 feet wide and 8 feet (2.4 m.) deep, marked by lights, leads through the shoals in the sound to the wharves at Biloxi. The most prominent mark from the sound is a tall water tower at Biloxi; the lighthouse there, a white masonry tower, is not readily picked up during daylight unless the light is favorable. There is good anchorage for small vessels close to the city in depths ranging from 6 to 12 feet (1.8 to 3.7 m.) Fresh water, gasoline, provisions, and some ship chandlery can be obtained. There are several marine railways of about 50 tons capacity, limited to drafts of about 6 feet. Storm warnings are displayed from a tower near the yacht club.

Biloxi Bay is a shallow body of water in the north shore of Mississippi Sound, eastward and northward of Biloxi. It can be

entered with a draft of 6 feet (1.8 m.) by passing eastward of **Deer Island,** about midway between the island and the mainland. There are no marks for this entrance, and local knowledge is required after passing the southeasterly end of Deer Island. Biloxi Bay has some trade in lumber, wood, charcoal, and oysters, carried in vessels of about 5 feet draft. The bay is crossed by a railroad bridge above **Ocean Springs,** a fishing village on the north shore. A draft of 4 feet (1.2 m.) can be carried to the wharves here. A long shallow extension of the bay westward is known as **Back Bay of Biloxi,** which is of little commercial importance.

Pass Christian is a town and railroad station on the north shore of Mississippi Sound, 8 miles west of Gulfport. A draft of 7 feet (2.1 m.) can be carried through a channel marked by lights (rectangular, slatted, day mark on pile) leading past the ends of the wharves. There are depths of 4 to 12 feet (1.2 to 3.7 m.) at the wharves and 8 to 12 feet (2.4 to 3.7 m.) in the anchorage off the wharves. Gasoline, fresh water, and provisions can be obtained, and there are facilities for repairing small boats.

Bay St. Louis is a summer resort on the north shore of Mississippi Sound, on the west side of the entrance to St. Louis Bay. A draft of 6 feet (1.8 m.) can be taken to within one-fourth mile of the shore at the town, but the depth at the wharves is under 4 feet (1.2 m.). The cannery wharf north of the bridge has a depth of about 5 feet (1.5 m.).

St. Louis Bay is an indentation in the north shore of Mississippi Sound, 11 miles west of Gulfport. The depths in the bay vary from 4 to 7 feet (1.2 to 2.1 m.) and decrease gradually toward the shore. The bottom is soft. A railroad drawbridge, with opening about 80 feet wide, crosses the mouth of the bay.

Wolf River and **Jordan River** empty into St. Louis Bay, the former into the northeast corner and the latter into the west side. Both have dredged approaches, 100 feet wide by 7 feet (2.1 m.) deep, marked by beacons. These channels have shoaled, and in June, 1925, the controlling depths were 5 feet (1.5 m.) in the approach to Wolf River, and 5½ feet (1.7 m.) in the approach to Jordan River. These depths extend for 17 miles up Wolf River and 14 miles up Jordan River.

Considerable quantities of lumber and forest products are shipped from both rivers. **Kiln,** on the Jordan River 10½ miles above its mouth, is a mill town of some importance. A drawbridge, 3 miles above Kiln, has a clear width of 30 feet. The beacons which mark the channels to these rivers are left close-to on the port hand in entering.

Cat Island is wooded nearly its whole length east and west. The eastern shore of the island, extending in a south-southwesterly direction for 3½ miles from **Great Sand Hill,** terminates in a low, narrow sand spit. **Cat Island Lighthouse** is near the western point of the island.

Isle au Pitre, on the south side of Cat Island Channel, is low and marshy, with scattered clumps of bushes.

Cat Island Channel and its extension, **South Pass,** form the most westerly connection between the Gulf of Mexico and Mississippi Sound, and lie between Cat Island, Miss., and Isle au Pitre, La. It

is a buoyed passage 14 feet (4.3 m.) deep, but the depth in the western part of the sound, to which it leads, is only 7 to 8 feet (2.1 to 2.4 m.). This passage is little used, except by small local craft and an occasional larger vessel entering the eastern end for anchorage. The current has an ordinary maximum velocity of about 1.6 knots in Cat Island Channel.

Pass Marianne is the main passage through the shoals extending across the western end of Mississippi Sound, southward of the town of Pass Christian. The pass has a controlling depth of about 9 feet (2.7 m.) and is marked by buoys and Merrill Shell Bank Light; white square house on piles, white light, 42 feet (12.8 m.) high; fog signal, bell, 1 stroke every 20 seconds.

Prominent features.—On a clear day vessels from eastward bound for Ship Island Pass usually sight first a white water tank, 100 feet (30.5 m.) high, at the quarantine station on Ship Island. At night they will sight Ship Island Light first. Vessels from southward may sight Chandeleur Lighthouse first. At the western extremity of Ship Island there is a semicircular brick fort with sodded parapet, which is a conspicuous landmark. Near the northeastern end of Cat Island there is a high white sand bluff, which can be seen at some distance on a clear day.

Ship Island Lighthouse is a white pyramidal tower on the westerly end of the island. The light is fixed red, 73 feet (22.2 m.) above the water, and visible 9 miles.

Chandeleur Lighthouse, at the northerly end of the Chandeleur Islands, is a pyramidal skeleton structure, painted black and brown. The light is flashing red (flash 0.5 second, eclipse 9.5 seconds), 99 feet (30.2 m.) above the water, and visible 16 miles.

Anchorage.—Large vessels can anchor outside the bar anywhere westward of a line between Chandeleur and Ship Island Lighthouses and have smooth water in any weather. An especially good anchorage in stormy weather is west of Chandeleur Lighthouse in 4 to 5 fathoms (7.3 to 9.1 m.). Sailing vessels, waiting for a towboat, anchor near the entrance buoy, 1¼ miles south of Ship Island Lighthouse. The holding ground is good and there is but little sea. Inside the bar good anchorage and holding ground can be found almost anywhere north of Ship Island that the depth is suitable.

The **harbor master** at Gulfport has control of anchoring and berthing all vessels at Ship Island Harbor and at Gulfport. The fees for boarding, docking, and shifting, are $5 each.

Ship's Lights.—The Gulfport Port Commission has ruled that all vessels alongside the Gulfport piers or in the harbor anchorage must have their cargo lights dimmed or matted to the southward, in order to avoid hampering the navigation of vessels using the dredged channel between Gulfport and Ship Island.

Pilots will be found off the bar between sunrise and sunset. Pilotage is compulsory for foreign vessels, and for United States vessels of over 150 tons. Rates are $4 per foot on foreign vessels and $3 per foot on coastwise vessels.

Towboats can be found at Gulfport. A towboat usually makes a daily trip from Gulfport to outside the bar.

Quarantine.—Vessels subject to visitation by the health officer are boarded at Gulfport Harbor. The quarantine station on Ship Island has been abandoned.

Hospital.—The nearest marine hospital is at Mobile, but there is a marine doctor located at Gulfport.

Customs and **immigration** officers are located at Gulfport and Biloxi.

Storm-warning signals are displayed at Gulfport, Biloxi, Pass Christian, and Bay St. Louis.

Tides.—The normal range of tide is 1.75 feet, but all tides are greatly affected by the winds. Northeast to south winds make high tides and southwest to north winds make low tides. A continued norther makes a **current** on Ship Island bar of as much as 4 knots.

LAKE BORGNE

is a westward extension of Mississippi Sound, from which it is partly separated by three islands and outlying shoals. Between the islands and shoals there are several navigable passages. The lake is about 23 miles in length, 5 to 10 miles in width, and 7 to 9 feet (2.1 to 2.7 m.) in depth, but 8 feet (2.4 m.) is about the greatest draft entering. The shores of the lake are low and marshy, and are but sparsely populated. The lake is of importance chiefly as a connecting link for inside navigation from Mississippi Sound to Lake Pontchartrain and the Mississippi River. The lake is tidal, but the tides are small, except for the wind tides. The tidal currents through Grand Island Pass have considerable velocity at times.

Vessels coming from eastward generally enter Lake Borgne through **Grand Island Pass,** which leads northward of **Grand** and **Grassy Islands** and close to the northerly shore of the lake; it is a deep channel, marked by lights and beacons.

Lake Borgne Lighthouse, on the north side of the pass, is a white tower surmounting a dwelling on brown pile foundation. The light is fixed white, 44 feet (13.4 m.) above the water, and visible 11 miles.

Pearl River empties into Lake Borgne from northward through two mouths, known as East Pearl River and West Pearl River. **East Pearl River,** the principal month, is 3 miles westward of Lake Borgne Lighthouse, and has a dredged channel depth of 8 feet (2.4 m.) The entrance is marked by two black beacons, one of them lighted. A depth of 8 feet (2.4 m.) can be taken 12 miles up the river, to **Logtown,** and 3 feet (0.9 m.) can be taken 114 miles farther. Drawbridges, with 60-foot openings, cross the river 1 mile and 27 miles above its mouth. **English Lookout,** formerly known as **Dunbar,** is a settlement and railroad station near the mouth of the river, 1½ miles above the first bridge. There is a small dredged basin for small craft here. Gasoline, oil, and some provisions can be obtained, and there are facilities for hauling out small boats up to 3-foot draft.

West Pearl River, the secondary mouth of Pearl River, empties through **West Mouth** into the easterly end of The Rigolets, 1 mile west of the railroad bridge. It connects with East Pearl River by

means of **East Mouth, North Pass,** and **Little Lake Pass,** and is good for about 7 feet draft (2.1 m.). A draft of 4 feet (1.2 m.) can be carried from Pearl River through the western end of **Little Lake** and East Pass to The Rigolets. The passages through the shoals in Little Lake are marked by piles and stakes.

The Rigolets is a deep passage, 7½ miles long and one-fourth mile wide, connecting Lakes Borgne and Pontchartrain. The entrance is 8½ miles west of Lake Borgne lighthouse at Grand Island Pass, and is marked by a beacon on the shoals off the south side of the entrance and a light on the north side. The shores of The Rigolets are low and marshy. A little westward of the Lake Borgne entrance, The Rigolets is crossed by a drawbridge with opening of 60 feet. **Rigolets** is a small settlement and railroad station on **Rabbit Island.** Gasoline, oil, and some provisions can be obtained here. A draft of 7 feet (2.1 m.) can be carried to the landing on Little Rigolets by entering from eastward.

Bridge Regulations.—The bridge will be opened at any time except for a period of 10 minutes before the time of the known arrival of a mail or passenger train. The signal for opening the draw is four distinct blasts of a whistle or horn, sounded when at least 1 mile distant from it. Intention of opening the bridge immediately is signified by sounding an answering four blasts of a whistle or horn, or by four shots in quick succession fired from a gun. If the draw is not to be opened immediately, it is signified by two whistles or two shots when the approaching vessel is at least half a mile away.

Currents, The Rigolets.—Tidal currents are very irregular and greatly influenced by winds. They set with great velocity through The Rigolets at times, and especially through the draw of the bridge. Westerly currents set west-southwestward on to the fender on the southwesterly side of the draw, and easterly currents set east by north on to the fender on the northeasterly side. The ordinary maximum velocity is 0.6 knot. The bridge should not be approached closely until the draw is opened, and then only with caution.

Chef Menteur Pass is another connecting passage between Lake Borgne and Lake Pontchartrain, its entrance from Lake Borgne being 12 miles southwestward of The Rigolets. It is 6 miles long and of considerable depth, but with shallow water off the entrances. It is used by small craft when going from Lake Pontchartrain to the Mississippi River, and by small pleasure craft and fishing boats from New Orleans. A drawbridge, with an opening 60 feet wide, crosses the pass 2 miles from the Lake Borgne entrance. This pass is not marked.

Bayou du Pre and **Lake Borgne Canal,** also known locally as **Ship Island Canal,** connect the west end of Lake Borgne with the Mississippi River at the village of **Violet,** about 10 miles below Canal Street, New Orleans. It is a toll canal, operated by the Alabama & New Orleans Canal Co., and is good for a draft of 5 feet (1.5 m.). Its approach in Lake Borgne is marked by a flashing red light and by a lighted range (white lights) leading along the axis of the entrance. From Lake Borgne to the river the distance is 6 miles. The river end of the canal is marked by two white lights. The canal

has one lock at the river end 280 feet long and 40 feet wide. Since the opening of the New Orleans Inner-Harbor Navigation Canal, connecting Mississippi River with Lake Pontchartrain, the traffic through Lake Borgne Canal has greatly diminished.

LAKE PONTCHARTRAIN

is a fresh-water lake, roughly elliptical in shape, 36 miles long, 22 miles wide at the widest part, and 10 to 16 feet (3 to 4.8 m.) deep, lying 4 miles northward of the Mississippi River at New Orleans. At the eastern end it is connected with Lake Borgne. At its western end it is connected with Lake Maurepas, through a narrow passage called Pass Manchac. It has considerable commerce in foodstuffs and fuel carried in small schooners and power boats to New Orleans. A shoal fills the eastern part of the lake, through which a channel 11 feet (3.4 m.) deep has been dredged. This channel, called **North Shore Channel,** connects the lake with the deep water of The Rigolets, and is marked on its western and southern side by beacons. **Tide** in the lake is governed almost entirely by winds and may have an extreme range of 3½ to 4 feet. It is claimed that the surface of the lake is lowered at least 2 feet during the winter, when northwest winds prevail. A draft of 9 feet (2.7 m.) can usually be carried from The Rigolets to the Mississippi River through North Shore Channel, Lake Pontchartrain, and Inner-Harbor Navigation Canal. A railroad bridge crosses the neck of the eastern extremity of the lake 4½ miles west of The Rigolets. It has two draws with double, clear openings of 106 feet at distances of 1 mile each from either shore. Regulations for opening the draws are prescribed similar to those for the bridge crossing The Rigolets.

The city limits of New Orleans extend from Lake Pontchartrain to the Mississippi River, but the business part of the city and the greater part of the residential section are on or close to the river bank. The pleasure resorts and the suburbs are on the lake shore.

The **Inner-Harbor Navigation Canal** is described on page 130.

Bayou St. John and its extension, **Old Canal,** having a combined length of 4½ miles, lead from a jettied entrance in Lake Pontchartrain to a small basin in New Orleans, one-half mile from the Mississippi River. The mid-channel depth at the entrance is 1½ feet (0.4 m.) at ordinary low water and 8 feet (2.4 m.) inside. The entrance is marked by **Bayou St. John Lighthouse** (white house on pile foundation, flashing red light), and by a private fixed red light which is maintained between April 16 and September 15 and shown on Sunday nights only. Several drawbridges cross the bayou, but there is no regular tender to operate the draws.

Spanish Fort, a pleasure resort at the mouth of Bayou St. John, is connected with New Orleans by electric railway.

Port Pontchartrain, or **Milneburg,** is a railroad terminus 1 mile east of Bayou St. John. The lighthouse at the end of the pier is a white conical tower, from which a fixed white light is shown.

New Canal, 1⅝ miles westward of Bayou St. John, extends in three straight sections to near the Union Station at New Orleans,

a distance of 5½ miles. The approach to the canal in Lake Pontchartrain is protected by jetties, with the west jetty projecting diagonally across the mouth, forming a breakwater. There is a depth of 7½ feet (2.3 m.) in the canal between perpendicular banks, which are protected by sheet piling. The canal is crossed by several drawbridges, and at the third, about 2¾ miles from the lake, pleasure boats are refused passage at certain hours unless provided with a pass. A toll of 30 cents per gross registered ton is charged. The ferries to Mandeville, Madisonville, and other towns on Lake Pontchartrain have their landings a short way inside the entrance to this canal, and the canal is also used extensively by pleasure boats, tugs, and barges. **Storm warnings** are displayed here.

New Canal Lighthouse (white house on pile foundation; occulting white light) and a red light on the west jetty mark the entrance. A fog bell at the lighthouse sounds a single stroke every 30 seconds in thick weather. Two occulting red lights, 96 feet apart, mark the outer end of the Southern Yacht Club Pier.

To enter New Canal, pass close to southeastward of the red jetty light and follow the west jetty. The red lights at the entrance to this canal are difficult to identify at a distance since there are several red street lights in the same vicinity.

West End, a pleasure resort, and the **Southern Yacht Club,** both located at the mouth of the canal, have electric railway communication with New Orleans.

Bayou Bonfouca empties into the north side of Lake Pontchartrain 3 miles northwestward of the north draw in the railroad bridge which spans the eastern end of the lake. The least channel depth on the bar at the mouth of the bayou is 7 feet (2.1 m.); the bottom is hard sand. Inside the bayou the depths vary from 10 to 16 feet (3 to 4.9 m.) to the town of Slidell, about 6 miles above the mouth. There is considerable traffic on the bayou in brick, tile, lumber, logs, and farm and garden produce, and it is planned to improve the depths over the bar in the near future to facilitate this traffic. A drawbridge crosses the bayou at Slidell. An occulting white light on a black beacon marks the entrance to the bayou. Southwestward of the light is a clubhouse on piles.

Slidell is a town of about 3,000 inhabitants located on Bayou Bonfouca, about 6 miles above its mouth, and on a railroad leading to New Orleans. A shipyard, sawmill, and a creosote works are located here and there is a commercial graving dock with the following dimensions: Length, 325 feet; width, 60 feet at bottom; depth over sill, 14 feet. Gasoline, fresh water, provisions, and some boat supplies can be had here. **Storm warnings** are displayed at **Salmen,** just below Slidell.

To enter Bayou Bonfouca, bring the south draw of the railroad bridge astern on a northerly course and pass 50 feet eastward of the light.

Bayou Lacombe empties into Lake Pontchartrain 4½ miles westward of Bayou Bonfouca and nearly 7 miles west-northwestward of the north draw in the railroad bridge. The least channel depth on the bar at the mouth is 4 feet (1.2 m.); hard sand bottom. Vessels of about 5½ feet (1.7 m.) draft enter on a favorable tide and go

about 7½ miles upstream to sawmills. A drawbridge crosses the bayou about 5 miles above its mouth at the village of Bayou Lacombe. The entrance is marked by a white light on a black structure.

To enter Bayou Lacombe, steer about north by west for a large tree on the west bank, passing about 100 yards eastward of the light, and then close to the east side of the entrance.

Mandeville is a town on the north shore of Lake Pontchartrain, 15 miles westward of the point where the railroad bridge crosses the lake and 20 miles north of New Orleans. There is railroad communication with points northward and regular ferry communication with New Orleans. There are several wharves and boat landings on the lake shore, but in stormy weather boats go to the yacht basin formed by the dredged channel leading into the entrance of Bayou Castine. This channel and basin have a depth of about 8 feet (2.4 m.) and the entrance is marked by a small white light on the western side. The channel is protected by sheet piling on each side for about 100 yards offshore. Gasoline, fresh water, and provisions can be obtained at Mandeville.

Chefuncte River empties into the most northerly part of Lake Pontchartrain, about 5 miles west of Mandeville. The least depth in the dredged channel across the bar is 10 feet (3 m.), and this depth can be carried up Chefuncte River to Madisonville. A depth of 8 feet (2.4 m.) can be carried up Chefuncte River and its tributary, Bogue Falia River, for a distance of 12 miles, to within 1 mile of **Covington.** A depth of 3½ feet (1.1 m.) can be carried to Covington, which is the head of navigation. **Bogue Falia River** empties into Chefuncte River about 9 miles above the mouth of the latter. The entrance to Chefuncte River is marked by a range of white lights, the front on a black structure and the rear on a white conical tower; two small red beacons indicate the east side of the dredged channel. A fog bell is sounded every 30 seconds during thick weather from the rear light. **Madisonville,** on the west bank of Chefuncte River, 2 miles above its mouth, has steamer communication with New Orleans. There are shipyards and marine railways at Madisonville which can haul out the largest vessel that can enter the lake.

To enter Chefuncte River, steer 18° true (N. by E. ⅛ E. mag.) for the lights in range. Pass westward of the red beacons, and when up with the latter, haul slowly eastward for the mouth of the river. Keep about in midstream, favoring, if anything, the upriver sides of the points at bends.

Tangipahoa River is a very narrow but comparatively deep stream flowing into Lake Pontchartrain 6 miles southwestward of Chefuncte River Lighthouse. It can be entered with a draft of about 4 feet (1.2 m.). Its approach is marked by a white light on a black and white striped structure 1⅝ miles northeastward of East Channel Light, Pass Manchac.

Pass Manchac and Lake Maurepas are described under a separate heading on page 123.

Courses, Mississippi Sound, Lake Borgne, and Lake Pontchartrain

	Course		Distance in nautical miles
	True	Magnetic	
	°		
1. From Mobile Bay light 8 to Pass aux Herons light 2.	263	W. by S.	4¾
Or, from Middle Ground gas buoy 2, 300° true (NW. by W. ¾ W. mag.) 5 miles. In Pass aux Herons pass about 50 yards southward of all beacons and lights.			
2. To Pass aux Herons light 4	233	SW. ¼ W.	¾
3. To Pass aux Herons light 8	248	SW. by W. ⅝ W	3
4. To position ½ mile north of Grand Batture Island Shoal gas buoy.	266	W. ¾ S.	12¾
5. To Pascagoula River entrance light A	296	WNW. ⅛ W.	4¼
Then, to go to Pascagoula, 320° true (NW. mag.), 4½ miles, passing about 60 yards westward of all beacons and lights, except the range lights at the mouth of the river.			
6. To a position 300 yards north of Round Island North Spit buoy 1.	293	WNW. ⅜ W.	5½
7. To position 100 yards south of Round Island Spit Light.	277	W. ¼ N.	1¼
8. To position ¼ mile south of Belle Fontaine gas buoy.	253	WSW.	7½
9. To Gulfport Channel light 2	265	W. ⅞ S.	12¾
Or, for the 14-foot passage north of Horn Island, from Pass aux Herons light 8, to a PS buoy northwestward of Horn Island Pass, 266° true (W. ¾ S. mag.), 17 miles. Then, to position 200 yards south of a second PS buoy, 214° true (SSW. ½ W. mag.), 1½ miles. Follow the north shore of Horn Island to buoy 10, westward 7 miles. Then, 355° true (N. by W. mag.) for ½ mile, and 327° true (NW. ⅝ N. mag.) for 1¾ miles to position ¼ mile west of PS buoy. Then, to Gulfport Channel Light 270° true (W. ½ S. mag.), 18 miles. Then, to go to Gulfport, 324° true (NW. ⅜ N. mag.), 6½ miles, passing southwestward of all lights.			
10. To position 200 yards north of Cat Island Shoal gas buoy.	267	W. ¾ S.	8½
Or, from Gulfport Channel beacon 8, 243° true (SW. by W. ⅛ W. mag.), 7¼ miles.			
11. To position 50 yards north of Pass Marianne buoy 9.	254	WSW. ⅛ W.	3½
Leave Pass Marianne buoys about 50 yards to southward.			
12. To Pass Marianne buoy 11, passing to southward of Merrill Shell Bank Light.	231	SW.	½
13. To Pass Marianne buoy 13	263	WSW. ⅞ W.	1
14. To Pass Marianne buoy 15	292	WNW. ½ W.	1
15. To position ½ mile southeast of Lake Borgne Lighthouse.	243	SW. by W. ⅛ W	10
On this course keep Lake Borgne Lighthouse well on starboard bow, and pass ¼ mile southward of a red beacon.			

Courses, Mississippi Sound, Lake Borgne, and Lake Pontchartrain—Continued

	Course		Distance in nautical miles
	True	Magnetic	
	°		
16. To position ½ mile northward of Grassy Island.	264	W. by S	1
To go to Lake Borgne Canal, with Lake Borgne Lighthouse astern, steer 230° true (SW. mag.), 16 miles, to position ½ mile northward of Alligator Point Light. Then, to Bayou du Pre Light 247° true (SW. by W. ¼ W. mag.), 6¾ miles. Pass 50 yards southward of the light and enter the bayou on the range. Then, keeping in mid-channel, follow the telegraph line to the locks into the Mississippi River.			
17. To position ½ mile southwest of Long Point Light, passing 100 yards south of Pearl River Light, and 100 yards north of can buoy No. 1.	257	WSW. ⅜ W	6¾
18. To the draw in the railroad bridge over The Rigolets. See Currents, Rigolets, on page 117.	298	WNW	1¾
19. To position ⅝ mile past the lighthouse at the west end of The Rigolets.	Mid-	channel	7¼
20. To position 25 yards northward of beacon 29.	322	NW	1¾
21. To position 25 yards northward of beacon 57	270	W. ½ S	1½
22. To the railroad north draw	285	W. ⅞ N	1¾
23. To Inner Harbor Navigation Canal Light	227	SW. ⅜ S	14½
Or, to New Canal, 234° true (SW. ¼ W. mag.), 18 miles.			
20a. From the west end of The Rigolets by way of the south drawbridge; follow the shore southward at a distance of ¼ mile until the red pile beacon bears west.			3
21a. To the beacon	275	W	1
22a. To position with the south draw of the railroad bridge well open east of Point aux Herbes.	315	NW. ½ W	2¼
23a. To the railroad south draw	284	W. ¾ N	2
24a. Then follow the shore ½ mile or more off, southward and westward to Inner Harbor Navigation Canal Light. New canal is 4 miles farther on.			11½

From the entrance to the Inner Harbor Navigation Canal, New Orleans, the following courses and distances lead to the approaches to points on Lake Pontchartrain; from the approaches the directions given after the descriptions of the rivers, bayous, etc., can be followed:

Bayou Bonfouca, 36° true (NNE. ⅝ E. mag.), 15 miles.

Bayou Lacombe, 20° true (N. by E. ¼ E. mag.), 13¼ miles.

Mandeville, 356° true (N. ⅞ W. mag.), 18¼ miles to Bayou Castine Light.

Chefuncte River, 340° true (NNW. ⅜ W. mag.), 20½ miles.

Pass Manchac, 316° true (NW. ½ W. mag.), 19¾ miles.

LAKE MAUREPAS,

lying west of Lake Pontchartrain, is 11½ miles long in a northeast and southwest direction, from 4 to 8 miles wide, and about 10 feet (3.0 m.) deep. The shores of the lake are low and thickly wooded and there are no cities or towns along them. The lake is of little commercial importance except as the approach to the Tickfaw and Amite Rivers, both of which have considerable trade to New Orleans passing through the lake.

Pass Manchac is a passage 5½ miles long by 150 to 200 yards wide connecting Lake Pontchartrain with Lake Maurepas. The pass has good depths, but the approaches in both lakes are across long bars on which the channel depths are 7 feet (2.1 m.). Three lights mark the approach from Lake Pontchartrain as follows: A white light on a white cylindrical tower attached to a building on the north side of the entrance, a red light on a red beacon south of the entrance, and a white light on a white beacon north of the entrance. The last two are on the east sides, respectively, of South Channel and East Channel and mark the entrances from the lake to these channels. **South Channel** is good for a draft of 7 feet (2.1 m.) in a dredged cut lying 125 feet west of the light and extending in a straight line to Pass Manchac Lighthouse. **East Channel** lies along the shore northward from Pass Manchac and is good for 5 feet (1.5 m.). A fog bell is struck every 30 seconds during thick weather at the central light. A railroad bridge, which has a draw opening 60 feet wide, spans the west end of the pass.

To enter Lake Maurepas from Lake Pontchartrain, pass 125 feet west of South Channel Light and head for Pass Manchac Lighthouse. Haul around the point at a distance of 150 to 200 yards and steer mid-channel courses through the pass to the railroad bridge and then follow the north shore at a distance of 200 to 300 yards for 1½ miles in order to avoid the middle ground in the entrance to the lake.

Tickfaw River flows into the northerly end of Lake Maurepas over a bar having a least channel depth of 7 feet (2.1 m.) The tributaries of this river, **Natalbany** and **Blood Rivers,** join it 1½ and 7 miles, respectively, above its mouth. **Ponchatoula River** is a tributary of Natalbany River, 3½ miles above its junction with the Tickfaw. All of these streams are navigable for any draft that can be taken across the outer bar and for distances above their respective mouths as follows: Tickfaw, 23 miles; Natalbany, 9 miles; Blood, 4 miles; and Ponchatoula, 4 miles. The town of **Springfield** is on Natalbany River, 8½ miles above its mouth. A white light on a white pile marks the west side of the mouth of Tickfaw River at the shore of the lake.

To enter Tickfaw River, steer northward for the light, giving the east side of the entrance a berth of 100 yards.

Amite River empties into Lake Maurepas 8 miles westward of Pass Manchac. A depth of 7 feet (2.1 m.) can be taken across the bar at the entrance and for a distance of about 32 miles above the mouth. Its tributary, **Bayou Manchac,** joins it about 32 miles above the mouth and is navigable for 5 feet (1.5 m.) draft for 8

miles, to the town of **Hope Villa.** The entrance to Amite River is marked by two single-pile beacons and a white light above a white house. A fog bell at the light is struck every 30 seconds during thick weather.

To enter Amite River pass northward of the two entrance beacons with the light nearly ahead, and when past the second beacon, head for the entrance to the river, passing well to eastward of the light.

CHANDELEUR AND BRETON SOUNDS

lie southward of Mississippi Sound and northward of the Mississippi River Delta—Chandeleur Sound to northward and Breton Sound to southward—with no clearly defined line of demarcation between them. Chandeleur Islands form the eastern boundary of Chandeleur Sound. They are a narrow, crescent-shaped chain of low islands, beginning 10 miles southward of Ship Island and extending in a general south by west direction for a distance of 23 miles. Southwestward from these islands are **Errol Island,** at a distance of 2 miles, and **Breton Island,** 8½ miles beyond Errol Island. These mark the eastern limit of Breton Sound. Vessels of less than 10 feet (3.0 m.) draft bound from Mississippi Sound to Mississippi River can pass through these sounds and have smoother water than by passing eastward of the islands.

Chandeleur Lighthouse, at the northerly end of the Chandeleur Islands, is a pyramidal, skeleton structure, painted black and brown. The light is flashing red (light 0.5 second, eclipse 9.5 seconds), 99 feet (30 m.) above the water, and visible 16 miles.

North, Freemason, Old Harbor, and **New Harbor Islands** are located on the eastern side of Chandeleur Sound. There are no houses on these islands and they are frequented only by fishermen and trappers. Several unmarked channels good for a draft of 8 feet (2.4 m.) or more, lie between them. Good protected anchorage for small boats in stormy weather can be found in **Shoalwater Bay, Smack Channel,** and in some of the other passages.

The western shore of both sounds is a network of marshy islands separated by shallow bayous and bays. The land is all low and is submerged on extremely high tides, in some places nearly to the banks of the Mississippi River. Several shallow canals lead from the southern part of Breton Sound to the river bank, but only one of them, Ostrica Canal, leads into the river. These canals are used by the large fleet of oyster boats operating in the sound to deliver their catch at the canneries and packing houses on the river bank.

Ostrica Canal is a privately-owned canal leading into the Mississippi River at the village of **Ostrica,** 21½ miles above the Head of the Passes. At high water a draft of 6 feet (1.8 m.) can be taken from Breton Sound, through **Quarantine Bay, Bayou Tourtillon,** and this canal, to the river, but on account of numerous oyster bars in these waters local knowledge is essential. The canal has one lock in the levee of the river which will accommodate a vessel 60 feet long, 18 feet wide, and 4 feet (1.2 m.) draft at low water, and 6 feet (1.8 m.) draft at high water. The entrance to the canal from the river is on the southeast side of a large cannery on the river bank. Toll charges for the canal are as follows: Vessels under 25 feet in

length, $3.25; from 25 to 30 feet, $3.75; over 30 feet, 15 cents for each additional foot.

The village of Ostrica is described on page 130.

Courses, Chandeleur and Breton Sounds

	Course		Distance in nautical miles
	True	Magnetic	
	°		
1. From Chandeleur lighthouse bearing 84° true (E. by N. mag.), distant 3 miles, to a PS buoy 1¼ miles westward of Old Harbor Islands.	204	S. by W. ⅝ W.	17½
Or, from the lighthouse astern, bearing 32° true (NNE. ⅜ E. mag.), distant 1½ miles, steer 212° true (SSW. ⅜ W. mag.) for 17½ miles.			
2. To a position 6½ miles south of the north end of Breton Island, passing 1½ miles eastward of the north end of Breton Island.	193	S. ¾ W.	23½
3. To position with Pass a Loutre Lighthouse bearing 230° true (SW. mag.), distant 4 miles.	135	SE. ½ E.	13½
4. To buoy No. 2	160	SSE. ¼ E.	4¼

MISSISSIPPI RIVER

The Mississippi River empties into the north central part of the Gulf of Mexico through several mouths or passes, which form what is known as the delta of the Mississippi. The delta is, roughly, of a bird-foot form, having four toe-like extensions (the passes), which consist of narrow-banked deposits of sand and clay brought down by the river current. Between the passes are bays of considerable extent, which are being slowly filled by wave and tidal action from the Gulf, carrying in the bar sands, and by sedimentation from river overflow from above. The upper half of **Garden Island Bay** has been filled in this manner and is now a marsh. The delta is being built seaward at an estimated average rate of about 300 feet a year.

The passes begin to diverge at a point called **Head of the Passes,** 12 and 17 miles above the mouths of South and Southwest Passes, respectively. The angle of greatest divergence is about 127°. The perimeter of the delta between the most widely divergent passes is about 35 miles.

PASS A LOUTRE

Pass a Loutre, the northeasternmost of the passes, has two mouths separated from each other by the **Middle Ground,** on the southern end of which is Pass a Loutre Lighthouse. The principal entrance is southward of the lighthouse and is obstructed by a shifting bar, across which there is a depth of about 7 feet (2.1 m.) This entrance is but little used. **North Pass,** the other mouth of Pass a Loutre, is not navigable. About 5 miles below the Head of the Passes,

Southeast Pass of Pass a Loutre branches off southeastward, and it, in turn, has a branch called **Northeast Pass.** Both of these branches have shallow outlets into the Gulf and are of but little importance. Pass a Loutre and all its branches have good depths from inside their mouths to the Head of the Passes. Sills have been placed across the pass at the Head of the Passes entrance, to divert the flow of water into the other passes. There is about 17 feet (5.2 m.) of water over these sills.

Pass a Loutre Lighthouse is a spirally banded black and white conical tower. The light is fixed red, 59 feet (18 m.) above the water, and visible 12 miles.

Northeast Pass unused lighthouse is a grayish white tower on the north side of the mouth of the pass.

SOUTH PASS

South Pass, sometimes called **Eads Pass,** is one of the two important commercial entrances to the Mississippi River from the Gulf of Mexico. It lies 425 miles northwestward of Dry Tortugas and 90 miles southwestward of Mobile Bay entrance. It has been improved by the construction of jetties on both sides of the entrance and by dredging, so that there is a usual depth of about 33 feet (10.0 m.) throughout the length of the pass from the Gulf to the Head of the Passes, a distance of about 12 miles. The width of the pass varies from 530 to 850 feet; the width in the clear between the jetties at their ends is about 670 feet. Immediately outside the entrance the depths are subject to considerable change, due to the large amounts of sediment brought down by the strong river currents; but at a distance of 1¼ miles out from the end of the jetties the depths are more dependable, and 10 fathoms (18.3 m.) can be found in any easterly or southerly direction.

Lying between one-fourth and one-half mile off the end of the jetties on the west side of the channel is a dangerous shoal marked by a bell buoy, with depths of 8 to 15 feet (2.4 to 4.6 m.) on it. This shoal, coupled with the strong currents coming out from the river, makes the navigation of South Pass difficult for strangers without the aid of a pilot. A bend in the channel near the Head of the Passes also adds to the difficulty of navigating South Pass.

Sand waves, appearing at times about halfway up the pass, have been known to delay vessels of deep draft. They are a temporary lodgement of large volumes of heavy sand in shoals at a certain stage of the river. They have not been of frequent occurrence in recent years.

South Pass Light Vessel lies about 1½ miles east-southeastward from the entrance in latitude 28° 59′ N., longitude 89° 07′ W. The vessel has a red hull with "South" painted on both sides; two black masts; and a black cylindrical lantern and gallery on tubular foremast. The light is a group flashing white, 2 flashes every 15 seconds (flash 0.6 second, eclipse 4.4 seconds; flash 0.6 second, eclipse 9.4 seconds), 50 feet (15.2 m.) high and visible 13 miles. A fixed white light is shown on the forestay. If the flashing white light is inoperative, a less brilliant fixed white light will be shown. The fog signal is a siren, blast 2 seconds, silent 2 seconds, blast 2 seconds, silent 24 second. If the siren is disabled, a bell will be rung by hand,

2 strokes every 15 seconds. The submarine bell rings group 2 strokes every 15 seconds.

The **entrance** between the jetties is marked by lighthouses and lighted ranges. The light on the outer end of the east jetty is occulting red. A fog bell sounds a single stroke every 10 seconds. The outer end of the west jetty is marked by a fixed white light, which, with another fixed white light 430 yards, 298° true (WNW. mag.) from it forms the range for entering. The front light is on a white house, black vertical stripe, on pile foundation, and has an air diaphone fog signal, 1 blast every 20 seconds. The rear light is on a black, square, pyramidal, skeleton structure, with a white vertical stripe, and is visible on the range line only.

South Pass Lighthouse, on the west bank 2¼ miles above the end of the jetties, is a white skeleton structure inclosing a cylindrical stairway. The light is flashing white (flash 1.5 seconds, eclipse 3.5 seconds), 108 feet (33 m.) above the water, visible 16 miles, and the strongest light at the passes of the Mississippi River.

The **Pilots Station** is a small settlement on the west bank about one-half mile above the end of the jetties. Rates for bar pilotage are given on page 134.

Port Eads, situated 2¼ miles above the end of the jetties on the east bank, is a post office and headquarters for the construction force employed in the maintenance of the pass.

South Pass Radio Compass Station, maintained by the United States Navy, is located in latitude 29° 00′ 43″ N., longitude 89° 09′ 33″ W. The call letters are NBX.

The following **regulations relating to the navigation of South Pass** of the Mississippi River have been prescribed for the protection of the pass and the works for its improvement.

Vessels navigating South Pass or any part thereof are required to reduce their speed so as not to exceed 10 miles (statute) per hour over the ground or from point to point, without regard to the velocity of the current or run of the tide.

All vessels anchoring in the pass shall take position near the eastern bank of the pass above a point marked by a post painted white, which is about one-half of a mile above South Pass Lighthouse, and below the island at the head of the pass; and vessels so anchoring shall put out such extra moorings as may be necessary to prevent their being blown athwart the channel and thus endangering the navigation of the pass, whenever required to do so by the United States inspecting officer of the works for the improvement of the pass.

No master or other person in command of a vessel drawing more than 12 feet of water shall enter the jetty channel from sea with such vessel until after a descending vessel which has previously entered said channel from above has passed to sea, and likewise no such vessel descending the river shall enter the channel at the head of the pass until after an ascending vessel which shall have passed the head of Goat Island has passed through the entrance at the head of the pass.

All vessels discharging or waiting to discharge ballast at Port Eads must be moored to the bank by lines, and no vessel shall discharge ballast into the Gulf of Mexico within a distance of 5 miles from the sea ends of the jetties; nor shall ashes or other refuse matter which may be liable to cause a shoaling or filling up of South Pass be dumped therein.

The United States dredge boats or any other boats operated under the direction of the War Department shall have the exclusive right of way over all other vessels navigating South Pass while they are at work therein, and all vessels in passing them must be governed by their signals. They shall give the usual steam-whistle signal for passing to port or starboard, and this shall be

responded to and obeyed by the passing vessel on the order of its master or pilot.

Sea-going vessels are not permitted to sail down the pass after dark or up the pass farther than the designated anchorage. When towed after dark not more than one such vessel, oil barge, or other craft shall be towed at the same time, either in or out, and that must be towed alongside the towboat. During daylight not more than two such vessels, oil barges, or other craft shall be towed through South Pass, either in or out, at the same time, and one of these shall be towed alongside the towboat, and the other on a short hawser.

Directions for South Pass are given on page 137.

SOUTHWEST PASS,

the westernmost of the passes of the Mississippi River, is 19 miles west-southwestward of South Pass entrance and 280 miles eastward of Galveston entrance. It has been improved by the construction of jetties on both sides at the entrance and by dredging, so that there is now (1925) a least depth of 35 feet (10.7 m.) (project depth, 35 feet) from the Gulf throughout the length of the pass, a distance of 17 miles. The width of the pass varies between 1,200 and 5,000 feet, averaging 2,000 feet; the width in the clear between the ends of the jetties is 1,750 feet. Dredging is continuously in progress to maintain the project depth.

Near the end of the jetties the depths are somewhat changeable, but at all times there seems to be deep water in the Gulf from nearly every direction up to within three-fourths mile of the entrance.

Southwest Pass entrance gas and whistling buoy lies about 1½ miles south of the entrance, and shows a flashing white light every 3 seconds. An occulting red gas buoy No. 2, light 10 seconds, eclipse 10 seconds, and a bell buoy No. 2, are located on the eastern side of the entrance channel.

The **entrance range** front light is exhibited from a black square pyramidal slatted structure on piles. The rear light from the same type structure, 0° true (N. ½ W. mag.), 440 yards from the front light; both lights are fixed white. The **East Jetty Light** is occulting red, light 1 second, eclipse 1 second, exhibited from a red, square, pyramidal, skeleton structure on piles.

Southwest Pass Lighthouse is a brown skeleton structure on the northwest side of the river; the light is fixed white, 124 feet (38 m.) above the water, and visible 17 miles.

Burrwood is a post office and the headquarters for the construction force employed upon the improvement of the pass; it is located on the southeast bank, 5 miles above the end of the jetties. There is a commercial radio station located here, the call letters of which are WBW. Gasoline and provisions in limited quantities can be obtained here.

The following regulations relating to **the navigation of Southwest Pass**, Mississippi River, are prescribed by the Secretary of War for the protection of the pass and the works for its improvement:

The speed of vessels or other craft navigating Southwest Pass, or any part thereof, shall be reduced so as not to exceed 10 miles (statute) per hour, distance traveled from point to point, without regard to the velocity of the current or run of the tide. The speed shall be still further reduced so as not to exceed 5 miles per hour when passing any floating plant or materials that are being

used for the improvement of the channel, and while passing the wharf at Burrwood, La.

All vessels anchoring in the pass shall take position near the eastern bank, and above a point marked by a post, painted white, upon the bank about 1½ miles above Southwest Pass Lighthouse.

No master or other person in command of a vessel shall enter the jetty channel from the sea with such vessel until after a descending vessel which shall have passed State Island has passed to sea.

Ashes or other refuse matter shall not be thrown or dumped in the pass, nor in the Gulf of Mexico within a distance of 5 miles from the sea ends of the jetties.

Dredge boats, while operating in the pass, shall have the exclusive right of way over all other vessels or craft. All passing vessels must be governed by signals of the dredges.

Seagoing sailing vessels shall not sail down the pass after dark, or up the pass farther than the designated anchorage.

Not more than one sailing vessel, barge, or other craft shall be towed after dark at the same time, either in or out, and must be towed either alongside or on a short hawser. During daylight not more than two such vessels, barges, or other craft shall be towed through the pass, either in or out, at the same time, and in such case one of these shall be towed alongside of the towboat and the other on a short hawser.

The pumping of oil from bilges of barges, or in any other manner discharging oil from vessels, while passing through Southwest Pass, or while in any locality whence the tide or current might convey oil into said pass, is prohibited.

Directions for Southwest Pass are given on page 138.

HEAD OF THE PASSES TO NEW ORLEANS

From the Head of the Passes to New Orleans, a distance of 81 miles, the river has a least width of 600 yards, and a clear unobstructed channel with depths of from 6 to 39 fathoms (11 to 71 m.). Shallow water does not extend far from the shore at any point, and the banks may be approached quite closely. The land on both sides of the river is low, and generally marshy, and in the lower reaches mostly covered with coarse grass or willows. Above Cubits Gap, on the east side, and The Jump, on the west side, levees have been constructed to prevent overflow at high water. The land back of the levees is laid out in sugar and rice plantations and is considered one of the richest agricultural districts in the United States. These plantations have communication with New Orleans by means of regular lines of power boats and by railroads, which extend down the west bank to **Buras** and down the east bank to **Pointe a la Hache,** 21½ and 37 miles, respectively, above the Head of the Passes.

Cubits Gap is an opening in the east bank 3 miles above the Head of the Passes, at which **Raphael, Main,** and **Octave Passes** meet and connect with the river. These passes are navigable for small craft, but there is no navigable connection between them and the Gulf. A sill of willow brush, weighted down by rocks, has been laid across the entrances to these passes; it can be crossed at certain places with a draft of 7 feet (2.1 m.), but local knowledge is necessary.

The Jump is the name of an opening in the west bank, 9 miles above the Head of the Passes, where **Grand Pass** and several smaller passes connect with the river. A draft of 11 feet (3.4 m.) can be taken 9 miles down Grand Pass, but there is very little depth beyond that point.

Pilottown, Venice, and **Olga** are post offices and small settlements 2, 10, and 14 miles, respectively, above Head of the Passes. Gasoline, oil, and provisions in limited quantities can be obtained at these towns, and there is boat communication with New Orleans twice a week. At Olga there is a machine shop and a marine ways capable of hauling out vessels up to 7 feet draft and 100 feet in length.

Ostrica and **Buras,** about 22 miles above Head of the Passes, the former on the east bank and the latter on the west bank of the river, are post offices and small settlements. Gasoline, oil, and provisions in limited quantities can be obtained at each town, and each have marine ways capable of hauling out small boats up to 5 feet draft. The Ostrica Canal (described on p. 124) has its Mississippi River entrance at Ostrica. Both towns have telephone and boat communication with New Orleans.

