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U. S. COAST AND GEODETIC SURVEY

E. LESTER JONES, SUPERINTENDENT

UNITED STATES COAST PILOT

ATLANTIC COAST

SECTION E

GULF OF MEXICO FROM KEY WEST TO THE RIO GRANDE

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DEPARTMENT OF COMMERCE,
U. S. COAST AND GEODETIC SURVEY,
Washington, D. C., May 6, 1916.

This publication covers the coast from Key West to the Rio Grande, including the harbors and 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 1915.

This volume covers the same territory formerly included in United States Coast Pilot, Part VIII, Gulf of Mexico from Key West to the Rio Grande, of which three editions were published, the first edition having been prepared by Lieut. Glennie Tarbox, United States Navy, and Mr. John Ross.

The present volume has been prepared by Arthur J. Ela, nautical expert, under the direction of R. S. Patton, chief, coast pilot section, in the office of Herbert C. Graves, chief of division of hydrography and topography, Coast and Geodetic Survey.

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 May 6, 1916.

Navigators are requested to notify the Superintendent of the Coast and Geodetic Survey of any errors or omissions they may find in this publication, or of additional matter which they think should be inserted for the information of mariners.

E. LESTER JONES,
Superintendent.

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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 equivalent *magnetic* value 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*.

Supplements and other corrections for this volume are issued from time to time, and will be furnished, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C., provided the volume itself has not been superseded by a subsequent edition.

UNITED STATES COAST PILOT.

ATLANTIC COAST—SECTION E—GULF OF MEXICO FROM KEY WEST TO THE RIO GRANDE.

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 navigation: Charts, Coast Pilots, Tide Tables, a catalogue of these Publications, and Notice 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, and on the older ones on the face of the chart; (2) the date of the latest correction to the chart plate, *printed* in the lower left-hand corner below the border; (3) the *date of issue*, *stamped* below 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 charts are published in Notices 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 to which they are designed to subserve. The most important distinctions are the following:

1. Sailing charts, mostly on a scale of approximately $\frac{1}{1,200,000}$ 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 $\frac{1}{400,000}$ and $\frac{1}{200,000}$ intended especially for coastwise navigation.

3. Coast charts, on a scale of $\frac{1}{80,000}$ 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.

Coast Pilots, relating to the surveyed waters of the United States, Porto Rico, and a part of Alaska, and Sailing Directions of the Philippine Islands, contain full nautical descriptions of the coast, harbors, dangers, and directions for coasting and entering harbors. Similar information relating to parts of Alaska and Hawaii is published in Coast Pilot Notes.

Coast Pilots are corrected for important information received to the date of issue, which is stamped on the correction sheets accompaying the volume. 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., 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 time and height of the tides 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 my means of which the tides at more than 3,000 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.

Agencies for the sale of the Charts, Coast Pilots, and Tide 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 suboffices. 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 Office, 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. Notice to Mariners, relating to the same waters, is published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey. These

publications can be obtained free of charge on application to the Division of Publications, Department of Commerce, Washington, D. C.

USE OF CHARTS.

ACCURACY OF CHART.—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 parts 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 of 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 larger 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 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 flood or ebb tide. In some localities the rise or fall may be at a 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 refer-

ence for soundings is the mean of all low waters; for the Pacific coast of the United States and Alaska, with the two exceptions noted below, and for the Hawaiian and Philippine Islands, it is the mean of the lower low waters. For Puget Sound, Wash., the plane of reference is 2 feet below mean lower low water, and for Wrangell Strait, Alaska, it 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 tidal 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 shores of straits, especially in bights and near points.

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 of 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 bearings 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 three-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 pricked 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 caller 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 before the position is obtained.

By taking the bearings 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 cases 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 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 re-

corded. 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 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.

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 reengraved 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 copmass 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 disturbance 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, such as 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.

41794°—16——2

COAST AND INLAND WATERS, GULF OF MEXICO FROM KEY WEST TO THE RIO GRANDE.[1]

GENERAL INFORMATION.

The information contained in this volume, Section E of the United States Coast Pilot, Atlantic 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.

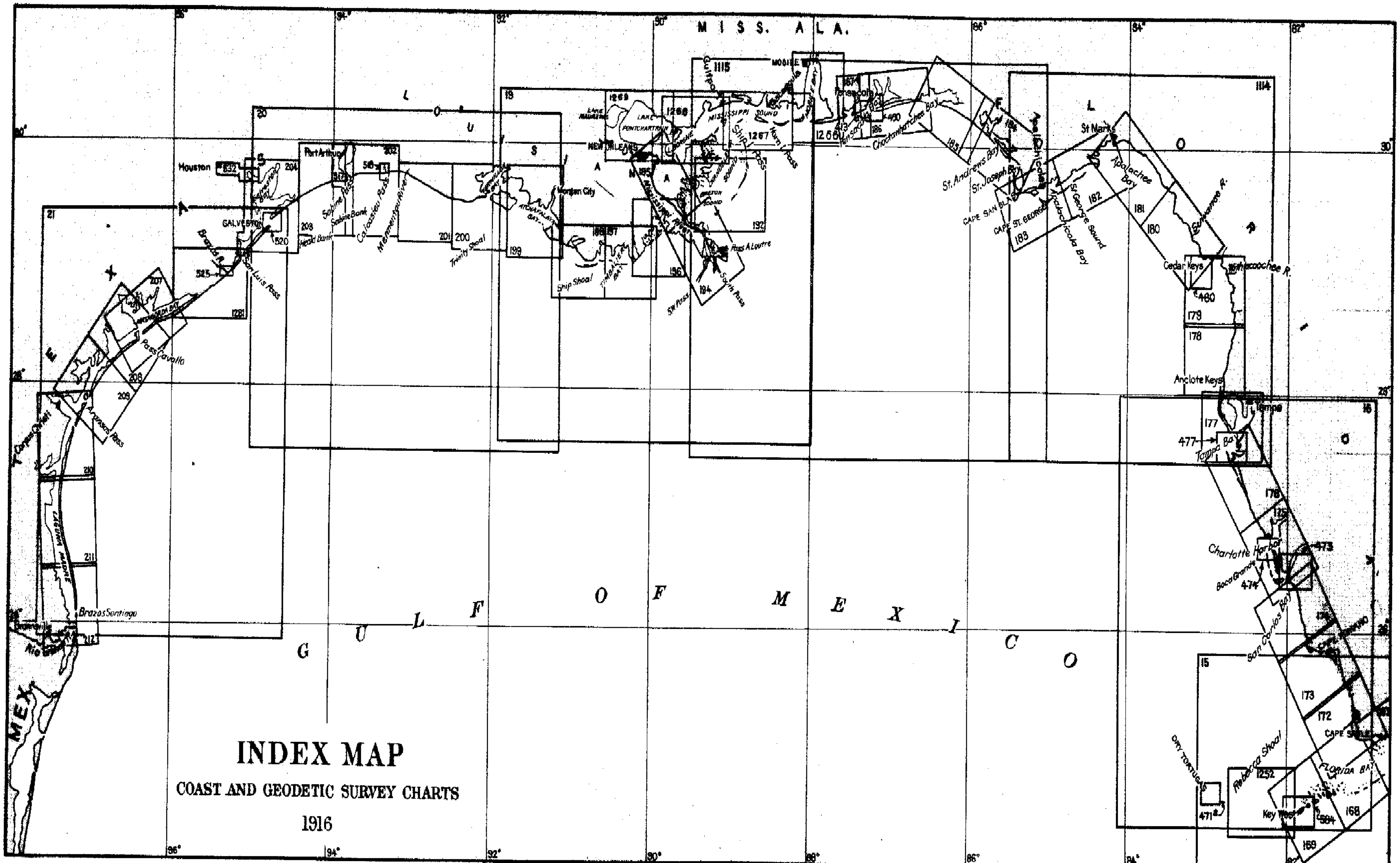
From Mississippi Sound to Galveston Bay the bottom is sand and silt, with several shoals lying well offshore, which change to some extent with severe storms; with the variable currents which are often encountered they are a serious menace to the navigator passing near them.

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 cases by jetties, to maintain or increase the present depths. Masters of vessels bound to the harbors along this coast should, in cases where the depths given in this

[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.



INDEX MAP

COAST AND GEODETIC SURVEY CHARTS

1916

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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 immediately replaced, 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.

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, published by the Lighthouse Service, which can be obtained, free of charge, from the Division of Publications, Department of Commerce, Washington, D. C.

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 of 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 the 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 had 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 twenty 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 seventy-five 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 seventy-five 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, Withlacoochee River, Carrabelle, Apalachicola, St. Andrews, Pensacola, Mobile, Pascagoula, Gulf-

port, New Orleans, Morgan City (Atchafalaya River), Sabine Pass, Galveston, and Aransas Pass.

Harbor masters are appointed for the principal ports, and they have charge of the anchorage and berthing of vessels in their respective harbors. Harbor 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 1915. 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.

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.

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 presence every summer of yellow fever at one or more points in Mexico, special quarantine regulations are regularly imposed between April 1 and November 1, for the protection of the southern ports of the United States from infection with yellow fever. 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 officers of the Public Health Service, who endeavor to enforce, wherever possible, any quarantine restrictions or measures in the port of departure which will tend to determine 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 that any special precautions enjoined may be complied with.

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

Key West, Fla.
Bocagrande, Fla.; telegraphic address Arcadia, post office address South Bocagrande.
Tampa Bay, Fla.; telegraphic address Palmetto, post office Fort de Soto.
Port Inglis, Fla.
Cedar Keys, Fla.
St. Georges Sound, Fla.; post office and telegraphic address Carrabelle.
St. Andrews, Fla.
St. Joseph, Fla.; post office address Port St. Joe.
Pensacola, Fla.
Mobile (Fort Morgan), Ala.
Pascagoula, Miss.
Biloxi (Ship Island), Miss.
New Orleans (Quarantine), La.
Galveston, Tex.

Marine hospital.—Information as to relief furnished seamen will be found in the regulations of the United States Public Health Service, which can be consulted at all stations of the service. Such stations are located at ports of any importance, and if not in charge of a service officer, relief will be provided by collectors of customs upon application.

The following stations are in charge of a service officer:

Key West (marine hospital), Fla.
Port Tampa, Fla.
Cedar Keys, Fla.
Pensacola, Fla.
Mobile (marine hospital), Ala.
Gulfport, Miss.
New Orleans (marine hospital), La.
Port Arthur, Tex.
Galveston, Tex.
Port Aransas, Tex.

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, for the navigation of certain sections of the inland waterways, and for passing plant engaged in dredging operations, 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.

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, Port Inglis, Apalachicola, St. Andrews, 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 and New Orleans 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	180	11	500
Port Inglis	do	175	7, 10	800
Apalachicola	do	100	8	250
Pensacola	do	110	9, 14	300
Alabama: Mobile	Dry dock	390	18	4, 300
	Railway	[1] 213	13	1, 300
Mississippi: Pascagoula	do	150	10	400
Louisiana:				
New Orleans	Dry dock	370	21	5, 000
	Dry dock (Govt.)	[1] 525	28	14, 000
Berwick	Railway	150	8	300
Texas:				
Orange	do	160	6, 15	1, 500
Galveston	do	[1] 90	12, 16	300

[1] Length over blocks.

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.

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 degrees 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 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 west 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 on the coasts of the United States and the Great Lakes.

Small craft warning.—A red pennant indicates that moderately strong winds are expected.

Storm warning.—A red flag with a black center indicates that a storm of marked violence is expected.

The pennant displayed with the flag indicates the direction of the wind—white, westerly; red, easterly. The pennant above the flag indicates that the wind is expected to blow from the northerly quadrants; below, from the southerly quadrants.

By night a red light indicates easterly winds, and a white light below a red light, westerly winds.

Hurricane warning.—Two red flags with black centers, displayed one above the other, indicate the expected approach of a tropical hurricane, or of one of those extremely severe and dangerous storms which occasionally move across the Great Lakes and northern 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, Santo Domingo, Turks Island, Bermuda, Haiti, Curacao, Porto Rico, St. Kitts, Dominica, Barbados, Trinidad, and Cuba. Neither small craft nor hurricane warnings are displayed at night.

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

FLORIDA:
- Apalachicola.
- Bocagrande.
- Carrabelle.
- Cedar Keys.
- Clearwater.
- Egmont Key.
- Fort Myers.
- [a] Key West.

FLORIDA—Continued.
- Key West, corner Caroline and Elizabeth Streets.
- Key West, No. 611 Front Street.
- Key West, Ruy Lopez Cigar Factory.
- Palmetto.
- Panama City.
- [a] Pensacola.

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

FLORIDA—Continued.
- Pinewood.
- Port Inglis.
- Port Tampa.
- Punta Gorda.
- Puntarasa.
- Rockwell.
- St. Petersburg.
- Sand Key.
- Santa Rosa Island.
- Sarasota.
- South Bocagrande.
- [1] Tampa.
- Tampa, Sedden Island.
- Tarpon Springs.

ALABAMA:
- Coden.
- Fort Morgan.
- [1] Mobile.
- Mobile, Turner-Hartwell Docks.

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

LOUISIANA:
- [1] Burrwood.
- Empire.

LOUISIANA—Continued.
- Morgan City.
- [1] New Orleans.
- Pilot Town.
- Salmen.
- West End.

TEXAS:
- Anahuac.
- Brazosport.
- [1] Corpus Christi.
- [1] Galveston.
- Glen.
- Harrisburg.
- Laporte.
- Matagorda.
- Morgan Point.
- Palacios.
- Point Isabel.
- Port Aransas.
- Port Arthur.
- Port Bolivar.
- Port Lavaca.
- Port O'Connor.
- Rockport.
- Sabine Pass.
- Seabrook.
- Texas City.
- Velasco.

Note.—The Weather Bureau station at Sand Key, Fla., is equipped for day and night communication with passing vessels. The International Code is used by day and the Morse Code, flash-light, by night. Messages to or from vessels will be forwarded to destination.

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 estimated velocity on the Atlantic coast between Hatteras and the island of Cuba is 5 to 15 miles per hour. They cover simultaneously an approximate circular area from 150 to 500 miles in diameter. At the center, the area of lowest barometer, which is from 10 to 20 miles in diameter, comparative 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 Caribbean Sea and take a westerly or northwesterly course. Some curve gradually northward, 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 northward or northeastward so as to strike the coast somewhere between Tampa,

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

Fla., 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 usually 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 or 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 disturbances, 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 and 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 maneuver should 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 hurricane, the barometer will rise and the wind and sea subside.

RADIO SERVICE.

The United States naval coastwise radio stations and all ships of the United States Navy equipped with radio apparatus are open for commercial business. Information concerning regulations, rates, and the commercial work of the stations may be obtained by addressing the Superintendent, Naval Radio Service, Radio, Va. Hydrographic information, weather reports, storm warnings, and time signals are sent out from the stations for the benefit of shipping.

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 at noon of the seventy-fifth meridian time on the Atlantic coast and at noon of the one hundred and twentieth meridian time on the Pacific coast. The signals begin at 11.55 and continue for five 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 noon signal is a longer contact after this long break. Similar time signals are also sent at 10 p. m. from some of the stations.

The supervision of radio communication in the United States 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, revenue cutters, vessels of the United States Navy, and amateurs, and the radio laws and regulations of the United States are published by that bureau, and either publication can be obtained from the superintendent of documents, Government Printing Office, Washington, D. C., price 15 cents each. Changes or additions to the stations 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 includes the stations of the United States, excepting amateurs, and contains additional information, such as geographical location, normal range in nautical miles, radio system, and rates. Persons desiring this list should communicate direct with the International Bureau of the Telegraphic Union (Radiotelegraphic Service), Berne, Switzerland. The price is 60 cents per copy, not including postage. The rates of postage are: One copy, 24 cents; 2 copies, 36 cents; 3 copies, 48 cents.

UNITED STATES COAST GUARD STATIONS.

Coast Guard stations are maintained at the places named in the following table. The stations are manned annually from August 1 to May 31, 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. Where telephone or telegraph facilities are available, requests for a tug or Coast Guard cutter will be received and promptly forwarded.

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 gunwale 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.

The difficulties of rescue by operations from the shore are greatly increased in cases where the anchors are let go after entering the breakers, as is frequently done, and the chances of saving life correspondingly lessened.

Name of station.	State.	Locality.
Santa Rosa	Fla.	Santa Rosa Island, 3 miles east of Fort Pickens.
Sabine Pass	Tex.	West side of pass, south of light.
Galveston	Tex.	On Pelican Spit, west side of channel entrance.
San Luis	Tex.	West end of Galveston Island.
Velasco	Tex.	Inside the mouth of Brazos River.
Saluria	Tex.	Northeast end Matagorda Island.
Aransas	Tex.	Northeast end Mustang Island.
Brazos	Tex.	North end Brazos Island, entrance to Brazos, Sanitago.

VARIATION OF THE COMPASS.

The magnetic variations for 1918 and annual increase at points mentioned are as follows:

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

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 nine 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 three to four hours later than at Key West. Extreme tides from 2½ feet below to 5½ 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 3½ 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.

Practically no tide ascends the Mississippi River above the Head of Passes. There is, however, a large fluctuation in the level due to the condition of the river. At New Orleans the mean annual fluctuation 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 50 cents for the general tables and 10 cents for the Atlantic coast reprint.

INLAND WATERWAYS.

Key West to New Orleans.—There are several detached stretches of inside waters, available for drafts of 4 to 5 feet, and a partially sheltered route with frequent harbors for small craft along the entire coast from Key West to New Orleans. Detailed descriptions are given under various headings elsewhere in this volume and are also given, with maps, in the Inside Route Pilot, Key West to New Orleans, 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
Cook Key, via Big Marco River and Pass, inside	11	4
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 Tampa Bay entrance, outside	58	.....
Tampa Bay entrance to Anclote Keys, inside	48	5
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, and Lake Borgne 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. These are described under the heading, Inland Waterways of Louisiana West of the Mississippi River, on page 120.

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, by way of several extensive bays and dredged canals connecting them. It is described under the heading, Inside Route, Galveston to Corpus Christi, on page 146. Beyond Corpus Christi there is no inside route.

Mississippi River and Great Lakes.—A draft of 4½ feet, 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 113.

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

Vessels of 7 feet 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 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, Albermarle and Pamlico Sounds, Neuse River, Adams Creek, canal to Core Creek, and Newport River. A draft of 3 feet 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 draft can pass inside from Winyah Bay, S. C., to St. Johns River, Fla. All bridges have draw openings.

Vessels of 4 feet 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 draft. Cuts with a depth of 5 feet have been made in places so that vessels of 4 feet 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 1½ to 4 feet draft (depending on the rainfall) have been taken across Florida by way of some of the drainage canals, Lake Okeechobee, and Caloosahatchee River, but owing to low stages of Lake Okeechobee in recent years, the route had become impracticable.

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, New York to Key West.

Tide Tables, Atlantic coast ports of the United States.

CURRENTS.

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 4¼ to 11½ 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 2¼ 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 mean position of the axis of the Gulf Stream, or the point where the greatest velocity may be found:

	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 Cay.

Station.	Distance east of Fowey Rocks.	Mean surface velocity observed.	Maximum daily variation observed.
	Miles.	*Miles.*	*Miles.*
1	8	2.66	2.38
1½	11½	3.46	1.83
2	15	3.16	1.67
3	22	2.73	.56
4	29	2.12	.58
5	36	1.71	.95

Between Rebecca Shoal and Cuba.

Station.	Distance south of Rebecca Shoal.	Mean surface velocity observed.	Greatest daily variation observed.
	Miles.	*Miles.*	*Miles.*
1	20	.30	.62
2	35	.74	1.15
3	50	2.24	.60
4	68	2.23	.80
5	86	.77	.82

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 againt 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 recent 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 noticeably 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 barometric 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.

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. On the eastern side of the harbor is the city of Key West, which is of some comercial importance. It 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 greatest draft of vessels coming to the port is 26½ feet and the average draft about 14 feet.

Sand Key Lighthouse is a brown, pyramidal, skeleton tower, on pile foundation, inclosing dwelling and stair cylinder. The light is group flashing white (flash 3 seconds, eclipse 1 second, flash 3 seconds, eclipse 3 seconds), with four red sectors, 109 feet above the water, and visible 16 miles. There is a Weather Bureau station here, equipped for day and night communication with passing vessels. The International Code is used by day and the Morse Code, flash light, by night. Messages to or from vessels will be forwarded to destination. Storm warnings are displayed here.

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

Northwest Passage Lighthouse is a white dwelling on brown pile foundation, standing in 4 feet of water, at the northwesterly entrance to Northwest Channel. The light is unwatched, group flashing white (flash 0.5 second, eclipse 1.5 seconds, flash 0.5 second, eclipse 7.5 seconds), 47 feet above the water, and visible 12 miles.

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) is midway between the entrance buoys of the Main Ship Channel and Key West Lighthouse, and can be readily distinguished from outside the reefs.

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 leading 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 over the coral heads, and it is not recommended for vessels of over 13 feet 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 30.5 feet for a width of 300 feet and is well marked by buoys and lights. This channel is used by the deeper-draft steamers and by strangers.

Southwest Channel is convenient for vessels approaching from southwestward; it has a navigable depth of 24 feet, if closely followed, and is marked by several buoys. Vessels of 16 feet 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 June, 1915, had a depth of 18 feet and width of 200 feet; it can be used by vessels of 16 feet draft. This channel affords a short cut from Key West Harbor to the Gulf of Mexico and is well marked.

Anchorage.—The best anchorage is in the inner or Man-of-War Harbor, where the depth is 3½ to 4½ fathoms; 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, 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 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 20.

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.

