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U. S. COAST AND GEODETIC SURVEY

E LESTER JONES, DIRECTOR

UNITED STATES COAST PILOT

ATLANTIC COAST

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2nd ed.
(1922)

SECTION D

CAPE HENRY TO KEY WEST

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CONTENTS.

	Page.
Introductory	v
Note	vi
Navigational aids and the use of charts	1
Index map ... Facing	19
Cape Henry to Key West, general information:	
Harbors and ports	19
Towboats; harbor masters	20
Navigation laws	20
National quarantine stations	20
Marine hospitals	20
Supplies; repairs	20
List of dry docks and marine railways	21
Weather; fog; gales	21
Storm warnings and stations	22
West India hurricanes	23
Radio service	25
Coast Guard stations	31
Variation of the compass	31
Tides, table of	32
Currents, Cape Henry to Key West	32
Gulf Stream	34
Wind currents	35
Directions, New York to Straits of Florida	36
Straits of Florida, caution as to currents	38
Directions, Straits of Florida to Cape Hatteras	42
Directions for entering Straits of Florida through Providence Channels	43
Coast from Cape Henry to Cape Lookout	47
Beaufort Harbor	52
Coast from Cape Lookout to Cape Fear	54
Cape Fear River	61
Coast from Cape Fear to Winyah Bay	65
Winyah Bay	67
Coast from Winyah Bay to Charleston	70
Charleston Harbor	72
Stono Inlet	77
North Edisto River; South Edisto River	77
St. Helena Sound	78
Port Royal Sound	82
Calibogue Sound	84
Tybee Roads and Savannah River	85
Wassaw Sound	89
Ossabaw Sound	91
St. Catherines Sound	92
Sapelo Sound	94

	Page.
Doboy Sound and Darien	97
Altamaha Sound	99
St. Simon Sound and Brunswick Harbor	100
St. Andrew Sound	104
Cumberland Sound and St. Marys Entrance	107
Nassau Sound	110
St. Johns River	111
Above Jacksonville	117
Coast from St. Johns River to Cape Florida	119
Biscayne Bay and Miami	123
Florida Keys and Reefs	126
Hawk Channel	128
Key West Harbor	132
Inland waterway between Chesapeake and Albemarle Sound	135
Pasquotank River	141
Albermarle Sound	142
Little River	145
Perquimans River	145
Edenton Bay	146
Chowan River	146
Roanoke River	147
Mackay Creek	148
Bull Bay and Scuppernong River	148
Alligator River	149
Croatan and Roanoke Sound	149
Pamlico Sound	151
Long Shoal River	152
Middleton Anchorage	153
Wyesocking Bay	153
Juniper Bay	154
Swan Quarter Bay	154
Rose Bay	155
Jones Bay	156
Cedar Island Bay	156
Royal Shoal	157
Core Sound	157
Pamlico River	159
Bay River	162
Neuse River	163
Appendix	169
List of Coast Pilots of the Coast and Geodetic Survey	169
Pilotage and harbor regulations	169
North Carolina	169
Cape Fear River	170
Port of Charleston regulations	174
Harbor regulations for the port of Savannah, Ga	180
Port of Brunswick, Ga., pilotage	184
Florida	185
Jacksonville	185
Key West	185
International rules to prevent collisions of vessels	186
Meteorological tables	195
Index	203

INTRODUCTORY.

DEPARTMENT OF COMMERCE,
U. S. COAST AND GEODETIC SURVEY,
Washington, D. C., July 1, 1922.

This publication covers the coast from Cape Henry to Key West, including Albemarle and Pamlico Sounds, and is based mainly upon the work of the United States Coast and Geodetic Survey, including the results of a special examination during 1921.

This volume covers the same territory as the first edition of Section D, excepting that the inland waterway from Beaufort, N. C., to Key West, Fla., has been omitted, as this route is fully described in the Inside Route Pilot, New York to Key West. The present (second) edition has been prepared by Commander Paul C. Whitney, hydrographic and geodetic engineer, U. S. 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 volume.

The aids to navigation are corrected to November 1, 1922.

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

E. LESTER JONES, *Director.*

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.

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; (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 chart are published in Notice to Mariners, and should be applied by hand to the chart immediately after the receipt of the notices.

The date of the edition of the chart remains unchanged until an extensive correction is made on the plate from which the chart is printed. The date is then changed and the issue is known as a new edition.

When a correction, not of sufficient importance to require a new edition, is made to a chart plate, the year, month, and day are noted in the lower left-hand corner.

All the notes on a chart should be read carefully, as in some cases they relate to the aids to navigation or to dangers that can not be clearly charted.

The charts are various in character, according to the objects which they are designed to subserve. The most important distinctions are the following:

1. Sailing charts, mostly on a scale of approximately $\frac{1}{1200000}$, 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 $\frac{1}{400000}$ and $\frac{1}{200000}$, intended especially for coastwise navigation.

3. Coast charts, on a scale of $\frac{1}{80000}$, by means of which the navigator is enabled to avail himself of the channels for entering the larger bays and harbors.

4. Harbor charts, on larger scales, intended to meet the needs of local navigation.

Note.—General charts of the Philippine Islands are on scales $\frac{1}{1600000}$, $\frac{1}{800000}$, and $\frac{1}{400000}$; coast charts are on scales $\frac{1}{100000}$ and $\frac{1}{200000}$.

Coast Pilots, relating to surveyed waters of the United States, Porto Rico, Alaska, and the Philippine Islands, contain full nautical descriptions of the coast, harbors, dangers, and directions for coasting and entering harbors. Similar information relating to 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 accompanying 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 by means of which the tides at more than 3,000 intermediate ports may be obtained. Separate reprints from the Tide Tables, United States and foreign ports, are issued for the Atlantic and Pacific coasts of the United States and its dependencies.

Current Tables, which have heretofore been issued as a part of the Tide Tables, are now published separately as Current Tables, Atlantic coast of the United States, and Current Tables of the Pacific coast of the United States.

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 field stations. If ordered by mail, prepayment is obligatory. Remittances should be made by postal money order or express order, payable to the "Coast and Geodetic Survey." Postage stamps, checks, and drafts can not be accepted. The sending of money in an unregistered letter is unsafe. Only catalogue numbers of charts need be mentioned. The catalogue of charts and other publications of the Survey can be obtained free of charge on application at any of the sale agencies or to the Coast and Geodetic Survey Office, Washington, D. C.

Other Publications.—Lists of Lights, Buoys, and other Daymarks of the United States, its insular possessions (Philippine Islands excepted), and the Great Lakes, are published by the Bureau of Lighthouses and may be purchased from its sale agences or from the Superintendent of Documents, Washington, D. C. Notice to Mariners, relating to the same waters, is published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey. 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 CHARTS.—The value of a chart depends upon the character and accuracy of the survey on which it is based, and the larger the scale of the chart the more important do these become. In these respects the source from which the information has been compiled is a good guide.

This applies particularly to the charts of the Alaska Peninsula, Aleutian Islands, Arctic Ocean, and part of Bering Sea and the Philippine Islands. The early Russian and Spanish surveys were not made with great accuracy, and until they are replaced by later surveys these charts must be used with caution.

With respect to these regions the fullness or scantiness of the soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed it may be taken for granted that the survey was not in great detail.

A wide berth should therefore be given to every rocky shore or patch; and this rule should invariably be followed, viz, that instead of considering a coast to be clear unless it is shown to be foul, the contrary should be assumed.

With respect to a well-surveyed coast only a fractional part of the soundings obtained are shown on the chart, a sufficient number being selected to clearly indicate the contour of the bottom. When the bottom is uneven the soundings will be found grouped closely together, and when the slopes are gradual fewer soundings are given. Each sounding represents an actual measure of depth and location at the time the survey was made.

Shores and shoals where sand and mud prevail, and especially bar harbors and the entrances of bays and rivers exposed to strong tidal currents and a heavy sea, are subject to continual change of a greater or less extent, and important ones may have taken place since the date of the last survey. In localities which are noted for frequent and radical changes, such as the entrance to a number of estuaries on the Atlantic, Gulf, and Pacific coasts, notes are printed on the charts calling attention to the fact.

It should also be remembered that in coral regions and where rocks abound it is always possible that a survey with lead and line, however detailed, may have failed to find every small obstruction. For these reasons, when navigating such waters the customary sailing lines and channels should be followed, and those areas avoided where the irregular and sudden changes in depth indicate conditions which are associated with pinnacle rocks or coral heads.

DREDGED CHANNELS.—These are generally shown on the chart by two broken lines to represent the side limits of the improvement. Before completion of the project the depth given is that shown by the latest survey received from the engineer in charge. After completion the depth given is the one proposed to be maintained by redredging when necessary.

The actual depth of a completed channel may be greater than the charted depth shortly after dredging, and less when shoaling occurs

as a result of storms or other causes. These changes are of too frequent occurrence and uncertain duration to chart. Therefore when a vessel's draft approximates the charted depth of a dredged channel the latest information should be obtained before entering.

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 shore 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 called a revolver, must be avoided. In case of doubt select from the chart three objects nearly in a straight line or with the middle object nearest the observer. Near objects are better than distant ones, and, in general, up to 90°, the larger the angles the better, remembering always that large as well as small angles may plot on or near the

circle and hence be worthless. If the objects are well situated, even very small angles will give for navigating purposes a fair position, when that obtained by bearings of the same objects would be of little value.

Accuracy requires that the two angles be simultaneous. If under way and there is but one observer, the angle that changes less rapidly may be observed both before and after the other angle and the proper value obtained by interpolation.

A single angle and a range give, in general, an excellent fix, easily obtained and plotted.

THE COMPASS.—It is not intended that the use of the compass to fix the position should be given up; there are many circumstances in which it may be usefully employed, but errors more readily creep into a position so fixed. Where accuracy of position is desired, angles should invariably be used, such as the fixing of a rock or shoal or of additions to a chart, as fresh soundings or new buildings. In such cases angles should be taken to several objects, the more the better; but five objects is a good number, as the four angles thus obtained prevent any errors.

When only two objects are visible, a sextant angle can be used to advantage with the compass bearings and a better fix obtained than by two bearings alone.

DOUBLING THE ANGLE ON THE BOW.—The method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called "bow and beam bearing," the distance from the object at the latter position being the distance run between the times of taking the two bearings, gives the maximum of accuracy and is an excellent fix for a departure, but does not insure safety, as the object observed and any dangers off it are abeam 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. A line of position may also be crossed with a radio compass bearing (see pages 9 and 25.)

DANGER CURVES.—The curves of depth will be found useful in giving greater prominence to outlying dangers. It is a good plan to trace out with a colored pencil the curve next greater than the draft of the vessel using the chart, and regard this as a "danger curve," which is not to be crossed without precaution.

Isolated soundings shoaler than surrounding depths should be avoided, as there is always the possibility that the shoalest spot may not have been found.

CAUTION IN USING SMALL-SCALE CHARTS.—It is obvious that dangers to navigation can not be shown with the same amount of detail on small-scale charts as on those of larger scale, therefore in approaching the land or dangerous banks regard should be had to the scale of the chart used. A small error in laying down a position means only yards on a large-scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile.

For the same reason, bearings to near objects should be used in preference to objects farther off, although the latter may be more prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn.

DISTORTION OF PRINTED CHARTS.—The paper on which charts are printed has to be dampened. On drying, distortion takes place from the inequalities in the paper, which varies with the paper and the

amount of the original dampening; but it is not sufficient to affect ordinary navigation. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree, when carefully plotted upon the chart, especially if the lines to objects be long. The longer the chart the greater the amount of this distortion.

Buoys.—Too much reliance should not be placed on buoys always maintaining their exact position, especially when in exposed positions; it is safer, when possible, to navigate by bearings or angles to fixed objects on shore and by the use of soundings.

Gas Buoys and other unwatched lights can not be implicitly relied on; the light may be altogether extinguished, or, if intermittent, the apparatus may get out of order.

Lights.—The distances given in the light lists and on the charts for the visibility of lights are computed for a height of 15 feet 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 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. (See Radiocompass on page 25.)

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 reference 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.

RADIO COMPASS positions are especially valuable at night during fog or thick weather when other observations are not obtainable. For practical navigating purposes radio vibrations may be regarded as traveling in a straight line from the sending station to the receiving station. Instruments for determining the bearing of this line are now available. The necessary observations may be divided into two general classes; first, where the bearing of the ship's radio call is determined by one, two, or more radio stations on shore and the resulting bearing or position is reported to the vessel (see p. 25, RADIO SERVICE); secondly, where the bearings of two or more known shore radio stations are determined on the vessel itself and plotted as cross bearings. Experiments show that these bearings can be determined with a probable error of less than 2°, and the accuracy of the resulting position is largely dependent on the skill and care of the observer. It must be remembered, however, that these lines are parts of great circles, and if plotted as straight lines on a Mercator chart, a considerable error may result when the ship and shore station are a long distance apart. The bearings may be corrected for this distortion or still greater accuracy may be obtained by plotting the observed bearings on a special chart on the gnomonic projection.

For plotting radio compass bearings the U. S. Coast and Geodetic Survey publishes three plotting charts, which may be obtained by application to the Director, Coast and Geodetic Survey, Washington, D. C., or the sales agents, price 20 cents each. Full directions for using them are printed on the reverse side of each chart.

Radio bearings may be combined with position lines obtained from astronomical observations and used in ways very similar to the well-known Sumner line when avoiding dangerous shoals or when making the coast.

Change of Variation of the Compass.—The gradual change in the variation must not be forgotten in laying down positions by bearings on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, and in some cases, such as with small scales or when the lines are long, the displacement of position from neglect of this change may be of importance. The compasses are reengraved for every new edition if the error is appreciable. Means for determining the mount of this error are provided by printing the date of constructing the compass and the annual change in variation near its edge.

The change in the magnetic variation in passing along some parts of the coast of the United States is so rapid as to materially affect the course of a vessel unless given constant attention. This is particularly the case in New England and parts of Alaska, where the lines of equal magnetic variation are close together and show rapid changes in magnetic variation from place to place, as indicated by the large differences in variation given on neighboring compass roses.

Local Magnetic Disturbance.—The term "local magnetic disturbance" or "local attraction" has reference only to the effects on the compass of magnetic masses external to the ship. Observation shows that such disturbance of the compass in a ship afloat is experienced only in a few places.

Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbance, because the effect of a magnetic force diminishes in such rapid proportion as the distance from it increases that it would require a local center of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow and the force strong the compass may be temporarily deflected when passing over such a spot, but the area of disturbance will be small, unless there are many centers near together.

The law which has hitherto been found to hold good as regards local magnetic disturbances is, that north of the magnetic equator the north end of the compass needle is attracted toward any center of disturbance; south of the magnetic equator it is repelled.

It is very desirable that whenever an area of local magnetic 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 position of these bags should vary with the circumstances. Running before the wind, they should be hung on either bow—e. g., from the cathead and allowed to tow in the water.

With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter.

Lying-to, the weather bow, and another position farther aft, seem the best places from which to hang the bags, using sufficient line to permit them to draw to windward while the ship drifts.

9. Crossing a bar with a flood tide, to pour oil overboard and allow it to float in ahead of the boat, which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances the effect can not be so much trusted.

On a bar, with the ebb tide running, it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil can be diffused well ahead of the boat and the bag readily hauled on board for refilling, if necessary.

USE OF SOUNDING TUBES.

Although of undoubted value as a navigational instrument, the sounding tube is subject to certain defects which, operating singly or in combinations, may give results so misleading as to seriously endanger the vessels whose safety is entirely dependent upon an accurate knowledge of the depths.

Efforts have been made from time to time by the Coast and Geodetic Survey to utilize tubes for surveying operations. The results obtained, however, have been so unsatisfactory that the general use of such tubes for surveying work has been discouraged.

In practical tests, carefully made by surveying parties, where up-and-down casts of the lead were taken with tubes attached to the lead, errors in the tube amounting at times to as much as 25 per cent of the actual depths have been noted. Errors of 10 to 12 per cent of the actual depth were quite common.

It is also worthy of note that in the great majority of cases the tubes gave depths greater than the true depths, which, in actual use in coastwise navigation, would usually have resulted in the conclusion that the ship was farther offshore than was really the case.

There are various types of tubes in common use which are too well known to require detailed description here. They are all based on the general principle that air is elastic and can be compressed, and that if a column of air in a tube be lowered into the water in such a way that the air can not escape, yet, at the same time, the pressure of the water can be transmitted to it, the amount by which the air is compressed furnished a measure of the depth to which it was lowered.

Theoretically this principle is sound, but when we come to apply the theory to actual practice certain elements enter which result in errors in the depth determination. It is important to note that the amount of these errors depends on the depth; the greater the depth the greater the numerical value of the error.

The causes which produce these errors are as follows:

1. In order to give correct results the bore of the tube must be exactly cylindrical; in other words, the volume of air in any one inch of length of the tube must be exactly the same as in an inch in any other part. But because of the way in which glass tubes are made it is very difficult to accomplish this. The bore may taper slightly or vary in other ways from a true cylinder. If tapering, the minimum diameter of bore may be at the top, middle, or bottom of the tube as submerged. If the minimum diameter be at the top, the tube will register depths less than the actual depths of water, and if at the bottom the registered depth will be greater than the true depth.

This defect may be detected in a suspected tube by introducing a small quantity of mercury into the tube and comparing its length at different points along the bore. For satisfactory results the length of this column should not vary more than 5 per cent.

2. In order that even a perfect tube should give accurate results, the conditions of barometric pressure and air and water temperatures under which the sounding is being taken must be the same as those under which the scale for reading the depths was made.

In making the scale a barometric pressure of 29 inches is usually assumed as normal.

Then, if in actual use, the barometer registers above normal, the air in the tube is already partly compressed, and when lowered to any given depth the amount of compression due to water pressure is correspondingly diminished. With a barometer below normal the reverse is true, and it therefore follows that when the barometer reads above normal the tubes will register less than the true depths, whereas if the barometer reads below normal the registered depths will be greater than the true. The amount of error introduced from this cause is about 3 per cent of the depth for each inch of barometric pressure above or below normal.

The density of the air in the tube also depends directly upon its temperature. Therefore, the difference between the temperature of the air in the tube before and after submergence will affect the accuracy of the sounding. Where the temperature of the tube in the air is greater than that of the tube in the water, the depth recorded will be greater than the actual depth, and, conversely, when the temperature of the air is lower than that of the water the depth recorded will be less than the true depth. Also, the temperature of the water may vary at different depths, so that the actual amount of this error depends on the difference between the temperatures of the tube in the air and at the bottom.

The amount of error introduced from this cause is about 1 per cent of the depth for each 3 degrees Fahrenheit difference in temperature.

3. While the tubes are usually 24 inches long, and the scales are designed for that length of tube, the manner of closing the upper end of the tube may introduce an error. The thickness of the caps used for this purpose varies considerably in different makes of tubes, even when such caps are made of the same material. This variation in thickness results in moving the tube slightly up or down in the scale. Thus, with a thin cap the sounding read from the scale will be too deep; with a thick cap, the sounding read will be less than the true depth.

Copper caps put on with sealing wax have been found to vary sufficiently to produce errors of about 5 per cent of the depth in depths of 50 to 70 fathoms. Rubber caps seem to be more nearly uniform and to give better results when new. Rubber, however, deteriorates, and when used too long there is apt to be leakage of air.

When removable caps are used care should be taken to see that they are pushed home thoroughly before sounding.

4. The integrity of the air in the tube should be carefully preserved. Even a slight leakage of air will result in showing a sounding considerably in excess of the true depth.

Vessels sometimes approach dangers coming from depths of over 100 fathoms. As they approach, they begin feeling for the bottom, sounding at infrequent intervals to pick up depths of 75 to 100 fathoms. So long as they get no bottom in such depths navigators feel secure. But a leaky tube may show no bottom at 100 fathoms when the ship is actually in much less depths, possibly resulting in disaster before the error is discovered.

Special precautions should, therefore, be taken on this point. Copper caps should be sealed in place with sealing wax, and rubber caps should be supplied with wire clamps, giving a tight fit.

5. Accumulated salt on the inner surface of the tube will cause the watermark to creep up and register greater than true depths.

The type of tube exemplified by the well-known Bassnett sounder is based on the same principle as the ordinary glass tube, but is more complicated in design. It consists essentially of a metal case containing a glass tube closed at the upper end. Inside the glass tube is a metal tube, through which the water enters and is trapped by a valve at the top of the metal tube.

In this device the scale is graduated directly on the glass tube, thus eliminating those errors due to thickness of cap; but, on the other hand, the possibility of errors increases directly with the number of working parts of which the sounder is made.

In using sounders of this type care should be exercised to preserve perfectly gasketed joints between the bottom of the glass tube and the metal case and to keep the outlet valve well oiled and water-tight.

Leaking valves and water remaining in the tube before a sounding is taken will give increased depths, while deficient depths may be recorded as a result of loss of water through suction at the inlet as the tube is being reeled in.

The Bassnet type, in common with all other forms of pressure tube, is subject to the above-described errors due to variations in temperature and barometric pressure.

It will be noted that wherever the amount of the various errors can be stated they are all small. Their importance lies in the fact that two or more of them, acting together, may result in considerable errors. As already stated, actual experiments show that errors of 10 to 12 per cent are not uncommon and that considerably greater errors may occur.

There are certain precautions which can be taken to eliminate or reduce these errors:

1. In purchasing tubes a type should be selected which can be used until broken or lost. The navigator can then make a study of the results obtained from each individual tube and thus gain a fair idea of its accuracy under known conditions. This necessitates some permanent means of identifying the various tubes used, which may readily be accomplished in the case of the glass tubes by means of various colored paints or threads.

2. Before undertaking the sounding necessary to make any particular landfall, the vessel should be stopped for an up-and-down cast of the lead in order to test the accuracy under the prevailing conditions of the tubes which are to be used. For this purpose it is not necessary to get bottom; simply run out 60 to 80 fathoms of wire and then see how closely the tubes register that amount. A number of tubes can be sent down at one time, and it is then possible to select one or two which register most nearly correct.

It is well to keep a permanent record of the results of each tube tested. By so doing the navigator will soon obtain valuable information as to the performance of the various tubes and the degree to which they may be trusted. Such a record should, of course, take into account the various conditions affecting the result.

It will be noted that the factors which produce errors may be divided roughly into three groups:

(*a*) Inherent: Those which occur as a result of permanent defects in the tube, such as the variation of the bore from a true cylinder, variation in the thickness of the cap, etc.

(*b*) External: Those which occur as a result of the conditions under which the sounding was taken, variations of temperature or barometric pressure from the normal, etc.

(*c*) Accidental: Those which affect a single sounding, due to the failure of the tube to register properly, leakage of air, loss of water from leaky valves, errors due to the presence of salt in the tube, etc.

These accidental errors are probably the most serious of the three types, both because they are apt to be larger in amount and because it is impossible to foresee when they will occur. But, on the other hand, they occur only as a result of a few known causes, already enumerated, and therefore by the exercise of proper caution in the use of the tubes they may be to a large extent eliminated. If the ordinary glass tube is used, see that the bore is thoroughly dry and free from salt and that the cap makes a tight fit. If using a sounder, see that the tube is free from water and that the valves are tight and well oiled.

And, above all, during the course of the sounding take an occasional up-and-down cast as a check, for by that means alone can one be sure that the proper results are being obtained.

The smallest possible number of tubes should be used. It is obviously much better to use over and over again one tube which is giving good results than to use a number whose errors are uncertain. This is particularly desirable where sounders involving valves are used.

If a tube shows no bottom at 100 fathoms, examine the arming to make sure that the lead actually failed to find bottom.

Finally, beware of overconfidence. Tubes which have been working properly for a number of soundings suddenly develop errors. It is chiefly for this reason that they have been discarded for surveying operations.

Assuming that the accidental errors can be reasonably controlled, the inherent and external errors present no serious difficulty.

As already indicated, the bore of a tube (or at least of any tube which is capable of constant use) can be tested with mercury, and those tubes rejected which show variations in bore greater than about 5 per cent.

Errors due to variations in the thickness of caps can be eliminated by using a scale graduated for a true length of 24 inches (the length of the glass tube) and removing the cap before the sounding is read.

Errors due to differences between air and water temperatures can be reduced to a minimum which can usually be neglected by immersing the tube, before using, in a bucket of sea water, newly drawn, so that its temperature has not had time to change. Care should, of course, be taken to see that no water enters the tube. When this is done, there may still remain an error due to the difference in temperature of the water at the surface and at the bottom. This may, if desired, be corrected by sending down a self-registering thermometer with the lead, but for the ordinary purposes of navigation this is a refinement which may be ignored.

There is no ready method available for correcting the error due to variations in the barometric pressure. The correction should be applied to the sounding recorded.

It is interesting to note that sounding tubes which give good results can readily be made from plain glass or metal tubes aboard ship—gauge glasses, for instance. One end of the tube is closed with a cork and sealing wax. A narrow strip of chart paper of uniform width, on which a line has been ruled with an indelible pencil, is inserted the entire length of the tube. The paper is held in place by bending the projecting lower end upward along the outside of the tube and securing it with a rubber band. The height to which the water rises in the tube will be indicated by the blurring of the pencil line.

If the air column in the tube is 24 inches long, the sounding may be read from any scale graduated for tubes of that length. If of a different length, a special scale must be prepared; its graduations, compared to those of the 24-inch scale, will be proportional to the comparative lengths of the two tubes.

If certain precautions are taken, these tubes will give results which compare favorably with commercial tubes. The paper should be inserted uniformly in the tube, and its upper end, or a mark from which the measurement is taken, should coincide with the top of the air column. Metal tubes have the advantage of uniform bore, but if metal tubes are used the paper, in order to insure uniformity, should be fastened at the upper end when that end is being sealed and then stretched lightly at the bottom. The depth should always be read from the dry portion of the paper, as the wet portion is subject to considerable change in length.

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. The channels of the entrances to the larger and more important harbors are being improved by dredging, and in some cases by jetties which extend from both sides of the entrance seaward to deep water outside of the bars. At the improved entrances more dependence can be placed on the channel depths, as given in this volume, than on the bars of the harbors not under improvement. Masters of vessels bound to the harbors along this coast should, in cases where the depths given in this volume are approximately the same as the draft of their vessel, inquire of local pilots what draft is at the time being taken in and out over the bar.

On the bars not under improvement 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 any of 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 easterly gales the sea breaks on most 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 the 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 in this volume see the Light List, Atlantic and Gulf Coasts of the United States, published by the Lighthouse Service, which can be obtained from the Division of Publications, Department of Commerce, Washington, D. C., price 30 cents.

Pilots cruise off the entrances of the principal ports, while at some of the others 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 inside the inlets. Pilots for parts of the inside route are obtained at the larger cities and towns along the route. Pilot rates for the entrances are given in the Appendix. In general, the charge for piloting in interior waters is by special agreement with the pilot.

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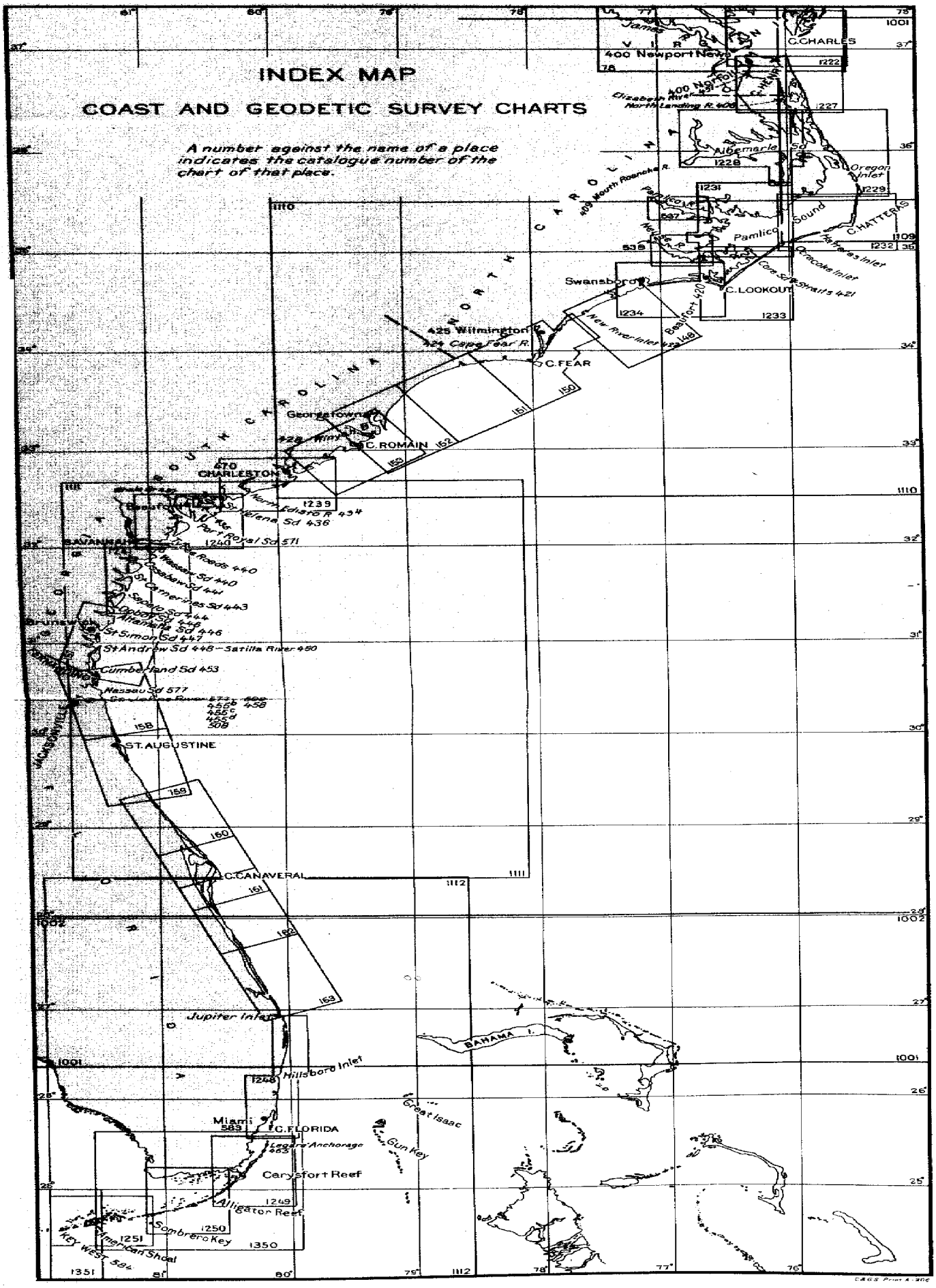
INDEX MAP
COAST AND GEODETIC SURVEY CHARTS
A number against the name of a place indicates the catalogue number of the chart of that place.
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
VIRGINIA
400 Newport News
400 Norfolk
C. CHARLES
Elizabeth River
North Landing R. 406
Albemarle Sd
Oregon Inlet
409 Mouth Roanoke R.
Pamlico Sound
C. HATTERAS
Hatteras Inlet
Ocracoke Inlet
Core Sd & Straits 421
C. LOOKOUT
Swansboro
Beaufort 420
New River Inlet
425 Wilmington
424 Cape Fear R.
C. FEAR
Georgetown
C. ROMAIN
470 CHARLESTON
North Edisto R 434
St Helena Sd 436
Port Royal Sd 571
Wassaw Sd 440
Ossabaw Sd 441
St Catherines Sd 443
Sapelo Sd 444
Altamaha Sd 446
St Simon Sd 447
St Andrew Sd 448 – Satilla River 450
Cumberland Sd 453
Nassau Sd 577
ST. AUGUSTINE
C. CANAVERAL
Jupiter Inlet
Hillsboro Inlet
Miami 589
C. FLORIDA
Legars Anchorage 465
Carysfort Reef
Alligator Reef
Sombrero Key
American Shoal
KEY WEST 584
BAHAMA I.
Great Isaac
Gun Key
JACKSONVILLE
Brunswick
Beaufort
SAVANNAH
C&GS Print A-206

UNITED STATES COAST PILOT.

ATLANTIC COAST—SECTION D.

CAPE HENRY TO KEY WEST.

The information contained in this volume, Section D of the "United States Coast Pilot, Atlantic Coast," relates to the coast from Cape Henry to Key West, a distance of over 1,000 miles, embracing the coasts of a part of Virginia, North Carolina, South Carolina, Georgia, and Florida.