Doullut Canal, 3½ miles above Buras and on the same side of the river, is a privately owned canal leading from Mississippi River to **Adams Bay.** At high water a draft of 4 feet (1.2 m.) can be carried from the river to the Gulf through Doullut Canal, Adams Bay, Bayou Cook, and Bastian Bay. (See description of Bastian Bay on p. 139.) The canal has one lock in the levee of the river which will accommodate a vessel 60 feet long, 18 feet wide, and 4 feet deep. The entrance to the canal is marked by two white lights on white posts. Toll charges for the canal are as follows: Vessels under 25 feet in length, $3.25; from 25 to 30 feet, $3.75; over 30 feet, 15 cents for each additional foot.

Several other canals with depths of 4 to 5 feet (1.2 to 1.5 m.) lead from near the river to the waters on either side. **Socola Canal,** at Socola, connects with waters leading to the Gulf. (See Grand Bayou on p. 139.) **Wilkinson Canal,** at Myrtle Grove, leads to Barataria Bay. (See description on p. 141.) These canals do not enter into the Mississippi River.

Lake Borgne Canal, connecting Mississippi River with Lake Borgne, is described on page 117. **Harvey Canal,** opposite New Orleans at **Harvey,** and **Company Canal,** at Westwego, connect with an extensive network of inland waterways west of New Orleans. They are described on page 155.

Inner-Harbor Navigation Canal provides a deep-water connection between Mississippi River and Lake Pontchartrain. The canal is 4.6 miles long, with a bottom width of 150 feet, and the following depths: 30 feet (9.1 m.) from Mississippi River to Florida Walk, then 25 feet (7.6 m.) to the Louisville & Nashville Railroad crossing, thence 20 feet (6.1 m.) to Lake Pontchartrain. A minimum of 9 feet (2.7 m.) is maintained in the approach channel in Lake Pontchartrain. Future activities contemplate increasing the bottom width in the canal to 500 and 600 feet. A lock near the Mississippi River end has an inside length of 640 feet, inside width of 75 feet, and a depth of 31½ feet (9.6 m.) over the sills. Four drawbridges with openings of ample width cross the canal. The Mississippi River entrance is marked by beacons, buoys, and a range. The lake entrance is marked by a flashing white light on the eastern side of the channel. There are shipyards, wharves, and industrial plants along the banks of the canal.

The following are extracts from the **tariff regulations** governing the Inner-Harbor Navigation Canal, effective January, 1923:

Canal and lockage fees

(1) For such vessels and water craft which use the canal without passing through the locks, the following canal fee is established: 2½ cents per gross ton. This covers a period of 10 days or fraction thereof. The minimum fee for any one vessel or water craft is $2.50. This fee covers a one-way trip in the canal.

(2) For such vessels and water craft which use both the canal and locks the following fee is established:

(*a*) Five cents per gross ton. This covers a period of 10 days or fraction thereof. The minimum charge for any one vessel or water craft is $5 except as noted below. This fee covers a one-way trip through the canal.

(*b*) A special rate of one-half of the above rate will be applied to all vessels and other water craft under 100 gross tons using the locks between the hours of 9 a. m. and 10 a. m. and 3 p. m. and 4 p. m. This rate will apply to vessels and other water craft arriving before 9 a. m. ready to go through the locks at 9 o'clock and before 3 p. m. ready to go through the locks before 3 o'clock.

(*c*) *Exception:* Vessels and other water craft of 500 gross tons measurement and over engaged in transportation on the Mississippi and Warrior Rivers and tributaries, Lake Borgne and Lake Pontchartrain and tributaries will be charged upon the basis of cargo carried, in lieu of upon gross measurement. The fee to be 5 cents per ton of cargo. Minimum fee to be $25.

Anchorage and moorage

(1) Vessels and other water craft in the canal for a period longer than 10 days are subject to the following charges:

	Per day
Vessels over 5,000 gross tons	$7.50
Vessels over 1,000 gross tons and under 5,000	5.00
Vessels over 100 gross tons and under 1,000	2.50
Vessels under 100 gross tons	1.00

Vessels exempt from canal and lockage fees

(1) On vessels and other water craft which either have paid or are about to pay tollage, or wharfage charges at any wharf or pier belonging to the board within the canal, or which are to receive cargo or discharge cargo on private wharves on the main canal or laterals, there shall be no fees or charges for passage through the canal and the lock.

(2) On tugboats or towboats actually towing barges or other cargo carrying craft within the canal or through the locks, or en route to pick up a tow for such service, there shall be no charges *provided* the said towboats or tugboats do not themselves carry cargo, and *further provided* they had paid the annual license fee of the board. If such towboats or tugboats do carry cargo, they shall pay the charges elsewhere specified in the tariff for the use of the canal. Towboats which have not paid the annual license fee of the board and which enter the canal shall pay the usual harbor fee.

New Orleans, the largest city along the Gulf coast of the United States, is situated on the east bank of the Mississippi River, 93 and 98 miles, respectively, above the entrances to South and Southwest Passes. It has an extensive foreign and coastwise trade in cotton, lumber, tobacco, wheat, corn, coffee, bananas, and miscellaneous products.

Abreast of New Orleans on the opposite bank of the river are the towns of **Algiers, Gretna,** and **Westwego,** all of which are connected with New Orleans by ferries. At Algiers are located shipyards and a **United States naval station.**

Chalmette, about 5 miles below Canal Street, New Orleans, and on the same bank of the river, has extensive terminal and cargo-handling facilities.

Carrollton is just above New Orleans on the same bank of the river.

Terminal facilities.—There are 10 miles of wharves, of which about 7 miles are covered by steel sheds and warehouses. The Board of Commissioners of the Port of New Orleans, an agency of the State of Louisiana, ordinarily referred to as the **Dock Board,** owns and operates the majority of these terminal facilities. These facilities include:

Three fruit landings, equipped with 13 banana unloaders. Many large floating derricks, several locomotive cranes, the telpher system for sugar, stationary and portable conveyors, special elevators for ore, sand, and gravel, and other economical devices.

A modern public cotton-handling terminal, with a storage capacity of 420,000 bales. Other cotton terminals are under construction.

Eight grain elevators with a storage capacity of 7,572,000 bushels, including a public elevator with a capacity of 2,622,000 bushels. At the latter elevator is located a marine leg unloader, with a capacity of 15,000 bushels per hour, and also a modern sacking plant.

A public coal and bulk commodity handling plant, with a coal storage capacity of 25,000 tons. Numerous tipples and colliers for handling coal and other commodities.

All port facilities are served by paved roadways and also by the Public Belt Railroad, a terminal switching facility, municipally owned and operated, which connects with all 12 trunk lines entering New Orleans. The depths at the wharves are ample for any vessel which can enter the Passes.

Port charges.—About 80 per cent of the wharves and warehouses at New Orleans are publicly owned, and they, as well as the entire system of levees and that part of the river contiguous to the city, are under control of the Board of Commissioners of the Port of New Orleans. The following excerpt from the **Rules and Regulations of the Board of Commissioners of the Port of New Orleans,** adopted August 5, 1924, give the principal port charges which have been established. A copy of these rules and regulations may be had on application to the Board of Commisisoners.

Harbor fee.—This charge applies to all vessels engaged in foreign or coastwise trade arriving in the port limits, with the following *exceptions:* (*a*) Vessels calling at the port for the sole purpose of receiving bunker fuel and/or ship supplies or changing pilot. (*b*) Vessels passing through the port and remaining less than 12 hours and not receiving or discharging cargo. (*c*) Government vessels not engaged in commerce. (*d*) Pleasure craft.

Vessels under 100 gross tons	$2.50
Vessels of 100 gross tons and under 500 gross tons	5.00
Vessels of 500 gross tons and over in ballast or with green fruit	10.00
Vessels of 500 gross tons or over with general cargo	15.00

The foregoing charges cover the duties of harbor masters and port wardens.

Dockage-Wharfage is a charge against vessels for the use of the public wharves or mooring facilities based upon the gross tonnage of the vessel. A

vessel shall be allowed, for the purpose of assembling cargo prior to her arrival, the use of such wharf and shed as may be assigned her for a maximum period of 10 days without incurring any dockage-wharfage charges until her arrival. On the arrival of said vessel before the expiration of said 10 days the following dockage-wharfage charges shall be levied, to wit:

3 cents per gross ton per day for the first and second days.
2½ cents per gross ton for the third day.
2 cents per gross ton for the fourth day.
1 cent per gross ton per day for the fifth and sixth days.
No charge for the seventh to the sixteenth days.
1 cent per gross ton per day for the seventeenth to twenty-first days.

Vessels using the wharves beyond the twenty-first day shall be assessed dockage-wharfage at the same rate as set forth above, commencing at 3 cents per gross ton per day for the twenty-second and twenty-third days, etc. (Other rules and rates affecting dockage-wharfage are given in the Rules and Regulations of the Board of Commissioners.)

Sheddage, a charge against vessels for the use of covered wharves based on the gross tonnage of the vessel is in addition to dockage-wharfage, and shall run concurrently therewith. Free time for assembling cargo is granted under the same conditions as for dockage-wharfage. Sheddage charges are: 3 cents per gross ton of the vessel for a period of 16 days or less; 1½ cents per gross ton of the vessel for the period from the seventeenth to the twenty-first day inclusive or less. Beyond the twenty-first day these charges shall be again assessed at the same rate.

Wharf tollage is a charge against vessels based on tons of cargo received or discharged while lying at public wharves or mooring facilities. The rate of wharf tollage shall be 15 cents per ton of 2,000 pounds with the following exception, viz: 10 cents per ton of 2,000 pounds shall be charged for bananas and coconuts.

The following cargoes will be exempted from the payment of wharf tollage: (*a*) Liquid cargoes received or discharged through pipes passing under the wharves and discharged into or pumped from storage plants located beyond the board's property line. (*b*) Coal or other bulk commodities passing through the Public Coal and Bulk Commodity Handling Plant to or from a vessel moored at the wharf. (*c*) Grain or other commodities passing through the Public Grain Elevator or Sacking Plant to or from a vessel moored at the wharf. (*d*) Ships stores and fuel intended for vessel's own consumption and use.

Special rates are made for inland water craft, and harbor excursion boats. (See Rules and Regulations.)

Supplies.—Bituminous and anthracite coal of good quality can be had at New Orleans from the coal wharf or from lighters anywhere alongside the levee or in the stream. Fuel oil can be obtained at Gretna on the opposite bank of the river. Excellent water can be obtained at New Orleans. During high river stages the river water is sometimes used for boilers. Ship chandler's stores of all kinds are obtainable. Provisions are plentiful and prices reasonable.

Repairs.—The facilities for repairs to hulls and machinery are excellent. There are several commercial floating docks at Algiers. The largest is 521 feet on keel blocks, 84 feet wide between wing walls, and has a capacity of 10,000 tons. For larger vessels, the floating drydock of the United States Naval Station is available. It is 525 feet long, has a capacity of 18,000 tons, and can take on a vessel of 28 feet draft.

There are also four privately owned floating derricks, the largest of which has a lifting capacity of 100 tons. There is a commercial graving dock at Slidell, on Bayou Bonfouca, with the following dimensions: Length, 325 feet; width, 60 feet; depth over sill, 14 feet. There are also several marine ways at New Orleans for small boats.

Distances from New Orleans to a few foreign and domestic ports are:

Ports	Nautical miles	Ports	Nautical miles
Colon	1, 395	San Juan	1, 535
Habana	601	Tampa	474
Key West	570	Tampico	718
New York	1, 737	Vera Cruz	798
Pensacola	228		

Landmarks.—The discolored water discharged from the Mississippi River is one of the first intimations to mariners approaching the passes of the proximity of land. This, however, can not be depended upon to indicate distance, for with high-river stages and northerly winds discolored water will be met in some directions 60 miles or more from land, and the water will at times appear broken from 15 to 20 miles from the passes.

The land near the entrances to the passes is low marsh, covered with tall, coarse grass and weeds. The lighthouses are the most prominent and easily recognized marks. The two radio towers at Burrwood, steel skeleton structures about 250 feet (76 m.) high, are also easily picked up. The light vessel off South Pass is a mark for the entrance to that pass. The smoke from steamers and dredges in the vicinity of South and Southwest Passes is also a guide.

Mud lumps, unstable mounds of earth of considerable extent, forced up by pressure underneath to a height of 2 to 8 feet (0.6 to 2.4 m.) above the surface of the water, are frequently found within about a mile of the mouth of each pass and are said to be most numerous on the right side of each channel. They generally rise in a few weeks' time and then gradually wear away, though sometimes they subside even more quickly than they rise.

Pilots.—There are two classes of pilots—bar pilots and river pilots. The former will generally be found outside the entrances to South and Southwest Passes, or they can be signaled for from the gas buoy at Southwest Pass or the light vessel at South Pass. They take vessels up to **Pilottown,** 2 miles above the Head of the Passes. The river pilots take vessels from Pilottown up the river to New Orleans.

Rates for bar pilotage.—The bar pilots for the port of New Orleans shall be entitled to ask and receive pilotage at the rate of $3.50 per foot of water drawn by any ship or vessel piloted by them drawing 10 feet of water or less and $4 per foot for all vessels drawing more than 10 feet of water. Ships coming to New Orleans for bunker or repair work are charged one pilotage only.

Vessels of 100 tons or under, lawfully engaged in the coasting trade of the United States, shall not be required to take a pilot unless the master of said vessel demands the services of a pilot.

Rates for river pilotage.—All vessels shall pay the sum of $2 per foot draft inward and the same outward and $5 per day for every day detained at quarantine station; and if fumigated only the sum of $5 shall be charged in addition to the regular fixed rate

of $2 per foot draft. For shifting berth the charge is $15 to $20 per shift. For all over two hours' detention the charge is $2 per hour.

Towboats are used by all sailing vessels entering the passes. In the absence of regular towboats, the steam pilot boat will usually come out to an approaching vessel and tow her to an anchorage inside the entrance to the pass. Towboats can always be had at New Orleans. Charges for shifting berths range from $30 to $190, depending upon distance. These charges are for ships of 5,000 gross tons and under; on ships of over 5,000 gross tons an additional charge of $5 for each 1,000 tons or fraction will be made.

Anchorage.—Above the Head of the Passes vessels may anchor on either side of the river where the depth is suitable. In the vicinity of New Orleans the best anchorage is between Chalmette and Algiers, on the south side of the river. The upper limit of anchorage is abreast of the American Sugar Refining Co.

Quarantine.—The quarantine station is on the east bank of the river about 3 miles above the Head of the Passes. Vessels subject to visitation by the health officer are boarded at anchor off the station. There is also a quarantine station just below New Orleans, and vessels need not be detained at the lower station unless there is some sickness aboard, but can be boarded at New Orleans.

Hospital.—A marine hospital is located at New Orleans.

The **customhouse** is on Canal Street, New Orleans, about three-eighths mile from the river.

A Coast and Geodetic Survey field station is located in Room 314, Customhouse, New Orleans. Complete files of charts, coast pilots, tide tables, and other publications relating to navigation may be consulted here, and other information affecting navigation obtained without charge.

A United States Branch Hydrographic Office is located in the customhouse. Bulletins are posted here giving information of value to mariners, who are also enabled to avail themselves of publications pertaining to navigation and to correct their charts from standards. No charge is made for this service. Mariners unable to get the noon time signal by radio can obtain chronometer comparisons at this office, either in person or by telephone.

Cable crossings.—Two telephone cables cross the river from Canal Street to the ferry landing at Algiers. Another telephone cable crosses the river from Walnut Street toward the grain elevator at Westwego. A telegraph cable crosses the river from Jackson Avenue to Gretna. Power cables cross from Market Street power plant to McDonoghville, and from Julia Street shed to Diana Street at Algiers.

Storm-warning displays are made at Burrwood radio station, Pilottown, Empire, West End, and at the foot of Canal Street, New Orleans.

Fogs.—From December to June fog may be encountered anywhere from 60 miles off the passes to the city of New Orleans. Southerly and easterly winds bring it in, and northerly and westerly winds clear it away.

Currents, Gulf of Mexico (see also p. 25).—The currents are variable in direction and velocity, depending at some seasons of the

year upon the direction and velocity of the wind and, near the entrance to the passes, upon the stage of the river.

During February, March, and April the current runs to the southeastward with considerable strength, especially near the Tortugas, and it will be directly against a vessel most of the way on the course from there to the Mississippi River. During the rest of the year a countercurrent sets a little to the northward for the first 50 miles west of Tortugas. Then for 150 miles the main current runs to the southward and southeastward. For the next 100 miles there is an area of little movement, and for the last 125 miles, before reaching the mouth of the river, it runs strong to the east-northeastward.

During a light southerly wind a northeasterly set of 2¼ knots has been observed 13 miles southeast of South Pass entrance, and at the same time there was an easterly set of one-half knot at the light vessel off the entrance.

At Southwest Pass gas buoy the current is due chiefly to the discharge of the river. Its direction is southwesterly, and the velocity varies from 0 to 4 knots, the average being 1.7 knots.

Tides and currents, Mississippi River.—In the passes there is generally but one high and one low water in 24 hours, the extreme range being about 1.7 feet. At New Orleans the tide is not noticeable. The current due to the tide is not strong at any point, and for purposes of navigation it is rarely taken into account. **High river stages,** usually occurring from April to July, decrease the effect of the tide. The average date of high river stage occurs in April and of low river stage in October. At New Orleans the extreme differences between high and low stages of the river is 21 feet; the mean difference is about 14 feet. The following table gives the velocity of the current in the river for the different months of the year:

Mean cross-sectional velocity

Month	Section midway between The Jump, Grand Pass and Fort St Philip	Section at steamboat wharf, New Orleans	Month	Section midway between The Jump, Grand Pass, and Fort St. Philip	Section at steamboat wharf, New Orleans
	Knots	*Knots*		*Knots*	*Knots*
January	3.2	2.9	August	1.2	1.1
February	6.5	5.8	September	.8	.8
March	4.7	4.2	October	1.2	1.1
April	3.7	3.2	November	1.9	1.8
May	3.4	2.9	December	2.0	1.8
June	3.1	2.8			
July	2.2	2.0	Mean	2.8	2.6

The greatest velocity in a given section is generally about one and one-third times the cross-sectional velocity. The velocities in narrower portions of the passes are probably a little greater than those at the steamboat wharf at New Orleans.

At several places in the lower parts of the river countercurrents, or eddies, are often found near the banks, which, if taken advantage of, can greatly assist vessels bound up the river.

At South Pass the river current frequently has an easterly set. At Southwest Pass it sets straight out from between the jetties, thence spreading out fan-shaped, with slightly greater velocity, to westward.

DIRECTIONS, MISSISSIPPI RIVER

Approaching the mouth of the Mississippi River from Florida Straits deep-draft vessels usually set a course direct to the passes from a position about 10 or 12 miles southwestward of Dry Tortugas Lighthouse, on Loggerhead Key. Low-powered vessels of moderate draft sometimes, particularly during the winter months, pass northward from Florida Strait in the vicinity of Rebecca Shoal Lighthouse, and for 200 miles set a course 10° to 20° northward of the course to the passes of the river, and then change course for the passes; this keeps them out of the strongest part of the Gulf current.

Going to Straits of Florida a course is usually set for a point 10 or 12 miles southwestward of Dry Tortugas.

In either direction the lead is of but little value for determining the ship's position, and observations should be relied upon. The currents vary considerably, and with the closest navigation a vessel bound for South Pass frequently makes a landfall at Pass a Loutre or Southwest Pass.

Approaching South Pass a vessel uncertain of her position can set a course so as to pick up the 20-fathom (37 m.) curve from 5 to 20 miles northeastward of the light vessel, and then follow the curve southwestward until the light vessel is located. However, vessels approaching the passes should now be fairly certain of their position in any weather by using *radiocompass bearings* from South Pass in conjunction with soundings. During thick weather vessels frequently ground northeastward of South Pass and northward of Southwest Pass, due to infrequent sounding. Due consideration should be given to possible occurrence of mud lumps.

In foggy or thick weather Southwest Pass is more accessible and more easily navigated than South Pass, because the channel is better marked, has greater width, and is nearly straight, and because a vessel is not set off the course to the same extent by the currents at the entrance.

South Pass.—Depths in the channel at the entrance to South Pass are subject to frequent change; strangers and all vessels of more than about 15 feet (4.6 m.) draft are advised to take a pilot. The current has considerable velocity, which tends to carry a vessel upon the shoal that lies straight out from the ends of the jetties on the west side of the channel.

Stand in for the South Pass Light Vessel and bring the west jetty range lights on bearing 297° true (WNW. mag.). Steer this range, passing a flashing white gas and bell buoy to port and leaving the end of the east jetty about 200 feet on the starboard hand. The current will strike the vessel on the starboard bow, and as the end of the east jetty is approached the vessel should be headed to meet it, and by the time she is abreast the end of the east jetty she should be heading fair between the jetties.

When in the pass the banks are a sufficient guide, care being taken to keep about midway between them, favoring the west bank for the last 3 miles before reaching Head of the Passes light.

Southwest Pass.—Vessels bound to Southwest Pass sometimes fall westward of the Mississippi River Delta, but this can be quickly ascertained by watching the lead, as the water shoals much more gradually along this part of the coast than off the Delta.

Depths in Southwest Pass entrance are subject to some change, but the current, so far as is known, can be depended upon to set nearly straight out from between the jetties.

From the gas and bell buoy steer the range 0° true (N. ½ W. mag.) for about 1⅜ miles, until in the middle of the entrance between the jetties, passing westward of a bell buoy and gas buoy No. 2. Leave gas buoy No. 1 on the port hand and head up between the jetties, slightly favoring the west jetty.

When in the pass the banks are a sufficient guide, care being taken to keep about midway between them.

MISSISSIPPI RIVER ABOVE NEW ORLEANS

Vessels of the deepest draft can go as far as Baton Rouge at all seasons of the year, and for considerable periods of time, at high-river stages, a draft of 28 feet (8.5 m.) can be taken to Natchez and 18 feet (5.5 m.) to Memphis.

A channel, 9 feet (2.7 m.) deep at low-river stages, is being maintained to Cairo and 8 feet (2.4 m.) to St. Louis, and the river is navigable with an extreme low-water draft of about 4 feet (1.2 m.) to St. Paul, Minn.

The following are a few of the more important towns along the river and their approximate distance in nautical miles above New Orleans:

Town	Nautical miles	Town	Nautical miles
Donaldsonville, La	68	Greenville, Miss	423
Plaquemine, La	97	Memphis, Tenn	638
Baton Rouge, La	117	Cairo, Ill	838
Natchez, Miss	230	St. Louis, Mo	991
Vicksburg, Miss	318	St. Paul, Minn	1,600

Inland route to Chicago and New York.—A draft of about 4 feet (1.2 m.) at low-river stages can be taken from **New Orleans to Lake Michigan at Chicago** by way of the Mississippi River, 1,041 miles; Illinois River, 194 miles; Illinois and Michigan Canal, 56 miles; Chicago Sanitary & Ship Canal, 28 miles; and Chicago River, 6 miles. The limiting dimensions by this route are—length 103 feet, width 17 feet, and headroom under fixed bridges about 11 feet.

Vessels can go from **Chicago to the Atlantic Ocean at New York** by way of Lake Michigan, Lake Huron, St. Claire River, Lake St. Claire, Detroit River, Lake Erie, Erie Canal, and Hudson River. The limiting dimensions are found in the Erie Canal, which is limited to craft of a length of 300 feet, beam 44 feet, draft 12 feet (3.7 m.).

COAST FROM MISSISSIPPI RIVER TO SABINE PASS

From the delta of the Mississippi River to Sabine Pass, a distance of 250 miles, the coast has a general westerly trend, with several deep indentations or bays nearly separated from the Gulf by chains of long narrow islands. It is characterized by a fringe of low sandy beaches backed for many miles by vast stretches of marshy ground. The off-lying water is shoal for long distances from the beach and, except for the first 50 miles west of Southwest Pass, the 10-fathom (18 m.) curve is 20 to 35 miles offshore. Numerous shallow areas, irregular in outline, situated well out of sight of land, are serious menaces to the navigation of vessels of even moderate draft.

An extensive network of bayous and canals, good for drafts of 3 to 7 feet (0.9 to 2.1 m.), cover the country for about 50 to 75 miles back from the coast. One canal (Doullut Canal) enters the Mississippi River below New Orleans, two enter at New Orleans (Harvey & Co. Canals), and one enters at Plaquemine, 97 miles above New Orleans. Many other canals extend to the Mississippi River levees but do not enter the river. This network of canals extends from the Mississippi River westward to Sabine Pass, and is used extensively by fishing boats, barges, shallow draft steamers, and pleasure boats. They are described in detail in the Inside Route Pilot, Key West to the Rio Grande. A brief description of the main inside routes is given on page 153. Those waterways that touch the coast are described on the following pages.

Current.—Inside the 100-fathom curve from Southwest Pass to Sabine Pass there is a westerly current which has an average velocity of about 0.5 knot.

From Southwest Pass to Barataria Pass, at the entrance to Barataria Bay, the shore line is broken by numerous small and unimportant passes and shallow bays, little frequented except by small boats and canoes, and never approached by seagoing vessels.

Bastian Bay, 26 miles northwestward of Southwest Pass, is 2½ miles long and 1½ miles wide, and has an average depth of 2 feet (0.6 m.). The bay is separated from the Gulf by **Bastian Island. Bastian Pass,** east of the island, is not navigable. The pass west of the island is the main entrance to Bastian Bay, and is also the entrance to Grand Bayou. **Bastian Bay Light,** a white light on a black, pyramidal, slatted structure on piles, is on the west side of the entrance to Bastian Bay and the east side of the entrance to Grand Bayou. **Bayou Cook,** emptying into the northern end of Bastian Bay, leads to Adams Bay. A fixed white light, on a red day-mark, is on the east side of the entrance to the bayou. A fixed white light on a black day-mark, is on the west side of the entrance into Adams Bay. Doullut Canal (described on page 130) connects Adams Bay with the Mississippi River. A draft of 4 feet (1.2 m.) can be carried on a favorable tide, from the Gulf to the Mississippi River through Bastian Bay, Bayou Cook, Adams Bay, and Doullut Canal; distance 8 miles.

Grand Bayou empties into the Gulf close to westward of Bastian Bay. **Bastian Bay Light** (fixed white) is on the east side of the entrance. Small boats can go to the levees in the Mississippi River at Socola through Grand Bayou, 10 miles, Bayou Vacherie, 6 miles, and Socola Canal, 1¼ miles. There are no tolls for this canal.

Quatre Bayou Pass, 5½ miles east of Barataria Lighthouse, is the entrance to **Bay Ronquille** and **Cat Bay. Quatre Bayou Pass Light,** a fixed white light shown from a white braced post, is on the west side of the pass. There are 8 to 12 feet (2.4 to 3.7 m.) of water across the bar and deeper water inside the pass, but the average depth in Bay Ronquille and Cat Bay is 3 feet (0.9 m.). Bay Ronquille is separated from Cat Bay by a group of islands, through which there is a pass known as **Four Bayous Cutoff.** At the north end of this pass, on the west side of the entrance to Cat Bay, is **Four Bayous Cutoff Light,** a fixed white light on a white braced post. On a favorable tide a draft of 4 feet (1.2 m.) can be taken to Barataria Bay through Quatre Bayou Pass, Bay Ronquille, Four Bayous Cutoff, and Cat Bay.

To enter the pass, approach from a southwest direction and favor the west bank. Take the first cutoff to westward, about three-eighths mile past Quatre Bayou Pass Light, and after leaving this cutoff follow the southwest shore of Bay Ronquille for 1 mile to Four Bayous Cutoff. Go through this cutoff into Cat Bay, leaving the light and some small reefs to westward.

Barataria Bay is a large marsh-fringed shallow lake, separated from the Gulf by a low, narrow sand island, known as **Grand Terre Island.** The bay has general depths of 4 to 5 feet (1.2 to 1.5 m.) and is frequented chiefly by fishermen and oystermen, who take their catch to New Orleans in launches and luggers of 3 to 4 feet draft, going by way of one of the various inside routes.

There are several small settlements on the islands in the bay, but the only post offices are at **Grand Isle,** 4 miles westward of Barataria Pass, and at **Manila Village,** at the northwestern end of the bay. A boat carrying mail, passengers, and freight makes trips three times a week between these two towns and **Myrtle Grove,** on the Mississippi River at the head of Wilkinson Canal. A freight boat makes trips to New Orleans twice a week via Harvey Canal. Gasoline, oil, and provisions, in limited quantities, can be obtained at Grande Isle and Manila Village, and there are facilities at each town for hauling out small boats up to 3½ to 4 feet draft.

Barataria Bay can be entered by two channels leading either side of Grand Terre Island. **Barataria Pass,** also known as **Grand Pass,** the westerly channel, affords the best water and is the one generally used; it is marked on its easterly side by a lighthouse and by **Fort Livingston.** A hard sand bar with about 6 feet (1.8 m.) over it extends 2 miles off the entrance from the west side. Another shoal extends southeastward of Barataria Bay Light, on which an island has formed at the northerly end. The best water in Barataria Pass is found in the **swash channel,** extending eastward from Barataria Bay Lighthouse. This channel passes northward of the island lying southeast of the light, and is good for a draft of about 6½ feet (2.0 m.).

Currents in Barataria Pass have a mean velocity at strength of flood of 1.4 knots and at strength of ebb of 1.7 knots.

Strangers should not attempt to enter without a pilot, as the bar shifts frequently and there are no aids except the lighthouse which would be of any assistance.

Barataria Bay Lighthouse is a white skeleton tower on the corner of Fort Livingston. The light is fixed white, 77 feet (23.5 m.) above the water, and visible 12 miles.

Bayou Regault, on the northern side of Grand Isle, is the approach to the town of Grand Isle. It can be entered only from the eastern end, which entrance is marked by a fixed white light on a white braced post, placed on the east side of the channel. The bayou is navigable for boats under 4 feet (1.2 m.) draft for about 2 miles, the last one-half mile of which boats of over 3 feet (0.9 m.) draft will drag through soft mud. There are no landings at Grand Isle, and vessels must anchor about 1 mile from the town. A shrimp factory is located on the west side of the channel, one-fourth mile inside the entrance.

On the westerly side of Barataria Bay and partly separated from it by low marshy islands are, successively, **Bay des Ilettes, Orlando Bay,** and **Caminada Bay.** They are shallow bodies of water of from 2 to 4 feet (0.6 to 1.2 m.) depth, partaking of the same general characteristics as Barataria Bay. Caminada Bay is entered from the Gulf by **Caminada Pass,** about 7 miles southwestward of Barataria Bay lighthouse. The pass has a depth of 3 to 4 feet (0.9 to 1.2 m.), but is unmarked and little used. These bays form the approach to the Southwestern Louisiana Canal, which connects Barataria Bay with Bayou La Fourche and Timbalier Bay. The approach to this canal is through **Bayou Fifi**, Bay des Ilettes, Bayou Andre or Orlando Bay, and Caminada Bay. These bays are shoal and boats drawing over 2½ feet (0.8 m.) must wait for high water to go to the canal, where deeper water is found. There is no marked channel through these bays, and strangers are advised to get some local fisherman at Grand Isle to act as pilot.

Inside routes northward from Barataria Bay.—The channel through Barataria Bay, good for 4 feet (1.2 m.) draft, leads between **Queen Bess Island** and **Independence Island,** and close to westward of **Shell Island Light,** a fixed white light on a white pile. **Wilkinson Canal** enters Barataria Bay about 1½ miles eastward of Bayou St. Denis. This canal is 11 miles long and leads to Myrtle Grove on the Mississippi River, but does not enter the river. The canal is good for a draft of 4 feet (1.2 m.) There are no toll charges. **Bayou St. Denis** has a depth of about 10 feet (3.0 m.), and with connecting waterways leads to the main inside route leading to New Orleans and Sabine Pass. A new channel, good for a draft of 4 feet (1.2 m.), project depth 5 feet (1.5 m.), leads from Bayou St. Denis, 3¼ miles above its mouth, through **Cutler Bayou, Dupree Cut,** and **Bayou Dupont** into **Bayou Barataria** at the town of **Lafitte.** Two other channels, controlling depth 3 feet (0.9 m.), lead from the head of Bayou St. Denis to **Bayou Rigolets** and thence to Bayou Barataria. One leads through **Lake Villere** and **Harvey Cutoff,** and the other through **Little Lake.** Two red lights on the east side of the channel in Lake Villere mark the entrance to Harvey Cutoff, and two white lights on the north side of the channel in Little Lake marks the entrance to Bayou Rigolets. **Grand Bayou** leads from Barataria Bay at Manila Village to Little Lake, but is used only

by local boats. Each end of the bayou is marked by a fixed white light.

From Barataria Bay westward to Atchafalaya Bay there is a succession of shallow passes leading to the bays inside. All of them are subject to considerable change, both in depth and position, and the few aids marking them are of but little assistance without local knowledge.

Pass Fourchon, 16 miles southwestward from Barataria Bay Lighthouse, is the entrance to Bayou Lafourche. It has a depth of 4½ feet (1.4 m.) in an unmarked channel and is but little used.

Bayou Lafourche was formerly an outlet of the Mississippi River at **Donaldsonville,** 68 miles above New Orleans, but for purposes of flood prevention it is now separated from that stream by a dam without locks at Donaldsonville. From Donaldsonville it extends in a southeasterly direction for 93 miles and empties into the Gulf of Mexico at Pass Fourchon, 41 miles westward of Southwest Pass. It varies in width from 75 to 150 feet. The low-water depths are 5 feet (1.5 m.) from Donaldsonville to Larose, and 7 feet (2.1 m.) from there to the Gulf, with 4½ feet (1.4 m.) on the bar at its mouth.

Bayou Lafourche is intersected by several canals, through two of which—the Harvey Canal and the Company Canal (described on p. 155)—traffic on the bayou has an outlet to the Mississippi River at New Orleans, and through a third—**Southwestern Louisiana Canal**—it has an outlet to Barataria Bay. A westward extension of the Southwestern Louisiana Canal leads to Timbalier and Terrebonne Bays and adjacent waters, including Bayou Terrebonne.

Belle Pass and **Raccoon Pass,** 19 and 20½ miles, respectively, southwestward of Barataria Bay Lighthouse, have depths of 2 or 3 feet (0.6 or 0.9 m.) on the bars at their entrances.

Southwestern Louisiana Canal is a toll canal connecting Barataria Bay with Timbalier Bay, and affords a protected inside passage for small boats. The canal crosses Bayou Lafourche 12½ miles above its mouth, and that part lying east of the bayou is known as **East Louisiana Canal** and the part west of the bayou **West Louisiana Canal.** The canal is about 10 miles long and has a depth of 5 feet (1.5 m.), but the eastern and western approaches are only good for a draft of 4 feet (1.2 m.) and that on a favorable tide. The approaches are not marked and are difficult for a stranger. The **toll charges** are 30 cents per net ton for East Louisiana Canal and 16 cents per net ton on West Louisiana Canal. The toll collectors are at the Bayou Lafourche end of each canal.

Timbalier Bay and **Terrebonne Bay** are large shoal-water bays separated from the Gulf by a chain of low sand islands. The average depths in these bays range from 4 to 7 feet (1.2 to 2.1 m.). Several passes having depths of 6 to 12 feet (1.8 to 3.7 m.) lead from the Gulf to these bays. There is no post office or settlement of any importance on these bays, but they are frequented by large numbers of fishing and oyster boats, which carry their catches through the inside passages to New Orleans or Houma.

Grand Pass Timbalier, known also as **Timbalier Pass,** 50 miles westward from Southwest Pass and 40 miles east-northeastward from Ship Shoal Lighthouse, is the principal entrance from the Gulf to **Timbalier Bay** and its tributaries. The pass has a depth of

8 feet (2.4 m.) in the channel over the bar, and depths of 4 to 5 feet (1.2 to 1.5 m.) 2 miles inside the bar. There is good anchorage, with a depth of 8 to 10 feet (2.4 to 3 m.), just inside the bar. A light on the inside of the eastern end of **Timbalier Island** is the only aid for entering.

Timbalier Light is a fixed red light shown from a white square tower, on a wooden dwelling on piles. The light is 56 feet (17 m.) high and visible for 13 miles. The fog signal is a bell, sounding one stroke every 20 seconds.

Caillou Pass, 9 miles westward of Grand Pass Timbalier, has a depth of 6 feet (1.8 m.) in the channel over the bar, and good anchorage inside the pass in 10 to 23 feet (3 to 7 m.) of water.

Cat Island Pass, about 3 miles westward of Caillou Pass, is the principal entrance to Terrebonne Bay. It has 12 feet (3.7 m.) on the bar, but only 8 feet (2.4 m.) at the anchorage, and from 4 to 8 feet (1.2 to 2.4 m.) in the bay.

Wine Island Pass is about 4½ miles westward of Cat Island Pass and 24 miles east-northeastward of Ship Shoal Lighthouse. The pass has depths of about 9 feet (2.7 m.) on the bar and 8 feet (2.4 m.) at the anchorage inside.

Lake Felicity, Lake Barre, and **Lake Raccourci** are shoal bodies of water lying northward of Timbalier and Terrebonne Bays, and are connected therewith and with each other by many bayous and passes. The controlling depth in these lakes is 5 feet (1.5 m.). A draft of 4 feet (1.2 m.) can be taken from Bayou Terrebonne through Lake Barre, Lake Felicity, Grand Bayou Felicity, and Lake Raccourci to Southwestern Louisiana Canal. The entrance to the canal, however, is only good for 4 feet (1.2 m.) on a favorable tide. These waters are not marked.

Bayou Terrebonne is navigable from its mouth to the town of **Houma,** a distance of 32 miles. The bayou empties through three mouths, the northern one into Lake Barre has a controlling depth of 5 feet (1.5 m.), the eastern mouth at the end of a long delta is not navigable, and the southern mouth into **Lake Lagraisse** having a depth of 3 feet (0.9 m.). **Sea Breeze Light,** a fixed white light on a white post, marks the entrance for the two navigable mouths. From the mouths to **Bush Canal** the depth is 8 feet (2.4 m.), and from Bush Canal to Houma the depth is 5 feet (1.5 m.). At the town of **Bourg,** 25 miles above the mouth, the bayou connects with the main inside route leading to New Orleans (see p. 155). Several other canals enter the bayou and are used extensively by small boats. Several drawbridges with openings of ample width cross the bayou. The banks of the bayou are thickly settled throughout its upper half, and there are frequent settlements where gasoline and provisions can be obtained. Repairs to small boats can be had at Boyne, 12 miles above the mouth, and at Houma.

Caillou Bay is a large bight, with depths of 5 to 6 feet (1.5 to 1.8 m.), lying northward of the western end of **Isle Derniere.** There is good anchorage in 8 feet (2.4 m.) close inside of **Raccoon Point,** the western point of Isle Derniere, but there is only about 7 feet (2.1 m.) in the approach.

A protected inside route is afforded small craft of 4 to 5 feet (1.2 to 1.5 m.) draft from Terrebonne and Timbalier Bays westward through **Lake Pelto** and **Caillou Boca** to Caillou Bay.

Caillou Bayou, locally known as **Bayou Grand Caillou,** rises near Houma and empties into the Gulf about 7 miles north of Racoon Point. The bayou has a depth of 5 feet (1.5 m.) at the entrance and a least depth of 12 feet (3.7 m.) in a channel 800 feet wide for a distance of 16 miles above the entrance. It is navigable for a draft of 3 to 4 feet (0.9 to 1.2 m.) throughout, and near the upper end connects with Bayou Terrebonne by **Cypress Company Canal** and **Bayou Little Caillou.** The bayou connects with a network of navigable lakes and canals and is extensively used by small boats.

Oyster Bayou, 13 miles northwestward of Raccoon Point, connects the Gulf with **Fourleague Bay,** an arm of Atchafalaya Bay. It affords a protected route for small craft of 3 to 4 feet (0.9 to 1.2 m.) draft going to Atchafalaya Bay from Caillou Bay or the waters to the eastward.

Oyster Bayou Lighthouse is a white house on pile foundation, on the east side of the entrance. The light is fixed red, 47 feet (14.3 m.) above the water, and visible 8 miles.

Ship Shoal, lying about 10 miles southward of Raccoon Point, is about 25 miles long in a general east and west direction, 1 to 3 miles wide, and has depths ranging from 5 to 18 feet (1.5 to 5.5 m.); for 6½ miles of its length it has a depth of less than 12 feet (3.7 m.). In stormy weather it may be distinguished at some little distance by a choppy or breaking sea. In calm weather its position is not indicated by natural phenomena, and it can best be avoided by use of the lead.

Ship Shoal Lighthouse stands in 14 feet (4.3 m.) of water, 86 miles 271° true (W. ⅜ S. mag.) from Southwest Pass gas and whistling buoy. It is a brown skeleton structure, inclosing a stair cylinder and cylindrical dwelling. The light is flashing white (flash 2.7 seconds, eclipse 27.3 seconds), 105 feet (32 m.) above the water, and visible 16 miles. A fog bell sounds a single stroke every 20 seconds. A flashing white gas and whistling buoy, "2SHIP," lies about 19 miles 164° true (SSE. mag.) from Ship Shoal Lighthouse. It is moored on the 10-fathom (18 m.) curve.

ATCHAFALAYA BAY AND RIVER

Atchafalaya Bay is a large indentation in the coast of Louisiana 112 miles westward of Southwest Pass, Mississippi River, and 37 miles northwestward of Ship Shoal Lighthouse. It is about 28 miles long in nearly an east and west direction, and averages 7 miles wide. It is full of shoals and oyster reefs, and has general depths of 3 to 9 feet (0.9 to 2.7 m.). The bay is partially separated from the Gulf by a fringe of reefs, the eastern end of which is known as **Point au Fer Shell Reef,** and the approach for 25 miles is shallow, with depths of 25 feet (7.6 m.) or less. Atchafalaya Bay is the approach to Atchafalaya River and Morgan City. The usual draft of vessels navigating the bay is 6 feet (1.8 m.) or less, except those using the dredged channel to Atchafalaya River, through which a draft of 16 feet (4.9 m.) has been taken: Depth at present, 6 feet (1.8 m.).

Prominent features.—In approaching Atchafalaya Bay, Point au Fer Reef Lighthouse is about the only object which can be easily recognized by a stranger, as the coast eastward and westward is low and marshy. **Belle Isle,** on the north shore of the bay, northward

of the lighthouse, is 130 feet (40 m.) high, and makes a conspicuous object from some distance offshore, but it will probably not be sighted before the lighthouse.

Point au Fer Reef Lighthouse is a white wooden house on pile foundation on **Eugene Island** on the westerly side of the dredged channel. The light is fixed white, 54 feet (16.5 m.) above the water, and visible 13 miles.

Southwest Reef unused lighthouse, 6½ miles west of Point au Fer Reef Lighthouse, is a black square pyramidal tower, connected to a square house on piles with a pyramidal tower on the roof. This is a prominent object for small vessels approaching close inshore from westward.

Atchafalaya Bay Ship Channel is a dredged cut extending from the Gulf northeastward through Point au Fer Shell Reef to the mouth of Atchafalaya River. It has a width of 200 feet and a project depth of 20 feet (6.1 m.), but these dimensions have not been maintained and the controlling depth is 6 feet (1.8 m.) for a short distance. The dredged channel is marked by lights and beacons on the northwesterly side, and by occasional piles on the southeasterly side. A spoil bank extends along the northwest side of the channel to Light No. 7.

A Cutoff Channel, marked on the northerly side by pile beacons, leads from the mouth of Atchafalaya River westward through the bay to the entrance to East Cote Blanche Bay, and to a channel leading to the Gulf at Southwest Reef unused lighthouse. This channel has been nearly abandoned and some of the beacons are gone. It is good for a draft of 6 feet (1.8 m.).

Atchafalaya River empties into the northeastern corner of Atchafalaya Bay from northward. It is the outlet of an extensive system of lakes and bayous in southern Louisiana which, in part, afford inside passages to the Mississippi and New Orleans and to other parts of the State.

From Atchafalaya Bay to Morgan City, a distance of 15 miles, the river has a crooked channel one-eighth to three-eights mile wide and 40 to 140 feet (12 to 43 m.) deep, the deepest water generally being found in midstream. A railroad drawbridge, with an opening 110 feet wide on each side of a center pier, crosses the river at Morgan City.

Bayou Boeuf extends eastward from Atchafalaya River from a junction at Morgan City, and forms a part of the inland waterway, New Orleans to Sabine Pass, described on page 153.

Bayou Plaquemine.—From Morgan City there is a waterway with an available depth of 7 to 10 feet (2.1 to 3 m.) northward to the Mississippi River at Plaquemine, a distance of 55 miles. It follows Atchafalaya River 2 miles, **Flat Lake** 2¾ miles, **Bayou Long** 6¼ miles, **Belle River** 8 miles, **Big** and **Little Godelle** 5 miles, **Bay Natchez** 5½ miles, **Grand River** 16½ miles, and Bayou Plaquemine 9 miles. The channel through Flat Lake is marked by lights and piles, and has a controlling depth of about 7 feet (2.1 m.), project depth 10 feet (3 m.)

A Government lock (no tolls) at **Plaquemine,** on the Mississippi River 95 miles above New Orleans, connects this route with the Mississippi River. The lock has an available length of 265 feet, a width of 55 feet, and a low-water depth over sills of 10 feet (3 m.). 298?