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, two dollars per foot; for steamers or vessels drawing from 6 to 10 feet, three dollars per foot; for steamers or vessels drawing from 10 to 14 feet, four dollars per foot; for steamers or vessels drawing from 14 to 20 feet, five dollars per foot; for steamers or vessels drawing over 20 feet, six dollars 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 ten dollars for dropping from one anchorage to another and those drawing over 14 feet shall pay the sum of twenty dollars.

Wharves.—The depth at the wharves ranges from 10 to 26 feet, according to locality.

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 and at Sand Key light station.

Tides.—The mean rise and fall of tides 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 30.5 feet deep has been cleared of shoals.

Key West Entrance gas buoy is moored in about 15 fathoms on the Main Ship Channel range, 4¼ miles eastward of Sand Key lighthouse. Buoys Nos. 1 and 2 mark the 24-foot 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 a pyramidal, horizontally slatted structure which surmounts the storehouse on the Lighthouse Service wharf; the structure is black, with a white stripe on the seaward face extending down the roof and side of the building. 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 buoys Nos. 11 and 8 at distances of about 200 yards each. Continue the course ⅜ mile past the latter buoy and anchor in 4 to 5 fathoms.

Or, from abreast buoy No. 8, steer 28° true (NNE ¼ E mag.), giving the wharves a berth of about 100 yards, to an anchorage in Man of War Harbor.

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 14 feet.

When Northwest Passage Lighthouse is distant 7 or 8 miles, bring it to bear 182° true (S mag.) and steer for it until up to the entrance bell buoy, passing about 1¼ miles eastward of **Smith Shoal gas and whistling buoy. Northwest Bar light** will then be in range with Sand Key Lighthouse, bearing 175° true (S ⅝ E mag.), the latter barely showing over Snipe Key.

Passing close westward of the bell buoy, steer 175° true (S ⅝ E mag.) and pass midway between the red and black buoys until within ¼ mile of Northwest Bar light and abreast of buoy No. 4. Then leave buoys Nos. 3, 5, and 7, about 200 feet on the port hand, steer 115° true (ESE mag.) and pass midway between buoys Nos. 9 and 6.

Passing about 100 yards eastward of the latter buoy, steer 136° true (SE ⅛ E mag.) for 2¼ miles with Key West lighthouse ahead, until up to a perpendicularly striped buoy, passing close westward of buoy No. 11. Then steer 146° true (SE ¾ S mag.) for ¾ mile, with Middle Ground light ahead. Pass about 100 yards westward of buoy No. 13, and steer 155° true (SSE ½ E mag.) for 1 mile, with Eastern Triangle light ahead, to Inner Mid-Channel buoy, which lies 350 yards southwestward of Middle Ground light. Then a 129° true (SE ¾ E mag.) course, with the house on the outer end of Fort Taylor wharf, or Key West front range light, ahead will lead in a depth of 14 feet over the southern end of Middle Ground. Then steer more eastward and anchor, or stand for the city wharves, passing southward of buoy No. 13.

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 the 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 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 1.5 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. There is a crooked but protected passage, good for a draft of 3½ feet at low water, across this shoal area from Key West to Boca Grande Channel. From near the perpendicularly striped buoy off the Middle Ground in Northwest Channel it leads about ⅝ mile northeastward, and ⅜ mile north, of **East Crawfish Key**, ⅜ mile south of Snipe Key, and ½ mile north of **Barracouta Key**. Then the course is about west to the narrow channel which leads in a southwesterly direction past the northwestern end of Boca Grande Key.

From near Snipe Key there is a channel, good for 4 feet, leading southward to West Channel, passing ⅜ mile westward of **West Crawfish Key**.

Another channel, good for a draft of 3½ feet at low water, leads southward to West Channel from a position 5 miles west of Barracouta Key. Keep the small key (locally known as **Ballast Key**) eastward of **Man Key** a little on the starboard bow, taking care to avoid a shoal on the starboard hand, which extends ¾ mile northward from Ballast Key. When east of the northern end of Ballast Key, pass through a narrow opening in the shoal (30 feet wide), heading for the key, and then continue southward.

These passages are unmarked, but the dangers are readily discernible.

Boca Grande Channel, lying about 15 miles westward of Key West between Boca Grande Key and Marquesas 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. Boca Grande Channel is good for a depth of about 11 feet and is buoyed, but it is used only by local boats of about 6 feet or less draft. A north (mag.) course will lead through the buoyed channel.

Marquesas Keys are a number of keys, roughly circular in outline, lying westward of Boca Grande 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 curves is about 4½ miles, with depths of only 2 to 6 feet over it in spots. At the western end of The Quicksands is **Half Moon Shoal,** with a least depth of 10 feet on it, and marked at its western extremity by a red buoy.

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. Its western extremity is marked by a gas and whistling buoy. On the northern side of New Ground the water shoals abruptly, and the least depth that can be depended upon to insure clearing the shoal is 13 fathoms.

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. Spots having 19 to 22 feet over them are found 7 miles eastward of New Ground, and the bottom inside of the 10-fathom 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.

Between Half Moon Shoal and Rebecca Shoal is a channel used by steamers with local knowledge drawing as much as 18 feet, 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, rising abruptly from depths of 6 to 7 fathoms. Another spot, known as **Isaac Shoal,** lies nearly 2 miles southeast by east from Rebecca Shoal and has a least depth of 16 feet. 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 2 hours after the time of low water at Key West, and slack water before the ebb (southerly) occurs 2 hours after the time of high water at Key West. The average velocity of the current at strength is ¾ 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 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 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; but there are indications that the line of reefs and shoals, lying 5½ miles southward of the main chain of keys, extends westward to Dry Tortugas. Until more detailed surveys have been made 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 ⅞ W mag.) from Rebecca Shoal lighthouse. A vessel is also reported to have struck an obstruction with about 18 feet over it 11 miles 147° true (SE ⅞ 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 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 ¾ 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 is as close as any vessel should approach, unless sure of her position.

Tortugas Harbor light, on Garden Key, is an unwatched, flashing white light (light 0.4 second, eclipse 1.6 seconds), 67 feet above the water and visible 14 miles.

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 above the water and visible 19 miles.

There are three buoyed channels known, respectively, as Southeast, Southwest, and Northwest, 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 greater than the draft. Northwest Channel shows evidences of a little less broken ground than either of the other two. Southeast Channel is the one generally used.

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 or more, but it should be used with caution by vessels drawing over 18 feet.

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, but it has not been closely developed outside of buoy No. 2.

Northwest Channel leads between the detached reefs which extend 4 miles northward of Garden Key. It is not recommended for vessels drawing over 18 feet. The buoys which formerly marked the channel a little eastward of the present buoyed channel have been removed.

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. 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. 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, but it has not been closely developed. Depths of less than 10 fathoms 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. 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 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, 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 draft. The western part of the bay is comparatively clear, with depths ranging from 7 to 13 feet, 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 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. Then a 19° true (N by E ½ E mag.) course for 3¾ miles leads to a position 200 yards eastward of another beacon. Then a 356° true (N ½ W mag.) course for 25 miles leads ½ mile off Cape Sable Northwest Cape.

Inside passage for small craft.—For small craft coming from the east coast of Florida and desiring to cross Florida Bay to the west coast there is a passage, between shoals which afford shelter from heavy seas, from **Upper Matecumbe Key** in a general west by north (mag.) direction to Cape Sable. For the greater part of the distance the depth is 6 feet or more; but in the crossings through the shoals there are several narrow and crooked, rocky, passes with least depths of 2½ feet at low tide and 5 feet at high tide, in which the bottom is covered with sea feathers, sponges, and crawfish. These passes are unmarked and difficult to find, especially during the winter months, when the water is murky; consequently this passage is not recommended for strangers.

Another route which offers almost equal protection from heavy sea and with fewer difficulties, leads westward from a position ½ mile northward of **Channel Key**, for 5½ miles, around the western end of **West Horse Neck Shoal**. Then a 342° true (N by W ¾ W mag.) course, for about 22 miles, leads ¼ mile off Cape Sable Middle Cape. West Horse Neck Shoal is discernible at some little distance. Good anchorage can be had on the south side of the shoal.

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 or less. With local knowledge 3 to 7 feet 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 draft in the southern half of the entrance, from ¼ to ½ 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 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.

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 ⅜ to ½ 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. Approaching from northward, keep at least 3 miles offshore until a northeast course will clear the south shore of the bay from ⅜ to ½ 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 or north or south, and the shoal northwest of the position will afford considerable protection from that direction. Boats drawing over 4 feet 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.

Chokoloskee is a post office and small settlement 2 miles up a bayou, the entrance to which is about 5½ miles above Pavilion Key.

Indian Key Anchorage, 38 miles northwestward of Northwest Cape and 10 miles below Big Marco River, is well protected from all winds and is good for drafts under 7 feet. The anchorage is easily entered during daylight and presents no difficulties after Indian Key, at the entrance, has been made out; but until this key has been positively identified one should proceed cautiously. **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 northeastward 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 extend close to it. A red buoy lies 3½ miles south-southwestward from Indian Key and 9½ miles 61° true (NE by E ¼ E mag.) from Cape Romano Shoals whistling buoy, and serves as a guide to the anchorage. From this buoy the course is about 28° true (NNE ¼ E mag.). Leave Indian

Key 200 yards on the port hand, and when 500 yards past the key a mid-channel course (about northeast) will lead to the anchorage, about 1 mile from the key, where a depth of 14 feet, gravel bottom, may be obtained.

Everglade is a post office up the bayou which enters the Gulf 2½ miles northwestward of Indian Key.

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 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 shoal. 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; vessels of less draft can stand well up and anchor in 7 to 8 feet, southeastward of the cape.

Caximbas 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. Persons acquainted with Caximbas Pass can be found at Key West, Puntarasa, and the intervening settlements.

Big Marco Pass and River afford at high water a safe passage inside of Cape Romano for small vessels of about 6 feet 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 **Gullivans 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 at mean low water. The channel is very narrow and crooked and is marked only by snags and bushes that have lodged on the shoals along its sides. The southern approach is across a shoal having a least depth of 4 feet 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 can be taken through the river, but good local knowledge is necessary.

Approaching from southeastward **Coon Key** can be seen 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 off 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 the key it can be recognized by its large quantity of high, dead timber, both the amount and the height of which appear to exceed that of 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. In entering leave the light on the port hand. When rounding **Goodland Point** follow the west shore, and when up to the point 2 miles northwestward where the channel divides, follow the south shore. Chart 173 is the guide.

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 had. 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. Pilots can be found at Marco.

Gordon, Big Hickory, and **Big Carlos Passes,** 25, 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. With the exception of a small light on **Black Island,** at the head of Big Carlos Pass, 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 light. A draft of 9 feet can be taken to a safe anchorage inside the entrance; 5 feet can be taken to the settlement of **Carlos,** 2¾ miles from the mouth; and 4 feet 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 fixed white, varied by a white flash (fixed 75 seconds, eclipse 19.3 seconds; flash 6.4 seconds, eclipse 19.3 seconds), 98 feet above the water, and visible 16 miles.

SAN CARLOS BAY (CHART 473)

is 110 miles 356° true (N ⅝ 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, 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 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 buoys and Punta Rasa range lights mark its axis. The front structure of the range is a white building on pile foundation; seen from seaward it is projected against a dark background, and shows well for 7 miles.

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

There is a narrow buoyed channel, with a least depth of 11 feet, 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. A draft of 12 feet can be taken to the wharf.

St. James City is a post office and small winter resort on the south end of Pine Island, 3½ miles westward of Punta Rasa.

Anchorage.—Good anchorage for vessels of too great a draft to enter the bay can be found in 15 to 25 feet, 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, 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 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 can generally 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.

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 buoys. The bank on the northeast side of the channel is very shallow and even bare in places. Hold Punta Rasa range until 150 yards past buoy No. 10, and then steer 7° true (N ½ E mag.) to a position off the wharves at Punta Rasa.

CALOOSAHATCHEE RIVER (CHART 473)

rises in Lake Okechobee 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 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 1915 it had a least depth of 9 feet. For 6 miles above Fort Myers the depth at low water is 5 feet, 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 at several places in its upper reaches.

The Caloosahatchee River is tidal as far as Labelle and has a mean range of about 1.6 feet from its mouth to that point. Freshets, lasting usually about two weeks, occur during the summer and early fall months and raise the river from 4 to 17 feet, depending upon the locality. Strong currents are prevalent in the upper reaches, especially during high river stages. Below Fort Myers there are strong currents at ebb tide 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 Okechobee and south to Cape Sable. It is the terminus of a railroad, and is connected with Tampa 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 Okechobee, there is communication with Fort Lauderdale, on the Atlantic coast. Drafts of from 5 to 10 feet can be taken to the various wharves at Fort Myers.

Fresh water, provisions, gasoline, and some ship chandlery can be had. Bituminous coal in small quantities can be had 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 (6 feet 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 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. Four drawbridges cross the stream, the first at a point 4 miles above Fort Myers and the others at Alva, Fort Denaud, and Labelle. All have draw openings 50 feet or more in width.

Directions, Caloosahatchee River to Fort Myers.—From the lower wharf at Punta Rassa steer 2° true (N. mag.) until up to the first one

of three small keys on the port hand and about midway between it and a small key on the starboard hand. Then head for a black beacon at the entrance to the first river cut. From this point the course follows the dredged channel, which is well marked by beacons and ranges. Chart 473 is the guide. Follow the ranges closely and pass the beacons (other than ranges) about 50 to 100 feet on their proper sides, being guided by the difference in color of the water—deepest where it is darkest.

INLAND ROUTE ACROSS SOUTH FLORIDA.

Boats of 1½ to 4 feet draft have been taken from the Gulf to the Atlantic by way of San Carlos Bay, Caloosahatchee River, Caloosahatchee Canal, Lake Hicpochee, Three-mile Canal, Lake Okechobee, North New River Canal, and New River. The approximate distance from San Carlos Bay to Lake Hicpochee is 67 miles, to Lake Okechobee 73 miles, and to Fort Lauderdale, on the Atlantic coast, 150 miles.

In 1916 this route had become impracticable because of lowered water level in Lake Okechobee, but improvements were in progress to secure a depth of about 3 feet throughout its length.

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, 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 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, but for a greater draft he should take a pilot.

Captiva Pass, leading from the Gulf into Pine Island Sound at a point 6 miles southward of Boca Grande, is good for a draft of 6 feet, 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 deep, south of a small point in Pine Island Sound, ½ 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 ½ 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.

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 deep, and vessels of about 24 feet draft have been taken out.

A channel, originally 200 feet wide and 12 feet 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 1915 a draft of 10 feet could be taken to the mouth of the river and 7 to 9 feet to 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 24 feet or more along the face of the south dock (No. 1), a dredged depth of 21 feet along the south side of the north dock (No. 2), and 12 feet along its face and north side.

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, mud bottom. It is reached by a dredged channel, about 20 feet wide and 8 to 9 feet deep, running east and west, about 200 yards south of the wharf.

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 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, 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 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 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 draft for a distance of 12 miles above its mouth.

Punta Gorda, on the south bank of Peace River near its mouth, has railroad communication with the interior of the State and with Fort Myers. There is a depth of 9 feet at low water at the city wharf (the longest wharf), and 7 to 8 feet at the railroad wharf, east of the city wharf. Fresh water, gasoline, and some supplies can be obtained. Minor repairs to engines and machinery can be made, and there are lift ways of limited capacity. A draft of 7 feet can be taken to **Cleveland**, 3 miles above Punta Gorda on the same bank. There is a marine railway here of about 50 tons capacity, on which vessels of 5 feet draft can be hauled out.

Charlotte Harbor and **Harbor View** are two villages on the north bank of Peace River opposite Punta Gorda.

Prominent features.—In approaching the entrance to Charlotte Harbor from the southward or southwestward, a water tank, 136 feet high, and a yellow chimney, 125 feet high, ⅜ 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), 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 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. 20.) Rates of pilotage to South Bocagrande are as follows:

	Per foot.
Under 6 feet	$2.00
6 to 8 feet	2.50
8 to 15 feet	3.00
All over 15 feet	3.50

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 suitable depth can be found. Good depths for small craft close inshore can be found anywhere within 1½ miles northward of the entrance and ½ 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 can be obtained at South Bocagrande. There is no supply of coal or water, but either can be brought by rail from the town of **Arcadia** on short notice.

Minor repairs only to machinery and hulls of small craft can be made at South Bocagrande. See also Punta Gorda and Cleveland preceding.

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

Tides and currents.—The mean rise and fall of the tides 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 and obliterate all traces of the normal tidal action.

The tidal currents in the entrance channel have considerable strength, especially on the ebb tide, and are 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 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 for a width of nearly ⅜ mile, and a depth of 24 feet in a dredged channel, 300 feet wide. It is marked by buoys and range beacons. A draft of 15 feet 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. From buoy No. 4 steer 67° true (NE by E ¾ E mag.), being guided by the buoys, and pass a little over ¼ mile southward of Gasparilla Island lighthouse.

A break in the shoal along the north side of the Bocagrande Channel forms what is known as the **Swash Channel**, a narrow passage 6 feet deep, close to the south 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.

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 **Stump Pass**, 10 and 13 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.

Sarasota Pass, Sarasota Bay, and **Little Sarasota Bay** are connecting bodies of water, or lagoons, extending southeastward from the lower part of Tampa Bay, for a distance of 28 miles, to Casey Pass, 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 5 feet from Tampa Bay to Sarasota, 15 miles, and 3 feet to Casey Pass, and to the landing of **Venice**, a mile eastward of Casey Pass. The channel is well marked by beacons and is easily followed.

There are several inlets and passes from the Gulf to Sarasota and Little Sarasota Bays, all of which are subject to change both in position and depth. They are not marked, and the only guides to them are the color of the water and the breakers. Strangers should not attempt to enter except with a smooth sea and a rising tide, and then only after a careful inspection.

Casey Pass, depth 3½ feet, and **Little Sarasota Pass**, depth 5 feet, 31 and 23 miles, respectively, southeastward of Tampa Bay, are used occasionally by small local fishermen, but are very crooked and should not be attempted by a stranger.

Big Sarasota Pass lies 17 miles southeastward of Tampa Bay, between Sarasota Key and the small islets northwestward, and in 1915 had a least depth of 6 feet on the bar. In coming from the southward it can be recognized when nearly up to Sarasota Point, the low sandy extremity of Sarasota Key, by a high-water tower at Sarasota and a hotel and windmill on Bird Island. This pass is the most difficult of any of its depth on this coast, the difficulty lying in the approach to the pass, where the channel for a distance of about 1 mile runs nearly parallel to the beach, between it and a shifting shoal, on which the sea usually breaks, and over a shifting bar. After the bar has been crossed the channel can be followed easily.

Sarasota is a small town and winter resort on the easterly shore at the southern end of Sarasota Bay, and has railroad and steamer communication with Tampa. A draft of 5 feet can be taken to the wharf. Fresh water, gasoline, and some supplies can be obtained. There is a repair shop for small boats and a marine railway of 50 tons capacity which can haul out boats up to 80 feet in length.

New Pass, 14 miles southeastward of Tampa Bay, has a depth of 4 feet, but is little used.

Longboat Inlet, 5 miles southeastward of Tampa Bay, between Anna Maria Key and **Long Key**, has a depth of 5 feet on the bar in a fairly straight channel. The entrance may be recognized from the Gulf by a white house with cupola, on the south side, and several unpainted buildings on the beach on the north side. In 1915 the channel trended seaward in a south-southwesterly direction from the opening and was well defined by prominent shoals on both sides. After entering the inlet from the Gulf turn northward and keep close to the shore until abreast of the landing; then be guided by the color of the water until the staked channel is reached.

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 along its axis, between broad shoals that extend from the shores on both sides. It has a depth of 25 feet in the dredged channel, 200 feet wide, up to Port Tampa, and a draft of 26 feet 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 in an improved channel, 500 feet wide, and is well marked by buoys, some of them lighted, and by Egmont Key range lights and red sector. **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 over them. It is marked by a horizontally striped buoy, which should be given a berth of ¼ mile or more.

Southwest Channel has a depth of about 14½ feet 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 in an unmarked, shifting channel, and is used only by small local vessels.

Prominent features.—Approaching Tampa Bay entrance on a clear day a water tank, 130 feet high, located on Egmont Key, 3/8 mile south of the lighthouse, is usually the first object sighted. The tall water tank and houses near the southern end of Mullet Key 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 fixed white, 85 feet above the water, and visible 15 miles. It has two red sectors, one covering the bar bell buoy at Southwest Channel and the other the entrance range of North Channel. The fog signal is a bell striking a group of 2 strokes every 10 seconds.

Sarasota Pass and Bay are described on page 56.

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 1/2 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 13 feet can be carried to **Hookers Point,** 8 feet to **Rocky Bluff,** 9 miles above the mouth, and 3 feet to **Rye,** the head of navigation, 20 miles above the mouth. The entrance, and also the channel as far as Rocky Bluff, is marked by buoys and beacons, some of which are lighted.

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, 6 1/2 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. Fresh water, gasoline, and some supplies can be had at Bradentown.

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. 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 deep; this cut is marked at both ends by lights. **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 3 1/2 to 4 feet for a distance of 8 miles above its mouth, and 3 feet 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. This entrance is marked by beacons and lights.

Boca Ceiga Bay, on the north side of the lower part of Tampa Bay, is described on page 63.

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 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 by following the improved channel to Port Tampa as far as cut J. A draft of 15 feet can be taken to the railroad (the longest) wharf, and from 7 to 9 feet to the wharf north of it. Small craft may land at the public wharf (depth 7 feet) at the head of the basin between the long wharves, but may not remain there. There is good anchorage off the wharves in depths of 15 to 25 feet, but with a fresh breeze from any direction east of north or south this anchorage is too exposed for small vessels. Small craft find the best anchorage in **Bayboro Harbor,** an artificial basin, 1,360 feet long, 450 feet wide, and 10 feet deep, ½ mile south of the center of the city. The basin is reached by a dredged channel, 200 feet wide and 10 feet deep, running east and west, close to the north side of a sandy point, ¾ mile south of the railroad wharf at St. Petersburg. A depth of 6 feet can be carried through a dredged channel into **Coffee Pot Bayou,** 1⅛ miles north of the railroad wharf. Fresh water, gasoline, provisions, and yacht supplies can be obtained at St. Petersburg, and there are facilities for making repairs to the machinery of small craft. Vessels of about 100 tons can be hauled out.