From Cape Henry to Cape Florida the general character of the coast is low and sandy, backed by woods, the highest land (63 feet) near the coast being Mount Cornelia, just northward of the entrance of St. Johns River. The principal harbors lie between Cape Lookout and St. Johns River, the stretches of the coast northward and southward of these limits being broken only by a number of unimportant inlets.

Between Winyah Bay and St. Johns River the shore is very broken, the harbors, inlets, and sounds being in many cases but little over 10 miles apart. This part of the coast has shoals which extend off from 3 to 8 miles. Cape Hatteras, Cape Lookout, Cape Fear, Cape Romain, and Cape Canaveral are distinguished for the distance to which dangerous shoals extend seaward from them. These shoals are generally sand, shifting to some extent with every heavy gale; with the strong currents which are found at times, they form the greatest danger for the navigator while passing along this coast.

From Cape Florida to Key West the coast is formed by a chain of small islands, known as Florida Keys, off and nearly parallel to which are the Florida Reefs. The harbors along this stretch of coast are Miami and Key West, and there are a few anchorages among the keys and reefs.

South of latitude 27° 24′ N., and lying at a least distance of 42 miles eastward of the coast of Florida, are Great and Little Bahama Banks and the Bahama Islands; and southward of the Florida Reefs, at a least distance of 78 miles, is the island of Cuba. North and west of these islands and skirting the coast of Florida are the Straits of Florida, through which flow the waters of the Gulf Stream. The straits, in connection with the channels between the islands, form the northern approach and entrance to the Gulf of Mexico.

Harbors and ports.—The more important places, either commercially or as harbors of refuge, are Lookout Bight, Beaufort Harbor

(N. C.), Cape Fear River, Winyah Bay, Charleston Harbor, Port Royal, Tybee Roads and Savannah River, Sapelo Sound, St. Simon Sound, Cumberland Sound, St. Johns River, Miami, and Key West.

Towboats are stationed at Cape Fear River, Winyah Bay, Charleston Harbor, Savannah River, St. Simon Sound (Brunswick), Cumberland Sound (Fernandina), and St. Johns River.

Harbor masters are appointed for the principal ports, and they have charge of the anchorage and berthing of vessels in their respective harbors. For harbor masters' fees see the appendix. 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 1919. This volume can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a price of $1.

National quarantine.—Quarantine for all ports within the limits of this volume are enforced in accordance with the regulations of the United States Public Health Service. 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 of by the bureau in Washington, D. C. Every vessel should be provided with the quarantine regulations. The following are the quarantine stations within the limits covered by this volume: Cape Charles, Va., address Quarantine, Fort Monroe, Va.; boarding and inspection station, Fort Monroe (Old Point Comfort), Va.; Washington, N. C.; Newbern, N. C.; Cape Fear (Southport), N. C.; Charleston, S. C.; Georgetown (South Island), S. C.; Port Royal, S. C.; Savannah, Ga.; Brunswick, Ga.; Cumberland Sound (Fernandina), Fla.; St. Johns River (Mayport), Fla.; Biscayne Bay (Miami), Fla.; Key West, Fla.

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: Norfolk, Va.; Washington, N. C.; Newbern, N. C.; Beaufort, N. C.; Wilmington, N. C.; Georgetown, S. C.; Charleston, S. C.; Savannah (marine hospital), Ga.; Brunswick, Ga.; Fernandina, Fla.; Jacksonville, Fla.; Key West (marine hospital), Fla.

Supplies.—Coal can be obtained at Newport News, Norfolk, Beaufort (N. C.), Wilmington, Charleston, Port Royal, Savannah, Jacksonville, and Key West; fuel oil at the places named, excepting Beaufort and Port Royal. Water, provisions, ship-chandler's stores, and gasoline can be had at the above cities and at all towns.

Repairs.—Newport News, Norfolk, Charleston, Savannah, and Jacksonville are the principal places at which extensive repairs to the hulls of vessels and machinery of steamers can be made. There are facilities for repairs at Elizabeth City, Washington, Newbern, Wilmington, Georgetown, Brunswick, and Key West. Minor repairs can be made and small craft can be hauled out at several other places.

Largest dry docks and marine railways.

Port.	Name.	Length over blocks.	Depth on sill at high water.	Capacity.
		Feet.	*Feet.*	*Tons.*
Newport News, Va	Dry dock	738	30	
Norfolk, Va	Floating dock	310	17	4,000
	Railway	410	14; 18	4,600
Elizabeth City, N. C	do	205	5; 10	800
Washington, N. C	do	155		600
Newbern, N. C	do	110		500
Wilmington, N. C	do	175	9; 18	1,200
Georgetown, S. C	do	110	5; 7	
Charleston, S. C	Dry dock (Government)	503	32½	
	Floating dock	440	20	8,000
Savannah, Ga	Railway	286		2,500
Brunswick, Ga	do		7; 12	400
Jacksonville, Fla	Floating dock	330	20	4,500
	Railway	210	9	1,200
Key West	do	180	10; 16	1,000

Fog.—The percentage of fog is highest from March to June, reaching a maximum of 30 per cent of days with fog near the mouth of Chesapeake Bay in June. This percentage decreases to 10 at Hatteras, but fog can be expected as far south as Florida.

Prevailing winds.—The winds are westerly north of the thirty-fifth parallel, except in September and October when they are northeasterly along the entire coast. The westerly winds extend to the thirtieth parallel from December to April, inclusive. Easterly winds prevail along the Florida coast. At Key West they are northeasterly, except during the summer months, when they are southeasterly.

Northers.—In the winter months heavy northers occur in the vicinity of the Straits of Florida. They blow generally from northwest to north, hauling, as a rule, northward and eastward, and rarely backing. Their approach is nearly always heralded by a heavy bank of clouds in the northwest, preceded by light airs from the contrary direction, and accompanied by a falling barometer; they commence with a violent squall, gradually settling to a fresh gale. Vessels caught in the narrower parts of the straits in these gales are subject to a most trying sea.

Southeast gales also occur at intervals during the winter months in the vicinity of the Straits of Florida. They usually commence to blow at about ENE., freshening rapidly with a falling barometer and rising thermometer, and hauling southward and eastward, obtain their greatest force at about southeast.

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

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

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

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

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

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

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

These warnings are displayed at all stations on the Atlantic and Gulf coasts of the United States and on the following islands in the Atlantic: Jamaica, Turks Island, Bermuda, Haiti, Curacao, Porto Rico, Virgin Islands of the United States, St. Kitts, Dominica, Barbados, Trinidad, St. Lucia, St. Vincent, Grenada, Swan Island, and Cuba.

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

VIRGINIA:
- *Cape Henry.
- Fort Monroe (Old Point Comfort).

NORTH CAROLINA:
- Beaufort.
- Coinjock.
- Columbia.
- Diamond Shoal Light Vessel.
- Edenton.
- Elizabeth City.
- Frying Pan Shoal Light Vessel.
- *Hatteras.
- Hertford.
- *Manteo.
- Morehead City.
- Newbern.
- Oak Island life-saving station.
- Southport.
- Washington.
- *Wilmington.

SOUTH CAROLINA:
- *Charleston.
- Georgetown.
- Mount Pleasant.
- Moultrieville.
- North Island.
- Parris Island (Marine Barracks).
- Port Royal.

GEORGIA:
- Brunswick.
- Darien.
- Sapelo Island Lighthouse.
- *Savannah.

Georgia—Continued.
- St. Simon Island.
- Thunderbolt.
- Tybee.

FLORIDA:
- Alligator Reef Lighthouse.
- American Shoal Lighthouse.
- Carysfort Shoal Lighthouse.
- Cocoa.
- Daytona.
- Eau Gallie.
- Fernandina.
- Fort Pierce.
- Fowey Rocks Lighthouse.
- *Jacksonville.
- Jupiter.
- *Key West.
- Key West, corner Caroline and Elizabeth Streets.
- Key West, No. 611 Front Street.
- Mayport.
- Melbourne.
- Miami.
- Miami Beach.
- New Smyrna.
- Palmetto.
- St. Augustine.
- Sand Key.
- Sombrero Key Lighthouse.
- Stuart.
- Titusville.
- *West Palm Beach.

Note.—The Weather Bureau stations at Cape Henry, Va., and Sand Key, Fla., are equipped for day and night communication with passing vessels. The International Code is used by day and the

*At these stations barometers will be compared with standards.

Morse Code, flash-light, by night. Messages to or from vessels will be forwarded to destination. At lighthouses and light vessels warnings are not displayed at night.

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 approximately 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 Winward 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, Fla., and the Rio Grande. Tracks of hurricanes are shown on pilot charts of the North Atlantic Ocean, published monthly by the 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.

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.

It 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.

The following special **signals for surveying vessels** of the United States employed in hydrographic surveying have been prescribed:

A surveying vessel of the United States, under way or at anchor in a fairway and employed in hydrographic surveying, may carry where they can best be seen, but in any case well above the rigging lights prescribed by law for preventing collisions, three lights in a vertical line one over the other and not less than 6 feet apart. The highest and lowest of these lights shall be green, and the middle light shall be white, and they shall be of such a character as to be visible all around the horizon at a distance of at least 2 miles. In the case of a small vessel the distance between the lights of such private code may be reduced to 3 feet if necessary.

By day such surveying vessel may carry in a vertical line, not less than 6 feet apart, where they can best be seen, three shapes of not less than 2 feet in diameter, of which the highest and lowest shall be globular in shape and green in color, and the middle one diamond in shape and white.

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.

The wire drags, some of which are over 2 miles long, used by the Coast and Geodetic Survey in sweeping for dangers to navigation, may be crossed by vessels without danger of fouling at any point except between the towing launches and the large buoys near them, where the towline approaches the surface of the water. Steamers passing over the drag are requested not to pass close to the towing launch; also to change course so as to cross the drag approximately at right angles, as a diagonal course may cause the propeller to foul the supporting buoys and attached wires.

RADIO SERVICE.

Radio compass bearings.—The Naval Communication Service will furnish radio bearings to mariners of all vessels equipped with radiotelegraph transmitters.

While the use of these bearings should not lead a mariner to neglect other precautions, such as the use of the lead, etc., during a fog, these bearings will greatly reduce the dangers to navigation for mariners who are compelled for any reason to proceed during foggy or misty weather.

These radio compass stations are provided primarily to assist the mariner in closing the land during fog or poor visibility, but they

may also be used to obtain the positions of vessels at sea in radio compass range, about 150 miles, when for any reason positions can not be obtained by other means.

The maximum distance for which bearings from these stations are accurate is 150 miles. But accurate positions can not be plotted when more than 50 miles from the shore on Mercator charts, for the Mercator projection introduces a distortion of the true bearing.

For plotting radio compass bearings the U. S. Coast and Geodetic Survey publishes three plotting charts, which may be obtained by application to the Director, Coast and Geodetic Survey, Washington, D. C., or the sales agents, price 20 cents each. Full directions for using them are printed on the reverse side of each chart.

Radio Compass Stations are divided into two classes:

(*a*) Single stations, operating independently and furnishing a single bearing. These stations are located with the view of giving service to ships at a distance of not over 150 miles from the station.

(*b*) Harbor entrance groups. All stations in harbor entrance groups are connected to and controlled by the master station; all stations of the group take bearings simultaneously and these bearings are transmitted to the ship requesting them by the control station. The purpose of these stations is to lead mariners to the light vessels off harbor entrances.

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

Wave lengths.—All independent and group radio compass stations keep watch on 800 meters. Only this wave should be used to call and work with these stations.

Calling a radio compass station.—To obtain a bearing from independent radio compass stations, call the station from which the bearing is desired in the usual manner and request bearings by means of the conventional signal given hereafter. Simultaneous bearings from two or more compass stations can be obtained by making the call include the other compass stations desired.

To obtain bearings from the harbor entrance compass stations carry out the procedure previously given. The compass control station only will answer.

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

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

The following radio compass stations are of use for vessels navigating within the limits covered by this volume:

Name of station.	Call letters.	Position.
Fire Island, L. I., N. Y	NAH	Lat. 40° 38′ 07″ N., long. 73° 12′ 32″ W.
Sandy Hook, N. J	NAH	Lat. 40° 27′ 54″ N., long. 73° 59′ 50″ W.
Mantoloking, N. J	NAH	Lat. 40° 01′ 30″ N., long. 74° 03′ 10″ W.
Cape May, N. J	NSD	Lat. 38° 55′ 53″ N., long. 74° 54′ 35″ W.
Cape Henlopen, Del	NSD	Lat. 38° 47′ 35″ N., long. 75° 05′ 26″ W.
Bethany Beach, Del	NSD	Lat. 38° 32′ 45″ N., long. 75° 03′ 22″ W.
Hog Island, Va	NCZ	Lat. 37° 22′ 36″ N., long. 75° 42′ 37″ W.
Virginia Beach, Va	NCZ	Lat. 36° 51′ 10″ N., long. 75° 58′ 33″ W.
Poyners Hill, N. C	NCZ	Lat. 36° 17′ 16″ N., long. 75° 47′ 48″ W.
Cape Hatteras, N. C	NDW	Lat. 35° 14′ 22″ N., long. 75° 31′ 42″ W.
Cape Lookout, N. C	NAN	Lat. 34° 36′ 11″ N., long. 76° 32′ 18″ W.
North Island, S. C	NZW	Lat. 33° 13′ 21″ N., long. 79° 11′ 06″ W.
Folly Island, S. C	NZV	Lat. 32° 41′ 00″ N., long. 79° 53′ 14″ W.
Jupiter, Fla	NAQ	Lat. 26° 56′ 59″ N., long. 80° 04′ 57″ W.
Key West, Fla	NAR	Lat. 24° 33′ 08″ N., long. 81° 45′ 18″ W.

PROCEDURE IN DETAIL.

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

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

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

All compass stations transmit on 800 meters.

Danger from reciprocal bearings.—Attention is invited to the fact that when a single bearing is furnished there is a possibility of an error of approximately 180°, as the operator at the compass station can not always determine on which side of the station the vessel lies. Certain radio compass stations, particularly those on islands or extended capes, are equipped to furnish two corrected true bearings for any observation. Such bearings when furnished vessels may differ by approximately 180°, and whichever bearing is suitable should be used.

Caution.—Mariners receiving bearings which are evidently the approximate reciprocal of the correct bearing should never attempt to correct these bearings by applying a correction of 180°, as such correction would not include the correction necessary on account of deviation at the compass station.

An error of as large as 30° may be introduced by mariners applying an arbitrary correction of 180° to such bearings. Vessels receiving bearings manifestly requiring an approximate 180° correction should request the other bearing from the radio compass station if not previously furnished.

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

When bearings from three or more compass stations are not over 2° of arc in error, but do not meet at a fixed point, the geometric center of the triangle formed by the bearings can generally be taken as the approximate position of the vessel.

Mariners until thoroughly familiar with the system are advised to use radio compass stations frequently, especially in clear weather, when positions of vessels can be accurately fixed in order to accustom operators to the procedure and to acquaint themselves with the degree of accuracy and dependability of bearings furnished by the radio compass stations.

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

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

There is no charge for bearings furnished by the U. S. Naval Radio Compass Station.

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

Fire Island Light Vessel, N. Y.:	
Group of two dashes for	25 seconds.
Silent	25 seconds.
Ambrose Channel Light Vessel, N. J.:	
Single dashes for	20 seconds.
Silent	20 seconds.
Seagirt Light Station, N. J.:	
Groups of three dashes for	60 seconds.
Silent	6 minutes.
Diamond Shoal Light Vessel, N. C.	
Group of two dashes	20 seconds.
Silent	30 seconds.

These radio log signals are intended for the use of vessels equipped with radio compass. By reason of this radio compass (also termed radio direction finder) the bearing of the radio fog signal station may be determined with an accuracy of approximately 2° and at

distances considerably in excess of the range of visibility of the most powerful coast lights. The apparatus is simple and may be operated by the navigator without the assistance of a radio operator or without knowledge of the telegraph code. The radio direction-finding apparatus consists of a radio receiving set, similar in operation to those used for radio telegraph or telephone reception, and a rotatable coil of wire in place of the usual antenna. By rotating the coil the intensity of the signal received from the transmitting station is caused to vary, and by noting the position of the coil when the signal is heard at its minimum intensity the bearing of the transmitting station is readily obtained.

The signals from the light vessels have definite characteristics for identifying the stations, as have the flashing lights and sound fog signals, and bearings may be obtained with even greater facility than sight bearings on visible objects. The radio fog signals are transmitted on a wave length of 1,000 meters, which is exclusively reserved for this purpose to avoid interference. The stations transmit continuously during thick weather and also for one-half hour twice each day, beginning at 9 a. m. and 3 p. m., regardless of weather conditions.

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

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 5 minutes. During this interval every tick of the clock is transmitted except the twenty-ninth second of each minute, the last 5 seconds of each of the first 4 minutes, and finally the last 10 seconds of the last minute. The 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, and Government vessels; Radio Communication Laws and Regulations of the United States; and Amateur Radio Stations of the United States are published by that bureau. Any of these publications can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.; price, 15 cents each. Changes or additions to the stations and to the laws and regulations are published in bulletins issued monthly; price, 5 cents per copy or 25 cents per year.

The International List of Radio Stations of the World (edition in English) can be procured from the International Bureau of the Telegraphic Union (Radiotelegraphic Service), Berne, Switzerland. In addition to the information contained in the list of the United States stations published by the Bureau of Navigation, the international

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

UNITED STATES COAST GUARD STATIONS.

Coast Guard stations and houses of refuge are maintained at the places named in the following table. The stations are manned 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 Coast Guard Service, Washington, D. C.

The life-saving stations are provided with the International Code of Signals. Where telephone or telegraph facilities are available, requests for a tug or revenue cutter will be received and promptly forwarded.

The houses of refuge on the coast of Florida are in charge of a keeper, and are supplied with boats, provisions, and restoratives.

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

Upon the discovery of a wreck by night, the station crew 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.

Number.	Name of station.	State.	Locality.
161	Cape Henry	Va	¾ mile southeast of lighthouse.
162	Virginia Beach	Va	5 miles south of Cape Henry light.
163	Dam Neck Mills	Va	9 miles south of Cape Henry light.
164	Little Island	Va	On beach abreast of North Bay.
165	False Cape	Va	On beach abreast of Back Bay.
166	Wash Woods	N. C.	On beach abreast of Knotts Island.
167	Penneys Hill	N. C.	5 miles north of Currituck Beach light.
168	Currituck Beach	N. C.	½ mile south of Currituck Beach light.
169	Poyners Hill	N. C.	6 miles south of Currituck Beach light.
170	Caffeys Inlet	N. C.	9½ miles south of Currituck Beach light.
171	Paul Gamiels Hill	N. C.	4½ miles north of Kitty Hawk.
172	Kitty Hawk	N. C.	On beach abreast north end of Kitty Hawk Bay
173	Kill Devil Hills	N. C.	4 miles south of Kitty Hawk.
174	Nags Head	N. C.	8 miles north of Oregon Inlet.
175	Bodie Island	N. C.	¾ mile northeast of Bodie Island light.
176	Oregon Inlet	N. C.	½ mile south of Oregon Inlet.
177	Pea Island	N. C.	2 miles north of New Inlet.
179	Chicamacomico	N. C.	4½ miles south of New Inlet.
180	Gull Shoal	N. C.	10 miles south of New Inlet.
181	Little Kinnakeet	N. C.	10 miles north of Cape Hatteras light.
182	Big Kinnakeet	N. C.	5 miles north of Cape Hatteras light.
183	Cape Hatteras	N. C.	1 mile south of the lighthouse.
184	Creeds Hill	N. C.	3½ miles west of Cape Hatteras light.
185	Durants	N. C.	2½ miles east of Hatteras Inlet.
186	Hatteras Inlet	N. C.	1¼ miles west of Hatteras Inlet.
187	Ocracoke	N. C.	2½ miles northeast of Ocracoke Inlet.
188	Portsmouth	N. C.	Northeast end of Portsmouth Island.
189	Core Bank	N. C.	Halfway between Ocracoke Inlet and Cape Lookout.
190	Cape Lookoout	N. C.	1½ miles south of the lighthouse.
191	Fort Macon	N. C.	Beaufort entrance, ¼ mile north of fort.
192	Bogue Inlet	N. C.	½ mile east of inlet.
193	Cape Fear	N. C.	On Smith Island, Cape Fear.
194	Oak Island	N. C.	West side mouth of Cape Fear River.
196	Sullivans Island	S. C.	At Moultrieville, at north end of harbor jetty.
202	Bulow [1]	Fla	17½ miles south of Matanzas Inlet.
203	Mosquito Lagoon [1]	Fla	On beach outside the lagoon.
204	Chester Shoal [1]	Fla	9½ miles north of Cape Canaveral.
205	Bethel Creek [1]	Fla	14 miles north of Indian River Inlet.
206	Indian River Inlet [1]	Fla	South side of inlet.
207	Gilberts Bar [1]	Fla	St. Lucie Rocks, 2 miles north of Gilberts Bar Inlet.
208	Fort Lauderdale [1]	Fla	3½ miles north of New River Inlet.
209	Biscayne Bay [1]	Fla	4¼ miles north of Miami entrance.

[1] House of refuge.

VARIATION OF THE COMPASS.

The magnetic variation for 1923, and annual increase or decrease at points mentioned, are as follows:

Locality	Variation.	Annual increase or decrease.
Off Cape Henry (10 miles)	6° W.	Increase, 3′.
Off Cape Hatteras (12 miles)	5¾° W.	Do.
Off Cape Lookout (15 miles)	4½° W.	Increase, 2′.
Off Cape Fear (15 miles)	3° W.	Do.
Off Charleston Entrance	1° W.	Increase, 1′.
Off Savannah (on bar)	0°	
On Doboy Sound bar	½° E.	
St. Johns River (outside jetties)	½° E.	
Off Cape Canaveral (12 miles)	½° E.	
At Fowey Rocks light	1½° E.	
At Alligator Reef light	2° E.	Increase, 1′
At Sombrero Key light	2½° E.	Do.
At Sand Key light	2½° E.	Do.
At Rebecca Shoal light	2½° E.	Do.
Hole in the Wall (Bahamas)	½° W.	Do.
At Great Isaac light (Bahamas)	½° E.	
On Salt Key Bank (north of Cuba)	1½° E.	
Middle of Albemarle Sound (off Bull Bay)	5½° W.	Increase, 3′.
Middle of Croatan Sound	5½° W.	Do.
Middle of Pamlico Sound (north of Ocracoke)	5° W.	Do.

Tides.[1]

Locality.	Lunitidal intervals.[2]		Mean range.
	High water.	Low water.	
	H. m.	*H. m.*	*Feet.*
On Hatteras Shoals	6 25	0 06	3.6
Lookout Bight	6 29	0 20	3.7
Cape Fear River, Southport	7 30	1 25	4.1
Winyah Bay, Georgetown light	7 37	1 52	3.5
Charleston, Fort Sumter	7 17	1 00	5.0
Tybee lighthouse	7 11	1 05	6.8
St. Simon Sound lighthouse	7 30	1 27	6.4
Fernandina, Dade Street	8 00	1 42	6.0
St. Johns River, Mayport	7 38	1 39	4.2
Cape Canaveral	8 00	1 52	5.0
Cape Florida Anchorage	8 24	2 29	1.7
Turtle Harbor, Florida Reefs	8 21	2 08	2.1
Key West Harbor	9 20	2 36	1.2
Tortugas	9 44	3 21	1.1

[1] Tide tables for the Atlantic coast of the United States, published annually by the Coast and Geodetic Survey, predicting the times and heights of tides for every day of the year, at all the principal ports, can be obtained from the agents; price, $0.15.

[2] The mean lunitidal interval for high water or for low water is the average time from the meridian transit of the moon to the next following high or low water, respectively; it is also called the corrected establishment.

CURRENTS, CAPE HENRY TO KEY WEST.

From our present information the indications are that, except during northerly and northeasterly winds, a current of about 0.5 knot, setting northeastward with the trend of the coast, may be expected outside the 10-fathom curve as far north as Cape Hatteras, and that it increases offshore toward the axis of the Gulf Stream.

Strong currents are produced by the wind along the coast in northeasterly and southerly gales, reversing or greatly accelerating the normal current. Their strength and set depend on the direction, strength, and duration of the gale. A table showing the direction and velocities of the currents that may be expected with winds of given strength is given on page 36.

Current tables for the Atlantic coast, giving the time of turning of the current for every day of the year at a number of stations, including Chesapeake Bay Entrance, Charleston Harbor Entrance, and Savannah River Entrance, are published annually in advance by the Coast and Geodetic Survey. These current tables are for sale at 10 cents per copy, and may be obtained from any of our sales agencies or direct from this Office.

The following is a more detailed statement of the currents along the coast.

Diamond Shoal light vessel (off Cape Hatteras, N. C.).—The tidal current here is rotary, turning clockwise, but very weak, the velocity of the current at time of strength being less than a tenth of a knot. The currents encountered off Cape Hatteras are therefore nontidal and depend chiefly on the wind. Winds from the southwest, south, and southeast directions bring about the strongest currents which set northeasterly, a wind of 35 miles per hour bringing about a current of 1¼ knots. Winds from the northeast and northwest are only about 70 per cent as effective in producing currents. a wind of 35 miles per hour from the northeast or northwest bringing about a southerly current of about 0.7 knot.

Cape Lookout Shoals (off Cape Lookout, N. C.).—The tidal current here is rotary, turning clockwise. The strength of the flood current occurs about two hours before the current turns west in the entrance to Chesapeake Bay and sets N. 85° W., with a velocity of 0.3 knot. The strength of the ebb current comes about two hours before the current turns east in the entrance to Chesapeake Bay and sets S. 85° E., with a velocity of 0.25 knot. The minimum currents before flood and ebb are very small, being less than 0.1 knot. Since the tidal current here is weak, the currents brought about by the winds completely mask the tidal currents. In general, the current appears to set northeasterly in the summer months and southerly during the winter months, with an average velocity of 0.25 knot.

Frying Pan Shoals light vessel (off Cape Fear River, N. C.).—The tidal current here is rotary, turning clockwise. The strength of the flood current occurs about one hour after the current turns west in the entrance to Charleston Harbor and sets N. 55° W., with a velocity of 0.4 knot. Strength of ebb comes about one hour after the current turns east in the entrance to Charleston Harbor and sets S. 65° E., with a velocity of 0.4 knot. The minimum current before flood comes about two hours before the current turns west in the entrance to Charleston Harbor setting southwesterly with a velocity of 0.25 knot. The minimum current before ebb comes about two hours before the current turns east in the entrance to Charleston setting northeasterly with a velocity of 0.25 knot.

Charleston light vessel (off the entrance to Charleston Harbor, S. C.).—The current is rotary, turning clockwise. The strength of the flood current occurs about one hour after the current turns west in the entrance to the Charleston Harbor and sets N. 80° W., with a velocity of 0.3 knot. The strength of the ebb current comes about 1½ hours after the current turns east in the entrance to Charleston Harbor and sets S. 80° E., with a velocity of 0.3 knot. The minimum currents before flood and ebb set southerly and northerly, respectively, with a velocity of 0.15 knot.

Martin's Industry gas and whistling buoy (off the entrance to Port Royal Sound, S. C.).—The current here is rotary, turning clockwise. The strength of the flood current occurs about 2½ hours after the current turns west in the entrance to the jetties of the Savannah River and sets N. 75° W., with a velocity of 0.6 knot. The strength of the ebb current comes about three hours after the current turns east in the entrance to the jetties of the Savannah River and sets S. 75° E., with a velocity of 0.6 knot. The minimum currents before flood and ebb set southerly and northerly, respectively, with the velocity of 0.15 knot.

Brunswick light vessel (off the entrance to St. Simon Sound, Ga.).—The tidal current is rotary, turning clockwise. The strength of the flood current occurs about three hours after the current turns west in the entrance to the jetties of the Savannah River and sets N. 60° W., with a velocity of 0.5 knot. The strength of the ebb current comes about 3½ hours after the current turns east in the entrance to the jetties of Savannah River and sets S. 60° E., with a velocity of 0.5 knot. The minimum currents before flood and ebb set southerly and northerly, respectively, with velocities of about 0.15 knot.

THE GULF STREAM.

The Gulf Stream sets eastward and northward through the Straits of Florida, and after passing between Fowey Rocks and Little Bahama Bank it continues northward and then northeastward, following the general direction of the 100-fathom curve. The axis of the Gulf Stream, or line of greatest velocity, lies from 10 to 20 miles eastward of the 100-fathom curve. Between Cuba and Florida Reefs, off Habana, the axis of the stream is nearer the Cuban coast; but after making the bend between Salt Key Bank and Florida Reefs the axis of the stream approaches the coast of Florida and lies from 4 to 11 miles outside the 100-fathom curve.

Northward of the West India Islands there is another stream, which, driven by the trade winds, is moving westward. This is a slow current, but where it joins the Gulf Stream proper at about latitude 30° N. it materially adds to the latter on its way toward the northern seas.

Off Cape Hatteras the width of the Gulf Stream is about the same as when it leaves the Straits of Florida. However, it is more liable to fluctuations in direction, particularly along the edges, and in its progress northward and 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. The investigations of the Gulf Stream indicate that there is no way of utilizing the thermometer to determine with certainty the direction of the current.

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

Crossing the Gulf Stream at Jupiter or Fowey Rocks an average allowance of 2½ knots in a northerly direction should be made for the set of the current. The weakest current will be experienced about three 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 to estimate. The effect of the tides on the stream amounts to about 0.5 knot, the maximum current of the Gulf Stream occurring three hours after the moon's meridian transit (upper or lower) and the minimum current three hours before the moon's transit. Outside of the straits of Florida the velocity of the stream is affected principally by the winds.

The mean surface velocity of the Gulf Stream is 3.5 knots at a point 11½ miles east of Fowey Rocks and 2.2 knots at a point 60 miles south of Rebecca Shoal. These points are on the axis of the

stream, or where the current is a maximum, the velocity of the stream decreasing gradually from these central points as the edges of the stream are approached. These velocities are affected considerably by prevailing winds.

The mean position of the axis of the Gulf Stream, or the point where the greatest velocity may be found, is given in the following table:

	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

In the straits of Florida, between Rebecca Shoal and Cuba, the following table gives the surface velocity of the Gulf Stream at five stations:

Distance south of Rebecca Shoal.	Mean surface velocity observed.
Miles.	*Knots.*
20	0.3
35	0.7
50	2.2
68	2.2
86	0.8

Between Fowey Rocks and Gun Key, in the straits of Florida. the following table gives the surface velocity of the Gulf Stream at six stations:

Distance east of Fowey Rocks.	Mean surface velocity observed.
Miles.	*Knots.*
8	2.7
11½	3.5
15	3.2
22	2.7
29	2.1
36	1.7

WIND CURRENTS.

In this table are given the results of recent investigations on the currents caused by local winds. These investigations are based on observations made on a number of the light vessels along the Atlantic coast from Nantucket Shoals light vessel to Brunswick light vessel. The results therefore apply more directly along the route between light vessels, but are applicable also to the coastal sailing routes farther offshore.

Direction of current due to wind.—It is evident that a wind continuing for some time will give rise to a current the velocity of which increased with an increase in the velocity of the wind, and the mariner has taken it for granted that this current brought about by the wind sets in the same direction as the wind, but the results of

careful observations show that this is not the case. Instead of setting with the wind the current on the Atlantic coast of North America produced by local winds sets about 20° to the right of the wind.

For example, a wind blowing from the north will, on the North Atlantic coast, bring about a current that sets not south but about 20° to the right of south, or S. 20° W. Similarly, a wind from south will produce a current setting 20° to the right of north, or N. 20° E. It is to be noted that while the current due to the wind will on the North Atlantic coast set 20° to the right of the wind direction the current which a vessel experiences at any time is the resultant of the combined actions of the tidal current, the wind current, and any other currents, such as the Gulf Stream or currents due to river discharge.

Table of current direction due to wind—North Atlantic Coast.

Wind from	N.	NE.	E.	SE.	S.	SW.	W.	NW.
Current sets	S. 20° W.	S. 65° W.	N. 70° W.	N. 25° W.	N. 20° E.	N. 65° E.	S. 70° E.	S. 25° E.

Velocity of current due to wind.—The velocity of the current brought about by winds of different velocities is given in the table below. It will be seen that on the Atlantic coast of the United States the velocity of the wind current is about 1½ per cent of the velocity of the wind.