At low-river stages, by using the outside gates, the lock has an available length of 356 feet, or by using gates 1 and 3, a length of 310 feet.

Bayou Grossetete, emptying into Bayou Plaquemine 6½ miles below the lock, is navigable for a draft of 5 feet (1.5 m.) for a distance of 25 miles above its mouth. It is used principally by barges carrying cane and by log rafts.

Bayou Teche is a waterway of southern Louisiana having its source in St. Landry Parish and flowing southeastward, parallel to and 35 miles westward of the Mississippi River, for 110 miles, to the point where it joins the lower Atchafalaya River, about 10 miles above Morgan City. It is navigable for a draft of 8 feet (2.4 m.) to Franklin and 4 feet (1.2 m.) to Arnaudville, 104 miles above Morgan City, and within 16 miles of the head of the bayou. The Teche is crossed by several drawbridges of ample width. Keystone Lock, 160 feet long and 36 feet wide in the clear, is about 66 miles above the mouth of Bayou Teche.

There is regular steamer communication between New Orleans, Houma, Morgan City, and the principal ports on the Teche.

Morgan City, a town of considerable importance on the east bank of Atchafalaya River, has railroad communication with all points east and west. The principal articles of commerce are fur, fish, oysters, and lumber. Steamers of 3 to 6 feet (0.9 to 1.8 m.) draft run to all adjacent bayous, lakes, and rivers, and to New Orleans. Coal, gasoline, water, provisions, and some ship chandlery can be obtained here. There is a machine shop and two marine ways with a capacity of about 300 tons and 8 feet draft.

Berwick is a small town opposite Morgan City and connected with it by ferry. It has a marine railway with a capacity of about 300 tons and 8 feet draft.

Wharves.—There are ample depths at most of the wharves at Morgan City for any vessel that can enter the bay and come up the river. The wharves are privately owned.

Anchorage.—There is good anchorage anywhere in the bay where suitable depth can be found. Vessels seldom anchor in the river, except just below the railroad bridge at Morgan City, on account of the depth and the currents, though the bottom affords good holding ground.

Storm warnings are displayed at Morgan City above the bridge.

Hospital.—There is a relief station of the United States Public Health Service at Morgan City; the nearest marine hospital is at New Orleans.

Pilots and towboats.—There are no regular pilots and but three towboats. Vessels desiring either should anchor between the inner buoy and the outer end of the dredged channel at the entrance to Atchafalaya Bay, and send a boat to Morgan City. Whenever a vessel is expected the towboat makes a trip from Morgan City to the Gulf daily until the vessel arrives.

Fog is most frequent during January, February, and March. Southerly winds bring it in and northerly winds clear it away.

Tides, currents, and freshets.—The rise and fall of the tide and the velocity of the current depend to a considerable extent upon the force and direction of the wind. At the entrance to the bay the mean range of tide is 1.2 feet; at Morgan City normal tide action is not perceptible. Northerly winds lower the water surface

at Morgan City as much as 1 foot, and southeasterly winds raise it 1½ to 2 feet.

Freshets occur frequently during May and June, at which times the river overflows its banks and the current has considerable velocity, making it difficult to keep in the channel. During ordinary stages of the river the current has a velocity of about one-half knot. When there are freshets in the rivers the water in Atchafalaya Bay is quite fresh and that in the Cote Blanche Bays is nearly so. The discolored water coming out of the mouth of the river will be encountered well offshore, the distance depending much upon the direction of the wind.

Directions, Atchafalaya Bay and River.—Vessels of 8 feet (2.4 m.) or more draft approaching the bay from eastward or westward should keep in about 3 to 4 fathoms (5.5 to 7.3 m.) of water until a 37° true (NNE. ¾ E. mag.) course will bring Point au Fer Reef Lighthouse ahead when sighted. This course will then lead along the axis of the dredged channel. Strangers should select anchorage as far inshore as the draft will permit, and obtain local assistance.

Leave beacons and lights to port and piles to starboard, and when up to light No. 7 (fixed white), haul eastward leaving beacon No. 13 to port and light No. 2 (fixed red) to starboard. When three-fourth mile past light No. 2 haul northward into the mouth of the river and steer midriver courses to Morgan City. The channel is marked by lights, while stakes with pointers mark the shoal water off the points.

Little Wax Bayou, leaving Atchafalaya River 3 miles below Morgan City, empties into **Wax Lake** and thence through **Wax Lake Pass** into the Gulf. **Big Wax Bayou,** a branch of Little Wax Bayou, empties into the Gulf at the entrance to Wax Lake Pass. The main inside route from Morgan City to West Cote Blanche Bay now extends through Little Wax Bayou, Wax Lake, Wax Lake Pass, the northern part of Atchafalaya Bay, and East Cote Blanche Bay. The other route, via Bayou Teche and Hanson Canal, is obstructed by fixed bridges over Hanson Canal, with an average clearance of 9 feet. (See description of Hanson Canal below.) The controlling depth is 10 feet (3.0 m.) in Little Wax Bayou, Wax Lake, and Wax Lake Pass, but the depth on the bar is only 6 feet (1.8 m.).

East Cote Blanche, West Cote Blanche, and **Vermilion Bays** are the names applied to three parts of a large body of water which extends west-northwestward from the northwestern side of Atchafalaya Bay and is separated from the Gulf by **Marsh Island.** The bays have a combined length of about 32 miles, with varying width of 5 to 15 miles and average depth of 5 to 9 feet (1.5 to 2.7 m.). With the exception of Cote Blanche Island and Weeks Island, the shores of these bays and of Marsh Island are low and marshy.

The bays are of little commercial importance, and there are but few settlements directly on their shores. Back a short distance from the east shore of East Cote Blanche Bay is the plantation settlement of **Southbend,** the terminus of a railroad branch line.

Vessels going from Atchafalaya Bay to East Cote Blanche Bay generally use **Morrison Cutoff,** between **Point Chevreuil** on the east and **Rabbit Island** on the west. Under favorable conditions

a draft of 5 feet (1.5 m.) can be taken through the cut-off into East Cote Blanche Bay and thence through West Cote Blanche Bay to Vermilion Bay, but local knowledge is required.

Bayou Portage, emptying into the northeastern end of West Cote Blanche Bay, and **Hanson Canal,** connecting with **Bayou Teche,** are a part of the Intracoastal Waterway from New Orleans to Sabine Pass. The controlling depth from West Cote Blanche Bay to Bayou Teche is 5 feet (1.5 m.). Three fixed bridges cross Hanson Canal at its entrance to Bayou Teche, having a low-water clearance of 12 feet and an average clearance of 9 feet. A lock just above the bridges has an inside length of 937 feet, width 30 feet, and depth 7 feet (2.1 m.). The canal is owned by the Government and is free of tolls.

Cote Blanche Island, on the northerly side of West Cote Blanche Bay, is about 70 feet (21 m.) high and on the bay side presents a reddish-yellow steep bluff. **Cote Blanche,** a large plantation on the island, has a landing at which an occasional steamboat from Morgan City stops. **Ivanhoe Canal,** leading around the west side of Cote Blanche Island, extends to **Iberia-St. Mary Canal,** which leads through Weeks Bayou to Weeks Bay. A draft of 4 feet (1.2 m.) can be taken from West Cote Blanche Bay into the canal, through which and connecting waterways a draft of 5 feet (1.5 m.) can be carried to Weeks Bay. A railroad bridge crosses the canal 2½ miles above its mouth.

Grande Cote Island, frequently called **Weeks Island,** near **Weeks Bay,** a northeasterly extension of Vermilion Bay, has an elevation of 204 feet (62 m.) and is a prominent landmark from the bays. **Weeks,** a post office on the island, is the location of extensive salt mines and the terminus of a railroad branch line. **Weeks Bayou** leads from Weeks Bay around the north end of Grande Cote Island and connects with Iberia-St. Mary Canal. Ivanhoe Canal joins Iberia-St. Mary Canal 5 miles from Weeks Bay and leads southward to West Cote Blanche Bay. The controlling depth in Weeks Bayou and Iberia-St. Mary Canal is 5 feet (1.5 m.).

Avery Island, on **Bayou Petite Anse,** about 5 miles north of Vermilion Bay, is the location of salt mines and the terminus of a railroad branch line. Gasoline, oil, and provisions can be obtained here, and there are facilities for hauling out small boats. The town is reached through **Avery Canal** 1½ miles, and Bayou Petite Anse 4½ miles. The controlling depth is 6 feet (1.8 m.) to Avery Island. The approach to the canal is through a dredged cut marked by range poles.

Vermilion River is a small stream flowing into the western end of Vermilion Bay from northward. It is navigable for about 6-foot (1.8 m.) draft for 45 miles above its mouth to **Lafayette. Abbeville, Milton,** and Lafayette have railroad communication. The principal commerce on the river is in sugar cane which is carried on barges. The **entrance** to the river is marked by a fixed white light and white day mark on a pile, located on the east side of the channel. The depth at the mouth of the river is 5½ feet (1.7 m.), but the approach through the western end of Vermilion Bay is good for only 4 feet (1.2 m.) at mean low water. A dredged channel, 5 feet (1.5 m.) deep, connects Vermilion River 1¼ miles above its mouth with Schooner Bayou.

Schooner Bayou, emptying into the extreme western end of Vermilion Bay, connects with canals and lakes leading to Sabine Pass and forms part of the Intercoastal Waterway. (See descriptions on p. 153.) The **approach** to the bayou is through a dredged channel 5 feet (1.5 m.) deep, and marked on the south side by a pile 1 mile offshore and by stakes, and on the north side by a fixed white light and black day mark on a pile at the entrance to the bayou.

Shell Keys, lying off **South Point,** the southernmost point of Marsh Island, are dry in places and on a clear day may be seen from aloft at a considerable distance. Shell Keys buoy No. 2 is placed 1¾ miles off the southerly end of an irregularly shaped shoal surrounding the keys.

Southwest Pass entrance to Vermilion Bay from the Gulf has a controlling depth of 6 to 7 feet (1.8 to 2.1 m.) and leads between the western end of Marsh Island and the mainland. This pass, if it can be found, is not difficult to enter with a draft of 6 feet (1.8 m.), but it is advisable to have local assistance.

Directions, Southwest Pass, Vermilion Bay.—These directions are good for a draft of about 6 feet (1.8 m.)

Examine chart No. 1277 before approaching the pass.

Coming from eastward, shape the course for Shell Keys buoy No. 2, from which steer 310° true (NW. by W. mag.) for 15 miles until a large clump of trees (about 1 mile northwestward of a smaller clump) bears 7° true (N. mag.) and **Lighthouse Point,** the eastern point at the entrance, bears 40° true (NE. by N. mag.). Lighthouse Point is low and grassy, with a sandy beach. Head for the point on the 40° true (NE .by N. mag.) course until within 1 mile of the shore; thence the chart and the appearance of the water are the guides.

Coming from westward, follow the beach at a distance of about 2 miles until a large clump of trees (about 1 mile northwestward of a smaller clump) bears 7° true (N. mag.) and Lighthouse Point, the eastern point at the entrance, bears 40° true (NE. by N. mag.). Head for the point on the 40° true (NE. by N. mag.) course until within 1 mile of the shore; thence the chart and the appearance of the water are the guides.

Trinity Shoal lies about 25 miles southward of Southwest Pass, Vermilion Bay, and 60 miles 285° true (W. ¾ N. mag.) from Ship Shoal Lighthouse. It is about 20 miles long in a west-southwesterly and east-northeasterly direction and has depths of 11 to 18 feet (3.4 to 5.5 m.). It is fairly steep-to on its southwestern side, the 10-fathom (18 m.) curve being distant only about 5 miles and the 5-fathom (9 m.) curve only about 1 mile. In calm weather Trinity Shoal can be discerned by a difference in color of the water; in stormy weather it is indicated by a choppy sea. Owing to its greater depth the sea does not break so heavily on Trinity Shoal as on Ship Shoal.

Trinity Shoal is marked off the south end of its southwesterly part by **Trinity Shoal gas and whistling buoy,** moored in 7 fathoms (13 m.) of water.

Mermentau River empties into the Gulf of Mexico from northeastward about 86 miles westward of Atchafalaya Bay entrance and 90 miles eastward of Bolivar Point Lighthouse. It is formed by the junction of **Bayou Nezpique** and **Bayou des Cannes,** and in its

course to the Gulf has four enlargements known as **Lake Arthur, Grand Lake, Upper Mud Lake,** and **Lower Mud Lake.** The river is navigable throughout its entire length, a distance of 60 miles, Bayou Nezpique is navigable for an additional 22 miles, and Bayou des Cannes for 14 miles. The available depths are 3 feet (0.9 m.) across the bar at the mouth; 6 feet (1.8 m.) throughout Mermentau River except in Lower Mud Lake and Grand Lake, where the depths range from 3 to 4 feet (0.9 to 1.2 m.); 8 feet (2.4 m.) in Bayou Nezpique; and 7 feet (2.1 m.) in Bayou des Cannes.

The two principal tributaries of Mermentau River, **Bayou Plaquemine Brule,** or **Medlenka River,** and **Bayou Queue de Tortue,** are navigable for a draft of 6 feet (1.8 m.) for distances of 16 and 12 miles, respectively.

The bar at the mouth of the Mermentau River is subject to change, and the channel is not marked except by a buoy 2 miles off the mouth of the river. This entrance to the river is but little used. There are no regular pilots.

There are several plantation settlements near the river, but **Grand Chenier,** 8 miles above the mouth, is the only post office in the lower reaches. **Lake Arthur,** at the upper end of the lake of that name; **Mermentau,** 2 miles below the head of the river; and **Riceville,** on Bayou Queue de Tortue, have railroad connections.

Mermentau River is connected with Vermilion Bay by a 4-foot (1.2 m.) passage through Grand Lake, White Lake, Schooner Bayou, and connecting canals. It is also connected with Calcasieu Lake and River by a canal 7 feet (2.1 m.) deep extending from a position 1½ miles above Grand Lake to Black Bayou, which empties into Calcasieu River. These connecting waterways form part of the Intracoastal Waterway described on page 153.

Calcasieu Pass (chart 518), the outlet of Calcasieu Lake and River, lies about 98 miles westward of Atchafalaya Bay entrance and about 78 miles eastward of Galveston entrance. It is obstructed by a shifting bar, which has been improved by the construction of two jetties extending southward from the mouth of the pass. The depth in the channel over the bar is 8 feet (2.4 m.).

Inside the entrance the pass for a distance of 5½ miles has an average width of 600 feet and a depth of 12 feet (3.7 m.) or more and is an excellent anchorage for vessels which can cross the bar. The head of the pass is obstructed by a bar with a depth of 4 feet (1.2 m.) over it, mud bottom.

Cameron is a post office and small village on the eastern shore of Calcasieu Pass about 2½ miles above its entrance. Mail is brought down the Calcasieu River to Cameron from Lake Charles, 36 miles distant, three times a week.

The vessels entering Calcasieu Pass from the Gulf are practically limited to small fishing vessels. There is very little traffic and there are no regular pilots stationed here. Fishermen from Cameron can give information relative to the pass.

Calcasieu Range Rear Lighthouse is a black pyramidal tower on pile foundation in the marsh on the west bank of the river. The light is fixed white, 53 feet (16.2 m.) above the water, and visible 12 miles.

The front range is a white slatted pyramidal structure, on pile foundation, standing in 5 feet (1.5 m.) of water near the west bank

of the river; the light is fixed red. With the rear light it forms a range leading between the jetties on a bearing of 355° true (N. by W. ⅛ W. mag.).

Calcasieu Lake, at the head of Calcasieu Pass, 6 miles from the Gulf, is 15 miles in length, averages 4 miles in width, and 5 to 6 feet (1.5 to 1.8 m.) in depth. Various projects have been undertaken to improve the depths in the lake, but there is only 4 feet (1.2 m.) in the upper and lower ends at present. The bottom is soft mud and a slightly greater draft can always drag through. A jetty 2¼ miles long, partly submerged, extends along the southern end of the lake on the north side of the channel. The **channel** through the lake is marked on its west side by 3-pile dolphins placed at intervals of 1,500 feet. The dredged channel into the entrance of Calcasieu River is marked on its west side by piles and stakes. This channel passes to eastward of the small island at the mouth of the river. The settlements of **Hackberry** and **Grand Lake** have private landings on the lake, and have communication with Cameron and Lake Charles by steamboat three times a week.

Directions, Calcasieu Pass and Lake.—From the perpendicularly striped buoy off the entrance, steer 355° true (N. by W. ⅛ W. mag.) with Calcasieu Range lights ahead. Pass to westward of buoy No. 2 at the end of the east jetty and then haul about one-half point to westward of the range (this range passes too close along the east jetty) so that the vessel will be midway between the two jetties at the entrance to the pass. Then steer mid-channel courses to an anchorage or to the wharves at Cameron.

If going to Calcasieu Lake, continue mid-channel courses to **St. John Island,** 2 miles above Cameron. Follow the main channel to eastward of the island, taking care to keep in mid-channel for the first half mile to avoid oyster bars that have built out on each side of the channel 600 yards above the fork. There is another bar on the east side of the channel about 1 mile above the fork, and vessels should keep close to St. John Island here.

On entering the lake, haul eastward, passing to southward of the jetty. Vessels should proceed carefully here, as the jetty is partly submerged and only marked by an occasional stake. Hold course along this jetty for 2½ miles to a three-pile dolphin. Pass to southward of this dolphin and haul northeastward and then northward through the lake, passing to eastward of all dolphins.

Calcasieu River empties into the upper end of Calcasieu Lake from northward. It is navigable at present for a draft of 8 feet (2.4 m.) to **Lake Charles,** 17 miles above Calcasieu Lake; 7 feet (2.1 m.) to **Jones Bluff,** 27 miles farther, and 3 feet (0.9 m.) to **Philips Bluff,** a total distance of 66 miles above Calcasieu Lake. In this distance it has three enlargements called **Moss Lake, Prien Lake,** and **Lake Charles.** Two miles above Prien Lake, a pass has been cut through a large loop in the river and is known as the **Cutoff.** A drawbridge with opening of ample width crosses the river between the Cutoff and Lake Charles. The commerce on the river consists of cattle, rice, logs, lumber, sand, fertilizer, and miscellaneous merchandise.

Calcasieu River is connected with the Intracoastal Waterway leading to New Orleans at Black Bayou, which enters the river 2½ miles

above Calcasieu Lake. (For description see p. 153.) The river is connected with Sabine River by the **Calcasieu-Sabine Canal,** which enters the river through two openings, 1½ miles and 4 miles above Calcasieu Lake. This passage is the principal waterway leading from the city of Lake Charles to the Gulf and leads through Calcasieu River, Calcasieu-Sabine Canal, Sabine River, Sabine-Neches Canal, Port Arthur Ship Canal, and Sabine Pass.

The project dimensions in Calcasieu-Sabine Canal and in Calcasieu River to Lake Charles is 12 feet (3.7 m.) depth, and width 90 feet, with a turning basin 12 feet (3.7 m.) deep, 1,000 feet long, and 400 feet wide at the city of Lake Charles. The project dimensions now exist in the Calcasieu-Sabine Canal. Authority has been granted to Calcasieu Parish to enlarge the river and canal where necessary to a depth of 30 feet (9.1 m.), with a bottom width of 125 feet. It is expected that this project will be completed in 1926. This will make the city of Lake Charles a port for ocean-going vessels.

Lake Charles is a city of about 16,000 inhabitants on the eastern bank of the lake of that name, 17 miles above Calcasieu Lake. It has communication with the interior by four railroad lines, and with the Gulf by the Calcasieu-Sabine Waterway. The Parish is developing a 30-foot (9.1 m.) waterway to the Gulf at a cost of $3,500,000, to be completed in 1926. Recent extensive oil discoveries in the vicinity have greatly increased the importance of the city. Gasoline, fresh water, provisions, and some yacht supplies can be obtained here. There are two machine shops, and facilities for hauling out vessels up to 200 tons, and 7 foot draft. There is a municipal wharf with 610 feet of berthing space.

Westlake, across the lake from Lake Charles, and **Lockport,** 4 miles below Lake Charles, are sawmill towns of some importance. There is regular ferry service between Lake Charles and Westlake.

Sabine Bank is a succession of detached shoal spots, about 38 miles in length east and west, lying off Sabine Pass and parallel to the coast at a distance averaging 17 miles. The depths on the bank range from 16 to 30 feet (4.9 to 9.1 m.), but they are undoubtedly subject to change. The bank is marked by Sabine Bank Lighthouse near the middle and by **Sabine Bank east end gas and whistling buoy** at its easterly extremity. In a heavy sea the outlines of the shoals are denoted by breakers.

There are several passages between the shoal spots. The one generally used by vessels approaching from southeastward lies 3 miles eastward of Sabine Bank Lighthouse and is 1¾ miles wide between the 30-foot (9 m.) curve, and is locally known as **The Hole in the Wall.** This passage is marked by buoys and is good for a draft of 32 feet (9.8 m.) at mean low water, but this may be reduced by as much as 3 feet during northers. Directions for this pass are given on page 166.

Sabine Bank Lighthouse is a red conical tower on cylindrical pier standing in 18 feet (5.5 m.) of water, 11½ miles 152° true (SE. ⅞ S. mag.) from Sabine Pass entrance. The light is flashing white, 72 feet (22 m.) above the water, and visible 14 miles.

To the southward of Sabine Bank, and about 6 miles inside of the 10-fathom (18 m.) curve, the bottom is somewhat irregular and broken, and several spots with depths of 35 feet (10.6 m.) or less are found with surrounding depths 10 to 20 feet (3 to 6 m.) greater.

A 26-foot (7.9 m.) spot lies 12.2 miles 143° true from Sabine Bank Lighthouse. This is the least depth found on a ridge extending out from Sabine Bank. There are two shoal spots of 31 feet (9.5 m.) each about 1,000 yards 106° true and 1,800 yards 287° true, respectively, from the 26-foot shoal with deeper water between the three shoals. A 32-foot (9.8 m.) spot lies about 7.3 miles 105° true from the 26-foot spot. These shoals lie in the direct track of vessels making the passage through Sabine Bank from the southeastward. Northward of Sabine Bank the general depths are from 36 to 40 feet (11 to 12.2 m.).

INTRACOASTAL WATERWAY, NEW ORLEANS TO SABINE PASS

In southern Louisiana west of the Mississippi River there is an extensive network of shallow inland waters, which lie within the region of alluvial deposit by the river and consist of vast stretches of marsh, containing numerous areas of cypress swamps varying in size from small patches to tracts several miles in extent, and also many lakes from one-fourth mile to 30 miles in length. These inland waters are intersected by navigable waterways, termed bayous, having a general north and south direction, with a well-defined current toward the Gulf of Mexico after a heavy rainfall, but for the greater part of the time with only a very sluggish current, which may often be reversed by a change in direction of the wind. The highest land is found immediately adjacent to the bayous in the form of natural levees; as a rule, the larger the bayou the higher its levee. In the western part of the section narrow "islands" or "ridges" rise to heights of 4 to 8 feet (1.2 to 2.4 m.) above the surrounding marsh; some of these ridges are 6 or 7 miles in length.

The depth of water in the bayous is nearly always sufficient for navigation by river craft and not infrequently is as great as 20 to 30 feet (6 to 9 m.) for miles in succession. The lakes, on the contrary, are generally shallow, having depths of possibly 6 to 10 feet (2 to 3 m.), with soft mud or ooze bottom. The shores are marshy, being a few inches above the surface of the lakes at low water and subject to overflow during high water. The land high enough to admit of cultivation, as well as that which lies within the limits of some project of artificial drainage, is extremely fertile and intensively cultivated; sugar, rice, and vegetables being the principal crops. The waters of the lower portion of this section in the vicinity of the Gulf abound with oysters, shrimp, and fish. For the most part the towns and villages are located on the high ground along the bayous, but small settlements are to be found in other advantageous locations.

There is a large traffic on these waterways in fish, oysters, logs, lumber, rice, sugar cane, fertilizer, vegetables, and general merchandise. The intracoastal waterway forms a connecting link between these bayous and affords an outlet for their products to the markets in New Orleans and other cities. The intracoastal waterway extends from New Orleans, La., to Corpus Chirsti, Tex., and has a project depth of 5 feet (1.5 m.) and a width of 40 feet. This waterway has been completed except for the section between Sabine Pass and Galveston Bay. Further activities contemplate increasing the

dimensions of the waterway to a depth of 9 feet (2.7 m.) and a width of 100 feet.

The entire waterway is now under the control of the Government and is free of tolls.

Regular steamboat service is maintained between New Orleans and the towns on Barataria Bay, Bayou Teche, and intervening towns.

Pilots for the eastern part of this section may be had at Harvey, La. For other sections they may be found at the larger towns and settlements.

These waterways are described in detail in the Inside Route Pilot, Key West to the Rio Grande.

The main routes, distances, and available depths are given in the following table:

Waterway	Length in nautical miles	Distance from lock at Harvey, La.	Available depth
			Feet
1. Harvey Canal	5	5	4
2. Bayou Barataria to town of Barataria	9½	14½	4
3. Bayou Villars to Lake Salvador	1½	16	5
4. Lake Salvador to Harvey Canal No. 2	10½	26½	5
5. Harvey Canal No. 2 to Larose	7	33½	5
6. Bayou La Fourche to Lockport	8½	42	5
7. Company Canal to Bourg	8	50	4
8. Bayou Terrebonne to Houma	6	56	6
9. Canal to Bayou Black	1½	57½	5
10. Bayou Black to Bayou Boeuf	25½	83	6
11. Bayou Boeuf to Morgan City	10	93	Ample.
12. * Atchafalaya River to Bayou Teche	10	103	Ample.
13. Bayou Teche to Garden City	12	115	6
14. Hanson Canal to Bayou Portage	4½	119½	5
15. Bayou Portage to West Cote Blanche Bay	4½	124	5
16. West Cote Blanche and Vermilion Bays to Schooner Bayou	33	157	5
17. Schooner Bayou to lock	4	161	5
18. Government Canal to White Lake	6	167	5
19. White Lake	12	179	5
20. Turtle, Alligator, and Collicon Lakes	5	184	3–4
21. Grand Lake to Mermentau River	10½	194½	4
22. Mermentau River to canal	1½	196	6
23. Canal to Lake Misere	7	203	7
24. Lake Misere Canal to Sweet Lake	9	212	7
25. Canal around Sweet and Willow Lakes	12	224	7
26. Black Bayou to Calcasieu River	4½	228½	7–9
27. Calcasieu River to canal	1½	230	28
28. Calcasieu-Sabine Canal to Sabine River	20	250	12
29. Sabine River to Orange, Tex	3	253	23
Sabine and Neches Rivers to Beaumont	32	282	23
Sabine River and Canal to Port Arthur	18	268	23
* The following alternative route from Morgan City to Schooner Bayou is often used, Hanson Canal being obstructed by fixed bridges with an average clearance of only 9 feet:			
12a. Atchafalaya River to Little Wax Bayou	3	96	Ample.
13a. Little Wax Bayou, Wax Lake and Pass	18	114	10
14a. Atchafalaya Bay to Morrison Cutoff	8	122	5
15a. East and West Cote Blanche Bays	18	140	5
16a. Vermilion Bay to Schooner Bayou	17	157	5

Harvey Canal.—The Harvey Canal extends from the town of Harvey to Bayou Barataria, a distance of 5 miles. **Harvey** is located on the west bank of the Mississippi River opposite New Orleans, with which it has regular ferry communication. Gasoline, fresh water, and provisions can be obtained. A lock at Harvey has an available length of 150 feet, width 30 feet, and depth over sills 6½ feet (2 m.). Three drawbridges cross the canal at Harvey.

Bayou Barataria and its branch, **Bayou Villars,** leads from Harvey Canal to Lake Salvador. (Barataria Pass and Barataria Bay are described on p. 140.) Supplies and repairs to small boats can be had at **Crown Point,** on Bayou Barataria, 11 miles from Harvey, and also at the town of **Barataria,** at the junction of Bayou Barataria and Bayou Villars.

Lake Salvador is a shallow lake 11 miles long and with an average width of 5 miles. The depths in the lake range from 5 to 7 feet (1.5 to 2.1 m.). The eastern entrance to the lake is marked by **Bayou Villars Light,** a fixed white light on a white post on a fog-signal house located on the southern side of the channel. The fog signal is 1 stroke of bell every 30 seconds. The western entrance to the lake is marked by **Harvey Canal No. 2 Light,** a fixed white light on a white post at the end of a row of piling on the north side of the channel. The course across the lake is 236° true (SW. ½ W. mag.).

Harvey Canal No. 2 leads from Lake Salvador to the town of **Larose** on Bayou Lafourche. Supplies and repairs can be had at Larose, which has semiweekly steamboat communication with New Orleans. A drawbridge crosses the canal here.

Bayou Lafourche is described on page 142. The intracoastal waterway follows the bayou from Larose to **Lockport,** a distance of 8½ miles. This part of the bayou is thickly settled on both banks. A pontoon bridge crosses the bayou at Larose and a drawbridge crosses at Lockport. Supplies can be had at Lockport which has railroad and steamboat communication with New Orleans and points westward. There is a machine shop here, and facilities for hauling out any vessel that can enter the bayou.

Company Canal is a toll canal extending from the Mississippi River at Westwego, opposite Walnut Street, New Orleans, through **Bayou Segnette,** Lake Salvador, and canal to Lockport, and thence to Bayou Terrebonne at the town of **Bourg.** The section of the canal between Lockport and Bourg forms part of the intracoastal waterway and was purchased by the United States Government in 1925 and is now free from tolls. A lock at Westwego is 160 feet long, 25 feet wide, and 6 feet (1.8 m.) deep. The eastern end of the route through Lake Salvador is marked by **Bayou Segnette Light** (fixed white) on the east side of the channel, and the western end of Lake Salvador by **Bayou des Allemands Light** (fixed white), on the south side of the channel. The intracoastal waterway section of this canal is crossed by two drawbridges, one at Lockport and one at Bourg. Supplies can be obtained at Bourg.

Bayou Terrebonne, Terrebonne Bay, and connecting waterways are described on page 142. The intracoastal waterway follows the bayou from Bourg to the canal just below **Houma,** a distance of 6 miles. Seven drawbridges cross this section of the bayou, the first

two of which are usually kept open. Supplies of all kinds can be had at Houma, and there is a machine shop and marine ways of 250 tons capacity, length 135 feet, and draft 3½ feet. Two canals connect Bayou Terrebone with Bayou Black. **Barrow Canal** above Houma is little used. The new canal, one-half mile below Houma, was completed in 1924 and has a depth of 5 feet (1.5 m.) and width of 40 feet.

Bayou Black and **Bayou Boeuf** form the waterway leading from Houma to Morgan City. Eight drawbridges cross Bayou Black and two cross Bayou Boeuf. There are two hyacinth booms across Bayou Black near its head which will be opened on signal.

Atchafalaya River and Bay are described on page 144, Morgan City on page 146, Plaquemine Bayou and connecting waterways on page 145, and Bayou Teche on page 146.

There are two routes leading from Morgan City westward to West Cote Blanche Bay. The main route, via Bayou Teche and Hanson Canal, is at present obstructed by fixed bridges, with an average clearance of only 9 feet. Future activities contemplate changing these fixed bridges to drawbridges. The other route via Little Wax Bayou, Wax Lake and Pass, Atchafalaya Bay, and East Cote Blanche Bay is used by all vessels unable to pass under the bridges over Hanson Canal. Little Wax Bayou and connecting waterways are described on page 147. Hanson Coal and Bayou Portage are described on page 148.

Schooner Bayou, emptying into the extreme western end of Vermilion Bay, connects with a series of canals and lakes leading to Mermentau and Calcasieu Rivers. The approach to the bayou is through a dredged channel 5 feet (1.5 m.) deep, and marked on the south side by a pile 1 mile offshore and by stakes, and on the north side by a fixed white light and black day mark on a pile at the entrance to the bayou. The lock in Schooner Bayou is a tidal lock to prevent salt water from flowing through the canal into White Lake, and is operated only when the current in the bayou is reversed. The lock is 300 feet long, 36 feet wide, and 8 feet (2.4 m.) deep. The lock is 4 miles from Vermilion Bay and 6 miles from White Lake.

White Lake is 12 miles long, 6 miles wide, and has depths ranging from 4 to 5 feet (1.2 to 1.5 m.), mud bottom. The east and west entrances to the lake are each marked by a fixed white light with black day mark, and a white beacon and stakes, all on the north side of the channel. The channel across the lake is not marked, and vessels should pass one-half mile south of the point in the north shore of the lake.

Turtle Lake is nearly round with a diameter of about three-fourths mile. The lake is shallow, but there is a narrow 5-foot (1.5 m.) channel across the lake, marked at each end by a single-pile beacon on the northeast side of the channel and by stakes in between. In crossing the lake, pass about 30 feet southwest of the beacons and stakes.

Alligator Lake is about the same size and depth as Turtle Lake. A narrow 5-foot (1.5 m.) channel has been dredged across the southern part of the lake, and is marked on the north side by a beacon at each end, and on the south side by a row of stakes. The beacons are about 100 yards north of the channel. **On entering** the lake from

the eastward, haul sharply to westward and pass about 30 feet northward of the stakes.

Collicon Lake is 3 miles long, 1 mile wide, and from 2 to 3 feet (0.6 to 0.9 m.) deep. A 5-foot (1.5 m.) channel has been dredged across the lake, but this has partly filled up at the western end, so that the controlling depth in April, 1925, was 3 feet (0.9 m.). Beacons and stakes mark the northeast side of the channel, about 25 feet from the center line.

Grand Lake is from 5 to 7 feet (1.5 to 2.1 m.) deep, but the entrances are subject to shoaling. The intracoastal waterway leads from a canal entrance on the southeast side of the lake to Mermentau River, on the northwest side of the lake. The southeast entrance is marked by a fixed white light, a white beacon, and a row of stakes located on the north side of the channel. The controlling depth in this entrance was 4 feet (1.2 m.) in April, 1925. Vessels should pass about 150 yards south of the light and beacon and close to southward of the stakes.

The **channel** across Grand Lake and the entrance to Mermentau River are not marked. Vessels should keep well off the eastern shore at the entrance to the river, on the point of which there is a prominent clump of trees, and follow the north shore into the river on an easterly course. Mermentau River is described on page 149.

A **canal** good for a draft of 7 feet (2.1 m.) leaves Mermentau River, 1½ miles above Grand Lake, and extends west-southwestward to **Lake Misere.** This canal crosses the extreme western end of the lake and is marked on its south side by stakes. **Lake Misere Canal** extends from Lake Misere to **Sweet Lake.** The entrances to Sweet Lake are obstructed by dams. A **canal** leads from Misere Canal south of Sweet Lake and west of **Willow Lake** and enters Black Bayou 4½ miles from Calcasieu River. A drawbridge crosses Black Bayou 2 miles above its mouth. Calcasieu River is described on page 151.

There are two **entrances** to the Calcasieu-Sabine Canal which leads from Calcasieu River to Sabine River. The northern entrance, good for a draft of 12 feet (3.7 m.), proposed depth 30 feet (9.1 m.), is located about 1¼ miles above Black Bayou. The southern entrance, good for a draft of 8 feet (2.4 m.), is located 1½ miles south of Black Bayou and is marked on its north side by a fixed red light and 3 dolphins. Calcasieu-Sabine Canal is described on page 152.

SABINE PASS AND TRIBUTARY WATERS

Sabine Pass (Chart 517), lying about 243 miles westward of Southwest Pass, Mississippi River, and 50 miles east-northeastward of Galveston entrance, is the approach from the Gulf of Mexico to Sabine Lake, Sabine and Neches Rivers, and the cities of Port Arthur, Lake Charles, Orange, and Beaumont. Sabine Pass, Lake, and River together form the boundary between the States of Louisiana and Texas for a distance of 275 miles northward from the Gulf.

The entrance is obstructed by a bar, which has been improved by the construction of two nearly parallel jetties, extending about 3½ miles in a southerly direction from shore and having a clear width

between them of 1,700 feet. The least general depth between the jetties is 12 to 14 feet (3.7 to 4.3 m.). The bar has been further improved by a dredged channel 32 feet (9.8 m.) deep and 200 feet wide or 30 feet (9.1 m.) deep and 300 feet wide (project depth 33 feet and width 450 feet), from the sea buoy to the jetties, and a channel inside the jetties 30 feet (9.1 m.) deep and 125 feet wide (project depth 30 feet and width 200 feet). The channel is marked at frequent intervals by buoys, some of which are lighted, and by lighted ranges.

Sabine Pass East Jetty Light, on the south end of the jetty, is flashing white light with red sector, flash every 3 seconds, on a red, square, skeleton structure on piles on a concrete block, 50 feet (15.2 m.) high, and visible for 10 miles. The red sector shows eastward of 349° true. The fog signal is maintained from November 1 to April 1, and is a bell rung continuously 1 stroke every 20 seconds.

Sabine Pass Lighthouse is a white octagonal tower on the east side of the pass, 4⅝ miles 342° true (NNW. ¼ W. mag.) from the end of the jetties. The light is fixed white, varied by a white flash of 2.3 seconds duration every 45 seconds, 84 feet (25.6 m.) above the water, and visible 15 miles.

Inside the jetties the pass extends in a northwesterly direction for about 6 miles to Sabine Lake, and has a least width of over one-fourth mile; but numerous shoals contract the navigable channel to a least width of about 300 feet. A least depth of 30 feet (9.1 m.) can be taken throughout the length of the pass to the entrance of the Port Arthur Ship Canal, and up the canal to the turning basin at the mouth of Taylors Bayou. The bottom outside of the channel for the most part is soft, and vessels can touch upon it without injury; but there are occasional patches of oyster bars, dangerous to vessels striking them. An oyster bar lies opposite the village of Sabine Pass, between the lighted beacon and the red buoy, one-fourth mile west-northwestward from it.

Sabine is a village and post office on the west shore of the pass, about 5¼ miles above the outer end of the jetties. It is connected with Port Arthur and Beaumont by a branch line of the Southern Pacific Railroad system. From the railroad terminals at Sabine cargoes of cotton, cottonseed products, crude petroleum, and sulphur are shipped to foreign and domestic ports. There are depths of 23 to 30 feet (7.0 to 9.1 m.) at the ends of the wharves, and a draft of 29 feet (8.8 m.) has been taken from them to sea.

Sabine Pass, a small village and post office on the west shore of the pass about 1½ miles above Sabine, is of some commercial importance as a crude petroleum shipping point.

Sabine Lake is about 15 miles long and has an average depth of about 6 feet (1.8 m.). At the southern end where it empties into Sabine Pass there is an unimproved bar with a depth of 4 feet (1.2 m.). The lake is of little commercial importance.

Johnson Bayou, in the extreme southwestern part of Louisiana, empties into the southeastern part of Sabine Lake, directly east of Port Arthur. The bayou has been improved by dredging, and is now navigable for a draft of 4½ feet (1.4 m.) for about 4½ miles to the settlement of **Johnson Bayou,** La.

There is a little commerce carried in launches of about 3 feet draft from Johnson Bayou, La., across Sabine Lake to Sabine River and up the river to Orange, Tex. The launches may enter the East Pass of the river, with a depth of 3½ feet (1.1 m.), or they may enter the Sabine-Neches Canal abreast of the third pile dolphin from the westward, where there is an opening in the spoil bank 150 feet wide and 4½ feet (1.3 m.) deep.

Port Arthur Ship Canal is about 7 miles in length, from Sabine Pass to Port Arthur, 30 feet (9.1 m.) in depth, and 150 feet bottom width, with a turning basin at the upper end 1,700 feet long and 600 feet wide. The canal is separated from the western shore of Sabine Lake by a narrow strip of land. The **entrance** to the canal is marked by a flashing red light, flash every 3 seconds, located on the north side of the channel. Beacons are located at frequent intervals on the northeast side of the channel. These consist of a single pile with two cross arms painted white, placed 75 yards from the center line of the canal. Three flashing white lights, on the southwest side of the channel about 800 yards apart, mark the bend in the channel near **Kieth Lake.**

Taylor Bayou, which joins the upper end of the Port Arthur Ship Canal, is navigable for a draft of 4 feet (1.2 m.) for 30 miles above West Port Arthur. Traffic on the bayou consists of towing barges loaded with oil and rice. The bayou is crossed by four drawbridges—two at West Port Arthur with openings 40 feet and 67 feet wide, respectively; one at 13 miles and one at about 25 miles up the bayou, with openings of about 20 feet each.

Port Arthur is a city on the west shore of Sabine Lake, 12 miles above the village of Sabine. Its principal industrial development is on Taylor Bayou, along the southwestern outskirts of the city and is sometimes known as **West Port Arthur.** Port Arthur has rail communication by means of two lines of steam railroad, and an electric railroad to Beaumont. It has deep-water connection with Sabine Pass by means of the Port Arthur Ship Canal to Taylor Bayou and by the Sabine-Neches Canal along its southeast front.

Port Arthur has considerable foreign and domestic commerce in crude petroleum and its refined products, cotton, cottonseed products, lumber, grain, and rice. The facilities for handling these cargoes are excellent. A draft of 29 feet (8.8 m.) has been taken to sea from Port Arthur through the ship canal.

The **Sabine-Neches Canal** begins at Port Arthur Ship Canal near its upper end and parallels the shore of Sabine Lake back of a narrow strip of land to the mouth of Neches River; thence it crosses the upper end of the lake to the mouth of Sabine River. It has a least bottom width of 125 feet and depth of 30 feet (9.1 m.) for the first 5 miles, thence 90 feet bottom width and depth of 25 feet (7.6 m.) to Neches River, and a bottom width of 90 feet and depth of 23 feet (7.0 m.) to the mouth of Sabine River. The project dimensions are a bottom width of 125 feet and depth of 30 feet (9.1 m.) throughout.

A drawbridge, with an opening 115 feet wide, crosses the canal at Port Arthur. Five miles above the drawbridge is a guard lock with a chamber 600 feet long and 28 feet (8.5 m.) deep over the sills. That part of the canal crossing the upper end of Sabine

Lake is marked on its north side by pile dolphins 1,000 feet apart, some of which are lighted.

The following are **extracts from the regulations** prescribed by the Secretary of War for the navigation of Port Arthur Ship Canal, the Sabine-Neches Canal, Taylor Bayou, and the turning basin at Port Arthur:

Navigation of canals, basins, and bayou.—Pilots and vessels, while in the canals, basins, and bayou, will be subject to all the rules and regulations of the United States relating to pilots and vessels on western rivers.

No boat of 10 tons gross tonnage or over, while in the canals or bayou, shall be raced with or crowded alongside of another boat, or moved at a greater rate of speed than 7 miles per hour, without regard to the velocity of the current or run of the tide.

In the basins, boats of 10 tons gross tonnage or over shall reduce their rate of speed to 4 miles per hour.

Boats, in navigating these canals, basins, or bayou, shall ordinarily keep to that side of the mid-channel which lies on the starboard side of such vessel, and when meeting other boats will alter their course to starboard, so that each may pass on the port side of the other.

Boats with tows or rafts, or any boat moving at a slow rate of speed, must permit boats moving in same direction and at a greater rate of speed to pass, and shall in no case attempt to cross the bow or crowd upon the course of the passing boat.

Sailing vessels and barges.—Sailing vessels of 100 gross tonnage or over shall not be permitted to sail up or down these canals, basins, or bayou. Not more than two (2) such vessels shall be towed through these canals, basins, or bayou by a towboat at the same time, and one of these shall be towed alongside the towboat and the other on a hawser not exceeding 500 feet long.

This rule shall also apply to the towing of barges of 100 gross tonnage or over through these canals, basins, or bayou, except that as many as four (4) such barges may be towed at one time through these canals, basins, and bayou when towed in the following described manner: Barge first behind towboat to be towed by a bridle line not exceeding 50 feet long, leading from opposite sides of bow of barge to towboat, and the following barges, not exceeding three, to be tied close up so that not more than 6 feet will intervene between any two barges.

Right of way.—United States dredges or other United States boats, and such contract dredges as may be employed from time to time by the United States in these canals, basins, and bayou, while they are at work therein shall have exclusive right of way over all vessels navigating such waters. All vessels in passing these dredges must exercise due caution by slowing down before reaching them and going by at a rate of speed less than 4 miles per hour.

Mooring boats, barges, etc.—No boats, barges, rafts, or other floating craft shall be anchored or tied up in these canals, basins, and bayou in such places or in such manner as to prevent or obstruct the passage of other boats, barges, rafts, or other floating craft.

No boats, barges, rafts, or other floating craft shall be anchored or tied up to the banks of these canals, basins, and bayou, or on the batture adjacent to same where they are liable to be carried into the canals, etc., by high tides, storms, floods, or otherwise for a greater period of time than 72 hours, unless such boats, etc., are engaged in receiving or discharging cargo.

Written requests for permission to moor boats, barges, rafts, or other floating craft in the basins or batture adjacent thereto for a period not to exceed 30 days may be granted by the engineer officer in charge or by his authorized representative, and boats, etc., so using the basin or batture must be securely moored by bow and stern lines to the places assigned to such boats, etc., and be promptly removed on due written notice being given. Owners of craft thus afforded mooring space must assume all risks of damage.

Refuse in the canals, basins, and bayou.—No ashes, cinders, slag, waste oil, refuse, or obstructive matter of any kind shall be dumped, cast out, or unloaded in these canals, basins, and bayou from or out of any ship, barge, or other floating craft, or from the shore, wharf, manufacturing establishment, or mill of any kind, nor shall such be deposited on the banks of these canals, etc., or in or on the banks of any tributary stream where the same shall be liable to be washed into these canals, etc., either by ordinary or high tides or by storms or floods.