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. The bay is generally shallow, with depths of 5 to 15 feet, except at its southern end, where there is a deep channel leading along the eastern side at a distance of ¾ 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 25 feet deep. The channel is well marked by buoys, lights, and range beacons. A dangerous rock with 20 feet 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 are depths of 18 to 24 feet 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.

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 to within 2 miles of its head. A channel 200 feet wide and 24 feet 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 deep extends upriver from the turning basin to within 100 feet of the first

bridge. A draft of 10 feet (11½ feet 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. 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 24 feet deep has been dredged eastward along the south water front of Tampa, and between it and Sedden Island to the railroad bridge, beyond which there is an uncompleted channel extending into and up **Ybor Estuary**. The ocean steamship docks are along the south water front of the city, and the docks for bay steamers and small vessels are along the east bank of Hillsboro River below the first bridge. 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 alongside 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. Vessels drawing 25½ feet have been taken to sea from Tampa at high water.

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 upon it. The deepest draft of vessels entering is 4 feet. A light, in about 4 feet 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. 20.) 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, 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; 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.

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 off the station within ¾ mile.

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. The water at St. Petersburg is considered best for steamers' boilers. Ship chandlers' stores can 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 500 tons, 180 feet in length, and 11 feet draft.

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 tide 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, 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...	98	E ½ S.....	3¾
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.			
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. 3F.....	0	N ⅛ W.....	1¼
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. 4.....	65	NE by E ⅝ E	4
15. To beacon No. 6.....	47	NE.....	⅜
16. Until past beacon No. 9.....	5	N ¼ E.....	5½
17. On Hillsboro River range astern, a tall stack 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 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 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 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 30° true (NNE ½ E mag.), and then steer for it until up to the bell

buoy. At night a vessel on this course should be in the narrow, faint-red sector of the light. From the bell buoy steer 58° true (NE by E mag.) for 3¼ miles, leaving a black buoy 150 yards on the port hand, a red buoy 300 yards on the starboard hand, and Southwest Channel light ¼ mile on the port hand. When the light is abeam a 62° 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.

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 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 5 feet (1915), the southern part of which is formed by Boca Ceiga Bay and the northern parts by Clearwater Harbor and St. Josephs Sound.

Boca Ceiga 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 7 feet deep has been dredged where necessary so that a least depth of 6 feet can be taken from Tampa Bay to near the head of Boca Ceiga Bay. This connects with a dredged channel 50 feet wide and 5 feet deep through the Narrows to Clearwater Harbor. The cuts in Boca Ceiga Bay and the Narrows have been marked from time to time with small stakes with pointers, indicating the side on which they should be passed, but the channel is difficult to follow without local knowledge. Tidal currents in Boca Ceiga Bay seldom exceed ½ knot.

In entering Boca Ceiga Bay from Tampa Bay the best water is said to lead from the light (No. 1) 2½ miles eastward of **Point Pinelos**, around the point at a distance of about ½ mile, to within about ¾ mile of the easterly end of **Bird Key**; thence west-southwestward for 2 miles, and west-northwestward for 1 mile, to the channel to Pass a Grille. From here the chart, the stakes with pointers, and the appearance of the water are the guides.

Pass a Grille is the name of a passage that leads from the Gulf to the lower part of Boca Ceiga Bay, between Pine and Long Keys. The name is also applied to a pleasure resort and beach on the south end of **Long Key**. The channel inside the bar is deep and is clearly defined by visible shoals on each side, but across the crest of the bar it is very tortuous, shifting, and difficult to find.

The depth on the bar at mean low tide is 5 to 7 feet. Strangers are advised not to enter this pass from the Gulf. Pass a Grille has frequent communication by power boats with St. Petersburg and Tampa. The wharves are on the east side of **Pine Key**, on the pass, and have sufficient depth alongside. Gasoline and some supplies can be had here.

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.

Johns Pass leads from the Gulf to Boca Ceiga 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 used much 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 can usually be seen in time to sheer off if moving slowly. The channel follows close to the shore on the north side of the pass, thence turns southward outside the pass, and crosses the crest of the bar, about ½ mile southward of the pass and between ¼ and ½ mile offshore. It has a depth of 7 feet on the bar and is quite narrow there. A black buoy marks the north side of the channel at the bar.

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

Clearwater Harbor extends for about 7 miles from the Narrows, north of Boca Ceiga 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. Cuts 50 to 100 feet wide and 5 feet deep connecting with these natural channels have been dredged from the Narrows through the shoals at the south end of the harbor.

Clearwater is a town with railroad connections on the east shore of Clearwater Harbor opposite Little Pass. There is a depth of 8 feet at the public wharf, from which a road leads to the center of town. Gasoline, provisions, and some launch supplies can be obtained.

Little Pass and **Big Pass** lead into Clearwater Harbor from the Gulf. Little Pass is 12 miles northward of Johns 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. Big Pass, 3 miles northward of Little Pass, is marked by a buoy which does not always indicate the best water. At times as much as 9 feet is found in the channels of these passes, and a depth of 6 feet 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. Josephs 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 4 feet can be carried through the sound, but in its present condition 4 feet is all that a stranger should attempt to carry, and that on a rising tide. **Dunedin** is a small village on the east shore, 3 miles north of Clearwater and about opposite Big Pass. It has railroad communication. A depth of about 3 feet at low water can be taken to the wharves.

The best water through St. Josephs Sound leads from the wharves at Clearwater about ¼ mile off the east shore as far as Dunedin. There are no stakes and the only guide is the lead. From a position ⅛ mile off the wharves at Dunedin it leads, in general, toward Anclote Keys lighthouse, passing ¾ mile off the northerly end of Hog Island.

Anclote Keys lighthouse is a brown skeleton tower on the south end of Anclote Keys. The light is flashing white (light 6 seconds, eclipse 24 seconds), 101 feet 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 or less draft, and can be reached by passing either northward or southward of the keys. Both passages are marked by beacons and buoys. Vessels of a greater draft than 7 feet 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 a red nun buoy. From this buoy, head 56° true (NE ¾ E mag.) so as to pass another red buoy close-to on the starboard hand, and a small black beacon, ¾ mile south of the lighthouse, ¼ mile on the port hand. When ¼ to ⅜ mile eastward of the beacon, 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 curve and steer for Anclote Keys lighthouse on any bearing eastward of 160° true (SSE mag.) until buoy No. 2, lying 5½ miles north-northwestward of the lighthouse, is sighted. From this buoy steer 92° true (E mag.) to buoy No. 4. Then steer 132° true (SE ½ E mag.) for a small black beacon. 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 ½ 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 6 feet 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 deep from there to the county bridge at Tarpon Springs, 1½ miles farther up the river. In 1915, 5 feet could be carried to Anclote and 3½ feet 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.

The bayou next eastward of Kramer Bayou extends southward from the river at an opening ½ mile above the island that is opposite

Anclote post office. On the eastern arm of this bayou there is a little concrete-faced basin. A draft of 4 feet 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 6 feet 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. 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 40 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. Pass close southward of the front light and bring it in line with another light astern, course 108° true (ESE ⅝ E mag.). This range leads into the mouth of the river. Above there the channel is marked by lights and beacons on both sides of the cuts. Leave the red lights and red triangular day marks on the starboard side of the channel, and the white lights and black square day marks on the port side. Strangers are advised to navigate cautiously after leaving Anclote post office.

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. Martins Reef.**

Strangers should approach the coast with great care, and vessels of deep draft should keep in 5 to 6 fathoms. Small vessels of 3 to 4 feet 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 anywhere between Anclote Keys and Cedar Keys, and, as there is but little sea, they can ride out anything except a hurricane.

The more important villages along this stretch of the coast are **Port Richey, Hudson, Aripeka, Bayport,** and **Homosassa,** the last about 4 miles up the **Homosassa River** from its mouth. These are 8½, 14, 20, 25, and 39 miles, respectively, northward of Anclote Keys lighthouse. With local knowledge a draft of 4 feet can be taken to any of them on a favorable tide. Homosassa has railroad communication with the interior of the State.

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 deep and 60 feet wide, has been dredged; this channel is subject to shoaling. Inside the mouth there is ample depth to a 4-foot shoal at the town of Crystal River, 6 miles up the river, and the channel is easily followed. A white tripod marks the channel through the outer reef, and several stakes mark the channel inside. The town of Crystal River has railroad communication. 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 the white tripod bears east, and then steer for it. Leave this mark 20 to 30 feet on the port hand and steer 56° true (NE ¾ E mag.) for nearly ⅝ mile, so as to leave a stake 50 feet on the port hand. Then steer 41° true (NE ½ N mag.) for about ½ mile, so as to leave a cluster of piles 30 feet on the starboard hand, and from there steer 86° true (E ½ N mag.) into the dredged channel. Hold the last course for a distance of 1¾ miles to the mouth of the river, leaving spoil banks and small stakes on each side. 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. **Port Inglis gas and whistling buoy,** 6⅜ miles south of the beacon on the southerly end of Seahorse Reef, and various other buoys mark the approach to the anchorage from deep water of the Gulf. The anchorage consists of a small basin among the shoals, locally known as the **loading pool,** which is used by ocean-going vessels while loading cargoes brought out in lighters from Port Inglis. In the loading pool are two mooring buoys at which vessels load to a draft of 22½ feet and have sufficient swinging room. There is room in the pool for five vessels of not more than 16 feet draft, in addition to the two at the mooring buoys.

Withlacoochee River empties into the Gulf 7½ miles northeastward of Withlacoochee anchorage, from which it is reached by a channel 100 feet wide and 10 feet deep, dredged through the reefs and shoals to Port Inglis at the mouth of the river. Above Port Inglis a draft of 7 feet at normal low water can be taken to the town of Inglis, and a draft of 4 feet for 2½ miles farther to a high dam, which is the head of continuous navigation. There is a considerable tonnage of phosphate rock shipped from the river.

Port Inglis is largely the plant of the Port Inglis Terminal Co. Located here are a post office and general store and officers of the United States Public Health Service, Customs Service, and Immigration Service.

Pilots for the channel leading from sea to Withlacoochee anchorage are stationed at Port Inglis and board vessels in the vicinity of the entrance buoy. Pilotage is compulsory. Rates for vessels of 6 feet or less draft, $2 per foot of draft; 6 to 10 feet, $2.25; 10 to 15 feet, $2.50; over 15 feet, $3.50 per foot. Vessels are exempt from paying inward pilotage if no pilot is taken and if not spoken by one before passing the second mid-channel buoy.

The **health officer** boards vessels at the loading pool.

Supplies.—Coal and provisions in limited quantities, gasoline, and fresh water can be had at Port Inglis.

Repairs.—The terminal company maintains a small but well-equipped shipyard at Port Inglis and a marine railway of 800 tons capacity capable of hauling out a vessel 175 feet in length, 7 feet draft forward, and 10 feet aft.

Storm warnings are displayed at Port Inglis.

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 tide 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 decrease the velocity of the currents and a southwesterly wind may increase them.

DIRECTIONS, WITHLACOOCHEE ANCHORAGE AND RIVER.

Vessels in ballast bound to Withlacoochee Anchorage from Florida Straits usually make Egmont Key lighthouse at the entrance to Tampa Bay, from 10 to 12 miles off; courses are given in the directions for Tampa Bay. Thence a 353° true (N ¾ W mag.) course for 77 miles leads to Port Inglis gas and whistling buoy, 15 miles westward of Withlacoochee anchorage.

For vessels loaded and bound to Florida Straits it is well to avoid areas with depths less than 6 fathoms. From a position 3 miles westward of Port Inglis gas and whistling buoy, a 179° true (S ¼ E mag.) course for 256 miles leads to a position 12 miles westward of Dry Tortugas lighthouse on Loggerhead Key, and a 172° true (S ⅞ E mag.) course for 260 miles leads to Rebecca Shoal lighthouse.

Caution.—A number of vessels in approaching Rebecca Shoal lighthouse from northward have stranded on New Ground Shoal.

From Port Inglis gas and whistling buoy a 68° true (NE by E ⅞ E mag.) course for 10 miles leads to Withlacoochee entrance buoy (perpendicularly striped), but passes close to a rocky shoal over which there is reported to be a depth of 18 feet. From the entrance buoy to Withlacoochee anchorage the chart and the buoys are the guides, but strangers are advised to take a pilot. Vessels usually anchor in the vicinity of the entrance buoy until a pilot comes on board.

To enter the river from the loading pool, with not over 10 feet draft, steer 53° true (NE ½ E mag.) for the entrance light until

½ mile from it. Then bring the light to bear 46° true (NE ⅛ N mag.) and 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.

Leave the light 125 feet on the port hand, and the rock dump 50 feet on the port side, until nearly ¾ mile past the light; the spoil banks along this part of the cut are wholly on the north side. Then be guided by the channel stakes and spoil banks, which will be found on both sides of the channel.

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 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 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 10 feet can be taken to the railroad wharf. Coal, gasoline, fresh water, and some provisions and launch supplies can be had, but there are practically no facilities for repairs. Storm warnings are displayed.

Main Ship Channel, east of Seahorse Key, has a depth of 10 feet, 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.

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. Small craft bound up the coast, if their daft will permit, should enter by the Main Ship Channel and leave by the Northwest Channel, rather than cross Seahorse Reef.

Pilots may be found at Cedar Keys.

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 is found in the channel just above **Turning Point light**, notheastward 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, with Seahorse Key bearing 13° true (N by E mag.), distant 2½ miles.

Quarantine.—Vessels subject to visitation by the health officer must not go above **Grassy Key** until they have been boarded and given pratique. A relief station of the United States Public Health Service is located at Cedar Keys.

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 tide and westward on the ebb. Inside, the currents in general follow the channels.

To enter Cedar Keys anchorage by the Main Ship Channel.—From Port Inglis gas and whistling buoy head 19° true (N by E ½ E mag.) for Seahorse Key until the entrance buoy is picked up, or pass southward and well eastward of the bell buoy at the south end of Seahorse Reef, steer northeastward until Seahorse Key bears 19° true (N by E ½ E mag.) and then head for it. Then follow the aids closely. The sharp turns in the channel, eastward, northward, and westward of Grassy Key require some care to keep in the best water and make the turns.

To leave by the Northwest Channel.—From buoy No. 12 the channel leads westward for ⅝ mile, then northwestward, passing eastward of the small key east of Middle Keys, and then through the southerly channel on the north side of Middle Keys. Numerous stakes, which are of use to those having local knowledge, mark the channel. The only permanent mark is **North Bank light** on the north side of the westerly entrance to the channel. Chart No. 480 is the best guide for strangers.

CEDAR KEYS TO CAPE SAN BLAS.

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. 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.

Pepperfish Keys are the only objects between Cedar Keys and St. Marks lighthouse that a stranger can recognize. They lie from ¼ 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 5 to 6 miles.

Suwanee River empties into the Gulf through two mouths, known as East Pass and West Pass, 9 and 10½ miles, respectively, northwestward of Cedar Keys. A narrow line of reefs, known as **Suwanee Reef**, extends northwestward from 4 miles northwest of Cedar Keys to northward of West Pass. Between the reefs and the mainland is a shallow bay, known as **Suwanee Sound**. Dredged cuts, 4 feet deep and 50 feet wide, lead around the southern end of Suwanee Reef, at a place known as **Derrick Key Gap**, to Suwanee Sound, and from Suwanee Sound to East Pass. These cuts are subject to shoaling and are marked only by a few piles. A draft of 5 feet can be taken up Suwanee River for about 70 miles, and 4 feet for over 100 miles. Persons acquainted with the river can be found at Cedar Keys, and strangers desiring to enter are advised to take a pilot from there.

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 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 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, ½ mile northwestward of the lighthouse. The depths are from 8 to 19 feet, with very shallow water close-to on all sides. Vessels of 7 feet 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 even half that draft. The anchorage is easily reached during daylight and is well protected on all sides.

St. Marks lighthouse is a white tower on the eastern point at the entrance of St. Marks River. The light is fixed white, 82 feet above the water, and visible 12 miles.

St. Marks is a small village on the north bank of St. Marks River, ½ 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. Supplies, if required, must be shipped from Tallahassee, which is 21 miles inland from St. Marks, and is connected therewith by railroad. There are no facilities for filling fuel or water tanks at St. Marks.

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 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.

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.

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 over a considerable part of it.

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 above the water, and visible 14 miles.

Cape San Blas Shoals, with depths of 3 fathoms or less, extend 4 miles southward from the cape, and spots with 4 to 5 fathoms 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 lies about 1¼ miles offshore from Cape San Blas lighthouse, and another channel, with a depth of 5 feet, 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), 98 feet above the water, and visible 16 miles.

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 deep at low tide, from Apalachee Bay to St. George Sound. A draft of 4½ feet 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 obstructed 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 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 ¾ 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 or more for a distance of 29 miles, and at least 3 feet 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 deep, except in a few short stretches where the depth is but 3½ feet at low water.

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 deep has been dredged across the Bulkhead; it is well marked by beacons and buoys and with the aid of the chart can be readily followed by a stranger during the daytime 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 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 draft coming from Ochlockonee Bay by way of Carabelle River. Apalachicola Bay can be entered from the Gulf by way of West Pass, and also with a draft of about 5 feet 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

narrow, crooked channel, with a depth of 7 feet, leading to it from Duer Channel, but for a stranger drawing over 5 feet 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 19 feet (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, leads west-northwestward from buoy No. 5.

Carrabelle River empties into St. George Sound, 5 miles northward of East Pass. A channel 100 feet wide and 10 feet 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 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 1915 a depth of 9 feet could be taken to the wharves.

Carrabelle is a small town and lumber shipping port on the east bank of the Carrabelle River, ½ 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 sand spit.

West Pass, entrance to Apalachicola Bay, is subject to frequent change and is but little used. The channel has a depth of about 12 feet over the bar, and 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.

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. It ships considerable lumber, fish, and oysters. The town is easily reached by a dredged channel of about 9 feet 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.

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 one marine railway that can haul out a vessel 100 feet long drawing 8 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 deep. In 1915 a draft of 9 feet could be taken through this dredged channel into the mouth of the river, 6 feet to **Blountstown**, 70 miles, and 5 feet to the head. A draft of 3 feet can be taken 90 miles up Flint River to **Albany, Ga.**, and 3½ feet 142 miles up Chattahoochee River to **Columbus, Ga.** The distances given are approximate, and the available drafts are at ordinary low river stages. A railroad drawbridge having an opening of ample width spans the river about 3 miles above its mouth.

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.

Pilots.—Pilotage is compulsory. (See the extracts from the laws of Florida relative to pilotage on p. 20.) 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 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 ½ and 1 mile south of the beacons at the entrance to the Carrabelle River, and has depths of 16 to 19 feet. At all of 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 Carrabelle and Apalachicola.

Storm warnings are displayed at Carrabelle and Apalachicola.

Tides and currents.—At East Pass the mean tidal range is 1.4 feet, and a little more than that inside. 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 tides at West Pass and in Apalachicola Bay is about 2 feet. The currents are influenced by the winds and by freshets, and at times are very strong, especially on ebb tide; at flood tide 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 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 over them, close-to on both sides. Inside the pass the chart and the buoys are the guides.

Apalachicola Bay.—Coming from St. George Sound a range of two lighted beacons, bearing 293° true (WNW ¼ W mag.), marks a dredged cut through the bulkhead 100 feet wide and 8 feet deep. When up to a red buoy at the western end of this cut, steer 246° true (SW by W ⅝ W mag.) for about 3 miles, so as to pass southward of a red buoy marking the south end of a chain of oyster reefs. Then head 273° true (W mag.) for 2 miles to a red buoy marking the entrance to the dredged channel into Apalachicola River. Rounding this buoy 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 1915 the dredged channel was 100 feet wide and 9 feet deep, but it is subject to rapid shoaling.

West Pass.—The channel is subject to such frequent and marked changes that no directions can be given, and strangers are advised not to attempt to enter unless the sea is smooth and the shoals are plainly distinguishable by difference in color of the water.

INLAND WATERWAY BETWEEN APALACHICOLA BAY AND ST. ANDREWS BAY.

The completion of that section of the intracoastal waterway which lies between Apalachicola Bay and St. Andrews Bay has made available a safe inland passage for small craft inside of Cape San Blas. This passage is good for a draft of at least 5 feet and leads partly through natural waterways, which have been improved by dredging, and partly through a dredged canal with a least depth of 5 feet and a width of 65 feet. The canal is free of toll and has no locks. The distance from the town of Apalachicola to Panama City, on St. Andrews 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. Andrews Bay. The channel through Wetappo River and the eastern part of East Bay has been dredged to a depth of 6 feet.

ST. JOSEPHS BAY

St. Josephs 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, and has an improved channel 300 feet wide and 24 feet 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 62° true (NE by E ¼ E mag.). A swash channel having a depth of 14 feet, follows the shore of **St. Josephs Point** at a distance of ¼ mile and passes between the shore and a shoal of about 8 feet 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 deep. Small craft can find protected anchorages in **Eagle Harbor,** a small bight in the west shore 6 miles south of St. Josephs Point, and in the narrow sloughs in the south end of the bay.