Table of current velocity due to wind—North Atlantic Coast.

Wind velocity, miles per hour	10	20	30	40	50	60
Current velocity, knots	0.2	0.3	0.4	0.6	0.8	1.0

An easily remembered working rule to get the velocity of the current due to wind is to multiply the velocity of the wind (in miles per hour) by 1½ and point off two places. This will give the velocity of the current in knots. For example, the current due to a 40-mile wind would be 40 by 1½=.60, or six-tenths of a knot.

DIRECTIONS, NEW YORK TO STRAITS OF FLORIDA.

New York to Cape Hatteras.—From Scotland light vessel steer 181° true (S. ⅞ W. mag.) for 42 miles, or from Ambrose Channel light vessel steer 186° true (S. by W. ⅜ W. mag.) for 43 miles, to a position 8 miles off Barnegat lighthouse bearing 276° true (WNW. ⅝ W. mag.); then steer 193° 30′ true (S. by W. ¾ W. mag.) for 287 miles to Diamond Shoal light vessel.

Delaware Bay to Cape Hatteras.—From Overfalls light vessel steer 150° true (SSE. mag.) for 25½ miles to Fenwick Island Shoal light vessel, and then steer 187° 30′ true (S. by W. ¼ mag.) for 203 miles to Diamond Shoal light vessel.

Chesapeake Bay to Cape Hatteras.—From Chesapeake Bay entrance gas and whistling buoy steer 158° true (S. by E. ½ E. mag.)

for 72 miles to a position with Bodie Island lighthouse bearing 287° true (WNW. mag.) distant 14 miles. Then steer 182° true (S. 5/8 W. mag.) for 40 miles to Diamond Shoal light vessel, leaving Wimble Shoal gas buoy 3½ miles to starboard.

The *currents* may be expected to set with the wind up or down the coast. High velocities of current may occur either with heavy gales or with long-continued gales from one direction, the estimated maximum velocity near the coast being 2 to 3 knots. In depths of 20 fathoms or more, 0.5 to 1 knot is regarded as nearer an average of what may be expected. Currents produced by on-shore winds set inshore as well as alongshore.

CAPE HATTERAS TO JUPITER.—From Diamond Shoal light vessel there are two routes to the Straits of Florida. Most of the regular lines use the route outside of the Gulf Stream. All vessels bound to any port as far south as St. Johns River follow the coast inside the Stream.

OUTSIDE ROUTE.—From Diamond Shoal light vessel across the Gulf Stream make good the course 191° 30′ true (S. by W. ½ W. mag.) for 173 miles to latitude 32° 15′ N., longitude 76° 00′ W. Under ordinary conditions an average allowance should be made for a 1-knot current setting 45° true for the entire run; with northeasterly winds there may be practically no current, while southerly, and especially southwest, winds may increase it considerably. Observations should be obtained as often as possible.

From the above latitude and longitude make good the course 212° true (SW. by S. mag.) for 300 miles to latitude 28° 00′ N., longitude 79° 00′ W. There is uncertainty as to the currents that may be expected on this run. It is probable that a Gulf Stream set of 0.5 knot against the vessel, and as the Bahama Bank is approached possibly some easterly drift also will be experienced. With northeasterly winds it is stated that a southwesterly set of 0.5 knot has been experienced. This and the easterly set mentioned are the dangerous ones to guard against in order not to overrun and get too close to Matanilla Shoal. Observations are the only guide and should be obtained as often as possible. In case of doubt from about latitude 28° N. vessels can stand westward and watch the lead carefully to pick up the edge of the bank on the Florida coast northward of Jupiter.

Matanilla Shoal should be given a wide berth. It is stated that discoloration of the water can not be relied upon to avoid the shoal, the current setting on it not permitting this usual reef warning.

From the position in latitude 28° 00′ N., longitude 79° 00′ W., the course is shaped across the Gulf Stream for Jupiter Inlet lighthouse. On this course an allowance should be made for a northerly current, averaging about 2¼ knots for the entire run of about 80 miles. It will therefore be necessary to shape the course for a position some 8 or 10 miles southeastward of Jupiter Inlet light to allow for the northerly set. When fixing the position by bearings on the light, keep in mind that while outside the 100-fathom curve the vessel is probably in the full strength of the Gulf Stream, where the northerly current may average a velocity of 4 knots. If the light is on the starboard bow, the vessel will be much closer to it than indicated by the distance run between the successive bearings on it.

INSIDE ROUTE.—From 1 mile off Diamond Shoal light vessel make good a 229° 30′ true (SW. ¾ W. mag.) course for 149 miles, which leads close eastward of Cape Lookout Shoals light vessel and 1 mile eastward of Frying Pan Shoals gas, whistling, and submarine bell buoy. From the latter position make good a 234° 30′ true (SW. by W. mag.) course for 150 miles to latitude 32° 00′ N., longitude 80° 00′ W. Then make good a 203° true (SSW. ⅛ W. mag.) course for 65 miles to latitude 31° 00′ N., longitude 80° 30′ W. Then make good a 180° true (S. mag.) course for 90 miles to latitude 29° 30′ N., longitude 80° 30′ W. Then make good a 169° true (S. by E. mag.) course for 52 miles, which should lead to a position 3 or 4 miles eastward of Hetzel Shoal gas and whistling buoy.

These courses lead in depths of 17 to 20 fathoms. In approaching and passing the shoals off Cape Canaveral care must be exercised; the depth should not be shoaled to less than 13 fathoms.

The *current* of the Gulf Stream may be expected under ordinary conditions to set against the vessel for the entire run with a velocity of about 0.5 to 0.8 knot, the direction of the current following the curve of the coast. It must be remembered, however, that the effect of winds is almost immediately felt on the currents, and that with northerly, and especially northeasterly, winds a current of about 1 knot will set with it along the coast. Southerly, and especially southwesterly, winds increase the velocity of the Gulf Stream.

Passing 3 or 4 miles eastward of Hetzel Shoal gas and whistling buoy, a 168 true (S. by E. ⅛ E. mag.) course will lead the same distance eastward of Bethel Shoal gas and whistling buoy, and this course should be continued until Jupiter Inlet lighthouse is made on the starboard bow. Then shape the course to pass from 3 to 6 miles eastward of it. On this run the 15-fathom curve is a good guide. The current of the Gulf Stream may be expected under ordinary conditions to have a velocity of about 0.7 knot off Cape Canaveral, increasing to 1.5 or 2 knots off Jupiter Inlet lighthouse.

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

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

At night, when bound southward and navigating at a safe distance from the reefs between Fowey Rocks and Sombrero Key, it is on the side of safety to assume that the vessel is steaming against a 3 or 4 knot current, and from one light to hold a course that will insure

clearing the reefs until the next light is sighted. It is also well to remember that near the reefs there is a tidal current, possibly as much as 0.5 knot in places directly on and off the reefs on the rising and falling tides, respectively.

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

The following are extracts from a report of a stranding:

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

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

Jupiter to Fowey Rocks.—Vessels follow the coast as close as safety permits—in the daytime at a distance of 1 to 1½ miles to Hillsboro Inlet lighthouse, then 1½ to 2 miles off until abreast Biscayne Shoal buoy, and pass 1 mile eastward of Florida Reefs North End gas buoy and Fowey Rocks lighthouse. Close attention should be given to the lead, and courses not depended upon entirely, and checked frequently. From Jupiter to Lake Worth Inlet the depth should not be shoaled to less than 13 fathoms, and then keep in over 15 fathoms. Southward of Lake Worth Inlet the depths increase so rapidly offshore that the hand lead can not be depended upon to insure safety for deep-draft vessels.

A narrow ridge, on which least depths of 7 to 12 fathoms were found and with somewhat deeper water inside it, lies from 1 to 1½ miles from this coast. This ridge has not been closely developed, and should be avoided by deep-draft vessels. A vessel with a draft of 23 feet reports striking at a point 1½ miles from shore and 6 miles southward of Jupiter Inlet light, and another with a draft of 19 feet at a point 1¾ miles from shore and 18½ miles northward of Fowey Rocks light. It is suspected that the reported grounding of several steamers on ridges south of New River Inlet is in a measure attributable to the indistinct shore line for which the line of trees

along the west edge of the marsh is mistaken, which would place a vessel 1 to 1½ miles inshore of her intended position.

The *current* of the Gulf Stream may be expected to have a velocity of 1.5 knots from well northward of Jupiter until southward of West Palm Beach, then 1 knot to Hillsboro Inlet, and then 0.7 knot to Fowey Rocks. The velocity increases rapidly offshore.

At night, from a position 6 miles off Jupiter Inlet light, make good a 183° true (S. ⅛ W. mag.) course for 82 miles, passing 2½ miles off the coast southward of Lake Worth Inlet, 3½ miles off Hillsboro Inlet lighthouse, 3 miles off Biscayne Shoal gas and bell buoy, 2½ miles off Florida Reefs North End gas and bell buoy, and 2 miles off Fowey Rocks lighthouse. The 15-fathom curve is a safe guide between Jupiter and Lake Worth Inlet. On this course the *current* of the Gulf Stream should be assumed to have a velocity of 2 knots in determining the distance off the lights by bow and beam bearings, and more if farther offshore than the distances stated.

Fowey Rocks to Sand Key.—Vessels follow the Florida Reefs from 1 to 2 miles off in the daytime and 2 to 4 miles off at night. The position should be checked on the aids as passed and on the lights and sectors at night. Care must be taken not to get inside of the line of reefs, beacons (spindles), buoys, or lighthouses, especially when passing parts of the reef that lie well back of the edge and do not break or show near the surface. The color of the water does not always mark the edge of the reefs.

Except in the vicinity of Fowey Rocks, where the 100-fathom curve is only about 2 miles outside the reef, the 50-fathom curve lies from 2 to 3 miles from Florida Reefs, and this is about the least depth that can be depended upon to insure safety in skirting them. The hand lead is practically of no value as an aid and should not be depended on.

The reefs are fringed in places with broken ground, which as a measure of safety should be avoided by deep-draft vessels where the depths are less than 10 or 12 fathoms.

Any crossing of the Gulf Stream should be regarded as difficult, on account of the strong current of variable velocity for which it may not be possible to make a proper allowance and the abrupt shoaling inside the 100-fathom curve. The axis of the Gulf Stream is nearest the reefs from about 10 miles northward of Carysfort Reef lighthouse to Molasses Reef lighthouse.

Vessels bound for Habana generally shape the course for that port when abreast of Alligator Reef lighthouse.

The following courses may serve as a check, and the distances at which they are laid from the reefs should be regarded as a minimum to insure safety:

In the daytime.—From 1 mile off Fowey Rocks lighthouse make good the course 187° true (S. ½ W. mag.) for 7 miles to 1 mile off Triumph Reef beacon "O"; then 193° true (S. by W. mag.) for 6½ miles to 1 mile off Pacific Reef lighthouse; then 203° true (S. by W. ⅞ W. mag.) for 10 miles, passing ½ mile off Turtle Harbor buoy (nun, No. 2), and to a position 1 mile off Carysfort Reef lighthouse.

From 1 mile off Carysfort Reef lighthouse make good the course 207° true (SSW. ¼ W. mag.) for 6 miles to 1¼ miles off The Elbow beacon "J"; then 219° true (SW. ⅝ S. mag.) for 10 miles to 1¼

miles off Molasses Reef lighthouse; then 234° true (SW. 5/8 W. mag.) for 16½ miles to 1¼ miles off Alligator Reef lighthouse.

From 1¼ miles off Alligator Reef lighthouse make good the course 234° true (SW. 5/8 W. mag.) for 11 miles to 1¼ miles off Tennessee Reef buoy (nun, No. 4); then 247° true (SW. by W. 3/4 W. mag.) for 11 miles to 2 miles off Coffin Patches beacon "C"; then 252° true (WSW. 1/4 W. mag.) for 9 miles to 1¼ miles off Sombrero Key lighthouse; then 253° true (WSW. 3/8 W. mag.) for 17 miles to 1⅜ miles off Looe Key beacon "G"; and then 257° true (WSW. 5/8 W. mag.) for 26½ miles, passing 1½ miles off American Shoal lighthouse and to a position 2 miles off Sand Key lighthouse.

At night.—From 2 miles off Fowey Rocks lighthouse make good the course 189° true (S. 5/8 W. mag.) for 13½ miles, keeping in the white rays of Fowey Rocks lighthouse, until Carysfort Reef lighthouse is in sight showing white and up to Pacific Reef light, distant off 2 miles; then 205° true (SSW. 1/8 W. mag.) for 11 miles to a position 2 miles off Carysfort Reef lighthouse.

A number of vessels have been lost on the reefs between The Elbow and Molasses Reef, and extra caution should be observed in this locality. The extremely variable current against the vessel should be carefully considered in determining the position off Carysfort Reef light, from which to shape the course to lead well clear of The Elbow. (The establishment of Molasses Reef lighthouse will undoubtedly minimize the danger in this locality.)

From a position 2 miles off Carysfort Reef light make good the course 212° true (SSW. 7/8 W. mag.) for 16½ miles to a position 2½ miles off Molasses Reef lighthouse; then 234° true (SW. 5/8 W. mag.) for 17 miles to a position 2½ miles off Alligator Reef light. The edge of the red sector of Carysfort Reef light leads close to the reefs between the light and The Elbow.

From a position 2½ miles off Alligator Reef light make good the course 234° true (SW 5/8 W. mag.) for 16½ miles until Sombrero Key light is in sight showing white; then 255° true (WSW. 1/2 W. mag.) for 15 miles to 2 miles off Sombrero Key light; then 254° true (WSW. 1/2 W. mag.) for 23 miles to 2¼ miles off American Shoal light; and then 259° true (WSW. 7/8 W. mag.) for 20½ miles to 2 miles off Sand Key Light.

Sand Key to Dry Tortugas.—On the south edge of Florida Reefs between Sand Key and Dry Tortugas there is broken ground with rocky, very uneven bottom, which, like other parts of Florida Reefs, rises abruptly from the deep water of the Straits of Florida. As a measure of safety this broken ground, including the areas with depths less than 10 or 12 fathoms lying southward and westward of Rebecca Shoal and Dry Tortugas, should be avoided by vessels of the deepest draft. The 50-fathom curve is about the least depth that can be depended upon to insure clearing this broken ground when skirting it, except southwestward and westward of Dry Tortugas. A vessel is reported to have struck an obstruction with about 18 feet over it lying 11 miles 147° true (SE. 7/8 S. mag.) off Rebecca Shoal lighthouse; the least depth found in this locality by a careful examination is 5½ fathoms. A vessel is also reported to have struck an obstruction 2 miles 285° true (WNW. 7/8 W. mag.) off Rebecca Shoal lighthouse.

The *currents* near the edge of the bank in this locality are variable, being influenced by the winds, by differences in 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 1.0 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 considered.

From a position 2 miles off Sand Key lighthouse make good the course 265° true (W. ⅝ S. mag.) for 41 miles, passing nearly 4 miles southward of Marquesas Rock nun buoy, the same distance southward of a gas and whistling buoy marking a wreck 2½ miles westward of Marquesas Rock, and to a position 13 miles from Rebecca Shoal lighthouse bearing 8° true (N. ½ E. mag.). Then make good the course 287° true (WNW. ¾ W. mag.) for 27 miles to a position 11½ miles 228° true (SW. mag.) of Dry Tortugas lighthouse.

DIRECTIONS, 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, indicating an easterly set.

From Florida Straits to Cape Hatteras, vessels follow the Gulf Stream, pass about 12 miles southwestward of Dry Tortugas lighthouse, about 14 miles southward of Rebecca Shoal lighthouse, then follow Florida Reefs about 8 miles off, and pass 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.

From latitude 30° 25′ N. and longitude 79° 40′ W. make good the course 26° true (NNE. ⅜ E. mag.) for 50 miles to latitude 31° 10′

N., longitude 79° 15′ W. Then 45° 30′ true (NE. ¼ E. mag.) for 243 miles to latitude 34° 00′ N., longitude 75° 50′ W.

It is stated that between latitude 30° 30′ and 32° 30′ N. heavy tide rips will be experienced, indicating a change in the direction of the stream and not an increase in the velocity, and creating in stormy weather a very uncomfortable sea.

From latitude 34° 00′ N. and longitude 75° 50′ W. make good the course 22° true (NNE. ⅜ E. mag.) for 69 miles and pass eastward of Diamond Shoal light vessel. Then follow the tracks to ports northward as described in the southbound routes on page 36.

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.

The courses given from Jupiter to Hatteras follow nearly the axis of the Gulf Stream. If followed, the best current will usually be obtained, but good observations are essential to avoid overrunning or underrunning. Due regard should be given to the seasons of the year. It is stated that winter currents are much lighter, often dropping to nothing after long spells of northerly and northeast winds.

DIRECTIONS FOR ENTERING STRAITS OF FLORIDA THROUGH PROVIDENCE CHANNELS.

The greater number of sailing vessels bound to the Gulf of Mexico from ports in Europe, British North America, or the northern Atlantic ports of the United States, and a large number of steamers from European ports, enter the Straits of Florida from eastward through the Providence channels, which have a least width of 22 miles between Great and Little Bahama Banks.

The point for which a course is shaped, and the first land sighted, is the south point of Great Abaco Island, known as Hole in the Wall. Vessels coming from northward, if at all doubtful of their reckoning, should make latitude 26° 30′ N., well eastward of the eastern end of Abaco Island, so that in case the wind falls light or the weather becomes thick they will not be picked up by Elbow Key. At night, in a sailing vessel, if the wind is from southward when in this locality, and the light is not sighted or the reckoning is doubtful, the vessel's head should be kept eastward, as the lead will be of little use to give warning of danger. Near the northeastern end of Great Abaco Island the currents are strong and variable and have caused many wrecks in the vicinity of Elbow Key.

Caution.—A branch of the North Equatorial Current runs strongly on the eastern side of Bahama Islands, and several vessels have stranded between Hole in the Wall and Elbow Key. The current

generally sets north-northwestward; its velocity is about 1.5 knots, increased during southeast winds, but it sometimes sets in an opposite direction.

In the Northeast Providence Channel the currents are variable and the reefs and keys should not be approached too closely in light winds. In the Northwest Providence Channel, between Great Stirrup Key and Great Isaac, the flood sets southward on the Great Bahama Bank and the ebb northward off the bank. In the middle of the channel there is generally but little current, except after northerly winds, when it frequently sets eastward with a velocity of about 1 knot. The tidal current has a velocity of about 1 knot on the banks, setting directly on and off on the rising and falling tide, respectively.

Steamers bound to ports in the Gulf of Mexico, after passing Great Isaac, will find it to their advantage to stand across the Straits of Florida for Fowey Rocks Lighthouse and follow the Florida Reefs into the Gulf. The reefs are so well marked in the daytime, and at night by the red sectors in the lights, that no uncertainty as to the position of a vessel is possible with ordinary care. This route is also shorter than the one along the western edge of Great Bahama Bank and across Salt Key Bank.

Sailing vessels after passing Great Isaac stand along the western edge of Great Bahama Bank for a distance of about 75 to 80 miles and then stand for the northwest end of Salt Key Bank; or, if not over 18 feet draft, they can cross Salt Key Bank, passing either side of Dog Rocks (30 feet high) and south of Double Headed Shot Keys, thus avoiding the strength of the Gulf Stream, which is weaker here than on its western side. From Salt Key Bank the wind generally decides whether the vessel bound into the Gulf of Mexico crosses the Straits of Florida so as to make Sand Key lighthouse, or follows the north shore of Cuba and crosses the straits so as to pass westward of Tortugas.

Vessels of less than 12 feet draft can stand across the northwest end of Great Bahama Bank after entering the Northwest Providence Channel, but this should not be attempted unless in the daytime, when the rocky patches can be seen so as to be avoided. A vessel using this route will leave the western edge of Great Bahama Bank about 78 miles southward of Great Isaac lighthouse, and southward of Orange Key.

Through Providence Channels to Great Isaac and Fowey Rocks.—When Hole in the Wall lighthouse is made, shape the course to pass from 3 to 5 miles southward of it; a narrow bank of soundings with depths of 9 to 12 fathoms extends 5 miles between the bearings southeastward and east-southeastward from Hole in the Wall. Then make good a 281° 30′ true (W. by N. mag.) course for 100 miles, passing 5 miles northward of Great Stirrup Key lighthouse and to a position near the edge of the bank with Great Isaac lighthouse bearing 231° true (SW. ½ W. mag.) distant 7 miles. Then round Great Isaac lighthouse at a distance of about 4 miles in a depth of about 12 or 13 fathoms.

The principal dangers are the *Gingerbread Ground* and the rocks and reefs lying between it and Great Isaac lighthouse, which have a total length of about 30 miles; and the greatest caution and attention to soundings should be observed in approaching this dangerous

locality, as the flood tide sets directly on the reefs, and in places parts of it are only about 1½ miles from the edge of the bank. From westward of Stirrup Keys to eastward of the Gingerbread Ground the northern edge of the bank is clear and the lead a safe guide, and vessels sometimes anchor here during light winds.

From northward of Great Isaac lighthouse steamers shape the course across the Gulf Stream for Fowey Rocks lighthouse. On this course an allowance should be made for a northerly current, averaging about 2¼ knots for the entire run. It will therefore be necessary to shape the course for a position some 8 or 10 miles southeastward of Fowey Rocks light to allow for the northerly set. When fixing the position by bearings on the light, keep in mind that while outside the 100-fathom curve the vessel is probably in the full strength of the Gulf Stream, where the northerly current may average a velocity of 4 knots; if the light is on the starboard bow, the vessel will be much closer to it than indicated by the distance run between the successive bearings on it. On account of the strong current and the abrupt shoaling inside the 100-fathom curve the greatest caution should be observed in approaching Fowey Rocks and in fixing the position from which to shape the course southward. (See the caution as to currents in the Straits of Florida on p. 38.)

To stand along the western edge of Great Bahama Bank.—If possible, daylight should be selected for the run.

Having rounded Great Isaac lighthouse at a least distance of 3 miles, steer 223° true (SW. ¼ S. mag.) for 10 miles to pass outside Eldorado Shoal (depth 10 feet), taking care in the night not to come within the depth of 10 fathoms, or to bring the light to bear northward of 51° true (NE. ½ E. mag.) until the shoal is passed. The course may then be altered more southward to follow the edge of the bank in not less than 10 fathoms and pass outside Moselle Shoal buoy.

After passing North Bemini the keys must be closely hugged in order to avoid the Gulf Stream, which sometimes comes close to the rocks. A short calm within a mile of the edge of this part of the bank might drift a sailing vessel so far northward as to oblige her to run around Little Bahama Bank and to enter again from eastward. Therefore, instead of attempting to beat along with a light wind it is more prudent to anchor under North Bemini and await a slant of wind to get around the elbow.

In the winter when near Great Isaac, if the weather indications give warning of a northwester, it is advisable for a sailing vessel to remain in the Northwest Providence Channel and be guided by bearings on Great Isaac until the wind draws northward, which it usually does in 24 to 48 hours.

Vessels proceeding westward from Great Bahama Bank should endeavor to strike soundings on the northwest end of Salt Key Bank. Should the wind be scant from westward they may run in on the bank on either side of Dog Rocks and pass off southward of the Double Headed Shot Keys; or, should the wind be light and tending to calm, they may anchor on the bank to avoid being set northward. At night vessels had better run down westward of the bank, paying great attention to the lead.

It is advisable for sailing vessels not to stand over for Salt Key Bank until after reaching Orange Key. In the summer months, when

light southeasterly winds prevail, a strong northwest current frequently runs into Straits of Florida from Santaren Channel, and vessels meeting with a calm or light airs at this period are sometimes drifted through the straits, even in sight of the keys along the edge of the bank.

Having passed Elbow Key lighthouse and being clear of Salt Key Bank, the course should be about 233° true (SW. ½ W. mag.) until close over to the coast of Cuba, to avoid the strength of the current. This course should lead toward the peak of Matanzas, and about 12 miles northwest of Piedras Key lighthouse, but this will depend upon where the vessel leaves the bank and the set of the current, which is very uncertain and sometimes strong into the Nicholas Channel. If bound to ports of the United States on the Gulf of Mexico, keep along the coast of Cuba as far west as Mariel, about 22 miles westward of Habana, and then shape a course to pass westward of Tortugas.

Vessels with a fair wind may shorten the passage by crossing over from Salt Key Bank to Sand Key lighthouse; a Gulf Stream current with a velocity of about 2 knots in a northeastly direction will be experienced.

To cross Great Bahama Bank.—Vessels of less than 12 feet draft can stand across the northwest part of Great Bahama Bank from Northwest Providence Channel, but this should not be attempted unless in the daytime, when the rocky patches can be seen so as to be avoided. The distance with a depth less than 4 fathoms is 70 miles. About half of this distance carries a depth of a little more than 2 fathoms; 15 miles of this is known as the flats or Middle Ground, which has narrow sand ridges and small black heads, between which the vessel must be guided by eye.

Passing 1½ miles northward of Great Stirrup Key lighthouse, bring the lighthouse to bear 112° true (ESE. mag.), distant 4 miles. Then steer 238° true (SW. by W. ⅛ W. mag.) for 33 miles to the edge of the flats or Middle Ground, which extends across the bank and is about 15 miles wide; allowance must be made for the tidal current. Thence a 217° true (SW. ¾ S. mag.) course for 50 miles will lead to a position 5 or 6 miles southeastward and in sight of Orange Key, and the course continued will lead to the edge of the bank about 12 miles southward of it.

In crossing the flats the eye must be the guide between the numerous white sand ridges and the small black heads, which are easily seen, even in the night time, if the weather is clear. Should a vessel enter upon the bank with the first of the flood, she should steer a little more westward, and more southward if she enters on the first of the ebb. Although the water is so shoal and clear, the lead should be kept constantly going, the lead line being marked to feet. If eastward of the track and approaching what is known as Long Bank, the little heads of sponge and dark fans will become more numerous. In the winter months, should the wind haul southward (a sure indication of a northwester), it is advisable to anchor and await the change instead of beating about among the shoals.

Tides.—It is high water, full and change, on the bank at 8 hours, and the current has a velocity of 1 to 0.5 knot to within a short distance of the north side of the Middle Ground. On the Middle Ground there is little current; and on the south side of the Middle

Ground the current is rotary, setting from east to south and west from high to low water, and through north to east from low to high water.

About 16 miles eastward of Orange Key it is not high water, full and change, before 10 hours 15 minutes, and the rise is 3 feet, so that a vessel will carry 2 hours more of high water across the shallower part of the bank. A steamer of 12 feet draft, coming from northward and making the northern edge of the Middle Ground at three-quarters flood, may cross the Middle Ground before the tide begins to fall.

COAST FROM CAPE HENRY TO CAPE LOOKOUT.

Cape Henry, on the south side of the entrance to Chesapeake Bay, is a bold range of sand hills, 80 feet high, with lower ones near the water. On the beach at the cape is Cape Henry lighthouse, and 340 feet southwestward of it is a disused lighthouse tower. Near the lighthouse are a storm-warning display station and a seacoast telegraph station of the United States Weather Bureau, from which vessels are reported to Norfolk and with which they may communicate by the use of International Code Signals.

Cape Henry lighthouse is an octagonal, pyramidal tower, upper and lower half of each face alternately black and white. The light is group flashing white (group of 3 flashes every 20 seconds) with a red sector, 157 feet above the water, and visible 19 miles. The fog signal is a siren, blast 4 seconds, silent interval 41 seconds.

Virginia Beach is a summer resort 5 miles southward of Cape Henry and has railroad communication with Norfolk. The buildings are prominent and there is a high black water tank there. Coast Guard station No. 162, located on the beach is a radio compass station.

From Cape Henry to Cape Hatteras the coast trends southward for 103 miles, and is broken by two unimportant inlets. From Cape Henry southward for 11 miles there are woods near the beach, but for the remainder of the distance the coast is a low, narrow strip of land or sand beach, from 1/8 to 2¾ miles wide, separating the ocean from the extensive interior waters of North Carolina. Currituck Beach, Bodie Island, and Cape Hatteras lighthouses, Diamond Shoal light vessel, the buoys, and the life-saving stations are the principal marks.

The coast between Cape Henry and Cape Hatteras is free from dangers if it be given a berth of 5 miles or more, and along the greater part of it 5 to 9 fathoms will be found as close as 1 mile from the beach. The shoals lying off this stretch of coast are False Cape Shoals, Platt Shoals, Wimble Shoals, and Hatteras Shoals. In navigating along this coast in thick weather the closest attention should be paid to the soundings and chart, and even then the navigator is likely to be confused and let into danger in consequence of the irregularities of depth.

About 21½ miles southward of Cape Henry there are two sand hills, one 60 and the other 40 feet high, called, respectively, Wash Hill and Sheep House Hill. When approaching from southward the locality resembles Cape Henry, and is called **False Cape.** Several spots with depths of 14 to 18 feet lie from ¾ to 1¾ miles offshore from False Cape. A gas and whistling buoy (flashing white light) is moored outside these shoals about 4¾ miles from shore.

Currituck Beach lighthouse, nearly 34 miles southward of Cape Henry lighthouse, is a red, conical tower. The light is fixed white with a red flash of 1.5 seconds every 45 seconds.

Bodie Island lighthouse, 36 miles southward of Currituck Beach lighthouse, is a conical tower, alternate white and black horizontal bands above granite base. The light is fixed white, 156 feet above the water, and visible 19 miles.

Oregon Inlet, about 2 miles southward of Bodie Island lighthouse, is entered over a shifting bar, the surveyed depth on which has varied from about 6 to 10 feet or more. When inside the bar anchorage can be found under the lee of the south entrance point. The tidal currents have considerable velocity, sometimes from 3 to 4 knots, and even 5 knots on the ebb with strong westerly winds. About 4 feet at high water can be taken from the inlet over the bulkhead into Pamlico Sound through a difficult, shifting channel. There are no aids.

Platt Shoals are a number of spots with 4½ to 6 fathoms over them, lying from 2¼ to 3¾ miles from the beach, and from 6 to 9 miles southeastward of Bodie Island lighthouse. There is a good channel with a depth of 8 to 14 fathoms inside this shoal and about 1⅜ miles from the beach. The shoals are about 3½ miles long in a south-southeast direction and are about 1½ miles wide. In easterly gales the shoaler spots are marked by breakers.

New Inlet, the opening in the beach nearly 10 miles southward of Bodie Island lighthouse, is used only by small boats. The sea breaks across the mouth in all but very calm weather.

Wimble Shoals are a number of ridges extending out from and lying off the shore to a distance of 4 miles with depths ranging from 3½ to 6 fathoms. The northern end of these shoals is about 15 miles southward of Bodie Island lighthouse and eastward of the northern end of Chicamacomico Woods. The spot with 3½ fathoms over it lies about 2⅝ miles from shore, and there are several spots with 4 fathoms over them inshore of it. In easterly gales the shoaler parts are marked by breakers. A gas and whistling buoy moored 4¼ miles offshore marks the outer limit of the shoals.

Cape Hatteras, where the coast makes a sharp bend westward, is low and sandy, and is marked by Cape Hatteras lighthouse. One mile northward of the lighthouse is a radio station. Westward of the lighthouse it is thickly wooded. There is a life-saving station about 1 mile southward of the lighthouse and just southward is a radio compass station.

Cape Hatteras lighthouse is a black and white, spirally banded tower with a red brick base. The light is flashing white (light 1.4 seconds, eclipse 4.6 seconds), 191 feet above the water, and visible 20 miles.

Hatteras Shoals extend nearly 10 miles in a southeasterly direction from Cape Hatteras, and consist of a number of irregular shoals, some of which have 4 and 5 feet on their shoaler parts. The three principal shoals have distinctive names. The Spit extends about 2 miles southeastward from the cape.

Diamond Shoal lies 3 miles southeastward of the cape, has little water over it, and is usually marked by breakers. Outer Shoal is at the southeast extremity of Hatteras Shoals, and consists of irregular patches with least depths of 5 and 11 feet over them, which are usually marked by breakers and a wreck or two. Outer Slue Channel, the

passage between Outer and Diamond Shoals, has a depth of about 3½ fathoms, but as there are several spots with only 14 and 16 feet over them, and as the channel is not marked, it is not safe to pass north of the Outer Shoal. During strong winds the currents set across the shoals with great velocity.