Sabine River, emptying into Sabine Lake from northward, has an improved depth of 23 feet (7.0 m.) from the Sabine-Neches Canal, for 9 miles, to Orange, and 11 feet (3.4 m.) for a farther distance of 9 miles, above which, for 225 miles, it is navigable in detached stretches for light drafts. A railroad drawbridge crosses the river 7 miles above Orange. The river below Orange is well marked by lights and buoys.

The Calcasieu-Sabine Canal, leading from Sabine River, 7½ miles above Sabine Lake, to Calcasieu River, is described on page 152.

Cow Bayou, emptying into Sabine River 4 miles above Sabine Lake, is a crooked stream navigable for a draft of 4½ feet (1.3 m.) for 22 miles. The commerce consists chiefly of oil barges towed up to the irrigation plants and rice shipped down from them. A highway drawbridge crosses the bayou 10 miles above the mouth.

Orange is a manufacturing city of some importance, 9 miles above Sabine Lake and 36 miles from the Gulf. Lumber, paper, cotton, rice, and crude petroleum are the principal articles of commerce. It has railroad communication. A depth of about 23 feet (7.0 m.) can be carried from Orange to the Gulf. There is a turning basin at Orange about 1,500 feet long and 500 feet wide.

Neches River, emptying into Sabine Lake from northwestward, has an improved depth of 24 feet (7.3 m.) for 20 miles to Beaumont, 10 feet (3 m.) for a farther distance of 30 miles, and 3 feet (0.9 m.) for an additional 60 miles. During high river stages, usually from January to the last of April, the depths are several feet greater. Three drawbridges cross the river at Beaumont. The river is well marked by lights and buoys. There is a turning basin at Beaumont 1,500 feet long and 500 feet wide.

There are several pipe and cable lines crossing the river. A pipe line, 40 feet below M. L. W., crosses the river at light No. 4. A pipe line, 50 feet deep, crosses at Smith Bluff. Two pipe lines, 27 feet deep, cross at Mansfield Ferry. A pipe line, 45 feet deep, crosses one-half mile below the turning basin. There are two cable crossings between the turning basin and the first drawbridge, and another just above the bridge.

Port Neches, on the Neches River 6 miles above Sabine Lake, is an oil-refining town of some importance. Considerable petroleum products, asphalt, and lumber are shipped from here. It has railroad communication and regular bus service with Port Arthur and Beaumont.

Beaumont, on Neches River, 20 miles above Sabine Lake and 44 miles from the Gulf, is the largest city in eastern Texas. It has railroad communication with all parts of the United States. Crude petroleum and its refined products, lumber, cotton, and rice are the principal articles of commerce. A depth of about 24 feet (7.3 m.) can be carried from Beaumont to the sea.

Pine Island Bayou, emptying into Neches River about 9 miles above Beaumont, is navigable at low river stages for a draft of 6 feet (1.8 m.) for 13 miles, and for 3 to 4 feet (0.9 to 1.2 m.) for another 13 miles. The principal traffic consists of the towing of logs, and scows loaded with lumber or oil. Two fixed bridges cross the bayou between 12 and 15 miles above its mouth.

Village Creek, emptying into the Neches River 24 miles above Beaumont, is navigable for a draft of 3 feet (0.9 m.) at low river stages for about 8 miles.

Terminal facilities.—At **Sabine** there is a wharf 720 feet long for handling of bulk oil served by pipe lines. There are also two slips and a wharf with shed about 400 feet long and another wharf about 275 feet long. Both these wharves have appliances for handling cargoes of menhaden fish and one has branch rail connection with the Southern Pacific Railway. Between the towns of Sabine and Sabine Pass there is a modern sulphur loading plant consisting of a wharf about 400 feet long with conveyors and traveling cranes owned by the Union Sulphur Co., and having branch rail connection with the Southern Pacific Railway; also there is a wharf about 400 feet long served by pipe lines for handling of fuel oil. At the town of Sabine Pass there is a wharf about 240 feet long for handling bulk oil. This is served by pipe lines, has connection with loading racks, and also has branch rail connection with the Southern Pacific Railway.

At **Port Arthur** there are wharves and docks with a total linear frontage of 7,919 feet, with extensive warehouses and sheds, and a modern grain elevator of 555,000 bushels capacity. The warehouses and sheds are not equipped with mechanical appliances, but are so constructed that cargo of all kinds can be handled. On the Port Arthur turning basin there are also modern wharves, 3,100 feet in length, with warehouses equipped with pipe lines for loading bulk oil and two conveyors for handling case oil, and on Taylors Bayou, about 1½ miles above the Port Arthur turning basin, is a concrete wharf 2,054 feet long, with modern warehouses, used exclusively for handling oil. All these Port Arthur wharves have railway and highway connections. The wharves above mentioned are privately owned, but all vessels dock on equal terms.

At the city of Port Arthur a small slip had been excavated in the bank of the canal and a small wharf provided for boats bringing produce, fish, and oysters, and taking out supplies.

At **Orange,** on Sabine River, there are two small wharves owned by the city used by small vessels free; in addition to these there are several privately owned and operated wharves, two of which are equipped with tramways for handling of lumber. The city has excavated a channel 200 feet wide and 3,000 feet long, extending from the right bank of Sabine River about 1,500 feet below the cut-off toward the town. On this channel the city owns and operates wharfage with a total length of apron of 1,504 linear feet, on which there are warehouses with 72,000 square feet of covered area, the remainder, 15,840 square feet, being open storage space. There are ample railroad facilities at the wharves connecting with all railroads entering the city. The mechanical equipment includes an electric hoist at timber rollway and locomotive crane of 20 tons capacity. The present facilities are adequate for existing commerce.

At **Beaumont,** on the Neches River, the city owns and operates 1,600 feet of wharves, 1,000 feet being of concrete construction, with warehouses and electric-crane equipment and has additional wharves under construction. These wharves are open to all on equal terms and have connection with all railroads. There is a concrete wharf 1,515 feet long a little over a mile below the turning basin. This

wharf is owned by the Magnolia Petroleum Co. and is equipped for handling of oil and oil products through pipe lines. There is also a wharf 400 feet long on land owned by the city just upstream from the turning basin. This wharf has railway connection and is used mostly for loading of lumber. Both at Orange and at Beaumont a number of small wharves have been erected by the various shipbuilding companies for their own use.

At **Port Neches,** on the Neches River, the Texas Co. owns and operates privately a wharf 468 feet long, with frame warehouses 96 by 312 feet, equipped with pipe lines for handling oil and having rail connection for handling a general cargo. Also, the Magnolia Petroleum Co. has recently erected a wharf 250 feet long on right bank of Neches River about 1 mile above Port Neches. This wharf is served by pipe lines. Near the mouth of the left bank of Neches River a wharf is being erected by the Humble Oil & Refining Co., which will, when completed, be equipped with pipe lines for handling of oil.

Port Charges.—Dockage rate is 1 cent per gross registered ton for vessels tied up at the wharves of the Port Arthur Canal and Dock Co., or the wharves of the Beaumont Dock and Wharf Commission, and not receiving or discharging any cargo. At Beaumont, vessels occupying outside berths are charged only one-half the above rate. There is no charge for vessels receiving or discharging cargo.

Wharfage charges are assessed in accordance with the nature of the cargo.

Lighterage service at Port Arthur is performed only on bulk oil. The charge for this service is 10 cents per barrel, with a minimum charge of $300. No freight is lightered at Beaumont or Orange except in emergencies.

Harbor dues.—None.

Port warden's fees.—Hatch survey, $5; hull and marine surveys, $25; cargo survey up to $500 damage, $25; cargo survey over $500 damage, 1 per cent of additional amount.

Running lines.—The charge is $25.

Agency fees.—A charge of $75 is made on tankers and $100 on cargo vessels.

Brokerage fee is one-fourth of 1 per cent of the value of the freight.

Supplies.—Fresh water can be obtained in unlimited quantities on the wharves at Beaumont and Orange. At Port Arthur, the city water has salt properties and boiler and drinking water is obtained from barges at the rate of $5 per 1,000 gallons. Coal in limited quantities can be had at Port Arthur. Oil for bunkering can be obtained at Port Arthur and Beaumont. Ship chandlery can be obtained at Port Arthur, Beaumont, and Orange. Provisions can be obtained at Port Arthur, Port Neches, Beaumont, Orange, and in limited quantities at Sabine.

Repairs.—Minor repairs to machinery of vessels can be made at Port Arthur, and there are facilities for hauling out small boats and barges. At Beaumont there are good machine shops and foundries, and marine ways, the largest having a capacity of 2,500 tons, capable of hauling out vessels up to 300 feet in length and a draft

of 17 feet aft and 12 feet forward. There are also two locomotive cranes of 15 and 25 tons capacity. At Orange there are machine shops and foundries. The largest marine ways has a capacity of 1,200 tons for barges and 300 tons for keel vessels. The length of the ways is 190 feet and draft 18 feet aft and 4 feet forward on the 190-foot length and 8 feet forward on the 100-foot length.

Prominent features.—The most prominent object in approaching Sabine Pass by day is a hulk of a shipping-board vessel lying west of the jetties, which is used as a clubhouse. This vessel is firmly embedded in the mud, but has the appearance of a vessel at anchor, and mariners approaching the pass should keep well offshore from it. Sabine Pass Lighthouse and the oil tanks and Coast Guard station below the village of Sabine are also conspicuous.

Pilots.—A pilot boat is usually on watch near the end of the jetties, or will come out to a vessel making signal. Pilotage is compulsory. (See the extracts from the laws of Texas relative to pilotage on p. 4.) The following rates of pilotage include one docking. The charge for an extra docking is $15.

	Per foot draft
Pilotage over the bar to Sabine:	
Vessels not over 500 net registered tons	$3.00
Vessels over 500 and not over 1,000 net registered tons	3.50
Vessels over 1,000 and not over 1,500 net registered tons	3.75
Vessels over 1,500 net registered tons	4.00
Pilotage over the bar to Port Arthur:	
Vessels not over 500 net registered tons	3.50
Vessels over 500 and not over 1,000 net registered tons	4.00
Vessels over 1,000 and not over 1,500 net registered tons	4.25
Vessels over 1,500 net registered tons	4.50
Over the bar to Orange or Beaumont:	
Vessels not over 500 net registered tons	5.50
Vessels over 500 and not over 1,000 net registered tons	6.00
Vessels over 1,000 and not over 1,500 net registered tons	6.25
Vessels over 1,500 net registered tons	6.50

Towboats are always employed by the larger and deeper draft sailing vessels. They are usually to be found inside the end of the jetties.

The towage charges given in the following tariff are for the services of one tug only. The towage charges for sailing vessels vary with the port and are not included in the following tariff.

Tugboat harbor tariff for the ports of Port Arthur, Beaumont, Orange, Sabine, and Port Neches

	Light	With cargo
ASSISTING STEAMERS		
City docks Beaumont to Port Arthur	$175.00	$200.00
Port Arthur to Sabine	120.00	140.00
Port Arthur to sea	120.00	140.00
Sabine to sea	95.00	110.00
City docks Beaumont to sea	275.00	300.00
City docks Beaumont to Sabine	275.00	300.00
Orange to sea	275.00	300.00
Orange to Sabine	275.00	300.00
Port Neches or locks to Port Arthur	150.00	175.00
Port Neches or locks to Sabine	200.00	250.00
Port Neches or locks to sea	200.00	250.00
Orange to city docks, Beaumont	300.00	325.00
Port Neches or locks to city docks, Beaumont	200.00	250.00
Port Neches or locks to city docks, Orange	200.00	250.00
For above bridges at Beaumont, additional	50.00	65.00

Tugboat harbor tariff for the ports of Port Arthur, etc.—Continued

	Light	With cargo
ASSISTING MOTOR SHIPS		
[Dead steamers and barges, plus 10 per cent]		
Beaumont to Port Arthur	$225.00	$250.00
Port Arthur to Sabine	150.00	200.00
Port Arthur to sea	150.00	200.00
Sabine to sea	120.00	135.00
Beaumont to sea	350.00	400.00
Beaumont to Sabine	350.00	400.00
Orange to sea	350.00	400.00
Orange to Sabine	350.00	400.00
Port Neches or locks to Port Arthur	200.00	225.00
Port Neches or locks to Sabine	300.00	325.00
Port Neches or locks to sea	300.00	325.00
For above bridges at Beaumont, additional	90.00	110.00
ASSISTING SHIFTING STEAMERS (WITH STEAM)		
Docking or undocking	65.00	75.00
Dock No. 1 to Dock No. 3, Sabine	80.00	100.00
Dock No. 2 to Dock No. 3, Sabine	70.00	80.00
Dock No. 1 to Dock No. 2, Sabine	65.00	75.00
Sun Co. Dock to Dock No. 1 or 2, Sabine	100.00	125.00
Sun Co. Dock to Dock No. 3, Sabine	65.00	75.00
Texas Co. to Gulf Refinery, Port Arthur	85.00	110.00
Mexican lumber dock to other docks, Port Arthur	70.00	85.00
Refinery dock at Beaumont	65.00	75.00
Magnolia Dock to city dock, Beaumont	85.00	105.00
Above bridges at Beaumont, additional	85.00	105.00
Shifting at Texas or Gulf Co. docks, Port Arthur	70.00	85.00
ASSISTING SHIFTING STEAMERS (WITHOUT STEAM) OR MOTOR SHIPS AND BARGES		
Docking or undocking	85.00	95.00
Dock No. 1 to Dock No. 3, Sabine	95.00	120.00
Dock No. 2 to Dock No. 3, Sabine	85.00	100.00
Dock No. 1 to Dock No. 2, Sabine	85.00	95.00
Sun Co. Dock to Dock No. 1 or 2, Sabine	120.00	145.00
Sun Co. Dock to Dock No. 3, Sabine	85.00	95.00
Texas Co. to Gulf Refinery at Port Arthur	105.00	135.00
Refinery dock at Beaumont	85.00	95.00
Mexican lumber docks to other docks, Port Arthur	90.00	105.00
Above bridges at Beaumont, additional	105.00	125.00
Magnolia Dock to city docks, Beaumont	105.00	125.00
Shifting at Texas or Gulf Co. docks, Port Arthur	85.00	105.00

Anchorage.—Vessels provided with good ground tackle can ride out any gale by anchoring about 7 miles westward of the jetties as close inshore as their draft will permit. The **shoal** west of the jetties is rapidly building out and vessels should approach this area with caution. The bottom is soft mud and ooze. In some places during southerly gales the surface has the appearance of being covered with oil. Small craft should find anchorage inside the jetties or in the pass. In the pass there are three anchorages. The quarantine anchorage southward of the lighthouse has a depth of 32 feet (9.7 m.). An anchorage alongside the west bank abreast of the northern end of the village of Sabine and an anchorage alongside the west bank for about a mile below the entrance to the Port Arthur Ship Canal have depths sufficient for any vessel that can enter the pass, but both have limited swinging room.

There are no anchorages at Beaumont or Orange. Anchorage is permitted in the Neches River only in an emergency. Vessels may be tied up to the banks of the rivers for limited periods if permission is obtained from the United States Engineer Department.

Quarantine is enforced by the United States Public Health Service. (See also information relative to quarantine on p. 5.)

Vessels subject to visitation by the health officer are boarded on the east side of the channel immediately below the lighthouse. A quarantine ship is tied up to the west bank of the channel below Sabine.

Hospital.—The nearest marine hospital is at New Orleans. There is a marine doctor stationed at the Federal Building at Port Arthur.

Customs officers are stationed at Port Arthur and Beaumont. The inspector at Beaumont handles the business of the port of Orange.

Storm warnings are displayed at Port Arthur, West Port Arthur, Orange, and at the village of Sabine Pass.

Tides and currents.—The mean range of tide is 1.4 feet at the entrance of Sabine Pass. Tidal action is felt at Beaumont and Orange. Winds from any easterly or southerly quarter raise the surface of the water by as much as 3 feet at Sabine and 1½ feet at Port Arthur. Northerly winds lower the surface by nearly the same amounts.

The currents off the entrance are dependent upon the direction and velocity of the wind. Following continued northerly, northeasterly, or easterly winds a southwesterly to westerly current will be found off the entrance, sometimes with a velocity of as much as 2 knots and frequently of 1 knot. Following southerly or southwesterly winds, the currents will be in the opposite direction but with less velocity.

DIRECTIONS, SABINE PASS

Approaching from eastward, deep-draft vessels should avoid Ship Shoal, Trinity Shoal, and the extensive area of broken ground between them. Sabine Bank (described on p. 152) parallels the coast at a distance averaging 17 miles and should be avoided. The gas and whistling buoys off Ship Shoal, Trinity Shoal, and the easterly end of Sabine Bank are useful and dependable marks. Deep-draft vessels approaching from eastward usually lay their courses for East End gas and whistling buoy. Comparatively few vessels from Dry Tortugas or points north of Dry Tortugas approach Sabine Pass through the buoyed channel in the bank 3 miles east of Sabine Bank Lighthouse, and with the recently charted 26-foot (7.9 m.) shoal 12 miles 143° true from Sabine Bank Lighthouse, it is probable that this approach will be less popular than ever. Mariners would prefer this approach (were it not for the fact that it is a difficult one), since it keeps them in deeper water with less bottom suction considerably longer than when approaching northward of the bank. Consequently many vessels that approach Sabine Pass to the northward of the bank depart by way of the passage through the bank.

Vessels coming from Dry Tortugas to Sabine Pass should hold up to the north in order to make their landfall course approximately parallel to the 10-fathom (18 m.) curve, and incidentally to a line connecting Ship Shoal gas and whistling buoy and Trinity Shoal gas and whistling buoy. If Ship Shoal buoy is missed they can continue on approximately the same course, and using the 10-fathom (18 m.) curve as a guide, invariably pick up Trinity Shoal buoy. As the run

from the latter to Sabine Bank East End buoy is comparatively short, there is little chance of missing it.

This approach is superior for deep-draft vessels to that of setting the course direct from Dry Tortugas to Sabine Bank Lighthouse. By the latter method the land fall must be made in the vicinity of several dangerous **shoals** and in a locality where the bottom is more or less uneven and where soundings taken do not assist materially in fixing a position.

After passing Sabine Bank East End gas and whistling buoy, vessels should haul to northward to avoid a **shoal** with a least depth of 18 feet (5.5 m.) over it, lying 8 miles 296° true from the buoy. Then set course for Sabine Pass gas and whistling buoy.

Moderate-draft vessels on a 285° true (W. ¾ N. mag.) course made good from Trinity Shoal gas and whistling buoy will make Sabine Bank Lighthouse ahead. When within about 4½ miles of the lighthouse, and Sabine Bank whistling buoy is abeam on the starboard hand, distant 1 mile, steer 318° true (NW. ⅜ W. mag.) for 14 miles to Sabine Pass gas and whistling buoy, leaving Sabine Bank whistling buoy and Sabine Bank buoy No. 1 at a distance of about three-fourths mile each on the starboard and port hands, respectively. If leaving Sabine Pass and going **eastward,** reverse these courses.

Light-draft vessels coming from eastward can also follow along the coast, giving it a berth of about 2 miles, or keeping in 3 fathoms (5.5 m.) until the gas and whistling buoy off the entrance is sighted.

Approaching from southwestward, deep-draft vessels make the land at Galveston entrance, taking care to pass northward of Heald Bank, and then set a course for a position 1 to 2 miles outside the gas and whistling buoy off Sabine Pass. The bottom is fairly regular, and there are no known dangers within 15 miles of the coast.

Light-draft vessels when eastward of Galveston entrance can follow the coast at a distance of 1 to 2 miles, increasing that distance to 5 miles as Sabine Pass is approached, and when the entrance buoy is sighted it may be approached, keeping it on the port bow.

In entering the pass strangers of deep draft should take a pilot. For vessels of modern draft chart 517 and the buoys are sufficient guides, if followed carefully.

The shoalest water in the entrance channel will generally be found about three-fourths mile outside the end of the jetties.

COAST, SABINE PASS TO GALVESTON

High Island, about 23½ miles eastward of Bolivar Point Lighthouse, is a mound about 1 mile in diameter and 40 feet (12.2 m.) high. This is the highest land on the coast between Sabine Pass and Galveston and is a landmark for vessels making, or standing along, the coast.

Heald Bank, lying 34 miles eastward of Galveston, is nearly 6 miles long in a northeast and southwest direction, and has depths of 25 to 35 feet (7.6 to 10.7 m.) over it, while depths of 50 to 60 feet (15 to 18 m.) are found as close as 1½ to 2 miles to the southeastward. In a heavy sea Heald Bank should be avoided by all

vessels, including those of moderate draft, which could pass over it in smooth water.

The **currents** at Heald Bank are due almost entirely to the winds. In calm weather or with light breezes little or no current is experienced. Wind velocities of 25 to 40 miles produce currents of about 0.5 to 1 knot, setting in a direction approximately fair with the wind. From observations made during the first six months of the year 1915 the greatest velocity of the current was 1.1 knots.

Heald Bank Light Vessel is moored in 7 fathoms of water off the southwestern end of the bank. The vessel has a red hull with "**HEALD**" on each side, and two masts with a lantern at the head of each. The lights are fixed white, 50 feet above the water, and visible 11 miles. The fog signal is a steam whistle, giving a group of two blasts of two seconds duration every 30 seconds. If the whistle is disabled, a bell is struck by hand. The submarine bell strikes "22" every 24 seconds. When the light vessel is withdrawn for repairs the station is marked by a gas buoy. The light vessel radio station receives and transmits messages. The call letters are WWBJ. **Storm warnings** are displayed at the light vessel.

Bolivar Point Lighthouse is a white and black, horizontally banded, conical tower, on the point at the northerly side of the entrance to Galveston Bay, about 5 miles westward of the entrance to the channel between the jetties. The light is flashing white (flash 2.3 seconds, eclipse 12.7 seconds), 117 feet (36 m.) above the water, and visible 17 miles.

GALVESTON BAY AND TRIBUTARIES

Galveston Bay is a large, irregularly shaped, shallow body of water in the coast of Texas about 285 miles westward from Southwest Pass, Mississippi River, and 755 miles westward from Key West, Fla. The bay is about 30 miles long in a general north-northeast and south-southwest direction, about 17 miles wide at its widest part, and has general depths of 7 to 9 feet (2.1 to 2.7 m.). It is nearly separated into two parts about midway of its length by a chain of small islets and shoals known as **Redfish Bar,** through which a channel 30 feet (9.1 m.) in depth has been dredged near its western end. That part of the bay northward of Redfish Bar is generally designated as the "Upper Bay," the part southward as "Lower Bay." The northeastern end of the upper bay is known as **Trinity Bay.**

Galveston Bay is the approach to East and West Bays, Houston Ship Channel, and the cities of Galveston, Texas City, and Houston, as well as to numerous smaller towns and bayous. Galveston Bay and tributaries form one of the most important ports commercially in the United States, having an extensive foreign and coastwise trade in crude petroleum and its refined products, cotton and cottonseed products, wool, grain, rice, fruits, ore, lumber products, and miscellaneous merchandise.

Galveston Entrance, the approach to Galveston Bay, lies between two converging jetties about 4 miles long and 1¼ miles apart at the outer end. The entrance is obstructed by two bars, known as the outer and inner bars, through which a channel has been dredged. The project depth over the outer bar is 34 feet (10.4 m.) for a width

of 800 feet, and over the inner bar 32 feet (9.8 m.) for a width of 800 feet. On June 30, 1925, the controlling depth over the outer bar was 33 feet (10.1 m.) for a width of 500 feet, and over the inner bar the project dimensions were obtained. The entrance channel is marked by buoys, some of which are lighted. There is a light at the outer end of each jetty.

Galveston Jetty Light, at the outer end of the south jetty, is a flashing alternately red and white light, flash 1 second, eclipse 1 second, shown from a cylindrical, concrete tower, on a black, square, skeleton structure 91 feet (27.7 m.) high and visible 15 miles. The fog signal is an air diaphone, blast 2 seconds, silent 28 seconds.

Galveston Harbor extends from the Gulf through the pass between the jetties to and including **Bolivar Roads,** where it connects with the ship channels to Galveston, Texas City, Houston, and Port Bolivar. The harbor lies between **Galveston Island, Pelican Island,** and **Bolivar Peninsula,** and has an anchorage area of 744 acres with over 30 feet (9.1 m.) depth. It affords good anchorage for large vessels at all seasons except during hurricanes, when refuge is taken at Houston.

Galveston Channel extends from a point in Galveston Harbor between Bolivar Peninsula and **Fort Point** to and along the wharf front at Galveston, and has a length of about 4 miles and width of 1,200 feet. The project provides for a channel 30 feet (9.1 m.) deep and 1,200 feet wide from the entrance to Fifty-first Street; and for its extension when the interests of navigation and commerce require it, with a width of 1,000 feet and depth of 30 feet (9.1 m.) to Fifty-seventh Street. On October 31, 1925, the controlling depth was 30 feet for a width of 600 feet.

Pelican Spit prevents a sea in Galveston Channel during northers. The entrance to the channel is marked by a gas buoy on the north side and by a gas buoy and a bell buoy on the south side.

Galveston, on the eastern end of Galveston Island, covers the entire width of the island southwestward to the city limits and has a total area of 15 square miles. The wharves are built on the north side of the city and abut on Galveston Channel. The south side of the city fronts upon the Gulf of Mexico and is protected by a concrete sea wall 17 feet (5.2 m.) high.

Galveston has a large foreign and domestic trade in petroleum products, cotton, cottonseed products, grain, and livestock, and a coastwise trade in cotton, ore, and general merchandise. It has direct communication by six lines of railroad with all parts of the United States and with Mexico, and regular steamship service to all important European, Asiatic, Latin-American, Cuban, and American ports.

Galveston is connected with the mainland by **Galveston Causeway,** a concrete and earth viaduct 1¾ miles long crossing the northerly end of West Bay. On the causeway are carried the tracks of three steam and one electric railway and a roadway for vehicles and pedestrians. The draw span, about midway of the length of the causeway, has a lift opening of 100 feet width.

Terminal facilities.—The terminal facilities at Galveston are the most extensive on the Texas coast. There are 31 piers at the port which have depths of water ranging from 12 to 30 feet (3.7 to

9.1 m.) at mean low water. Of these, 9 are used for overseas freight, such as cotton, flour, oil cake, meal, etc.; 2 for rough overseas freight, consisting of sulphur, scrap iron, steel billets, copper, etc.; and 4 for general overseas freight. There are 4 wharves used for handling fuel oil, 1 for import fruit, 1 for handling fish, 1 for handling coal, gravel, and shell, 4 for export grain, with 4 elevators of capacity of 5½ million bushels, 1 for railroad-car transfer, while the remainder are used for miscellaneous and private purposes.

The principal piers at Galveston are located on the south side of the channel and extend from Ninth Street to Forty-seventh Street, a distance of 2½ miles. A few facilities devoted to **ship-repair** purposes are located on Pelican Spit, on the north side of the channel where there is an additional mile of frontage. The terminals of the Galveston Wharf Co. extend from Tenth Street west to Forty-first Street, and occupy a total channel frontage of 12,400 linear feet, with a berth capacity of 31,152 linear feet. Extending west of the Galveston Wharf Co. is the property of the Southern Pacific Terminal Co., consisting of a channel frontage of 4,290 feet, of which 1,350 feet is developed. There are 3 piers and 2 slips, having a berthing capacity for 7 average-size ships.

The terminal facilities are all privately owned. Those of the Galveston Wharf Co. are open to all carriers on equal terms. The Southern Pacific wharves are used principally by the Atlantic Steamship lines, but one pier is also used to some extent by other ocean carriers for export trade, and is open to all such carriers on equal terms.

Port charges.—Dockage charges as given below are made for the use of the piers, wharves, and sheds of the Galveston Wharf Co. No dockage charges are made at the railroad piers except when vessels occupy berths while being fitted for loading grain.

One cent per gross ton per day for first to sixth day.
No charge for the seventh to sixteenth day.
One cent per gross ton per day for seventeenth to twenty-first day.
All vessels making use of the shedded piers beyond this period of time shall be assessed on the same basis applied under the above schedule.

Sheddage charges are given in the schedule below. Additional charges for shed hire are made on cotton and cottonseed products:

(*a*) Where shedded piers or wharves are occupied, vessels using same for export cargo shall pay a shed hire as follows:

Vessels over 5,000 net registered tons	$175
Vessels 3,000 to 5,000 net registered tons	150
Vessels 2,000 to 3,000 net registered tons	125
Vessels 1,000 to 2,000 net registered tons	100
Vessels 500 to 1,000 net registered tons	75
Vessels 1 to 500 net registered tons	50

(*b*) Where shedded piers or wharves are occupied, vessels using same for import cargo shall pay a shed hire of 20 cents per net ton on all cargo unloaded, with a maximum of $100 per vessel.

Wharfage charges vary with the commodity.

Lighters are not used at this port. There is only one car float in Galveston Harbor, and this is used as part of the through transportation facilities of the Gulf, Colorado & Santa Fe Railroad. No separate charge is assessed.

Harbor master.—The harbor master at Galveston enforces the rules and regulations prescribed by city ordinances for the control of the harbor and docks. The following are extracts:

No vessel or steamer coming into the harbor of Galveston shall be allowed to lay in the stream in front of the wharves, north, for a longer time than 24 hours preparatory to hauling into a berth at the wharves, and no vessel preparing to go to sea shall be allowed to lay in the stream in front of the wharves for a longer time than 24 hours after leaving her berth at the wharf.

All vessels of 75 tons and upward on arriving in the stream of the port of Galveston shall, before hauling into berth and within 24 hours after such arrival, report at the harbor master's office and book for berth.

No vessel shall be allowed to moor within a cable length of any wharf, and no vessel whatever between the wharves of said city and outer bar shall throw overboard any stone or other ballast below high-water mark.

Regulations governing the use of Galveston Channel are prescribed by the Secretary of War as follows:

1. The speed of all vessels of over a net tonnage of 100 tons or of greater draft than 6 feet moving in Galveston Channel bounded by Pelican Island dike, the city of Galveston wharf front, the Second Turn Beacon (red), and the western limits of the excavated area, shall be reduced to and shall not exceed a rate of 4 miles per hour through the water when within 300 feet of the wharves or Pelican Island dike, and elsewhere in said channel the speed shall not exceed a rate of 6 miles per hour through the water.

2. All vessels are forbidden to drop anchor, weights, or other ground tackle within 200 feet of the water main and electric cables crossing Galveston Channel from pier 14, Galveston, to Pelican Island.

Port Bolivar Channel connects Galveston Harbor with a turning basin at the wharves of Port Bolivar. The project provides for a channel 30 feet (9.1 m.) deep and 200 feet wide from deep water in Galveston Harbor to a turning basin 1,600 feet long, with an average width of about 750 feet and 30 feet (9.1 m.) deep in front of the wharves. On October 31, 1925, the controlling depth in the channel was 22 feet (6.7 m.) for a width of 200 feet, and in the basin 20 feet (6.1 m.) for a width of 400 feet. The channel is marked by a lighted range and by buoys.

Port Bolivar, at the southwestern extremity of Bolivar Peninsula and 3½ miles north of Galveston, is the terminus of a line of the Gulf, Colorado & Santa Fe Railway from Beaumont and the interior of the State. It has good terminal facilities and car-ferry service to Galveston. The terminals are open to all carriers on equal terms, but it is understood that the Gulf, Colorado & Santa Fe Railway Co., which owns the terminals, has cancelled all its tariffs and closed the port. The only commerce, therefore, at present is the car-ferry traffic between Port Bolivar and Galveston.

Texas City Channel extends from deep water in Galveston harbor through the lower end of Galveston Bay to the wharves at Texas City. The project provides for a channel 30 feet (9.1 m.) deep and 300 feet wide from Galveston Harbor to Texas City, a distance of about 6½ miles. This channel was completed in 1916, but shoaling has occurred, and on October 31, 1925, the controlling depth was 29 feet (8.3 m.) for a width of 150 feet. There is a depth of 30 feet (9.1 m.) along the faces of the wharves and in the slips. The channel is protected on its northerly side for about 4 miles out from the mainland by a timber and earth dike, 1,150 feet from the axis of the channel at the easterly end and 2,500 feet from the axis at the

turn leading to the docks. The channel is marked by lighted ranges, beacons, and buoys.

Texas City, on the west side of lower Galveston Bay, about 7 miles northwestward from Galveston, is a port of considerable commercial importance, having an extensive foreign and coastwise trade in petroleum products, cotton, grain, hardware, and general merchandise. The facilities for handling cargoes are very good. There are five railroad lines entering the city and there are three steamship lines operating on regular schedule, one to Cuban ports and two to Mexico. Lines operating to the United Kingdom, Europe, and the Orient call at the port as required.

Terminal facilities.—The terminal facilities are all located on the mainland at the inner end of the channel. They consist of 1 pier 1,200 feet long by 1,000 feet wide and another 900 feet long by 500 feet wide, with 2 slips 1,200 feet long by 210 feet wide and another 900 feet long by 200 feet wide; 5 steel or concrete-steel warehouses and 1 wooden warehouse on these piers; 1 open pier (oil dock) 900 feet long 34 feet wide; 1 concrete-steel grain elevator of 500,000 bushels capacity; 4 steel and 1 wooden warehouses and 2 cotton compresses on land between piers; and 38.05 miles of railroad siding, storage yards, etc., with a railroad 6 miles in length connecting the wharves with the trunk line entering Galveston. All these terminal facilities are owned by the Texas City Transportation Co., but are open to all carriers on equal terms. In addition to the above facilities is the Texas Sugar Refining Co. plant located on the water front with privately owned and operating pier warehouse 400 feet long and 104 feet wide, and bulkhead pier, 900 feet long and 600 feet wide.

Port charges.—Dockage charges as given below apply on all steamers, sailing vessels, or other craft:

For each vessel over 1,000 gross registered tons, per trip	$50
For each vessel under 1,000 gross registered tons, per trip	25
For barges and small craft, per day	5

Wharfage varies with the commodity.

Lighters or car floats are not operated at Texas City.

The following are extracts from the **revised ordinances of the city of Texas City,** as ordained by the board of commissioners:

Vessels hauling into wharves to top yards, etc.—It shall be unlawful for any ship or vessel to haul into wharves of Texas City without their yards being topped, anchor flukes taken inboard or stoppered at the hawse pipes, cables bent and clear with 10 fathoms range of chain overhauled, jib and flying jibboom rigged in, stern and quarter davits and bumpkins turned in or unshipped.

Speed of vessels.—It shall be unlawful for any ship or vessel passing in the channel in the harbor of Texas City in front of the wharves to exceed 3 miles an hour with the current, and 5 miles an hour against the current.

Vessels to have ship keepers on board.—It shall be unlawful for any ship or vessel, steamer or barge, not to have a good and proper ship keeper at all times on board while in the harbor of Texas City.

East Bay is a large shallow bay making eastward about 16 miles from the southern end of Galveston Bay and lying northwestward of Bolivar Peninsula. It is partially separated from Galveston Bay by a chain of low sand islands and shoals, known as **Hanna Reef.** The depths in the bay range from 2 to 7 feet (0.6 to 2.1 m.), with a

depth of 4¼ feet (1.3 m.) in a dredged channel through Hanna Reef.

East Bay Bayou, emptying into the northeasterly end of East Bay from northeastward, has a low-water depth of 1½ feet (0.5 m.) on the bar at the entrance, and 6 to 8 feet (1.8 to 2.4 m.) inside for about 4 miles, to the village of **High Island,** and 3 feet (0.9 m.) for about 15 miles farther. It has a little traffic in oysters and truck.

Oyster Bayou, emptying into the northeasterly end of East Bay from northward, has a depth of about 3 feet (0.9 m.) for a distance of 20 miles. It has a little commerce in rice.

Robinson Bayou has a depth of only 1½ feet (0.5 m.) on the bar at the entrance, and is little used except by hunters.

Double Bayou enters upper Galveston Bay on the east side, about 26 miles by the usually traveled channels northward of Galveston. It has a little commerce in rice, truck, and poultry. A channel 6 feet (1.8 m.) deep and marked by two lights has been dredged through the shoals at the entrance. The channel is subject to shoaling. One-half mile above its mouth the bayou divides into east and west branches, navigable for a draft of about 3 feet (0.9 m.) for distances of 10 and 7 miles, respectively. **Glen, Eagle,** and **Double Bayou** are three villages on the west branch ½ mile, 3 miles, and 7 miles, respectively, from Galveston Bay. A county bridge crosses the bayou near the village of Double Bayou.

Anahuac is a village at the northeastern end of Trinity Bay, opposite the mouth of Trinity River. A channel 7 feet (2.1 m.) deep, marked by lights, has been dredged across the shoals from deep water past Anahuac to the mouth of Browns Pass, Trinity River. The channel is subject to considerable shoaling. There is regular launch communication between Anahuac and Galveston.

Turtle Bay is separated from Trinity Bay by an earth dam. The entrance to Turtle Bay is through the mouth of Browns Pass. A lock is at the entrance of the pass into Turtle Bay and prevents salt water from flowing into the bay. The water of the bay is fresh and the shore lands are utilized for rice growing. A channel 5 feet (1.5 m.) deep and 50 feet wide at the bottom has been dredged from the lock across Turtle Bay to **Turtle Bayou.** A draft of 6 feet (1.8 m.) can be carried for 5 miles up the bayou.

Trinity River, emptying into the northeastern end of Trinity Bay, is one of the largest rivers in the State of Texas, and at high water has been navigated by light-draft steamers to **Dallas,** a distance of 445 miles. It has a little commerce in lumber, charcoal, cotton, truck, and grain. The river can be entered from Trinity Bay through **Browns Pass,** with a draft of 7 feet (2.1 m.), and that draft can be carried to **Wallisville,** 5 miles above the mouth; 6 feet (1.8 m.) can be carried at low water to **Moss Bluff** and **Liberty,** 17 and 35 miles above the mouth. **Pilots** for the river may be found at Galveston and Anahuac.

Cedar Bayou is a crooked stream of considerable depth, flowing in a southerly direction and emptying into the northwestern corner of Galveston Bay from northeastward, 25 miles from Galveston. The bayou has an extensive traffic in rice, truck, and building

material, carried in vessels and scows of 6 feet or less draft. The entrance to the bayou is obstructed by shoals forming a bar, which has been improved by the construction of two jetties extending from the entrance of the bayou into the bay. A channel has been dredged from deep water in the bay, between the jetties, to deep water in the bayou. In June, 1924, this channel had a depth of 8 feet (2.4 m.), subject to change. After crossing the bar a least depth of 9 feet (2.7 m.) can be carried up the bayou for 15 miles. **Cedar Bayou** is a small town and post office 7 miles above the mouth.

Goose Creek empties into **Black Duck Bay** 1½ miles north of Morgan Point. It is connected with the Houston Ship Channel by a private dredged channel lying on the northwest side of **Hog Island.** A draft of 6 feet (1.8 m.) can be carried through this channel and for about 2 miles up Goose Creek. A large oil field is located east of the creek. The traffic on the creek consists chiefly of crude petroleum carried in barges. A ferry crosses the creek about 1 mile above its mouth.

Morgan Point is located at the entrance to San Jacinto River, and on the western side of the Houston Ship Channel. There is a tug wharf close to westward of the channel on **San Jacinto Bay.** The town of **Laport** is 2 miles southwest of Morgan Point. Morgan Point and Laport have railroad communication.

The **Houston Ship Channel** (charts 1282 and 532) extends from Galveston Harbor across Galveston Bay and through parts of San Jacinto River and **Buffalo Bayou** to the city of Houston, a distance of 50 miles. It has a large traffic in crude petroleum and its refined products, cotton, rice, and general merchandise, and there are 45 regular steamship lines operated from the ports on the channel to all parts of the world. The project provides for a channel 30 feet (9.1 m.) deep and 250 feet wide across Galveston Bay, and 30 feet (9.1 m.) deep and 150 feet wide from Morgan Point through San Jacinto River and Buffalo Bayou to the head of **Long Reach,** where it ends in a **turning basin** about 1,000 feet wide and 30 feet (9.1 m.) deep. The project also provides for an extension of the channel 8 feet (2.4 m.) deep and 40 feet wide from the turning basin to the foot of Main Street in Houston, Tex. It is expected that the project will be completed about December 1, 1925. The channel is well marked throughout by lights, lighted ranges, and buoys.

Across lower Galveston Bay the dredged material has been deposited on the west side of the channel with an opening at light No. 7. North of light No. 8 in the upper bay the dredged material has been deposited on the east side of the channel. North of light No. 14 this material shows above water and forms a dike which protects the channel from easterly seas. There is an opening marked by piles in this dike at light No. 16.

Cable crossings and ferries.—Four ferries cross Houston Ship Channel, one at Lynchburg, one three-fourths mile above Lynchburg, one small hand ferry at **Channel City,** and one at Pasadena. There are 2 pipe lines and 1 cable, depth 37 feet (11.2 m.), across the channel one-fourth mile below Baytown; 2 pipe lines and 1 cable, depth 37 feet (11.2 m.), at Lynchburg; 9 pipe lines, depth 33 feet (10 m.), at Sinco; and an overhead power cable crossing between Sinco and Galena, 190 feet (58 m.) high over the river.

Eleven **bridges** cross Buffalo Bayou between the turning basin and Franklin Avenue. The first eight bridges above the turning basin are drawbridges, with a least width of 80½ feet. The San Jacinto Street, Main Street, and Franklin Avenue bridges are fixed, of concrete construction, and with a clearance above M. L. W. of 38.8, 54.2, and 28.8 feet (11.8, 16.5, and 8.7 m.), respectively. The last bridge has a clear width of only 47 feet. There are no bridges below the turning basin.

Baytown, 4 miles above Morgan Point, is the location of the Humble Oil Refineries, and is the shipping port for their products. There are good steamship terminals located here.

Lynchburg, at the junction of Buffalo Bayou and San Jacinto River, 8 miles above Morgan Point, is the location of the Gulf Refining Co.s' terminals.

Pasadena, 17 miles above Morgan Point, is the location of the Crown Oil Co.'s terminals.

Galena, 18 miles above Morgan Point, is the location of the Galena Signal Oil Co.'s terminals.

Sinco, 18½ miles above Morgan Point, is the location of the Sinclair Oil Refining Co.'s terminals. The Texas Oil Co. have their terminals across the river from Sinco.

Clinton, 19 miles above Morgan Point, is the location of the Clinton Compress Co. There are no terminals here at present, but the Southern Pacific Railroad Co. is constructing modern terminal facilities with a berthing space for six ships.

Manchester, 20 miles above Morgan Point, is the location of the Channel Fuel Oil Co., American Maid Flour Mills, Texas Portland Cement Co., Deepwater Refining Co., and the Texas Chemical Co. There are good terminals here for ocean-going vessels.

Harrisburg, 1¾ miles below the turning basin, is an industrial town of considerable importance. Many launches and ferries have their landings on **Harrisburg Bend** and **Brays Bayou.**

Houston, one of the largest cities in the State of Texas, has communication by means of 17 railroads with all parts of the United States and Mexico, and is the distributing point for the southeastern part of the State. There are 45 steamship lines operated from the port to all parts of the world. Houston has a large foreign and domestic commerce in cotton and cotton products, crude and refined oil, rice, sugar, molasses, iron and steel manufactures, and general merchandise.

Terminal facilities.—The city of Houston has constructed 3,649 linear feet of wharves at the turning basin with transit sheds supported by a concrete warehouse and covered cotton storage sheds. These terminals consist of eight wharves, served by modern loading facilities, and with a berthing space for about 10 ships. In addition to the above, six new reinforced concrete municipal wharves and sheds are under construction on the east side of the turning basin, with railroad tracks, storage yard and a concrete grain elevator, the total estimated cost of this new development being about $4,000,000.

There has also been constructed by the city of Houston at Manchester 2 miles below the turning basin one municipal concrete wharf 500 feet long, with steel-covered transit shed of 86,400 square feet area. This wharf is connected by carrier house and grain-loading

legs with a 500,000-bushel grain elevator and flour mill. A coal-bunkering plant and wharf has also been built adjacent to the Manchester Wharf.

The city also owns a large, open concrete wharf at the foot of Main Street and a small, open timber wharf at foot of Baker Street in Houston, which are extensively used by light-draft boats in bringing sand, shell, and supplies into Houston and taking out merchandise to the neighboring bay-shore towns. All the municipal wharves are open to all on equal terms.

There are 12 miles of municipally owned terminal railway tracks connecting with the various railroads entering Houston, with an extension of 8 miles of this track down the south side of channel to connect with oil refineries and other industries.

In addition to these municipal wharves, which are the most extensive on the channel, there are a number of privately owned wharves at various industrial plants located along the waterway and a number of loading and unloading chutes for handling cotton and rice, pipe-line terminals for handling oil, etc. All these are for private use and are understood not to be open to the public.

Port charges.—The following regulation covers the dockage charges against steamships:

Vessels berthed at any wharf or made fast to a vessel so berthed, while not discharging inward cargo, or loading outward cargo, will be charged storage at the rate of 1½ cents per lineal foot, based on the length of vessel, per day, provided that Sundays or legal holidays shall not be included in this charge, nor the first and last day of the ship in port. This charge will apply as well on vessels so berthed for the purpose of undergoing repairs.

Wharfage charges vary with the commodity. The rates may be obtained from the wharfmaster.

Lighterage.—There is no free lighterage by rail carriers at this port. When lighterage is necessary, it is performed by private companies through arrangements with shippers. The oil refineries occasionally lighter their vessels in Bolivar Roads of part of their cargo when the draft of the vessel is too great to navigate the channel with a full load.