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 20 feet 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. 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. Josephs Bay northwestward to **St. Andrews Point** is known as **Bell Shoal.** It has depths of 16 feet near the dredged channel, but much shoaler depths approaching St. Andrews Point. The point should be given a berth

of 3 miles. **Crooked Island** is a long, narrow island extending northwestward from St. Andrews Point to the entrance to St. Andrews Bay. It incloses a shallow, unimportant body of water known as **St. Andrews Sound.**

ST. ANDREWS 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 deep. St. Andrews 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. Andrews Bay, extending in a general east-southeasterly direction for about 18 miles. It is from ⅜ mile to 2¼ miles wide, and has a channel depth of 20 to 40 feet for 9 miles, and 12 feet for a farther distance of 3 miles. The inland waterway from Apalachicola Bay reaches the head of East Bay by way of Wetappo River.

North Bay, extending in a northeasterly direction from St. Andrews Bay, is from ⅜ mile to 2¼ miles wide, and has a channel depth of 12 feet for 5 miles, and 7 feet to **Bayhead,** a village at the head of the bay. Several small, unimportant streams enter the bay at its head.

West Bay, extending in a northwesterly direction from St. Andrews Bay, is 2 miles wide, and has a depth of 12 feet for 5 miles, and 8 feet 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.

On St. Andrews Bay and tributaries are the four incorporated towns, **St. Andrews, Panama City, Millville,** and **Lynn Haven,** and 24 smaller villages. All have considerable commerce in lumber and naval stores. The four incorporated towns have railroad communication with the interior of the State and steamer communication with Apalachicola, Pensacola, and Mobile. **Southport,** a mill village on **North Arm,** also has railroad communication. Depths as follows can be taken to wharves at the various towns: St. Andrews, 14 to 16 feet; Panama City, 9 to 25 feet; Millville, 13 feet; **Bay Harbor,** 21 feet; Lynn Haven, 10 feet.

Prominent features.—Approaching the entrance to St. Andrews 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. Andrews Bay from the Gulf and has been improved by dredging a channel 200 feet wide and 22 feet 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.

West Pass, west of Hurricane Island, has a depth of about 4 feet, 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. 20.) 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 St. Andrews.

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. Andrews, between **Buena Vista** and **Dyers Points**, 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 per cent per ton is placed upon all vessels entering the port to discharge or load cargo, and ½ cent per ton for each steamer entering for bunker coal.

Quarantine.—The quarantine officer is stationed at St. Andrews. 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 St. Andrews.

Supplies.—Coal in small quantities, gasoline, fresh water, provisions, and some ship chandlery can be obtained at St. Andrews and Panama City.

Repairs.—Minor repairs to small vessels can be made at St. Andrews and Millville, where there are marine ways of about 60 tons capacity.

Storm warnings are displayed at Panama City.

Tides.—The mean rise and fall of tides is 1.4 feet. Winds affect tides to such an extent that the height and time of tides is variable. 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.—During ebb tide a strong 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 tide.

Directions, St. Andrews 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. Andrews Bay. Coming from westward it is well to keep 1 mile or more from the beach and in at least 4 fathoms, on about a 127° true (SE by E mag.) course, until the entrance buoy is sighted.

The bearing of the entrance range is 10° true (N ⅝ E mag.), but as the channel across the bar is subject to change, the range can not be depended upon to lead in the best water, and the beacons may be obscured by mist. The better guides are the buoys, and especially the breakers and the difference in color of the water—deepest where it is darkest. Inside the entrance the chart is the guide.

ST. ANDREWS BAY TO PENSACOLA BAY.

For 94 miles westward of St. Andrews 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. Andrews 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 ¼ mile to about 4 miles. The depths of water in the bay decrease gradually from west to east, there being 18 to 25 feet over the western two-thirds, except near the shores, and a depth of 6 feet 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 Choctawhatchee Bay. It is obstructed by a shifting bar, on which the depth is said to vary between 4 and 10 feet, 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 ¼ 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. The best water generally favors the easterly side at the entrance, and trends about northeast across the bar, lying close to the north shore from the range lights to the point of Santa Rosa Island on the south side, and thence nearer to the south shore until nearly up to the fishing village.

Choctawhatchee River, emptying into the eastern end of Choctawhatchee Bay, has a depth at ordinary low water of 4 feet for 24 miles, to Holmes River. The east side of the river entrance is marked by a light. **Holmes River** has been improved by snagging in the channel, and is navigable for a draft of 3½ feet at low water to the town of **Vernon**, 21 miles above the mouth.

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, but owing to gradual shoaling the controlling depth in 1915 was about 5½ feet. The western part of the sound and the approach from Pensacola Bay have channel depths of 15 feet or more. In the western part of the sound, lying from ½ 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.

Camp Walton, **Mary Esther**, and **Harris** are post offices on the north shore of the Narrows.

With the aid of the chart and the ranges that mark the most difficult places and by keeping a sharp lookout for indications of shoals a stranger should be able to take a draft of 5 feet throughout the length of the sound.

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 ¾ mile wide and partly obstructed by shoals extending 1½ miles seaward. **East Bank**, with 14 to 18 feet over it, extends 1 mile southward of the western part of Santa Rosa Island. **Caucus Shoal**, with depths of 6 to 18 feet, extends 1½ miles from the point on the western side of the entrance. **Middle Ground** is between the two and has depths of 8 to 18 feet over it. All the shoals are shown on the charts.

Across the bar formed by these shoals there is a well-marked channel 500 feet wide, 31 feet deep (in 1915), and maintained by dredging to a depth of at least 30 feet. 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 8 feet and is used only by small local vessels. Inside the entrance a depth of 31 feet can be taken up Pensacola Bay 7½ miles to the city of Pensacola, and about 20 feet 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.

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 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. On the point east of the town is a **United States naval station** and a **naval radio station**, call letters NAS.

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. Andrews Bay, and Apalachicola. The depths at the wharves range from 13 to 30 feet, soft mud bottom.

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 at the mouth to 7 feet 2 miles above the bridge. **Mulat** is a small town on the east shore of the bay above the bridge.

Escambia River empties into the bay through several mouths, the principal one being about 1½ miles above the bridge. A depth of 5½ feet can be carried through a dredged channel, 150 feet wide, across the bar and up the river 18 miles to the town of **Moline**, and 3 feet can be carried for 37 miles farther. Timber and logs are rafted down the river and bay to Pensacola.

East Bay is an eastward extension of Pensacola Bay, with which it is connected by a passage ¾ mile wide between shoals. It varies in depth from 8 to 12 feet, but there are several small shoals of less than 5 feet depth scattered over the bay, and a submerged rock pile a little over 1 mile SE by S (mag.) from **White Point**.

Blackwater River empties into **Blackwater Bay**, the northern arm of East Bay. A draft of 8½ feet can be taken from Pensacola Bay, through East and Blackwater Bays, and in a dredged channel 100 feet wide up the Blackwater River to the town of Milton, 4 miles above the river mouth, and 21 miles from Pensacola.

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 at Milton and a small dry dock at Bagdad.

The channel through East and Blackwater Bays is marked by beacons and lights, but requires local knowledge for drafts of more than 5 feet. The chart of these waters can not be depended upon to show the latest conditions. Vessels of more than 5 feet draft usually pass ½ 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 ¼ 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 ¼ mile north of the beacon.

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

Santa Rosa Sound is described on page 81.

Big Lagoon is a shallow, unimportant body of water about 5 miles long and from ¼ 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 buildings, 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.

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. 20.) The rates are, for steamers or vessels drawing less than 6 feet, $1 per ½ foot of draft; for vessels drawing 6 feet and less than 10 feet, $1.50 per ½ foot of draft; vessels drawing 10 feet and less than 14 feet, $2 per ½ foot of draft; vessels drawing 14 feet and less than 20 feet, $2.50 per ½ foot of draft; vessels drawing 20 feet and upward, $3 per ½ 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 ½ 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 $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. If fumigation is necessary they are required to go to the quarantine station southeastward of **Deer Point**, at the entrance to Santa Rosa Sound.

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. A marine railway at Pensacola can haul out a vessel of 300 tons, 110 feet long, drawing 9 feet forward and 14 feet 8 inches aft.

Storm warnings are displayed from the American National Bank Building, at Pensacola, where they can be seen from the harbor; at Pinewood; and at the Coast Guard station on Santa Rosa Island.

Tides.—The mean rise and fall of tides at the entrance and in the bay is 1.4 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 curve approaching the coast very much more closely eastward than it does westward of the entrance. Depths of 10 fathoms 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 until the lighthouse is sighted or the position is otherwise determined.

The following courses and distances lead to Caucus Cut 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 buoy No. 8	341	NNW	2
2. On Fort Barrancas range past buoy No. 12	11	N ⅝ E	¾
3. On Fort McRee range astern	57	NE ¾ E	½
4. On Pensacola Bay range astern to buoy No. 19	102	E ¾ S	1½
This course leads about ⅛ 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 irregularly shaped body of water of from 7 to 12 feet 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 4½ feet 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 30 feet, 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 or more in a channel width of ½ mile, and a depth of 30 feet, in a dredged channel 300 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 ⅜ mile between the shoals which rise abruptly from the deep water of the channel. The channel is marked by Sand Island lighthouse and range and by buoys.

A swash channel, with a depth of 7 feet, leads from eastward, close around Mobile Point into the upper end of Main Ship Channel. Another channel, depth 13 feet, 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.

From the lower anchorage inside the entrance a dredged channel, 200 feet wide, extends the length of Mobile Bay to the city of Mobile, at the mouth of Mobile River, a distance of about 25 miles. The least depth at low water is 25 feet (project depth, 27 feet), but the bed of the channel is formed of such soft material that a draft of 26½ feet can 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.

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 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 light, well off its outer end.

Bon Secours Bay is a large indentation of Mobile Bay, extending 14 miles eastward from inside Mobile entrance. It has an average depth of 10 to 12 feet, but is of little importance commercially. Bon Secours is a village near the head of the bay, and has some traffic in oysters, watermelons, and truck.

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 27 feet, 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.

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 27 feet to **Chickasaw Creeek,** 3½ miles above the mouth, and 14 feet to its head. The deepest draft navigating Mobile River above Chickasaw Creek is 9 feet. There are no towns of importance on the river. A draft of 4½ feet 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 can be taken to the landing of **Stockton**. The vessels navigating Apalachee River are scow-built steamers of 4 feet 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 4 feet can be taken to **Montgomery**, 293 miles above Mobile, and at higher river stages greater drafts in proportion. A draft of 2 feet 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 June.

Tombigbee River is navigable at ordinary low river stages for a draft of 6 feet to **Demopolis**, Ala., a distance of 200 miles from Mobile. Except during the period of extreme low water it is navigable for 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 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 6½ feet 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.

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 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 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 are at present required to pay single pilotage only.

Towboats are used by all the larger sailing vessels. They will sometimes be found cruising outside the bar in fine weather or will be near Sand Island Lighthouse on the lookout for approaching vessels. 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, 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. The quarantine anchorage is eastward of this anchorage and marked by yellow buoys. 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 draft to attempt to cross the bar.

Tides.—The mean rise and fall of tides at the entrance is about 1 foot.

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 ½ 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.

The **harbor master** at Mobile has control of the mooring of all vessels at the lower anchorage and in the river abreast of the city. At the latter place vessels must be moored fore and aft, so as to hold them straight up and down the stream. The harbor master also fixes the maximum draft to which vessels may load at Mobile.

Wharfage.—Cargoes are subject to a wharfage charge, but ordinarily vessels are not.

Quarantine.—Vessels subject to visitation by the health officer are boarded at the quarantine anchorage northeastward of Fort Morgan.

A **marine hospital** is located at Mobile. The office of the surgeon in charge is at the customhouse.

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 having a capacity for a vessel of 4,300 tons, 390 feet long and 18 feet draft. There are 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 channel across the bar at the entrance to Mobile Bay is subject to change in depths and position. In 1915 the best water from the entrance buoy was to be found on a 356° true (N ¾ W mag.) course, heading for Sand Island lighthouse with the two rear range lights showing westward of it, the three lights being about equally spaced.

When well past the first gas buoy (No. 2) change course to 9° true (N ⅜ E mag.) for nearly 4 miles, until Fort Morgan is abeam. Then steer 350° true (N by W ¼ W mag.) for 1½ miles, to the first light marking the entrance to the dredged channel. 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 route from Mobile Bay to New Orleans or the Mississippi River see page 99.

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 from Mobile Bay nearly to its western end, where the depth is but 7½ feet. 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 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 beacons and lights, about 50 yards from the axis.

Grants Pass, ¼ mile north of Pass aux Herons, is a toll pass dredged by private interests. In 1915 it had a depth of 6 feet, but was shoaling rapidly and was not expected to be redredged. It was marked by pile beacons, which will probably not be maintained.

Petit Bois Pass, an entrance from the Gulf, between Dauphin and Petit Bois Islands, has a depth of 7 feet in an unstable channel. It is not marked and is seldom used.

Horn Island Pass is described under a separate heading following.

Dog Keys Pass, lying about midway between Horn Island and Ship Island, is good for a draft of at least 12 feet, 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.

Ship Island Pass is described under a separate heading following.

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 deep, but the depth in the western part of the sound, to which it leads, is only 7 to 8 feet. 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.

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.

HORN ISLAND PASS,

the approach to the city of Pascagoula, leads between **Petit Bois Island** and Horn Island. It has a depth of 21 feet (project depth, 25 feet) in a dredged channel, and is marked by buoys which are shifted from time to time to conform to changes in the channel. A draft of 23 feet has been taken out over the bar. **Petit Bois Spit**, on the eastern side of the pass, is making out slowly in a direction parallel to the channel. A 48° true (NE ⅛ N mag.) course, with Horn Island lighthouse ahead, leads through the dredged channel. It is advisable for strangers of over 15 feet draft to take a pilot.

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 above the water and visible 12 miles.

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. It is reached from the pass by a dredged channel 17 feet deep, which is subject to gradual shoaling. The channel is marked by beacons, lights, and buoys, but requires some local knowledge to carry the best water. 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 12 feet depth, where fresh water can be taken. Fresh water can also be obtained from the towboats at moderate prices. There are facilities for making minor repairs to vessels at the shipyard above the bridge. Vessels of 400 tons and a draft of 9 feet can be hauled out.

Pascagoula River and its tributary **Dog River** are navigable for a draft of 17 feet, for 9 miles above Pascagoula, to a large paper mill near Moss Point. Pascagoula River is navigable for 7 feet draft for 34 miles, to Dead Lake, and for 3 feet 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 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.

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. It is connected with Pascagoula by an electric railway, distance 4 miles. A draft of 17 feet can be taken there at low water, and 18½ has been taken out at high 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 seaward 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 18 feet draft while loading is found on the north side of the eastern end of Horn Island. Vessels of less than 18 feet draft go to Pascagoula or Moss Point to load. Small vessels anchor in the river abreast of Pascagoula. The quarantine anchorage is northeastward of beacon A. 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 northeastward of beacon A.

Marine hospital.—The nearest marine hospital is at Mobile.

Storm warnings are displayed at Pascagoula.

Tides and currents.—The mean rise and fall of tide at Horn Island Pass and at the mouth of the river is 1.5 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 approaches 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 23½ feet (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 somewhat in heavy gales, but is fairly stable. A 10° true (N ⅜ 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 ¼ 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 or less at all times, and for a draft of 24 feet when the sea is smooth. The depths in the barbor range from 20 to 30 feet, soft bottom.

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 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. Fresh water, gasoline, provisions, and some ship chandlery can be obtained. There are several marine

railways of about 30 tons capacity, limited to drafts of about 5 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 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 town on the north shore. A long, shallow extension of the bay westward is known as the **Back Bay of Biloxi.**

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. Lumber is towed here in lighters from Wolf and Jordan Rivers for shipment by water.

From Ship Island Harbor there is a dredged channel to Gulfport 200 feet wide and 17½ feet deep, but as the bottom is a soft ooze it is good for 20 feet, and a draft of 22½ feet has been taken out at high water. This channel is subject to rapid shoaling and is redredged at frequent intervals; it is marked by lights and buoys.

When up to about light No. 10 there can be picked up a range of a horizontally slatted day mark (white light), 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 323° true (NW ¼ N mag.) course.

The harbor at Gulfport is a dredged, rectangular basin, protected by breakwaters, nearly ¼ by ½ mile in extent, with depths of 21 or 22 feet, 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.

Pass Christian is a town and railroad station on the north shore of Mississippi Sound, 8 miles west of Gulfport. A depth of 4½ feet can be taken to the wharf, but there are no marks, and local knowledge is required.

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 can be taken to within ¼ mile of the shore at the town, but the depth at the wharves is under 4 feet. The cannery wharf north of the bridge has a depth of about 5 feet.

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 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 deep, marked by

beacons. A draft of 7 feet can be taken into Jordan River and for 14 miles up it. Wolf River is navigable for a draft of 7 feet for 17 miles.

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.

Prominent features.—On a clear day vessels from eastward bound for Ship Island Pass usually sight first a white water tank, 100 feet 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 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 above the water, and visible 16 miles.

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 $3.50 per foot on foreign vessels and $3 per foot on coastwise vessels.

A towboat makes a trip daily from Gulfport to outside the bar.

The **quarantine** station is on Ship Island, 4 miles eastward of the lighthouse. Vessels subject to visitation by the health officer are boarded at the quarantine anchorage, northward of Ship Island and 2 miles eastward of the usual anchorage; the anchorage is marked by yellow buoys.

The nearest **marine hospital** is at Mobile.

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. 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.

A United States **customs officer, immigration officer and storm warning** display station are located at Gulfport.

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 in depth, but 8 feet 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, buoyed and lighted.

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 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 mouth, is 3 miles westward of Lake Borgne lighthouse, and has a dredged channel depth of 9 feet. The entrance is marked by two black beacons, one of them lighted. A depth of 9 feet can be taken 12 miles up the river, to **Logtown**, and 3 feet can be taken 114 miles farther. Drawbridges, with 60-foot openings, cross the river 1 mile and 27 miles above its mouth. **Dunbar** is a settlement and post office near the mouth of the river.

West Pearl River, the secondary mouth of Pearl River, empties through **West Mouth** into the easterly end of The Rigolets, opposite an unused lighthouse, 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.

The Rigolets is a deep passage, 7½ miles long and ¼ 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.

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 5½ to 6 feet, depending upon the level of Lake Borgne. Its approach in Lake Borgne is marked by a 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 lights. The canal has one lock at the river end 280 feet long and 40 feet wide.

Toll rates for the various classes of craft using the canal are published by the canal company. The rates for enrolled vessels, under their own power, is 30 cents per gross registered ton, which includes passage through the canal and lockage.

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 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 end of the lake and limits the draft that can be brought into it to about 5 feet at low water and 7½ feet with a favorable tide. Tide in the lake is governed almost entirely by winds and may have an extreme range of 2 to 3 feet. 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.

Bayou St. John and its extension, **Old Canal**, having a combined length of 4½ miles, lead from a jettied entrance in Lake Pont-

chartrain to a small basin in New Orleans, ½ mile from the Mississippi River. The mid-channel depth at the entrance is 2 to 4 feet at ordinary low water and 6 to 8 feet inside. The entrance is marked by **Bayou St. John lighthouse** (white house on pile foundation, red light), and by a lighted range (red lights on red posts).

The waterway is entered by lake steamers, which make fast to the banks near the mouth, and by small craft of all kinds, which can go to the basin. Pleasure boats rarely go above Esplanade Street bridge, 2¾ miles from the entrance.

Several bridges with draw openings of ample width cross the bayou.

A toll of 5 cents per foot of length over all, per month, is charged small power boats.

Spanish Fort, a pleasure resort at the mouth of Bayou St. John, is connected with New Orleans by electric railway.

To enter Bayou St. John, head for the red range lights bearing 207° true (SSW mag.). Keep in the middle of the entrance and look out for piles and stumps on each side.

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 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.

New Canal lighthouse (white house on pile foundation; 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.

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.

To enter New Canal, pass close eastward of the red light and follow the west jetty.

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.

Bayou Bonfuca 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 5 feet; the bottom is hard sand. Towboats of about 6 feet draft enter on a favorable tide and go as far upstream as the town of Slidell, a distance of 5 or 6 miles. A drawbridge crosses the bayou at this point. A white light on a black beacon marks the entrance. Southwestward of the light is a clubhouse on piles.

To enter Bayou Bonfuca, bring the south draw of the railroad bridge astern on about a north (mag.) course and pass 50 feet eastward of the light.

Bayou Lacombe empties into Lake Pontchartrain 4½ miles westward of Bayou Bonfuca 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; hard sand bottom. Vessels of about 5½ feet 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 no harbor, but during calm weather boats can lie at a long pier which extends from the shore to a depth of about 10 feet in the lake. About 1 mile west of this pier, a canal, 60 feet wide by 10 feet deep, has been dug at right angles with the shore line, for a distance of about 100 yards to a sawmill. The approach to this canal is protected by sheet piling on each side for about 100 yards offshore. The outer end of the east piling is marked by a small light. Mandeville has railroad communication.

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 5 feet, and this depth can be carried up Chefuncte River and its tributary, Bogue Falia River, for a distance of about 12 miles, to the town of **Covington**. **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 Bayou St. John and Milneburg. There are shipyards and marine railways at Madisonville, which can haul out the largest vessels 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 up-river 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. 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 101.

Courses, Mississippi Sound, Lake Borgne, and Lake Pontchartrain.