Wrecks on the Outer Shoal usually occur in the case of vessels approaching from southward in thick weather. The difficulty of making a proper allowance for the set of the Gulf Stream, and also the strong currents near the shore and the shoals, may cause considerable error in the reckoning. The lead and Diamond Shoal light vessel are the guides for clearing the shoals. When approaching and uncertain of the position, the greatest care should be observed, the lead kept going at frequent intervals until bottom is found, and care should then be taken not to get into less than 20, or preferably 30, fathoms. Sailing vessels are cautioned against rounding Hatteras Shoals inside of the light vessel, as in case the wind should fail the strong currents are liable to set them on the shoals.

Diamond Shoal light vessel is moored in a depth of 30 fathoms 13⅝ miles 137° true (SE. ⅝ S. mag.) of Cape Hatteras lighthouse. The vessel has a red hull, with "Diamond" on each side, two masts, and a circular gallery under the lens lantern at each masthead. The lighting characteristic is an occulting white light every 20 seconds, light 12 seconds, eclipse 8 seconds; visible 13 miles; if light on foremast can not be shown a similar light will be shown from the main mast. The fog signal is a steam chime whistle, blasts 5 seconds, silent interval 55 seconds. If the whistle is disabled the ship's bell will be struck by hand rapidly 5 seconds, silent interval 55 seconds. The submarine bell strikes "5," thus: 5 strokes in 9 seconds, silent interval 3 seconds. Radio fog signal transmits signals on a 1,000 meter wave, a series of double dashes for 20 seconds, silent 30 seconds. Signals are transmitted continuously during thick or foggy weather and 9 to 9.30 a. m. and 3 to 3.30 p. m. each day. Wireless messages will be received and transmitted. Storm warnings are displayed during daytime only.

From Cape Hatteras to Cape Lookout the coast trends generally southwestward for 62 miles and is broken by two inlets. From Cape Hatteras southwestward for 6 miles it is thickly wooded near the beach; between the woods and the beach is a range of sand hills from 10 to 40 feet high, and for the remainder of the distance the coast is a narrow sand beach, with numerous sand hills, separating the ocean from the extensive interior waters of North Carolina. Cape Hatteras, Ocracoke, and Cape Lookout lighthouses, Diamond Shoal and Cape Lookout Shoals light vessels, and the life-saving stations are the principal aids.

The coast between Cape Hatteras and Cape Lookout is fairly bold and 4 to 7 fathoms will be found as close as ½ mile from the shore, except off Hatteras Inlet, where shoals extend out 1¼ miles, and off Ocracoke Inlet, where they make out nearly 1¾ miles.

Hatteras Inlet, 11 miles westward of Cape Hatteras lighthouse, is entered over a shifting bar, the depth over which varies from about 7 to 12 feet. It is used as a harbor of refuge by small local coasting vessels, there being fair anchorage inside the bar in depths of 2 to 3 fathoms. Strangers should not enter without a pilot, as the

buoys may not always mark the best water. Pilots are on the lookout for vessels and will cross the bar when the sea permits.

The channel over the bulkhead from the inlet to Pamlico sound is subject to change both in position and depth. In 1921, it was said to have a least depth of 5 feet. The channel is used chiefly by local fishermen.

On the west side of the inlet the shore is a bare sand beach; Hatteras Inlet life-saving station is 1½ miles westward of the inlet and the most prominent object in that direction. About 2¼ miles eastward of the entrance is a clump of woods and a storm warning display station; on the beach in front of the woods is Durants life-saving station. A white church spire in the village of Hatteras is prominent.

Tides.—The range of the tide is about 2 feet on the bar. In the channels over the bulkhead the height of the water depends upon the direction and force of the wind.

Currents.—The tidal currents in the inlet and the channels through The Swash are much influenced by the winds and attain a velocity at times of 2 to 2½ knots. The flood current commences nearly 3½ hours after low water and the ebb current about 3 hours after high water.

Ocracoke Inlet, about 26 miles west-southwestward of Cape Hatteras lighthouse and 15 miles from Hatteras Inlet, is entered over a shifting bar, the depth over which varies, according to the records of the surveys for many years back, from 10 to 12 feet. Strangers should not enter without a pilot, as the buoys may not always mark the best water. Pilots are on the lookout and will board vessels if the sea will permit them to cross the bar.

Inside the entrance there are several channels or slues which lead into the shoals lying northward of the inlet; **Teaches Hole Channel** is marked by buoys and lights, and leads northeastward along the western side of Ocracoke Island and then northwestward over the bulkhead into Pamlico Sound; a survey in 1916 found a least depth of 6 feet in the channel. **Wallace Channel** is marked by beacons, and leads northwestward from the inlet and through a former dredged channel over the bulkhead into Pamlico Sound; a least depth of 4½ feet is in this channel.

Ocracoke lighthouse and the village of **Ocracoke** are near a clump of woods on the eastern side of the entrance. Ocracoke lighthouse is a white tower. The light is fixed white, 75 feet above the water, and visible 14 miles. On the western side of the entrance is the village of **Portsmouth**; the life-saving station is the largest building and is nearest the inlet.

The best anchorage is in the channel off the village of Ocracoke, from just below the lower wharf to abreast the life-saving station; the depths range from 8 to 18 feet. Small boats go into Silver Lake, a circular basin with an entrance depth of 2 feet.

Tides.—The range of tide is about 2 feet over the bar and about 1 foot at Ocracoke. In the channels over the bulkhead the height of the water depends upon the direction and force of the wind.

Currents.—The currents in the inlet and the channels over the bulkhead are much influenced by the winds. The ebb current usually has a greater velocity than the flood, sometimes attaining a velocity of 2 to 2½ knots. The flood current commences nearly 3½ hours after low water and the ebb current about 3 hours after high water.

Cape Lookout is the extremity of a long and very narrow strip of sand beach projecting into the sea from the sharp angle of the coast which forms the point of division between Raleigh and Onslow Bays. The land near the cape is low, with sand hills from 10 to 40 feet high; the cape is, however, readily identified by Cape Lookout lighthouse, which can be seen at a distance of about 13 miles on a clear day.

Cape Lookout lighthouse is a black and white, diagonally checkered tower. The light is a white group occulting light every 10 seconds, 156 feet above the water, and visible 19 miles.

Cape Lookout Shoals extend 8¼ miles south-southeastward from the cape, their outer end, with a depth of less than 18 feet, lying 10 miles 165° true (S. by E. mag.) of Cape Lookout lighthouse. The greatest width of the shoals is about 1¾ miles, and the depth over them ranges from 2 to 18 feet. Lookout Breakers is the name given to a ridge on the shoals which has depths of 2 to 6 feet and lies about 8 miles from the lighthouse and 3 miles from the red buoy which marks the southern end of the shoals. Outside of Lookout Shoals proper and the buoy are two irregular shoals with 4¾ fathoms over them, which will be avoided by passing near the light vessel. In thick weather always use the lead, and if uncertain of the position do not go into a less depth than 14 fathoms. Cape Lookout slough is a channel across Cape Lookout shoals, 3¾ miles south of the lighthouse. Its eastern and western ends are marked by buoys.

Cape Lookout Shoals light vessel is moored in 15 fathoms about 20 miles 163° true (S. by E. ⅛ E. mag.) of Cape Lookout lighthouse and 9¼ miles 158° true (S. by E. ⅝ E. mag.) of the buoy marking the south end of the shoals. It has a red hull from bow to pilot house and from mainmast aft, midship section yellow, with "Lookout" on each side; two masts and brown, oval, cage-work daymark at head of each. A group flashing white light, 3 flashes every 12 seconds, is exhibited from an elevation of 50 feet and is visible 12 miles. The fog signal is a steam chime whistle, blast 3 seconds, silent interval 27 seconds. If the whistle be disabled a bell will be struck by hand rapidly 3 seconds, silent interval 17 seconds. The submarine bell strikes a group of 2 strokes every 10 seconds.

Lookout Bight is on the west side of Cape Lookout and affords good anchorage for large vessels except with winds from south through west to northwest.

A breakwater is being constructed at Cape Lookout, 306° true (NW. ½ W. mag.) from Cape Lookout Coast Guard station. In 1920 it was visible above low water for a distance of 4,800 feet. Vessels are advised to use care in the vicinity, as the temporary lights maintained on the structure may be extinguished by storms. A gas and bell buoy marks the outer end of the breakwater about 1⅞ miles 262° true from Cape Lookout lighthouse. When completed the breakwater will form a harbor of refuge behind it, with protection from all winds.

The anchorage is northward or northeastward of Wreck Point, with Cape Lookout lighthouse bearing between 86° true (E. mag.) and 109° true (ESE. mag.), in 5 to 6 fathoms. A limited number of small vessels of about 9 feet or less draft can anchor, with shelter

from all winds, inside the hook on which there are a number of huts; but the width of the anchorage, with depths of 10 to 18 feet, is only about 200 yards. To anchor inside the hook, pass 75 yards eastward and southward of the east end of the spit, 100 yards eastward of the huts, and anchor in the cove 200 yards southeastward of the huts.

When eastward of Cape Lookout Shoals, the greatest difficulty in making the anchorage in Lookout Bight is in the distance which must be run southward of the cape to clear the shoals. In easterly gales the shoals are marked by breakers, and when westward of them the sea will be somewhat broken. When westward of Cape Lookout Shoals, do not shoal the water to less than 8 fathoms until Cape Lookout lighthouse bears eastward of 41° true (NE. mag.). Then give the western side of the cape a berth of over 1 mile, passing well westward of the gas and bell buoy marking the end of the unfinished breakwater. When northward of the gas and bell buoy and Cape Lookout lighthouse bears 105° true (ESE. ¼ E. mag.) steer for it and anchor as recommended above.

BEAUFORT HARBOR

is the southern entrance to the inland waterway between Beaufort and Norfolk Harbors and is the most important harbor on the coast between Cape Henry and Cape Fear. The most prominent and easily recognized objects are the standpipe near the large hotel at the eastern end of Morehead City, the large yellow Marine Biological Station, on Pivers Island, near Beaufort, and the water tank in Beaufort.

Core Creek is a part of the inland waterway between Beaufort Harbor and Pamlico Sound and is described on pages 167 and 168.

Newport River, the approach to the Clubfoot Canal, is a broad shallow stream emptying into the head of the harbor. The canal is good for a depth of 3½ feet at high water.

The entrance to Beaufort Harbor is about 7½ miles west-northwestward of Cape Lookout lighthouse; it is obstructed by a shifting bar which extends nearly 1½ miles seaward. Dredging is occasionally done to obtain a channel 300 feet wide and 20 feet deep across the bar; shoaling is liable to occur soon after dredging. In 1921 the controlling depth was 14 feet. Ample depth for the class of vessels using the inland passage can be expected at all times. The channel is marked by range lights and buoys. Inside the bar there is a depth of 3 to 5½ fathoms in the channel and secure anchorage for vessels.

Beaufort, a town on the eastern side of the harbor, is the terminus of a railroad and has communication by telegraph and telephone. There is no anchorage near the town, but there are several small wharves to which a draft of 6 feet can be taken at low water. A small supply of coal is kept on hand, and larger quantities can be had by giving notice well in advance.

Beaufort is reached from southward through a dredged channel 100 feet wide and 7 feet deep, the entrance to which is marked on its west side by **Shark Shoal light** (horizontally striped structure off the south end of a stone jetty on Shark Shoal). From the entrance the channel leads northward along the jetty, then to pass eastward of **Reids Creek light** (black structure), then curves northeastward to the

northwest end of Town Marsh, then along the southeast side of the marshy islet northward of Town Marsh, and then northward for the passage between **Pivers Island** (marked by several large yellow buildings) and Beaufort until up to the small wharf at the western end of the town. Here a channel 200 feet wide and 10 feet deep runs southeastward along the wharves, and another channel leads northward past the railroad wharf.

A dredged channel 60 feet wide and 9 feet deep leads northward from Beaufort through **Gallant Channel** to the main channel of the inland waterway between Beaufort Harbor and Pamlico Sound. The channel is crossed at Beaufort by a drawbridge (opening 60 feet wide), from which it trends northward for ⅜ mile, to the fish factory wharf, then northwestward for ½ mile toward Newport Marshes upper light to a lighted beacon, then 34° true (NE. ⅝ N. mag.) for nearly ⅝ mile to lighted beacon 2, and then 348° true (N. ¾ W. mag.) for ⅞ mile, to Russells Creek light, on the west side of the main channel of the inland waterway. The channel is not difficult at low water, the sides of the cut then showing by a difference in the color of the water.

A channel has been dredged 5 feet deep from the wharves at Beaufort eastward through Taylors Creek to Core Sound at Lenoxville Point. It is marked by beacons at the western entrance and a light at the eastern entrance.

Morehead City, on the western side of the harbor, has communication by railroad, telegraph, and telephone, and is a shipping point for oysters, fish, and clams. The railroad wharf extends to deep water of the channel on the west side of the harbor near the drawbridge, and both are prominent. A channel 10 feet deep, with a least width of 100 feet, leads from Beaufort Harbor to the wharves of the town. From near buoy No. 3 in Bogue Sound the channel trends about 320° true (NW. ¾ N. mag.) for the cupola of the hotel until abreast a spindle on the port hand, then 293° true (NW. by W. ⅝ W. mag.) close to the end of the hotel wharf, and then along the wharves.

Anchorage can be had in the channel of Beaufort Harbor from Fort Macon to the railroad bridge, and vessels of 8 feet or less draft can anchor, convenient to Morehead City, in the channel of Bogue Sound westward of buoy No. 3.

Pilots will come out to a vessel if the sea will permit them to cross the bar. They can also be obtained here to take vessels along the coast and into the inlets between Beaufort and Cape Fear.

Supplies.—Coal, gasoline, ice, fresh water, provisions, and some ship chandlery can be obtained at Morehead City or Beaufort. Repairs can be made to small craft, which can be hauled out at both places.

Hospital.—The nearest marine hospital is at Norfolk, Va. At Beaufort there is a relief station of the United States Public Health Service.

Storm warnings are displayed at Beaufort and Morehead City.

Currents.—The tidal currents in the entrance run with considerable velocity, especially during spring tides. They generally follow the direction of the channel, but on the last quarter of the flood and first of the ebb they are apt to set across the shoals in the entrance.

DIRECTIONS.—From Cape Lookout Shoals light vessel a 327° true (NNW. 5/8 W. mag.) course made good for 25½ miles will lead 1¾ miles westward of the red buoy on the end of Cape Lookout Shoals, and to Entrance gas buoy.

From Frying Pan Shoals light vessel a 40° true (NE. 1/8 N. mag.) course made good for 86 miles will lead to Entrance gas buoy.

A good lookout for Entrance gas buoy should be kept as soon as Cape Lookout lighthouse bears southward of 97° true (E. by S. mag.). The prominent standpipe in Morehead City bearing 338° true (N. by W. 5/8 W. mag.), or the large yellow building of the Biological Station near Beaufort bearing 6° true (N. 7/8 E. mag.), will lead to the gas buoy.

From the Entrance gas buoy steer 0° true (N. 3/8 E. mag.) with Fort Macon range lights in line ahead (fixed white), until up to black can buoy "3," which is at the turning point from Fort Macon range to Bird Island range. The rear beacon in daytime will be seen against the sky, on top of Fort Macon. In the afternoon the front object is not easily picked up. From this buoy steer 32° true (NE. 3/4 N. mag.) with Bird Island range lights in line ahead (fixed red, front object three pile red beacon, rear object skeleton tower), pass 100 yards northwestward of nun buoy "2" and to a position about 300 yards southward of Fort Macon Spit bell buoy. Then gradually haul northward, to pass about midway between the bell buoy and a red and black nun buoy northeastward of it.

From this position steer 323° true (NNW. 7/8 W. mag.) to a position about 100 yards westward of nun buoy No. 4. Then steer 287° true (WNW. 1/8 W. mag.), and give the shore above Fort Macon a berth of 150 yards. Leave buoy No. 6 on the starboard hand, and follow the marsh at a distance of 125 yards. When the outer end of the railroad wharf bears 338° true (N. by W. 5/8 W. mag.) steer for it, which will lead eastward of the horizontally striped buoy on the north side at the entrance of the channel leading to Bogue Sound. There is a middle ground of 11 feet 400 yards south-southeastward of the buoy, which narrows the channel at this point and vessels of greater draft must exercise care in passing here.

For directions and descriptions of the inland waters to Pamlico Sound see page 167.

COAST FROM CAPE LOOKOUT TO CAPE FEAR.

The coast extends about 8 miles in a northwesterly direction from Cape Lookout and then curves gradually westward and southward to Cape Fear. This coast, nearly 100 miles in length, is similar to that between Cape Hatteras and Cape Lookout, but the strips of land forming it are separated from the mainland by much narrower bodies of water, and consequently the thick woods of the mainland can be seen from much farther seaward. That part of the Atlantic Ocean bordering on this curved coast is known as **Onslow Bay**.

The depths along this stretch of coast are very regular; 4 to 6 fathoms can be taken to within 1 mile of the beach; the 10-fathom curve extends nearly parallel to, and at an average distance of about 8 miles from, the shore until eastward of Cape Fear, where it bends southward and eastward around Frying Pan Shoals. The 20-fathom curve is from 20 to 45 miles offshore.

Inside passages.—Westward of Beaufort Harbor there is an inside passage as far as Bear Inlet for boats of 4 feet draft, high water, and as far as New River Inlet for 3 feet draft at high water; a draft of 1½ feet can be carried at high tide as far as Wrightsville Inlet, but this section is never used by strangers. There are several inlets between Beaufort Harbor and Cape Fear through which 6 or 7 feet at high tide can be taken to sheltered anchorage, but all are obstructed by shifting bars on which the sea breaks when at all rough.

With local knowledge, a smooth sea, and high water, boats of 5 feet or less draft can enter Cape Fear River through Corncake Inlet, and boats of about 8 feet or less draft can cross Frying Pan Shoals by the swash channel. Otherwise all vessels must pass outside Frying Pan Shoals, by which route the distance from Entrance gas buoy off Beaufort Harbor to smooth water in Cape Fear River, is 112 miles. Pilots for the inlets, inland passages, and open waters between Beaufort and Charleston can be had at Beaufort.

Bogue Sound is shallow, extends 21 miles westward along the coast from Beaufort Inlet to Bogue Inlet, and is separated from the ocean by **Bogue Banks**, a wooded beach ⅛ to ¾ mile wide. The sound has a width of about 2 miles near its middle, but narrows at each end; its western end is partly closed by marshy islets. A channel, partly dredged, extends through Bogue Sound from Beaufort Harbor to Bogue Inlet, and is navigable for a draft of 3 feet at low water and 4 feet at high water.

The channel is buoyed from Beaufort Harbor nearly to Carolina City (marked by fish factory and several mills and farther west by radio towers), a distance of 1½ miles. Westward of Carolina City the channel follows the north shore at a distance of ⅛ to ¼ mile for 9 miles to the mouth of Broad Creek, and is marked by lighted beacons. About 1½ miles westward of Carolina City there is a light which marks the north side of a short dredged cut through a shoal; there are spoil banks on the south side of this cut. After passing through cut head west-southwestward for 1 mile to a position ½ mile southward of a lone tree on the north shore and enter a dredged cut, marked by a spoil bank on the south side. Follow through this cut in a general westerly course for 2 miles, and continue the same heading until up to a dredged cut west of Gales Creek and marked by a spoil bank on the south side. There is a prominent house with a red roof with a dock in front just east of the mouth of the creek. Go through the cut toward lighted beacon 1 (black slatted day mark on pile) south of the mouth of Broad Creek. (The creek is crossed by an arched bridge ¼ mile above its mouth.) Pass northward of the lighted beacon 1 and follow the dredged cut marked by the aids, south to beacon 2, north of beacon 3, south of beacon 4, and north of beacon 5. Between beacons 5 and 7 the spoil bank is visible in some places on both sides of the channel and between 7 and 8 they are out of water practically continuously on both sides.

From Guthries Point the waterway follows the natural channel, and is well marked by lighted beacons for 1½ miles to Hunting Island. From the light on the south end of Hunting Island the waterway leads westward to the marshy islets, and then between them and the wooded north shore for ½ mile, then leaves a small and a large island to starboard, and follows the well-defined channel be-

tween the islands for ¾ mile to the mouth of the channel leading westward to Swansboro, marked on the east side by a red day mark.

Boats **bound to Bogue Inlet** should continue past this beacon and follow the main channel southward for ⅝ mile, then westward for ½ mile, passing northward of two islets, to the marsh on the west side, then southward to the inlet. The shoals in the vicinity of the inlet are subject to change, and no directions can be given. The buoys and the appearance of the water are the best guides.

Boats **bound to Swansboro,** to Bear Inlet, or the inland waterways beyond Swansboro should enter the channel southward of the red day mark mentioned above, and follow it westward to its outlet in Main Channel, then continue westward, past a broad opening leading toward Swansboro, and into the opening leading westward toward a house on Huggins Island. Continue in mid-channel westward to the island, follow this northwestward, and then steer northward in a dredged channel, marked by spoil banks, to the waterfront of Swansboro.

Provisions and gasoline are obtainable at **Swansboro,** and there is a railway for hauling out boats 60 feet long and 4 feet draft, and machine shops for ordinary repairs to motors.

Tides in Bogue Sound vary from about 3½ feet average rise and fall at each end, near the inlets, to about 1 foot where the tides meet near the middle. Strong south or southwest winds may raise the tide a foot or even more and north to northwest winds lower it a corresponding amount.

From Swansboro to New River Inlet there is an inside passage which has been improved in places by dredging to a minimum width of 40 feet in the cuts and a minimum depth of 4 feet at a mean high tide; it is used by boats of 3 feet draft. Some deterioration has taken place, especially near Browns Inlet, where the channel is almost closed by a shoal. The passage is not marked, and although there are evidences of dredging in places, a stranger may encounter some difficulty in following the channel.

Tides in this passage vary from an average rise and fall of about 3½ feet at the inlets to 1½ feet at points remote from the inlets; the latter may be increased to 2 feet by strong southerly winds.

From Swansboro the waterway leads southwestward between an islet marked by a shanty, and the mainland keeps well in the bight westward of the islet and follows the shore southward and westward to the mouth of Queens Creek. It leads southwestward across the mouth of Queens Creek and then follows a dredged channel, well marked by spoil banks, for 6 miles until close to Brown Inlet.

It follows the beach closely across Brown Inlet and then follows a very crooked natural waterway at a distance of ⅛ to ⅜ mile from the beach for about 3 miles. There are many branches, but the waterway follows the main stream, which is usually well defined. From this point to New River the waterway runs approximately parallel to the coast and is well defined by the evidences of dredging. In the wider passages, favor the side upon which the dredged material is deposited. The waterway crosses two open bodies of water, but is well defined by the spoil banks.

Bogue Inlet is 22 miles westward of Beaufort Harbor and 3 miles southward of the town of Swansboro, which can be seen from outside. The inlet is between a high wooded ridge on the west and a

long, low spit on the east; on the inside of the spit, 1 mile eastward of the inlet is a Coast Guard station, which can be seen from the outside. The entrance is obstructed by a shifting bar, extending about ½ mile seaward, through which the channel depth varies from a minimum of 3 feet at low tide in some years to a maximum of 14 feet at high tide in other years; in October, 1921, there was a depth of 3 feet on the bar. The tides have a range of about 3½ feet on the bar, and high water occurs 2 hours earlier on the bar than at the head of the marshes inside. The channel is marked by a sea buoy, ½ mile outside the bar, and by small buoys on the bar and in the entrance. There are no regular pilots; some one familiar with the channel may sometimes be had from the Coast Guard station. Fishermen are sometimes present outside and can be followed in. A stranger should wait for a rising tide and should never attempt to enter when the bar is breaking; the bar buoys can not be seen when there is any sea on.

The channels inside the inlet are subject to considerable change and no directions for navigating them can be given. A depth of about 3 feet at low water and 4 feet at high water, can be brought to the inlet from eastward, as described under Bogue Sound preceding.

From the inlet to **Swansboro,** a distance of 4 miles, the channel has a depth of about 3 feet at low water. The channel is obstructed by shoals, and at high tide the marshes on each side are covered, rendering it difficult for a stranger to follow.

White Oak River, for a distance of 4 miles above Swansboro, has a width of 1 mile or more, through which there is a narrow, tortuous channel between flats and oyster rocks; farther up the river is narrow and leads between marshes. The channel is marked by red and black stakes. **Stella** is a post office about 7 miles above Swansboro. A sliding drawbridge crosses the river at the town. Boats of about 4 feet draft have towed logs on the river as far up as 6 miles above Stella. Lumber is towed through Bogue Sound to Morehead City.

Bear Inlet, 3½ miles westward of Bogue Inlet, is used considerably as a harbor by local boats and to some extent by pleasure craft bound to and from the inside waters. The entrance is about ¼ mile wide between high sand dunes. It has a broad, straight channel, and is marked by buoys; in 1921, there was about 7 feet on the bar at high water. There is good anchorage close to the beach on the eastern side, just inside the inlet.

Boats bound to Bear Inlet inside can carry the best water (3 feet at low water and 6 feet at high water) by following the inland waterway as described on page 56 to Swansboro. From here the best water leads westward, between an islet marked by a shanty and the mainland, and then southward, following the main channel leading westward of Higgins and Dudley Island, to the beach ½ mile westward of Bogue Inlet, then follows a narrow channel westward, parallel to the beach, to Bear Inlet. Boats of 3 feet draft can go direct from Bogue Inlet to Bear Inlet, just inside the beach, at high water only.

Brown Inlet, 3 miles westward of Bear Inlet, had a depth of 3 or 4 feet in 1916; it is little used. The entrance is similar in appearance to Bear Inlet.

New River Inlet, 35 miles westward of Beaufort Harbor, is not marked, is considered dangerous by local pilots, and should not be

attempted except under the most favorable conditions. There is a strong ebb current from the inlet sometimes as long as three hours after low tide, which causes a heavy break on the bar when there is any sea outside. In 1921 there was 5 feet at low tide on the bar, which was broad and showed no well-defined channel, and is subject to rapid change. The entrance is narrow, with spits on both sides, and only shows when open. On the western side of the opening there is a wooded hammock and on the eastern side bare sand dunes and a shanty. There is a group of shanties 1 mile westward of the inlet.

Tides.—The mean rise and fall at these inlets is about 3.5 feet; but freshets, particularly in New River, may raise the level a foot or more inside. On the bars at the entrances of the inlets between Cape Lookout and Cape Fear high and low waters are about one hour earlier than at Charleston.

New River is navigable for boats of 5 feet draft for a distance of 7 miles above Jacksonville, the latter being a town on the New Bern-Wilmington branch of the Atlantic Coast Line 20 miles above the mouth of New River Inlet. The river has a width of 1 to 2 miles from the head of the marshes above the inlet to 1 mile below Jacksonville, above which it is a narrow stream. From the inlet the channel to New River has a depth of 1½ to 6 feet and leads northward and northwestward to the northern end of Chadwicks Bay, where it follows the southwest side of a dike. It then follows the western shore at a distance of 200 yards, passes that distance eastward of Hatch Rock, and then turns eastward to the middle of the river.

From New River Inlet to **Wrightsville Inlet** there is a continuous passage said to be navigable for a draft of 1½ feet at high tide. It is used to some extent by fishermen in small power boats, but is said to be difficult to follow and should never be attempted by strangers. From New River to Alligator Bay, at the east end of Stump Sound, the channel passes close to Swan Point into Chadwicks Bay, which is generally about 3 feet deep, and the channel is staked. From the south side of the bay the route is through a narrow tortuous stream to Alligator Bay. There are several places where the water is sometimes only about 1 foot deep at high tide, and this portion is the shoalest part of the route between New River and Wrightsville. In this locality the wind has more effect in raising the water than the tide. A long-continued easterly or southerly wind will raise the water over the marshes. There is little tide in Stump Sound.

New Topsail Inlet is 18 miles westward of New River Inlet and 53 miles westward of Beaufort Harbor. The channel is unmarked, and is obstructed by a shifting bar, which had shoaled to a depth of about 3½ feet in 1916. A small house stands on the eastern spit, about ⅛ mile from its end. This inlet is used by local boats, but should not be entered by a stranger.

Old Topsail Inlet, 2 miles westward of New Topsail Inlet, had a depth of about 3½ feet across a broad bar in 1921, in an unmarked channel, easily entered with a smooth sea. The shores on each side are low sand beaches and there are no distinguishing marks.

Rich and Queens Inlets are 5 miles and 8½ miles, respectively, westward of New Topsail Inlet, and have channel depths over their

bars of 2 to 4 feet at low tide. They are used to some extent as anchorages by small local craft but are not recommended to strangers.

Wrightsville Inlet is 11½ miles southwestward of New Topsail Inlet and 23¾ miles north-northeastward of Cape Fear lighthouse. Lying 2½ miles southwestward is **Masonboro Inlet**, and on the beach between the two inlets is the summer resort of **Wrightsville Beach**, the large hotels and buildings of which are visible from far offshore. Wrightsville Inlet is used to a considerable extent as an anchorage for small yachts. The opening is a little over ⅛ mile wide between spits and is about ½ mile northeastward of the most northern hotel on the beach. A bar extends less than ½ mile seaward from the opening, and in June, 1916, the minimum channel depth on it was 6 feet at low water At that time the best water in entering followed the shore at a distance of about 350 yards from abreast the northerly hotel, northward to the inlet; passed close to the beach on the south side in entering; then close to the beach on the north to avoid a shoal extending northeastward from the inner point of the beach on the south side.

Vessels can find anchorage in the lee of either spit or can go southward as far as the bridge, carrying from 5 to 7 feet. Landing can be made at a wharf on the railroad bridge near its eastern end. An electric railway connects Wrightsville Beach with Wilmington. The average rise and fall is about 4 feet.

Corncake Inlet, 4 miles northward of Cape Fear lighthouse, and the southerly of two openings in this vicinity 2½ miles apart, is connected with Cape Fear River by a shallow passage north of Smith Island, known locally as Cedar Creek or the Thoroughfare; it is much used by small craft to avoid rough weather on Frying Pan Shoals and is a short cut from northward into Cape Fear River. There is about 5 feet at low water on the bar, 6 feet inside, and 1½ feet in the shallowest part of the channel through to Cape Fear River, and a draft of 5 feet can be taken through at high water. The bar is short and close to the entrance and the channel over it is narrow and well defined by shoals on each side, the shoal on the northern side being nearly bare at low tide; the entrance is ⅛ mile wide between low sand spits. Boats often enter the inlet as soon as the height of tide permits and anchor just inside, close to the southern spit, until able to go through into the river.

From the inlet the channel follows the western shore of the southern spit and some marshy islands at a distance of 50 to 100 yards for about ½ mile, and then crosses Buzzard Bay on a west-southwesterly course, with the tank at Fort Caswell well on the starboard bow. The crossing is the shallowest place, beyond which there should be little difficulty getting into the river. The channel trends southwestward and southward at a distance of 50 to 100 yards off the marshy islets on the western side, until down to the last one, which at high tide shows only as a few tufts of grass. Rounding this islet the channel trends about 324° true (NW. by N. mag.) until abreast a concrete pile on the starboard hand; then about 245° true (WSW. mag.), following the northern shore of Smith Island to a position close to a narrow point of marsh on the starboard hand; from here steer west-northwestward, heading about midway between Fort Cas-

well and Southport, for ¼ mile, then west-southwestward, with Fort Caswell well on the starboard bow, for 1 mile to the main channel of Cape Fear River. The mean rise and fall of tides is about 4 feet.

Cape Fear is the low, sharp point of sand beach forming the southern extremity of Smith Island. This island, lying on the eastern side of the entrance to Cape Fear River, is mostly low and marshy, but has a thick growth of trees on its western side. Near the southern end of the island is Cape Fear lighthouse, which will usually be the first object seen in approaching the cape.

Cape Fear lighthouse is a white, iron, skeleton tower, upper part black. The light is flashing white (light 2.5 seconds, eclipse 7.5 seconds), 159 feet above the water, and visible 19 miles.

Bald Head lighthouse is on the westerly side of Smith Island, easterly side of the entrance to Cape Fear River. The structure is a white, octagonal, pyramidal tower. The light is occulting white every 2 seconds, with a dark sector between 220° and 308°, 99 feet above the water, and visible 16 miles.