A lighterage service has been inaugurated for the handling of cotton by barges from the upper or light-draft channel to ship side in the turning basin. No definite schedule of charges for handling cotton has been arranged as yet.

The **director of the port** is charged with the general management of the port.

The **wharfmaster** is in charge of the municipal wharves, and vessels are moved, shifted, and assigned berths under his direction.

General harbor regulations.—The following are extracts from the local regulations for the port:

Forbidden anchorage.—It shall be unlawful for any vessel or barge to anchor in the turning basin or channel.

Speed limit.—No steam vessel shall exceed a speed limit of 8 knots in any part of the harbor; and provided further, that upon approaching another vessel or barge under way, moored, anchored, or fastened to a wharf, or under repair or construction, said vessel shall slow down to the slowest speed at which her steerageway may be maintained; and provided further, that no steam vessel may pass any dock or wharf at a greater speed than 5 knots.

Restriction of towage.—The director of the port shall be authorized to stipulate the number of barges or the tonnage or the size of rafts which shall be allowed to be towed through said port by any certain power boat or tow-

boat, and that, except in the case of seagoing barges or vessels, it shall be unlawful for a towboat to tow a barge or barges while lashed to the side of the same, and that in all towing, except in the case of seagoing barges and vessels, the barge or barges shall be in a single line astern of the towboat or boat towing same.

Vessels to be properly moored.—No barge or vessel shall be moored or fastened to a dock in such a manner that one end shall be free to swing athwart stream.

Lights on moored vessels.—All vessels or barges shall display lights from sunset to sunrise while lying at any wharf or dock, steam vessels to conform to navigation rules applying when moored or anchored in the channel, and barges to display white lights visible all around the horizon located at least 8 feet above the water line on their outside or channel corners; provided, that said regulation shall not apply to pleasure craft and other small vessels and barges which may be located in the said channels or other small waterways which are not a part of the Houston Ship Channel proper.

Vessels at docks not to interfere with navigation.—The director of the port shall be authorized to state the total number and nature of vessels which may be docked at the same time at any certain dock with the authority to stipulate the manner in which they shall be placed, with a view to the protection of navigation and the maintaining of the thoroughfares free of obstruction.

Discharging of oils, etc., into channel.—It shall be unlawful for any person, persons, firm, or corporation to deposit, place, or discharge into the Houston Ship Channel, between Main Street viaduct and Morgan Point, or into Buffalo Bayou or White Oak Bayou or the tributaries of either within or without the limits of the city of Houston, either directly or through private or public sewers, any sanitary sewage, butcher's offal, garbage, dead animals, gaseous liquid, or solid matter, oil, gasoline, residuum of gas, calcium carbide, trade waste, tar or refuse, or other matter which is capable of producing floating matter or scum on the surface of the water, sediment in the bottom of the channel, or the odors and gases of putrefaction.

San Jacinto River above Lynchburg is navigable for a draft of 4 feet (1.2 m.) for a distance of 13 miles, to a closed bridge, which is considered about the head of navigation, although a draft of 3 feet (0.9 m.) can be carried for 3 miles farther, to **Big Eddy.** The headroom at the closed bridge is 26 feet at mean low water and 4 feet at high-river stages. The principal commerce of the river is towing logs and barges loaded with oil or rice. **Elena** and **Sheldon,** 5 and 12 miles, respectively, above Lynchburg, are post offices and pumping plants for rice farms. There are also numerous log landings and small settlements along the river.

Greens Bayou, entering Buffalo Bayou from the northward at a point 6 miles above Lynchburg, is navigable for a draft of 4 to 5 feet (1.2 to 1.5 m.) for a distance of about 8½ miles, at which point it is crossed by two fixed bridges, each having about 31½ feet (9.6 m.) headroom at mean low water. The bayou has some traffic in timber and rice.

Clear Creek empties into upper Galveston Bay on the west side, about 20 miles northwestward from Galveston. About 2 miles above its mouth it broadens into a shallow body of water 2½ miles long, known as **Clear Lake.** A channel 7 feet (2.1 m.) deep has been dredged through the sand bar at the mouth of the creek and across Clear Lake. The channel is subject to shoaling. The creek is navigable for a draft of 6 to 7 feet (1.8 to 2.1 m.) to **Friendswood,** 17 miles above Galveston Bay. **League City** is a small town 11 miles above the bay. **Seabrook** is a small village on the northern side of the entrance to the creek. The creek is crossed by 5 drawbridges, 1 with an opening of 60 feet, 3 of 24 feet, and 1 of 24 feet, at 1, 8¾, and 10 miles, respectively, above the mouth. There is con-

siderable traffic in rice, oil, and general merchandise between League City and points above it. The dredged channel at the entrance is marked by a light and beacons, and that across Clear Lake is marked by bush stakes.

Dickinson Bayou empties into lower Galveston Bay on the west side, about 13 miles northwestward of Galveston. A channel 4½ feet (1.4 m.) deep has been dredged across the bar at its mouth. After crossing the bar a depth of 10 feet (3.0 m.) can be carried up the bayou for 13 miles, and a depth of 6 feet (1.8 m.) for an additional 5 miles. Dickinson is a small town about 7 miles above the mouth. Four bridges cross the bayou at distances above the mouth of about 3, 7, 7, and 8 miles, respectively. The first is a drawbridge with opening of 60 feet; the second, third, and fourth are fixed and have 12 to 17 feet (3.6 to 5.1 m.) headroom at low water.

The dredged entrance to the bayou is marked by several beacons on the south side.

Moses Lake is a shallow, unimportant lagoon, south of the mouth of Dickinson Bayou.

Prominent features.—Approaching the entrance to Galveston Harbor on a clear day among the first objects sighted will be the grain elevators, 165 feet (50 m.) high, on the channel front at Fourteenth and Twenty-eighth Streets, Galveston, the hotel near the sea wall, and the skeleton lighthouse tower on the south jetty near its outer end. Bolivar Point Lighthouse (117 feet (35 m.) high) and a clubhouse on the north jetty show conspicuously on closer approach and are easily identified. Gas buoys are established outside the entrance and at frequent intervals on the sides of the channel between the jetties. They are shifted from time to time to conform to changes in the channel. Vessels approaching from the eastward near the coast will first sight High Island, and those approaching from the southwestward will probably first sight the hotel near the sea wall.

Pilots will be found between sunrise and sunset outside the bar or at anchor near the end of the jetties. There are two classes of pilots stationed at the jetties, the Galveston pilots for the ports of Galveston, Texas City, and Port Bolivar, and the Houston pilots for the port of Houston. During thick or foggy weather the Galveston pilot boat when in open water blows four blasts of the whistle, and the Houston pilot boat blows two long and three short blasts. Steamers approaching the bar and hearing the whistles reply to the pilot boat they desire. This is repeated at intervals until the pilot boat arrives alongside the steamer. During clear weather steamers approaching the bar will hoist the "Galveston" signal AWVC, or the "Houston" signal AWVF, for the pilot boat desired. Pilotage is compulsory for foreign vessels and certain classes of coastwise vessels. (See extracts of State of Texas Pilot Regulations, on p. 4.)

The rates of pilotage inward and outward for Galveston and Texas City are:

	Per foot draft
Not over 500 net registered tons	$3.00
500 to 1,000 net registered tons	3.50
1,000 to 1,500 net registered tons	3.75
Over 1,500 net registered tons	4.00

The rates of pilotage for Houston are:

	Per foot draft
Gulf of Mexico to Houston, or vice versa	$5.50
Bolivar Roads to Houston, or vice versa	2.50
Gulf of Mexico to Bolivar Roads, or vice versa	4.00

The pilot rate for shifting vessels from dock to dock or anchorage to dock is $20 each.

Towboats will come out to sailing vessels outside the bar or they may be had at Galveston. With a fair wind, sailing vessels under the direction of a pilot usually come in as far as the quarantine anchorage without the aid of a towboat.

For Houston Ship Channel, ships of over 2,500 tons register usually have the assistance of one or more tugs from the entrance of the channel to the docks. Application for this service may be made when applying for a berth. Rates of towage prevailing are $300 per tug, Houston to Bolivar Roads, or vice versa, for assisting a steam vessel. For sailing vessels the rate per round trip is 70 cents per gross ton, with a minimum charge of $600.

The rate for assisting steamer between Bolivar Roads and Galveston or Texas City, including on or off dock charge, is $80 for one tug. For the second tug, $80 at Galveston and $70 at Texas City. For shifting steamer from pier to pier, $55 for the first tug, $50 for the second tug, and $45 for the third tug.

Sailing vessels, rate per gross ton

	Cents
Towage between Galveston Bar and Galveston Dock	30
Towage between Galveston Bar and Bolivar Dock	30
Towage between Galveston Bar and Texas City Dock	35
Towage between Galveston Bar and Bolivar Roads	25
Towage between Bolivar Roads and Galveston Dock	15
Towage between Bolivar Roads and Bolivar Dock	15
Towage between Bolivar Roads and Texas City Dock	20

Anchorage.—Vessels outside of the bar, if prevented from entering by a norther, can anchor in about 5 fathoms (9 m.), with Bolivar Point Lighthouse bearing about northwest. The holding ground is good, and there is but little sea.

The best anchorage for large vessels is in Bolivar Roads, between Bolivar Point and Pelican Island and Spit. The depths range from 3 to 8 fathoms (5.5 to 14.5 m.), and the bottom is good holding ground.

The quarantine anchorage is northeastward of Fort Point.

Anchorage grounds for Galveston Bay, Port Bolivar, and Texas City have been prescribed by the War Department. The limits are defined as follows:

Vessels may anchor only in the anchorage basin known as Bolivar Roads, lying between Bolivar Point on the north and Galveston Island, Pelican Spit, and Pelican Island on the south, west of a line ranging from the north end of the United States concrete sea wall at Fort Jacinto to the east end of the United States concrete sea wall in front of Fort Travis (Bolivar Point), and east of a line ranging from the triangulation beacon "M" on the east end of Pelican Island to the Port Bolivar front range light near the north edge of Port Bolivar turning basin, and only in those portions of said anchorage lying outside of the Galveston Channel, the Texas City Channel, and the Port Bolivar Channel and turning basin.

On account of the amount of traffic Galveston Channel can be used only for temporary anchorage by steamers preparing to haul into berths at the wharves or after leaving the wharves before going to sea.

In Galveston Bay small craft can anchor anywhere outside of the dredged channels where the depth is sufficient. The water in the bay may be lowered as much as 3 feet (0.9 m.) by a norther, and vessels should make due allowance for it when selecting anchorage during the winter months.

Vessels are prohibited from anchoring in the Houston Ship Channel or turning basin except in cases of great emergency, and under such circumstances shall be placed as near the edge of the channel or turning basin as possible, so as not to interfere with free navigation nor obstruct the approach to any pier. Three mooring places have been provided, consisting of 4 clusters of 16 piles each. Two of these are in Galveston Bay 8 and 14 miles from the entrance to the Houston Ship Channel, and the other in San Jacinto Bay, 1 mile above Morgan Point.

At Texas City there is anchorage space within the harbor with 30-foot (9.1 m.) depth at mean low water for five standard ships. This anchorage is protected by dikes on the east, south, and north sides and by land on the west side. Vessels are forbidden to anchor in any part of the channel.

Quarantine is enforced in accordance with the regulation of the United States Public Health Service, with some additional local requirements at times. (See also the information relative to quarantine on p. 5.)

The State quarantine station is located inside of Fort Point, on the east side of the channel; the national quarantine station is nearly opposite, on the north end of Pelican Spit. Vessels are boarded by the health officer between sunrise and sunset, at the quarantine anchorage northeastward of Fort Point.

Hospital.—Relief is furnished at Galveston as provided in the United States Public Health Service regulations for stations of Class II. There is also a Public Health relief station at Houston. Each of these stations have a marine ward in some local hospital. The nearest marine hospital is at New Orleans.

Customs officers in Galveston are located at the customhouse, five city blocks south of Pier No. 25. At Texas City, a branch of the customhouse is located 100 feet west of the main slip bulkhead between warehouses A and B. There is no customhouse at Houston. The customs department maintains an office in the Federal building, with a suboffice on the wharf No. 1 at the turning basin.

Supplies.—Bunker coal, either anthracite or bituminous, in large quantities can be had at the wharves in Galveston and Manchester, and in limited quantities at Texas City. Oil for bunkering purposes can be had at Galveston, Texas City, and at several places along the Houston Ship Channel. Fresh water of excellent quality for drinking or boiler purposes can be had at the wharves or from barges. Provisions and ship chandler's stores can be had at Galveston, Texas City, or Houston.

Repairs.—There is one large dry dock and three marine railways at Galveston. The dry dock has a capacity of 10,000 tons dead weight; length, 525 feet; width, 80 feet; and depth over sills, 23 feet.

The largest marine ways has a capacity of 1,200 tons; length, 196 feet; draft, forward 12 feet and aft 14 feet. There are good machine shops at Galveston and Texas City.

At Harrisburg there is a marine railway of 400 tons capacity; length, 120 feet; and draft, 6 feet. At Clinton and Lynchburg there are marine ways of 600 tons capacity; length, 150 feet; and draft of 8 feet.

Storm warnings are displayed on the Loan & Trust Co. Building, Galveston; Quarantine Station, Galveston; Texas City Terminal Co.'s elevator, Texas City, Ninth Street and Ninth Avenue; Anahuac; Laporte; Morgan Point; Harrisburg; and Seabrook.

A **United States Branch Hydrographic Office** is located in the City National Bank Building. Bulletins are posted here giving information of value to mariners who are also enabled to avail themselves of publications pertaining to navigation and to correct their charts from standards. No charge is made for this service.

Tides and currents.—The maximum normal range of tide is 1.4 feet at the end of the jetties, 1.3 feet at Galveston, and 0.8 foot at Morgan Point, and occurs near the time when the moon's declination is greatest, north or south. At such time there is but one high tide daily. When the moon is near the Equator there are two high tides daily, though small. For the intermediate declinations the tides are irregular in character. The tide is influenced by the wind to such an extent that the high tide of some days is frequently lower than the low tide of other days, or vice versa. It is not an uncommon occurrence for the wind to blow from the east and southeast for a number of days, banking the water up in this part of the Gulf and filling the bays to from 2 to 4 feet above mean low tide. The wind then suddenly changes to the north and blows steadily and with considerable violence for several days, blowing the water out of the bay and reducing the level of the Gulf and the bay to 2 or 3 feet below mean low water.

The currents also are largely dependent on the force and direction of the wind. Easterly and southeasterly winds cause the current to set inward between the jetties, sometimes continuously for three days; northers then cause an outward current of great velocity. The normal tidal currents, unaffected by wind, also have considerable velocity at times on the bar at the entrance, along the wharves, and in the dredged cuts in the bay and tributaries.

Winds.—The prevailing winds are northerly from November to March, throughout which time "northers" occur frequently. These gales, although occasionally blowing with a velocity of over 40 miles, are not dangerous to vessels anywhere close to the coast, as they blow offshore and the sea is not heavy; the Weather Bureau warning of their approach gives vessels ample time for preparation. From April to October the prevailing winds are southerly, and hurricanes occur occasionally; these are dangerous to shipping near the coast because the wind is on-shore. Hurricanes of marked violence at Galveston have occurred as follows: September, 1875; September, 1877; September, 1900; and August, 1915. During the hurricane of August, 1915, the wind attained a velocity of over 100 miles per hour.

Approaching from northeastward, vessels should make High Island and then follow alongshore, taking care to be far enough off to clear the end of the jetty. The bottom is fairly regular and there are no known dangers within 15 miles of the coast.

Approaching from southwestward, keep in 5 to 6 fathoms (9 to 11 m.) in winter and deeper water in summer, because of the prevailing southerly winds and swell. The hotel near the sea wall at Galveston will be the first object readily distinguishable from any distance offshore. The bottom is regular and there are no known dangers.

Coming from Straits of Florida.—From a position 8 to 10 miles southward of Dry Tortugas Lighthouse on Loggerhead Key, a course of 295° true (WNW. ½ W.), made good for 666 miles leads to Heald Bank Light Vessel (described on p. 168). Thence a course of 300° true (WNW. mag.) for 27 miles leads to Galveston bar gas and whistling buoy. Eastbound from Galveston bar gas and whistling buoy a course of 120° true (ESE. mag.) leads to Heald Bank Light Vessel. Thence a course of 115° true leads across the Gulf to the vicinity of the Tortugas.

During the winter months when northers are frequent it is well for westbound vessels to keep a little northward of the 295° course, but go southward of the light vessel in passing. In either direction verify the ship's position as often as possible, because no sailing directions can be given which will suffice for all of the varying conditions of current encountered. For 300 miles before reaching Heald Bank westbound vessels frequently overrun, especially during the winter months, and eastbound vessels overrun for the last 300 miles before reaching the Tortugas. Depend upon the lead westbound, but upon observations eastbound.

The following hints regarding currents apply to the general conditions which may be looked for, and are based mainly on reports received by the United States Hydrographic Office:

During February, March, and April the current runs southeastward with varying strength, and will be directly against a vessel most of the way on the 295° course until within about 100 miles of Heald Bank, when it sets southwestward with considerable strength.

During May, June, and July the current runs southward and southeastward for 200 miles west of the Tortugas. Then for 200 miles it often sets slightly northward. For the next 150 miles the current runs northeastward and eastward, and when approaching Heald Bank it sets southwestward.

During August, September, and October (the hurricane season) the current is very irregular and uncertain. For the first 200 miles west of the Tortugas it runs southward and southeastward with varying velocities, depending much upon the direction and force of the wind in the Atlantic and the Gulf. For the second 200 miles it sets north-northwestward and northward, often with greater velocity than during the preceding three months. For the next 150 miles the current runs northeastward and eastward. When approaching Heald Bank, it frequently sets southwestward.

During November, December, and January, the season when northers occur most frequently, the current runs southward and

southeastward for the first 200 miles west of the Tortugas. For the next 200 miles it runs northwestward and northward, and is said to be strong enough to offset the southerly set of the first 200 miles. For the next 150 miles the current may have a slight northeasterly set; but ordinarily it is not so noticeable as at other seasons. When approaching Heald Bank, it sets southwestward with considerable strength.

Entering Galveston Harbor, since the channel is changeable, it is advisable for strangers of deep draft to take a pilot. For vessels of moderate draft the chart and buoys are sufficient guides if followed carefully.

COAST, GALVESTON TO THE RIO GRANDE

From Galveston entrance to the entrance to Matagorda Bay at Pass Cavallo, a distance of 107 miles, the coast trends in a general southwest by west direction. From Pass Cavallo it curves gently to the southward for 100 miles to latitude 27° N., where its trend is north and south, true; thence it curves gently a little east of south for 64 miles to the mouth of the Rio Grande. Throughout the whole distance the coast incloses a chain of shallow bays or lagoons, some of them of considerable size, separated from the Gulf by long, narrow islands and peninsulas, which are generally low and sandy, with but few natural distinguishing marks. A few of the bays and lagoons may be entered from the Gulf through small passes partly obstructed by bars with little depths on them, except the ones which have been improved by the construction of jetties and by dredging.

Except in the vicinity of the passes, the coast has fairly uniform depths with but few outlying dangers, and can be approached to within about 2½ miles by a vessel of any draft. The only reported dangers are found for about 20 miles southwestward of the entrance to the Brazos River and consist of occasional ridges of soft mud having as little as 4 fathoms (7 m.) over them, with general surrounding depths of 5 to 5½ fathoms (9 to 10 m.)

Currents.—The tidal and permanent currents along the entire western coast of the Gulf of Mexico are, as a rule, very weak, the principal currents of interest to navigators being due to the winds. Moderately strong currents set with the wind along the coast, their strength and set depending on the direction, strength, and duration of the wind. Wind velocities of 20 to 40 miles produce currents of about 0.5 to 0.9 knot, setting in a direction approximately fair with the wind, modified by the shore line. The currents seldom exceed 1 knot.

SAN LUIS PASS

leads from the Gulf to the southwestern end of West Bay. It is obstructed by a bar, across which there is an unmarked channel one-fourth mile wide and 7 feet (2.1 m.) deep, with at least that depth for some distance inside. Good anchorage can be found on the east side of **Mud Island** for any vessel that can enter the pass. Fishermen acquainted with the pass can sometimes be found to pilot vessels in.

West Bay is a shallow body of water extending 16 miles southwestward from the southwestern part of Galveston Bay, between

Galveston Island and the mainland. It is of no commercial importance, except as forming a link in the inland waterway system. A channel 40 feet wide and 5 feet (1.5 m.) deep, maintained by dredging, but subject to rapid shoaling, extends the length of the bay from **Deer Islands** to Mud Island; it is marked by beacons at frequent intervals.

Offatt Bayou, 1 mile south of the draw span in the Galveston causeway, averages 25 feet (7.6 m.) in depth, and affords secure anchorage for boats and small launches. It can be entered with a draft of 5 to 6 feet (1.5 to 1.8 m.) at high water.

Green Lake, Karankawa Lake, and **Halls Lake** are shallow, unimportant bodies of water on the northerly side of West Bay.

Chocolate Bay and Bayou form a tributary of West Bay on the north side of its southwestern end. A channel 5 feet (1.5 m.) deep has been dredged across the bar at the mouth of the bayou, but in 1924 the controlling depth was only 2 feet (0.6 m.). Inside the bar a depth of 8 feet (2.4 m.) can be carried for several miles, and 2 to 3 feet (0.6 to 0.9 m.) can be carried for 17 miles. Three drawbridges, with openings of 51, 46, and 63 feet, cross the river at distances of about 6, 6½, and 7 miles, respectively, above the mouth of the bayou. The last is near the town of **Liverpool.**

Bastrop Bayou empties into **Bastrop Bay** 4 miles northwestward of San Luis Pass. The bay and mouth of the bayou are obstructed by shoals. A channel 5 feet (1.5 m.) deep, subject to shoaling, has been dredged through the upper end of Mud Island and connects Bastrop Bay with West Bay. This channel, **Galveston and Brazos River Canal,** extends through the lower part of Bastrop Bay and through Oyster Bay and connecting waterways to Brazos River. From the mouth of Bastrop Bayou a channel 3½ feet (1.1 m.) deep, project depth 4 feet (1.2 m.), extends through Bastrop Bay to a junction with the Galveston and Brazos River Canal at **Christmas Point.** A draft of 4 feet (1.2 m.) can be carried up Bastrop Bayou for a distance of 15 miles.

Austin Bayou, which is navigable for about 9 miles, enters Bastrop Bayou about 10½ miles above its mouth. The principal commerce on these two bayous consists of fuel oil and shells. There are no towns on the bayous, although Angelton is only a few miles away from the head of Bastrop Bayou. Two drawbridges cross Bastrop Bayou about 14 miles above its mouth.

Hoskins Mound is an oil and sulphur field about 3 miles northwest of Bastrop Bay. There is one stack and four or more derricks here, which are prominent objects from offshore. Steamers approaching the coast should not confuse this mound with **Bryan Mound** 3 miles southwest of Freeport, which has four stacks and several derricks.

Oyster Bay and **Drum Bay** are shallow bodies of water extending southwestward of Bastrop Bay. They are traversed by the Galveston and Brazos River Canal, depth 5 feet (1.5 m.), which connects them with Brazos River. The canal across the bays is marked at frequent intervals by beacons.

Oyster Creek is a tortuous stream emptying into the Galveston and Brazos Canal about 2½ miles northeastward of Brazos River Lighthouse, from which point it forms a part of the canal. It has a

ruling depth of 2 feet (0.6 m.) for 2 miles above its junction with the canal, and a depth of 3 feet (0.9 m.) for a farther distance of 13 miles, beyond which it is overhung with trees to such an extent as to prohibit navigation. Oyster Creek has a small amount of traffic in agricultural products.

BRAZOS RIVER,

(chart 525), unlike all other large rivers within the State of Texas, flows without the intervention of a bay directly into the Gulf of Mexico, at a point 40 miles southwestward of Galveston Entrance. It is about 825 miles in length, and during high-river stages has been ascended by light-draft steamers as far as **Old Washington,** 221 miles above the mouth. At ordinary river stages a draft of 7½ feet (2.3 m.) can be carried to **Bolivar Landing,** 41 miles above the mouth, and a draft of 2 feet (0.6 m.) to Old Washington. The river is not improved above Old Washington. The city of **Waco** is located on the river 374 miles above the mouth.

The river is tidal as far as Bolivar Landing. It is subject to sudden floods which are liable to occur at any time of the year. The current is rapid in the upper portion, and sluggish in the lower portion, except during floods. The width varies from 550 feet at the mouth to 150 feet at Waco.

The **entrance** to the river is obstructed by a bar of quicksand, subject to frequent change, which has been improved by the construction of two parallel jetties, 550 feet apart, and by dredging in the channel. The project depth over the bar is 18 feet (5.5 m.) in a channel 150 feet wide. On October 31, 1925, the depth was 15½ feet (4.7 m.) in a channel 100 feet wide. The entrance is marked by buoys.

Freeport Harbor is formed in the mouth of the Brazos River. The section of the river improved under the above title extends, however, from the mouth of Velasco, about 5 miles above. It is subject to tidal action and has a width of 500 to 550 feet.

The project provides for a channel 22 feet (6.7 m.) deep and 150 feet wide from the jetties up to the steamship wharf at Brazosport, and for such extension of the project upstream toward the town of Freeport as may be found desirable. In March, 1925, the controlling depth was 20 feet (6.1 m.) to the turning basin off the wharf, and 27 to 33 feet (8.2 to 10 m.) in the turning basin. A depth of 13 feet (4 m.) could be carried to the towns of Velasco and Freeport. The depth alongside the sulphur dock and extending for 75 feet out from the dock was 18 feet (5.5 m.) at the lower end and 6 feet (1.8 m.) at the upper end.

Brazos River Lighthouse, near the mouth of the river, is a pyramidal skeleton structure painted brown, with black lantern. The light is flashing white (flash 0.5 second, eclipse 9.5 seconds), 98 feet (30 m.) above the water, and visible 16 miles.

Brazosport consists of the wharf and terminals of the Houston & Brazos Valley Railway near the lighthouse. It is not a post office. Brazosport has railroad communication with Houston and freight steamer communication with New York. The principal articles of commerce are sulphur, fuel oil, and cotton. The intracoastal canal intersects the river at Brazosport.

Freeport and **Velasco** are towns about 5 miles above the mouth of the river on the south and north banks, respectively. Both have railroad communication with Brazosport and Houston. There are depths of 10 to 12 feet (3 to 3.7 m.) close to the banks in places abreast of both towns and at the small landings. The principal articles of commerce are the export of sulphur and the import of fuel oil.

A combined railroad and county drawbridge, with an opening 125 feet wide, crosses the river at Freeport.

Extensive sulphur mines 3 miles southward of Freeport have railroad connection with Freeport and Brazosport.

Brazoria and **Columbia** are towns 22 and 27 miles, respectively, above the mouth of the river. A railroad drawbridge, with an opening 95 feet wide, crosses the river at Brazoria.

Terminal facilities.—The terminal facilities are located at the towns of Freeport and Velasco and at a point about a mile above the inner ends of the jetties. The facilities at Freeport consist of two small wharves, privately owned, but open to the public on equal terms, and one free public wharf owned by the municipality of Freeport. The wharves at Velasco are small, privately owned, and in such a bad state of preservation as to be practically useless. They are open to the public on equal terms. The facilities just inside the mouth of the river consist of one sulphur-loading dock, about 250 feet long, by means of which crude sulphur from the mines near Freeport is loaded directly into vessels from railroad cars by means of chutes, one oil dock, and one steamship wharf, about 450 feet long, with wooden shed, which is owned by the railroad company and has in the past been used for handling miscellaneous freight brought to it by regular trips of a freight steamer from New York. The sulphur dock and oil dock are not open to the public. The steamship wharf is open to the public when not occupied by the owners.

Wharfage.—There are no wharfage charges or other port charges on vessels or cargo.

A deputy collector of **customs** is stationed at Freeport.

Supplies.—Fuel oil and fresh water can be obtained at Brazosport. A small amount of coal is kept on hand and larger quantities can be had by giving due notice. Provisions and some ship chandler's stores can be obtained at Freeport.

Repairs.—Galveston is the nearest place where repairs to machinery and hulls of steamers can be made. Vessels of less than 36 feet in length and 3½ feet draft can be hauled out at Freeport. There is a machine shop at the sulphur mines, 3 miles from Freeport. There is also a small marine ways near the sulphur company's wharf opposite Brazosport.

Prominent features.—The derricks, stacks, and rising smoke at the sulphur mines at Bryan Mound, 4 miles westward of the entrance, are the first objects sighted in clear weather. The warehouse and elevated sulphur conveyor on the railroad wharf at Brazosport and the lighthouse are seen on nearer approach. The jetties show above water except near their ends.

Vessels approaching the entrance should not mistake Hoskins Mound, 6 miles northwest of San Luis Pass, and which consists

of one stack and several derricks, with Bryan Mound, which consists of four stacks and several derricks.

Pilots are stationed at Brazosport. The pilotage rate is $4 per foot of draft. There is no pilotage charge for docking.

Towboats are not regularly stationed here, but they make occasional trips to the mouth of the river from Galveston and Port Arthur.

Anchorage may be found anywhere in the river that the depth is suitable, but there is not much swinging room for large vessels.

Quarantine regulations are enforced by State health officers in accordance with the regulations of the United States Public Health Service, with some additional local requirements at times. The health officer is stationed at Freeport and boards vessels at the mouth of the river.

Storm warnings are displayed at Freeport and Velasco.

A Coast Guard station is located on the northeast bank of the river inside the jetties.

Tides and currents.—The mean range of the tide at the mouth of the river is 1.9 feet. The current has a normal velocity of about 1 knot, which may increase to 4 or 5 knots during high river stages.

The current off the entrance generally sets to westward, with a counter current near the beach, which is largely influenced by the direction of the wind. The bar is very rough with an easterly breeze, especially when the river current is strong.

Directions, Brazos River.—Bring Brazos River Lighthouse to bear 306° true (NW. by W. ½ W. mag.), and stand for it. If a stranger and drawing over 12 feet (3.7 m.), anchor in 20 feet (6.1 m.) or more and signal for a pilot.

The channel for a mile outside the end of the jetties is subject to frequent and marked changes, and the buoys do not mark the best water at all times. For several years it has been shifting to the northeastward, but there are indications that it has about reached the limit of its movement in that direction and that it may break out to the southward or southeastward at any time. In 1925 a course of 295° true (WNW. ½ W. mag.), from the sea buoy, heading a little outside the end of the jetties, led into the best water, care being taken to avoid the submerged end of the northeast jetty, which extends out 200 feet beyond the visible portion, and which is marked by a flashing red gas buoy.

SAN BERNARD RIVER

flows into the Gulf of Mexico about 9 miles southwestward from the mouth of Brazos River. Its mouth is obstructed by a shifting bar, on which the depth varies from 18 inches to 4 feet (0.5 to 1.2 m.). Inside the bar it is said to have a depth of 8 feet (2.4 m.) for about 40 miles, and a depth of 1½ to 2½ feet (0.5 to 0.8 m.) for a farther distance of 40 miles. There are numerous plantation settlements along the river, but no towns of importance. Six drawbridges cross the river at 10, 15, 22, 27, 29, and 40 miles, respectively, above the mouth; the widths of openings vary from 31 to 62 feet. The narrows about 3 miles above the mouth are difficult to navigate without local knowledge. Persons familiar with the river live near the mouth.

The entrance to the river can be identified by two dark weather-beaten houses, one on each side of the entrance. The house on the northeast bank is the largest. These houses show fairly prominent from offshore.

The intracoastal canal from Brazos River to Matagorda Bay enters the San Bernard about one-fourth mile above its mouth, and leaves it at **Longs Bayou**, one-half mile farther up.

Cedar Lakes are shallow bodies of water having a total length of about 5 miles, lying one-half mile westward of San Bernard River, and connected therewith by Longs Bayou. A channel 5 feet (1.5 m.) deep (the intracoastal waterway) has been dredged from Longs Bayou through these lakes and extending westward connects them with Matagorda Bay. This channel through the lakes is well marked by beacons. It is subject to considerable shoaling.

PASS CAVALLO

is an entrance from the Gulf to the southwestern corner of Matagorda Bay, 108 miles southwestward from Galveston entrance. It is 1¼ miles wide between **Matagorda Peninsula** on the east and **Matagorda Island** on the west, and formerly was of some little commercial importance; but since the completion of the intracoastal canal it is little used.

The entrance is obstructed by a bar subject to frequent change in both location and depth, and the bar buoy can not be depended on to indicate the best water. The depths over the bar vary from 5 to 10 feet (1.5 to 3.0 m.).

The ruins of East Shoal Lighthouse and West Shoal Lighthouse are just visible above the water at the northern end of the pass and should be avoided.

Matagorda Lighthouse and the buildings of the Coast Guard station on Matagorda Island are the most prominent landmarks by which the locality can be recognized.

With northerly winds or smooth sea good anchorage may be had outside the bar in 4 to 6 fathoms (7 to 11 m.), with the lighthouse bearing about W. ½ S. (mag.). Inside the bar anchorage may be found in about 20 feet (6.1 m.) near the head of the pass. There are no licensed **pilots**. Vessels desiring to enter usually signal the Coast Guard station, whereupon the keeper of the station places two poles with blue flags on the range marking the best water; at night white lights take the place of the flags, the higher light being the rear one. When desired the keeper of the station will come out, if practicable to enter, and pilot a vessel in over the bar.

Matagorda Lighthouse is a black conical tower. The light is flashing white (flash 2 seconds, eclipse 18 seconds), 85 feet (26 m.) above the water, and visible 15 miles.

Matagorda Bay is an irregularly shaped body of water, 45 miles long in a general northeasterly and southwesterly direction, from 1 to 10 miles wide, and separated from the Gulf by **Matagorda Peninsula. Dog Island Reef**, about 20 miles from the northeastern end of the bay, divides the bay into two parts, with somewhat dissimilar characteristics. Eastward of the reef the bay is a shallow lagoon, with a greatest depth of 5 feet (1.5 m.), soft mud or silt bottom, and shows indications of being filled up rapidly. The Colorado River

empties into this part of the bay. Westward of Dog Island Reef the depths range from 5 to 13 feet (1.5 to 4.0 m.), averaging 10 or 12 feet (3.0 to 3.7 m.) over the greater part. These depths are fairly stable. A dredged cut 8 feet (2.4 m.) deep across the southerly end of Dog Island Reef connects the two parts of the bay. This cut is marked by beacons on its southeast side.

The intracoastal waterway extends through the entire length of Matagorda Bay. (See description on p. 197.) It enters the bay at its eastern end at Caney Creek and extends through a dredged cut 5 feet (1.5 m.) deep, marked on its southern side by beacons, to the cut through Dog Island Reef. Westward of the reef the depths average 5 feet (1.5 m.) or more, and there is no marked channel.

Caney Creek empties into the extreme northeastern part of Matagorda Bay, through a canal one-half mile long. It meanders through a fertile country, but is of little commercial importance at present except for occasional small cargoes of general agricultural products.

A draft of 5 feet (1.5 m.) can be carried up the creek to a fixed county bridge about 25 miles above Matagorda Bay. **Hawkinsville,** some 15 miles up the creek, is the terminus of a railroad. **Gainesmore** and **Cedar Lane** are small settlements and post offices.

Live Oak Bay and **Bayou,** tributary to the eastern part of Matagorda Bay, are shallow and of no importance. On exceptionally high tides the bayou can be ascended with a draft of 3 feet (0.9 m.) for about 15 miles.

Colorado River empties into Matagorda Bay through two mouths about 3 miles northeastward of Dog Island Reef. The mouths are obstructed by bars, on which the depth at low tide is about 1 foot (0.3 m.). Inside the bars there is a controlling depth of 8 feet (2.4 m.) for about 6 miles, and 2 to 3 feet (0.6 to 0.9 m.) for 16 miles farther.

A channel 5 feet (1.5 m.) deep has been dredged from the eastern mouth of the river to a junction with the intracoastal canal. This channel is subject to shoaling and in 1924 the controlling depth was 3½ feet (1.1 m.). Colorado Channel beacons Nos. 1 and 2 mark the entrance to the channel from the intracoastal canal.

Matagorda is a small town and post office at the mouth of Colorado River. It is headquarters for a small fleet of oystermen and has railroad communication with the interior of the State. A draft of only 1 foot (0.3 m.) can be carried to the wharves on Matagorda Bay and these have been nearly abandoned. The principal wharves are on the Colorado River which have ample depths for any vessel that can enter the river. Gasoline, fresh water, and provisions can be obtained at Matagorda and there are facilities for hauling out small vessels.

Storm warning signals are displayed here.

Gulf is a small town 4½ miles eastward of Matagorda. There are extensive sulphur mines north of the town which are connected by railroad with Matagorda and the interior of the State. The tall stacks and derricks at the mines are prominent objects from offshore.

A privately dredged channel, 3 feet (0.9 m.) deep, connects the intracoastal canal with a wharf and turning basin at the sulphur mines. This channel is marked by private range lights.

Trespalacios Bay is an unimportant tributary on the north side of the western part of Matagorda Bay. Five feet (1.5 m.) can be taken to within 1 mile of **Palacios** and 3 to 3½ feet (0.9 to 1.1 m.) to **Collegeport,** villages on opposite sides of the bay. **Trespalacios River** empties into the northern extremity of Trespalacios Bay. It has a depth of 2½ feet (0.8 m.) at the entrance and a controlling depth of 6 to 10 feet (1.8 to 3 m.) for about 25 miles inside. In entering Trespalacios Bay, **Bird Island Channel** is the one generally used. It lies about 1 mile west of **Olivers Point** and is marked on its easterly side by a light. **Storm warnings** are displayed at Palacios.

Karankawa Bay, 6 miles west of Trespalacios Bay, is a shallow unimportant body of water, navigated only by a few flat-bottom sailboats.

Lavaca Bay, an arm of Matagorda Bay at its northwestern corner, has a controlling depth of 5 feet (1.5 m.) in dredged channels across **Sand Point** and **Gallinipper Reefs** to the town of Port Lavaca on the western shore. These channels are marked by beacons on their southern sides.

Keller Bay, an arm of Lavaca Bay to the eastward, has some little traffic in cotton and cattle. **Olivia** is a post office near the head of the bay.

Lavaca River, emptying into Lavaca Bay near its head, is obstructed by a bar at the mouth, on which there is a depth of 2½ feet (0.8 m.). Above the mouth it has a depth of 5 feet (1.5 m.) for 10 miles, at which point it is joined by the Navidad River. **Vanderbilt** is a town near the junction of the two streams. It has a little traffic in cotton and cattle. A railroad drawbridge crosses the river at Vanderbilt. **Navidad River** is navigable for a distance of 5 miles above its junction with the Lavaca.

Garcitas Creek, emptying into the head of Lavaca Bay, is navigable for small boats only, and is of no commercial importance.

Port Lavaca, on the western shore of Lavaca Bay, is the headquarters for the fish and oyster industry of this section of the coast, and has considerable traffic by water with the adjacent country. It also has railroad communication with the interior of the State. There are depths of 5 to 6 feet (1.5 to 1.8 m.) at the ends of the wharves. Gasoline, fresh water, provisions, and some boat supplies can be obtained here, and there are facilities for hauling out small boats.

Storm warning signals are displayed here.

Port O'Connor, at the southwestern end of Matagorda Bay, is a small town having railroad communication with the interior of the State. It is the headquarters of a small oyster fleet. A recreation pier extends into the bay from the northern part of the town. The commercial docks are on the south side of the town at **Barroom Bay,** an arm of Espiritu Santo Bay. A health officer of the State is stationed here. **Storm warnings** are displayed where they are visible to shipping.

Espiritu Santo, San Antonio, Mesquite, and **Aransas Bays** are the names applied to a series of shallow bodies of water, extending southwesterly along the coast for a distance of 50 miles from Pass Cavallo to Aransas Pass, and separated from the Gulf by Matagorda

and St. Joseph Islands. They are filled with islands, reefs, and shoals, and are of little commercial importance, except as forming a link in the intracoastal waterway. (See description on p. 197.)

Espiritu Santo Bay can be entered from Pass Cavallo through **Big Bayou** with a draft of 2 feet (0.6 m.) at low tide, and through Barroom Bay Cut with a draft of 5 feet (1.5 m.).

San Antonio Bay is separated from Espiritu Santo Bay by **First Chain of Islands,** through which a dredged cut affords passage for a draft of 5 feet (1.5 m.). **Seadrift** and **Long Mott,** on the shores of San Antonio Bay, and **Austwell,** on **Hynes Bay,** are small villages having railroad connections with the interior. A draft of 2½ feet (0.8 m.) can be carried to these towns.

Guadalupe River empties into the northerly end of San Antonio Bay through two mouths, the southerly one being generally used. A channel has been dredged to a depth of 5 feet (1.5 m.) across San Antonio Bay to the mouth of the river, where the usual depth is about 2 feet (0.6 m.), very soft bottom. This channel is no longer maintained, and in 1925 the controlling depth was only 2 feet (0.6 m.). Inside the mouth there is a controlling depth of 3 feet (0.9 m.) for about 10 miles, above which, although the depth is about 2½ feet (0.8 m.) for 35 miles to **Victoria,** the river is usually so obstructed by snags as to render it unnavigable. **Tivoli** is a village with railroad communication 7 miles up the river. A railroad drawbridge crosses the river 2 miles above Tivoli.

Mesquite Bay lies between the **Second** and **Third Chain of Islands,** and is of no commercial importance except for its fish and oysters.

Aransas Bay is 15 miles in length, 3 to 4 miles in width, and with depths in the middle and near the southern end ranging from 8 to 12 feet (2.4 to 3.7 m.). Near the northern end, where it joins Mesquite Bay, it is very shallow.

Rockport, a town on the west shore of Aransas Bay, is a summer and winter resort and distributing point for merchandise. It has railroad communication with the interior of the State. A draft of 7 feet (2.1 m.) can be carried to the wharves. Gasoline, fresh water, and provisions can be obtained here. There is a shipyard and machine shop here, and facilities for hauling out small vessels.

Storm warning signals are displayed here.

St. Charles Bay is an arm of Aransas Bay extending northward. It is of little commercial importance except for the traffic in agricultural products. It has a controlling depth of about 2 feet (0.6 m.).

Copano Bay is a northwesterly extension of Aransas Bay. It is encumbered with reefs, between which are several narrow sloughs or channels with depths of 7 feet (2.1 m.). **Bayside** is a small town on the north shore of Copano Bay near its western end, and can be reached with a draft of 6 feet (1.8 m.) **Aransas River,** emptying into the northwestern end of Copano Bay, is navigable only for small boats.

ARANSAS PASS

lies 154 miles southwestward of Galveston entrance, 113 miles northward of the mouth of the Rio Grande, and is the principal approach from the Gulf of Mexico to Aransas and Corpus Christi Bays and

their numerous tributaries. It lies between **St. Joseph Island** on the north and **Mustang Island** on the south. Directly opposite the inner end of the pass is **Harbor Island,** which separates Aransas Bay from Corpus Christi Bay.

The entrance to Aransas Pass is obstructed by a bar, which has been improved by the construction of two jetties extending over a mile into the Gulf, and by dredging, so that a depth of 22½ feet (6.8 m.) is available (1925) in a channel having a least width of 100 feet. It is marked by buoys, some of which are lighted. When completed the channel will be 600 feet wide and 25 feet (7.6 m.) deep.

Aransas Pass Lighthouse is a pyramidal brick tower on the southeasterly shore of Harbor Island. The light is fixed white, 65 feet (20 m.) above the water, and visible 12 miles.

Harbor Island Basin lies between Harbor Island and St. Joseph Island, and has a project depth of 25 feet (7.6 m.) for a width of 1,200 feet and length of 3,000 feet. This basin has not been maintained and in 1924 the controlling depth was 10 feet (3 m.).

The dredged **turning basin** in front of the railroad wharf on Harbor Island has a depth of 24 feet (7.3 m.) for a width of 600 feet and length of 1,650 feet.

Port Aransas, inside the entrance on the southwest side, is the headquarters of the construction force employed upon the improvement of the pass. A dredged channel 6 feet (1.8 m.) deep extends from the inner end of the pass to a turning basin in front of the wharves. This channel has a project depth of 12 feet (3.7 m.) for a width of 100 feet to a turning basin 200 feet wide. About one-half mile northwest of Port Aransas, on Harbor Island, are the terminals of a railroad which affords communication with the town of Aransas Pass. There is also daily mail-boat communication with Aransas Pass. This boat also carries passengers and freight. Port Aransas has telephone communication with Aransas Pass, where there is telegraph service.

Crude oil, cotton, and lumber are the principal items of commerce. The local commerce consists chiefly of fish, ice, and truck.

Terminal facilities.—The principal terminal facilities are located on Harbor Island at the head of Aransas Pass and consisted of a single wooden steamship wharf about 1,000 feet long with a wooden shed, terminal tracks and switches, and a terminal railroad leading thence to the town of Aransas Pass, on the mainland about 6½ miles distant, where it connects with the San Antonio & Aransas Pass Railway. These terminal facilities are privately owned but open to all carriers on equal terms. They were practically destroyed by the hurricane of September, 1919. Necessary repairs have been made to the wharves, sheds, and storehouses to allow of their use by the vessels visiting the port. The terminal railway has been repaired and is in use and work on the rehabilitating of sidings is being done. At the inner end of the 12-foot (3.6 m.) channel leading to the town of Port Aransas the public wharf has been rebuilt by the town, and is open to general public use.