	Course. True.	Course. Magnetic.	Distance in nautical miles.
1. From Mobile Bay light 2 to Pass aux Herons light 2	° 279	W ⅜ N	4½
Or, from light M G, Mobile Bay, 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 1 mile south of Grand Batture Island Beacon 8	266	W ¾ S	12¾
5. To Pascagoula River entrance light A	293	WNW ⅜ W	4¾
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 2½ miles northeastward of East Point	253	WSW	9¾
9. To Gulfport Channel light 2	267	W ¾ S	10¾
Or, for the 14-foot passage north of Horn Island, from Pass aux Herons light 8, to a P S buoy northwestward of Horn Island Pass, 266° true (W ¾ S mag.), 17 miles. Then, to position 200 yards south of a second P S buoy, 208° true (SSW mag.), 1½ miles. Follow the north shore of Horn Island to buoy 10, westward 7 miles. Then, to a P S buoy, 334° true (NNW ¾ W mag.), 2 miles, and 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 and buoys.			
10. To position ¼ mile past Cat Island Shoal buoy, passing 200 yards north of the buoy	267	W ¾ S	8¾
Or, from Gulfport Channel beacon 8, 245° true (SW by W ¼ W mag.), 7½ miles.			
11. To position with **Merrill Shell Bank lighthouse**, distant ½ mile, in range with a church steeple at Bay St. Louis	245	SW by W ¼ W	3½
On this course keep the lighthouse a little on the starboard bow.			
12. To position ¼ mile north of **Merrill Coquille** buoy 9	269	W ⅝ S	3
13. To P S buoy ½ mile southeast of Lake Borgne lighthouse	244	SW by W ¼ W	9
On this course keep Lake Borgne lighthouse well on starboard bow, and pass ⅜ mile southward of a red beacon.			
14. 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.), 13 miles, to position 2½ miles eastward of **Alligator Point**. Then, to Bayou du Pre light 242° true (SW by W mag.), 9¼ 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.			

Courses, Mississippi Sound, Lake Borgne, and Lake Pontchartrain—Continued.

	Course.		Distance in nautical miles.
	True.	Magnetic.	
15. To position ¾ mile past **Polecat Shoal** beacon, passing ¼ mile south of it	° 239	SW ¾ W	4¾
On this course Lake Borgne lighthouse is astern.			
16. To the draw in the railroad bridge over The Rigolets, passing ½ mile southwestward of Long Point light. See Currents, Rigolets, on page 95.	298	WNW	4
17. To position ⅝ mile past the lighthouse at the west end of The Rigolets	Mid-	channel	7¼
18. To position with **Salt Bayou** abeam, distant ¼ mile	326	NW ½ N	1¼
19. To position northwestward of small shoal	287	W by N	1½
On this course the north draw of the railroad bridge is a little on the port bow.			
20. To the railroad north draw	282	W ⅝ N	2
21. To Bayou St. John, New Orleans	231	SW	16½
Or, to New Canal, 234° true (SW¼W mag.), 18 miles.			
18a. 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	.....	.....	2
19a. To the beacon	275	W	1
20a. To position with the south draw of the railroad bridge well open east of Point aux Herbes	315	NW ½ W	2¼
21a. To the railroad south draw	284	W ¾ N	2
22a. Then follow the shore ½ mile or more off, southward and westward to Bayou St. John. New canal is 1¾ miles farther on.	.....	.....	14

From the entrance to New 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 description of the rivers, bayous, etc., can be followed:

Bayou Bonfuca, 44° true (NE ⅝ N mag.), 18¼ miles.
Bayou Lacombe, 32° true (NNE ⅜ E mag.), 16 miles.
Mandeville, 5° true (N mag.), 19½ miles to wharf.
Chefuncte River, 352° true (N by W ¼ W mag.), 21 miles.
Pass Manchac, 326° true (NW ½ N mag.), 18 miles.

From New Orleans to Lake Borgne Canal via Chef Menteur Pass.—This is the usual route for craft of 5 feet or less draft, and the distance from the place where the two routes separate at the south draw of the railroad bridge is about half as great by this route as by the route through The Rigolets.

From the south draw of the railroad bridge which spans the eastern end of Lake Pontchartrain, steer so as to give **Point aux Herbes** a berth of ¼ mile. Turn southward when past this point and follow the shore at a distance of between ¼ and ½ mile until Chef Menteur Pass opens, about 1 mile distant. Then keep close to the southern

and western shore until in the pass. The pass is deep from shore to shore. On leaving the pass, steer 152° true (SE by S mag.) for 1 mile, and then 216° true (SSW ¾ W mag.) for 5½ miles to **Bayou du Pre light** at the entrance to the canal.

Pass 50 yards south of the light and steer southwestward into the bayou, the entrance of which is marked by white lights on the north bank and by an old fort on the south bank. There is a wooden training wall along the southerly side of the channel extending a short distance from the entrance. Having entered the bayou, keep in mid-channel and follow the telegraph line when in doubt as to which branch to take. Two drawbridges cross the canal just before reaching the lock into the Mississippi River.

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 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.

Lake Maurepas can be entered from the northwestern side of Lake Pontchartrain by **Pass Manchac**, a passage 5½ miles long by 150 to 200 yards wide. The pass has good depths, but the approaches in both lakes are across long bars on which the channel depths are only 6 to 7 feet. A railroad drawbridge with an opening 60 feet wide crosses the pass at its westerly end.

The approaches in Lake Pontchartrain to Pass Manchac are **South Channel**, depth 7 feet, and **East Channel**, depth 6 feet, lying parallel to the adjacent shores at a distance of about 350 yards. Both approaches are marked by lights.

To enter Lake Maurepas from Lake Pontchartrain, pass south and west of South Channel light (red) and follow the shore northward, keeping 150 to 200 yards off the point. 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 6½ feet. The tributaries of this river, **Natalbany** and **Blood Rivers**, join it 1½ and 8 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, 14 miles; Natalbany, 10½ miles; Blood, 3½ miles; and Ponchatoula, 4½ 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 about north (mag.) 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 6½ feet can be taken across the bar at the entrance and for a distance of about 36 miles above the mouth. Its tributary, **Bayou Manchac,** joins it about 32 miles above the mouth and is navigable for the same draft for 8 miles, to the town of **Hope Villa.** The entrance to Amite River is marked by a beacon and 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 entrance beacon and the light and follow a mid-channel course.

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 11 feet 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 above the water, and visible 16 miles.

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 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 draft at low water, and 6 feet 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 at the rate of 50 cents per gross ton, with a minimum charge of $1.75 for all classes of vessels.

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 ¾ E mag.), distant 1½ miles, steer 212° true (SSW ¾ W mag.) for 17½ miles.			
2. To a PS buoy, 1¼ miles eastward of the north end of Breton Island.....	193	S ¾ W.....	17
3. To a PS buoy, 3 miles south of Breton Island...	196	S by W.....	5¼
This course passes close to a PS buoy when abreast the middle of the island.			
4. To position with Pass a Loutre lighthouse bearing 230° true (SW mag.), distant 3½ miles....	141	SE.....	14½
5. To buoy No. 2.....	160	SSE ¼ E.....	3½

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 6 feet. 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.

Pass a Loutre lighthouse is a spirally banded black and white conical tower. The light is fixed red, 63 feet 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 30 feet 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 can be found in any easterly or southerly direction.

Lying between ¼ and ½ mile off the end of the jetties on the west side of the channel is a dangerous shoal with depths of 8 to 15 feet 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 lodgment 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 gas, whistling, and submarine bell buoy lies about 1½ miles east-southeastward from the entrance, in latitude 28° 59′ north, longitude 89° 07′ west. The whistle and submarine bell are sounded irregularly by the action of the sea.

The entrance between the jetties is marked by lighthouses and lighted ranges. The light on the outer end of the east jetty is fixed 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 445 yards, 298° true (WNW mag.) from it, forms the range for entering.

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 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 ½ mile above the end of the jetties.

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.

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.

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 (1916) a least depth of 28 feet (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 2,400 feet. Dredging is continuously in progress to obtain and 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 ¾ mile of the entrance.

Southwest Pass light vessel is moored in 17 fathoms, about 1¼ miles outside the end of the jetties, almost on the axis of the entrance range. The vessel has a red hull with "Southwest" on each side and one skeleton tower with day mark at the head. The light is group flashing white (light 0.6 second, eclipse 0.4 second, light 0.6 second,

eclipse 9.4 seconds), 50 feet above the water, and visible 11 miles. The fog signal is an air diaphone, blast 4 seconds, silent 56 seconds. If the whistle be disabled, a bell will be struck by hand. A submarine bell strikes "4–3" every 19 seconds. The light vessel is withdrawn annually during the months of August, September, and the first half of October.

Southwest Pass lighthouse is a brown skeleton structure on the northwest side of the river; the light is fixed white, 124 feet above the water, and visible 16 miles.

The **entrance range** front light is a movable, pyramidal, skeleton structure, upper half black, lower half white, mounted on a spur dike making out from the west jetty; it is moved whenever necessary, so that the range conforms to the changes in the channel over the bar. The light is fixed white, 37 feet above the water. The rear range light is Southwest Pass lighthouse; the approximate bearing of the range is 28° true (NNE mag.).

A fixed red light marks the outer end of the east jetty. Numerous gas and spar buoys are located at regular intervals on the northwesterly side of the channel; two spar buoys are placed between each two adjacent gas buoys, and bell buoys are established alongside the outer and the inner gas buoys. When the current is strongest the spar buoys sometimes tow under and the gas buoys become listed so that their lights may not be seen from seaward.

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.

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 Stake 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.

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. 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 **Bohemia**, 21½ and 34 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, 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 can be taken 9 miles down Grand Pass, but there is very little depth beyond that point.

A number of canals, with depths of 4 to 5 feet, lead from the river or near it to the waters on either side. Lake Borgne Canal and Ostrica Canal, leading to Lake Borgne and Breton Sound, are described on pages 96 and 102. **Doullet Canal,** on the west bank, 25 miles above the Head of the Passes, leads to **Adams Bay. Wilkinson Canal,** also on the west bank, at **Myrtle Grove,** 49½ miles above the Head of the Passes, leads to Barataria Bay. **Harvey Canal,** opposite New Orleans at Harvey, and **Company Canal,** at Westwego, connect with Lake Salvador, Bayou Lafourche, and an extensive network of inland waterways west of New Orleans. These canals are used extensively for towing logs, for bringing fish, oysters, and truck to market at New Orleans, and for carrying general merchandise from New Orleans to the settlements. These canals and waterways are described on pages 120–125.

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. There are 5 miles of wharves, of which 3½ miles are covered by steel sheds and warehouses. The depths at most of the

wharves are ample for any vessel which can enter the passes. Nearly all of the wharves have direct rail connections with several of the railroad systems of the country.

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.

The deepest draft that has been taken from New Orleans to sea is 31 feet. The usual draft is about 25 to 28 feet.

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, horizontally striped black and white skeleton structures, about 250 feet high, are also easily picked up. The light vessel off Southwest 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 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 South Pass or the light vessel at Southwest 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 up to 18 feet of water; vessels drawing more than 18 feet of water to pay at the same rate as vessels drawing 18 feet and no more.

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, except vessels of 100 tons and under regularly engaged in the coasting trade, shall pay the sum of $1.75 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 $1.75 per foot draft.

Exception: Sailing vessels in tow of a tugboat from the port of New Orleans are not required to pay pilotage.

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.

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.

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.

Hospital.—A marine hospital is located at New Orleans.

The **customhouse** is on Canal Street, New Orleans, about ⅜ mile from the river.

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 constitution of the State of Louisiana gives the port charges which have been established (1913) for the publicly owned docks:

Wharfage on seagoing vessels.—All seagoing vessels shall pay for the use of the wharves, etc., two cents per ton per day, based upon the gross tonnage of vessels, for the first three days, and the sum of one cent per ton per day for the next three ensuing days, making a maximum charge of nine cents on the gross tonnage for the first six days; and thereafter a vessel shall be free from charge for a period of thirty days.

Any part of a day shall be considered a full day, as to the above charges, but a charge shall not be made for a subsequent day until 24 hours after arrival or first charge; and the above charges shall apply to each voyage.

Shed charges.—Where sheds are provided, vessels using same shall pay an additional charge of 1½ cents per ton on the gross tonnage of vessels. Sheds to be used under rules and regulations adopted by the board.

Harbor dues.—* * * the commissioners are also authorized and empowered in charge all vessels visiting the port a fee not exceeding ten dollars, on vessels arriving in ballast, or with green fruit, and a further charge of five dollars for vessels with general cargo.

(The board has adopted resolutions fixing the above charges on vessels under 100 tons at $2.50, vessels of 100 tons and under 500 tons, $5.00, and vessels 500 tons and over, rates mentioned in acts to apply.)

The board is also empowered to make a charge of one dollar for each copy of certificate issued for the inspection of hatches, surveys of cargoes, etc. The master of each vessel, however, being furnished free one copy of all surveys upon their respective vessels or cargoes.

The foregoing charges cover the duties of harbor masters and port wardens.

The port commissioners specially desire to call the attention of those interested to the fact that the above are the entire port charges, and that no charge whatever applies to any part of cargo of vessel placed upon the wharves or landings, either for export or import.

Supplies.—Bituminous and anthracite coal of good quality can be had at New Orleans from lighters anywhere alongside the levee or in the stream. The price (1915) of bituminous coal delivered alongside is $3 to $3.50 a short ton; trimmed in bunkers, $3.25 to $3.75. It can be delivered at the rate of 1,000 to 1,200 tons per day. 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 at New Orleans. Provisions are plentiful and at reasonable prices.

Repairs.—The facilities for repairs to hulls and machinery are excellent. There are several commercial floating docks at Algiers. The largest is 332 feet long, has a capacity of 5,000 tons, and can take on a vessel 370 feet in length and of 21 feet draft. For larger vessels the floating dry-dock of the United States Naval Station is available. It is 525 feet long, has a capacity of 14,000 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.

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 and Toulouse Street to Algiers.

Storm-warning displays are made at Burrwood radio station, Pilottown, 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. 32).—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 counter current 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 ½ knot at the gas buoy off the entrance.

At Southwest Pass light vessel 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. 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 counter currents, 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 1 to 2 points 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 observation should be relied upon. The depths off Pass a Loutre and Northeast Pass are less than charted. 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 curve from 5 to 20 miles northeastward of the gas buoy, and then follow the curve southwestward until the gas buoy is located. Due consideration should be given to the 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 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.

Bring South Pass lighthouse to bear 312° true (NW ¾ W mag.) with East Jetty lighthouse open westward of it. Stand on this bearing until East Jetty lighthouse is about ¼ mile distant, and then steer 297° true (WNW mag.), heading for West Jetty range front light in range with West Jetty range rear light, and leave 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 three 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.

The entrance rear range is Southwest Pass lighthouse. The front range is a movable, pyramidal, skeleton structure on a spur dike, making out from the west jetty, and is moved whenever necessary so

that the range, if closely followed, can be depended upon to lead in the best water over the bar. The light vessel is moored nearly on the range.

From the light vessel, steer the range 28° true (NNE mag.) for about 1¾ miles, until up to the first gas buoy, passing 150 yards westward of a bell buoy. Leave the first gas buoy and all succeeding buoys about 150 yards on the port hand.

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 can be taken to Natchez and 18 feet to Memphis.

A channel, 9 feet deep at low-river stages, is being maintained to Cairo, and 8 feet to St. Louis, and the river is navigable with an extreme low-water draft of about 4 feet 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	Memphis, Tenn	702
Plaquemine, La	97	New Madrid, Mo	860
Baton Rouge, La	117	Columbus, Ky	904
Red River Landing, La	182	Cairo, Ill	921
Natchez, Miss	246	Thebes, Ill	960
Vicksburg, Miss	351	St. Louis, Mo	1,081
Greenville, Miss	465	St. Paul, Minn	1,600
Helena, Ark	629		

Inland route.—A draft of about 4½ feet at low-river stages can be taken from **New Orleans to Lake Michigan at Chicago**, by way of the Mississippi River, 1,117 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 at present limited to craft of a length of 98 feet, beam 17½ feet, draft 6 feet, and overhead clearance 11 feet. The new Erie Canal, which is expected to be completed in 1918, will pass vessels of 311 feet length, 45 feet width, 10 feet draft, and 15½ feet headroom.

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 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.

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.

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 and is frequented only 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 office in the locality is at Grand Isle, 4 miles westward of Barataria Pass.

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 6½ feet over it extends 2½ miles off the entrance.

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. Slack water before the flood occurs 5 hours after the time of high water at Galveston, and slack water before the ebb occurs 30 minutes before the time of low water at Galveston.

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 above the water, and visible 12 miles.

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 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 4 to 5 feet, but is unmarked and little used.

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. (See p. 123.) It has a depth of 4½ feet in an unmarked channel and is but little used.

Belle Pass and **Raccoon Pass**, 19 and 20½ miles, respectively, southwestward of Barataria Bay lighthouse, have depths of 2 or 3 feet on the bars at their entrances.

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 in the channel over the bar, and depths of 4 to 5 feet 2 miles inside the bar. There is good anchorage, with a depth of 8 to 10 feet, just inside the bar. A light on the inside of the eastern end of **Timbalier Island** is the only aid for entering. There is no post office or settlement of any importance on Timbalier Bay.

Caillou Pass, 9 miles westward of Grand Pass Timbalier, has a depth of 6½ feet in the channel over the bar, and good anchorage inside the pass in 10 to 23 feet of water.

Cat Island Pass, about 3 miles westward of Caillou Pass, is the principal entrance to **Terrebonne Bay**. It has 12 feet on the bar, but only 8 feet at the anchorage, and from 4 to 8 feet 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 on the bar and 8 feet at the anchorage inside.

Caillou Bay is a large bight, with depths of 5 to 6 feet, lying northward of the western end of **Isle Derniere**. There is good anchorage in 8 feet close inside of **Raccoon Point**, the western point of Isle Derniere, but there is only about 7 feet in the approach.

A protected inside route is afforded small craft of 4 to 5 feet draft from Terrebonne and Timbalier Bays westward through **Lake Pelto** and **Caillou Boca** to Caillou Bay.

Caillou Bayou, emptying into the Gulf north of Raccoon Point, has a depth of about 5 feet at its entrance, and a least depth of 12 feet in a channel 800 feet wide for a distance of 16 miles above the entrance.

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 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 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; for 6½ miles of its length it has a depth of less than 12 feet. 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 13 feet of water, 86 miles 271° true (W ⅜ S mag.) from Southwest Pass light vessel. It is a brown skeleton structure, inclosing a stair cylinder and cylindrical dwell-

ing. The light is flashing white (flash 2.7 seconds, eclipse 27.3 seconds), 105 feet above the water, and visible 16 miles. A fog bell sounds a single stroke every 20 seconds.

Atchafalaya Bay and River are described under a separate heading following.

East Cote Blanche (known also as **St. Bernard Bay**), **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 widths of 5 to 15 miles and average depths of 5 to 9 feet. 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.

Cote Blanche Island, on the northerly side of West Cote Blanche Bay, is about 70 feet 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.

Grand Cote Island, near **Weeks Bay**, a northeasterly extension of Vermilion Bay, has an elevation of 204 feet, 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.

Avery Island, on **Petite Anse Bayou**, about 5 miles north of Vermilion Bay, is the location of salt mines and 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 can be taken through the cutoff into East Cote Blanche Bay and thence through West Cote Blanche Bay to Vermilion Bay, but local knowledge is required. A draft of 4 feet can be taken from the northwest side of Weeks Bay through a canal to Petite Anse Bayou and thence up to Avery Island, a distance of 5 miles. The entrance to the canal is marked by range poles. Four feet can also be taken up **Vermilion River** (emptying into the western end of Vermilion Bay from northward) to **Lafayette**, and about that depth up **Schooner Bayou**.

Southwest Pass entrance to Vermilion Bay from the Gulf has a controlling depth of 6 to 7 feet 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, but it is advisable to have local assistance.

Directions, Southwest Pass, Vermilion Bay.—These directions are good for a draft of about 6 feet.

Examine chart No. 200 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.

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.

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. It is fairly steep-to on its southwestern side, the 10-fathom curve being distant only about 5 miles and the 5-fathom curve only about a 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 of water.

Mermentau River Pass, the river, and its tributaries are described on page 124.

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.

Inside the entrance the pass for a distance of 5½ miles has an average width of 600 feet and a depth of 12 feet 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 3 feet over it.

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 usually small schooners in the lumber trade.

Strangers should not attempt to enter without a pilot. Pilots usually come out to a vessel making signal near the bar buoy or they may be had from Cameron. Pilotage is not compulsory and there are no fixed rates.

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 above the water, and visible 12 miles.

The front range is a white slatted pyramidal structure, on pile foundation, standing in 5 feet 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 and River are described on page 125.

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, 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 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 2¼ miles wide between the 30-foot curves; it is marked by buoys. Directions for this passage are given on page 130.

Sabine Bank lighthouse is a red conical tower on cylindrical pier standing in 18 feet of water, 11½ miles 152° true (SE ⅞ S mag.) from Sabine Pass entrance. The light is fixed white, 72 feet above the water, and visible 14 miles. A foghorn sounds a blast of 5 seconds duration every 30 seconds. The horn points southeastward, and consequently can be heard for a greater distance in this direction than in others.

To the southward of Sabine Bank, and about 6 miles inside of the 10-fathom curve, the bottom is somewhat irregular and broken, and several spots with depths of 35 feet or less are found with surrounding depths 10 to 20 feet greater. A 30-foot spot is reported 21½ miles east-southeastward from Sabine Bank lighthouse. Northward of Sabine Bank the general depths are 30 to 40 feet, with some broken ground, on which vessels drawing about 28 feet are reported to have grounded.

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. 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 or less. Atchafalaya Bay is the approach to Atchafalaya River and Morgan City. The usual draft of vessels navigating the bay is 6 feet or less, except those using the dredged channel to Atchafalaya River, through which a draft of 16 feet has been taken.

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 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 above the water, and visible 13 miles.

A dredged channel extends from the Gulf northeastward through Point au Fer Shell Reef to the mouth of the Atchafalaya River. It has a width of 200 feet and a project depth of 20 feet, but as it is subject to rapid shoaling, 10 to 15 feet is the greatest depth to be depended upon at all times. The shoalest part is usually to be found in the third mile southwestward from the lighthouse, below light No. 3. The approach to the dredged channel is marked by buoys; the dredged channel is marked by lights on the northwesterly side and by occasional pile beacons on the southeasterly side 200 feet from the center line.