Cape Fear Swash is a narrow channel across Frying Pan Shoals, 1 mile southward of Cape Fear lighthouse, and about ¾ mile southward of the point of the Cape as determined in 1914. It has a least depth of about 9 feet, according to the latest report; is marked by buoys, and is used by local vessels. The channel in 1922 had a ESE. and WNW. direction; strangers using it should be guided by the buoys and should use it with caution, on account of the shifting nature of the shoals in this vicinity. Pilots for the Swash or Corncake Inlet can be obtained at Southport.

Frying Pan Shoals, with general depths of 7 to 14 feet, extend in an unbroken line 10 miles south-southeastward from Cape Fear; for a distance of 5½ miles farther in the same direction the shoals are broken, the depth over them ranging from 10 to 24 feet. Frying Pan Shoals light vessel is moored off the end of this part of the shoals and a red whistling buoy is moored off the western side of the shoals, nearly 8½ miles northwestward of the light vessel. Broken ground with depths of 6 to 7 fathoms extends 7 miles eastward and 12 miles east-southeastward from the light vessel; the least depth is 3¾ fathoms, and lies 9 miles 99° true (E. by S. mag.) of the light vessel. The outer end of the shoals is marked by a gas whistling and submarine bell buoy (flashing white light), which lies 12 miles 118° true (SE. by E. ¼ E. mag.) of Frying Pan Shoals light vessel. Large, deep-draft vessels generally pass southward of the gas and bell buoy.

Frying Pan Shoals light vessel is moored in a depth of 10 fathoms, 18½ miles 156° true (S. by E. ⅞ E. mag.) of Cape Fear lighthouse. The vessel has a yellow hull, with "Frying Pan" on each side, and two masts with the lantern on the foremast. The light is a group flashing white light every 30 seconds, flashes "22," 63 feet above the water, and visible 14 miles. The fog signal is a steam chime whistle, blast 5 seconds, silent interval 55 seconds. If the whistle is disabled, a bell will sound 5 strokes in 5 seconds, silent intervals 55 seconds. The submarine bell strikes 1 stroke every 3 seconds. The light vessel is a radio station and receives and transmits messages. Call letters NLC.

CAPE FEAR RIVER.

Cape Fear River has a total length of about 371 miles, and empties into the sea immediately westward of Cape Fear. It is the approach to the city of Wilmington, which is 27 miles above its mouth. Frying Pan Shoals light vessel, Cape Fear lighthouse, and Bald Head lighthouse are the principal guides for the approach, and are described with the coast from Cape Lookout to Cape Fear.

The entrance of the river is obstructed by a bar which extends about 2 miles offshore. The channel is under improvement to maintain a depth of 26 feet from sea to Wilmingon with a width of 400 feet across the bar, 300 feet in the river, and increased width at the bends. The channel is well marked by range lights and buoys, and with the aid of the chart it should not be difficult for a stranger of 16 feet draft to navigate it on a rising tide; sailing vessels usually employ a towboat for crossing the bar and in the river.

Southport is a town on the west side of the river about 2½ miles above Bald Head lighthouse. It has communication by steamboat and railroad with Wilmington. Supplies in limited quantities, fresh water, and gasoline can be obtained.

The city of **Wilmington** is on the east bank of the river, 27 miles above its mouth; it is the chief port of the State of North Carolina and has considerable trade in cotton, lumber, and fertilizers. The city has railroad communication and daily steamboat communication with the river landings southward to Southport.

Cape Fear River above Wilmington has a low-water depth of 7 feet to **Kings Bluff**, 34 miles; 5 feet to **Elizabethtown**, 64 miles; and 4 feet to **Fayetteville**, 100 miles, the head of navigation. These depths are secured by dredging and the building of two dams, one at Kings Bluff and the other at Browns Landing, 34 and 64 miles, respectively, above Wilmington. The tidal range at Kings Bluff is 1.5 feet. A depth of about 18 feet at low water can be taken 3¾ miles up river to the fertilizer works near the railroad bridge. This river is called Northwest Branch for a short distance above Wilmington.

Northeast River, known locally as **Northeast Branch**, empties into Cape Fear River from northeastward at Wilmington; a depth of 16½ feet at low water can be taken about 2¼ miles above Wilmington. It has a low-water depth of 6 feet to **Bannerman Bridge**, 42 miles, and 3 feet to **Croom Bridge**, 49 miles. Above Croom Bridge for a distance of 41 miles to **Kornegays Bridge**, the river is so shallow that navigation is practicable only during high-water stages.

Black River empties into Cape Fear River about 12½ miles above Wilmington, and has a low-water depth of 5 feet to **Point Caswell**, 21 miles; 2½ feet to **Haws Narrows**, 28 miles, and 1½ feet to **Clear Run**, 57½ miles. Above Clear Run for a distance of 7 miles to **Lisbon** the river is so shallow that navigation is practicable only during high-water stages.

Anchorages.—On account of the Government submarine cable, vessels are cautioned not to anchor on or near a line from Bald Head lighthouse to Fort Caswell. The best anchorage is off the town of Southport, where the depth ranges from 4 to 6 fathoms; the holding ground is good, but on account of the strong tidal currents vessels

should anchor with a good scope of chain. This anchorage is sometimes used as a harbor of refuge in the winter by coasting vessels. There is a limited anchorage basin abreast the lower end of Wilmington, on the easterly side of the river just above the mouth of Alligator Creek.

National Quarantine.—The quarantine and boarding station is on the east side of the channel about 1 mile above Southport. **Pilots** for the bar and river may be had at Southport, and they will come out in answer to signal. Pilotage from sea to Southport is compulsory for certain vessels. Extracts from the regulations relating to pilots and pilotage are given in the Appendix, page 170.

Towboats can be had at Southport or Wilmington.

Harbor regulations and wharves.—The harbor master at Wilmington has control of the berthing and anchorage of all vessels. For harbor fees, see the Appendix, page 172. The depth alongside the principal wharf at Southport is about 18 feet and at the Wilmington wharves 12 to 30 feet.

Supplies.—Provisions and ship chandler's stores can be had at Wilmington; coal for steamers can be had alongside the wharves or out in the stream from lighters. Fresh water can be had from a water boat or alongside the wharves through pipe and hose; it is also taken from the river at Wilmington.

Repairs.—Ordinary repairs to the machinery of steamers can be made at Wilmington; there is a marine railway here capable of hauling out vessels of about 1,200 tons register. The draft that can be hauled out at high water is 9 feet forward and 18 feet aft.

Storm warnings are displayed at Wilmington, Southport, and at the life-saving station on Oak Island (C. G., No. 194).

Public Health Service.—There is a relief station at Wilmington.

Tides.—See the tide tables for the Atlantic coast of the United States, in which the tides are predicted for every day at Wilmington. Proceeding toward the mouth of the river the tides are earlier than at Wilmington, the differences for high and low water, respectively, being Brunswick River entrance, 36m. and 51 m.; Orton Point, 1h. 34m. and 2h. 18m; Southport, 2h. 14m. and 3h. 33m; Bar, 2h. 34m. and 3h. 56m. The mean range at the entrance is 4.9 feet and at Wilmington 2.9 feet.

Currents.—The tidal currents on the bar run with considerable velocity, and as a rule set nearly in the direction of the channels, but on the last of the flood and first of the ebb they tend more or less across the shoals. In the river their set is generally in the direction of the channel, and during freshets the ebb has great velocity, sometimes entirely overcoming the flood. Abreast of Southport the estimated velocity of the ebb at strength of spring tides is 2.5 to 3.5 knots. At ordinary times a strong flood is felt for a considerable distance above Wilmington, where it runs 5¼ hours to nearly 7 hours of ebb; going down the river from Wilmington the periods of flood and ebb become more nearly equal. On the bar slack water occurs about 1 hour after high and low water.

Freshets.—Low-water stages prevail in the rivers above Wilmington from two to four months during the summer, and freshets usually occur as often as once a month during the rest of the year, but with no regularity.

DIRECTIONS.—The channel from sea to Wilmington is a dredged cut from 300 to 400 feet wide, the currents have considerable velocity, the dredged channel across the bar is subject to a gradual change in position, and strangers are advised to take a pilot. Unless with a local pilot, vessels do not run the river at night; sailing vessels require a towboat.

1. FROM NORTHWARD.—The safer course, and the one generally used by large, deep-draft vessels, is to pass outside of Frying Pan Shoals gas, whistling and submarine bell buoy. From Cape Lookout Shoals light vessel a 230° true (SW. ¾ W. mag.) course for 78 miles will lead to Frying Pan Shoals gas, whistling and submarine bell buoy, or a 238° true (SW. by W. ⅜ W. mag.) course made good for 84 miles will lead to Frying Pan Shoals light vessel.

From Frying Pan Shoals gas, whistling and submarine bell buoy steer 297° true (NW. by W. ⅜ W. mag.) for 12 miles to Frying Pan Shoals light vessel. Then steer 290° true (WNW. mag.) for 7 miles to a position 3 miles southward of Frying Pan Shoals whistling buoy. Then steer 338° true (N. by W. ¾ W. mag.) for 14½ miles, passing 1½ miles westward of Frying Pan Shoals whistling buoy and to the gas and whistling buoy off the entrance of Cape Fear River.

1A. FROM SOUTHWARD.—The principal danger southward of Frying Pan Shoals is the broken ground extending off between Cape Romain and Winyah Bay, on which there is a depth of 3¾ fathoms near the wreck of the *Hector* lying 11 miles from shore. The wreck is marked by a gas and whistling buoy. Another wreck 1½ miles northward is marked by a red and black nun. Deep-draft vessels should pass outside of this broken ground, giving the coast a berth of over 12 miles, and this is the safer course for all vessels at night. When clear of the broken ground the course can be shaped for the gas and whistling buoy off the entrance of Cape Fear River. When approaching from the southwestward in daytime the water tanks on Fort Caswell will generally be picked up before Cape Fear lighthouse.

Currents.—Except with northeasterly winds, some overrun, probably amounting to 0.5 knot at times, may be expected in approaching from southward. (See currents on page 33.)

2. SEA TO SOUTHPORT.—The channel over the bar is subject to change, and strangers should be guided by the buoys and range lights. The successive surveys show that the Middle Ground is gradually moving southward and encroaching on the channel marked by the Bald Head range lights. The ranges leading into the river had recently been moved to conform to the channel changes due to the encroachments of the shoals and they now lead through the best water, although further shifting of the shoals may be expected.

From a position 50 yards northward of Cape Fear River entrance gas and whistling buoy, 2 C. F. (flashing white), steer in on the New Channel range, course 58° true (NE. by E. ½ E. mag.). When nun buoy No. 4 is abeam, steer 96° true (E. ¾ S. mag.) with the Bald Head range (pyramidal skeleton structures, white day marks) in line ahead. After passing can buoy No. 5 starboard slowly to meet Smith Island range. Bring it on line ahead on course 32° true (NE. by N. mag.). Do not cross this range to the westward in the vicinity of can buoy No. 5A. When abeam of Fort Caswell range front light star-

board, and bring that range (rear light, Bald Head lighthouse) on over the stern, on course 334° true (NNW. mag.). Hold 200 yards eastward of the range when passing can buoy 7A coming back when abeam of Fort Caswell. Leave Battery Island light (red structure) about 250 yards on the starboard hand. Then haul gradually northward and pass the small islet just southward of Southport at a distance of about 300 yards, and the wharves at a distance of about 200 yards.

3. Southport to Reeves Point.—Pass the wharves at Southport at a distance of about 200 yards, pass midway between can buoy No. 9 and a yellow nun buoy, and steer 56° true (NE. by E. ¼ E. mag.) with lower Swash Channel range lights in line ahead until up with nun buoy No. 6A. Above this point the aids marking the edge of the dredged cuts should be passed at a distance of about 200 feet.

From nun buoy No. 6A steer 45° true (NE. ¼ E. mag.) for 2¼ miles with Snow Marsh Channel range lights in line ahead. When can buoy No. 13 is abeam, steer 24° true (NNE. ⅜ E. mag.), with Horseshoe Shoal Channel range lights (Lower Swash Channel front in line with Bald Head lighthouse) in line astern, for 1 mile until up with can buoy No. 13A. Then steer 5° true (N. ⅝ E. mag.) for 1 mile, with Reeves Point Channel range lights in line astern, until abreast nun buoy No. 10.

4. Reeves Point to Campbell Island.—From nun buoy No. 10 steer 15° true (N. by E. ⅝ E. mag.) for nearly 1½ miles, with Lower Midnight Channel range lights in line ahead, until abreast beacon No. 17. Then steer 359° true (N. ⅛ E. mag.) for 1½ miles, with Upper Midnight Channel range lights in line astern, until abreast can buoy No. 19.

From can buoy No. 19 steer 345° true (N. by W. mag.), with Orton Cove lower range lights in line astern for nearly ¾ mile. When 250 yards southward of nun buoy 12, haul slowly northward and leave it 200 feet on the starboard hand.

When past the buoy, steady on course 24° true (NNE. ⅜ E. mag.), with Orton Cove upper range lights in line ahead, for ¾ mile. Pass Orton Point at a distance of about 150 yards and when nearly up to the wharf just above Orton Point steer 13° true (N. by E. ⅜ E. mag.) for 1¼ miles, with Lower Liliput Channel range lights in line ahead.

Continue the course until abreast can buoy No. 23 and then steer 352° true (N. ½ W. mag.) for 1⅝ miles, with Upper Liliput Channel range lights in line astern until abreast nun buoy 16A. Then steer 2° 30′ true (N. ½ E. mag.) with Keg Island Channel range lights in line ahead.

5. Campbell Island to Wilmington.—Continue on the Keg Island Channel range, and when beacon No. 25 is abeam steer 330° true (NNW. ⅜ W. mag.) for ⅝ mile, with Big Island Channel lower range lights in line astern. When beacon No. 25A is abeam steer 307° 30′ true (NW. ⅜ W. mag.) for ⅜ mile, with Big Island Channel upper range lights in line astern.

Pass between buoy No. 22 and beacon No. 25B and steer 334° true (NNW. mag.) for 1½ miles, with Lower Brunswick Channel range lights in line ahead. When buoy No. 26 is abeam steer 11° true

(N. by E. ¼ E. mag.) for ⅞ mile, with Upper Brunswick Channel range lights in line ahead.

When abreast buoy No. 27 steer 5° true (N. ¾ E. mag.) with Fourth Eastern Jetty range lights in line astern for 1 mile. When buoy No. 29 is abeam steer 336° true (N. by W. ⅛ W. mag.) with Upper Brunswick Channel range rear light astern for ¼ mile, and when buoy No. 28 is abeam steer 2° true (N. ⅜ E. mag.) for ⅞ mile, with Clarks Island range lights in line astern.

When buoy No. 30 is abeam steer 18° true (N. by E. ⅞ E. mag.) with Eagle Island Light astern for 1 mile, and then follow the wharves on the eastern side of the river at a distance of 50 to 100 yards.

COAST FROM CAPE FEAR TO WINYAH BAY.

From Cape Fear the coast trends first in a northwesterly direction, then curves gradually westward and southward to the entrance of Winyah Bay. That part of the Atlantic Ocean bordering on this curved coast is known as **Long Bay**. The coast is 80 miles in length between Cape Fear and Georgetown lighthouses, and consists of a sand beach, with numerous small sand hills, separated from the heavily wooded mainland by small streams and marsh; from offshore the woods appear to extend to the water. The coast is clear and 4 fathoms can be taken as close as 1½ miles from the beach; the 10-fathom curve is from 18 to 21 miles offshore, and inside of it the water shoals gradually as the shore is approached. There is no inside passage; there are three inlets, with shifting bars, that can be entered by light-draft vessels with local knowledge.

Western Bar Channel, close to Oak Island at Fort Caswell, is used considerably by small craft from Cape Fear River bound westward along the coast. It is good for about 6 feet at low tide, but is not buoyed. The best water lies from 100 to 150 yards from shore southward of Fort Caswell, and from there the channel through the shoals trends about 256° true (W. by S. mag.). Abreast the life-saving station the shore should not be approached closer than ¼ mile.

Lockwoods Folly Inlet is about 11 miles westward of Cape Fear River. The depth on the bar is 3 feet at low tide, and there are no aids; the passage over the bar to the river is said to be difficult. **Lockwoods Folly River** is navigable for a draft of 5 feet at high water for a distance of 18 miles to **Supply** post office. The head of navigation is Lockwoods Folly Bridge, about 4 miles above Supply. The range of the tide is 4½ feet near the inlet and 2 feet at Supply.

Shallotte Inlet, about 18½ miles westward of Cape Fear River, has a depth of about 3 feet at low water on the bar. **Shallotte River** is navigable a distance of 10½ miles to the closed bridge at the town of **Shallotte**; boats without masts might go a few miles farther. Where the river is most obstructed, from 2 to 3½ miles above the inlet, a channel has been dredged along the western bank. There is a depth of 3 feet at low water to Whites Landing, and 2 feet in the next 2 miles to Shallotte. The range of tide is about 4½ feet near the inlet and 3 feet at Shallotte. Tubbs Inlet, 5 miles westward of Shallotte Inlet, had a depth in 1916 of about 4 feet in an unmarked channel across the bar. There is a landing and store 1 mile from the inlet, to which a depth of 5 feet can be carried at high water.

Little River Inlet, South Carolina, is about 27 miles westward of Cape Fear River. The opening, about 1¼ miles wide between spits, is partly filled by Bird Island, which is ¾ mile wide. The main channel is close westward of Bird Island; in 1921 there was a depth of 4 feet at low tide on the bar, but the channel changes in depth and position. The channel across the bar is marked by buoys which are shifted as the channel changes. Boats up to 7 feet draft go to the wharf at the lower end of **Little River**, a town on the river of the same name about 3½ miles above the entrance. A branch making eastward is known as Calabash Creek. The river is obstructed by shoals and difficult for a distance of 1¼ miles below the wharf to the lower sawmill. The entrance is marked by a prominent, high, white sand dune on **Waiters Island**, on the west side of the inlet and a beacon on the western part of Bird Island.

From Little River Inlet to Murrells Inlet, a distance of 31½ miles, the coast trends southwestward, sweeping in somewhat from a straight line joining the two points. For about 5 miles west from Little River Inlet the coast is backed by a strip of marsh lying between it and the woods on the mainland, and the same is true for about the same distance to the northward and eastward of Murrells Inlet. For the rest of the stretch the woods rise immediately back of the beach, which shows the usual stretch of sand, with many hills more or less conspicuous. In this stretch of coast there are many inlets, but none with sufficient water to make them of any commercial importance.

Myrtle Beach is a summer resort with railroad communication on the beach on the east side at the mouth of **Eight Mile**, or **Wither, Swash**, nearly 20 miles west-southwestward of Little River Inlet and 31½ miles north-northeastward of Georgetown lighthouse.

Murrells Inlet communicates with Main and Drunken Jack Creeks, which drains a considerable extent of swamp lying between the coast and mainland.

North Inlet, about 7 miles northward of Georgetown lighthouse, is connected by both Town Creek and Jones Creek with Winyah Bay; Jones Creek, the southerly thoroughfare, is easier to follow and is good for 6 feet at high tide. In 1921 there were two openings about ½ mile apart. The southern entrance had a depth of about 3 feet on the bar, is the easier to enter, and the only one that should be used by strangers. The high sand dunes between the two inlets are the most prominent in this vicinity. Strangers are advised not to enter with a greater draft than 3 or 4 feet, and then only with a smooth sea and on a rising tide. The best water in 1921 led southwestward of a wreck, showing above high water, just outside the entrance. The appearance of the water is the best guide. When inside, haul southward to pass midway between the sand spit and the marsh, and follow the marsh on the starboard hand southward through Jones Creek. One mile below the inlet Jones Creek bends west-southwest, then south; beyond this last bend keep to the left at all openings. From the southern end of the creek steer about 218° true (SW. ½ S. mag.) for red buoy No. 4 in Winyah Bay. The average rise and fall of the tide is 4.5 feet.

Georgetown lighthouse, near the south end of North Island, east side of Winyah Bay, is a white tower and dwelling. The light is fixed

white, 85 feet above the water, and visible 15 miles. Storm warnings are displayed near the lighthouse. A radio compass station is close southeastward of the lighthouse.

Winyah Bay South Jetty light structure is a black, pyramidal, skeleton tower on a mound at the end of the south jetty, entrance of Winyah Bay. The light is flashing white (flash 0.5 second, eclipse 4.5 seconds), 30 feet above the water, and visible 11 miles.

WINYAH BAY

is the first opening of any importance southward of Cape Fear River. In 1921 there was a depth of 18 feet or more in the channel over the bar, and inside the bay a channel 13 feet deep is available to Georgetown.

The city of **Georgetown** is situated on the north bank of the Sampit River, just inside its mouth; it has considerable trade in lumber, naval stores, and cotton. It is the terminus of a branch of the Seaboard Air Line Railway. The river trade to the Santee, Waccamaw, and Peedee Rivers is considerable.

Waccamaw River empties from northward into Winyah Bay just above Georgetown; it has low-water depths of 12 feet to **Bucksport**, 30 miles; 9 feet to **Conway**, 44 miles; and 2 feet to **Reeves Ferry**, 102 miles. At high-water stages 3 feet can be taken 26 miles farther up the river to **Lake Waccamaw**, the head of navigation. The most important landing is Conway.

Peedee River empties into Winyah Bay just westward of Waccamaw River; it has low-water depths of 9 feet to **Smiths Mills**, 45 miles, and about 3½ feet to **Cheraw**, 145 miles, but above **Caines Landing**, 86 miles, the river is obstructed by snags.

Black River empties from northward into Peedee River about 3½ miles above its mouth; it is navigable for river steamers for a distance of 44 miles. **Mingo Creek** empties into Black River, about 22 miles above its mouth; it has a low-water depth of about 8 feet for a distance of 10 miles to **Hemmingway Bridge**, the head of navigation, but there are many sharp bends.

Little Peedee River empties from northward into Peedee River from 30 miles above Winyah Bay and is navigable at high-water stages a distance of 41 miles to **Gallivant Bridge** for vessels of 2½ feet draft. The head of navigation is **Little Rock**, 98 miles above the mouth of the river. At low-water stages the river is nearly dry.

Sampit River is entered from Georgetown Harbor through a dredged channel 100 feet wide and 16½ feet deep, or a 14-foot channel 200 feet wide, which leads through the extensive shoals obstructing the mouth of the river. The depth in the river channel for a distance of 2½ miles above the dredged cut is 18 feet, and this is the depth abreast the city of Georgetown. The principal landing above Georgetown is Sampit, about 10 miles above the mouth of the river.

The **Estherville-Minim Creek Canal**, having a width of 40 to 50 feet and depth of about 6 feet at low water, connects the Santee River with Winyah Bay. The entrance to this canal is about 7 miles below Georgetown and 3 miles above the quarantine station. There has been a shoaling at the entrance to the canal, to 2½ feet at low water.

Channels.—**South Jetty Channel** parallels the South Jetty for a distance of about 1½ miles to the intersection with the Middle Ground range line and is marked by range lights and buoys. The channel is about 400 feet wide and 18 feet or more deep.

Middle Ground Channel is a dredged cut about 500 feet wide with a least depth of 18 feet and is marked by range lights and buoys. It leads in a northwesterly direction from the South Jetty Channel to the deep water of the bay.

North Jetty Channel has a least depth of about 9 feet and leads south of the north jetty in a west direction to the Middle Ground range. This channel is not marked and is used only small local craft.

Western Channel leads along the western side of the bay. It is 400 feet wide and has a least depth of about 13 feet. It is marked on its southwest and west sides by lights which are 250 feet from the middle of the channel.

Pilots.—Pilotage is compulsory for certain vessels. There is no regular pilot boat, but pilots will come out upon signal. For pilot rates see Appendix.

Towboats are employed by sailing vessels and may be had from Georgetown by making the signal when outside the bar.

Anchorages.—Good anchorage can be found anywhere in the bay between Georgetown lighthouse and South Island light. There is a limited anchorage in the upper part of the bay off the mouth of Sampit River. On account of the limited swinging room only small craft anchor in the Sampit River abreast Georgetown.

Quarantine.—The quarantine boarding station is on South Island on the western side of the bay, about 1⅜ miles above Georgetown lighthouse.

Hospital.—The nearest marine hospital is at Savannah, Ga. At Georgetown there is a relief station of the United States Public Health Service.

Supplies.—Provisions, some ship-chandler's stores, and fresh water can be obtained at Georgetown.

Repairs.—The nearest place for repairs to large vessels or machinery of steamers is at Charleston. There is a marine railway at Georgetown 110 feet long and 22 feet wide. The draft that can be hauled out at high water is 5 feet forward and 7 feet aft.

Storm warnings are displayed at Georgetown lighthouse, South Island, and Georgetown.

Tides.—The mean rise and fall is 3½ feet. High water occurs at Georgetown lighthouse 9 minutes after high water and low water 25 minutes after low water at Charleston. At Georgetown high water occurs 1 hour 2 minutes and low water 1 hour 46 minutes later than at Georgetown lighthouse.

Currents.—The tidal currents in Winyah Bay vary in velocity with the state of the rivers emptying into it, as well as with the stage of the tide. Their velocity is greatest between the jetties, where, at strength, it is 2½ to 3½ knots. The set is diagonally across the south jetty. During freshets in the rivers, also with westerly winds, the buoys between the jetties are nearly towed under at times on the ebb. Off South Island the average velocity is from 2 to 2½ knots, increasing somewhat with the springs. Between North and South Islands the set of the flood current is toward Mud Bay until past the north point of the latter, when the set is more westward. North-

ward of Frazier Point the flood sets into the channel eastward of Hare Island and also into Waccamaw River. In the western channel the current sets generally fair with the course to be steered.

DIRECTIONS.—The tidal currents have a velocity of about 2 to 3 knots at strength and do not set fair with the channel between the jetties. In a heavy southerly or easterly sea large vessels require careful handling and should take a pilot if one can come out to them. It is advisable for strangers to wait until daylight before entering.

From eastward.—From Frying Pan Shoals gas and whistling buoy make good a 258° true (W. ⅞ S. mag.) course for 75½ miles to Georgetown whistling buoy.

From Frying Pan Shoals light vessel make good a 25° true (WSW. ½ W. mag.) course for 67 miles to Georgetown whistling buoy.

From Cape Fear River entrance gas and whistling buoy make good a 233° true (SW. ⅞ W. mag.) course for 64 miles to Georgetown whistling buoy.

From southwestward.—From Charleston light vessel make good a 60° true (NE. by E. ½ E. mag.) course for 37 miles to a position ½ mile southeastward of Cape Romain gas and whistling buoy and 8½ miles 95° true (E. ¾ S. mag.) of Cape Romain lighthouse. Then steer 3° true (N. ½ E. mag.) for 7 miles; Winyah Bay South Jetty light will then bear 324° true (NW. by N. mag.). Then steer 336° true (NNW. mag.) for 5 miles to the perpendicularly striped nun buoy off the entrance.

From Sea to Georgetown.—From Georgetown whistling buoy steer 254° true (WSW. ¾ W. mag.) for 1¾ miles to the perpendicularly striped nun buoy. Then steer 270° (W. ⅛ N. mag.) on the line of the South Jetty Channel range lights (black and white day marks) passing southward of the buoys, until northward of the middle mound on the south breakwater and south of nun buoy "4"; then steer 285° true (WNW. ½ W. mag.) on the Middle Ground Channel range (white day marks) until a little over ¼ mile from the front light, or at night in the red sector of the South Jetty Channel front light. Then pass ⅛ mile northeast of the front light of the Middle Ground Channel range and bring it in range astern with South Jetty Channel range rear light (both with black day marks) on a 337° true (N. by W. ⅞ W. mag.) course, and leave the shore of North Island about 300 yards on the starboard hand.

When about 1¾ miles past Georgetown lighthouse and up to the old quarantine station steer about 344° true (NW. mag.), following the western shore at a distance of about 400 yards. Pass 250 yards northward of South Island light and steer 288° true (WNW. ¼ W. mag.) into the cut, passing 100 feet southward of buoy No. 4. Then be guided by the lights which are about ½ mile apart and mark the southwest side of the dredged channel, 250 feet from its middle. From a position 250 feet eastward of light No. 15 steer 7° true (N. ¾ E. mag.), passing about 100 yards westward of light No. 2. When nearly up to buoy No. 10, steer 27° true (NNE. ½ E. mag.), passing 100 yards westward of it, with light No. 4 a little on the starboard bow and buoy No. 5 on the port bow.

When the Sampit River range lights (white structures) are in range, bring them astern on a 335° true (NNW. ⅛ W. mag.) course,

passing through the dredged cut into the river, and then favor the eastern bank to Georgetown. Vessels should go to the wharves.

Remarks and dangers.—There are no dangers eastward of the entrance. The dangers southward of the entrance are described with the coast from Winyah Bay to Charleston. The south jetty is covered at high water, with the exception of the three mounds on it, which are 5/8 mile apart. Winyah Bay South Jetty light, on the mound at the end of the jetty, and Georgetown lighthouse are described with the coast preceding. The **Middle Ground** is extending seaward, and its eastern end should be given a good berth when off the entrance.

COAST FROM WINYAH BAY TO CHARLESTON HARBOR.

Between Winyah Bay and Charleston Harbor there is an inland waterway good for vessels of 5 feet draft at high water. It is described in the Inside Route Pilot, New York to Key West.

Santee River is one of the largest rivers of South Carolina, and empties into the ocean between Winyah Bay and Cape Romain. There are two mouths, known respectively as North Santee and South Santee; both are obstructed by shifting bars, with little depth, as shown on the chart. Boats enter the river from Winyah Bay through the Estherville-Minim Creek Canal, and the inland passage to Charleston extends westward from the river through Alligator Creek. Santee River is formed by the junction of the **Wateree** and **Congaree Rivers**, 124 miles above its mouth, and is navigable throughout. Wateree River is navigable 58 miles to the town of **Camden** and Congaree River 44 miles to the town of **Columbia**. The rivers are under improvement by the removal of snags and shoals to maintain a depth of 4 feet at low water to these towns.

East Bank, with 8 feet over it, is the southeasterly end of the shoals, which extend 4 miles from shore southward of the entrance of Winyah Bay. The southeasterly end of the bank is marked by a buoy, which lies nearly 2 miles 170° true (S. 3/4 E. mag.) of Winyah Bay South Jetty light.

Between East Bank and Cape Romain shoals extend 2 to 3 miles from shore; spots with 15 feet over them extend 5 3/4 miles from shore in one place, the outer one lying 5 3/4 miles southward of Winyah Bay South Jetty light. Farther out is broken ground with 5 fathoms and less, which extends 12 3/4 miles from shore. There is a wreck, marked by a buoy, on one of the shoaler places so far found, lying about 14 miles 92° true (E. 1/4 S. mag.) of Cape Romain lighthouse and nearly that distance 159° true (S. by E. 3/4 E. mag.) of Georgetown lighthouse; there is a depth of 3 3/4 fathoms northwestward of and near the wreck. Another wreck (*Hector*) lies 1 3/4 miles southward and is marked by a nun buoy. The southeastern extremity of this broken ground is marked by Cape Romain Gas and Whistling buoy. This broken ground has not been closely examined, and deep-draft vessels should pass outside of the gas buoy, giving the coast a berth of over 12 miles.

Cape Romain Shoal extends nearly 4 miles southeastward from Cape Romain, and is marked off its end, where the depth on the shoal is 7 to 10 feet, by a buoy. There is a depth of 4 3/4 fathoms 2 1/4 miles

south-southeastward of the buoy, while the 6-fathom curve is 3 miles southward.

Cape Romain lighthouse is an octagonal, pyramidal tower, lower half white, upper half faces alternately black and white, and black top. The light is flashing white (light 5.0 seconds, eclipse 55.0 seconds), 154 feet above the water, and visible 19 miles.

Cape Romain Harbor is a good anchorage for small craft inside of Cape Island (Cape Romain). There are two entrances, both unmarked, one from eastward around the north end of Cape Island, with a depth of 4 feet at low water, and the other from southward, leading westward of Cape Island, with a depth of about 5 feet and not marked. Cape Romain Harbor communicates with the inland passage to Santee River and Winyah Bay eastward and to Bull Bay and Charleston westward. The harbor is used only by small local craft, and it is not safe for a stranger to attempt to make the anchorage, as the shoals at both entrances are subject to changes. A stranger seeking an anchorage should go to Winyah Bay or Bull Bay. The mean rise and fall of tides is 5 feet.