Corpus Christi Bayou forms a thoroughfare between Aransas and Corpus Christi Bays and is largely used by local fishermen and small craft drawing less than 6 feet (1.8 m.). The southern part of the bayou has been improved by dredging and is known as **Morris**

and Cummings Cut. A railroad drawbridge with an opening 24 feet wide crosses the bayou near the middle.

The town of **Aransas Pass** is situated on the mainland about 2 miles westward of the middle of Corpus Christi Bayou and 6 miles northwestward of Port Aransas, with both of which it is connected by a privately dredged canal across Harbor Island paralleling the railroad. The canal has a depth of 3 feet (0.9 m.) (1925) from the landings southeastward of the town to Corpus Christi Bayou; thence it has a depth of 4 feet (1.2 m.) to Port Aransas. Aransas Pass has railway communication with the interior of the State.

Corpus Christi Bay is a large body of water lying westward of Aransas Pass, and connected therewith by Corpus Christi Channel. The general depths in the bay are 8 to 14 feet (2.4 to 4.3 m.). **Portland** is a resort village and post office on the north shore of the bay. **Ingleside,** on **Ingleside Cove,** is a small fishing village. A draft of 3 feet (0.9 m.) can be carried to the landings here.

Corpus Christi Channel extends from Aransas Pass, through **Turtle Cove,** to the shore line at Corpus Christi. The project provides for a channel 25 feet (7.6 m.) deep, and 200 feet wide with widened places for passing. The city of Corpus Christi is constructing a turning basin 25 feet (7.6 m.) deep, 1,200 feet wide, and 3,000 feet long, with a channel 25 feet (7.6 m.) deep and 200 feet wide connecting this basin with Corpus Christi Channel. A drawbridge with a clear width of 90 feet crosses the channel at the entrance to the turning basin. Work on the above channel and basin was begun in 1924. The present (1925) controlling depth from Aransas Pass to Corpus Christi Bay is 6 feet (1.8 m.).

Corpus Christi, on the western side of the bay, 18 miles from Aransas Pass, is the most important city commercially on the coast of Texas southwestward of Galveston. It has considerable coastwise traffic in cotton, cottonseed products, and general merchandise. A channel 100 feet wide and 6 feet (1.8 m.) deep has been dredged from deep water in the bay to a dredged turning basin, 1,000 feet square, off the wharves. The wharves are exposed to winds from easterly to southerly directions, that blow quite regularly with considerable violence, and make a short, choppy sea at the docks, which is uncomfortable for small craft. A breakwater has been constructed which partially protects the wharves and protects the anchorage northeastward of the wharves. A fixed red light on a red beacon marks the channel leading to the basin. A fixed red light on the northerly side of the north opening in the breakwater marks this approach to the anchorage.

When the Corpus Christi Channel and Basin are completed the city of Corpus Christi will be a port for ocean-going vessels. The old breakwater is being extended northward to protect the entrance to the new turning basin.

Terminal facilities.—At Corpus Christi there is one municipal wharf about 1,000 feet long and 200 feet wide, built by the city of Corpus Christi. It is an earth fill between concrete bulkheads, with a wooden apron on piles at its outer end. It is open to the public, only sufficient charge being made to cover its maintenance. There is also a wooden pier, 16 feet wide, 1,150 feet long, with a pierhead, 40 feet by 40 feet, which is owned by the city of Corpus Christi, and is open to the public on equal terms, and several small wharves

or piers, privately owned by the fish companies and not open to the public. The Texas-Mexican Railway owns and operates a railway trestle extending into Corpus Christi Bay, its use being confined to oil cargoes.

Modern terminal facilities are being constructed at the new turning basin north of the city to accommodate seven ocean-going vessels, with ample provision for future expansion.

Nueces Bay is a tributary of Corpus Christi Bay, partially separated from it by sand spits and a railway bridge. The bridge has a draw span with an opening 32 feet wide near its southwesterly end. Nueces Bay has depths of only 1 to 2 feet (0.3 to 0.6 m.) and is of but little importance. **Nueces River,** emptying into the western part of Nueces Bay, is navigable for boats for a distance of 9 miles to a dam. The river is of no commercial importance.

Prominent features.—In approaching Aransas Pass in daytime the first object sighted is a water tower 145 feet (44 m.) high located on Harbor Island opposite the inner end of the pass. Smoke from the dredges used in improvement of the pass may also be seen. The lighthouse and buildings at Port Aransas will be sighted as the pass is approached.

Pilots for Aransas Pass are stationed at Port Aransas and will come out to vessels making signal off the bar. Pilotage is compulsory for all vessels of over 20 tons except certain vessels licensed for the coasting trade in the State of Texas. The rate for pilotage is $4 per foot of draft each way. (See the extracts from the laws of Texas relative to pilotage on p. 4.)

Towboats.—There are no towboats stationed here at present.

Anchorage.—Harbor Island Basin has filled up and affords anchorage only for vessels of less than 10 feet (3.0 m.) draft. Deep draft vessels anchor in the Gulf eastward of the jetties wherever the depth is suitable and lighter their cargoes.

Quarantine.—The quarantine station is located at Corpus Christi. Vessels subject to visitation are boarded between sunrise and sunset at any point 656 feet (200 m.) from the shore line in the vicinity of the pass. Vessels that do not enter the harbor but lighter their cargoes are boarded at the anchorage outside the jetties.

Hospital.—Relief is furnished at Aransas Pass and Corpus Christi as provided in the United States Public Health Service regulations for stations of Class III. The nearest marine hospital is at New Orleans.

A **customs** officer is stationed at Corpus Christi.

Supplies.—Fresh water and fuel oil may be had at the railroad wharf on Harbor Island. Coal in limited quantities, brought by rail from the town of Aransas Pass, may be obtained at the railroad wharf. Fresh water and gasoline for small craft, as well as small quantities of provisions, may be had at Port Aransas. All kinds of supplies may be obtained at Corpus Christi.

Repairs.—The nearest facilities for dry-docking large vessels are located at Galveston. Small craft of less than 65 feet length can be hauled out at the shipyards at Hog Island, north of the drawbridge over Corpus Christi Bayou, and at Turtle Bayou, southward of Rockport. Vessels up to 6 feet draft can be hauled out at Port Aransas and at Corpus Christi. There is a machine shop at Corpus Christi.

Storm warnings are displayed at Port Aransas, Aransas Pass, and Corpus Christi. A Coast Guard station is located at Port Aransas, inside the pass.

Winds from any easterly direction make a rough bar and raise the water inside as much as 2 feet above the normal; winds from any westerly direction have an opposite tendency. A sudden shift of wind from south to north makes an especially rough bar for a short time.

The **currents** in the pass have considerable velocity at times and are greatly influenced by the winds. Just inside the end of the jetties the current sets close to the north jetty. Slack water before flood occurs about 2 hours after low water and slack water before ebb 2 hours after high water at Galveston; this time, however, is affected considerably by winds.

The chart and the aids are the guides.

CORPUS CHRISTI PASS,

17 miles southwestward of Aransas Pass, is an unmarked and seldom used entrance for small craft from the Gulf to the southerly part of Corpus Christi Bay. It has variable depths of 3 to 6 feet (0.9 to 1.8 m.) on the bar at the entrance, but only about 1½ feet (0.5 m.) at the head of the pass. Sometimes the pass is entirely closed.

Laguna Madre is a shallow unsurveyed body of water, scarcely more than a few inches deep in places, extending southward from Corpus Christi Bay for a distance of 100 miles, and separated from the Gulf by only a low and barren storm-swept strip of sand beach, known as **Padre Island.** A few small streams are tributary to it, but neither they nor the laguna are of any commercial importance.

BRAZOS SANTIAGO

is a narrow pass from the gulf to the lower end of Laguna Madre, at the south end of **Padre Island** and between that island and **Brazos Island.** It lies 236 miles south-southwestward of Galveston entrance, 106 miles southward of Aransas Pass, and 7 miles northward of the mouth of the Rio Grande, and is of importance only as the approach to the town of Point Isabel, 2½ miles distant, on the mainland opposite the pass.

The **entrance** is obstructed by a bar of quicksand extending a little over one-half mile into the Gulf, and having about 6½ feet (2.0 m.) of water over it. The project provides for a channel 18 feet (5.5 m.) deep and 400 feet wide across the bar. Local interests are required to contribute sufficient funds to maintain a channel 16 feet (4.9 m.) deep and 100 feet wide from Brazos Santiago to the wharf at Point Isabel, with a turning basin 16 feet (4.9 m.) deep and 500 feet square at the wharf. On June 30, 1924, the controlling depth across the bar was 9½ feet (2.8 m.) for a width of 200 feet, and 4½ feet (1.4 m.) deep in the channel leading to Point Isabel. It is understood that this project will be redredged in 1925.

Brazos Santiago (Padre Island) Lighthouse is a white hexagonal house with dark roof and trimmings on a brown skeleton screw-pile foundation. The light is fixed white, 60 feet (18.3 m.) above the water, and visible 12 miles.

Point Isabel, 2½ miles westward of the entrance, is a fishing village and post office. It is afforded communication with Brownsville by a narrow-gauge railroad. Fishermen's supplies in limited quantities can be obtained here. A United States Navy radio station was constructed here but is not in operation. The towers remain and make good landmarks. There are facilities for hauling out fishing launches but no machine repairs can be made.

Terminal facilities consist only of the railroad wharf, 1,400 feet long at Point Isabel. This wharf carries a narrow gauge railroad track, which extends to Brownsville. Future activities contemplate changing this track to standard gauge. There are no freight handling facilities on this wharf. It is understood to be open to all on equal terms.

Prominent features.—In approaching Brazos Santiago on a clear day the old unused lighthouse, a white conical brick tower at Point Isabel, is the first object sighted, followed soon by Brazos Santiago Lighthouse and the quarantine station inside the entrance on the north side, and the Coast Guard station on the south side. A few miles northward of the entrance a succession of large sand hills 20 to 25 feet (6 to 7.6 m.) high, known as **The Tanks,** are distinctive marks for this stretch of the coast.

Directly off the entrance the bottom is soft and affords fair **anchorage** with good holding ground; farther north and south the bottom is harder.

Storm warnings are displayed at the Coast Guard station.

There is no health officer regularly in attendance at the **quarantine station.** A Public Health surgeon is stationed at Brownsville.

The keeper of the Coast Guard station acts as the **customs** officer.

Vessels should not attempt to cross the bar except when there is no sea or swell. If practicable to enter, the keeper of the Coast Guard station will come out on signal and assist vessels in entering.

Boca Chica, at the south end of Brazos Island and 4 miles southward of Brazos Santiago, is an entrance from the Gulf to Laguna Madre. It has a depth of 1½ to 3 feet (0.5 to 0.9 m.) at the entrance but only a few inches inside, and is seldom used.

THE RIO GRANDE

which for about 1,000 miles of its length forms the boundary between the United States and Mexico, empties into the Gulf 7 miles southward of Brazos Santiago. The entrance is obstructed by a bar having a depth of 4 feet (1.2 m.) over it, in a channel subject to frequent change. Inside the entrance there are depths of 10 to 30 feet (3 to 9 m.); 3 to 4 feet (0.9 to 1.2 m.) can be carried to **Brownsville,** on the American side, and **Matamoros,** on the Mexican side, a distance of 55 miles by river, but only 20 miles by air line. Light-draft steamers have ascended the river as far as **Rio Grande City,** 200 miles above the mouth, and this is considered about the head of navigation.

Strangers desiring to enter the river from the Gulf should obtain local assistance. The keeper of the Coast Guard station at Brazos Santiago and fishermen in the vicinity have knowledge of the entrance. In 1925 the best water paralleled the Mexican shore for one-half mile or more below the mouth.

INSIDE ROUTE, GALVESTON TO CORPUS CHRISTI

A draft of 3 to 5 feet (0.9 to 1.5 m.) can be taken through the inland waterway system of the coast of Texas from Galveston to Corpus Christi, a distance of 175 miles. The route lies behind a series of long and narrow, low sand islands and peninsulas, which separate from the Gulf of Mexico a chain of shallow bays or lagoons, connected one with another by Government canals, dredged where necessary to a depth of 5 feet (1.5 m.) in a channel width of about 40 feet.

The dredged portions, especially in some of the bays, are subject to gradual shoaling, and although an effort is continually made to maintain a depth of 5 feet (1.5 m.) throughout the system, it sometimes happens that the controlling depth is less than that for short sections of the route. Information as to the latest condition of the shoaler places can be obtained at the United States Engineer Office, Loan and Trust Building, Galveston.

In the bays the bottom is mostly soft mud or silt, except for occasional reefs of oyster shell. Small craft are seldom damaged by grounding.

Beacons with rectangular slatted day marks mark the channels. Even-numbered beacons are red and are left on the starboard hand, going south; odd-numbered beacons are black and are left on the port hand. Beacons at turns in the channels have a white board below the day mark. Many of the dredged channels are marked by range beacons.

This inside route is described in detail in the Inside Route Pilot, Key West to the Rio Grande.

The route, distances, and controlling depths in 1925 are given in the following table:

Route	Length in nautical miles	Distance from Galveston	Available depth
			Feet
Through west end of Galveston Channel to drawbridge	5	5	5
Through West Bay to Mud Island	18½	23½	4
Through Oyster Bay to Rattlesnake Point	5½	29	5–7
Drum Bay and Oyster Creek to Brazos River	7½	36½	5–8
Canal from Brazos River to San Bernard River	8½	45	4–6
San Bernard River to Longs Bayou	½	45½	8
Longs Bayou and Cedar Lakes	6	51½	4
Canal to Caney Creek	6½	58	4–5
Caney Creek to Matagorda Bay	2	60	5
Matagorda Bay to Dog Island Reef	19	79	4
Dog Island Reef to Port O'Connor light No. 1	25	104	5–13
Barroom Bay and Espiritu Santo Bay to First Chain of Islands	14½	118½	5–7
First Chain of Islands to Panther Reef	6	124½	5–7
Panther Reef to Second Chain of Islands	6½	131	5
Second Chain of Islands to Gaston Reef	5	136	5
Gaston Reef to Halfmoon Reef	6	142	5
Halfmoon Reef to Murray Shoal beacon No. 8 [1]	11	153	5–12
Eastward of Harbor Island to Aransas Pass	4	157	6–15
Through Corpus Christi Channel to Corpus Christi	18	175	6–15

[1] This route is preferred to the one through Corpus Christi Bayou.

APPENDIX

COAST PILOTS AND FIELD STATIONS OF THE COAST AND GEODETIC SURVEY

COAST PILOTS

	Price
U. S. Coast Pilot, Atlantic Coast, Section A, from St. Croix River to Cape Cod	$0.75
U. S. Coast Pilot, Atlantic Coast, Section B, from Cape Cod to Sandy Hook, including Long Island Sound	.75
U. S. Coast Pilot, Atlantic Coast, Section C, Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays	.75
U. S. Coast Pilot, Atlantic Coast, Section D, Cape Henry to Key West	.75
U. S. Coast Pilot, Gulf Coast, from Key West to the Rio Grande (this volume)	.75
U. S. Coast Pilot, West Indies, Porto Rico, and Virgin Islands	.75
Inside Route Pilot, coast of New Jersey	.30
Inside Route Pilot, New York to Key West	.30
Inside Route Pilot, Key West to the Rio Grande	.50
U. S. Coast Pilot, Pacific Coast, California, Oregon, and Washington	.75
U. S. Coast Pilot, Pacific Coast, Alaska, Part I, from Dixon Entrance to Yakutat Bay	.75
U. S. Coast Pilot, Pacific Coast, Alaska, Part II, Yakutat Bay to Arctic Ocean	.75
U. S. Coast Pilot, Hawaiian Islands	.50
U. S. Coast Pilot, Philippine Islands, Part I, Luzon, Mindoro, and Visayas	.75
U. S. Coast Pilot, Philippine Islands, Part II, Palawan, Mindanao, and Sulu Archipelago	.75

FIELD STATIONS

Boston, Mass., Appraisers Building, 408 Altantic Avenue.
New York, N. Y., 311–312, Maritime Exchange Building, 78 Broad Street.
New Orleans, La., room 314, Customhouse.
San Francisco, Calif., room 305–306, Customhouse.
Seattle, Wash., room 202, Burke Building.
Manila, P. I., Intendencia Building.

At these stations complete files of the United States Coast and Geodetic Survey charts, Coast Pilots, Tide Tables, Current Tables, and other publications relating to navigation may be consulted and information affecting navigation obtained without charge. Light Lists, Buoy Lists, and Notices to Mariners are kept for sale or for free distribution to mariners. The field stations are also sales agencies for the Coast and Geodetic Survey publications. A chart catalogue, giving lists of charts, coast pilots, tide tables, and agencies of the Coast and Geodetic Survey, can be obtained from any of the field stations, or will be sent, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C. Frequent changes occur in the agencies, and the list of agencies is published in the first notice each month of the Notices to Mariners.

NAVIGATIONAL AIDS AND THE USE OF CHARTS

The Coast and Geodetic Survey is charged with the survey of the coasts, harbors, and tidal estuaries of the United States and its insular possessions and issues the following publications relating to these waters as guides to naviga-

tion: Charts, Coast Pilots, Tide Tables, Current Tables, a catalogue of these publications, and Notices to Mariners, the last named published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey.

CHARTS bear three dates, which should be understood by persons using them: (1) The date (month and year) of the edition, *printed* on the late charts below the border in a central position; (2) the date of the latest correction to the chart plates, *printed* in the lower left-hand corner below the border; (3) the *date of issue, stamped* below the the border and just to the left of the subtitle. Charts show all necessary corrections as to lights, beacons, buoys, and dangers, which have been received to the *date of issue*, being hand corrected since the latest date printed in the lower left-hand corner. All small but important corrections occurring subsequent to the *date of issue* of the chart are published in Notice to Mariners and should be applied by hand to the chart immediately after the receipt of the notices. The date of the edition of the chart remains unchanged until an extensive correction is made on the plate from which the chart is printed. The date is then changed and the issue is known as a new edition. When a correction, not of sufficient importance to require a new edition, is made to a chart plate, the year, month, and day are noted in the lower left-hand corner. All the notes on a chart should be read carefully, as in some cases they relate to the aids to navigation or to dangers that can not be clearly charted. The charts are various in character, according to the objects which they are designed to subserve. The most important distinctions are the following:

1. Sailing charts, mostly on a scale of approximately 1:1,200,000, which exhibit the approaches to a large extent of coast, give the offshore soundings, and enable the navigator to identify his position as he approaches from the open sea.
2. General charts of the coast, on scales of 1:400,000 and 1:200,000, intended especially for coastwise navigation.
3. Coast charts, on a scale of 1:80,000, by means of which the navigator is enabled to avail himself of the channels for entering the larger bays and harbors.
4. Harbor charts, on larger scales, intended to meet the needs of local navigation.

NOTE.—General charts of the Philippine Islands are on scales 1:1,600,000, 1:800,000, and 1:400,000; coast charts are on scales 1:100,000 and 1:200,000.

COAST PILOTS, relating to surveyed waters of the United States, Porto Rico, Alaska, Hawaiian Islands, and the Philippine Islands, contain full nautical descriptions of the coast, harbors, dangers, and directions for coasting and entering harbors. From time to time, as the material accumulates, supplements are issued, containing the more important corrections since the publication of the volume. The supplements are printed on one side of the paper only, so that they may be cut and pasted in the appropriate places in the volume. Supplements and other corrections for any volume can be furnished, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C., or any of its field stations, provided the volume itself has not been superseded by a subsequent edition.

TIDE TABLES.—The Coast and Geodetic Survey Tide Tables are issued annually in advance of the year for which they are made and contain the predicted times and heights of the tide for each day in the year at the principal ports of the world, including the United States and its possessions. A table of tidal differences is given by means of which the tides at about 3,500 intermediate ports may be obtained. Separate reprints from the general Tide Tables are issued for the Atlantic and Pacific coasts of the United States and its dependencies.

CURRENT TABLES, which have heretofore been issued as a part of the Tide Tables, are now published separately as Current Tables, Atlantic Coast of the United States, and Current Tables, Pacific Coast of the United States.

AGENCIES for the sale of the Charts, Coast Pilots, Tide Tables, and Current Tables of the Coast and Geodetic Survey are established in many ports of the United States and in some foreign ports. They can also be purchased in the office of the Coast and Geodetic Survey, Washington, D. C., or any of the field stations. If ordered by mail, prepayment is obligatory. Remittances should be made by postal money order or express order, payable to the "Coast and Geodetic Survey." Postage stamps, checks, and drafts can not be accepted. The sending of money in an unregistered letter is unsafe. Only catalogue numbers of charts need be mentioned. The catalogue of charts and other

publications of the survey can be obtained free of charge on application at any of the sale agencies or to the Coast and Geodetic Survey, Washington, D. C.

OTHER PUBLICATIONS.—Lists of Lights, Buoys, and other Daymarks of the United States, its insular possessions, and the Great Lakes, are published by the Bureau of Lighthouses and may be purchased from its sale agencies or from the Superintendent of Documents, Washington, D. C. Notice to Mariners, relating to the same waters, is published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey; this publication can be obtained free of charge on application to the Division of Publications, Department of Commerce, Washington, D. C.

USE OF CHARTS

ACCURACY OF CHARTS.—The value of a chart depends upon the character and accuracy of the survey on which it is based, and the larger the scale of the chart the more important do these become. In these respects the source from which the information has been compiled is a good guide. This applies particularly to the charts of the Alaska Peninsula, Aleutian Islands, Arctic Ocean and part of Bering Sea, and the Philippine Islands. The early Russian and Spanish surveys were not made with great accuracy, and until they are replaced by later surveys these charts must be used with caution.

With respect to these regions the fullness or scantiness of the soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed, it may be taken for granted that the survey was not in great detail. A wide berth should therefore be given to every rocky shore or patch, and this rule should invariably be followed, viz, that instead of considering a coast to be clear unless it is shown to be foul, the contrary should be assumed.

With respect to a well-surveyed coast only a fractional part of the soundings obtained are shown on the chart, a sufficient number being selected to clearly indicate the contour of the bottom. When the bottom is uneven, the soundings will be found grouped closely together, and when the slopes are gradual fewer soundings are given. Each sounding represents an actual measure of depth and location at the time the survey was made. Shores and shoals where sand and mud prevail, and especially bar harbors and the entrances of bays and rivers exposed to strong tidal currents and a heavy sea, are subject to continual change of a greater or less extent, and important ones may have taken place since the date of the last survey. In localities which are noted for frequent and radical changes, such as the entrance to a number of estuaries on the Atlantic, Gulf, and Pacific coasts, notes are printed on the charts calling attention to the fact.

It should also be remembered that in coral regions and where rocks abound it is always possible that a survey with lead and line, however detailed, may have failed to find every small obstruction. For these reasons when navigating such waters the customary sailing lines and channels should be followed, and those areas avoided where the irregular and sudden changes in depth indicate conditions which are associated with pinnacle rocks or coral heads.

DREDGED CHANNELS.—These are generally shown on the chart by two broken lines to represent the side limits of the improvement. Before completion of the project the depth given is that shown by the latest survey received from the engineer in charge. After completion the depth given is the one proposed to be maintained by redredging when necessary. The actual depth of a completed channel may be greater than the charted depth shortly after dredging and less when shoaling occurs as a result of storms or other causes. These changes are of too frequent occurrence and uncertain duration to chart. Therefore, when a vessel's draft approximates the charted depth of a dredged channel, the latest information should be obtained before entering.

DANGER CURVES.—The curves of depth will be found useful in giving greater prominence to outlying dangers. It is a good plan to trace out with a colored pencil the curve next greater than the draft of the vessel using the chart and regard this as a "danger curve," which is not to be crossed without precaution. Isolated soundings shoaler than surrounding depths should be avoided, as there is always the possibility that the shoalest spot may not have been found.

CAUTION IN USING SMALL-SCALE CHARTS.—It is obvious that dangers to navigation can not be shown with the same amount of detail on small-scale charts as on those of larger scale; therefore in approaching the land or dangerous banks regard should be had to the scale of the chart used. A small error in laying

down a position means only yards on a large-scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile. For the same reason bearings to near objects should be used in preference to objects farther off, although the latter may be more prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn.

DISTORTION OF PRINTED CHARTS.—The paper on which charts are printed has to be dampened. On drying distortion takes place from the inequalities in the paper, which varies with the paper and the amount of the original dampening; but it is not sufficient to affect ordinary navigation. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree when carefully plotted upon the chart, especially if the lines to objects be long. The longer the chart the greater the amount of this distortion.

BUOYS.—Too much reliance should not be placed on buoys always maintaining their exact position, especially when in exposed positions. It is safer, when possible, to navigate by bearings or angles to fixed objects on shore and by the use of soundings.

GAS BUOYS and other unwatched lights can not be implicitly relied on; the light may be altogether extinguished or, if intermittent, the apparatus may get out of order.

LIGHTS.—The distances given in the light lists and on the charts for the visibility of lights are computed for a height of 15 feet (4.6 m.) for the observer's eye. The table of distances of visibility due to height, published in the Light List, affords a means of ascertaining the effect of a greater or less height of the eye. The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Again, refraction may often cause a light to be seen farther than under ordinary circumstances.

When looking for a light, the fact may be forgotten that from aloft the range of vision is increased. By noting a star immediately over the light a bearing may be afterwards obtained from the standard compass. The actual power of a light should be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen. The power of a light can be estimated by its candlepower as given in the light lists and in some cases by noting how much its visibility in clear weather falls short of the range due to the height at which it is placed. Thus a light standing 200 feet above the sea and recorded as visible only 10 miles in clear weather is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles if of sufficient power.

FOG SIGNALS.—Sound is conveyed in a very capricious way through the atmosphere. Apart from the wind, large areas of silence have been found in different directions and at different distances from the origin of the sound signal, even in clear weather. Therefore too much confidence should not be felt as to hearing a fog signal. The apparatus, moreover, for sounding the signal may require some time before it is in readiness to act. A fog often creeps imperceptibly toward the land and is not observed by those at a lighthouse until it is upon them, whereas a vessel may have been in it for many hours while approaching the land. In such a case no signal may be sounded. When sound travels against the wind it may be thrown upward; in such a case a man aloft might hear it when it is inaudible on deck. The conditions for hearing a signal will vary at the same station within short intervals of time. Mariners must not, therefore, judge their distance from a fog signal by the force of the sound and must not assume that a signal is not sounding because they do not hear it. Taken together, these facts should induce the utmost caution when nearing the land or danger in fog. The lead is generally the only safe guide and should be faithfully used.

SUBMARINE BELLS have an effective range of audibility greater than signals sounded in air, and a vessel equipped with receiving apparatus can determine the approximate bearing of the signal. These signals can be heard also on vessels not equipped with receiving apparatus by observers below the water line, but a bearing of the signal can not then be readily determined.

TIDES.—A knowledge of the tide, or vertical rise and fall of the water, is of great and direct importance whenever the depth at low water approximates to or is less than the draft of the vessel and, wherever docks are constructed so as to be entered and left near the time of high water. But under all conditions such knowledge may be of indirect use, as it often enables the mariner

to estimate in advance whether at a given time and place the current will be running flood or ebb. In using the tables slack water should not be confounded with high or low tide nor a flood or ebb current with a rising or falling tide. In some localities the tide may be at a high or low water stand while the current is at its maximum velocity.

THE TIDE TABLES published by the Coast and Geodetic Survey give the predicted times and heights of high and low waters for most of the principal ports of the world and tidal differences and constants for obtaining the tides at all important ports.

PLANE OF REFERENCE FOR SOUNDINGS ON CHARTS.—For the Atlantic coast of the United States and Porto Rico the plane of reference for soundings is the mean of all low waters; for the Pacific coast of the United States and Alaska, with the one exception noted below, and for the Hawaiian and Philippine Islands, it is the mean of the lower low waters. For Wrangel Strait, Alaska, the plane of reference is 3 feet below mean lower low water. For the Atlantic coast of the Canal Zone, Panama, the plane of reference for soundings is mean low water, and for the Pacific coast of the same it is low-water springs. For foreign charts many different planes of reference are in use, but that most frequently adopted is low-water springs.

It should be remembered that whatever plane of reference is used for a chart there may be times when the tide falls below it. When the plane is mean low water or mean lower low water, there will generally be as many low waters or lower low waters below those planes as above them; also the wind may at times cause the water to fall below the plane of reference.

TIDAL CURRENTS.—In navigating coasts where the tidal range is considerable special caution is necessary. It should be remembered that there are indrafts into all bays and bights, although the general set of the current is parallel to the shore. The turn of the tidal current offshore is seldom coincident with the time of high and low water on the shore.

At the entrance to most harbors without important tributaries or branches the current turns at or soon after the times of high and low water within. The diurnal inequality in the velocity of current will be proportionately but half as great as in the height of the tides. Hence, though the heights of the tide may be such as to cause the surface of the water to vary but little in level for 10 or 12 hours, the ebb and flow will be much more regular in occurrence. A swift current often occurs in narrow openings between two bodies of water, because the water at a given instant may be at different levels. Along most shores not seriously affected by bays, tidal rivers, etc., the current usually turns soon after high and low waters.

Where there is a large basin with a narrow entrance, the strength of the current in the entrance may occur near the time of high and low water, and slack water at about half tide, outside. The swiftest current in straight portions of tidal rivers is usually in the mid-channel, but in curved portions the strongest current is toward the outer edge of the curve. Counter currents and eddies may occur near the shore of straits, especially in bights and near points.

THE CURRENT TABLES published by the Coast and Geodetic Survey give the predicted times of slack water and other current data for a number of places on the Atlantic and Pacific coasts of North America.

TIDE RIPS AND SWIRLS occur in places where strong currents occur, caused by a change in the direction of the current, and especially over shoals or in places where the bottom is uneven. Such places should be avoided if exposed also to a heavy sea, especially with the wind opposing the current. When these conditions are at their worst, the water is broken into heavy, choppy seas from all directions, which board the vessel, and also make it difficult to keep control, owing to the baring of the propeller and rudder.

CURRENT ARROWS on charts show only the usual or mean direction of a tidal stream or current. It must not be assumed that the direction of the current will not vary from that indicated by the arrow. In the same manner the velocity of the current constantly varies with circumstances, and the rate given on the chart is a mean value, corresponding to an average range of tide. At some stations but few observations have been made.

FIXING POSITION.—The most accurate method available to the navigator for fixing a position relative to the shore is by plotting with a protractor, sextant angles between well-defined objects on the chart. This method, based on the "three-point problem" of geometry, should be in general use.

In many narrow waters also where the objects may yet be at some distance, as in coral harbors or narrow passages among mud banks, navigation by sextant and protractor is invaluable, as a true position can in general be obtained only by its means. Positions by bearings are too rough to depend upon, and a small error in either taking or plotting a bearing might under such circumstances put the ship ashore. For its successful employment it is necessary, first, that the objects be well chosen; and second, that the observer be skillful and rapid in his use of the sextant. The latter is only a matter of practice.

Near objects should be used either for bearing or angles for position in preference to distant ones, although the latter may be more prominent, as a small error in the bearing or angle or in laying it on the chart has a greater effect in misplacing the position the longer the line to be drawn. On the other hand, distant objects should be used for direction because less affected by a small error or change of position. The 3-arm protractor consists of a graduated circle with one fixed and two movable radial arms. The zero of the graduation is at the fixed arm, and by turning the movable arms each one can be set at any desired angle with reference to the fixed arm.

To plot a position, the two angles observed between the three selected objects are set on the instrument, which is then moved over the chart until the three beveled edges in case of a metal instrument, or the radial lines in the case of a transparent or celluloid instrument, pass respectively and simultaneously through the three objects. The center of the instrument will then mark the ship's position, which may be picked on the chart or marked with a pencil point through the center hole. The tracing-paper protractor, consisting of a graduated circle printed on tracing paper, can be used as a substitute for the brass or celluloid instrument. The paper protractor also permits the laying down for simultaneous trial of a number of angles in cases of fixing important positions. Plain tracing paper may also be used if there are any suitable means of laying off the angles.

The value of a determination depends greatly on the relative positions of the objects observed. If the position sought lies on the circle passing through the three objects, it will be indeterminate, as it will plot all around the circle. An approach to this condition, which is called a "revolver," must be avoided. In case of doubt select from the chart three objects nearly in a straight line or with the middle object nearest the observer. Near objects are better than distant ones, and, in general, up to 90°, the larger the angles the better, remembering always that large as well as small angles may plot on or near the circle and hence be worthless. If the objects are well situated, even very small angles will give for navigating purposes a fair position, when that obtained by bearings of the same objects would be of little value.

Accuracy requires that the two angles be simultaneous. If under way and there is but one observer, the angle that changes less rapidly may be observed both before and after the other angle and the proper value obtained by interpolation. A single angle and a range give, in general, an excellent fix, easily obtained and plotted.

THE COMPASS.—It is not intended that the use of the compass to fix the position should be given up. There are many circumstances in which it may be usefully employed, but errors more readily creep into a position so fixed. Where accuracy of position is desired, angles should invariably be used, such as the fixing of a rock or shoal or of additions to a chart, as fresh soundings or new buildings. In such cases angles should be taken to several objects, the more the better; but five objects is a good number, as the four angles thus obtained prevent any errors. When only two objects are visible, a sextant angle can be used to advantage with the compass bearings and a better fix obtained than by two bearings alone.

DOUBLING THE ANGLE ON THE BOW.—The method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called "bow and beam bearing," the distance from the object at the latter position being the distance run between the times of taking the two bearings, gives the maximum of accuracy and is an excellent fix for a departure, but does not insure safety, as the object observed and any dangers off it are abeam when the position is obtained. By taking the bearing at two points and four points on the bow a fair position is obtained before the object is passed, the distance of the latter at the second position being, as before, equal to the distance run in the interval, allowing for current. Taking afterwards the beam bearing gives, with slight additional trouble, the distance of the object when abeam. Such beam bearings and distances, with the times, should be continuously recorded as fresh departures,

the importance of which will be appreciated in case of being suddenly shut in by fog. A graphic solution of the problem for any two bearings of the same object is frequently used. The two bearings are drawn on the chart, and the course is then drawn by means of the parallel rulers, so that the distance as measured from the chart between the lines is equal to the distance made good by the vessel between the times of taking the bearings.

DANGER ANGLE.—The utility of the danger angle in passing outlying rocks or dangers should not be forgotten. In employing the horizontal danger angle, however, charts compiled from early Russian and Spanish sources, referred to in a preceding paragraph, should not be used.

SOUNDINGS.—In thick weather, when near or approaching the land or danger, soundings should be taken continuously and at regular intervals and, with the character of the bottom, systematically recorded. By marking the soundings on tracing paper, according to the scale of the chart, along a line representing the track of the ship and then moving the paper over the chart parallel with the course until the observed soundings agree with those of the chart, the ship's position will in general be quite well determined.

SUMNER'S METHOD.—Among astronomical methods of fixing a ship's position the great utility of Sumner's method or one of its many modifications should be well understood, and this method should be in constant use. The Sumner line—that is, the line drawn through the two positions obtained by working the chronometer observation for longitude with two assumed latitudes, or by drawing through the position obtained with one latitude a line at right angles to the bearing of the body as obtained from the azimuth tables—gives at times invaluable information, as the ship must be somewhere on that line, provided the chronometer is correct. If directed toward the coast, it marks the bearing of a definite point; if parallel with the coast, the distance of the latter is shown. Thus, the direction of the line may often be usefully taken as a course. A sounding at the same time with the observation may often give an approximate position on the line. A very accurate position can be obtained by observing two or more stars at morning or evening twilight, at which time the horizon is well defined. The Sumner lines thus obtained will, if the bearings of the stars differ three points or more, give an excellent result. A star or planet at twilight and the sun afterwards or before may be combined; also two observations of the sun with sufficient interval to admit of a considerable change of bearing. In these cases one of the lines must be moved for the run of the ship. The moon is often visible during the day, and in combination with the sun gives an excellent fix.

RADIOCOMPASS positions are especially valuable at night and during fog or thick weather when other observations are not obtainable. For practical navigating purposes radio vibrations may be regarded as traveling in a straight line from the sending station to the receiving station. Instruments for determining the bearing of this line are now available. The necessary observations may be divided into two general classes: First, where the bearing of the ship's radio call is determined by one, two, or more radio stations on shore and the resulting bearing or position is reported to the vessel (see p. 12, Radio Service); secondly, where the bearings of two or more known radio stations are determined on the vessel itself and plotted as cross bearings. Experiments show that these bearings can be determined with a probable error of less than 2°, and the accuracy of the resulting position is largely dependent on the skill and care of the observer. It must be remembered, however, that these lines are parts of great circles, and if plotted as straight lines on a Mercator chart a considerable error may result when the ship and shore station are a long distance apart. The bearings may be corrected for this distortion as explained on page 12.

Radio bearings may be combined with position lines obtained from astronomical observations and used in ways very similar to the well-known Sumner line when avoiding dangerous shoals or when making the coast.

CHANGE OF VARIATION OF THE COMPASS.—The gradual change in the variation must not be forgotten in laying down positions by bearings on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, and in some cases, such as with small scales, or when the lines are long, the displacement of position from neglect of this change may be of importance. The compasses are replotted for every new edition if the error is appreciable. Means for determining the amount of this error are provided by printing the date of constructing the compass and the annual change in variation near its edge.

The change in the magnetic variation in passing along some parts of the coast of the United States is so rapid as to materially affect the course of a vessel unless given constant attention. This is particularly the case in New England and parts of Alaska, where the lines of equal magnetic variation are close together and show rapid changes in magnetic variation from place to place, as indicated by the large differences in variation given on neighboring compass roses.

LOCAL MAGNETIC DISTURBANCE.—The term "local magnetic disturbance" or "local attraction" has reference only to the effects on the compass of magnetic masses external to the ship. Observation shows that such disturbance of the compass in a ship afloat is experienced only in a few places. Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbance, because the effect of a magnetic force diminishes in such rapid proportion as the distance from it increases that it would require a local center of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow and the force strong the compass may be temporarily deflected when passing over such a spot, but the area of disturbance will be small, unless there are many centers near together. The law which has hitherto been found to hold good as regards local magnetic disturbances is, that north of the magnetic equator the north end of the compass needle is attracted toward any center of disturbance; south of the magnetic equator it is repelled. It is very desirable that whenever an area of local magnetic disturbances is noted the position should be fixed and the facts reported as far as they can be ascertained.

USE OF OIL FOR MODIFYING THE EFFECT OF BREAKING WAVES.—Many experiences of late years have shown that the utility of oil for this purpose is undoubted and the application simple. The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil skillfully applied may prevent much damage both to ships (especially of the smaller classes) and to boats by modifying the action of breaking seas. The principal facts as to the use of oil are as follows:

1. On free waves—i. e., waves in deep water—the effect is greatest.
2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain, as nothing can prevent the larger waves from breaking under such circumstances, but even here it is of some service.
3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when nothing else is obtainable; but all animal and vegetable oils, and generally waste oil from the engines, have great effect.
4. A small quantity of oil suffices, if applied in such a manner as to spread to windward.
5. It is useful in a ship or boat, either when running or lying-to or in wearing.
6. No experiences are related of its use when hoisting a boat at sea or in a seaway, but it is highly probable that much time would be saved and injury to the boat avoided by its use on such occasions.
7. In cold water the oil, being thickened by the lower temperature and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.
8. For a ship at sea the best method of application appears to be to hang over the side, in such a manner as to be in the water, small canvas bags, capable of holding from 1 to 2 gallons of oil, the bags being pricked with a sail needle to facilitate leakage of the oil. The oil is also frequently distributed from canvas bags or oakum inserted in the closet bowls. The positions of these bags should vary with the circumstances. Running before the wind, they should be hung on either bow; e. g., from the cathead and allowed to tow in the water. With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter. Lying-to, the weather bow, and another position farther aft seem the best places from which to hang the bags, using sufficient line to permit them to draw to windward while the ship drifts.
9. Crossing a bar with a flood tide, to pour oil overboard and allow it to float in ahead of the boat, which would follow with a bag towing astern.

would appear to be the best plan. As before remarked, under these circumstances the effect can not be so much trusted. On a bar with the ebb tide running it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil can be diffused well ahead of the boat and the bag readily hauled on board for refilling if necessary.

USE OF SOUNDING TUBES

Although of undoubted value as a navigational instrument, the sounding tube is subject to certain defects which, operating singly or in combinations, may give results so misleading as to seriously endanger the vessels, whose safety is entirely dependent upon an accurate knowledge of the depths. Efforts have been made from time to time by the Coast and Geodetic Survey to utilize tubes for surveying operations. A tube recently designed by this bureau, and now undergoing tests by surveying parties, gives promise of results far exceeding in accuracy any other type of tube. There are various types of tubes in common use which are too well known to require detailed description here. They are all based on the general principle that air is elastic and can be compressed, and that if a column of air in a tube be lowered into the water in such a way that the air can not escape, yet at the same time, the pressure of the water can be transmitted to it, the amount by which the air is compressed furnishes a measure of the depth to which it was lowered. Thoretically this principle is sound, but when we come to apply the theory to actual practice certain elements enter which result in errors in the depth determination. It is important to note that the amount of these errors depends on the depth; the greater the depth the greater the numerical value of the error. The causes which produce these errors are as follows:

1. In order to give correct results the bore of the tube must be exactly cylindrical. In other words, the volume of air in any 1 inch of length of the tube must be exactly the same as in an inch in any other part. But because of the way in which glass tubes are made it is very difficult to accomplish this. The bore may taper slightly or vary in other ways from a true cylinder. If tapering, the minimum diameter of bore may be at the top, middle, or bottom of the tube as submerged. If the minimum diameter be at the top, the tube will register depths less than the actual depths of water, and if at the bottom the registered depth will be greater than the true depth. This defect may be detected in a suspected tube by introducing a small quantity of mercury into the tube and comparing its length at different points along the bore. For satisfactory results the length of this column should not vary more than 5 per cent.

2. In order that even a perfect tube should give accurate results, the conditions of barometric pressure and air and water temperatures under which the sounding is being taken must be the same as those under which the scale for reading the depths was made. In making the scale a barometric pressure of 29 inches is usually assumed as normal. Then, if in actual use, the barometer registers above normal, the air in the tube is already partly compressed, and when lowered to any given depth the amount of compression due to water pressure is correspondingly diminished. With a barometer below normal the reverse is true, and it therefore follows that when the barometer reads above normal the tubes will register less than the true depths, whereas if the barometer reads below normal the registered depths will be greater than the true. The amount of error introduced from this cause is about 3 per cent of the depth for each inch of barometric pressure above or below normal.

The density of the air in the tube also depends directly upon its temperature. Therefore the difference between the temperature of the air in the tube before and after submergence will affect the accuracy of the sounding. Where the temperature of the tube in the air is greater than that of the tube in the water, the depth recorded will be greater than the actual depth, and, conversely, when the temperature of the air is lower than that of the water the

depth recorded will be less than the true depth. Also, the temperature of the water may vary at different depths, so that the actual amount of this error depends on the difference between the temperatures of the tube in the air and at the bottom. The amount of error introduced from this cause is about 1 per cent of the depth for each 3° F. difference in temperature.

3. While the tubes are usually 24 inches long and the scales are designed for that length of tube, the manner of closing the upper end of the tube may introduce an error. The thickness of the caps used for this purpose varies considerably in different makes of tubes, even when such caps are made of the same material. This variation in thickness results in moving the tube slightly up or down in the scale. Thus, with a thin cap the sounding read from the scale will be too deep; with a thick cap, the sounding read will be less than the true depth.

Copper caps put on with sealing wax have been found to vary sufficiently to produce errors of about 5 per cent of the depth in depths of 50 to 70 fathoms. Rubber caps seem to be more nearly uniform and to give better results when new. Rubber, however, deteriorates, and when used too long there is apt to be leakage of air. When removable caps are used, care should be taken to see that they are pushed home thoroughly before sounding.

4. The integrity of the air in the tube should be carefully preserved. Even a slight leakage of air will result in showing a sounding considerably in excess of the true depth. Vessels sometimes approach dangers coming from depths of over 100 fathoms. As they approach they begin feeling for the bottom, sounding at infrequent intervals to pick up depths of 75 to 100 fathoms. So long as they get no bottom in such depths navigators feel secure. But a leaky tube may show no bottom at 100 fathoms when the ship is actually in much less depths, possibly resulting in disaster before the error is discovered. Special precautions should, therefore, be taken on this point. Copper caps should be sealed in place with sealing wax, and rubber caps should be supplied with wire clamps, giving a tight fit.

5. Accumulated salt on the inner surface of the tube will cause the water-mark to creep up and register greater than true depths. The type of tube exemplified by the well-known Bassnett sounder is based on the same principle as the ordinary glass tube, but is more complicated in design. It consists, essentially, of a metal case containing a glass tube closed at the upper end. Inside the glass tube is a metal tube, through which the water enters and is trapped by a valve at the top of the metal tube. In this device the scale is graduated directly on the glass tube, thus eliminating those errors due to thickness of cap; but, on the other hand, the possibility of errors increases directly with the number of working parts of which the sounder is made. In using sounders of this type care should be exercised to preserve perfectly gasketed joints between the bottom of the glass tube and the metal case and to keep the outlet valve well oiled and water-tight.

Leaking valves and water remaining in the tube before a sounding is taken will give increased depths, while deficient depths may be recorded as a result of loss of water through suction at the inlet as the tube is being reeled in. The Bassnett type, in common with all other forms of pressure tube, is subject to the above-described errors due to variations in temperature and barometric pressure.