An abandoned channel leads in a northwesterly direction between the shoals 6 miles west-northwestward from Point au Fer Reef lighthouse, and thence by devious courses to the mouth of Atchafalaya River. Some of the beacons which formerly marked this channel still remain.

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. These are described on pages 120–125.

From Atchafalaya Bay to Morgan City, a distance of 15 miles, the river has a crooked channel ⅛ to ⅜ mile wide and 40 to 140 feet 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.

Morgan City, a town of considerable importance on the east bank of the river, has railroad communication with all points east and west. The principal articles of commerce are sugar, fuel oil, and lumber. Much of the lumber is shipped to domestic ports in schooners of about 800 tons. Steamers of 3 to 6 feet draft run to all adjacent bayous, lakes, and rivers. Coal, gasoline, water, provisions, and some ship chandlery can be obtained here.

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 that 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.

Quarantine.—The quarantine station is about 1 mile below Morgan City. Vessels subject to visitation by the health officer usually anchor below the railroad bridge, where they are boarded.

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 one towboat. 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 tides 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 normal tidal range averages nearly 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 ½ 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 or more draft approaching the bay from eastward or westward should keep in about 3 to 4 fathoms 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, passing the entrance buoy 8¾ miles from the lighthouse. Strangers should select anchorage as far inshore as the draft will permit, and obtain local assistance.

INLAND WATERWAYS OF LOUISIANA WEST OF THE MISSISSIPPI RIVER.

The distances are given in nautical miles; statute miles may be obtained by adding 15 per cent to the distances given.

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 ¼ 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 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 for miles in succession. The lakes, on the contrary, are generally shallow, having depths of possibly 6 to 10 feet, 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 higher ground along the bayous, but small settlements are to be found in other advantageous locations.

The waterways are used almost wholly by fishermen, oystermen, and settlers for the transportation of their fish, oysters, and produce to market and for bringing general merchandise and supplies back to the settlements.

The waterways of southern Louisiana are shown on chart 1116 (in preparation) and on a map issued by the United States Engineer Office, customhouse, New Orleans.

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.

From New Orleans to the eastern part of this section and to Morgan City there are four possible routes—namely, Harvey Canal, Company Canal, Bayou Plaquemine, and Atchafalaya River. The last two are described on pages 124 and 119. From Morgan City to Sabine Lake there is but one route, except between Morgan City and Vermilion Bay.

Harvey Canal route.—Harvey Canal is a toll canal, connecting with the Mississippi River by a lock at Harvey, opposite the wharves of the dock board's Harmony Street landing, near Louisiana Avenue, New Orleans, 2½ miles above Canal Street.

The canal extends in two sections with intervening waters to Larose on Bayou Lafourche. The distance by this route from Canal Street, New Orleans, to Larose is 35 miles, and to Morgan City 94 miles. The controlling depths are 5 to 6 feet (maintained by dredging) to Bayou Lafourche, 4 to 5 feet thence to **Houma**, 3 to 5 feet thence to **Gibson** (15 miles westward from Houma), and 5 feet thence to Morgan City. The route follows Harvey Canal 4¾ miles; **Bayou Barataria**, 9½ miles; **Bayou Villars**, 1¾ miles; **Lake Salvador**, 9½ miles; **Harvey Canal No. 2**, 6½ miles; to Larose, Bayou Lafourche, to Lockport, 10 miles; canal across **Lakes Field and Long**, 7 miles; to Morgan City. The route follows Harvey Canal, 4¾ miles; **Bayou Chene**, 1½ miles; and **Bayou Boeuf**, 7 miles, to Morgan City.

The lock at Harvey is 150 feet long, 30 feet wide, and 7 feet deep over the sills. Six drawbridges cross this route between New Orleans and Houma with widths in the clear of 30 to 38 feet; three cross at Harvey, one at Larose, and two between Bayou Lafourche and Bayou Terrebonne.

Company Canal route.—Company Canal is a toll canal, connecting with the Mississippi River by a lock at Westwego, opposite Walnut Street, New Orleans, about 6 miles above Canal Street, and extending in several sections, with intervening bodies of water, to **Lockport** on Bayou Lafourche. The distance by this route from Canal Street, New Orleans, to Lockport is 39 miles, and to Morgan City 88 miles. The controlling depths are 3½ to 6 feet in the canal to Bayou Lafourche; 4 to 5 feet thence to Houma; 3 to 5 feet thence to Gibson, 15 miles westward from Houma; and 5 feet thence to Morgan City. The route follows Company Canal 1¾ miles; **Bayou Segnette**, 7¾ miles; Lake Salvador, 11½ miles; **Bayou des Allemands** and Company Canal, 12¼ miles, to Lockport on Bayou Lafourche; thence by the canal across Lakes Field and Long, 7 miles; Bayou Terrebonne, 7½ miles, to Houma; Bayou Black, 26 miles; Bayou Chene, 1½ miles; and Bayou Boeuf, 7 miles, to Morgan City.

The lock at Westwego is 160 feet long, 25 feet wide, and 6 feet deep. Nine drawbridges cross this route between the Mississippi River and Houma, with widths in the clear of 30 to 36 feet each. Three are near the Mississippi River end of the canal, four between Bayou des Allemands and Bayou Lafourche, and two between Bayou Lafourche and Bayou Terrebonne.

There is regular steamer service between New Orleans and Houma over this route.

From Morgan City to Sabine Lake the approximate distances in nautical miles and least depths along the usually traveled route are given in the table following. From Morgan City to Vermilion Bay there are two routes. The one by way of Hanson Canal is the more protected, but at present it is limited to small boats by three fixed bridges, with headroom of about 8 feet, crossing the canal.

	Distance in nautical miles.	Depth.
		Feet.
Atchafalaya River and Bayou Teche	22	8
Hanson Canal (private)	4	5
Bayous Portage and Bartholomew	4½	5
West Cote Blanche Bay	15	5
Vermilion Bay	18	5
Schooner Bayou (4 to 5 feet on bar at mouth)	4	8
Government Canal	6	5
White Lake	12	4–5
Turtle, Alligator, and Collicon Lakes	5	5
Grand Lake	12	6
Morgan City to Mermentau River	104	.....
Lake Misere	7	4
Lake Misere Canal	9	4
Sweet Lake	2	4
N. A. L. & T. Co. Canal	5	4
Morgan City to Calcasieu Lake	127	.....
Across Calcasieu Lake to north end	9	5
Inland Waterway Canal	20	5
Sabine River	8	25
Morgan City to Sabine Lake	164	.....

The following alternate route may be used from Morgan City to Vermilion Bay, instead of the route given in the first four lines above:

	Distance in nautical miles.	Depth.
		Feet.
Atchafalaya River	3	Ample.
Little and Big Wax Bayous	17	7
Atchafalaya Bay	8	6
Cote Blanche Bays	19	5

New Orleans to Barataria Bay.—A draft of 4 to 5 feet can be carried from New Orleans to Barataria Bay and the Gulf of Mexico by way of Harvey Canal, 4¾ miles; Bayou Barataria, 15 miles; **Bayou Rigolettes**, 6½ miles; **Harvey Cutoff** and **Lake Villere**, 4¼ miles; **Bayou St. Denis**, 11 miles; and Barataria Bay, 11¼ miles, to Barataria Pass, a total distance of 53 miles. Or, instead of leaving Bayou Rigolettes at Harvey Cutoff, passage may be made by way of **Little Lake**, **Grand Bayou**, and Barataria Bay. This route has a little less depth, but passes more settlements than the other, and is about the same distance.

From Barataria Pass entrance to Barataria Bay there is a route westward by way of Bay des Ilettes, Caminada Bay, Southwestern Louisiana Canal, **Lake Raccourci**, Timbalier Bay, **Lake Felicity**, and **Lake Barre**, to the mouth of Bayou Terrebonne. This route crosses Bayou Lafourche 12½ miles above its mouth, and is approximately 40 miles in length, with depths of 3 to 5 feet.

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 2½ to 5 feet from Donaldsonville to Lockport, and 5 feet from there to the Gulf, with 4½ feet 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. 121)—traffic on the bayou has an outlet to the Mississippi River at New Orleans, and through a third—**Southwestern Louisana 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. At Lockport a canal (mentioned under Harvey Canal and Company Canal) also leads westward across Lakes Field and Long to Bayou Terrebonne.

Thirty miles above Lockport the **Cancienne Canal** leads, by way of **Bayou Magazille**, **Bayou Long**, **Flat Lake**, and Atchafalaya River, to Morgan City. **Larose**, at the outlet of Harvey Canal, and **Lockport**, at the outlet of Company Canal, are 36½ and 46½ miles, respectively, from the Gulf.

Bayou Terrebonne, a small stream 40 to 200 feet wide, is navigable for a draft of 4½ to 6 feet from Houma southward to Terrebonne Bay, a distance of 32 miles. The canal from Bayou Lafourche across Lakes Field and Long enters Bayou Terrebonne 7½ miles below Houma. At Houma, Bayou Terrebonne is connected with Bayou Black by a short canal known as **Barrow Canal.**

Bayou Plaquemine.—From Morgan City there is a waterway with an available depth of 6 to 10 feet 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** 6½ miles, **Grand River** 15½ miles, and Bayou Plaquemine 9 miles.

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.

Atchafalaya River, or more properly the Atchafalaya River system, is an outlet of the Mississippi River at a point 181 miles above New Orleans. It flows in a southerly direction for about 150 miles to Atchafalaya Bay, an arm of the Gulf of Mexico. Morgan City is located on the Atchafalaya River, 15 miles above its mouth. For 30 miles above Morgan City there is an enlargement of the river called **Grand Lake,** or Lake Chetimacha, having an average width of about 4 miles.

A depth of 10 to 16 feet can be taken from the Gulf across Atchafalaya Bay to the mouth of the river. (For further description see p. 118.) From the mouth to Grand Lake the depth is 40 to 140 feet. At least 6 feet at low river stages can be taken throughout the length of the river.

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 to **Franklin** and 6 feet 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 and the principal ports on the Teche.

Vermilion River is a small stream flowing into the western end of Vermilion Bay from northward. It is navigable for about 4 feet draft for 45 miles above its mouth to **Lafayette. Abbeville, Milton,** and **Lafayette** have railroad communication.

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, and Bayou Nezpique is navigable for an additional 22 miles. The available

depth is 6 feet, except on a bar at the foot of Grand Lake, and over shoals in Lower Mud Lake, where the depth is only 3 to 4 feet.

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 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.

Calcasieu Lake and River.—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 in depth. Various projects have been undertaken to improve the depths in the lake, but there is only 3 to 4 feet in the upper and lower ends at present.

Calcasieu River empties into the upper end of Calcasieu Lake from northward. It is navigable for a draft of 8 feet to **Jones Bluff**, a distance of 44 miles above the lake. In this distance it has three enlargements, known as **Moss Lake**, **Prien Lake**, and **Lake Charles**. The town of Lake Charles, on the eastern bank, 17 miles above Calcasieu Lake, has railroad communication and ships considerable quantities of lumber by rail and in small schooners. There are facilities for making repairs to engines and hulls of small craft here; supplies may also be obtained.

Much of the water-borne traffic on the river consists of timber products and the towing of logs.

Calcasieu Pass, the connection between Calcasieu Lake and the Gulf, is described on page 117.

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, 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 1,800 feet. The least general depth between the jettties is 12 to 14 feet. The bar has been further improved by a dredged channel 25 feet deep and 100 feet wide, except for about 1½ miles out from the entrance range red light, where it is 150 feet wide. The dredged channel is marked at frequent intervals by buoys and by lighted ranges, and is not difficult to follow.

The jetties, except their uncompleted outer ends, are built up to a height of about 4 feet above the water. A lighted beacon is erected

near the outer end of the built-up part of the east jetty. In 1915 the uncompleted part of this jetty, which did not show above water, was about 3,000 feet long.

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 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 ¼ mile; but numerous shoals contract the navigable channel to a least width of about 300 feet. A least depth of 26 feet 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, ¼ 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 27 feet at the ends of the wharves, and a draft of 27 feet 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 lumber shipping point.

Sabine Lake is about 15 miles long and has an average depth of about 6 feet. At the southern end where it empties into Sabine Pass there is an unimproved bar with a depth of 4 feet. 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 3½ feet 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, 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 deep.

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 26¾ feet has been taken to sea from Port Arthur through the ship canal.

Port Arthur Ship Canal is about 7 miles in length, from Sabine Pass to Port Arthur, 26 feet in depth, and 250 feet top 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.

Taylor Bayou, which joins the upper end of the Port Arthur Ship Canal, is navigable for a draft of 4 feet 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 39 feet and 70 feet wide, respectively; one at 13 miles and one at about 25 miles up the bayou, with openings of about 20 feet each.

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 top width of 180 feet and a depth of 25 feet. A depth of 25 feet can be carried from the canal up the Neches River to Beaumont, and up the Sabine River to Orange, 30½ and 22½ miles, respectively, above the junction of the canal with the Port Arthur Ship Canal.

A bascule-type drawbridge, with an opening 90 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 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. There are turning basins at Beaumont and Orange, each about 1,500 feet long by 500 feet wide.

Two pipe lines, with a depth of 27 feet over them, cross the river and canal at **Mansfield Ferry Cutoff**, 4 miles below Beaumont.

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 25 feet from the Sabine-Neches Canal, for 9 miles, to Orange, and 11 feet 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.

Cow Bayou, emptying into Sabine River 4 miles above Sabine Lake, is a crooked stream navigable for a draft of 4½ feet 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 tobacco are the principal articles of commerce. It has railroad communication. A depth of about 25 feet can be carried from Orange to the Gulf.

Neches River, emptying into Sabine Lake from northwestward, has an improved depth of 25 feet for 20 miles to Beaumont, 10 feet for a farther distance of 30 miles, and 3 feet for an additional 60 miles. During high river stages, usually from January to the last of April, the depths are several feet greater. Two drawbridges cross the river at 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. There is a municipal dock, 700 feet long, at the foot of Pearl Street. A depth of about 25 feet 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 for 13 miles, and for 3 to 4 feet 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 at low river stages for about 8 miles.

Prominent features.—The most prominent object in approaching Sabine Pass by day is a clubhouse on the west jetty, 2 miles out from the shore; it is a gray-painted building 30 feet above the water. Sabine Pass lighthouse, and the oil tanks and Coast Guard station below the village of Sabine, are 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. 20.)

EXTRACTS FROM RULES AND REGULATIONS GOVERNING SABINE PASS PILOTS.

1. That the rates of pilotage shall be as follows:

On all vessels from seventy-five tons to two hundred tons, inclusive, net register, two dollars and fifty cents on each foot of water vessels draw, both in and out; from two hundred tons to three hundred tons, inclusive, three dollars per foot; from three hundred tons to four hundred tons, inclusive, three dollars and fifty cents per foot; and all vessels over four hundred tons pay four dollars per foot.

4. That vessels piloted in, which have to go into quarantine, shall also be piloted from quarantine to berth without extra charge.

5. That after vessels coming in get inside of the red light without being spoken by a pilot they shall not be liable for pilotage and may refuse a pilot both in and out.

An additional charge of $0.50 per foot draft is made for piloting vessels from inside of Sabine Pass through the canal to Port Arthur.

Towboats are always employed by the larger and deeper draft sailing vessels. They are usually to be found inside the end of the jetties.

Quarantine is enforced by State of Texas health officers in accordance with the regulations of the United States Public Health Service with some additional local requirements at times, usually during the summer months. (See also information relative to quarantine on page 21.) Vessels subject to visitation by the health officer are boarded on the east side of the channel, immediately below the lighthouse.

Hospital.—The nearest marine hospital is at New Orleans.

Anchorage.—Vessels provided with good ground tackle can ride out any gale by anchoring westward of the jetties as close to the beach as their draft will permit. The bottom for a distance of 6 miles alongshore is soft mud and ooze. In some places during south-

erly gales the surface has the appearance of being covered with oil. Small craft can find excellent anchorage, except during the hurricane season, in what is locally known as the **Oil Pond**, between the end of the jetties and the **Dumping Ground**, in depths ranging from 6 to 16 feet. In the pass there are three anchorages. The quarantine anchorage southward of the lighthouse has depth of 18 to 27 feet. 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.

Supplies.—Coal, oil, and water can be had at the docks at Port Arthur. Water can also be obtained from water boats at Port Arthur and Sabine. Some ship chandlery can be had at Port Arthur. Provisions can be obtained at Port Arthur, Beaumont, Orange, and in limited quantities at Sabine.

Repairs.—Minor repairs can be made to the machinery of steamers at Port Arthur. There are machine shops and a railway at Beaumont. At Orange there is a railway with a capacity for keel vessels of about 500 tons or flat-bottomed vessels of 1,500 tons.

Storm warnings are displayed at Port Arthur and at the village of Sabine Pass.

Tides and currents.—The mean range of tide is 0.7 foot 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. 118) parallels the coast at a distance averaging 17 miles and should be avoided. The gas buoys off the southwesterly end of Trinity Shoal and the easterly end of Sabine Bank are useful marks and the former is very dependable. Deep-draft vessels, after passing Trinity Shoal, usually stand in for Calcasieu lighthouse on some course between northwest and west-northwest and bring it to bear about 7° true (N mag.), distant about 8 miles. Then a 266° true (W by S mag.) course for 24 miles will lead to a position 1 mile outside the gas and whistling buoy off Sabine Pass.

Moderate-draft vessels on a 285° true (W ¾ N mag.) course made good from Trinity Shoal gas 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 ¾ 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 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, until the gas and whistling buoy is sighted, and then head for it.

In entering the pass strangers of deep draft should take a pilot. For vessels of moderate draft chart 517 and the buoys are sufficient guides, if followed carefully.

The shoalest water in the entrance channel will generally be found about ¾ 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 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 27 to 35 feet over it, while depths of 50 to 60 feet 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.

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 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. 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 25 feet 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 cotton and cottonseed products, wool, grain, rice, fruits, ore, lumber products, and miscellaneous merchandise.

The approach to Galveston Bay, known as **Galveston Entrance** (chart 520), lies between two converging jetties about 4 miles long and 1¼ miles apart at the outer end. The channel is improved by dredging, so that in 1915 there was a least depth of 32 feet in a channel 800 feet wide. There was a least depth of 24 feet in the channel to Port Bolivar; 30 feet for a width of 1,200 feet along the water front of Galveston; 22 feet (project, 30 feet) for a channel width of 300 feet to Texas City; and 21.4 feet (project, 25 feet) in the Houston Ship Channel. All of the channels are subject to change, and dredging is usually in progress to maintain them.

Galveston Harbor, the name generally applied to the southern part of Galveston Bay inside the entrance, is divided into two parts, **Bolivar Roads** and **Galveston Channel.** The former includes the deep water between Bolivar Point on the north and **Pelican Island** and **Fort Point** on the south. It affords good anchorage for large vessels at all seasons except during hurricanes. Galveston Channel is a dredged channel 30 to 35 feet deep and 1,000 to 1,200 feet wide, extending for about 3½ miles from Bolivar Roads southward and westward, past Fort Point and the northwestern end of Galveston Island, and along the northern front of the city of Galveston. A dike along the southerly side of **Pelican Spit** prevents a sea in Galveston Channel during northers.

The city of **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 high.

Galveston has a large foreign and domestic trade in cotton, cottonseed products, grain, and live stock, 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. Warehouse and cargo-handling facilities are very good, and there is wharf frontage for over 100 ocean-going vessels.

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.

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. Lumber and cotton are the principal articles of commerce. A channel, 200 feet wide and 24 feet deep in June, 1915 (project depth, 30 feet), has been dredged from Bolivar Roads to a turning basin, 1,000 feet wide, in front of the wharves. The channel is marked by buoys and a lighted range.

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 cotton, grain, hardware, and general merchandise. The facilities for handling cargoes are very good. A channel, 30 feet deep and 300 feet wide, being dredged from the deep water of Bolivar Roads to Texas City, is expected to be completed in 1916. It is protected on its northerly side, for about 4 miles out from the mainland, by a timber and earth dike 600 feet from the axis of the channel. The channel is marked by beacons and lights, some of them forming ranges.

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, with a depth of 4½ feet 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 on the bar at the entrance, and 6 to 8 feet inside for about 4 miles, to the village of **High Island**, and 3 feet 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 for a distance of 20 miles. It has a little commerce in rice.

Robinson Bayou has a depth of only 1½ feet 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 6½ feet deep (June, 1915) 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 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 6¾ feet deep (June, 1915) has been dredged across the shoals from deep water past Anahuac to Turtle Bay and 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 a dam with a guard lock near its eastern end, 130 feet long, 36 feet wide, and 12 feet deep. The water of the bay is fresh, and the shore lands are utilized for rice growing. A depth of 3 feet can be carried across Turtle Bay to **Turtle Bayou**, and 6 feet 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 4.5 feet, and that draft can be carried to **Wallisville**, 5 miles above the mouth; 4 feet can be carried at low water to **Moss Bluff** and **Liberty**, 17 and 35 miles above the mouth, although there is a bar about 4 miles below Liberty which at extreme low water has only about 3 feet on it. 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, 1915, this channel had a depth of 5½ feet, subject to change. After crossing the bar a least depth of 9 feet can be carried up the bayou for 15 miles. Cedar Bayou is a small town and post office 7 miles above the mouth.

The Houston Ship Channel (chart 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 considerable traffic in cotton and general merchandise, and there is regular steamer service from the towns on the channel to New Orleans, Tampa, and New York. The canal has been dredged to a depth of 25 feet, in a channel 100 feet wide (150 feet across Galveston Bay) for 44 miles from Galveston Harbor to the turning basin, 6 miles below Houston, and to a depth of 8 feet for the remaining distance; the channel is subject to shoaling. The entrance to the channel from Bolivar Roads is marked by a lighted range; across Galveston Bay the channel is marked by lights at frequent intervals, and at the cut through Redfish Bar by a lighthouse with fog bell.