Bull Bay is broad and shallow, with numerous shoals, some bare at high water, but there is a narrow channel, which is occasionally used as an anchorage, on its southwest side. There is a depth of about 10½ feet at low water in the channel over the bar, and the anchorage is easy of access for sailing vessels in southerly and easterly winds, if the sea is not too heavy. With a smooth sea vessels of 8 feet draft at low water and 12 feet at high water can be taken in to the anchorage. The perpendicularly striped sea buoy lies 3 miles southeastward of the eastern end of Bull Island, the southwestern point at the entrance. From the sea buoy steer 314° true (NW. mag.) for 1¾ miles. Then steer about 342° true (N. by W. ½ W. mag.) to a position ½ mile eastward of the east end of Bull Island. A shoal on which a least depth of 2 feet has been found extends ⅜ mile off the point. It is close to the channel, but is generally marked by breakers. Then follow the shore of Bull Island at a distance of about 300 yards, being guided by the lead and the appearance of the shoals. Anchor in the channel when well sheltered from the sea off Jacks Creek, or smaller boats can go up Bull Creek into Wharf Creek opposite Harrison's wharf.

There is an unmarked channel, with a least depth of 7 feet at low water into **Five Fathom Creek**, around the western end of Raccoon Key.

Bull Breakers extend 4¼ miles southward from the shore on the southwest side at the entrance of Bull Bay, and are marked off the southeasterly end by a buoy which lies 5½ miles 168° true (S. by E. mag.) of the eastern end of Bull Island.

Between Bull Bay and Charleston there are several shoal entrances over shifting bars that are not used except by local boats.

Price Inlet, 5½ miles westward of Bull Bay, has an entrance depth of 5 feet in a narrow, unmarked channel. It is little used.

Capers Inlet, between Capers Island and Dewees Island, has about 5 feet over the bar, but the entrance is narrow and there are many shoals inside the bar which are dangerous, because the sea does not break on them.

Dewees Inlet, between Dewees Island and Isle of Palms, has a least depth of 6 feet in the channel over the bar. It is the best inlet be-

tween Charleston and Bull Bay, but is little used except by local fishing boats.

Isle of Palms is a pleasure resort about 4 miles eastward of the entrance of Charleston Harbor. There is a prominent water tank here. There is communication by electric railway with Mount Pleasant, and thence by ferry to Charleston.

Breach Inlet has a little water on the bar, and is used only by small boats. The draw in the bridge across it is not operated.

Rattlesnake Shoal lies a little over 3 miles from shore southeastward of Isle of Palms, and east-northeastward of the entrance between the jetties of Charleston Harbor. It is about 2 miles long east and west, has a least depth of 9 feet, and is marked by a can buoy at its eastern end and a nun buoy at its western end.

Charleston light vessel is moored in a depth of 7 fathoms, 5½ miles off the ends of the jetties at the entrance of Charleston Harbor. The vessel has a white hull, with "Charleston" on each side, and two masts with black cylindrical grating at each masthead. The light is a group flashing (2 flashes every 6 seconds) white, 44 feet above the water, and visible 12 miles. The fog signal is an air diaphone, blast 3 seconds, silent interval 57 seconds. If the whistle is disabled, a bell will sound 3 strokes in 3 seconds, silent interval 3 seconds, 4 strokes in 4 seconds, silent 50 seconds.

Charleston lighthouse is 4 miles southwestward of the entrance of Charleston Harbor. The structure is a black and white horizontally banded conical tower, black at top. The light is fixed white, 155 feet above the water, and visible 19 miles.

CHARLESTON HARBOR

is 260 miles southwestward of Cape Hatteras and about 65 miles northeastward of Savannah entrance. The harbor is the approach to the city of Charleston and to Cooper and Ashley Rivers; it is easy of access either day or night in clear weather, and is one of the best harbors of refuge on the southern coast. The port has a large foreign and coastwise trade, the principal articles of commerce being cotton and cotton goods, lumber, petroleum products, and fertilizer material.

The entrance is between two converging jetties, which extend nearly 3 miles seaward across the bar. In 1921 there was a straight channel across the bar of 30 or more feet at low water, with a least width of 400 feet. There is a projected channel of 40 feet and 1,000 feet wide. The channel is marked by Charleston light vessel, range lights, and buoys.

Prominent features.—Eastward of the entrance, on the Isle of Palms, is a water tank, which shows prominently from seaward. On the southern side of the entrance is **Charleston lighthouse** and about 5½ miles southeastward from the entrance between the jetties Charleston light-vessel is moored in 7 fathoms of water. On the eastern side of the entrance is the village of **Moultrieville**, and **Fort** Sumter is on the west side of the channel inside the entrance. The spires and houses of the city of Charleston will be seen from outside the bar when the entrance is fairly opened out. At night Charleston light will be seen before the light vessel is made by vessels approach-

ing the entrance from southward, and will be sighted at about the same time as the light vessel when approaching from northward or eastward.

Cooper River enters Charleston Harbor from northward and on the eastern side of the city of Charleston; the navy yard is on its west bank about 6 miles above the customhouse in the city. There are no towns or villages of importance, the principal landings being at lumber mills and phosphate works. The river is navigable for vessels of 30 feet draft to the navy yard and to the port terminal 3 miles above it. It is marked by range lights, beacons, and buoys. The channel westward of Drum Island through Town Creek is marked by lights and is used by vessels going alongside piers westward of the island. The channel of Cooper River is good for a distance of about 22 miles above the navy yard to where the river forks at what is called the Tee. Vessels have loaded to 15 feet at **Strawberry**, on the western branch just above the Tee; a draft of 7 feet can be taken about 15 miles above the Tee to **Springfield Landing** and 5 feet about 20 miles farther to **Wadboo Bridge**, the head of navigation. A draft of 7 feet can be taken up the eastern branch about 4 miles above the Tee to the chapel, and launches can go about 13 miles farther. Distances given above the Tee are approximate only.

Wando River empties into Cooper River eastward of Drum Island; a draft of 7 feet can be taken to Wando, about 12 miles from the customhouse wharf at Charleston, but in places the channel is very narrow; 5 feet can be taken 8 miles farther to **Garon Bridge** (closed), the head of navigation.

Shipyard Creek empties on the west side of Cooper River above Drum Island. There are a number of manufactories on the creek, where vessels load phosphate and lumber.

A fixed white light, on a white slatted structure is on the north point of the entrance to the creek. A channel with a depth of 14 feet leads into the creek.

Ashley River empties into Charleston Harbor from northwestward on the southwest side of Charleston. There are no towns or villages of importance; the principal landings are at numerous phosphate works, all of which have wharves extending to the channel. There is an available depth of 20 feet at low water in a channel of 100 feet or better up to Standard Wharf, the upper phosphate plant near Duck Island. Above Standard Wharf a least depth of about 7 feet at low water or 13 feet at high water can be taken a distance of about 8 miles to **Lambs**. Above Lambs there is a depth of 7 feet in the channel for a distance of 5 miles and thence 3 feet for a distance of 1½ miles to **Greggs**. **Bacons Bridge** (closed), which is usually considered the head of navigation, is 5½ miles above Greggs. The tides have a range of 5 to 6 feet to Greggs. Four drawbridges with openings 78 to 80 feet wide cross the river; the first is at Charleston about 2 miles above the Battery; the second is the S. A. L. Railway bridge about 3 miles above the Battery; the third is the A. C. L. Railroad bridge at **Bees Ferry**; and the fourth is at **Magnolia Garden**, 1 mile below Lambs. The bridge at Bees Ferry requires caution when passing up the river on the ebb current, which sets across the end of the draw; vessels can pass on either side of the draw pier.

Wappoo Creek, on the west side of Ashley River 1¼ miles above the Battery, is the entrance to the inland passage leading southward. The entrance is marked by a light and range beacons.

Charleston is situated at the head of the harbor at the confluence of the Cooper and Ashley Rivers. The principal wharves are on the eastern water front of the city extending along the west bank of Cooper River. The distance from the ends of the jetties to the city wharves is between 7 and 8 miles.

Anchorages.—On account of submarine cables vessels are cautioned not to anchor northeastward of Fort Sumter, between it and Sullivan Island. Areas of prohibited anchorages are described in the Appendix, page 178.

Lower anchorage has good holding ground, but is somewhat exposed to southeast winds; this also applies to the anchorage southeastward of the city. The best anchorage is in the mouth of Cooper River about 1 mile above the city. The **quarantine anchorage** is on the south side of South Channel abreast Fort Johnson and is marked by two yellow buoys. The anchorage and berthing of vessels is under the control and supervision of the harbor master, and masters are required to report to him within 24 hours after arrival. See page 174.

Quarantine.—Vessels subject to visitation by the health officer will be boarded when off the quarantine anchorage at Fort Johnson.

Pilots will be found cruising outside the bar; the limit of their cruising ground is 30 miles from the entrance. Pilotage is compulsory for certain vessels. For pilot rates see Appendix, page 177. Vessels desiring a pilot and not having obtained one, can anchor about 2 miles northwestward of the light vessel until boarded by one. Pilots for the Inland Passage can be obtained in Charleston.

Towboats will sometimes be found cruising outside the bar; the deeper draft sailing vessels tow in and out. All seagoing sailing vessels bound into Cooper and Ashley Rivers employ towboats either outside the bar or at Charleston. Towboats can always be had by making signal while outside the bar, at the wharves, or may be ordered from the towboat offices in the city.

Wharves.—At some of the wharves deep-draft vessels lie aground in the soft mud at low water. The Southern Railway coal pier is west of the northern end of Drum Island. There is a cotton compress and warehouse company 6 miles up the Cooper River which has a marginal wharf 700 feet long. About 9 miles up the Cooper River from Charleston are the Charleston port terminals. They consist of marginal wharves 2,030 feet long, extensive warehouse and railroad connections, and some facilities for rapid interchange of freight between ships and railroads. A 30-foot channel leads to them. There are no publicly owned wharves in the city, but there is a movement to establish city terminals at foot of Columbus Street (west of Drum Island). The regulations in regard to fires on board vessels lying at the cotton wharves are very strict. For harbor fees, see Appendix, page 177.

Supplies.—Coal, either anthracite or bituminous, in large quantities for steamers, can be had alongside the wharves or from lighters in the stream. Fuel oil may be had. Water can be had alongside the wharves or from water boats. Provisions and ship chandler's stores can be obtained in the city.

Repairs to machinery of steamers and to hulls of vessels can be made; there are marine railways here capable of hauling out a vessel up to 1,500 tons. There is a floating dry dock of 8,000 gross tons' capacity, and will take a vessel 450 feet long and 22 feet draft.

Storm warnings are made from the customhouse at Charleston and at Moultrieville.

United States Public Health Service.—Medical attendance is furnished by a medical officer of the service. Seamen requiring long-continued hospital treatment are sent to the marine hospital at Savannah, Ga.; for short terms of hospital treatment they are sent to one of the hospitals in the city.

Tides.—See the tide tables for the Atlantic coast of the United States, in which the tides are predicted for every day at Charleston. At Fort Sumter the tides occur approximately 15 minutes earlier than at Charleston. The mean range at Fort Sumter is 5.2 feet.

The **tidal currents** off the entrance are revolving (see the results of observations at Charleston light vessel on p. 33).

The tidal currents between the jetties and in Charleston Harbor generally set fair with the channel near its axis. At a point about 1 mile outside Fort Sumter, branches from the main ebb current set through the openings between the jetties and the shore with a velocity of about 2 knots at strength. The maximum observed velocities at the strength of the ebb are about 2.6 knots between the jetties, 3 knots between Fort Sumter and Fort Moultrie, and 2 knots in the South Channel and off the eastern front of Charleston; the velocity of the flood current is less than the ebb, depending on the freshet flow from the rivers. Slack water occurs between the jetties about 1 hour after high or low water at Charleston, and between Fort Sumter and Fort Moultrie 1 hour and 30 minutes, and South Channel 2 hours after high and low water at Charleston.

DIRECTIONS.—*From northward.*—The safer course, and the one generally used by large, deep-draft vessels, is to pass outside of Frying Pan Shoals gas and bell buoy. From Cape Lookout Shoals light vessel a 230° true (SW. ¾ W. mag.) course for 78 miles will lead to Frying Pan Shoals gas and whistle buoy, or a 237° true (SW. by W. ⅜ W. mag.) course made good for 84 miles will lead to Frying Pan Shoals light vessel.

From Frying Pan Shoals gas and whistle buoy make good a 242° true (SW. by W. ¾ W. mag.) course for 90 miles; or, from Frying Pan Shoals light vessel make good a 236° true (SW. by ¼ W. mag.) course for 83 miles. Either course should lead in a least depth of about 12 fathoms to a position with Cape Romain lighthouse bearing 326° true (NW. by N. mag.) distant 17 miles. The only danger is the broken ground extending off between Winyah Bay and Cape Romain, on which there is a depth of 3¾ fathoms near the wreck lying 11 miles from shore, which is marked by Cape Romain gas and whistling buoy.

From this position a 255° true (WSW. ⅞ W. mag.) course made good for 25 miles should lead to a position 2 miles east-southeastward of Charleston light vessel. If uncertain of the position keep in a depth of over 8 fathoms until the light vessel is sighted. The dangers between Winyah Bay and Charleston are described with the coast preceding.

From southward.—From a position 2 miles southeastward of Martins Industry gas and whistling buoy a 48° true (NE. 3/8 E. mag.) course made good for 51 miles will lead in a least depth of about 7 fathoms to a position 2 miles southeastward of Charleston light vessel.

From Charleston light vessel steer 299° true (NW. by W. 3/8 W. mag.) on the Main Channel range (Fort Sumter lighthouse in line with St. Philips Church spire), and pass midway between the buoys which mark the sides of the dredged channel until nearly 2 miles inside the ends of the jetties and up to the intersection with the Mount Pleasant range line. *Fort Sumter light* (fixed white) is on a skeleton structure close to the north side of Fort Sumter; the latter is a stone structure. At night a flashing white light every 2 seconds exhibited from a white pyramidal square tower, 1,350 yards 119° from Fort Sumter light, serves as the front range object.

Leave can buoy No. 17 about 200 feet on the port hand and steer 317° true (NW. 1/4 N. mag.) with the *Mount Pleasant range* lights (pyramidal, black, slatted structures) in line ahead, until abreast Fort Sumter and up to the intersection with the South Channel range line. The Mount Pleasant range is hard to pick up in the daytime, except in clear weather. After leaving the Main Channel range the channel widens and so continues to Charleston, the principal dangers being marked by buoys.

Steer 270° true (W. 1/8 N. mag.) with *South Channel range* lights (black structures with daymarks) in line ahead until about 1/4 mile past Fort Ripley Shoal (Middle Ground) lighthouse. Then haul northwestward, leave gas buoy No. 12 about 100 yards on the starboard hand, steer 337° true (NNW. mag.), and then follow the wharves at a distance of 1/4 mile or less. See Anchorages in the description preceding.

If going to the navy yard or port terminals.—After rounding the gas and bell buoy No. 12 steer a 337° true (NNW. mag.) course until abeam of nun buoy No. 16, distant 300 yards, leaving Potts Shoal buoy No. 14, 200 yards to starboard. Then haul northward to course 2° true (N. 1/4 E. mag.), holding it to a position 400 yards westward of *Shutes Folly Island Spit light No. 3.* Then steer 11° true (N. by E. 1/8 E. mag.) for 1 5/8 miles, passing westward of Drum Island. When abeam of *Drum Island Channel rear light* (white daymark, black round center on white skeleton structure on piles) starboard to meet the *Drum Island Channel range*, bringing it on astern, course 299° true (NW. by W. 3/8 W. mag.). Steer this course passing between the red and black buoys marking the channel north of Drum Island until northeastward of *Drum Island North Spit light No. 8* (red square daymark on pile structure). Then steer 0° true (N. mag.) with *Cooper River Lower range* on ahead. When 500 yards from the front range light and *Marsh Point light No. 9* is on range with *Upper Marsh light No. 11* (seen over the marsh) starboard to meet the *Cooper River Upper range.* Bring it on astern, course 278° true (W. 7/8 W. mag.) and continue on this range until northward of light No. 11. Then haul northward to bring on the *Navy Yard Channel range* astern (front object, light No. 11; rear object, light No. 7, seen over the marsh), course 317° true (NW. 1/4 N. mag.). Keep somewhat east of the range in passing the navy yard wharves, if not going alongside, and when by the northern radio

tower haul northward and follow the western bank of the river. Keep close to buoy No. 32 in passing, then the western bank should be kept at a distance of not more than 150 yards off until up to the port terminals.

STONO INLET

is about 7 miles southwestward of Charleston lighthouse. The entrance of the inlet is obstructed by a shifting bar which extends 2¼ miles seaward and had 10 feet in the channel across it in 1921. A sea buoy marks the entrance. From this buoy the channel in 1921 had a west-northwesterly direction to within about ⅓ of a mile from the western point of the inlet. A private range was in place at that time. Inside the bar the depth in the inlet ranges from 3 to 7 fathoms.

Stono River empties into the inlet from northward, about 1¾ miles above the entrance. On the west bank of the river, 3¼ miles above the entrance of the inlet, is the village of Legareville. The river is of little commercial importance. Its upper reach, above Elliott Cut, forms part of the inland passage from Charleston to Savannah. Vessels enter the river by the inside route from Charleston.

NORTH EDISTO RIVER.

The entrance to this river is 17 miles southwestward of Charleston lighthouse and 17 miles northeastward of Hunting Island lighthouse. There is a prominent water tank on the eastern point of the entrance. The river is of little commercial importance and rarely used. Shoals extend offshore nearly 3 miles at the entrance of the river, forming a shifting bar, over which there is a channel depth of about 10 feet. This channel is marked by buoys which are moved, when practicable, to indicate the best water. It is well defined by breakers. Pilots can be obtained at Charleston. Two of the tributaries of North Edisto River, Wadmelaw River from eastward and Dawho River from westward, are part of the inland passage from Charleston to Savannah. **Rockville** is a village on Bohicket Creek, 2 miles above the entrance of North Edisto River.

The mean rise and fall of tides is 5.8 feet. On the bar the direction of the current is generally across the channel. The flood current sets about southwestward and the ebb east-northeastward, and both have considerable velocity. Inside the bar, in the channel between the breakers, the ebb current is to be guarded against, particularly as it sets across the north breakers.

SOUTH EDISTO RIVER

empties into the Atlantic about 8 miles northeastward of Hunting Island lighthouse and just eastward of St. Helena Sound entrance. The river is of little commercial importance, but it is navigable for flatboats and rafts for a distance of about 220 miles above its mouth. From the entrance to Dawho River it is known as South Edisto and above Dawho River it is known as **Edisto River**. The stretch of the river between Fenwick Island Cut and Dawho River forms part of the inland passage from Charleston to Savannah. Near the junction of Dawho and Edisto Rivers the water is generally fresh and

suitable for boilers. **Jacksonboro** is a village on the railroad about 33 miles above the mouth of the river, to which point a draft of 7 feet can be taken at high water.

The entrance of the river is obstructed by a shifting bar which forms a part of the extensive shoal which makes offshore for a distance of about 6 miles from the entrance to St. Helena Sound. The depth over the bar into South Edisto River is 10 feet, through an unmarked channel. The river is entered by way of the inside route, and the entrance from sea is not used. Pilots for the bar and river may be obtained from Charleston or Beaufort, S. C. The mean rise and fall of tides is 6 feet.

ST. HELENA SOUND

is the broadest opening in the coast between Chesapeake entrance and the Gulf of Mexico. From Bay Point on the east to Hunting Island on the west the entrance is 6½ miles wide. About 1¾ miles from the northern end of Hunting Island is Hunting Island lighthouse, the principal guide to the entrance. Shoals make off for a distance of 6 miles seaward from the entrance, through which there are several channels leading into the sound. The principal channel has a depth ranging from 16 to 18 feet, and is marked by buoys which are moved to indicate the best water. In 1921 there was a depth of about 16 feet, and vessels of 18 feet draft were taken out at high water with a smooth sea.

Hunting Island lighthouse is a conical tower, lower part white, upper part black. The light is flashing white (light 4.5 seconds, eclipse 25.5 seconds), 133 feet above the water, and visible 18 miles.

A number of navigable rivers empty into the sound, the most important of which are Coosaw, Ashepoo, Bull, Combahee, Morgan, and Harbor Rivers. Ashepoo and Coosaw Rivers and Brickyard Creek are a part of the principal inland passage from Charleston to Savannah.

Coosaw River empties into the head of the sound about 5 miles above its entrance. It is important only as a part of the inside passage. The channel in the river is irregular in depth, having been made so partly by the phosphate dredges. It is buoyed for a distance of about 10 miles to the mouth of Brickyard Creek, and a depth of 15 feet can be taken to this point at high water. Brickyard Creek connects Coosaw and Beaufort Rivers and has a least depth of 7 feet. Whale Branch connects Coosaw and Broad Rivers and has a least depth of about 5 feet. Two drawbridges cross the branch about 4½ and 5½ miles westward of the entrance to Brickyard Creek.

Bull River empties into Coosaw from northward about 5 miles above its mouth. There is a large phosphate plant and wharf (not operating, 1921), with 21 feet at its end, on the west bank of the river about 2 miles above its mouth, and there is a least depth of about 17 feet in the river to it. Opposite the phosphate plant and just inside the mouth of a creek are the buildings of a closed National quarantine station. Chisolm is a small settlement on the west bank of the river about 3½ miles above its mouth; some provisions, gasoline, and water can be obtained in case of necessity. Williman Creek has a depth of about 5 feet around the north side of Williman Island.

North Wimbe Creek, southward of Williman Island, is nearly dry in places at low water.

Combahee River empties into Coosaw River from northward about 2 miles above its mouth. The river is unobstructed for a distance of 52 miles above its mouth excepting by the S. A. L. Railway bridge 13 miles from the Coosaw River, to the A. C. L. Railroad bridge (closed), and is navigable for this distance by boats of about 5 feet draft; the tides have a range of about 6 feet at the mouth of the river and 2.5 feet at the bridge, and are felt for about 18 miles above the bridge.

Old Cheehaw Creek empties into Combahee River about 3 miles above its mouth; about 1 mile above the junction of Old and New Cheehaw Creeks is a large sawmill at the village of Wiggins. Wiggins has railroad and telephone communication, and some provisions can be obtained. The deepest draft loaded at the mill is about 15 feet. A towboat is stationed here.

New Cheehaw Creek empties into Combahee River at its mouth; it is unimportant and has no traffic.

Ashepoo River empties into St. Helena Sound from northward just inside the entrance; for a distance of 2¾ miles above the entrance to Fenwick Island Cut the river forms part of the inland passage between Charleston and Savannah. At high water a draft of about 6 feet can be taken approximately 39 miles above the entrance to the A. C. L. Railroad drawbridge, and boats have gone to within 8 miles of the town of Walterboro. The S. A. L. Railway crosses the river 26½ miles above the entrance. There are no settlements of any importance on the river.

Morgan River empties into St. Helena Sound from westward. It is about 9 miles long and at its head connects with Chowan Creek, a tributary of Beaufort River; at the divide this passage is nearly dry at low water. The best entrance to Morgan River is through **Parrott Creek,** which has a depth of 13 to 14 feet and leads from Coosaw River nearly opposite the mouth of Bull River. There is also an entrance with a depth of 8 feet, through **Lucy Point Creek,** also known as **Dales Creek.** It is marked by a red and black beacon off Sams Point. There is a wharf and prominent white buildings just inside of the creek. Vessels going to the former phosphate plant on Lucy Point Creek, entered at high water from Coosaw River drawing 12 feet or less, and left by way of Morgan River and Parrott Creek drawing 15 feet.

Harbor River empties into St. Helena Sound from the southwestward. At its head the river connects with **Story River** and the latter with **Station Creek,** forming an inland waterway with a least depth of about 4 feet, from St. Helena Sound to Port Royal Sound; but this passage is rarely used. It is described in the Inside Route Pilot, New York to Key West.

Pilots for the sound can be had by writing or wiring to Beaufort, S. C.; Charleston pilots will sometimes take vessels into the sound. Pilotage is compulsory for certain vessels. For pilot rates see Appendix.

Towboats.—There is a towboat at Wiggins. Vessels sometimes tow to St. Helena Sound from Charleston and Savannah.

Tides.—The mean rise and fall of tides on the bar and entrance to St. Helena Sound is 6 feet.

DIRECTIONS.—From Charleston light vessel a 237° true (SW. by W. ⅛ mag.) course made good for 34½ miles will lead in a least depth of about 4 fathoms to the Sea buoy off the entrance of St. Helena Sound. From Martins Industry gas and whistling buoy make good a 36° true (NE. ¾ N. mag.) course for 15¾ miles, and then steer 4° true (N. ½ E. mag.) for about 3 miles to the Sea buoy.

The channel between the shoals from the entrance of St. Helena Sound out to the bar has maintained about the same position since the first survey was made in 1857, the channel on the bar having moved southward nearly 1 mile since that date. The depths on the bar have been from 12 to 17 feet. With the aid of the chart vessels of about 12 feet draft, with a rising tide and a smooth sea, should have no difficulty in entering by following the buoys. The depths, especially on the crest of the bar, are subject to frequent change, and local knowledge is required to carry the best water. In 1921 surveys showed a least depth of 15 feet in the buoyed channel over the bar. Hunting Island lighthouse and the buoys are the only aids for the bar. The buoys are moved as necessary to mark the channel. The Sea buoy off the entrance is a perpendicularly striped whistling buoy, located in a depth of about 5 fathoms about 7¾ miles from Hunting Island lighthouse. A 278° true (W. ¾ N. mag.) course for the lighthouse will lead sufficiently close to the Sea buoy to see it in clear weather; vessels should keep in a low water depth of over 5 fathoms until the Sea buoy is sighted.

Follow the buoyed channel across the bar until up with can buoy No. 3, with Hunting Island lighthouse bearing 225° true (SW. mag.). Pass 200 yards northeastward of this buoy and steer 309° true (NW. ½ W. mag.) heading for the next perpendicular-striped buoy lying 1¾ miles distant. Above this buoy anchorage can be selected in the channel of St. Helena Sound and Coosaw River.

From the perpendicularly striped buoy steer 296° true (NW. by W. ⅝ W. mag.), pass ¼ mile southward of Combahee Bank gas buoy and nun buoy No. 4 at a distance of about 300 yards. When opposite can buoy 5 P B edge over to port some to avoid running too close to a 10-foot shoal at the edge of Combahee Bank. From the nun buoy steer 307° true (NW. ⅝ W. mag.), leave Marsh Island Spit light 400 yards on the port hand, and follow the north bank at a distance of 300 yards to the horizontally striped buoy at the entrance of Combahee River.

The passage to Wiggins leads up Combahee River nearly 4 miles above this buoy and then up Old Cheehaw Creek, but sailing vessels require a towboat for this part of the route and strangers should take it on a rising tide. There is scant room for anchorage in Combahee River, and none in Old Cheehaw Creek. Leave the horizontally striped buoy at the entrance of Combahee River on the port hand and follow the east bank at a distance of 300 to 400 yards to buoy No. 1. Leave this buoy on the port hand, and then follow the bight in the west bank at a distance of about 100 yards to buoy No. 3. Leave this buoy 75 yards on the port hand, steer 340° true (N. by W. ¾ W. mag.) for 1½ miles, and pass 100 yards off the point on the west bank. Then be guided by the buoys at the entrance of Old Cheehaw

Creek. Small steamers of less than 9 feet draft should have no difficulty in going up Old Cheehaw Creek to Wiggins on a rising tide; the channel follows the ebb-tide bends, favors the bight in the west bank in passing the mouth of New Cheehaw Creek, and then favors the south bank in passing the point of woods just above.

Bound to Bull River.—Pass 3/8 mile southward of the horizontally striped buoy at the entrance of Combahee River, steer 275° true (W. 1/2 N. mag.) for the entrance of Bull River, with Bull Spit light (on red and black beacon) a little on the port bow, and pass 300 to 500 yards off the south bank (north end of Morgan Island). Leave the light about 150 yards on the port hand, favor the south bank at the entrance of the river, then follow the east bank at a distance of 200 yards for 1 mile until up with the point on the west bank 1/2 mile below the wharf at the phosphate plant, and then follow the west bank to the wharf.

COAST FROM ST. HELENA SOUND TO TYBEE ROADS.

The general trend of the part of the coast is southwesterly and its length 30 miles. It presents the same characteristic features when viewed from seaward as that to the eastward. It is broken by one opening of importance, Port Royal Sound, situated about midway between St. Helena and Tybee, and four shallow and unimportant inlets, Fripps, Skull, Pritchards, and Trenchards.

Fripps Inlet is obstructed by shoals at its mouth, over which but 3 or 4 feet can be taken in the smoothest weather. Harbor River, entering into the inlet at its head, connects with St. Helena Sound to the eastward, and Story River connects to the westward with Trenchards Inlet. **Story River** is a section of the inside route between St. Helena and Port Royal Sounds and is described in the Inside Route Pilot, New York to Key West.

Between Fripps Inlet and Trenchards Inlet, **Fripps Island, Pritchard Island, and Capers Island** form the seacoast. They appear to be densely wooded except the last mentioned, near Trenchards Inlet, where it is low and marshy, with a white sandy beach, with sand dunes 15 feet high. Skull Inlet, which separates Fripps Island from Pritchards Island, is a narrow passage, with very little water on the bar. Pritchards Inlet, separating the island with that name from Capers Island, is a stream of the same description.

Trenchards Inlet is of but little importance. Its bar extends about 3 miles from shore and had by the last survey (1921) a least depth of about 5 feet in a narrow unbuoyed channel. There is a swash channel close under the western point of Capers Island, which carries a depth about 6 feet into the inlet. There is also a shoal channel to Port Royal Sound, close under Philips Island to Bay Point. Station Creek connects this inlet with Port Royal Sound to the westward.

Philips Island forms the west bank of Trenchards Inlet and extends as far as Port Royal Sound. It is wooded in the vicinity of the former and also in the vicinity of Bay Point, its western extremity, but between these the land is low and marshy.

To the westward of Port Royal Sound is **Hilton Head Island.** It is over 10 miles in length and is nearly 5 miles in width on its northern face, tapering to a rounded point at its western end. It is heavily wooded over most of its surface, but there are some cleared and

cultivated farms in the vicinity of Skull Creek. The *Hilton Head range* is on its seaward side. Inside this island Skull Creek and Calibogue Sound form an inside route between Port Royal Sound and Tybee Roads.

PORT ROYAL SOUND

is the largest and best unimproved harbor on the coast of South Carolina; between Bay Point on the northeast and Hilton Head on the southwest the entrance is about 2 miles wide. Shoals extend 8 miles in a general south-southeast direction from the entrance, forming a bar at the outer part, through which there are two channels. Southeast Channel is the principal one, and is marked by Hilton Head range lights (white structures) and buoys, and by the last survey had a least depth of about 21 feet. South Channel is not marked and in 1921 was not used.

Martins Industry gas and whistling buoy is moored in a depth of 48 feet, on the Hilton Head range, about 13½ miles 106° true (ESE. ½ E. mag.) of the front light. The buoy is black and white, and shows a flashing white light every 15 seconds, flash 5 seconds duration, 16 feet above water.

Beaufort River empties into the sound from the northward and just inside of Bay Point. It is the approach to Beaufort, Port Royal, and the United States Naval Station, and with Brickyard Creek forms a part of the principal inland passage. Beaufort is about 10 miles above the mouth of the river; it has a little trade and can be reached at high water by vessels of 18 feet draft; there are depths of 12 to 14 feet alongside the wharves. **Station Creek** empties into Beaufort River from eastward at its mouth; with Story and Harbor Rivers it forms an inland passage, with a least depth of about 4 feet, between Port Royal Sound and St. Helena Sound. There is a group of prominent palmettos on the north shore near the mouth of the creek. **Chowan Creek (Johnsons River)** empties into Beaufort River from eastward 5 miles above Bay Point, and at its head connects with Morgan River; at the divide this passage is nearly dry at low water, but at high water it can be used by light-draft boats in going to St. Helena Sound. **Battery Creek** empties into Beaufort River 7 miles above Bay Point; just inside its entrance is the town of Port Royal, a railroad terminus. There is a depth of 20 feet or more at one of the wharves. **Archers Creek** is a narrow passage leading westward from the mouth of Battery Creek to Broad River. The eastern entrance north of the small island is closed at low water. South of the island about 4 feet can be taken into the creek. The western entrance carries 9 feet and is marked by a lighted beacon to be left to southward when entering.