It will be noted that wherever the amount of the various errors can be stated they are all small. Their importance lies in the fact that two or more of them acting together, may result in considerable errors. As already stated, actual experiments show that errors of 10 to 12 per cent are not uncommon and that considerably greater errors may occur. There are certain precautions which can be taken to eliminate or reduce these errors:

1. In purchasing tubes a type should be selected which can be used until broken or lost. The navigator can then make a study of the results obtained from each individual tube and thus gain a fair idea of its accuracy under known conditions. This necessitates some permanent means of identifying the various tubes used, which may readily be accomplished in the case of the glass tubes by means of various colored paints or threads.

2. Before undertaking the sounding necessary to make any particular landfall the vessel should be stopped for an up-and-down cast of the lead in order to test the accuracy under the prevailing conditions of the tubes which are to be used. For this purpose it is not necessary to get bottom; simply run out 60 to 80 fathoms of wire and then see how closely the tubes register that amount. A number of tubes can be sent down at one time, and it is then pos-

sible to select one or two which register most nearly correct. It is well to keep a permanent record of the results of each tube tested. By so doing the navigator will soon obtain valuable information as to the performance of the various tubes and the degree to which they may be trusted. Such a record should, of course, take into account the various conditions affecting the result. It will be noted that the factors which produce errors may be divided roughly into three groups:

(*a*) Inherent: Those which occur as a result of permanent defects in the tube, such as the variation of the bore from a true cylinder, variation in the thickness of the cap, etc.

(*b*) External: Those which occur as a result of the conditions under which the sounding was taken, variations of temperature or barometric pressure from the normal, etc.

(*c*) Accidental: Those which affect a single sounding, due to the failure of the tube to register properly, leakage of air, loss of water from leaky valves, errors due to the presence of salt in the tube, etc.

These accidental errors are probably the most serious of the three types, both because they are apt to be larger in amount and because it is impossible to foresee when they will occur. But, on the other hand, they occur only as a result of a few known causes, already enumerated, and therefore by the exercise of proper caution in the use of the tubes that they may be to a large extent eliminated. If the ordinary glass tube is used, see that the bore is thoroughly dry and free from salt and that the cap makes a tight fit. If using a sounder, see that the tube is free from water and that the valves are tight and well oiled. And, above all, during the course of the sounding take an occasional up-and-down cast as a check, for by that means alone can one be sure that the proper results are being obtained.

The smallest possible number of tubes should be used. It is obviously much better to use over and over again one tube which is giving good results than to use a number whose errors are uncertain. This is particularly desirable where sounders involving valves are used. If a tube shows no bottom at 100 fathoms, examine the arming to make sure that the lead actually failed to find bottom.

Finally, beware of overconfidence. Tubes which have been working properly for a number of soundings suddenly develop errors. It is chiefly for this reason that they have been discarded for surveying operations. Assuming that the accidental errors can be reasonably controlled, the inherent and external errors present no serious difficulty.

As already indicated, the bore of a tube (or at least of any tube which is capable of constant use) can be tested with mercury, and those tubes rejected which show variations in bore greater than about 5 per cent. Errors due to variations in the thickness of caps can be eliminated by using a scale graduated for a true length of 24 inches (the length of the glass tube) and removing the cap before the sounding is read. Errors due to differences between air and water temperatures can be reduced to a minimum which can usually be neglected by immersing the tube before using in a bucket of sea water newly drawn, so that its temperature has not had time to change. Care should, of course, be taken to see that no water enters the tube. When this is done there may still remain an error due to the difference in temperature of the water at the surface and at the bottom. This may, if desired, be corrected by sending down a self-registering thermometer with the lead, but for the ordinary purposes of navigation this is a refinement which may be ignored. There is no ready method available for correcting the error due to variations in the barometric pressure. The correction should be applied to the sounding recorded.

BOUNDARY LINES OF THE HIGH SEAS

The following lines divide the high seas from rivers, harbors, and inland waters described in this volume. Waters inshore of the lines here laid down are "inland waters," and upon them the pilot rules for western rivers (where noted) or the inland rules and pilot rules given on page 217 apply. Upon the high seas, viz, waters outside of the lines here laid down, the international rules given on page 210 apply.

FLORIDA REEFS AND KEYS.—A line drawn from the easterly end of the northerly jetty at the entrance to the dredged channel one-half mile northerly of Norris Cut, 94° (E. ¼ S.), 1⅝ miles, to Florida Reefs North End Whistling Buoy,

W (HS); thence 178° (S. ¼ E.), 8 miles, to Biscayne Bay Sea Bell Buoy, 1; thence 182° (S. ⅛ W.), 2⅜ miles, to Fowey Rocks Lighthouse; thence 188° (S. ⅝ W.), 6¾ miles, to Triumph Reef Beacon, O; thence 193° (S. by W.), 4½ miles, to Ajax Reef Beacon, M; thence 194° (S. by W. ⅛ W.), 2 miles, to Pacific Reef Beacon, L; thence 196½° (S. by W. ⅜ W.), 5 miles, to Turtle Harbor Sea Buoy, 2; thence 210° (SSW. ½ W.), 4⅞ miles, to Carysfort Reef Lighthouse; thence 209½° (SSW. ½ W.), 5¾ miles, to Elbow Reef Beacon, J; thence 217½° (SW. ¾ S.), 9¾ miles, to Molasses Reef Gas Buoy, 2 M; thence 235½° (SW. ¾ W.), 6 miles to Conch Reef Beacon, E; thence 234½° (SW. ¾ W.), through Crocker Reef Beacon, D, 10⅜ miles, to Alligator Reef Lighthouse; thence 234° (SW. ⅝ W.), 10⅞ miles, to Tennessee Reef Buoy, 4; thence 251° (WSW. ⅛ W.), 10½ miles, to Coffins Patches Beacon, C; thence 247° (SW. by W. ¾ W.), 8¾ miles, to Sombrero Key Lighthouse; thence 253½° (WSW. ⅜ W.), 16¾ miles, to Looe Key Beacon, 6; thence 257½° (WSW. ¾ W.), 6⅜ miles, to American Shoal Lighthouse; thence 253½° (WSW. ⅜ W.), 2⅞ miles, to Maryland Shoal Beacon, S; thence 259° (WSW. ⅞ W.), 5¼ miles, to Eastern Sambo Beacon, A; thence 253° (WSW. ¼ W.), 2¼ miles, to Western Sambo Beacon, R; thence 257° (WSW. ⅝ W.), through Western Sambo Buoy, 2, 5½ miles, to Key West Entrance Gas Buoy (PS); thence 262° (W. ⅞ S.), 4¼ miles, to Sand Key Lighthouse; thence 261° (W. by S.), 2¾ miles, to Western Dry Rocks Beacon, 2; thence 268° (W. ⅜ S.), 3½ miles, through Satan Shoal Buoy (HS) to Vestal Shoal Buoy, 1; thence 274½° (W. ⅛ N.), 5¼ miles, to Coal Bin Rock Buoy, CB (HS); thence 324½° (NW. ⅝ N.), 7¼ miles, to Marquesas Keys left tangent; from northwesterly point Marquesas Keys 59° (NE. by E.), 4⅜ miles, to Bar Buoy, 1, Boca Grande Channel; thence 83° (E. ⅞ N.), 9¾ miles, to Northwest Channel Entrance Bell Buoy, 1, Northwest Channel into Key West; thence 68° (NE. by E. ⅞ E.), 23½ miles, to northerly side of Content Keys; thence 49° (NE. ¼ E.), 29 miles, to East Cape, Cape Sable.

Charlotte Harbor and Punta Gorda, Fla.—Eastward of Charlotte Harbor Entrance Gas and Bell Buoy (PS), off Boca Grande, and in Charlotte Harbor, in Pine Island Sound and Matlacha Pass. Pilot Rules for Western Rivers apply in Peace and Miakka Rivers north of a 250° and 70° (WSW. and ENE.) line through Mangrove Point Light; and in Caloosahatchee River northward of the steamboat wharf at Punta Rasa.

Tampa Bay and Tributaries, Fla.—From the southerly end of Long Key 245° (SW. by W. ⅝ W.) 9 miles, to Tampa Bay Gas and Whistling Buoy (PS); thence 129° (SE. ¾ E.), 6½ miles, to Bar Bell Buoy (PS), at the entrance to Southwest Channel; thence 103° (E. by S.), 2¾ miles, to the house on the north end of Anna Maria Key. Pilot Rules for Western Rivers apply in Manatee River inside Manatee River Entrance Buoy, 2; in Hillsboro Bay and River inside Hillsboro Bay Light, 2.

St. George Sound, Apalachicola Bay, Carrabelle and Apalachicola Rivers, and St. Vincent Sound, Fla.—North of a line from Lighthouse Point 246° (SW. by W. ⅝ W.), 13¼ miles, to southeasterly side of Dog Island; to northward of East Pass Bell Buoy, 1, at the entrance to East Pass, and inside West Pass Bell Buoy (PS) at the seaward entrance to West Pass. Pilot Rules for Western Rivers apply in Carrabelle River inside the entrance to the dredged channel; in Apalachicola River northward of Apalachicola Dredged Channel Entrance Buoy, 2.

Pensacola Harbor.—From Caucus Cut Entrance Gas and Whistling Buoy, 1A, 3° (N. ⅛ W.), tangent to easterly side of Fort Pickens, to the shore of Santa Rosa Island, and from the buoy northward in the buoyed channel through Caucus Shoal.

Mobile Harbor and Bay.—From Mobile Entrance Gas and Whistling Buoy (PS) 40° (NE. ⅞ N.) to shore of Mobile Point, and from the buoy 320° (NW.) to the shore of Dauphin Island. Pilot Rules for Western Rivers apply in Mobile River above Choctaw Point.

Sounds, Lakes, and Harbors on the Coasts of Alabama, Mississippi, and Louisiana, Between Mobile Bay Entrance and the Delta of the Mississippi River.—From Sand Island Lighthouse 259° (WSW. ⅝ W.), 43½ miles to Chandeleur Lighthouse; westward of Chandeleur and Errol Islands, and west of a line drawn from the southwesterly point of Errol Island 182° (S. ¼ E.), 23 miles, to Pass a Loutre Lighthouse. Pilot Rules for Western Rivers apply in Pascagoula River, and in the dredged cut at the entrance to the river, above Pascagoula River Entrance Light, A, marking the entrance to the dredged cut.

NEW ORLEANS HARBOR AND THE DELTA OF THE MISSISSIPPI RIVER.—Inshore of a line drawn from the outermost mud lump showing above low water at the entrance to Pass a Loutre to a similar lump off the entrance to Northeast Pass; thence to a similar lump off the entrance to Southeast Pass; thence to the outermost aid to navigation off the entrance to South Pass; thence to the outermost aid to navigation off the entrance to Southwest Pass; thence northerly, about 19½ miles, to the westerly point of the entrance to Bay Jaque.

SABINE PASS, TEX.—Pilot Rules for Western Rivers apply to Sabine Pass northward of Sabine Pass Gas and Whistling Buoy (PS), and in Sabine Lake and its tributaries. Outside of this buoy the International Rules apply.

GALVESTON HARBOR.—A line drawn from Galveston North Jetty Light 129° (SE. by E. ¼ E.), 2 miles, to Galveston Bar Gas and Whistling Buoy (PS); thence 276° (W. ⅛ S.), 2¼ miles, to Galveston (S.) Jetty Lighthouse.

BRAZOS RIVER, TEX.—Pilot Rules for Western Rivers apply in the entrance and river inside of Brazos River Entrance Gas and Whistling Buoy (PS). International Rules apply outside the buoy.

GENERAL RULE.—At all buoyed entrances from seaward to bays, sounds, rivers, or other estuaries for which specific lines have not been described, Inland Rules shall apply inshore of a line approximately parallel with the general trend of the shore, drawn through the outermost buoy or other aid to navigation of any system of aids.

RULES OF THE ROAD—INTERNATIONAL RULES TO PREVENT COLLISIONS OF VESSEL

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following regulations for preventing collisions at sea shall be followed by all public and private vessels of the United States upon the high seas in all waters connected therewith navigable by seagoing vessels.

ART. 30. Nothing in these rules shall interfere with the operation of a special rule, duly made by local authority, relative to the navigation of any harbor, river, or inland waters.

PRELIMINARY

In the following rules every steam vessel which is under sail and not under steam is to be considered a sailing vessel, and every vessel under steam, whether under sail or not, is to be considered a steam vessel.

The words "steam vessel" shall include any vessel propelled by machinery.

A vessel is "under way," within the meaning of these rules, when she is not at anchor, or made fast to the shore, or aground.

RULES CONCERNING LIGHTS AND SO FORTH

The word "visible" in these rules when applied to lights shall mean visible on a dark night with a clear atmosphere.

ARTICLE 1. The rules concerning lights shall be complied with in all weathers from sunset to sunrise, and during such time no other lights which may be mistaken for the prescribed lights shall be exhibited.

ART. 2. A steam vessel when under way shall carry—(a) On or in front of the foremast, or if a vessel without a foremast, then in the fore part of the vessel, at a height above the hull of not less than twenty feet, and if the breadth of the vessel exceeds twenty feet, then at a height above the hull not less than such breadth, so, however, that the light need not be carried at a greater height above the hull than forty feet, a bright white light, so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side, and of such a character as to be visible at a distance of at least five miles.

(b) On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least two miles.

(c) On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw

the light from right ahead to two points abaft the beam on the port side, and of such a character as to be visible at a distance of at least two miles.

(d) The said green and red side lights shall be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent these lights from being seen across the bow.

(e) A steam vessel when under way may carry an additional white light similar in construction to the light mentioned in subdivision (a). These two lights shall be so placed in line with the keel that one shall be at least fifteen feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance.

ART. 3. A steam vessel when towing another vessel shall, in addition to her side lights, carry two bright white lights in a vertical line one over the other, not less than six feet apart, and when towing more than one vessel shall carry an additional bright white light six feet above or below such lights, if the length of the tow measuring from the stern of the towing vessel to the stern of the last vessel towed exceeds six hundred feet. Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white light mentioned in article two (a), excepting the additional light, which may be carried at a height of not less than fourteen feet above the hull.

Such steam vessel may carry a small white light abaft the funnel or aftermast for the vessel towed to steer by, but such light shall not be visible forward of the beam.

ART. 4. (a) A vessel which from any accident is not under command shall carry at the same height as a white light mentioned in article two (a), where they can best be seen, and if a steam vessel in lieu of that light two red lights, in a vertical line one over the other, not less than six feet apart, and of such a character as to be visible all around the horizon at a distance of at least two miles; and shall by day carry in a vertical line one over the other, not less than six feet apart, where they can best be seen, two black balls or shapes, each two feet in diameter.

(b) A vessel employed in laying or in picking up a telegraph cable shall carry in the same position as the white light mentioned in article two (a), and if a steam vessel in lieu of that light three lights in a vertical line one over the other not less than six feet apart. The highest and lowest of these lights shall be red, and the middle light shall be white, and they shall be of such a character as to be visible all around the horizon at a distance of at least two miles. By day she shall carry in a vertical line, one over the other, not less than six feet apart, where they can best be seen, three shapes not less than two feet in diameter, of which the highest and lowest shall be globular in shape and red in color, and the middle one diamond in shape and white.

(c) The vessels referred to in this article, when not making way through the water shall not carry the side lights, but when making way shall carry them.

(d) The lights and shapes required to be shown by this article are to be taken by other vessels as signals that the vessel showing them is not under command and can not therefore get out of the way.

These signals are not signals of vessels in distress and requiring assistance. Such signals are contained in article thirty-one.

ART. 5. A sailing vessel under way and any vessel being towed shall carry the same lights as are prescribed by article two for a steam vessel under way with the exception of the white lights mentioned therein, which they shall never carry.

ART. 6. Whenever, as in the case of small vessels under way during bad weather, the green and red side lights can not be fixed, these lights shall be kept at hand, lighted and ready for use; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such manner as to make them most visible, and so that the green light shall not be seen on the port side nor the red light on the starboard side, nor, if practicable, more than two points abaft the beam on their respective sides. To make the use of these portable lights more certain and easy the lanterns containing them shall each be painted outside with the color of the light they respectively contain, and shall be provided with proper screens.

ART. 7. Steam vessels of less than forty, and vessels under oars or sails of less than twenty tons gross tonnage, respectively, and rowing boats, when under way, shall not be required to carry the lights mentioned in article two (a), (b),

and (c), but if they do not carry them they shall be provided with the following lights:

First. Steam vessels of less than forty tons shall carry—

(a) In the fore part of the vessel, or on or in front of the funnel, where it can best be seen, and at a height above the gunwale of not less than nine feet, a bright white light constructed and fixed as prescribed in article two (a), and of such a character as to be visible at a distance of at least two miles.

(b) Green and red side lights constructed and fixed as prescribed in article two (b) and (c), and of such a character as to be visible at a distance of at least one mile, or a combined lantern showing a green light and a red light from right ahead to two points abaft the beam on their respective sides. Such lanterns shall be carried not less than three feet below the white light.

Second. Small steamboats, such as are carried by seagoing vessels, may carry the white light at a less height than nine feet above the gunwale, but it shall be carried above the combined lantern mentioned in subdivision one (b).

Third. Vessels under oars or sails of less than twenty tons shall have ready at hand a lantern with a green glass on one side and a red glass on the other, which, on the approach of or to other vessels, shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side.

Fourth. Rowing boats, whether under oars or sail, shall have ready at hand a lantern showing a white light which shall be temporarily exhibited in sufficient time to prevent collision.

The vessels referred to in this article shall not be obliged to carry the lights prescribed by article four (a) and article eleven, last paragraph.

ART. 8. Pilot vessels when engaged on their station on pilotage duty shall not show the lights required for other vessels, but shall carry a white light at the masthead, visible all around the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed fifteen minutes.

On the near approach of or to other vessels they shall have their side lights lighted ready for use, and shall flash or show them at short intervals, to indicate the direction in which they are heading, but the green light shall not be shown on the port side nor the red light on the starboard side.

A pilot vessel of such a class as to be obliged to go alongside of a vessel to put a pilot on board may show the white light instead of carrying it at the masthead, and may, instead of the colored lights above mentioned, have at hand, ready for use, a lantern with green glass on the one side and red glass on the other, to be used as prescribed above.

Pilot vessels when not engaged on their station on pilotage duty shall carry lights similar to those of other vessels of their tonnage.

A steam pilot vessel, when engaged on her station on pilotage duty and in waters of the United States, and not at anchor, shall, in addition to the lights required for all pilot boats, carry at a distance of eight feet below her white masthead light a red light, visible all around the horizon and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least two miles, and also the colored side lights required to be carried by vessels when under way.

When engaged on her station on pilotage duty and in waters of the United States, and at anchor, she shall carry in addition to the lights required for all pilot boats the red light above mentioned, but not the colored side lights. When not engaged on her station on pilotage duty, she shall carry the same lights as other steam vessels.

ART. 9. Fishing vessels and fishing boats, when under way and when not required by this article to carry or show the lights hereinafter specified, shall carry or show the lights prescribed for vessels of their tonnage under way.

(a) Open boats, by which is to be understood boats not protected from the entry of sea water by means of a continuous deck, when engaged in any fishing at night, with outlying tackle extending not more than one hundred and fifty feet horizontally from the boat into the seaway, shall carry one all-round white light.

Open boats, when fishing at night, with outlying tackle extending more than one hundred and fifty feet horizontally from the boat into the seaway, shall carry one all-round white light, and in addition, on approaching or being approached by other vessels, shall show a second white light at least three feet below the first light and at horizontal distance of at least five feet away from it in the direction in which the outlying tackle is attached.

(b) Vessels and boats, except open boats as defined in subdivision (a), when fishing with drift nets, shall, so long as the nets are wholly or partly in the water, carry two white lights where they can best be seen. Such lights shall be placed so that the vertical distance between them shall be not less than six feet and not more than fifteen feet, and so that the horizontal distance between them, measured in a line with the keel, shall be not less than five feet and not more than ten feet. The lower of these two lights shall be in the direction of the nets, and both of them shall be of such a character as to show all around the horizon, and to be visible at a distance of not less than three miles.

Within the Mediterranean Sea and in the seas bordering the coasts of Japan and Korea sailing fishing vessels of less than twenty tons gross tonnage shall not be obliged to carry the lower of these two lights. Should they, however, not carry it, they shall show in the same position (in the direction of the net or gear) a white light, visible at a distance of not less than one sea mile, on the approach of or to other vessels.

(c) Vessels and boats, except open boats as defined in subdivision (a), when line fishing with their lines out and attached to or hauling their lines, and when not at anchor or stationary within the meaning of subdivision (h), shall carry the same lights as vessels fishing with drift nets. When shooting lines, or fishing with towing lines, they shall carry the lights prescribed for a steam or sailing vessel under way, respectively.

Within the Mediterranean Sea and in the seas bordering the coasts of Japan and Korea sailing fishing vessels of less than twenty tons gross tonnage shall not be obliged to carry the lower of these two lights. Should they, however, not carry it, they shall show in the same position (in the direction of the lines) a white light visible at a distance of not less than one sea mile on the approach of or to other vessels.

(d) Vessels when engaged in trawling, by which is meant the dragging of an apparatus along the bottom of the sea—

First. If steam vessels, shall carry in the same position as the white light mentioned in article two (a) a tricolored lantern so constructed and fixed as to show a white light from right ahead to two points on each bow, and a green light and a red light over an arc of the horizon from two points on each bow to two points abaft the beam on the starboard and port sides, respectively; and not less than six nor more than twelve feet below the tricolored lantern a white light in a lantern, so constructed as to show a clear, uniform, and unbroken light all around the horizon.

Second. If sailing vessels, shall carry a white light in a lantern, so constructed as to show a clear, uniform, and unbroken light all around the horizon, and shall also, on the approach of or to other vessels, show where it can best be seen a white flare-up light or torch in sufficient time to prevent collision.

All lights mentioned in subdivision (d) first and second shall be visible at a distance of at least two miles.

(e) Oyster dredgers and other vessels fishing with dredge nets shall carry and show the same lights as trawlers.

(f) Fishing vessels and fishing boats may at any time use a flare-up light in addition to the lights which they are by this article required to carry and show, and they may also use working lights.

(g) Every fishing vessel and every fishing boat under one hundred and fifty feet in length, when at anchor, shall exhibit a white light visible all around the horizon at a distance of at least 1 mile.

Every fishing vessel of 150 feet in length or upward, when at anchor, shall exhibit a white light visible all around the horizon at a distance of at least 1 mile, and shall exhibit a second light as provided for vessels of such length by article 11.

Should any such vessel, whether under 150 feet in length or of 150 feet in length or upward, be attached to a net or other fishing gear, she shall on the approach of other vessels show an additional white light at least three feet below the anchor light, and at a horizontal distance of at least five feet away from it in the direction of the net or gear.

(h) If a vessel or boat when fishing becomes stationary in consequence of her gear getting fast to a rock or other obstruction, she shall in daytime haul down the day signal required by subdivision (k); at night show the light or lights prescribed for a vessel at anchor; and during fog, mist, falling snow, or heavy rain storms make the signal prescribed for a vessel at anchor. (See subdivision (d) and the last paragraph of article 15.)

(i) In fog, mist, falling snow, or heavy rain storms drift-net vessels attached to their nets, and vessels when trawling, dredging, or fishing with any kind of drag net, and vessels line fishing with their lines out, shall, if of twenty tons gross tonnage or upward, respectively, at intervals of not more than one minute make a blast; if steam vessels, with the whistle or siren, and if sailing vessels, with the foghorn, each blast to be followed by ringing the bell. Fishing vessels and boats of less than twenty tons gross tonnage shall not be obliged to give the above-mentioned signals; but if they do not, they shall make some other efficient sound signal at intervals of not more than one minute.

(k) All vessels or boats fishing with nets or lines or trawls, when under way, shall in daytime indicate their occupation to an approaching vessel by displaying a basket or other efficient signal where it can best be seen. If vessels or boats at anchor have their gear out, they shall, on the approach of other vessels, show the same signal on the side on which those vessels can pass.

The vessels required by this article to carry or show the lights hereinbefore specified shall not be obliged to carry the lights prescribed by article four (a) and the last paragraph of article eleven.

ART. 10. A vessel which is being overtaken by another shall show from her stern to such last-mentioned vessel a white light or a flare-up light.

The white light required to be shown by this article may be fixed and carried in a lantern, but in such case the lantern shall be so constructed, fitted, and screened that it shall throw an unbroken light over an arc of the horizon of twelve points of the compass, namely, for six points from right aft on each side of the vessel, so as to be visible at a distance of at least one mile. Such light shall be carried as nearly as practicable on the same level as the side lights.

ART. 11. A vessel under one hundred and fifty feet in length when at anchor shall carry forward, where it can best be seen, but at a height not exceeding twenty feet above the hull, a white light, in a lantern so constructed as to show a clear, uniform, and unbroken light visible all around the horizon at a distance of at least one mile.

A vessel of one hundred and fifty feet or upwards in length when at anchor shall carry in the forward part of the vessel, at a height of not less than twenty and not exceeding forty feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall not be less than fifteen feet lower than the forward light, another such light.

The length of a vessel shall be deemed to be the length appearing in her certificate of registry.

A vessel aground in or near a fairway shall carry the above light or lights and the two red lights prescribed by article four (a).

ART. 12. Every vessel may, if necessary in order to attract attention in addition to the lights which she is by these rules required to carry, show a flare-up light or use any detonating signal that can not be mistaken for a distress signal.

ART. 13. Nothing in these rules shall interfere with the operation of any special rules made by the Government of any nation with respect to additional station and signal lights for two or more ships of war or for vessels sailing under convoy, or with the exhibition of recognition signals adopted by shipowners, which have been authorized by their respective Governments and duly registered and published.

ART. 14. A steam vessel proceeding under sail only, but having her funnel up, shall carry in daytime, forward, where it can best be seen, one black ball or shape two feet in diameter.

SOUND SIGNALS FOR FOG, AND SO FORTH.

ART. 15. All signals prescribed by this article for vessels under way shall be given.

First. By "steam vessels" on the whistle or siren.

Second. By "sailing vessels" and "vessels towed" on the foghorn.

The words "prolonged blast" used in this article shall mean a blast of from four to six seconds' duration.

A steam vessel shall be provided with an efficient whistle or siren sounded by steam or by some substitute for steam, so placed that the sound may not be intercepted by any obstruction, and with an efficient foghorn, to be sounded by mechanical means, and also with an efficient bell. In all cases when the rules require a bell to be used a drum may be substituted on board Turkish vessels, or a gong where such articles are used on board small seagoing vessels. A

sailing vessel of twenty tons gross tonnage or upward shall be provided with a similar foghorn and bell.

In a fog, mist, falling snow, or heavy rainstorms, whether by day or night, the signals described in this article shall be used as follows, namely:

(*a*) A steam vessel having way upon her shall sound, at intervals of not more than two minutes, a prolonged blast.

(*b*) A steam vessel under way, but stopped, and having no way upon her, shall sound, at intervals of not more than two minutes, two prolonged blasts, with an interval of about one second between.

(*c*) A sailing vessel under way shall sound at intervals of not more than one minute, when on the starboard tack, one blast; when on the port tack, two blasts in succession; and when with the wind abaft the beam, three blasts in succession.

(*d*) A vessel when at anchor shall, at intervals of not more than one minute, ring the bell rapidly for about five seconds.

(*e*) A vessel when towing, a vessel employed in laying or in picking up a telegraph cable, and a vessel under way, which is unable to get out of the way of an approaching vessel through being not under command, or unable to maneuver as required by the rules, shall, instead of the signals prescribed in subdivisions (*a*) and (*c*) of this article, at intervals of not more than two minutes, sound three blasts in succession, namely: One prolonged blast followed by two short blasts. A vessel towed may give this signal and she shall not give any other.

Sailing vessels and boats of less than twenty tons gross tonnage shall not be obliged to give the above-mentioned signals, but if they do not, they shall make some other efficient sound signal at intervals of not more than one minute.

Speed of Ships to be Moderate in Fog, and so Forth

Art. 16. Every vessel shall, in a fog, mist, falling snow, or heavy rain storms, go at a moderate speed, having careful regard to the existing circumstances and conditions.

A steam vessel hearing, apparently forward of her beam, the fog signal of a vessel the position of which is not ascertained shall, so far as the circumstances of the case admit, stop her engines, and then navigate with caution until danger of collision is over.

Steering and Sailing Rules

PRELIMINARY—RISK OF COLLISION

Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing of an approaching vessel. If the bearing does not appreciably change, such risk should be deemed to exist.

Art. 17. When two sailing vessels are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other, as follows, namely:

(a) A vessel which is running free shall keep out of the way of a vessel which is closehauled.

(b) A vessel which is closehauled on the port tack shall keep out of the way of a vessel which is closehauled on the starboard tack.

(c) When both are running free, with the wind on different sides, the vessel which has the wind on the port side shall keep out of the way of the other.

(d) When both are running free, with the wind on the same side, the vessel which is to the windward shall keep out of the way of the vessel which is to the leeward.

(e) A vessel which has the wind aft shall keep out of the way of the other vessel.

Art. 18. When two steam vessels are meeting end on, or nearly end on, so as to involve risk of collision, each shall alter her course to starboard, so that each may pass on the port side of the other.

This article also applies to cases where vessels are meeting end on, or nearly end on, in such a manner as to involve risk of collision, and does not apply to two vessels which must, if both keep on their respective courses, pass clear of each other.

The only cases to which it does apply are when each of the two vessels is end on, or nearly end on, to the other; in other words, to cases in which, by day, each vessel sees the masts of the other in a line, or nearly in a line, with her own; and by night, to cases in which each vessel is in such a position as to see both the side lights of the other.

It does not apply by day to cases in which a vessel sees another ahead crossing her own course; or by night, to cases where the red light of one vessel is opposed to the red light of the other, or where the green light of one vessel is opposed to the green light of the other, or where a red light without a green light, or a green light without a red light, is seen ahead, or where both green and red lights are seen anywhere but ahead.

ART. 19. When two steam vessels are crossing, so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way of the other.

ART. 20. When a steam vessel and a sailing vessel are proceeding in such directions as to involve risk of collision, the steam vessel shall keep out of the way of the sailing vessel.

ART. 21. Where, by any of these rules, one of two vessels is to keep out of the way, the other shall keep her course and speed.

Note—When, in consequence of thick weather or other causes, such vessel finds herself so close that collision can not be avoided by the action of the giving-way vessel alone, she also shall take such action as will best aid to avert collision. [See articles twenty-seven and twenty-nine.]

ART. 22. Every vessel which is directed by these rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.

ART. 23. Every steam vessel which is directed by these rules to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed or stop or reverse.

ART. 24. Notwithstanding anything contained in these rules every vessel, overtaking any other, shall keep out of the way of the overtaken vessel.

Every vessel coming up with another vessel from any direction more than two points abaft her beam—that is, in such a position, with reference to the vessel which she is overtaking that at night she would be unable to see either of that vessel's side lights—shall be deemed to be an overtaking vessel; and no subsequent alteration of the bearing between the two vessels shall make the overtaking vessel a crossing vessel within the meaning of these rules, or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

As by day the overtaking vessel can not always know with certainty whether she is forward of or abaft this direction from the other vessel she should, if in doubt, assume that she is an overtaking vessel and keep out of the way.

ART. 25. In narrow channels every steam vessel shall, when it is safe and practicable, keep to that side of the fairway or mid-channel which lies on the starboard side of such vessel.

ART. 26. Sailing vessels under way shall keep out of the way of sailing vessels or boats fishing with nets, or lines, or trawls. This rule shall not give to any vessel or boat engaged in fishing the right of obstructing a fairway used by vessels other than fishing vessels or boats.

ART. 27. In obeying and constructing these rules due regard shall be had to all dangers of navigation and collision, and to any special circumstances which may render a departure from the above rules necessary in order to avoid immediate danger.

SOUND SIGNALS FOR VESSELS IN SIGHT OF ONE ANOTHER

ART. 28. The words "short blast" used in this article shall mean a blast of about one second's duration.

When vessels are in sight of one another, a steam vessel under way, in taking any course authorized or required by these rules, shall indicate that course by the following signals on her whistle or siren, namely:

One short blast to mean, "I am directing my course to starboard."

Two short blasts to mean, "I am directing my course to port."

Three short blasts to mean, "My engines are going at full speed astern."

NO VESSEL, UNDER ANY CIRCUMSTANCES, TO NEGLECT PROPER PRECAUTIONS

ART. 29. Nothing in these rules shall exonerate any vessel, or the owner or master or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper lookout, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

RESERVATION OF RULES FOR HARBORS AND INLAND NAVIGATION

ART. 30. Nothing in these rules shall interfere with the operation of a special rule, duly made by local authority, relative to the navigation of any harbor, river, or inland waters.

DISTRESS SIGNALS

ART. 31. When a vessel is in distress and requires assistance from other vessels or from the shore the following shall be the signals to be used or displayed by her, either together or separately, namely:

In the daytime: First. A gun or other explosive signal fired at intervals of about a minute.

Second. The international code signal of distress indicated by N C.

Third. The distance signal, consisting of a square flag, having either above or below it a ball or anything resembling a ball.

Fourth. A continuous sounding with any fog-signal apparatus.

At night: First. A gun or other explosive signal fired at intervals of about a minute.

Second. Flames on the vessel (as from a burning tar barrel, oil barrel, and so forth).

Third. Rockets or shells throwing stars of any color or description, fired one at a time, at short intervals.

Fourth. A continuous sounding with any fog-signal apparatus.

RULES OF THE ROAD—INLAND RULES TO PREVENT COLLISION OF VESSELS

AN ACT To adopt regulations for preventing collisions upon certain harbors, rivers, and inland waters of the United States

Whereas the provisions of chapter eight hundred and two of the laws of eighteen hundred and ninety, and the amendments thereto, adopting regulations for preventing collisions at sea, apply to all waters of the United States connected with the high seas navigable by seagoing vessels, except so far as the navigation of any harbor, river, or inland waters is regulated by special rules duly made by local authority; and

Whereas it is desirable that the regulations relating to the navigation of all harbors, rivers, and inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, shall be stated in one act: Therefore

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following regulations for preventing collision shall be followed by all vessels navigating all harbors, rivers, and inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, and are hereby declared special rules duly made by local authority:

PRELIMINARY

In the following rules every steam vessel which is under sail and not under steam is to be considered a sailing vessel, and every vessel under steam, whether under sail or not, is to be considered a steam vessel.

The words "steam vessel" shall include any vessel propelled by machinery.

A vessel is "under way," within the meaning of these rules, when she is not at anchor, or made fast to the shore, or aground.

Rules Concerning Lights, and so Forth

The word "visible" in these rules, when applied to lights, shall mean visible on a dark night with a clear atmosphere.

Article 1. The rules concerning lights shall be complied with in all weathers from sunset to sunrise, and during such time no other lights which may be mistaken for the prescribed lights shall be exhibited.

Art. 2.[1] A steam vessel when under way shall carry—(*a*) On or in front of the foremast, or, if a vessel without a foremast, then in the fore part of the vessel, a bright white light so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side, and of such a character as to be visible at a distance of at least five miles.

(*b*) On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least two miles.

(*c*) On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side, and of such a character as to be visible at a distance of at least two miles.

(*d*) The said green and red side lights shall be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent these lights from being seen across the bow.

(*e*) A seagoing steam vessel when under way may carry an additional white light similar in construction to the light mentioned in subdivision (a). These two lights shall be so placed in line with the keel that one shall be at least fifteen feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance.

(*f*) All steam vessels (except seagoing vessels and ferryboats) shall carry in addition to green and red lights required by article two (*b*), (*c*), and screens as required by article two (*d*), a central range of two white lights; the after light being carried at an elevation at least fifteen feet above the light at the head of the vessel. The headlight shall be so constructed as to show an unbroken light through twenty points of the compass, namely, from right ahead to two points abaft the beam on either side of the vessel, and the after light so as to show all around the horizon.

Art. 3. A steam vessel when towing another vessel shall, in addition to her side lights, carry two bright white lights in a vertical line one over the other, not less than three feet apart, and when towing more than one vessel shall carry an additional bright white light three feet above or below such lights, if the length of the tow measuring from the stern of the towing vessel to the stern of the last vessel towed exceeds six hundred feet. Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white light mentioned in article two (a) or the after range light mentioned in article two (f).

Such steam vessel may carry a small white light abaft the funnel or aftermast for the vessel towed to steer by, but such light shall not be visible forward of the beam.

Art. 5. A sailing vessel under way or being towed shall carry the same lights as are prescribed by article two for a steam vessel under way, with the exception of the white lights mentioned therein, which they shall never carry.

Art. 6. Whenever, as in the case of vessels of less than ten gross tons under way during bad weather, the green and red side lights can not be fixed, these lights shall be kept at hand, lighted and ready for use; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision in such manner as to make them most visible, and so that the green light shall not be seen on the port side nor the red light on the starboard side, nor, if practicable, more than two points abaft the beam

[1] Article 2 is amended by act of Congress approved June 9, 1910, effective on and after July 9, 1910, in rules for lights required to be carried by every vessel propelled by machinery and not more than 65 feet in length, except tugboats and towboats propelled by steam. (See p. 227.)

on their respective sides. To make the use of these portable lights more certain and easy, the lanterns containing them shall each be painted outside with the color of the light they respectively contain, and shall be provided with proper screens.

ART. 7. Rowing boats, whether under oars or sail, shall have ready at hand a lantern showing a white light which shall be temporarily exhibited in sufficient time to prevent collision.

ART. 8.[2] Pilot vessels when engaged on their station on pilotage duty shall not show the lights required for other vessels, but shall carry a white light at the masthead, visible all around the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed fifteen minutes.

On the near approach of or to other vessels they shall have their side lights lighted, ready for use, and shall flash or show them at short intervals, to indicate the direction in which they are heading, but the green light shall not be shown on the port side nor the red light on the starboard side.

A pilot vessel of such a class as to be obliged to go alongside of a vessel to put a pilot on board may show the white light instead of carrying it at the masthead, and may, instead of the colored lights above mentioned, have at hand, ready for use, a lantern with a green glass on the one side and a red glass on the other, to be used as prescribed above.

Pilot vessels, when not engaged on their station on pilotage duty, shall carry lights similar to those of other vessels of their tonnage.

ART. 9. (*a*) Fishing vessels of less than ten gross tons, when under way and when not having their nets, trawls, dredges, or lines in the water, shall not be obliged to carry the colored side lights; but every such vessel shall, in lieu thereof, have ready at hand a lantern with a green glass on one side and a red glass on the other side, and on approaching to or being approached by another vessel such lantern shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side.

(*b*) All fishing vessels and fishing boats of ten gross tons or upward, when under way and when not having their nets, trawls, dredges, or lines in the water, shall carry and show the same lights as other vessels under way.

(*c*) All vessels, when trawling, dredging, or fishing with any kind of drag nets or lines, shall exhibit from some part of the vessel where they can be best seen, two lights. One of these lights shall be red and the other shall be white. The red light shall be above the white light, and shall be at a vertical distance from it of not less than six feet and not more than twelve feet; and the horizontal distance between them, if any, shall not be more than ten feet. These two lights shall be of such a character and contained in lanterns of such construction as to be visible all around the horizon, the white light a distance of not less than three miles and a red light of not less than two miles.

(*d*) Rafts, or other water craft not herein provided for, navigating by hand power, horsepower, or by the current of the river, shall carry one or more good white lights, which shall be placed in such manner as shall be prescribed by the Board of Supervising Inspectors of Steam Vessels.

ART. 10. A vessel which is being overtaken by another, except a steam vessel with an after-range light showing all around the horizon, shall show from her stern to such last-mentioned vessel a white light or a flare-up light.

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[2] AN ACT Relating to lights on steam pilot vessels

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That a steam pilot vessel, when engaged on her station on pilotage duty and in waters of the United States, and not at anchor, shall, in addition to the lights required for all pilot boats, carry at a distance of eight feet below her white masthead light a red light, visible all around the horizon and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least two miles, and also the colored side lights required to be carried by vessels when under way.

When engaged on her station on pilotage duty and in waters of the United States, and at anchor, she shall carry in addition to the lights required for all pilot boats the red light above mentioned, but not the colored side lights.

When not engaged on her station on pilotage duty, she shall carry the same lights as other steam vessels.

SEC. 2. That this act shall be construed as supplementary to article 8 of the act approved June 7, 1897, entitled "An act to adopt regulations for preventing collisions upon certain harbors, rivers, and inland waters of the United States," and to article 8 of an act approved August 19, 1890, entitled "An act to adopt regulations for preventing collisions at sea."

SEC. 3. That this act shall take effect on June 30, 1900.

Approved, February 19, 1900.

ART. 11. A vessel under one hundred and fifty feet in length when at anchor shall carry forward, where it can best be seen, but at a height not exceeding twenty feet above the hull, a white light, in a lantern so constructed as to show a clear, uniform, and unbroken light visible all around the horizon at a distance of at least one mile.

A vessel of one hundred and fifty feet or upward in length when at anchor shall carry in the forward part of the vessel, at a height of not less than twenty and not exceeding forty feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall be not less than fifteen feet lower than the forward light, another such light. The length of a vessel shall be deemed to be the length appearing in her certificate of registry.

ART. 12. Every vessel may, if necessary, in order to attract attention, in addition to the lights which she is by these rules required to carry, show a flare-up light or use any detonating signal that can not be mistaken for a distress signal.

ART. 13. Nothing in these rules shall interfere with the operation of any special rules made by the Government of any nation with respect to additional station and signal lights for two or more ships of war or for vessels sailing under convoy, or with the exhibition of recognition signals adopted by shipowners, which have been authorized by their respective Governments and duly registered and published.

ART. 14. A steam vessel proceeding under sail only, but having her funnel up, may carry in daytime, forward, where it can best be seen, one black ball or shape two feet in diameter.

SOUND SIGNALS FOR FOG, AND SO FORTH

ART. 15. All signals prescribed by this article for vessels under way shall be given:

1. By "steam vessels" on the whistle or siren.
2. By "sailing vessels" and "vessels towed" on the foghorn.

The words "prolonged blast" used in this article shall mean a blast of from four to six seconds duration.

A steam vessel shall be provided with an efficient whistle or siren, sounded by steam or by some substitute for steam, so placed that the sound may not be intercepted by any obstruction, and with an efficient foghorn; also with an efficient bell. A sailing vessel of twenty tons gross tonnage or upward shall be provided with a similar foghorn and bell.

In fog, mist, falling snow, or heavy rainstorms, whether by day or night, the signals described in this article shall be used as follows, namely:

(*a*) A steam vessel under way should sound, at intervals of not more than one minute, a prolonged blast.

(*c*) A sailing vessel under way shall sound, at intervals of not more than one minute, when on the starboard tack, one blast; when on the port tack, two blasts in succession, and when with the wind abaft the beam, three blasts in succession.

(*d*) A vessel when at anchor shall, at intervals of not more than one minute, ring the bell rapidly for about five seconds.

(*e*) A steam vessel when towing shall, instead of the signals prescribed in subdivision (a) of this article, at intervals of not more than one minute, sound three blasts in succession, namely, one prolonged blast followed by two short blasts. A vessel towed may give this signal and she shall not give any other.

(*f*) All rafts or other water craft not herein provided for, navigating by hand power, horsepower, or by the current of the river, shall sound a blast of the foghorn, or equivalent signal, at intervals of not more than one minute.

SPEED OF SHIPS TO BE MODERATE IN FOG, AND SO FORTH

ART. 16. Every vessel shall in a fog, mist, falling snow, or heavy rainstorms, go at a moderate speed, having careful regard to the existing circumstances and conditions.

A steam vessel hearing, apparently forward of her beam, the fog signal of a vessel the position of which is not ascertained shall, so far as the circumstances of the case admit, stop her engines and then navigate with caution until danger of collision is over.

STEERING AND SAILING RULES

PRELIMINARY—RISK OF COLLISION

Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing of an approaching vessel. If the bearing does not appreciably change, such risk should be deemed to exist.

ART. 17. When two sailing vessels are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other as follows, namely:

(*a*) A vessel which is running free shall keep out of the way of a vessel which is close-hauled.

(*b*) A vessel which is close-hauled on the port tack shall keep out of the way of a vessel which is close-hauled on the starboard tack.

(*c*) When both are running free, with the wind on different sides, the vessel which has the wind on the port side shall keep out of the way of the other.

(*d*) When both are running free, with the wind on the same side, the vessel which is to the windward shall keep out of the way of the vessel which is to the leeward.

(*e*) A vessel which the wind aft shall keep out of the way of the other vessel.

ART. 18. RULE I. When steam vessels are approaching each other head and head, that is, end on, or nearly so, it shall be the duty of each to pass on the port side of the other; and either vessel shall give, as a signal of her intention, one short and distinct blast of her whistle, which the other vessel shall answer promptly by a similar blast of her whistle, and thereupon such vessels shall pass on the port side of each other. But if the course of such vessels are so far on the starboard of each other as not to be considered as meeting head and head, either vessel shall immediately give two short and distinct blasts of her whistle, which the other vessel shall answer promptly by two similar blasts of her whistle, and they shall pass on the starboard side of each other.

The foregoing only applies to cases where vessels are meeting end on or nearly end on, in such a manner as to involve risk of collision; in other words, to cases in which by day each vessel sees the masts of the other in a line, or nearly in a line, with her own and by night to cases in which each vessel is in such a position as to see both the side lights of the other.