Across lower Galveston Bay, up to a point ¼ mile south of beacon No. 2, the dredged material has been deposited on the west side of the channel, with openings 1,000 feet wide immediately southward of beacons Nos. 1 and 3. North of beacon No. 2 in the upper bay the dredged material is on the east side, with an opening 500 feet wide and 4 feet deep northward of beacon No. 4, and another opening 2,000 feet wide and 8 feet deep about 2¾ miles above beacon No. 4.

In San Jacinto River the channel is crooked and marked by buoys and temporary range beacons.

Lynchburg is a town at the junction of Buffalo Bayou and San Jacinto River, 29 miles above Galveston Harbor. **Clinton** and **Harrisburg**, on Buffalo Bayou, 40 and 42 miles, respectively, above Galveston Harbor, are towns with good terminal facilities. The turning basin, 6 miles below Houston, is 1,200 feet long by 900 feet wide and has good municipally owned terminal facilities.

Houston, one of the largest cities of the State of Texas, has communication by means of several lines of railroad with all parts of the United States and with Mexico, and is a distributing point for the southeastern part of the State.

There are several small shipyards and marine railways at Lynchburg, Clinton, and Harrisburg; the largest has a capacity of about 150 tons.

A county ferry crosses the river at Lynchburg.

Twelve bridges cross Buffalo Bayou above the turning basin; most of them have draw spans, and the smallest closed span (Franklin Avenue) has a width of 20 feet in the clear and headroom of 33 feet at mean low water.

Pilots for the Houston Ship Channel may be found at Galveston.

San Jacinto River above Lynchburg is navigable for a draft of 4 feet for a distance of 13 miles, to a closed bridge, which is considered about the head of navigation, although a draft of 3 feet 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 for a distance of about 8½ miles, at which point it is crossed by two fixed bridges, each having about 31½ feet 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 6 feet deep (June, 1915) 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 to **Friendswood**, 17 miles above Galveston Bay. **League City** is a small town 11 miles above the bay. The creek is crossed by five drawbridges, one with an opening of 60 feet,

three of 24 feet, and one of 24 feet, at 1, 8¾, and 10 miles, respectively, above the mouth. There is considerable 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 5 to 6 feet deep (June, 1915) has been dredged across the bar at its mouth. After crossing the bar a depth of 10 feet can be carried up the bayou for 13 miles, and a depth of 6 feet 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 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 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 high) and a club house 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 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. During thick or foggy weather the pilot boat, when in open water, blows four blasts of the whistle; steamers approaching the bar and hearing the whistle reply with similar blasts. This is repeated at frequent intervals until the pilot boat arrives alongside the steamer. Rates of pilotage for the port of Galveston are: Vessels not over 500 tons, net registered tonnage, $3 per foot of draft each way; vessels over 500 and not over 1,000 tons, $3.50 per foot of draft; vessels over 1,000 and not over 1,500 tons, $3.75 per foot of draft; vessels of 1,500 tons and over, $4 per foot of draft. (See also the extracts from the laws of Texas relative to pilotage on p. 20.)

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.

Anchorage.—Vessels outside of the bar, if prevented from entering by a norther, can anchor in about 5 fathoms, 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, and the bottom is good holding ground.

The quarantine anchorage is northeastward of Fort Point.

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 by a norther, and vessels should make due allowance for it when selecting anchorage during the winter months.

Harbor master.—The harbor master's office is on pier 25 at the foot of Twenty-fifth Street. He 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.

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. 21.)

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. The nearest marine hospital is at New Orleans.

Supplies.—Coal for steamers, either anthracite or bituminous, in considerable quantities can be had at the wharves in Galveston and Texas City or from lighters in the stream. Fresh water of excellent quality for drinking purposes can be had at the wharves or from

water boats. Provisions and ship chandler's stores can be obtained at Galveston.

Repairs.—There is a marine railway with cradle 90 feet long and a capacity of about 300 tons on Pelican Spit. The facilities for repairs to hulls of small craft are good, and a number of machine shops in the city have facilities for ordinary repairs to the machinery of steamers. The nearest dry dock for large vessels is at New Orleans.

Storm warnings are displayed on the Loan & Trust Co. Building, Galveston, at Port Bolivar, Texas City, Anahuac, Laporte, Harrisburg, and Seabrook.

Time ball.—A time ball is dropped daily, except Sundays, at noon, seventy-fifth meridian time, or one hour before noon of ninetieth meridian time. It is located on the roof of the City National Bank Building, where it is plainly visible to shipping.

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.

A **Coast and Geodetic Survey suboffice** is located in the Cotton Exchange Building, at which complete files of United States Coast and Geodetic Survey charts, Coast Pilots, Tide Tables, and other publications relating to navigation may be consulted and information affecting navigation obtained without charge. Charts and other publications of the Coast and Geodetic Survey are also on sale here.

Tides and currents.—The maximum normal tidal action is 2 feet at the end of the jetties, 1.5 feet at Galveston, and 0.7 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.

DIRECTIONS, GALVESTON.

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 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 south (mag.) of Dry Tortugas lighthouse on Loggerhead Key, a course of 295° true, made good for 666 miles leads to Heald Bank light vessel (described on p. 131.) 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 over them, with general surrounding depths of 5 to 5½ fathoms.

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 ¼

mile wide and 7 feet deep, with at least that depth for some distance inside. Good anchorage can be found on the south 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. In 1915 the best water was found on about a 300° true (WNW mag.) course, with the house on Mud Island open a little eastward of the white sand banks on the right tangent of San Luis Island.

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 for 200 miles, but at ordinary river stages it is navigable for only 35 miles, to **Bolivar Landing**, with a draft of 3 feet.

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 560 feet apart, and by dredging, so as to maintain a channel 150 feet wide and at least 18 feet deep; in 1916 the ruling depth was 18 feet in the channel over the bar and up the river to the turning basin abreast of the railroad wharf at Brazosport, 1½ miles above the end of the jetties, and 22 feet along the face of the wharf. The entrance is marked by a few buoys in the approach and by Brazos River lighthouse.

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 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 (weekly) with New York. The principal articles of commerce are sulphur 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 close to the banks in places abreast of both towns and at the small landings.

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.

Prominent features.—The derricks, stacks, and rising smoke at the sulphur mines, 4½ 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.

Pilots.—There are no regular pilots, but generally some one acquainted with the channel will come out from the Coast Guard station in response to signals. It is advisable for strangers of over 12 feet draft to secure local assistance.

Towboats are not regularly stationed here, but they make frequent 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 Velasco and boards vessels at the mouth of the river.

Wharfage.—There are no wharfage charges or other port charges on vessels or cargo.

A deputy collector of **customs** is stationed at Velasco.

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 can also be had.

Repairs.—Galveston is the nearest place where repairs to machinery of steamers can be made. New Orleans is the nearest place for docking vessels of over 300 tons. Vessels of less than 300 tons can be docked at Galveston.

Storm warnings are displayed at Brazosport 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 tides at the mouth of the river is 1.8 feet. The current has a normal velocity of about 1 knot, which may increase to 4 or 5 knots during high river stages.

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, anchor in 20 feet 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 1915 a course of 278° true W (mag.), 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.

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

upon to indicate the best water. The depths range from 5 to 10 feet, the former depth prevailing in January, 1915.

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, with the lighthouse bearing about W ½ S (mag.). Inside the bar anchorage may be found in about 20 feet, 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 9 seconds, eclipse 81 seconds), 85 feet above the water, and visible 15 miles.

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. These are described on page 149. 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 20 feet is available (1916) in a channel having a least width of 200 feet. It is marked by buoys, some of which are lighted. When completed the channel will be 600 feet wide and 25 feet deep.

Aransas Pass lighthouse is a pyramidal brick tower on the southeasterly shore of Harbor Island. The light is fixed white, 65 feet above the water, and visible 12 miles.

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 11 feet deep extends from the inner end of the pass to a municipal dock in front of the port. About ½ mile northward of Port Aransas, on Harbor Island, are the wharf, warehouse, and terminals of a railroad which affords communication with the town of Aransas Pass.

Prominent features.—In approaching Aransas Pass in daytime the first object sighted is a water tower 145 feet 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. 20.)

Towboats.—Except under especially favorable conditions, sailing vessels are advised to take a towboat. One is usually stationed at the railroad docks inside the pass.

Anchorage with limited swinging room may be found in the dredged turning basin, 1,700 feet by 2,000 feet, eastward and northeastward of the railroad docks. Deep-draft vessels anchor in the Gulf eastward of the jetties wherever the depth is suitable and lighter their cargoes.

Quarantine is enforced by health officers of the State of Texas in accordance with the requirements of the United States Public Health Service, with some additional local requirements at times. The quarantine station is located on the north end of Harbor Island. Vessels subject to visitation are boarded between sunrise and sunset at any point 200 meters (656 feet) from the shore line in the vicinity of the pass. Vessels which do not enter the harbor but lighter their cargoes are boarded at the anchorage outside the jetties.

Hospital.—Relief is furnished at Port Aransas 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 Port Aransas.

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.

Minor repairs to machinery of vessels, large and small, can be made at Port Aransas. The nearest facilities for dry-docking vessels of over 300 tons is at New Orleans. Vessels of less than 300 tons can be hauled out 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.

Storm warnings are displayed at Port Aransas. 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 occurs about two hours after the time of tide 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 on the bar at the entrance, but only about 1½ feet 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 Chritsi 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 ½ mile into the Gulf, across which there is a channel, shifting with the season of the year, having a depth of about 6½ feet.

The seasonal changes at Brazos Santiago are quite marked. During the winter months the best water is said to be in a northeasterly direction from the Coast Guard station. The point on the north side of the entrance builds out, while that on the south side cuts away, and the depth inside the bar may be as little as 3 feet. During the summer months the best water over the bar is said to extend southeastward from the lighthouse. The point on the north side of the entrance cuts away, that on the south side builds out, and the depth inside the bar increases to as much as 30 feet.

Inside the entrance there was formerly a depth of 10 feet in a dredged channel to the end of the railroad wharf at Point Isabel, but this channel has filled in, so that 3 to 4 feet is the greatest depth that can be carried for any distance above the lighthouse.

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 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 is being constructed here (1915). Storm warnings are displayed.

In approaching Brazos Santiago on a clear day the old lighthouse 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 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.

There is no health officer regularly in attendance at the quarantine station.

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 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 3 feet over it, in a channel subject to frequent change. Inside the entrance there are depths of 10 to 30 feet; 3 to 4 feet 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 1915 the best water paralleled the Mexican shore for ½ mile or more below the mouth.

INSIDE ROUTE, GALVESTON TO CORPUS CHRISTI.

A draft of 3 to 5 feet can be taken through the inland waterway system of the coast of Texas from Galveston to Corpus Christi, a distance of 173 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 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 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.

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 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 in depth, and affords secure anchorage for boats and small launches. It can be entered with a draft of 5 to 6 feet at high water.

Greeen Lake and **Karankawa 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 deep has been dredged across the bar at the mouth of the bayou, but in 1915 the controlling depth was only 2 to 3 feet. Inside the bar a depth of 8 feet can be carried for several miles, and 2 to 3 feet 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.**

San Luis Pass, an entrance from the Gulf to the southwestern end of West Bay, is described on page 140.

Bastrop Bayou empties into **Bastrop Bay** 4 miles northwestward of San Luis Pass. The bay and mouth of the bayou are obstructed by shoals, over which there is a channel depth of 1.8 feet. Above these shoals the bayou is navigable for a draft of 4 feet for about 15 miles. It is crossed by two drawbridges, about 14 miles above the mouth. Rice, cotton, and truck are the chief articles of commerce. There are no villages on the bayou, although the town of **Angleton** is only a few miles away from it, near the head of navigation.

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 2½ feet for 2 miles above its junction with the canal, and a depth of 4 feet 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 is described on page 141.

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. Inside the bar it is said to have a depth of 8 feet for about 40 miles, and a depth of 1½ to 2½ feet 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 intracoastal canal from Brazos River to Matagorda Bay enters the San Bernard about ¼ mile above its mouth, and leaves it at **Longs Bayou,** ½ mile farther up.

Caney Creek empties into the extreme northeastern part of Matagorda Bay, through a canal ½ 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 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.

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, 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, averaging 10 or 12 feet over the greater part. These depths are fairly stable. A dredged cut 8 to 10 feet deep across the southerly end of Dog Island Reef connects the two parts of the bay. The principal local traffic on the bay is carried by fishermen and oystermen in light-draft vessels.

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 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 unimproved bars, on which the depth at low tide is about 1 foot. Inside the bars there is a controlling depth of 8 feet for about 6 miles, and 2 to 3 feet for 16 miles farther. There is no commerce on the river.

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 15 to 18 inches can be taken to the docks at low tide. Storm-warning signals are displayed here.

Trespalacios Bay is an unimportant tributary on the north side of the western part of Matagorda Bay. Five feet can be taken to within 1 mile of **Palacios** and 3 to 3½ feet 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 at the entrance and a controlling depth of 6 to 10 feet 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.

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 7 feet in dredged channels across **Sand Point** and **Gallinipper Reefs** to the town of Port Lavaca on the western shore. The town is headquarters for the fish and oyster industry of this section of the coast, and has considerable traffic by water with the adjacent country. **Port Lavaca** has railroad communication with the interior of the State. Storm warnings are displayed here.

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. Above the mouth it has a depth of 5 feet 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 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 the shipping.

Pass Cavallo, a shallow entrance from the Gulf to the southwestern end of Matagorda Bay, is described on page 142.

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.

Espiritu Santo Bay can be entered from Pass Cavallo through **Big Bayou** with a draft of 2 feet at low tide, and through Barroom Bay Cut with a draft of 3 to 5 feet.

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 3 to 5 feet. **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.

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 across San Antonio Bay to the mouth of the river, where the usual depth is about 2 feet, very soft bottom. Inside the mouth there is a controlling depth of 3 feet for about 10 miles, above which, although the depth is about 3 feet 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. 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 can be taken to the wharves at Rockport from Aransas Pass. Storm warnings are displayed.

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.

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. **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. **Aransas River**, emptying into the northwestern end of Copano Bay, is navigable only for small boats.

Corpus Christi Bayou forms a thoroughfare between Aransas and Corpus Christi Bays which is largely used by local fishermen and small craft drawing less than 6 feet. 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 (1915) from the landings southeastward of the town to Corpus Christi Bayou; thence it has a depth of 6 feet to Port Aransas. Aransas Pass has railway communication with the interior of the State.

Aransas Pass, an entrance with 20 feet depth from the Gulf to Aransas and Corpus Christi Bays, is described on page 143.

Corpus Christi Bay is a large body of water, lying westward of Aransas Pass, and connected with it by a dredged channel 100 feet wide and 12 feet deep. The general depths in the bay are 8 to 14 feet. **Harbor City** and **Portland** are resort villages and post offices on the north shore of the bay.

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 12 feet 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 and even dangerous for open boats.

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 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.

REGULATIONS FOR THE NAVIGATION OF THE INLAND WATERWAY.

The following are extracts from the laws, rules, and regulations for the navigation of the inland waterway on the coast of Texas

prescribed by the Secretary of War; complete copies can be obtained upon application to the United States engineer office, Loan & Trust Building, Galveston:

All vessels approaching dredges and other vessels engaged on improvements to the canal shall be required to stop and give the signal for passing and on receiving the answering signal shall proceed and pass such dredge or other vessel at a speed of not to exceed 3 miles per hour.

Pilots or masters in charge of boats, on coming within a half mile of a movable bridge and desiring to pass through it at once, shall signal for passage by three long blasts of the whistle. Should a boat land within this limit, this signal shall be given when it is ready to leave its landing. Boats shall not attempt to pass through any bridge until signaled to do so. If the draw is ready to be opened the signal from the vessel shall be answered by three long blasts of the whistle from the bridge. If not ready for opening, by two short blasts of the whistle from the bridge. Pilots and vessels while in the canal will be subject to all the rules and regulations of the United States relating to pilots and vessels on rivers whose waters flow into the Gulf of Mexico and their tributaries.

No boat in the dredged portion of the canal shall proceed at a greater rate of speed than 8 miles (statute) per hour, and upon approaching and passing through drawbridges all vessels shall slacken speed to 4 miles per hour or even less if that be necessary to pass through the bridge without colliding with it or its fenders.

There are movable bridges at Quintana, Bryans, Longs Bayou, and Caney Creek, Texas, of which the clear width of opening is 50 feet, the clearance under the bridges at mean low tide being 6 feet. The standard depth of water in the canal is 5 feet at mean low tide.

No ashes, cinders, slag, refuse, or obstructive matter of any kind shall be dumped, cast out, or unloaded in the dredged portion of the canal. Ashes, cinders, and other like material from boats shall be deposited on the bank or transported entirely out of the dredged portion of the canal. Refuse or offensive material of any kind shall not be deposited on the canal grounds.

A white flag on the bridge or the bridge tender's dwelling by day, or a white light displayed above the red light on the bridge by night, will signify that the bridge tender has instructions for passing vessels.

The route, distances, and charts of the inland waterway are given in the following table:

	Nautical miles.	Chart.
Galveston to Mud Island	24	204
Mud Island to Brazos River	13	1281
Brazos River to San Bernard River	9	1281
San Bernard River to Matagorda Bay	14	1281
Matagorda Bay to Dog Island Reef	19	1281
Dog Island Reef to Port O'Connor	25	207
Port O'Connor to First Chain of Islands	14	207
First Chain of Islands to Panther Reef	6	208
Panther Reef to Second Chain of Islands	6½	208
Second Chain of Islands to Halfmoon Reef	10½	209
Halfmoon Reef to Corpus Christi Bayou	10¾	209
Corpus Christi Bayou to Corpus Christi, direct	20¾	210
Corpus Christi Bayou to Corpus Christi via Port Aransas	23	210

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 channel have a white board below the day mark.

Pilots for the inside route may be found in Galveston.

Supplies, gasoline, and fresh water can be obtained at the principal towns.

DIRECTIONS, INSIDE ROUTE, GALVESTON TO CORPUS CHRISTI.

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

From the western end of Galveston Channel follow along the dike on the south side of Pelican Spit, passing about 150 yards off the lighted beacon at its western end. Then head about half way between the causeway drawbridge and the group of buildings on **Virginia Point**, course 267° true (W by S mag.). Hold this course for about 2 miles, and then head for the northerly end of the fender-pile approach to the draw span. This will clear the ruins of an old pile trestle about 200 yards northeastward of the causeway. Favor the southeasterly side of the draw opening in passing through.

Galveston West Bay.—When through the draw, steer about 210° true (SSW mag.) for ½ mile, and then 238° true (SW ½ W mag.) for 2 miles to beacon No. 11, between the Deer Islands. Then steer 233° true (SW mag.) for 16 miles to the cut which has been dredged across Mud Island to Bastrop Bay.

Galveston Bay to Brazos River.—The dredged channel along the easterly side of Bastrop Bay, course 204° true (S. by W ½ W mag.), is marked by small stakes with pointers and by the spoil bank on the southeasterly side. Pass southeastward of the small islet with two conspicuous bushes on it at the southern end of the channel, and if bound for Bastrop Bayou round it and steer 334° true (NW by N mag.). If bound for **Titlum-Tatlum**, the slough around the south end of Mud Island, bring the islet astern and steer about 160° true (SSE ½ E mag.).

If crossing Oyster Bay, round **Christmas Point**, giving it a good berth, and leaving Christmas Point Channel beacons Nos. 1 and 3 20 yards on the port hand. When up to Oyster Bay Channel beacon No. 1, which marks a turn in the channel, steer about 207° true (S by W ¾ W mag.) for 3 miles, passing between **Arcadia Reef** on the port hand, and **Rattlesnake Point** on the starboard, into **Drum Bay**. In crossing Drum Bay keep midway between the spoil banks on either side. Hold a mid-channel course through the canal to Oyster Creek, down Oyster Creek, and through a canal and **East Union Bayou** to Brazos River. Hold well out into the river before turning northward, so as to avoid the shoal on the starboard side at the junction of the canal and river. A drawbridge, with opening 50 feet wide, crosses the canal ½ mile westward of Oyster Creek.

If bound up the Brazos River to Freeport or Velasco, hold a mid-channel course, passing between the oil tanks and sulphur-loading docks on the south and north sides, respectively.

Brazos River to Matagorda Bay.—If going to Matagorda Bay, enter the canal eastward of the oil tanks, favoring the bank on the east side to avoid the point of the shoal making off from the west side. Pass through Quintana and Bryan bridges, ¼ and 2¾ miles, respectively, from the Brazos River. These are highway bridges with draw openings 50 feet wide. Hold a mid-channel course through the canal to San Bernard River.

The route leads up the San Bernard River for about ½ mile and leaves it at Longs Bayou, passing on either side of a small island with an old house on it, and through Longs Bayou bridge (draw opening 50 feet wide).

Cedar Lakes, of which Longs Bayou is the outlet, are four shallow ponds, practically dry at low water, partially separated from one another by shell banks. In crossing them follow the beacons.

Leaving the fourth lake, the canal leads between well-defined banks into Caney Creek and thence into the eastern end of Matagorda Bay, passing through Caney bridge (draw opening, 50 feet) a short distance before entering the creek.

Matagorda Bay is a shallow lagoon with depths of 5 feet or less for the first 20 miles of its length from eastward. In the eastern end of the bay the channel is marked by beacons at irregular intervals on the south side at distances of about 25 yards from the axis.

A 247° true (SW by W ¼ W mag.) course leads across the eastern part of Matagorda Bay to Dog Island Reef cut. This cut is marked by beacons.