Broad River extends northwestward from the head of Port Royal Sound, and is about 16 miles long; with the aid of the chart it is not difficult to Whale Branch. The Seaboard Air Line Railway crosses Broad River 3 miles above Whale Branch. **Pocotaligo, Tulifiny, and Coosawhatchie Rivers** empty into the head of Broad River; these rivers are said to have a depth of about 1½ feet at low water to the closed highway bridges which cross them below the A. C. L. Railroad.

Chechessee River empties into the head of Port Royal Sound from westward; **Colleton River,** one of its tributaries, is of little importance, but has a good channel for a distance of 5 miles. A depth of

24 feet can be taken up the Chechessee to the mouth of the Colleton River, and 20 feet up the latter for a distance of 5 miles. These rivers are of no commercial importance.

Skull Creek enters Port Royal Sound from southwestward about 4 miles above Hilton Head. The creek forms part of the inland passage to Savannah and is well marked. There is an oyster factory and wharf 1 mile from its western end.

Anchorages.—The usual and best anchorage is in the mouth of Beaufort River, abreast the mouth of Station Creek; southward of Bay Point the holding ground is poor. There is good anchorage, with a depth of about 4 fathoms, in the channel of Beaufort River from a short distance below the Quarantine Station to a short distance above the Naval Station. Vessels should not anchor on the Paris Island range. The sound is sometimes used as a harbor of refuge in winter.

Quarantine.—The national quarantine station is on the west bank of Beaufort River 5 miles above Bay Point.

Pilots.—Licensed pilots may be had by engaging one in advance from Beaufort. There are none cruising off the bar excepting when a vessel is expected. Pilotage is compulsory for certain vessels. For pilot rates see Appendix.

Towboats.—Sailing vessels seldom employ towboats either over the bar or in Beaufort River. Towboats can be had at Charleston or Savannah.

Supplies.—Water and coal can be had alongside the wharves at Port Royal, and provisions, water, and gasoline at Beaufort.

Repairs.—The nearest place where a vessel can be hauled out is Savannah.

Storm warnings.—Storm warnings are displayed from a signal station at Port Royal.

Tides.—The mean rise and fall of tides on the bar is 6.4 feet, and at Beaufort, 7.3 feet.

Currents.—The currents on the bar have an estimated velocity of 1½ knots, and set fair with the channel. The currents in the sound have a velocity of possibly 2 knots or more at times, and the tide rips on Fishing Rip and Middle Shoal have the appearance of breakers at times.

Directions.—The channel between the shoals from the entrance of Port Royal Sound out to the bar has maintained its position practically without change since the first survey was made in 1856, the only change noted having occurred on the bar or in its vicinity. On the bar, Northeast Breakers and Southeast Channel have moved bodily southward nearly 1 mile since that date, the succeeding surveys showing a fairly uniform rate of movement of 100 feet per year. The depths on the bar range from 18 to 22 feet. As the depths on the crest of the bar are subject to frequent change, local knowledge is required to carry the best water, which was 21 feet in 1921. With the aid of the chart vessels of about 15 feet draft, with a rising tide and a smooth sea, should have no difficulty in entering during daylight by following the buoys. Martins Industry gas and whistling buoy, the ranges, and buoys are the guides. The boiler of a wreck, shown on the chart nearly 5 miles southeastward of Bay Point, is a permanent mark and can be used for cross bearings.

Approaching from any direction, shape the course for Martins Industry gas and whistling buoy, and from it steer 286° true (WNW. ½ W. mag.) on the Hilton Head range until up with the outer buoys off the bar. Follow the buoyed channel across the bar, giving the red gas and bell buoy at the southwest end of Northeast Breakers a berth of over 100 yards in rounding it. When past the black buoy, lying 1 mile north-northwestward of the gas and bell buoy and up to the midchannel gas and bell buoy, steer 335° true (NNW. ¼ W. mag.) and keep on or a little eastward of the line of the Paris Island range beacons until past Fishing Rip gas and bell buoy, and then follow the range or keep a little westward of it until past Bay Point.

To go up Beaufort River, when about 1 mile past Bay Point steer 8° true (N. ¾ E. mag.) and pass about 150 yards eastward of buoys Nos. 7 and 9. When the old wharf (marked by Fort Fremont Wharf light, white post at shore end) on the eastern bank is abeam steer 346° true (N. by W. ¼ W. mag.) to a position about 100 yards westward of buoy No. 6. Then steer 333° true (NNW. ⅜ W. mag.) for the turning point on the eastern bank until abreast the naval station, and then steer 324° true (NW. ⅞ N. mag.). Round the point on the eastern bank at a distance of about 300 yards and steer 7° true (N. ⅝ E. mag.) for the low grassy point on the eastern bank. Give the first point on the west bank above Battery Creek a berth of about 300 yards, and then keep in midriver until past buoy No. 13. Then follow the west bank at a distance of about 200 yards, pass about 100 yards westward of buoy No. 10, pass 200 yards off the next point on the south bank, and anchor in midstream, keeping the easternmost wharves at Beaufort bearing eastward of 0° true (N. mag.).

Boats drawing less than 6 feet, with local knowledge go through a cut-off channel after leaving buoy No. 13 by following the eastern bank of the river and entering a slough through the marsh. The northern end is narrow and the least water is found just before coming out into the main stream. The best water here is close to the eastern grass line.

CALIBOGUE SOUND.

The entrance to this sound lies 11 miles southwestward of Port Royal Sound entrance and 5 miles northward of Tybee lighthouse; it is obstructed by shifting shoals through which there are several unmarked crooked channels. From sea the best way of entering the sound is from Tybee Roads, and the depth that can be taken over the bar at low water is about 10 feet. Above the bar the depths are ample. These waters are a part of the inland passage from Charleston to Savannah, and otherwise are of little importance.

May River, which empties into the sound from westward about 5½ miles above the entrance, is the approach to the village of **Bluffton**, situated about 7 miles above its mouth. There is a depth of 10 feet at low water to the town by entering May River through Tybee Roads and Calibogue Sound, 12 feet or more by way of Port Royal Sound and Skull Creek, and 7 feet from Savannah through the passage by way of Mud River and Ramshorn Creek.

Cooper River empties into the sound from westward about 2¼ miles above the entrance. This river is only important as a part of the inland passage to Savannah which leads through Ramshorn Creek from Cooper River.

Mackays Creek enters the sound from northward at its junction with Skull Creek; the latter connects with Port Royal Sound and forms part of the inland passage.

On the south side of the entrance to Cooper River are the **Daufuskie Island range** lights (white structures) for entering the sound from Tybee Roads.

DIRECTIONS.—From Tybee Roads steer 321° true (NW. ½ N. mag.) on the Bloody Point range for about ⅞ mile past gas and bell buoy No. 13; or, coming down Savannah River, pass about ¼ mile southward and eastward of Bloody Point Spit buoy (can, No. 1). Then steer 3° true (N. ¼ E. mag.) to a position close westward of bell buoy No. 2. Then steer 355° true (N. ½ W. mag.), with Daufuskie Island range lights (white structures) in line ahead, into the sound. Keep somewhat east of the range until up to can buoy No. 3.

TYBEE ROADS AND SAVANNAH RIVER.

Tybee Roads is the name applied to an anchorage surrounded by the shoals which lie off the entrance to Calibogue Sound and Savannah River, eastward of the northeastern end of Tybee Island. This anchorage can be entered either in the daytime or at night; its general depth is 19 to 24 feet, and the shoals assist to break the sea from any direction. There are two good channels leading across the bar off the roads—the North Slue Channel with 15 feet and the Main Channel with 24 feet; both of these channels are marked by buoys, and the Main Channel by a number of ranges which are easily followed. The main channel over the bar is being improved by dredging.

Savannah light vessel is moored in about 51 feet of water, about 10½ miles 117¼° from Tybee lighthouse on the prolongation of the Tybee Range line. The vessel has a red hull, with "Savannah" on each side, and two masts with lanterns and circular cagework daymarks at head of each. A fixed white light is shown from the foremast and a fixed red light from the mainmast, each 44 feet above the water. The white light is visible 12 miles and the red 11 miles. The fog signal is an air siren, blast 2 seconds, silent interval 18 seconds. If the whistle is disabled a bell will be struck by hand a double blow every 20 seconds. The submarine bell strikes "2," thus: 2 strokes in 2 seconds, silent 20 seconds.

Tybee lighthouse, on the north end of Tybee Island, is an octagonal brick tower, lower 50 feet black, middle part white, upper part black. The light is fixed white, 144 feet above the water, and visible 18 miles.

Savannah River forms the boundary between the States of South Carolina and Georgia, and is navigable during the greater part of the year for steamers of 5 feet draft to the city of **Augusta**, a distance of about 176 miles above Savannah; flatboats can be taken up the river about 3 miles farther. There is a dam 8 miles above Augusta; pole boats go from Augusta to the river above the dam through a canal, and the river is navigable for this class of boats from the dam to Petersburg, a distance of 43 miles. Between Savannah and Augusta there are numerous landings, but no towns or villages of importance; several bridges, with draws about 60 feet wide, cross the river below Augusta.

From its entrance to the quarantine station the river is being improved to obtain a depth of 30 feet with a general width of 500 feet, thence 26 feet deep with a general width of 400 feet to the S. A. L. Railroad bridge; and thence 21 feet deep and 300 feet wide to Kings Island, a total distance of 24 miles. At present (1921) it has a least depth of 23 feet at low water from sea to the city; it is marked by buoys and range lights, but strangers of over 15 feet draft and sailing vessels should always employ a pilot when entering the river. The deepest draft taken out of the river and over the bar is 29½ feet.

Savannah is on the south bank of the river about 15 miles above the entrance; it is the chief port of the State of Georgia and one of the important southern ports for the shipment of cotton, lumber, and naval stores. There is sufficient water at the wharves for vessels that are brought to the city. Many of the present wharves are equipped with mechanical unloading devices for handling bulk cargo; all have direct connection with the railways, and all but those on Hutchinsons Island have street or highway connections.

Anchorages.—The usual anchorage for vessels waiting for a favorable tide to go up the river is in Tybee Roads, about 2 miles eastward of Tybee lighthouse, or outside the bar near Tybee gas and whistling buoy. The holding ground is good at both anchorages, but 22 feet is about the greatest depth available in the roads. Vessels rarely anchor in the river as there is no room for large vessels to swing; in case of necessity there is a small anchorage off Fort Jackson, about 2 miles below the city.

A **Branch Hydrographic Office** of the Navy Department is located at the customhouse; this office is supplied with the latest information and publications affecting navigation for the consultation of mariners.

Quarantine.—The national quarantine station and boarding station is on the south side of the channel west of Cockspur Island.

U. S. Public Health Service.—At Savannah there is a marine hospital.

Pilots.—A pilot boat will be found outside the bar. Pilotage is compulsory for certain vessels. For pilot rates see Appendix.

The **Harbor Master** has charge of the berthing of vessels. The limit of speed of steamers passing the wharves is 4 miles an hour, and the engines must be stopped when passing where two or more vessels are moored abreast. Steamers must be slowed, and where necessary engine stopped in passing dredges at work in the river. For laws and regulations see Appendix.

Towboats will come out over the bar to vessels making signal. With a fair wind sailing vessels usually sail into the roads, but a towboat is necessary for large sailing vessels between the roads and Savannah.

Supplies.—Coal, either anthracite or bituminous, in large quantities, or fuel oil can be had at the wharves at Savannah or from lighters towed down to vessels at the roads. Fresh water is usually brought to shipping by tugs; the river water at Savannah is fresh at any stage of the tide. Provisions and ship chandler's stores can be had in the city or are sent down to the roads in tugs.

Repairs.—The facilities for repairs to the machinery of steamers are good. There are several marine railways; the largest has a dead weight lifting capacity of 2,500 tons and will dock a vessel 300 feet long.

Storm warnings are displayed at Savannah and from a signal tower near Tybee lighthouse.

Tides.—For tidal data at Savannah River entrance (Tybee lighthouse) see the tide tables for the Atlantic coast of the United States, published annually in advance by the Coast and Geodetic Survey, in which the tides are predicted for every day of the current year. On the bar high and low waters occur about 30 minutes before high and low waters, respectively, at Tybee lighthouse. At Savannah high water occurs 1 hour 15 minutes and low water 1 hour 51 minutes after high and low water, respectively, at Tybee lighthouse. The mean durations of rise and fall of the tide are 6 hours 5 minutes and 6 hours 20 minutes at Tybee lighthouse, and 5 hours 30 minutes and 6 hours 55 minutes at Savannah.

The mean rise and fall of tides at Tybee lighthouse is 6.8 feet, and at Savannah 6.5 feet. At Purysburg, 20 miles above Savannah, the mean rise and fall of tides is a little less than 1 foot; when the river is low the tides are felt possibly 7 miles above Purysburg, while during heavy freshets the rise and fall at Cross Tides, 3½ miles above Savannah, is 2 feet or less.

Currents.—The mean velocity at the strength of the ebb current is 2.75 knots between the training walls at the entrance, 2.4 knots below Venus Point, 1.75 knots at The Bight, and 1.1 knots (estimated) at Savannah; the flood current has a velocity about one-fourth less than the ebb current in the lower part of the river, and about one-half less at Savannah. From the entrance nearly to Savannah slack water occurs about 1 hour after high and low water stand; in the vicinity of the entrance near Tybee lighthouse, therefore, slack water occurs about 1 hour after high and low water at the lighthouse, and at Savannah slack water occurs about 1½ hours and 2½ hours after high and low water, respectively, at Tybee lighthouse. The time of slack water is considerably influenced by the wind and freshets. For the time of slack water at the entrance to Savannah River see the Current Tables, published annually in advance by the Coast and Geodetic Survey.

The currents set in the direction of the channel except at the entrance near Tybee lighthouse, where the flood sets northwestward across the channel.

Freshets occasionally occur in the spring, but do not endanger the shipping at the wharves at Savannah.

Directions.—The channel from sea to Savannah is a dredged cut from 400 to 600 feet wide, the tidal currents have considerable velocity, and strangers are advised to take a pilot. The ranges mentioned in the following directions mark the axis of the cut; in addition to the ranges, the channel is buoyed. Vessels waiting for the tide when in the river formerly made fast to the old mooring wharves at Venus Point and The Bight, but the depth in the channel is now sufficient to make it unnecessary; in 1921 these wharves were in bad repair.

From northward shape the course for Savannah light vessel.

From southward deep-draft vessels should not shoal the water to less than 6 to 7 fathoms. From Brunswick light vessel make good a 24° true (NNE. ⅛ E. mag.) course for 61½ miles for Savannah light vessel. Or, in clear weather when the light vessel is sighted the

course can be shaped to pass as much as 3 miles inside. Vessels should expect an inshore set with the tide flooding.

From sea to Tybee Roads.—From Savannah light vessel steer 297° true (NW. by W. ⅝ W. mag.) for 6¾ miles with *Tybee range lights* (white skeleton structure in range with Tybee lighthouse) in line ahead leaving Tybee gas and whistling buoy close to on either side, until up with gas and bell buoy, No. 2. Leave the buoy 100 yards on the starboard hand and steer 321° true (NW. ½ N. mag.) for 2¾ miles with *Bloody Point range lights* (white structures) in line ahead until up with gas and bell buoy No. 13. To anchor in Tybee Roads, anchor just eastward of the dredged channel, with Tybee lighthouse bearing about 270° true (W. mag.). In addition to the ranges these channels are well marked by buoys.

To enter by the North Slue Channel, for vessels of 11 feet draft, in the daytime with a smooth sea.—From Martins Industry gas and whistling buoy make good a 257° true (WSW. ⅞ W. mag.) course for 16½ miles to a perpendicularly striped can buoy, from which Tybee lighthouse bears 262° true (W. ¾ S. mag.) distant 3½ miles. On this course care must be taken to pass at least ½ mile southward of the black can buoy off the southeasterly end of Gaskin Banks, and Tybee lighthouse should be made and kept on the starboard bow. From the perpendicularly striped can buoy steer for Tybee lighthouse, pass about 250 yards southward of nun buoy No. 2, and then head up for gas and bell buoy No. 13.

From Tybee Roads to Quarantine.—Leave gas and bell buoy No. 13 about 100 yards on the port hand and steer 284° true (WNW. ¾ W. mag.) for 1¾ miles with *Jones Island range light* (white structures) in line ahead. Pass about 200 yards northward of gas buoy No. 3A and steer 263° true (W. ½ S. mag.) for 2⅛ miles with *Tybee Knoll Cut range lights* (tower on white house in range with high skeleton structure) in line ahead. Three water tanks at the quarantine station are almost on the range line and may be confusing in daytime to a stranger when picking up this range. When nun buoy No. 6 is abeam, steer 280° true (W. by N. mag.) for about ½ mile, with *New Channel range lights* (skeleton structures) in line ahead, and the Quarantine station will be abeam.

From Quarantine to The Bight.—From abreast the quarantine station continue the 280° true (W. by N. mag.) for 1 mile with New Channel range lights in line ahead. When Long Island Crossing range front light is abaft the beam, turn with an easy port helm and steer 319° true (NW. ⅜ N. mag.) for 2¼ miles with *Long Island Crossing range lights* (pyramidal structures, north half red, south half white) in line astern until up with the old mooring wharf at Venus Point. Then follow the north bank of the river, keeping about 250 feet from the piling along the bank.

Then steer 280° true (W. ⅞ N. mag.) with *Lower Flats range lights* (pryamidal structures, north half red, south half white) in line astern until approaching *Elba Island light* (black post on outer end of wharf. Then follow the south bank, keeping about 200 feet from the ends of the piling, until abreast Upper Flats front light. Then turn with an easy port helm and steer 329° true (NNW. ¾ W. mag.) with *Upper Flats range lights* (pyramidal structures, northeast half red, southwest half white) in line astern and Barnwell Place light

(brown-slatted skeleton tower) ahead until up with the old mooring wharf in The Bight. Then follow the north bank at a distance of about 100 yards.

From The Bight to Savannah.—Follow the north bank in The Bight and the piling eastward of Proctor Place light at a distance of about 100 yards and pass about 125 yards off *Proctor Place light* (red structure at northeast end of training wall). Then steer about 236° true (SW. by W. mag.) for a little over ¼ mile until the lights of *Fort Jackson range* (brown slatted tripods) are in line, and then stand on the range ahead, course 212° true (SSW. ⅞ W. mag.).

When abreast the training wall at Mackey Point, steer 244° true (SW. by W. ¾ W. mag.) with *Oglethorpe range front light* (white square day mark on unpainted pile structure inside of training wall) in line with *Barnwell Place light* (brown, slatted skeleton tower) astern, giving the south bank of the river a berth of a little over 125 yards and passing 75 to 100 yards northward of Fort Jackson (Oglethorpe).

Continue on the range until up to *Fig Island jetty light* (red square day mark on unpainted pile structure), then slowly port, following midchannel, steadying on a 277° true (W. ⅝ N. mag.) course until approaching the wharves on the south bank. Then follow the wharves on the south bank at a distance of 250 to 300 feet.

THE COAST FROM TYBEE ROADS TO WASSAW SOUND

is about 6½ miles in extent and is formed by the shore of Tybee Island, which lies in a northeasterly and southwesterly direction.

This island has a breadth at its widest part of 3¼ miles, is mostly low and marshy, but has many wooded hummocks with numerous creeks winding among them. On the eastern shore several large creeks come into the sea, but they are of little importance, as their mouths are obstructed by shoals, with crooked channels of 2 or 3 feet at low water through them. **Tybee Beach** is a summer resort south of Tybee lighthouse and the houses show up well from seaward.

Tybee Creek, with **Lazaretto Creek**, is used by small boats as an inside approach to Tybee Beach.

The southeast part of the island, separated from the main body by a stretch of marsh, is called **Petit Chou Island**, and is distinguishable by a large and heavily wooded hummock, which marks the northern point of the entrance to Wassaw Sound. Dangerous shoals make off from the short of Tybee Island to a distance of 4½ miles.

WASSAW SOUND.

The entrance to this sound lies 8 miles southwestward of Tybee lighthouse. Shoals extend offshore a distance of 3½ to 4 miles from the entrance, forming a shifting bar, through which there is a channel with a depth of about 11 feet. After crossing the bar there is a good channel with 3 to 7 fathoms, which leads along the southern and western part of the sound and for a distance of 6 miles up Wilmington River. The sound is for the most part shallow, but the channels into its principal tributaries will permit any draft that can be taken over the bar. Fishing boats are practically the only vessels using the sound.

Tybee River empties into the sound from northward; it is about 7 miles in length to its junction with **St. Augustine** and Turner Creeks;

by the former it is connected with Savannah River about 5 miles below the city of Savannah; a depth of 9 feet can be taken through to Savannah River. The entrance to Tybee River is obstructed by a shoal in Wassaw Sound, over which a depth of 8 feet can be taken into the river. About 2 miles above the mouth of Tybee River it is entered from southeastward by Lazaretto Creek; this creek connects the river with Savannah River near its mouth and forms an inlet passage with a depth of about 7 feet. Turner Creek connects Tybee River with Wilmington River and has a depth of 7 feet.

Wilmington River empties into Wassaw Sound from northwestward. It has a northwesterly direction for 8 miles to the village of **Thunderbolt**, and then turns northward for about 4 miles and, joining St. Augustine Creek, connects with Savannah River. The river is important only as being a part of the inland passage from Savannah to Fernandina. A depth of 9 feet can be taken through to Savannah River.

Skidaway River empties into Wilmington River from southwestward about 2 miles southeastward of Thunderbolt and 5¾ miles above Wassaw Sound, and with **Skidaway Narrows** and **Burnside River** is a part of the principal inland passage between Savannah and Fernandina; the least depth in this passage is 8 feet. **Isle of Hope** is a village on the west bank of Skidaway River about 3¼ miles above its mouth.

Romerly Marsh Creek enters the western end of Wassaw Sound at the mouth of Wilmington River, and with **Romerly Marshes** and Adams Creek forms an inland passage to Vernon River. This paspasage is only good for shallow-draft boats and is practically abandoned. There is another passage, used to some extent, through **Old Romerly Marsh Channel, Parsons Cut, Wassaw Creek,** Odingsell River, and Adams Creek to Vernon River. This passage has shoaled to less than 3 feet and is practically abandoned as a through route. Savannah pilots will take vessels into Wassaw Sound. The mean rise and fall of tides is 6.8 feet.

Currents.—The tidal currents in Wassaw Sound have considerable velocity and must be allowed for. Advantage may be taken of them on the flood to beat in or on the ebb to beat out; but no vessel, however smart working, should attempt to beat against them.

Directions.—There are no prominent landmarks that can be readily recognized by a stranger when approaching the entrance. Wassaw Island, which forms the southern side of the entrance, is heavily wooded along its seaward side and presents a level, unbroken appearance, while Tybee Island, on the northern side of the sound, shows lower with scattered wooded hammocks. Tybee lighthouse, 8 miles northward of Wassaw Sound, shows well from off the bar and is a good mark. Approaching the entrance vessels should keep over 5 miles from shore in a depth of over 6 fathoms until the sea buoy is sighted. There are no buoys on the bar, and vessels not having local knowledge, should not attempt crossing without a pilot.

COAST FROM WASSAW SOUND TO OSSABAW SOUND.

This is formed by the shore of Wassaw Island, which lies in a northeasterly and southwesterly direction between the two sounds. It is triangular in shape, having a length of side of 4¾ miles and an ex-

treme breadth of 3⅜ miles in a northwesterly and southeasterly direction. It is for the most part low and marshy, the strip of firm land forming the coastline being only from one-fourth to three-fourths mile in width. This is heavily wooded and has a broad sand beach backed by sand hills. From this beach dangerous shoals make off to a distance of 4 miles. The marshy portion of the island inside this strip is cut up by numerous creeks, with numberless branches winding among heavily wooded hummocks. The island is separated from the land to the westward by *Romerly Marsh Creek* and the Odingsell River.

OSSABAW SOUND

is a broad opening in the coast 15 miles southwestward of Tybee lighthouse. The greater part of the sound is shallow, but the channels to the two river entrances have a depth sufficient for any vessel that can cross the bar. Shifting shoals extend seaward off the entrance for a distance of 3½ to 5 miles, through which two channels, the northern, with a depth of about 7 feet, and the southern, with a depth of about 9 feet, lead into the sound. There are no aids and the entrance is not used; strangers should not attempt it without a pilot.

Vernon River enters Ossabaw Sound from northwestward. Burnside River enters Vernon River from northward about 3½ miles above its entrance, and with Skidaway Narrows and River is a part of the principal inland passage. **Montgomery** is a post village on Vernon River, 1½ miles above Burnside River; it is connected by electric road with Savannah. **Little Ogeechee River** enters Vernon River from westward about 2 miles above its mouth.

Adams Creek enters Ossabaw Sound from northward about 2¾ miles above its entrance, and with Odingsell River, Wassaw Creek, Parsons Cut, and Old Romerly Marsh Channel forms an inland route to Wassaw Sound with a depth of less than 3 feet. Odingsell River enters Ossabaw Sound from northward at the entrance to the sound.

Ogeechee River enters the western part of the sound, and is the second largest river on the coast of Georgia. It is navigable for a distance of about 15 miles above Florida Passage, to the railroad bridge, for small vessels of 8 feet draft. The principal inland passage leads up this river a distance of 2¾ miles, and thence through Florida Passage and Bear River to St. Catherines Sound. It has a least depth of about 7 feet.

There are no regular **pilots** for Ossabaw Sound or its tributaries. Persons competent to pilot vessels can be found at Savannah or Thunderbolt. The mean rise and fall of tides is 6.6 feet.

The tidal currents in the sound have considerable velocity, and allowance must be made for them. The ebb setting out of Ogeechee River is particularly strong.

COAST FROM OSSABAW SOUND TO ST. CATHERINES SOUND.

The coast line between these sounds is formed by the eastern shore of Ossabaw Island. This island lies in a northeasterly and southwesterly direction, having a length of 7⅜ miles and a width of 5½ miles. The eastern half of the island is heavily wooded. The

western half is almost entirely marshy, and is cut up by numerous creeks that afford access to the higher ground to the eastward. The north end of the island forms the south shore of Ossabaw Sound, into which flows a small stream called Bradleys River, that penetrates to the center of the island.

The seaward side of the island is unbroken by streams of any size and presents to the view only a white sand beach backed by heavy woods. Dangerous shoals make off from this shore to a distance of nearly 5 miles.

The southwestern point of the island borders on St. Catherines Sound and is well wooded. On the west the island is separated from the marshes of the mainland by Bear River and Florida Passage, connecting streams which afford an inside passage from one sound to the other. From these streams **Queens Bess Creek**, **Can Patch Creek**, **Buck Head Creek**, **Big Tom Creek**, and **Newell Creek** run through the marshes to the wooded portions of the island.

ST. CATHERINES SOUND

is about 24 miles southwestward of Tybee lighthouse and 21 miles northeastward of Sapelo lighthouse. The entrance to the sound is over a shifting bar which extends 5 miles offshore and in 1921 had a least depth of about 11 feet in the channel as marked by the buoys. The sound is for the most part shallow, but channels with depths of 3 to 5 fathoms lead from inside the bar into the entrances of its tributaries.

Bear River enters St. Catherines Sound from northwestward just inside the entrance. About 8 miles above its mouth the river joins **Florida Passage**, and this affords an inside passage, with a depth of about 7 feet to Ossabaw Sound. A depth of 10 feet can be taken up Bear River and about 3 miles up **Kilkenny Creek**, its principal tributary. A wharf and sawmill are at Kilkenny, 1¾ miles above the mouth of the creek. Schooners load to 15 and 16 feet here and tow out over St. Catherines bar at high water. A depth between 1 and 2 feet at low water can be taken from Kilkenny Creek through Skippers Narrows to Florida Passage.

Medway River enters the sound from westward. With the aid of the chart the channel is not difficult to the entrance of **Belfast River**, but 6 feet at low water is about the best depth that can be taken to **Belfast** in the absence of local knowledge. A depth of about 14 feet can be taken 6½ miles above the mouth of the river to the entrance of Belfast River and 12 feet up Belfast River for 3 miles to the mill at Belfast. Vessels load lumber to a draft of 17 feet at Belfast and are towed up and down the river. Belfast is a post office and has telephone and railroad communication; water, gasoline, and provisions can be obtained.

Walburg Creek enters the sound from southward just inside its entrance, and with North Newport River, Johnson Creek, and South Newport River form the principal inland passage to Sapelo Sound. A least depth of 7 feet can be taken through this passage.

North Newport River enters the sound from southward just west of Walburg Creek. It is of little commercial importance, except that a small part of it is used as one of the connecting links in the inland

passage. Vessels formerly loaded to a draft of 16 feet at **Carrs Neck**, about 12 miles above the mouth of the river, and a draft of 6 feet can be taken nearly up to the railroad bridge (closed).

There are no towns on the sound, and Belfast and Kilkenny are the only shipping points on its tributaries. Strangers seldom enter the sound except to load at Belfast or Kilkenny. There are no regular local pilots, but Savannah pilots will take vessels in over the bar. On a clear day the entrance may be recognized, showing the break between the wooded points on its northern and southern sides.

The mean rise and fall of tides is 7.4 feet. The tidal currents have considerable velocity at the entrance and in the sounds.

Directions.—Approaching the entrance vessels should keep over 6 miles from shore in a depth of over 6 fathoms until the Sea buoy is sighted. The surveys made of the bar in 1867 and 1904 showed that during that time the shoal on the south side of the channel for a distance of 3 miles inside the bar had extended northward, and thence to the south point of Ossabaw Island the shoal on the north side of the channel had extended southward; the south point of Ossabaw Island had extended southward nearly ¼ mile. With the aid of the chart vessels of about 9 feet or less draft, on a rising tide with a smooth sea should have no difficulty in crossing the bar by following the buoys.

After crossing the bar the channel to Medway River leads northward of the horizontally striped buoy in the middle of the entrance, then 261° true (W. ¾ S. mag.) for a horizontally striped buoy on the south side of the channel southward of Medway Spit, and then westward along the south bank to the crossing, 1 mile above the entrance of the river, passing southward of nun buoy No. 2. This crossing is marked by can buoy No. 1, and by small range beacons, maintained by local pilots on both the south and north banks, course 335° true (NNW. ¼ W. mag.).

The crossing 2¼ miles above buoy No. 1 is sometimes marked by small range beacons, maintained by local pilots on the north bank, which are in range astern on a 255° true (WSW. ⅝ W. mag.) course. The channel then follows the south bank to abreast Dickinson Creek, then through the East Channel past the long island at Sunbury, and follows the east bank into Belfast River until across the mouth of Tivoli River; a shoal extends halfway across from the west bank abreast Tivoli River. The channel then follows the south bank until abreast the point northwestward of a small island.

For a distance of ¼ mile northward of this point the channel follows the east bank past a mid-channel shoal with 3 feet over it, above which 6 feet at low water is about the best depth that can be carried in the absence of local knowledge; a channel 125 feet wide and 12 feet deep has been dredged here. When about ½ mile above the point the channel crosses to the west bank, which it follows until approaching the sharp bend below Belfast. Round this bend in mid-channel, and pass northward of a ballast pile, bare at low water, which lies near mid river abreast the lower end of Belfast, and is marked by piles. The tidal currents have an estimated velocity of 3 knots or more in the river at Belfast.

To go up Bear River and Kilkenny Creek.—When ¼ mile east-northeastward of the horizontally striped buoy in the middle of the

entrance (see first paragraph), steer 132° true (SE. ¼ E. mag.), heading between the south point of Ossabaw Island and a horizontally striped buoy off Medway Spit. When by the buoy, steer 329° true (NNW. ¾ W. mag.), heading for the point of marsh on the east side of the river. When abreast the hummock at the mouth of Newall Creek, favor the west side of the river until it turns northward, after which keep in the middle until up to the mouth of Kilkenny Creek. Enter the creek favoring the north shore. Just after passing the mouth of Cabbage Creek keep well over to starboard to avoid a spit with little water on it making off the southern shore. Then the best water is in the middle of the creek to the dock at Kilkenny.

COAST FROM ST. CATHERINE SOUND TO SAPELO SOUND.

The coast line from St. Catherine Sound to Sapelo Sound is formed by St. Catherine Island. This lies nearly in a north and south line, having a length of 9½ miles and a breadth at its widest part of about 3 miles. The whole island is flat, and extensive portions of it are marshy. Its higher parts are heavily wooded. Seen from seaward at a distance it presents no prominent distinguishing features, showing only dense woods in level outline. It has a white sand beach, and near its center there are sand hills 20 feet high, which show up from some directions. The island is separated from the marshes lying between it and the main land by Walburg Creek, Johnson Creek, and the South Newport River.