It does not apply by day to cases in which a vessel sees another ahead crossing her own course, or by night to cases where the red light of one vessel is opposed to the red light of the other, or where the green light of one vessel is opposed to the green light of the other, or where a red light without a green light or a green light without a red light, is seen ahead, or where both green and red lights are seen anywhere but ahead.

RULE III. If, when steam vessels are approaching each other, either vessel fails to understand the course or intention of the other, from any cause, the vessel so in doubt shall immediately signify the same by giving several short and rapid blasts, not less than four, of the steam whistle.

RULE V. Whenever a steam vessel is nearing a short bend or curve in the channel, where, from the height of the banks or other cause, a steam vessel approaching from the opposite direction can not be seen for a distance of half a mile, such steam vessel, when she shall have arrived within half a mile of such curve or bend, shall give a signal by one long blast of the steam whistle, which signal shall be answered by a similar blast, given by any approaching steam vessel that may be within hearing. Should such a signal be so answered by a steam vessel upon the farther side of such bend, then the usual signals for meeting and passing shall immediately be given and answered; but, if the first alarm signal of such vessel be not answered, she is to consider the channel clear, and govern herself accordingly.

When steam vessels are moved from their docks or berths, and other boats are liable to pass from any direction toward them, they shall give the same signal as in the case of vessels meeting at a bend, but immediately after clearing the berths so as to be fully in sight they shall be governed by the steering and sailing rules.

RULE VIII. When steam vessels are running in the same direction, and the vessel which is astern shall desire to pass on the right or starboard hand of the vessel ahead, she shall give one short blast of the steam whistle, as a signal of such desire, and if the vessel ahead answers with one blast, she shall put

her helm to port; or if she shall desire to pass on the left or port side of the vessel ahead, she shall give two short blasts of the steam whistle as a signal of such desire, and if the vessel ahead answers with two blasts, shall put her helm to starboard; or if the vessel ahead does not think it safe for the vessel astern to attempt to pass at that point, she shall immediately signify the same by giving several short and rapid blasts of the steam whistle, not less than four, and under no circumstances shall the vessel astern attempt to pass the vessel ahead until such time as they have reached a point where it can be safely done, when said vessel ahead shall signify her willingness by blowing the proper signals. The vessel ahead shall in no case attempt to cross the bow or crowd upon the course of the passing vessel.

RULE IX. The whistle signals provided in the rules under this article, for steam vessels meeting, passing, or overtaking, are never to be used except when steamers are in sight of each other, and the course and position of each can be determined in the daytime by a sight of the vessel itself, or by night by seeing its signal lights. In fog, mist, falling snow, or heavy rainstorms. when vessels can not so see each other, fog signals only must be given.

ART. 19. When two steam vessels are crossing, so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way of the other.

ART. 20. When a steam vessel and a sailing vessel are proceeding in such directions as to involve risk of collision, the steam vessel shall keep out of the way of the sailing vessel.

ART. 21. Where, by any of these rules, one of the two vessels is to keep out of the way, the other shall keep here course and speed.

ART. 22. Every vessel which is directed by these rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.

ART. 23. Every steam vessel which is directed by these rules to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed or stop or reverse.

ART. 24. Notwithstanding anything contained in these rules every vessel, overtaking any other, shall keep out of the way of the overtaken vessel. Every vessel coming up with another vessel from any direction more than two points abaft her beam; that is, in such position, with reference to the vessel which she is overtaking that at night she would be unable to see either of that vessel's side lights, shall be deemed to be an overtaken vessel; and no subsequent alteration of the bearing between the two vessels shall make the overtaking vessel a crossing vessel within the meaning of these rules, or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

As by day the overtaking vessel can not always know with certainty whether she is forward or abaft this direction from the other vessel she should, if in doubt, assume that she is an overtaking vessel and keep out of the way.

ART. 25. In narrow channels every steam vessel shall, when it is safe and practicable, keep to that side of the fairway or mid-channel which lies on the starboard side of such vessel.

ART. 26. Sailing vessels under way shall keep out of the way of sailing vessels or boats fishing with nets, or lines, or trawls. This rule shall not give to any vessel or boat engaged in fishing the right of obstructing a fairway used by vessels other than fishing vessels or boats.

ART. 27. In obeying and construing these rules due regard shall be had to all dangers of navigation and collision, and to any special circumstances which may render a departure from the above rules necessary in order to avoid immediate danger.

SOUND SIGNALS FOR VESSELS IN SIGHT OF ONE ANOTHER

ART. 28. When vessels are in sight of one another a steam vessel under way whose engines are going at full speed astern shall indicate that fact by three short blasts on the whistle.

NO VESSEL UNDER ANY CIRCUMSTANCES TO NEGLECT PROPER PRECAUTIONS

ART. 29. Nothing in these rules shall exonerate any vessel, or the owner or master or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper lookout, or of the neglect of any

precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

ART. 30. The exhibition of any light on board of a vessel of war of the United States or a revenue cutter may be suspended whenever, in the opinion of the Secretary of the Navy, the commander in chief of a squadron, or the commander of a vessel acting singly, the special character of the service may require it.

DISTRESS SIGNALS

ART. 31. When a vessel is in distress and requires assistance from other vessels or from the shore, the following shall be the signals to be used or displayed by her, either together or separately, namely:

In the daytime: A continuous sounding with any fog-signal apparatus, or firing a gun.

At night: First. Flames on the vessel as from a burning tar barrel, oil barrel, and so forth.

Second. A continuous sounding with any fog-signal apparatus, or firing a gun.

RULES FOR LIGHTS FOR CERTAIN CLASSES OF VESSELS NAVIGATING THE HARBORS, RIVERS, AND INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL AND THE RED RIVER OF THE NORTH AND RIVERS EMPTYING INTO THE GULF OF MEXICO AND THEIR TRIBUTARIES.

The following rules for lights to be carried by ferryboats, rules for lights for barges and canal boats in tow of steam vessels, rules for lights for rafts and other water craft navigating by hand power, horsepower, or by the current of the river, rule relating to use of searchlights, rule prohibiting unnecessary sounding of the steam whistle, rule prohibiting the carrying of unauthorized lights on steam vessels, and rule relating to drawbridges over navigable waters of the United States were adopted by the Board of Supervising Inspectors, Steamboat-Inspection Service, and approved by the Secretary of Commerce.

These rules concerning lights shall be complied with in all weathers from sunset to sunrise.

RULES FOR LIGHTS TO BE CARRIED BY FERRYBOATS NAVIGATING THE HARBORS, RIVERS, AND INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL AND THE RED RIVER OF THE NORTH AND RIVERS EMPTYING INTO THE GULF OF MEXICO AND THEIR TRIBUTARIES

Ferryboats propelled by machinery and navigating the harbors, rivers, and other inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, shall carry the range lights and the colored side lights required by law to be carried on steam vessels navigating those waters, except that *double-end ferryboats* shall carry a central range of clear, bright, white lights, showing all around the horizon, placed at equal altitudes forward and aft, also on the starboard side a green light, and on the port side a red light, of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 2 miles, and so constructed as to show a uniform and unbroken light over an arc of the horizon of 10 points of the compass, and so fixed as to throw the light from right ahead to 2 points abaft the beam on their respective sides.

The green and red lights shall be fitted with inboard screens projecting at least 3 feet forward from the lights, so as to prevent them from being seen across the bow.

Local inspectors in districts having ferryboats shall, whenever the safety of navigation may require, designate for each line of such boats a certain light, white or colored, which shall show all around the horizon, to designate and distinguish such lines from each other, which light shall be carried on a flagstaff amidships, 15 feet above the white range lights.

RULES AND LIGHTS FOR BARGES AND CANAL BOATS IN TOW OF STEAM VESSELS AND FOR LIGHTS AND DAY SIGNALS FOR DREDGES, VESSELS WORKING ON WRECKS, ETC., NAVIGATING THE HARBORS, RIVERS, AND OTHER INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL AND THE RED RIVER OF THE NORTH AND RIVERS EMPTYING INTO THE GULF OF MEXICO AND THEIR TRIBUTARIES

Lights for barges and canal boats in tow of steam vessels on certain inland waters on the seaboard, except the Hudson River and adjacent waters and Lake Champlain.—On the harbors, rivers, and other inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, and except on the waters of the Hudson River and its tributaries from Troy to the boundary lines of New York Harbor off Sandy Hook, as defined pursuant to section 2 of the act of Congress of February 19, 1895, the East River, and Long Island Sound (and the waters entering thereon, and to the Atlantic Ocean), to and including Narragansett Bay, R. I., and tributaries, and Lake Champlain, barges (except scows) and canals boats in tow of steam vessels shall carry lights as follows:

Barges and canal boats towing astern of steam vessels, when towing singly, or what is known as tandem towing, shall each carry a green light on the starboard side and a red light on the port side, and a white light on the stern, except that the last vessel of such tow shall carry two white lights on her stern, athwartship, horizontal to each other, not less than 5 feet apart, and not less than 4 feet above the deck house, and so placed as to show all around the horizon.

When two or more boats are abreast, the colored lights shall be carried at the outer sides of the bows of the outside boats. Each of the outside boats in last tier of a hawser tow shall carry a white light on her stern.

The white light required to be carried on stern of a barge or canal boat carrying red and green side lights shall be carried in a lantern so constructed that it shall show an unbroken light over an arc of the horizon of 12 points of the compass, namely, for 6 points from right aft on each side of the vessel, and shall be of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 2 miles.

Barges or canal boats towing alongside a steam vessel shall, if the deck, deck houses, or cargo of the barge or canal boat be so high above water as to obscure the side lights of the towing steamer when being towed on the starboard side of the steamer, carry a green light upon the starboard side; and when towed on the port side of the steamer, a red light on the port side of the barge or canal boat; and if there is more than one barge or canal boat abreast, the colored lights shall be displayed from the outer side of the outside barges or canal boats.

The colored side lights referred to in these rules for barges and canal boats in tow shall be fitted with inboard screens, so as to prevent them from being seen across the bow, and of such a character as to be visible on a dark night, with a clear atmosphere, at a distance of at least 2 miles, and so constructed as to show a uniform and unbroken light over an arc of the horizon of 10 points of the compass, and so fixed as to throw the light from right ahead to 2 points abaft the beam on either side. The minimum size of glass globes shall not be less than 6 inches in diameter and 5 inches high in the clear.

Scows when being towed by steam vessels on the waters covered by the first paragraph of these rules shall carry a white light at each end of each scow, except that when such scows are massed in tiers, two or more abreast, each of the outside scows shall carry a white light on its outer bow, and the outside scows in the last tier shall each carry, in addition, a white light on the outer part of the stern. The white light shall be carried not less than 8 feet above the surface of the water and shall be so placed as to show an unbroken light all around the horizon, and shall be of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 5 miles.

Lights for barges and canal boats in tow of steam vessels on the Hudson River and adjacent waters and Lake Champlain.—All nondescript vessels known as scows, car floats, lighters, and vessels of similar type, navigating the waters referred to in the following rules, shall carry the lights required to be carried by barges and canal boats in tow of steam vessels, as prescribed in such rules.

Barges and canal boats, when being towed by steam vessels on the waters of the Hudson River and its tributaries from Troy to the boundary lines of New York Harbor off Sandy Hook, as defined pursuant to section 2 of the act of Congress of February 19, 1895, the East River, and Long Island Sound (and the waters entering thereon, and to the Atlantic Ocean), to and including Narragansett Bay, R. I., and tributaries, and Lake Champlain, shall carry lights as follows:

Barges and canal boats being towed astern of steam vessels, when towing singly or what is known as tandem towing, shall each carry a white light on the bow and a white light on the stern, except that the last vessel of such tow shall carry two white lights on her stern, athwartship, horizontal to each other, not less than 5 feet apart, and not less than 4 feet above the deck house, and so placed as to show all around the horizon: *Provided*, That seagoing barges shall not be required to make any change in their seagoing lights (red and green) on waters coming within the scope of these rules, except that the last vessel of the tow shall carry two white lights on her stern, athwartship, horizontal to each other, not less than 5 feet apart, and not less than 4 feet above the deck house, and so placed as to show all around the horizon.

Barges and canal boats, when towed at a hawser two or more abreast, when in one tier, shall carry a white light on the bow and a white light on the stern of each of the outside boats; when in more than one tier, each of the outside boats shall carry a white light on its bow; and the outside boats in the last tier shall each carry, in addition, a white light on the outer afterpart of the stern.

Barges or canal boats towed alongside a steam vessel, if on the starboard side of said steam vessel, shall display a white light on her own starboard bow; and if on the port side of said steam vessel shall display a white light on her own port bow; and if there is more than one barge or canal boat alongside the white lights shall be displayed from the outboard side of the outside barge or canal boat: *Provided*, That barges known as car floats, when towed alongside, shall have a white light at each outboard corner of said barge.

When barges or canal boats are massed in tiers and towed at a hawser, as is usual on the Hudson River, there shall be carried on the forward port side of the port boat of each tier a white light, and on the forward starboard side of the starboard boat in each tier a white light, and on the after port side of the port boat in the stern tier a white light, and on the afterstarboard side of the starboard boat in the stern tier a white light.

The white bow lights for barges and canal boats referred to in the preceding rules shall be carried at least 10 feet and not more than 30 feet abaft the stem or extreme forward end of the vessel. On barges and canal boats required to carry a white bow light, the white light on bow and the white light on stern shall each be so placed above the hull or deck house as to show an unbroken light all around the horizon, and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 5 miles.

Provided, That nothing in these rules shall be construed as compelling barges or canal boats in tow of steam vessels, passing through any waters coming within the scope of these rules where lights for barges or canal boats are different from those of the waters whereon such vessels are usually employed, to change their lights from those required on the waters from which their trip begins or terminates; but should such vessels engage in local employment on waters requiring different lights from those where they are customarily employed, they shall comply with the local rules where employed.

RULES FOR LIGHTS AND DAY SIGNALS TO BE CARRIED BY VESSELS, DREDGES OF ALL TYPES, AND VESSELS WORKING ON WRECKS OR OTHER OBSTRUCTIONS TO NAVIGATION, OR MOORED FOR SUBMARINE OPERATIONS OR MADE FAST TO A SUNKEN OBJECT WHICH MAY DRIFT WITH THE TIDE OR BE TOWED

Rule for signals to be displayed by a towing vessel when towing a submerged or partly submarged object upon a hawser when no signals are displayed upon the object which is towed.—The vessel having the submerged object in tow shall display by day, where they can best be seen, two shapes, one above the other, not less than 6 feet apart, the lower shape to be carried not less than 10 feet above the deck houses. The shapes shall be in the form of a double frustum of a cone, base to base, not less than 2 feet in diameter at the center nor less than 8 inches at the ends of the cones, and to be not

less than 4 feet lengthwise from end to end, the upper shape to be painted in alternate horizontal stripes of black and white, 8 inches in width, and the lower shape to be painted a solid bright red.

By night the towing vessel shall display the regular side lights, but in lieu of the regular white towing lights shall display four lights in a vertical position not less than 3 feet nor more than 6 feet apart, the upper and lower of such lights to be white, and the two middle lights to be red, all of such lights to be of the same character as is now prescribed for the regular towing lights.

Rule for steamers, derrick boats, lighters, or other types of vessels made fast alongside a wreck, or moored over a wreck which is on the bottom or partly submerged, or which may be drifting.—Steamers, derrick boats, lighters, or other types of vessels made fast alongside a wreck, or moored over a wreck which is on the bottom or partly submerged, or which may be drifting, shall display by day two shapes of the same character and dimensions and displayed in the same manner as required by the foregoing rule, except that both the shapes shall be painted a solid bright red, but where more than one vessel is working under the above conditions, the shapes need be displayed only from one vessel on each side of the wreck from which it can best be seen from all directions.

By night this situation shall be indicated by the display of a white light from the bow and stern of each outside vessel or lighter not less than 6 feet above the deck, and in addition thereto there shall be displayed in a position where they may best be seen from all directions two red lights carried in a vertical line not less than 3 feet nor more than 6 feet apart, and not less than 15 feet above the deck.

Rule for dredges which are held in stationary position by moorings or spuds.—Dredges which are held in stationary position by moorings or spuds shall display by day two red balls not less than 2 feet in diameter and carried in a vertical line not less than 3 feet nor more than 6 feet apart, and at least 15 feet above the deck house and in such a position where they can best be seen from all directions.

By night they shall display a white light at each corner, not less than 6 feet above the deck, and in addition thereto there shall be displayed in a position where they may best be seen from all directions two red lights carried in a vertical line not less than 3 feet nor more than 6 feet apart, and not less than 15 feet above the deck. When scows are moored alongside a dredge in the foregoing situation they shall display a white light on each outboard corner not less than 6 feet above the deck.

Rule for self-propelling suction dredges under way with their suctions on the bottom.—Self-propelling suction dredges under way with their suction on the bottom shall display by day the same signals as are used to designate any steamer not under control; that is to say, two black balls not less than 2 feet in diameter and carried not less than 15 feet above the deck house, and where they may best be seen from all directions.

By night they shall carry, in addition to the regular running lights, two red lights of the same character as the masthead light, in the same vertical plane and underneath the masthead light, the red lights to be not less than 3 feet nor more than 6 feet apart and the upper red light to be not less than 4 feet and not more than 6 feet below the white masthead light, and on or near the stern two red lights in the same vertical plane not less than 4 feet nor more than 6 feet apart, to show through 4 points of the compass; that is, from right astern to 2 points on each quarter.

Rule for vessels which are moored or anchored and engaged in laying pipe or operating on submarine construction or excavation.—Vessels which are moored or anchored and engaged in laying pipe or operating on submarine construction or excavation shall display by day, not less than 15 feet above the deck, where they can best be seen from all directions, two balls not less than 2 feet in diameter, in a vertical line not less than 3 feet and not more than 6 feet apart, the upper ball to be painted in alternate black and white vertical stripes 6 inches wide, and the lower ball to be painted a solid bright red.

By night they shall display three red lights carried in a vertical line not less than 3 feet nor more than 6 feet apart and not less than 15 feet above the deck, and in such position as may best be seen from all directions. All the lights required by these special rules for dredges, wrecking boats, lighters, etc., shall be of such size and character as to be visible on a dark night with a clear atmosphere for a distance of at least 2 miles.

Rule relating to the use of searchlights.—Any master or pilot of any steam vessel who shall flash or cause to be flashed the rays of the searchlight into the pilot house of a passing vessel shall be deemed guilty of misconduct and shall be liable to have his license suspended or revoked.

Rule for vessels which are moored or at anchor.—Vessels of more than 300 gross tons propelled by machinery when moored or anchored in a fairway or channel where traffic is liable to congestion or confusion shall display between sunrise and sunset on the forward part of the vessel where it can best be observed from other vessels one black ball or shape not less than 2 feet in diameter.

Rule prohibiting the carrying of unauthorized lights on steam vessels.—Any master or pilot of any steam vessel who shall authorize or permit the carrying of any light, electric or otherwise, not required by law, on the outside structure of the cabin or hull of the vessel that in any way will interfere with distinguishing the signal lights shall, upon conviction thereof before any board of inspectors having jurisdiction, be deemed guilty of misconduct and shall be liable to have his license suspended or revoked.

AN ACT To amend laws for preventing collisions of vessels and to regulate equipment of certain motor boats on the navigable waters of the United States

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the words "motor boat" where used in this act shall include every vessel propelled by machinery and not more than sixty-five feet in length, except tug boats and tow boats propelled by steam. The length shall be measured from end to end over the deck, excluding sheer: *Provided*, That the engine, boiler, or other operating machinery shall be subject to inspection by the local inspectors of steam vessels, and to their approval of the design thereof, on all said motor boats, which are more than forty feet in length, and which are propelled by machinery driven by steam.

SEC. 2. That motor boats subject to the provisions of this act shall be divided into classes as follows:

Class one. Less than twenty-six feet in length.

Class two. Twenty-six feet or over and less than forty feet in length.

Class three. Forty feet or over and not more than sixty-five feet in length.

SEC. 3. That every motor boat in all weathers from sunset to sunrise shall carry the following lights, and during such time no other lights which may be mistaken for those prescribed shall be exhibited.

(a) Every motor boat of class one shall carry the following lights:

First. A white light aft to show all around the horizon.

Second. A combined lantern in the fore part of the vessel and lower than the white light aft showing green to starboard and red to port, so fixed as to throw the light from right ahead to two points abaft the beam on their respective sides.

(b) Every motor boat of classes two and three shall carry the following lights:

First. A bright white light in the fore part of the vessel as near the stem as practicable, so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side. The glass or lens shall be of not less than the following dimensions:

Class two. Nineteen square inches.

Class three. Thirty-one square inches.

Second. A white light aft to show all around the horizon.

Third. On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side. On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side. The glasses or lenses in the said side lights shall be of not less than the following dimensions on motor boats of—

Class 2. Sixteen square inches.

Class 3. Twenty-five square inches.

On and after July 1, 1911, all glasses or lenses prescribed by paragraph (*b*) of section three shall be fresnel or fluted. The said lights shall be fitted with

inboard screens of sufficient height and so set as to prevent these lights from being seen across the bow, and shall be of not less than the following dimensions on motor boats of—

Class 2. Eighteen inches long.

Class 3. Twenty-four inches long: *Provided*, That motor boats as defined in this act, when propelled by sail and machinery or under sail alone, shall carry the colored lights suitably screened, but not the white lights prescribed by this section.

SEC. 3. (*a*) Every motor boat under the provisions of this act shall be provided with a whistle or other sound-producing mechanical appliance capable of producing a blast of two seconds or more in duration, and in the case of such boats so provided a blast of at least two seconds shall be deemed a prolonged blast within the meaning of the law.

(*b*) Every motor boat of class two or three shall carry an efficient foghorn.

(*c*) Every motor boat of class two or three shall be provided with an efficient bell, which shall be not less than eight inches across the mouth on board of vessels of class three.

SEC. 5. That every motor boat subject to any of the provisions of this act, and also all vessels propelled by machinery other than by steam more than sixty-five feet in length, shall carry either life preservers or life belts or buoyant cushions, or ring buoys or other device, to be prescribed by the Secretary of Commerce, sufficient to sustain afloat every person on board and so placed as to be readily accessible. All motor boats carrying passengers for hire shall carry one life preserver of the sort prescribed by the regulations of the Board of Supervising Inspectors for every passenger carried, and no such boat while so carrying passengers for hire shall be operated or navigated except in charge of a person duly licensed for such service by the local board of inspectors. No examination shall be required as the condition of obtaining such a license, and any such license shall be revoked or suspended by the local board of inspectors for misconduct, gross negligence, recklessness in navigation, intemperance, or violation of law on the part of the holder, and if revoked the person holding such license shall be incapable of obtaining another such license for one year from the date of revocation: *Provided*, That motor boats shall not be required to carry licensed officers, except as required in this act.

SEC. 6. That every motor boat and also every vessel propelled by machinery other than by steam, more than sixty-five feet in length, shall carry ready for immediate use the means of promptly and effectually extinguishing burning gasoline.

SEC. 7. That a fine of not exceeding one hundred dollars may be imposed for any violation of this act. The motor boat shall be liable for the said penalty and may be seized and proceeded against by way of libel, in the district court of the United States for any district within which such vessel may be found.

SEC. 8. That the Secretary of Commerce shall make such regulations as may be necessary to secure the proper execution of this act by collectors of customs and other officers of the Government. And the Secretary of the Department of Commerce may, upon application therefor, remit or mitigate any fine, penalty, or forfeiture relating to motor boats except for failure to observe the provisions of section six of this act.

SEC. 9. That all laws and parts of laws only in so far as they are in conflict herewith are hereby repealed: *Provided*, That nothing in this act shall be deemed to alter or amend acts of Congress embodying or revising international rules for preventing collisions at sea.

RULES FOR LIGHTS FOR RAFTS AND OTHER WATER CRAFT NAVIGATING BY HAND POWER, HORSEPOWER, OR BY THE CURRENT OF THE RIVER, ON THE HARBORS, RIVERS, AND OTHER INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL AND THE RED RIVER OF THE NORTH AND RIVERS EMPTYING INTO THE GULF OF MEXICO AND THEIR TRIBUTARIES.

Any vessel, except rafts and rowing boats under oars, navigating by *hand power, horsepower, or by the current of the river*, shall carry one white light forward, not less than 8 feet above the surface of the water.

Rafts propelled by hand power or by the current of the river, or which shall be anchored or moored in or near a channel or fairway, shall carry white lights, as follows:

Rafts of one crib and not more than two in length shall carry one white light. Rafts of three or more cribs in length and one crib in width shall carry one white light at each end of the raft. Rafts of more than one crib abreast shall carry one white light on each outside corner of the raft, making four lights in all.

The *white light* required by these rules for rafts and other water craft shall be carried from sunset to sunrise in a lantern so fixed and constructed as to show a clear, uniform, and unbroken light, visible all around the horizon, and of such intensity as to be visible on a dark night with a clear atmosphere at a distance of at least 1 mile. The lights for rafts shall be suspended from poles of such height that the lights shall not be less than 8 feet above the surface of the water.

Meteorological table compiled by the United States Weather Bureau

KEY WEST, FLA.

Month	Barometer at 32° F. and mean sea level: Mean: For month	Barometer: Extremes: Highest	Barometer: Extremes: Lowest	Barometer: Extremes: Range	Air temperature, in °F.: Mean: For month	Air temperature: Mean: Mean max.	Air temperature: Mean: Mean min.	Air temperature: Mean: Range	Air temperature: Extremes: Highest	Air temperature: Extremes: Lowest	Air temperature: Extremes: Range	Average relative humidity	Average amount of clouds, 0-10	Precipitation: Average fall	Precipitation: Number of days 0.01 inch or more	Precipitation: Max. fall in 24 hours	Wind: Statute miles: Average hourly velocity	Wind: Statute miles: Highest velocity	Wind: Average number of times (observations at 8 a. m. and 8 p. m.) from—: N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	Number of days with winds of 40 miles or over	Number of days dense fog
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	°	%		*Ins.*		*Ins.*													
January	30.10	30.50	29.71	0.79	69.5	73.8	65.1	8.7	90	41	49	82	4	1.98	7	3.97	11.1	58	8	30	9	4	2	2	1	6	0	[1] 0	0
February	30.07	30.47	29.60	.87	70.5	75.1	65.9	9.2	87	44	43	80	4	1.64	6	2.99	10.8	50	9	17	11	8	3	1	2	5	0	0	0
March	30.05	30.47	29.60	.87	72.6	77.4	67.8	9.6	89	48	41	77	3	1.48	5	4.52	11.0	56	8	13	19	10	3	1	1	7	0	0	0
April	30.02	30.37	29.63	.74	75.7	80.5	71.0	9.5	91	54	37	74	3	1.30	4	3.23	10.7	49	7	13	16	11	3	1	2	7	0	0	0
May	29.97	30.25	29.68	.57	79.1	83.9	74.4	9.5	93	63	30	75	4	3.36	8	5.83	9.4	54	6	9	21	12	4	3	3	4	0	0	0
June	29.99	30.26	29.62	.64	81.9	86.8	77.1	9.7	100	69	31	76	5	4.25	11	5.48	8.0	50	3	7	19	16	7	3	2	3	0	0	0
July	30.03	30.24	29.77	.47	83.5	88.6	78.4	10.2	100	68	32	74	5	3.59	13	7.46	7.7	52	2	7	24	14	5	4	2	4	0	0	0
August	29.98	30.20	29.67	.53	83.5	88.8	78.2	10.6	100	68	32	74	5	4.69	14	4.04	7.7	50	3	8	23	13	5	4	3	2	1	0	0
September	29.94	30.17	28.83	1.34	82.2	87.2	77.2	10.0	97	69	28	77	5	6.79	16	11.95	8.3	110	3	17	24	8	3	2	0	2	1	0	0
October	29.94	30.28	28.47	1.81	79.1	83.4	74.8	8.6	92	59	33	79	4	5.38	13	11.23	11.0	100	7	27	13	5	2	3	2	3	0	0	0
November	30.02	30.45	29.65	.80	74.3	78.2	70.3	7.9	91	51	40	70	4	2.36	8	8.86	11.3	52	9	33	8	3	1	1	1	4	0	0	0
December	30.08	30.52	29.63	.89	70.3	74.5	66.2	8.3	88	44	44	81	4	1.84	7	3.93	10.9	56	10	25	10	6	3	1	2	5	0	0	0
Mean	30.02				76.8	81.5	72.2	9.3				78	4				9.8												
Total														38.66	112				75	206	197	110	41	26	21	52	2	0	0

[1] Mean less than 1.

Meteorological table compiled by the United States Weather Bureau

TAMPA, FLA.

Month	Barometer at 32° F. and mean sea level: Mean: For month	Barometer: Extremes: Highest	Barometer: Extremes: Lowest	Barometer: Extremes: Range	Air temperature, in °F.: Mean: For month	Air temperature: Mean: Mean max.	Air temperature: Mean: Mean min.	Air temperature: Mean: Range	Air temperature: Extremes: Highest	Air temperature: Extremes: Lowest	Air temperature: Extremes: Range	Average relative humidity	Average amount of clouds, 0-10	Precipitation: Average fall	Precipitation: Number of days 0.01 inch or more	Precipitation: Max. fall in 24 hours	Wind: Statute miles: Average hourly velocity	Wind: Statute miles: Highest velocity	Wind: Average number of times (observations at 8 a. m. and 8 p. m.) from—: N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	Number of days with winds of 40 miles or over	Number of days dense fog
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	°	%		*Ins.*		*Ins.*													
January	30.12	30.56	29.44	1.12	60.4	69.3	51.5	17.8	83	23	60	82	5	2.80	7	3.58	6.9	46	9	20	5	3	4	4	5	12	0	[1] 0	3
February	30.10	30.59	29.48	1.11	61.9	70.8	53.1	17.7	86	22	64	79	5	3.27	7	4.06	7.4	49	6	16	3	4	4	6	5	12	0	0	2
March	30.07	30.51	29.52	.99	66.8	76.1	57.6	18.5	92	32	60	78	4	2.81	6	2.15	7.4	41	6	15	6	4	4	7	9	10	1	0	1
April	30.06	30.39	29.59	.80	70.9	80.3	61.6	18.7	90	38	52	73	4	1.85	5	2.87	7.4	42	4	14	7	5	2	7	11	10	0	0	1
May	29.99	30.33	29.64	.69	76.3	85.4	67.2	18.2	94	52	42	74	4	2.92	7	3.37	6.9	44	3	19	9	6	3	5	9	8	0	0	0
June	30.01	30.32	29.60	.72	80.2	88.6	71.8	16.8	98	59	39	79	5	8.34	14	5.54	6.2	44	3	13	10	9	5	5	9	6	0	0	0
July	30.04	30.29	29.80	.49	81.2	89.1	73.3	15.8	96	65	31	81	6	8.43	18	5.16	5.7	43	4	13	10	8	4	8	9	5	1	0	0
August	30.00	30.26	29.57	.69	81.5	89.4	73.6	15.8	97	66	31	82	6	8.59	18	5.04	5.5	36	3	18	9	8	3	8	7	5	1	0	0
September	29.97	30.24	29.46	.78	79.9	88.0	71.9	16.1	96	54	42	83	5	7.41	15	6.56	6.2	49	5	28	11	4	3	2	2	5	0	0	0
October	29.98	30.43	28.81	1.62	74.3	82.5	66.1	16.4	93	43	50	80	5	2.97	8	6.48	7.2	68	11	31	5	2	1	2	2	8	0	0	1
November	30.08	30.51	29.67	.84	66.9	75.8	57.9	17.9	87	32	55	79	4	1.72	5	4.18	6.8	36	10	28	4	1	2	2	4	9	0	0	1
December	30.12	30.64	29.64	1.00	61.1	70.0	52.1	17.9	84	19	65	81	5	2.02	7	3.93	6.6	40	11	21	4	3	4	4	3	11	1	0	2
Mean	30.04				71.8	80.4	63.1	17.3				79	5				6.7												
Total														53.13	117				75	236	83	57	39	60	75	101	4	0	11

[1] Mean less than 0.5.

Meteorological table compiled by the United States Weather Bureau

PENSACOLA, FLA.

Month	Barometer at 32° F. and mean sea level: Mean: For month	Barometer: Extremes: Highest	Barometer: Extremes: Lowest	Barometer: Extremes: Range	Air temperature, in °F.: Mean: For month	Air temperature: Mean: Mean max.	Air temperature: Mean: Mean min.	Air temperature: Mean: Range	Air temperature: Extremes: Highest	Air temperature: Extremes: Lowest	Air temperature: Extremes: Range	Average relative humidity	Average amount of clouds, 0-10	Precipitation: Average fall	Precipitation: Number of days 0.01 inch or more	Precipitation: Max. fall in 24 hours	Wind: Statute miles: Average hourly velocity	Wind: Statute miles: Highest velocity	Wind: Average number of times (observations at 8 a. m. and 8 p. m.) from—: N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	Number of days with winds of 40 miles or over	Number of days dense fog
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	°	%		*Ins.*		*Ins.*													
January	30.14	30.75	29.18	1.57	52.5	59.8	45.2	14.6	79	15	64	80	6	4.04	10	3.52	14.0	60	6	7	5	3	2	2	1	5	0	2	3
February	30.11	30.67	29.17	1.50	55.2	62.2	48.1	14.1	78	7	71	80	5	4.49	10	5.05	14.0	60	6	6	3	3	1	2	2	5	0	2	3
March	30.06	30.60	29.39	1.21	60.3	67.0	53.6	13.4	87	24	63	80	5	5.36	9	8.32	14.2	62	5	6	4	5	2	3	3	3	0	2	3
April	30.02	30.40	29.40	1.00	66.7	73.2	60.2	13.0	92	34	58	79	5	3.16	7	8.91	13.9	68	4	4	4	5	3	3	2	5	0	2	1
May	29.99	30.39	29.56	.83	73.9	80.3	67.4	12.9	94	44	50	78	4	2.68	7	5.63	12.5	76	3	5	3	4	4	5	3	4	0	1	0
June	29.99	30.25	29.62	.63	89.3	85.4	73.2	12.2	101	55	46	79	5	4.87	10	10.70	11.4	66	4	6	2	3	3	5	3	4	0	2	0
July	30.01	30.27	28.92	1.35	81.0	87.0	74.9	12.1	103	64	39	82	6	7.27	14	5.01	11.2	104	4	5	1	2	3	5	5	6	0	1	0
August	29.98	30.24	29.27	.97	80.9	87.2	74.6	12.6	99	62	37	83	5	7.16	14	9.60	10.3	80	5	7	2	3	2	3	4	5	0	2	0
September	29.99	30.25	28.51	1.74	78.0	84.7	71.4	13.3	98	49	49	80	5	5.23	9	7.68	11.8	103	7	10	3	2	2	1	2	3	0	2	0
October	30.03	30.54	28.76	1.78	69.9	77.3	62.5	14.8	95	35	60	76	4	4.08	6	6.58	12.6	120	8	12	2	1	2	1	1	4	0	1	0
November	30.11	30.59	29.60	.99	60.2	68.0	52.3	15.7	81	25	56	78	4	3.74	7	7.66	12.9	62	7	9	5	2	1	1	2	3	0	1	1
December	30.15	30.68	29.03	1.65	54.0	61.5	46.4	15.1	77	14	63	81	5	4.17	10	4.32	13.4	80	7	7	4	2	2	2	2	5	0	3	2
Mean	30.05				67.9	74.5	60.8	13.6				80	5				12.7												
Total														56.25	113				66	84	38	35	27	33	30	52	0	21	13

Meteorological table compiled by the United States Weather Bureau

NEW ORLEANS, LA.

Month	Barometer at 32° F. and mean sea level				Air temperature, in °F.							Average relative humidity	Average amount of clouds, 0-10	Precipitation			Wind										Number of days with winds of 40 miles or over	Number of days dense fog
	Mean	Extremes			Mean				Extremes								Statute miles		Average number of times (observations at 8 a. m. and 8 p. m.) from—										
	For month	Highest	Lowest	Range	For month	Mean max.	Mean min.	Range	Highest	Lowest	Range			Average fall	Number of days 0.01 inch or more	Max. fall in 24 hours	Average hourly velocity	Highest velocity	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm		
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	°	%		*Ins.*		*Ins.*												
January	30.13	30.80	29.27	1.53	54.2	61.8	46.6	15.2	82	15	67	79	6	4.63	10	4.28	8.6	51	11	9	9	8	9	4	3	9	0	[1] 0	4
February	30.09	30.71	29.13	1.58	57.3	65.1	49.5	15.6	83	7	76	78	6	4.47	9	5.71	9.1	52	11	9	6	9	5	6	3	7	0	0	2
March	30.04	30.71	29.44	1.27	62.8	70.6	55.0	15.6	86	30	56	78	5	5.30	9	8.66	9.1	45	8	6	7	13	12	5	6	5	0	0	3
April	30.00	30.48	29.50	.98	68.8	76.5	61.1	15.4	90	38	52	77	5	4.91	7	9.22	8.8	48	7	7	6	17	11	4	4	4	0	0	1
May	29.97	30.38	29.62	.76	75.4	83.0	67.8	15.2	96	52	44	76	5	3.88	9	6.94	7.4	48	6	9	5	16	12	6	3	5	0	0	[1] 0
June	29.98	30.34	29.63	.71	80.6	87.8	73.4	14.4	102	58	44	77	5	6.16	13	5.48	6.5	50	4	7	3	13	12	9	8	4	0	0	0
July	30.00	30.29	29.41	.88	82.4	89.3	75.4	13.9	102	66	36	79	6	6.47	15	7.52	6.0	42	3	4	5	9	11	14	12	4	0	0	0
August	29.98	30.29	29.43	.86	82.2	89.0	75.4	13.6	100	63	37	80	6	5.61	14	8.90	5.9	60	4	7	6	10	11	10	9	4	1	0	0
September	29.98	30.31	28.11	2.20	79.2	86.0	72.5	13.5	98	54	44	79	5	4.81	10	8.20	7.2	86	9	13	7	10	8	4	4	4	1	0	0
October	30.03	30.55	29.21	1.34	71.0	78.1	64.0	14.1	94	40	54	77	4	2.93	7	7.79	7.6	54	12	17	10	8	4	2	3	6	0	0	1
November	30.10	30.68	29.62	1.06	61.6	69.1	54.0	15.1	89	29	60	78	5	3.79	7	4.39	8.1	42	11	14	9	9	6	2	3	5	1	0	3
December	30.13	30.71	29.55	1.16	55.6	63.2	48.1	14.8	83	19	64	80	6	4.46	10	4.83	8.5	48	11	16	10	7	4	2	5	7	0	0	2
Mean	30.04				69.3	76.6	61.8	14.7				78	5				7.7												
Total														57.42	120				97	118	83	129	105	68	63	64	3	0	16

[1] Mean less than 0.5.

Meteorological table compiled by the United States Weather Bureau

GALVESTON, TEX.

Month	Barometer at 32° F. and mean sea level				Air temperature, in °F.							Average relative humidity	Average amount of clouds, 0-10	Precipitation			Wind											Number of days with winds of 40 miles or over	Number of days dense fog
	Mean	Extremes			Mean				Extremes								Statute miles		Average number of times (observations at 8 a. m and 8 p. m.) from—										
	For month	Highest	Lowest	Range	For month	Mean max.	Mean min.	Range	Highest	Lowest	Range			Average fall	Number of days 0.01 inch or more	Max. fall in 24 hours	Average hourly velocity	Highest velocity	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm		
	Ins.	Ins.	Ins.	Ins.	°	°	°	°	°	°	°	%		Ins.		Ins.													
January	30.13	30.90	29.43	1.47	53.8	59.2	48.3	10.9	75	11	64	84	5	3.62	10	3.61	11.6	64	9	7	8	16	8	4	3	7	0	1	6
February	30.07	30.94	29.19	1.65	56.3	61.6	51.0	10.6	76	8	68	84	5	3.10	9	3.79	11.9	59	9	7	9	13	8	2	2	6	0	1	4
March	30.01	30.61	29.18	1.43	62.4	67.4	57.4	10.0	85	30	55	84	6	2.90	8	3.98	11.7	61	6	5	7	22	12	2	2	6	0	1	5
April	29.97	30.53	29.36	1.17	68.7	73.3	64.1	9.7	85	41	44	83	6	3.13	7	9.23	12.1	72	6	5	6	22	12	3	2	4	0	1	1
May	29.94	30.41	29.52	.89	74.8	79.2	70.4	8.8	93	52	41	80	5	3.23	6	6.13	11.3	60	3	5	7	29	12	2	1	3	0	1	0
June	29.95	30.27	29.50	.77	80.7	85.2	76.3	8.9	99	57	42	79	4	4.75	7	6.40	10.1	62	2	4	3	21	20	4	4	2	0	0	0
July	29.98	30.26	29.59	.67	83.4	88.0	78.8	9.2	99	66	33	78	4	3.98	9	14.35	8.9	68	3	1	1	13	25	10	5	3	1	0	0
August	29.96	30.25	28.63	1.62	83.0	87.7	78.3	8.4	98	67	31	78	5	5.01	9	9.05	8.5	93	2	3	4	14	24	8	5	2	0	0	0
September	29.98	30.31	28.55	1.76	70.1	84.8	75.4	9.4	94	54	40	76	4	5.41	9	10.00	9.8	84	8	8	6	17	12	2	2	5	0	0	0
October	30.03	30.57	29.39	1.18	72.7	77.7	67.7	10.0	91	41	50	76	4	4.18	7	14.10	10.2	62	12	12	8	13	8	1	2	5	1	0	0
November	30.09	30.68	29.38	1.30	63.3	68.6	58.0	10.6	85	26	59	80	4	4.02	8	5.63	10.9	54	13	8	8	16	7	2	2	4	0	1	2
December	30.12	30.83	29.52	1.31	56.4	61.8	51.0	10.8	80	18	62	82	5	3.73	10	4.50	11.4	54	14	9	8	11	5	2	4	9	0	1	
Mean	30.02				69.6	74.5	64.7	9.8				80	5				10.7												
Total														47.06	99				87	74	75	207	153	42	34	56	2	7	3

Meteorological table compiled by the United States Weather Bureau

CORPUS CHRISTI, TEX.

Month	Barometer at 32° F. and mean sea level				Air temperature, in °F.							Average relative humidity	Average amount of clouds, 0–10	Precipitation			Wind											Number of days with winds of 40 miles or over	Number of days dense fog
	Mean	Extremes			Mean				Extremes								Statute miles		Average number of times (observations at 8 a. m. and 8 p. m.) from—										
	For month	Highest	Lowest	Range	For month	Mean max.	Mean min.	Range	Highest	Lowest	Range			Average fall	Number of days 0.01 inch or more	Max. fall in 24 hours	Average hourly velocity	Highest velocity	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm		
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	°	%		*Ins.*		*Ins.*													
January	30.10	30.93	29.41	1.52	56.0	63.1	48.8	14.3	85	16	69	84	5	2.25	8	2.00	11.2	50	14	7	7	15	9	2	2	6	0	[1]0	2
February	30.05	30.92	29.40	1.52	58.4	65.4	51.5	13.9	88	11	77	84	6	2.04	7	5.80	12.3	60	15	5	9	13	7	1	1	5	0	1	2
March	29.98	30.62	29.35	1.27	65.0	71.2	58.8	12.4	96	28	68	84	6	1.85	7	4.66	14.5	54	10	3	10	25	7	2	1	4	0	1	2
April	29.95	30.52	29.34	1.18	70.8	76.3	65.4	10.9	95	41	54	85	6	1.80	6	4.22	15.3	64	8	4	11	25	6	2	1	3	0	2	[1]0
May	29.90	30.32	29.47	.85	76.2	81.1	71.3	9.8	96	44	52	85	6	2.78	7	6.56	16.7	80	4	4	11	34	5	1	1	2	0	1	[1]0
June	29.91	30.23	29.39	.84	81.0	86.2	75.8	10.4	97	56	41	84	4	2.74	6	4.51	14.1	66	3	2	6	34	12	2	0	1	0	[1]0	[1]0
July	29.96	30.21	29.68	.53	82.7	88.2	77.2	11.0	98	65	33	82	3	1.66	5	4.35	13.1	48	1	1	2	36	17	3	1	1	0	[1]0	[1]0
August	29.93	30.23	29.07	1.16	82.5	88.1	77.0	11.1	100	65	35	85	4	2.28	5	5.13	12.4	90	2	1	4	38	13	2	0	2	0	[1]0	[1]0
September	29.95	30.34	28.65	1.69	79.7	85.4	74.0	11.4	99	53	46	83	3	4.00	9	6.18	11.5	72	7	3	8	25	8	2	1	6	0	[1]0	[1]0
October	30.00	30.58	29.51	1.07	73.2	79.4	66.9	12.5	92	41	51	81	3	2.05	7	4.17	10.9	56	14	6	11	18	4	2	1	6	0	[1]0	1
November	30.07	30.69	29.32	1.37	64.3	71.0	57.6	13.4	91	29	62	84	5	2.41	7	4.61	10.9	60	13	8	8	15	6	1	2	7	0	[1]0	1
December	30.12	30.74	29.55	1.19	58.0	64.9	51.0	13.9	87	20	67	83	5	1.32	7	2.03	10.7	41	19	7	6	8	7	1	2	12	0	[1]0	2
Mean	29.99				70.6	76.7	64.6	12.1				84	5				12.8												
Total														27.18	81				110	51	93	286	101	21	13	55	0	5	10

[1] Mean less than 1.

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