From the cut steer about 242° true (SW ¾ W mag.) for about 24 miles to the jettied entrance to **Barroom Bay Cut**, ¾ mile south of the pavilion pier at Port O'Connor. The cut is marked by lights. The commercial wharves at Port O'Connor are located at the westerly end of the cut.

Espiritu Santo Bay.—At some seasons of the year the dredged channels from Espiritu Santo Bay to Aransas Bay may become filled with floating grass, which seriously impedes navigation.

After passing the wharves at Port O'Connor steer about 246° true (SW by W ¼ W mag.) for 2 miles, with Barroom Bay Cut lights nearly on range astern. For the next 2 miles the alignment of the channel is subject to change. The directions in the following sentence were good in 1915: When on line between a large house about 1 mile westward of the wharves at Port O'Connor and the next to the last beacon from the westward, head for the beacon on about a 230° true (SW ¼ S mag.) course until within about 10 yards of it, and then head so as to pass the last beacon to the westward about 10 yards on the port hand. Then steer 225° true (SW ¾ S mag.) for about 5 miles and pass southward of Dewberry Island Shoal beacon. From this beacon a 236° true (SW ¼ W mag.) course for 6 miles leads to the cut through the First Chain of Islands.

San Antonio Bay.—Leaving the First Chain of Islands steer 242° true (SW ¾ W mag.) for 5¾ miles to Panther Point Reef cut. Leaving the cut steer about 236° true (SW ¼ W mag.) for 5½ miles to beacon No. 1. Then steer 211° true (SSW mag.) for 1½ miles through the dredged cut at the Second Chain of Islands.

Mesquite Bay.—From the Second Chain of Islands the beacons and the chart are the guides. The successive courses are 233° true (SW mag.), 1 mile, heading for the northerly end of a small islet at **Ayres Reef**; round the islet close-to for ⅛ mile; 247° true (SW by W ¼ W mag.) about 2½ miles, passing through **Belden Dugout**; pass between an islet on the port side and an island on the starboard side at **Gastons Reef**, for ½ mile; 211° true (SSW mag.), 1¼ miles; 231° true (SW ¼ S mag.), ½ mile to a position midway between two beacons marking **Cape Carlos Dugout**.

Aransas Bay.—From the last position steer 234° true (SW mag.), ⅝ mile; 205° true (S by W ½ W mag.), 1 mile, to **Poverty Reef**; 244° true (SW by W mag.), 1½ miles; and 232° true (SW ⅛ S mag.) to **Halfmoon Reef** cut.

From Halfmoon Reef, if going to Rockport, steer about 217° true (SSW ½ W mag.), so as to pass southward of the beacon ½ mile southwestward of **Nine Mile Point**, and then head about for the large hotel building near the water front at Rockport.

Aransas Bay to Corpus Christi.—If going to Corpus Christi, from Halfmoon Reef steer 208° true (S by W ¾ W mag.) for 10¾ miles, to a beacon with circular day mark on the south side of the entrance to Corpus Christi Bayou; from Rockport a 189° true (S mag.) course for 6 miles leads to the beacon. Take a mid-channel course through the bayou, following the channel markers on either side to the drawbridge. The width of the draw opening of the bridge is 24 feet. Then steer about 203° true (S by W ¼ W mag.) through Morris and Cummings cut, pass 100 yards westward of **Ransom Point beacon**, and at beacon No. 11 enter the dredged channel to Corpus Christi. Thence about a 259° true (WSW ¼ W mag.) course for 13¾ miles will lead across Corpus Christi Bay to the docks at Corpus Christi.

Or, if going to Corpus Christi by way of Port Aransas, leave the beacon at the south side of the entrance to Corpus Christi Bayou in Aransas Bay at some distance on the starboard hand, and follow either one of two channels leading southward. The controlling depths in both of these channels is 7 feet. The easier channel for a stranger to follow leads west of beacon No. 6, and then about 200 yards off the Harbor Island shore to Aransas Harbor. Thence about a 259° true (WSW ¼ W mag.) course for 18 miles leads through the dredged channel (12 feet depth) and across Corpus Christi Bay to the docks at Corpus Christi.

APPENDIX.

COAST PILOTS OF THE COAST AND GEODETIC SURVEY.

	Price
U. S. Coast Pilot, Atlantic Coast, Parts I–II, from St. Croix River to Cape Ann	$0.50
U. S. Coast Pilot, Atlantic Coast, Part III, from Cape Ann to Point Judith	.50
U. S. Coast Pilot, Atlantic Coast, Part IV, from Point Judith to New York, including Long Island Sound	.50
U. S. Coast Pilot, Atlantic Coast, Section C, Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays	.50
U. S. Coast Pilot, Atlantic Coast, Section D, Cape Henry to Key West	.50
U. S. Coast Pilot, Atlantic Coast, Section E, Gulf of Mexico, from Key West to the Rio Grande	.50
Inside Route Pilot, coast of New Jersey	.20
Inside Route Pilot, New York to Key West	.20
Inside Route Pilot, Key West to New Orleans	.20
U. S. Coast Pilot, Pacific Coast, California, Oregon, and Washington	.50
U. S. Coast Pilot, Pacific Coast, Alaska, Part I, from Dixon Entrance to Yakutat Bay	.50
U. S. Coast Pilot, Pacific Coast, Alaska, Part II, Yakutat Bay to Arctic Ocean; will replace Coast Pilot Notes, from Yakutat Bay to Cook Inlet and Shelikof Strait, and Coast Pilot Notes on Bering Sea and Arctic Ocean	.50
U. S. Coast Pilot, West Indies, Porto Rico	.50
Coast Pilot Notes on Hawaiian Islands	Free.

SAILING DIRECTIONS, PHILIPPINE ISLANDS.

Section I. North and west coasts of Luzon and adjacent islands	Free.
Section II. Southwest and south coasts of Luzon and adjacent islands	Free.
Section III. Coasts of Panay, Negros, Cebu, and adjacent islands	Free.
Section IV. Coasts of Samar and Leyte and the east coast of Luzon	Free.
Section V. Coasts of Mindanao and adjacent islands	Free.
Sections VI and VII. Mindoro Strait, Palawan Island, and Sulu Sea and Archipelago	Free.

Meteorological table compiled by the United States Weather Bureau.

KEY WEST, FLA.

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 in. 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	30.50	29.71	0.79	68.8	73.9	65.0	8.9	90	41	49	82	4	1.98	8	3.97	11.1	58	8	30	9	4	2	2	1	6	0	0	0
February	30.07	30.42	29.60	0.82	70.8	75.4	66.0	9.4	87	44	43	80	4	1.64	6	2.99	10.8	49	9	17	11	8	3	1	2	5	0	1	0
March	30.05	30.47	29.70	0.77	72.8	77.5	68.2	9.3	89	48	41	77	3	1.48	5	4.52	10.8	56	8	13	19	10	3	1	1	7	0	1	0
April	30.02	30.37	29.63	0.74	75.5	80.4	71.1	9.3	91	54	37	74	3	1.30	4	3.23	10.6	48	7	13	16	11	3	1	2	7	0	0	0
May	29.97	30.25	29.68	0.57	79.0	84.0	74.5	9.5	93	63	30	74	4	3.36	8	5.83	9.3	54	6	9	21	12	4	3	3	4	0	0	0
June	29.99	30.26	29.62	0.64	82.2	87.0	77.2	9.8	100	69	31	76	5	4.25	12	5.48	8.0	50	3	7	19	16	7	3	2	3	0	0	0
July	30.03	30.24	29.77	0.47	83.7	88.7	78.5	10.2	100	68	32	76	5	3.59	13	4.00	7.6	52	2	7	24	14	5	4	2	4	0	0	0
August	29.98	30.20	29.67	0.53	83.8	88.8	78.4	10.4	100	68	32	74	5	4.69	14	4.04	7.5	44	3	8	23	13	5	4	3	2	1	0	0
September	29.94	30.17	29.13	1.04	82.5	87.4	77.3	10.1	97	69	28	78	5	6.79	16	7.90	8.1	87	3	17	24	8	3	2	0	2	1	0	0
October	29.94	30.28	28.47	1.81	78.7	83.0	74.7	8.3	92	59	33	78	4	5.38	13	11.23	11.1	100	7	27	13	5	2	3	2	3	0	1	0
November	30.02	30.45	29.65	0.80	74.3	78.1	70.4	7.7	91	51	40	80	4	2.36	8	8.86	11.2	52	9	33	8	3	1	1	1	4	0	0	0
December	30.08	30.52	29.63	0.89	70.1	74.4	66.1	8.3	88	44	44	81	4	1.84	7	3.93	10.9	48	10	25	10	6	3	1	2	5	0	0	0
Mean	30.02				76.8	81.6	72.3	9.2				78	4				9.8												
Total														38.66	114				75	206	197	110	41	26	21	52	2	3	0

Meteorological table compiled by the United States Weather Bureau.

TAMPA, FLA.

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 in. 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	30.12	30.56	29.44	1.12	60.1	68.9	51.2	17.7	83	23	60	82	5	2.80	7	3.58	6.9	40	9	20	5	3	4	4	5	12	0	[1] 0	2
February	30.10	30.56	29.48	1.08	62.3	70.3	52.5	17.8	86	22	64	80	5	3.27	7	4.06	7.6	49	6	16	3	4	4	6	5	12	0	0	2
March	30.07	30.51	29.65	0.86	66.3	76.0	57.6	18.4	92	32	60	79	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	0.80	71.0	80.2	61.4	18.8	90	38	52	74	4	1.85	5	2.70	7.5	42	4	14	7	5	2	7	11	10	0	0	0
May	29.99	30.33	29.64	0.69	76.4	85.5	67.2	18.3	94	53	41	75	4	2.92	7	3.36	6.9	42	3	19	9	6	3	5	9	8	0	0	0
June	30.01	30.32	29.60	0.72	80.0	88.6	71.5	17.1	96	64	32	80	5	8.34	15	5.54	6.2	44	3	13	10	9	5	5	9	6	0	0	0
July	30.04	30.29	29.80	0.49	81.2	89.1	73.2	15.9	96	65	31	82	5	8.43	18	5.16	5.6	43	4	13	10	8	4	8	9	5	1	0	0
August	30.00	30.24	29.57	0.67	81.4	89.2	73.5	15.7	96	66	30	84	6	8.59	18	5.04	5.5	34	3	18	9	8	3	8	7	5	1	0	0
September	29.97	30.24	29.46	0.78	79.7	88.0	71.8	16.2	96	54	42	84	5	7.41	15	6.56	6.2	49	5	23	11	4	3	2	2	5	0	0	0
October	29.98	30.43	28.95	1.48	73.8	82.0	65.6	16.4	93	43	50	80	4	2.97	7	2.90	7.2	48	11	31	5	2	1	2	2	8	0	0	0
November	30.08	30.45	29.67	0.78	66.8	75.7	57.9	17.8	87	32	55	81	4	1.72	5	2.90	6.7	36	10	28	4	1	2	2	4	9	0	0	1
December	30.12	30.64	29.64	1.00	61.2	70.0	52.3	17.7	83	19	64	82	5	2.02	7	3.93	6.7	40	11	21	4	3	4	4	3	11	1	0	1
Mean	30.04	.....	.....	.....	71.7	80.3	63.0	17.3	.....	.....	.....	80	5	.....	.....	.....	6.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	53.13	117	.....	.....	.....	75	236	83	57	39	60	75	101	4	0	7

[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.				Air temperature, in ° F.							Average relative humidity.	Average amount of clouds, 0-10.	Precipitation.			Wind.											
	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 in. or more.	Maximum fall in 24 hours.	Average hourly velocity.	Highest velocity.	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	29.46	1.29	52.3	59.9	45.4	14.5	79	15	64	80	5	4.04	10	3.52	13.0	60	6	7	5	3	2	2	1	5	0	2	3
February	30.11	30.61	29.17	1.44	55.5	62.4	48.3	14.1	78	7	71	79	5	4.49	10	5.05	15.0	60	6	6	3	3	1	2	2	5	0	2	3
March	30.06	30.60	29.45	1.15	61.1	67.9	54.4	13.5	87	25	62	80	5	5.36	9	8.32	13.0	62	5	6	4	5	2	3	3	3	0	2	4
April	30.02	30.40	29.40	1.00	67.7	73.6	60.5	13.1	92	34	58	77	4	3.16	6	4.75	14.0	68	4	4	4	5	3	3	2	5	0	2	1
May	29.99	30.39	29.56	0.83	74.8	80.5	67.2	13.3	93	44	49	75	4	2.68	7	5.63	12.0	76	3	5	3	4	4	5	3	4	0	1	0
June	29.99	30.25	29.62	0.63	80.0	85.7	73.5	12.2	101	55	46	78	5	4.87	10	10.70	12.0	54	4	6	2	3	3	5	3	4	0	1	0
July	30.01	30.27	28.92	1.35	81.4	87.2	74.8	12.4	103	64	39	80	5	7.27	14	5.01	11.0	72	4	5	1	2	3	5	5	6	0	1	0
August	29.98	30.24	29.27	0.97	81.0	87.4	74.6	12.8	97	62	35	80	5	7.16	14	8.67	11.0	80	5	7	2	3	2	3	4	5	0	1	0
September	29.99	30.25	29.23	1.02	77.9	85.1	71.5	13.6	98	53	45	78	4	5.23	9	7.68	11.0	83	7	10	3	2	2	1	2	3	0	2	0
October	30.06	30.54	29.22	1.32	69.4	77.1	62.0	15.1	95	35	60	72	4	4.08	6	6.58	12.0	68	8	12	2	1	2	1	1	4	0	1	0
November	30.11	30.59	29.60	0.99	59.6	68.1	52.6	15.5	81	25	56	76	4	3.74	7	7.66	13.0	62	7	9	5	2	1	1	2	3	0	1	1
December	30.15	30.68	29.03	1.65	53.9	61.7	46.4	15.3	77	14	63	80	5	4.17	10	4.32	14.0	80	7	7	4	2	2	2	2	5	0	2	1
Mean	30.05	.....	.....	.....	67.9	74.7	60.9	13.8	.....	.....	.....	78	5	.....	.....	.....	13.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	56.25	112	.....	.....	.....	66	84	38	35	27	33	30	52	0	18	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 in. or more.	Maximum 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	29.52	1.28	53.0	61.9	46.8	15.1	82	15	67	79	5	4.63	10	4.28	9.2	51	11	9	9	8	9	4	3	9	0	[1]0	3
February	30.09	30.71	29.13	1.58	56.3	64.1	48.9	15.2	82	7	75	78	6	4.47	10	5.71	10.1	52	11	9	6	9	5	6	3	7	0	0	2
March	30.04	30.71	29.55	1.16	62.0	71.0	55.4	15.6	86	30	56	78	5	5.30	9	8.66	9.9	45	8	6	7	13	12	5	6	5	0	0	2
April	30.00	30.47	29.50	0.97	67.9	76.4	61.2	15.2	89	38	51	76	5	4.91	7	9.22	9.6	48	7	7	6	17	11	4	4	4	0	0	1
May	29.97	30.38	29.62	0.76	74.5	82.7	67.6	15.1	96	52	44	74	5	3.88	9	6.94	8.2	48	6	9	5	16	12	6	3	5	0	0	1
June	29.98	30.34	29.63	0.71	79.6	87.7	73.6	14.1	102	58	44	76	5	6.16	13	5.48	7.2	50	4	7	3	13	12	9	8	4	0	0	0
July	30.00	30.29	29.70	0.59	81.3	89.0	75.4	13.6	102	66	36	78	6	6.47	16	7.52	6.6	42	3	4	5	9	11	14	12	4	0	0	0
August	29.98	30.29	29.43	0.86	81.0	88.9	75.3	13.6	100	63	37	80	6	5.61	14	8.90	6.4	60	4	7	6	10	11	10	9	4	1	0	0
September	29.98	30.31	28.11	2.20	78.0	85.6	72.6	13.0	98	55	43	79	6	4.81	11	8.20	7.5	86	9	13	7	10	8	4	4	4	1	0	0
October	30.03	30.55	29.21	1.34	69.5	77.6	63.4	14.2	94	40	54	75	4	2.93	6	7.79	8.1	54	12	17	10	8	4	2	3	6	0	0	1
November	30.10	30.68	29.62	1.06	60.6	69.5	54.2	15.3	89	29	60	78	5	3.79	7	4.39	8.5	42	11	14	9	9	6	2	3	5	1	0	2
December	30.13	30.71	29.56	1.15	54.4	62.7	47.9	14.8	83	20	63	79	6	4.46	10	4.36	9.3	48	11	16	10	7	4	2	5	7	0	0	3
Mean	30.04	.....	.....	.....	68.2	76.4	61.8	14.6	.....	.....	.....	78	5	.....	.....	.....	8.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	57.42	122	.....	.....	.....	97	118	83	129	105	68	63	64	3	0	15

[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.	Maximum 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	30.83	29.43	1.40	52.7	56.6	45.5	11.1	75	11	64	84	5	3.62	11	3.61	11.5	64	9	7	8	16	8	4	3	7	0	1	6
February	30.07	30.73	29.19	1.54	55.6	61.1	50.4	10.7	76	8	68	85	5	3.10	10	3.79	11.9	59	9	7	9	13	8	2	2	6	0	2	4
March	30.01	30.61	29.18	1.43	62.3	67.6	57.6	10.0	85	30	55	86	5	2.90	9	3.98	11.6	61	6	5	7	22	12	2	2	6	0	1	6
April	29.97	30.49	29.36	1.13	68.7	71.4	62.1	9.3	85	43	42	84	5	3.13	6	9.23	11.9	72	6	5	6	22	12	3	2	4	0	1	2
May	29.94	30.41	29.52	0.89	75.4	80.2	71.1	9.1	93	52	41	80	4	3.23	6	5.24	11.2	60	3	5	7	29	12	2	1	3	0	2	0
June	29.95	30.27	29.50	0.77	80.9	85.9	76.8	9.1	97	57	40	79	3	4.75	7	6.40	10.0	54	2	4	3	21	20	4	4	2	0	0	0
July	29.98	30.26	29.59	0.67	83.0	88.0	78.7	9.3	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	30.23	28.63	1.60	82.6	87.8	78.3	9.5	98	68	30	78	4	5.01	9	9.05	8.4	93	2	3	4	14	24	8	5	2	0	0	0
September	29.98	30.31	28.55	1.76	79.4	84.5	75.2	9.3	94	54	40	77	4	5.41	10	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	72.4	77.4	67.6	9.8	91	44	47	76	4	4.18	7	14.10	10.3	62	12	12	8	13	8	1	2	5	1	1	1
November	30.09	30.68	29.38	1.30	62.9	68.4	58.0	10.4	85	26	59	80	5	4.02	8	5.63	11.0	54	13	8	8	16	7	2	2	4	0	1	2
December	30.12	30.83	29.52	1.31	56.3	61.5	51.0	10.5	77	18	59	82	6	3.73	10	4.50	11.4	54	14	9	8	11	5	2	4	9	0	1	3
Mean	30.02	.....	.....	.....	69.4	74.5	64.4	10.1	.....	.....	.....	81	4	.....	.....	.....	10.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47.06	102	.....	.....	.....	87	74	75	207	153	42	34	56	2	10	24

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.	Maximum 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	30.80	29.55	1.25	53.5	66.0	49.9	16.1	84	16	68	82	5	2.25	7	1.89	10.6	46	14	7	7	15	9	2	2	6	0	0	2
February	30.05	30.81	29.49	1.32	57.7	63.6	49.6	14.0	88	11	77	82	5	2.04	7	2.66	11.9	60	15	5	9	13	7	1	1	5	0	1	2
March	29.98	30.62	29.35	1.27	64.4	71.5	59.3	12.2	96	28	68	82	5	1.85	7	4.66	13.5	54	10	3	10	25	7	2	1	4	0	1	2
April	29.95	30.51	29.46	1.05	70.9	75.7	65.0	10.7	95	41	54	82	6	1.80	7	4.22	14.4	52	8	4	11	25	6	2	1	3	0	2	1
May	29.90	30.32	29.50	.82	76.5	80.3	71.6	8.7	96	44	52	82	5	2.78	7	6.56	14.6	60	4	4	11	34	5	1	1	2	0	2	0
June	29.91	30.22	29.39	.83	80.6	85.6	72.2	13.4	97	59	38	82	4	2.74	6	4.51	13.4	62	3	2	6	34	12	2	0	1	0	1	0
July	29.96	30.20	29.68	.52	82.7	87.2	77.0	10.2	98	65	33	82	4	1.66	5	4.35	12.9	42	1	1	2	36	17	3	1	1	0	1	0
August	29.93	30.23	29.72	.51	82.1	87.9	77.2	10.7	98	65	33	82	4	2.28	5	5.13	12.1	44	2	1	4	38	13	2	0	2	0	1	0
September	29.95	30.30	29.60	.70	79.0	85.7	74.4	11.3	99	53	46	80	4	4.00	8	4.44	10.8	44	7	3	8	25	8	2	1	6	0	1	0
October	30.00	30.58	29.58	1.00	72.6	78.9	66.9	12.0	91	42	49	78	4	2.05	7	3.92	10.6	51	14	6	11	18	4	2	1	6	0	1	1
November	30.07	30.69	29.32	1.37	63.4	71.5	58.8	12.7	91	29	62	80	5	2.41	7	3.82	10.5	51	13	8	8	15	6	1	2	7	0	0	2
December	30.12	30.74	29.55	1.19	56.6	63.5	49.7	13.8	86	20	66	80	6	1.32	8	2.03	10.0	41	19	7	6	8	7	1	2	12	0	0	3
Mean	29.99	.....	.....	.....	70.0	76.6	64.3	12.2	.....	.....	.....	81	5	.....	.....	.....	12.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	27.18	81	.....	.....	.....	110	51	93	286	101	21	13	55	0	11	13

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