McQueen Inlet is the only break on the seaward side of the island. It is unimportant, as it is blocked by shoals at low water. Dangerous shoals make off from the eastern shore to a distance of 5 miles. Between the south point of this island and the north point of Blackbeard Island lies the entrance to Sapelo Sound.

SAPELO SOUND

is 10 miles northeastward of Sapelo lighthouse and 34 miles southwestward of Tybee lighthouse. The entrance is obstructed by shifting shoals, which extend nearly 5 miles seaward, through which there is a channel with a least depth of about 17 feet in 1921. The sound affords excellent anchorage for any vessel that can cross the bar. Vessels of too deep draft for Doboy Sound enter Sapelo Sound to Front River to load lumber, which is brought to them in rafts. The deepest draft that can cross the bar is about 22 feet at high water with a smooth sea. There are no towns or villages of any importance on the sound or its tributaries.

South Newport River enters the sound from northward just inside the entrance; the river has a channel depth of 11 feet for a distance of 11 miles to its junction with North Newport River, and at high water 8 feet can be taken about 5 miles farther up the river. Entering the sound from northwestward is **Barbour Island River**, through which a draft of 8 feet at high water can be taken to South Newport River, in its northern part the channel leads southward and eastward around the large island to South Newport River.

Sapelo River, which enters the sound from westward, is navigable for vessels of about 8 feet draft at high water a distance of about 10 miles to the closed county bridge at **Eulonia** post office. A channel

150 feet wide and 17 feet deep with a present controlling depth of 14 feet is dredged from deeper water in Sapelo River into the mouth of **Front River.** On the western side just inside the entrance of Front River are loading berths at which vessels load lumber; this is the principal shipping point for Darien.

At the head of Front River a canal 6 feet deep has been dredged to Old Teakettle Creek, and this forms a part of the inland route to Doboy Sound.

Mud River enters the head of Sapelo Sound from southward; it is a broad, shallow body of water with a channel depth of 6 feet marked by range beacons, and is important only as a part of the inland passage between Savannah and Fernandina. No further dredging will be done to maintain this depth, as the present inland route leads through Front River.

Pilots for Sapelo Sound can be obtained by writing or wiring to Darien. Pilotage is not compulsory unless the vessel is spoken by a pilot. (For pilot rates see Appendix.)

Anchorages.—There is good anchorage anywhere in the channel of the sound, but vessels entering for shelter usually anchor in South Newport River or on either side of Dog Hammock Spit.

The mean rise and fall of tides is 7.3 feet.

DIRECTIONS.—Shoals extend about 5 miles from shore, and vessels should keep in a depth of over 5 fathoms until the Sea buoy is sighted. The break in the shore at the entrance to the sound can be seen a distance of about 8 miles on a clear day, and the old quarantine station can be seen from the Sea buoy. Sapelo lighthouse, 10 miles southward of Sapelo Sound, can also be seen from off the bar, and is a good mark.

With the aid of the chart vessels of 15 feet or less draft, on a rising tide with a smooth sea, should have no difficulty in entering during daylight by following the buoys. A comparison of the surveys made in 1859 and 1902 shows practically no change in the bar during that time, except in the vicinity of the shoalest part of Experiment Shoal, which has moved southward about ¼ mile; the slue between that shoal and St. Catherines Island has also deepened and extended.

When in the sound pass about ¼ mile northward of the old quarantine structure in the water and stand westward in the buoyed channel to an anchorage northward of Dog Hammock Spit. The channel into Front River should be taken by a stranger on a rising tide.

COAST FROM SAPELO SOUND TO DOBOY SOUND.

The coast line from Sapelo Sound to Doboy Sound is formed by the shores of Blackbeard and Sapelo Islands. These are separated only by a strip of marsh and a narrow inlet blocked by shoals at low water. From all points of view they appear as a single island, and may be described as one. Taken together they have a length of 10½ miles in a north-northerly direction and with a width of about 4 miles. Large portions of both islands are heavily wooded, but the western part of Sapelo Island consists almost entirely of broad marshes through which wind numerous creeks. The most important of these is the Duplin River, which has deep water for several miles

and affords means of communication to the island. Sapelo Island is separated from the marshes lying between it and the mainland by Mud River and New Teakettle Creek. Seen from seaward these islands present no well-marked distinguishing features, nothing being visible other than the usual sand beach backed by the dense woods in level outline, with the exception of the lighthouse and old tower near the south point of Sapelo Island.

DOBOY SOUND AND DARIEN

is 46 miles southwestward of Tybee Roads and 16 miles northeastward of St. Simon lighthouse. It is marked on its northern side by Sapelo lighthouse and a disused lighthouse, and on its southern side by a disused lighthouse (two-story building). The entrance is about 1 mile wide, and is obstructed by shifting shoals, which extend about 4½ miles offshore. In 1919 a survey showed a least depth of 11 feet on the outer bar and 10 feet on the inner bar. The deepest draft crossing the bar is 16 feet at high water. A swash channel with a least depth of 8 feet makes into the sound close under the south point of Sapelo Island. It is not marked. Another channel seems to be forming north of the buoyed channel between what is now called North Breakers and Chimney Spit. The sound extends northwestward for a distance of about 5 miles and has an average width of ¾ mile. It is the commercial outlet of numerous tributaries, the town of Darien, and also of the Altamaha River. Lumber is the principal commodity.

Sapelo lighthouse is a white, square, pyramidal skeleton tower, upper part black. The light shows 6 flashes every 30 seconds (flashes 0.5 second, 5 eclipses of 2.0 seconds, and 1 eclipse of 17.0 seconds), 100 feet above the water, and visible 16 miles. Nearly 300 yards southwestward of it is a disused light tower, with red and white bands.

Duplin River enters Doboy Sound from northward about 1½ miles inside of Sapelo lighthouse; it is a small stream about 5 miles long and good for a depth of 9 feet until near its head. Sapelo is a post office near the southern end of Sapelo Island. It is reached by boat by going up Duplin River 2 miles to a small creek on the eastern shore; thence up this creek to the first starboard hand creek; thence to the landing.

New Teakettle Creek enters the sound from northward about 1 mile northwestward of Duplin River. This creek connects with Mud River and forms part of the inland passage; a depth of 6 feet can be taken through this passage.

Old Teakettle Creek branches from New Teakettle Creek and joins Mud River farther westward. See the description of Front River under Sapelo Sound, preceding.

Atwood River and **Hudson Creek** are small streams emptying into the head of the sound from northwestward. About 7 feet can be taken up the former for a distance of 2½ miles, and 9 feet about 3 miles up the latter.

Connegan River enters the head of the sound from southwestward. It joins North River by a branch known as **Buzzards Roost Creek**, through which 8 feet may be taken.

North River enters Doboy Sound west of Doboy Island. It extends westward 6 miles to the post village of **Ridgeville** to which a draft of 14 feet can be taken. Here it joins **May Hall Creek**, which, running southward, connects with Darien River 5 miles above its mouth. There is a depth of about 13 feet in May Hall Creek, except where it enters Darien River the depth is only 4 feet; a draft of 8 feet can be taken through at high water.

Back River is on the southern side of Doboy and Commodore Islands and forms another entrance from the sound to North and Darien Rivers. It is little used.

Darien River extends southwestward for a distance of 11½ miles, where it joins the Altamaha River. The town of **Darien** is 8½ miles above Doboy Island on the north bank of the river. Darien has steamboat communication with Brunswick; it also has telephone communication. A least depth of 9.3 feet can be taken to Darien at low water, and vessels can load to 15 feet at the sawmills and be towed to sea over Doboy bar at high water. Large rafts of timber are sometimes secured to the banks of the river at and below Darien, and sunken logs are sometimes bad near the town. Lumber is also towed to Front River. (See Sapelo Sound, preceding.) The water is fresh in the river after the ebb has been running about 3 hours. There is a depth of about 3 feet at ordinary low tides into Altamaha River; only light-draft steamers are engaged in the carrying trade on the river.

Light-draft vessels running between Darien and Brunswick use the route through **Three Mile Cut,** which has a least depth of 6 feet at its south end. In the absence of local knowledge, this passage is recommended only for boats of less than 5-feet draft. The route follows the channel of Darien River to the point on the north bank northeastward of Three Mile Cut, then crosses to the south bank eastward of the mouth of a small slue, and then follows the south bank into Three Mile Cut. At the south entrance of Three Mile Cut the channel follows closely the east side of the cut, then leads through a dredged cut marked by range beacons, to the south bank of the Altamaha River. The course through the cut is 33° true (NNE. ⅞ E. mag.). It then leads eastward along the south bank through **One Mile Cut** to Buttermilk Sound, where it joins the regular inside route.

A branch of Darien River known as **Rockdedundy River** connects with Little Mud River from Altamaha Sound, and forms part of an inland passage with a depth of about 6 feet.

South River enters Doboy Sound from southwestward about ¾ mile inside the entrance. It extends in a general westerly direction for 3 miles, where it joins Little Mud River; it is little used.

Pilots for Doboy Bar can be had by writing or wiring to Darien, and if pilots are desired for the inland passage they can generally be obtained at either Darien or Brunswick. Pilots for Doboy Sound will also take vessels into St. Catherines or Sapelo Sounds. Bar pilotage is compulsory for certain vessels. (For pilot rates, see Appendix.)

Towboats belonging to the sawmills on the waters tributary to the sound cruise outside if a vessel is expected to arrive, and they will come out to a vessel signaling for one. All sailing vessels bound to Darien take a towboat, and when loaded tow out over the bar. Towboats can be had at Brunswick.

Anchorages.—There is good anchorage anywhere in the channel of the sound inside the entrance, but vessels usually stand up until abreast the mouth of North River, near the red and black buoy at its entrance. Vessels subject to visitation by the health officer must wait to be boarded in the sound. There is good anchorage in about 21 feet in North River, but the channel is too narrow for a large vessel to anchor in Darien River.

Supplies.—Provisions and gasoline can be had at Darien. Vessels can obtain fresh water from water boats. The nearest places for obtaining coal for steamers are Brunswick and Savannah. Water may be obtained from an artesian well on Doboy Island and also at Sapelo lighthouse by using small boats.

Repairs to hulls of vessels and machinery of steamers can not be made nearer than Savannah. (See also Brunswick Harbor.)

Wharves.—The depth of water alongside the wharves at Darien is 7 to 14 feet, and all vessels make fast to wharves or piling, as the river is too narrow for them to anchor near the town.

The mean rise and fall of tides is 7.3 feet at Sapelo lighthouse and 6.5 feet at Darien. The tidal currents on the bar have a velocity of about 1½ knots on the ebb and slightly less on the flood.

Directions.—Shoals extend nearly 5 miles from shore in places in the vicinity of Doboy Sound, and vessels should keep in a depth of 5 fathoms or more until the Sea buoy is sighted. If there is too much sea to cross Doboy bar, vessels can make an anchorage in Sapelo Sound.

The surveys of Doboy bar in recent years show it to have been in a state of change. By the survey of 1919 the buoyed channel, which leads in a northwesterly direction, crosses two bars, the outer one with depths of 11 to 12 feet and the inner one with 9 to 11 feet. It is not considered safe for a stranger to attempt to enter by following the buoys with a greater draft than 8 feet, and then only under the safest condition of a rising tide and a smooth sea.

When across the bar, the chart is a good guide in the sound to an anchorage near the red and black buoy at the entrance of North River. Sailing vessels require a towboat from this anchorage to Darien, but small powered vessels up to about 9 feet draft should have no difficulty in going up to the town. Chart 446 is the best guide.

Leaving the red and black buoy on the starboard hand, the channel follows the west bank of North River until abreast the north end of Doboy Island. Then favor the shore of Doboy Island and pass 75 to 100 yards off the south end of this island. Doboy Island is wooded, and there are several ruined buildings and an artesian well on its southwest end. Then cross Back River on a 185° true (S. ½ W. mag.) course and favor the east bank to the mouth of Darien River. Then follow the ebb-tide bends up Darien River, favor well the east bank in crossing the mouth of Rockdedundy River, and continue to follow the ebb-tide bends to Darien passing through Pico Cut. The

principal mill near Darien is at the north end of the long bend, the entrance of which is at the east end of Pico Cut. Wing dams to confine the channel are built out from the banks in places and are marked by piles which show above water.

ALTAMAHA SOUND

is 5 miles southward of Sapelo lighthouse and about 11 miles northeastward of St. Simon lighthouse. The entrance is so much obstructed by shoals and the sound itself is so full of them that it is rarely entered by anyone, and never by strangers. There is a channel through the shoals, which extend out for a distance of 4 miles from the entrance, but this channel shifts and is not marked. The vessels entering the sound pass in through Doboy or St. Simon Sounds and then through the inland passage.

Altamaha River is formed by the confluence of the Oconee and Ocmulgee Rivers, 112 miles above the town of Darien and 122 miles above its mouth, and flows in a general southeasterly direction, entering the western end of Altamaha Sound. This river is shallow and crooked, and has a least depth of about 1½ feet for its entire length at ordinary summer low water. Considerable timber is rafted down these rivers for shipment from Darien and Brunswick. The influence of the tides is felt in the river for a distance of about 20 miles above Darien. **Oconee River** has a channel depth of about 1.0 feet at ordinary summer low water to the city of **Milledgeville**, about 126 miles above its junction with Altamaha River. **Ocmulgee River** has a channel depth of about 1.5 feet at ordinary summer low water for a distance of 178 miles to the city of Macon. The principal cities, towns, and villages on the river, with their distances above the junction with the Altamaha River, are: **Lumber City**, 10 miles; **Abbeville**, 62 miles; **Hawkinsville**, 114 miles; and **Macon**, 178 miles. Transfer of freight between the river and connecting railroads is practicable at Macon and Lumber City by means of elevating machinery; at Hawkinsville, Abbeville, Barrows Bluff, and Mosquito Bluff by means of spur tracks and highways.

Little Mud River enters Altamaha Sound from northward about 2½ miles inside the entrance. It is important only as being part of the inland passage from Doboy Sound to Altamaha Sound.

Buttermilk Sound enters Altamaha Sound from southwestward. It has an average width of ½ mile, but is full of shoals, through which there is a narrow channel. At its head the sound connects with Frederica River and Mackay River, the latter connecting with Back River. These three rivers enter the western end of St. Simon Sound from northward, and Frederica River with Buttermilk Sound forms part of the regular inland passage, through which a depth of 7 feet may be taken at low water.

The mean rise and fall of tides in the entrance to Altamaha River is 6.4 feet.

Sailing directions of any value can not be given. It is advisable in every case where a vessel desires to enter Altamaha Sound, if coming from the northward, to pass into Doboy Sound; or, from the southward, to pass into St. Simon Sound, and then through the inland passages to Altamaha Sound. In either case a local pilot should be obtained.

COAST FROM ALTAMAHA SOUND TO ST. SIMON SOUND.

This coast line, having a length of 11⅜ miles and trending about south-southwestward, is formed by the shore of Little St. Simon Island, Isle of Palms, and St. Simon Island. These are separated only by stretches of marsh traversed by small streams and appear as one body of land when seen from seaward, although from certain points of view the marshes, alternating with patches of trees, give the land an unusually broken appearance.

Of the three named, St. Simon Island forms the main body of land between the two sounds, and in a general description the other two may be considered as parts of it. The three thus taken together form a body of land 11⅜ miles in length and 6 miles in width at its northern end, diminishing gradually to 2½ near its southern point. Immediately along the coast and in the central parts it is heavily wooded. Between the two wooded portions there is a stretch of marsh from a mile to 1½ miles in width extending nearly the whole length of the island, and to the westward it is separated from the mainland by extensive marshes, through which flow the Frederica and Mackay Rivers, connecting Altamaha and St. Simon Sounds.

The northern portion is mainly marshy and is traversed by **Hampton River**, a stream of some size, which, flowing in an easterly and southeasterly direction, separates St. Simon and Little St. Simon Islands and comes out on the coast 5 miles below Altamaha Sound. There is about 8 feet of water on the bar at the entrance, but there are dangerous shoals on both sides and the channel is unmarked. Eight feet may be carried through to Buttermilk Sound at low water. **Village Creek** empties into Hampton River from the southward, about 1½ miles above its mouth. It flows through a stretch of marsh separating Isle of Palms from St. Simon Island. After a crooked course of several miles it connects with **Black Bank River**, a narrow and tortuous stream flowing to the southward between the two islands named and entering the sea about 4 miles south of Hampton River.

The southern part of St. Simon Island is heavily wooded. The buildings of a summer resort and the white tower of St. Simon lighthouse are conspicuous objects from seaward. All along the coast dangerous shoals make off from 3 to 5 miles.

ST. SIMON SOUND AND BRUNSWICK HARBOR

lie 17 miles southward of Sapelo lighthouse and 27 miles northward of Amelia Island lighthouse. On the northern side of its entrance, which is ⅞ mile wide, is St. Simon lighthouse. This sound is one of the most important harbors on the coast of Georgia, being the approach to the city of Brunswick, which is the second seaport in commercial importance in the State.

The entrance is obstructed by dangerous shifting shoals, which make offshore to a distance of 5½ miles, forming a bar through which there is a dredged channel 500 feet wide and 24 feet deep, project depth of 27 feet, marked by range lights and buoys. Drafts of 28 feet are taken over the bar at high water. Inside the bar and in the channel of the sound there is a good depth of water and excellent anchorage.

Brunswick light vessel is moored in a depth of 50 feet, 14¼ miles 123° true (SE. by E. ⅛ E. mag.) of St. Simon lighthouse. The

vessel has a yellow hull, with "Brunswick" on each side, and two masts with red cylindrical day marks at head of each. The light is a group flashing white, 3 flashes every 20 seconds, 66 feet above the water, and visible 13 miles. The fog signal is a steam whistle, blast 5 seconds, silent intervals 25 seconds. If the whistle is disabled the ship's bell will be struck by hand 8 strokes, silent interval 4 seconds, 4 strokes, silent interval 40 seconds. The submarine bell strikes "84," thus: 8 strokes in 22⅔ seconds, silent interval 4 seconds, 4 strokes in 11⅓ seconds, silent interval 8 seconds.

St. Simon lighthouse is a white conical tower attached to a brick dwelling. The light is fixed white varied by a white flash of 5 seconds duration every 60 seconds, 104 feet above the water, and visible 16 miles.

Entering the western end of the sound from northward are **Frederica, Mackay,** and **Back Rivers.** These all extend northward and connect with Buttermilk Sound, and thus afford a passage into Altamaha Sound. Frederica River is the easternmost of the three rivers and the one used by vessels passing through the inland passage.

St. Simon Mills is a village on the east bank of Frederica River, about 1½ miles above its mouth. There are several abandoned mills here. There is 12 feet of water in the channel up to the village, and vessels formerly loaded to a draft of 18 feet at the mills.

St. Simon is a summer resort and landing at the south end of the island of St. Simon.

Brunswick River enters the sound from southward and just inside the entrance. The river for a distance of 2¾ miles above its mouth has an average width of 1¼ miles, but the deep-water channel averages only a little over ¼ mile in width, and in one place is only 200 yards wide. Above Brunswick Point the river for a distance of about 2½ miles has an average width of ¾ mile, and above this it is divided into two branches by Buzzards Island. The southern branch is known as **Turtle River,** and the northern branch, on which the city of Brunswick is situated, is known as the **East River,** or Brunswick Harbor. The city of **Brunswick** is about 7¼ miles from St. Simon lighthouse; it has regular steamboat communication with Darien, Satilla River, Fernandina, and intermediate places, and a large coastwise and foreign commerce. A depth of 21 feet at low water can be taken up East River to Brunswick, and up Turtle River to the Southern Railroad wharves.

South Brunswick River enters Brunswick River from westward opposite Buzzards Island. **Fancy Bluff Creek** enters South Brunswick River from the southwestward 1¼ miles above its mouth. This creek affords a narrow channel, good for a depth of about 4 feet at low water, to Little Satilla River.

Jekyl Creek enters Brunswick River from southward about 2½ miles above its mouth; with Jekyl and St. Andrews Sounds it forms part of the inland passage to Fernandina. A depth of 6½ feet at low water can be taken from Brunswick River through the creek. The dredged entrance from Brunswick River is marked by range lights (white structures) and a jetty.

Plantation Creek and Clubb Creek have been improved to a depth of 6 feet. The entrance from Brunswick River is ½ mile above the quarantine station, and the channel then leads through a cut across

the marsh in a northeast direction, cutting off the westerly loop of Plantation Creek. The channel is in the middle of Plantation Creek, except in the reach trending southward of east, where it favors well the north bank; then after favoring the outside of the sharp bend, the channel favors the east bank until halfway up the northward trending reach. The channel then leads through a cut to Clubb Creek, and so in mid creek to Back River.

Back River with Mackay River, is used by small steamers as a part of an inland route to Altamaha River. There is a depth of 4 feet at low water through Rock River to Mackay River. On Back River 2¼ miles above Clubb Creek there is a mill at which vessels load to a draft of about 17 feet.

Prominent features.—In clear weather St. Simon lighthouse shows well at a distance of 8 miles, and from the gas and whistling buoy Little Cumberland Island disused lighthouse can be seen southwestward. Near the beach eastward and northeastward of St. Simon lighthouse are a number of cottages and several large houses.

Pilots.—Pilots are on the lookout at St. Simon lighthouse and will come out when a vessel is sighted. Pilotage is compulsory for certain vessels. For pilot rates see Appendix. Pilots for the inland passage can be obtained at Brunswick.

Towboats are usually employed by the larger and deeper draft sailing vessels. They can be had at Brunswick and by making signal outside.

Quarantine.—The national quarantine station is at Brunswick Point, on the north bank of Brunswick River, about 1½ miles below the city. Vessels subject to visitation by the health officer will be boarded in the sound.

Hospital.—At Brunswick there is a relief station of the United States Public Health Service.

Harbor control.—The limit of speed of steamers passing the wharves of Brunswick is 4 miles an hour, and the engine must be stopped and turned over slowly when passing where two or more vessels are moored abreast and where barges or flats are employed at any point in the harbor.

Anchorages.—There is good anchorage anywhere in the channel in St. Simon Sound or Brunswick River off the range lines. Off the city of Brunswick there is no anchorage, except for small craft westward of the Brunswick Harbor range. Small vessels can anchor in East River near the mouth of Academy Creek.

Supplies.—Provisions, ship chandler's stores, anthracite or bituminous coal, gasoline, fuel oil, ice, and fresh water can be obtained at Brunswick.

Repairs.—Light repairs can be made to the machinery of steamers, and there is a small marine railway with a capacity of about 400 tons and a draft of 7 feet forward and 12 feet aft; but Savannah and Jacksonville are the nearest places where large vessels can be hauled out for extensive repairs.

Wharves.—The facilities for loading and discharging cargoes at Brunswick are good. There is from 7 to 28 feet alongside the wharves according to locality, and 26 feet at the wharves of the Southern Railroad on Turtle River. The railroad parallels the

water front and serve the separate wharves by spurs. All wharves except the Southern Railway terminals have highway or street connections. None of the wharves are equipped with mechanical unloading devices, except those owned by the Southern Railway Co. and the Atlantic Refining Co., the latter wharf being equipped with a pumping station for the discharge of fuel oil from ships.

Storm warnings are displayed at Brunswick.

The mean rise and fall of the **tides** on the bar is 6.3 feet.

The **tidal currents** follow the general direction of the dredged channel across the bar, and have an estimated velocity of 1 to 2 knots. They set diagonally across the Plantation Creek range. Currents turn about 1 hour after high and low water.

DIRECTIONS.—There is a project depth of 27 feet and 500 feet wide across the bar; 24 feet and 400 feet wide to Brunswick Point; 24 feet and 350 feet wide in Bunswick Harbor and Turtle River; and 24 feet and 150 feet wide in Academy Creek. In 1921 there was 24.4 feet over the bar, 21 feet into Brunswick Harbor, and 24 feet to the Southern terminals. All of the dredged channels are marked by range lights and buoys. The tidal currents set with the channel on the bar, but with northerly or southerly winds a current, which should be kept in mind, sets with the wind across the channel.

Approaching St. Simon Sound from any direction shape the course for Brunswick light vessel, from which a 303° true (NW. by W. ⅛ W. mag.) course for 7 miles will lead to St. Simon gas and whistling buoy. In clear weather and the light vessel is sighted a course can be shaped to pass as much as 5 miles inside of it; then bring it astern on a 303° true (NW. by W. ⅛ W. mag.) course until up with St. Simon gas and whistling buoy. Soundings of 4½ to 5½ fathoms have been found on what appears to be a bank or broken ground, lying 2 to 4½ miles east and east-southeastward of St. Simon gas and whistling buoy. This area should be avoided in heavy weather. There is also a spot with 4½ fathoms over it lying about ⅜ mile north-northeastward of St. Simon gas and whistling buoy.

From St. Simon gas and whistling buoy steer 303° true (NW. by W. ⅛ W. mag.) heading for *St. Simon lighthouse* (white conical tower); on this course *St. Simon range front light* (white skeleton structure) will be in line with St. Simon lighthouse. Continue the course, keeping close on the range which leads about midway between the buoys marking the sides of the channel.

When abreast nun buoy No. 14 steer 285° true (WNW. ¾ W. mag.) with *Plantation Creek range lights* (white structures) in line ahead, and pass about 200 yards northward of can buoy No. 13. Good anchorage can be found northward of the range and about ½ mile northwestward of buoy No. 13.

St. Simon Sound to Brunswick.—When about ½ mile westward of can buoy No. 13 and Jekyl Island range lights (white structures, fixed white lights) are in line ahead, steer 216° true (SW. ¾ S. mag.) for 1¾ miles, passing about 200 yards southeastward of nun buoy No. 16 and giving the shore of Jekyl Island a berth of at least 200 yards. When up to buoy No. 18 bring *Cedar Hammock range lights* (white structures, fixed red lights) in line ahead, course 255° true (WSW. ¾ W. mag.).

When up to nun buoy No. 20 steer 293° true (WNW. mag.) heading for *Turtle River lower range lights* (white structures, fixed white lights) and give the north bank a berth of about 350 yards. When the Quarantine station is abeam, steer 299° true (NW. by W. ½ W. mag.) for 1 mile, heading for a red and black horizontally striped nun buoy. Then steer 344° true (N. by W. ½ W. mag.) with *Brunswick Harbor range lights* (white structures, fixed red lights) in line ahead. Stand in on this range, giving the wharves along the city front a berth of 75 to 100 yards, and make fast to a wharf until assigned a berth by the harbor master.

To the Southern Railway and Atlantic Refining Co. wharves on Turtle River.—From the Quarantine station continue the 293° true (WNW. mag.) course with the *Turtle River lower range lights* in line ahead, passing through a dredged cut marked by two can buoys. When about ¾ mile westward of the last can buoy (No. 3) haul northward to a 338° true (NNW. mag.) course, with the *Blythe Island range lights* (white day marks, with vertical strips, on piles, fixed white lights) in line ahead. When up to nun buoy No. 4, haul northward, bringing in line over the stern *Turtle River Upper range lights* (white day marks on piles, fixed white lights), course 10° true (N. ⅞ E. mag.). Pass through the dredged cut, the northern end of which is marked by nun buoy No. 6, and continue the course, avoiding the shoals on the port hand, marked by a can buoy, to the wharves of the Southern Railway. If going to the Atlantic Refining Co. wharves, favor the eastern shore of the river past the railway wharves.

COAST FROM ST. SIMON SOUND TO ST. ANDREW SOUND.

This stretch of coast, trending very nearly north and south, is formed by the shores of Jekyl Island, which has a length of 6½ miles and a width of 1 mile. The island is wooded all along its eastern shore. To the westward large portions of it are marshy. Seen from seaward it shows the usual stretch of sand beach with many conspicuous bluffs and sand hills, backed by dark woods, which are quite level in general outline but with many tall pines showing above the main body. There is a settlement on the western side, reached through Jekyl Creek.

From the shore of this island shoals make off to a distance of 3 to 5 miles. To the westward the island borders on the Brunswick River, Jekyl Creek, and Jekyl Sound. By the creek it is separated from an extensive track of marsh lying between it and the mainland. This marsh is cut up by numerous small streams connecting Brunswick River with Jekyl and St. Andrew Sound.

ST. ANDREW SOUND

lies about 7 miles southward of St. Simon Sound and 17 miles northward of St. Marys entrance. On the southern point at its entrance is a disused lighthouse tower. In the sound are extensive shoals, between which channels lead into its principal tributaries, which are known as Jekyl Sound, Satilla River, and Cumberland River. The entrance is over a shifting bar, which extends 5 miles offshore, and is usually good for a depth of 14 feet at low water. The sound is little used as a harbor. A number of vessels enter Satilla River to

load lumber, and the vessels using the inland passage cross the sound. Jekyl Creek and Jekyl Sound from northward, and Cumberland River from southward, are parts of the inland passage connected by St. Andrew Sound.

Jekyl Sound enters St. Andrew Sound from northward just inside the northern point at the entrance. It is full of shoals, between which there are three channels which lead to its three principal tributaries. **Jekyl Creek** enters the sound from northward. It is part of the inland passage, its northern part connecting with Brunswick River. A depth of 6½ feet can be taken from Jekyl Sound to Brunswick River. **Jointer Creek** enters Jekyl Sound from northwestward. It is crooked and has a number of narrow branches which connect with Brunswick River above Jekyl Creek. About 12 feet can be taken into the creek at low water, and about 4 miles above its mouth. **Little Satilla River** enters Jekyl Sound from westward, and is good for a depth of 12 feet for several miles above its mouth. Jointer Creek and Little Satilla River are of little importance. Small craft going to the landings on Little Satilla River enter from South Brunswick River through Fancy Bluff Creek, which is good for about 4 feet at low water.

Cumberland River enters St. Andrew Sound from southward just inside the point of Little Cumberland Island; its general direction is southerly for a distance of 11 miles, where it joins Cumberland Sound, thus affording a passage good for a depth of about 7 feet at low water. The most difficult part of the passage is at the "Divide" at the north mouth of Crooked River; at this point the channel is marked by range beacons.

Satilla River enters St. Andrew Sound from westward; its entrance is obstructed by extensive shoals, between which there is a narrow channel. The settlements on the river have communication with Brunswick by telephone, and there is railroad communication from **Woodbine**, 22 miles above its mouth. A railroad bridge crosses the river at Woodbine (width of draw 52 feet). A steamer from Brunswick makes regular trips to points on the river up to **Burnt Fort**, 45 miles from the mouth, to which there is a depth of 6 feet at low water. Seagoing vessels load lumber at the mills on the river as far up as **Owens Ferry**, 28 miles above the mouth, to which point there is a depth of 9 feet at low water or 17 feet on a good high water. There is a depth of 1 foot to Waycross. Provisions and artesian water can be obtained at the mills and other settlements; a small quantity of gasoline can be had generally at Owens Ferry.

Most vessels bound to Satilla River enter St. Simon Sound and tow through Jekyl Creek. When loaded, they are towed to sea, with the aid of a pilot, over St. Andrew Bar. The channel follows the ebb tide bends, and with the aid of charts 448 and 450 steamers of moderate draft (say up to 10 feet) should have no difficulty in going as far as Owens Ferry. The only sharp turn below Owens Ferry is at **Hopewell Point**, where special care is also required on account of the narrow channel. There are no aids above the entrance. The mean rise and fall of tides is about 6.9 feet at the entrance, 6.8 feet at Ceylon, and 3.4 feet at Burnt Fork.

White Oak River empties into Satilla River from northward 15 miles above its mouth. A draft of 8 feet at high water can be taken

10 or 12 miles above its mouth to **White Oak** and **Waverly,** which are railroad stations at the head of navigation on its two branches.

Brickhill River is a branch of Cumberland River, from which it branches about 5 miles above its mouth and again joins it a short distance north of the "Divide."

Floyds Creek enters Cumberland River from westward about 4½ miles above the north end of Little Cumberland Island. For a distance of nearly 3 miles above its mouth the channel in the creek has a depth of about 19 feet. With local knowledge a draft of 3 feet at high water can be taken from the head of Floyds Creek westward through a shallow pond into **Todds Creek,** and thence northward to Satilla River.

Shellbine and **Delaroche Creeks** enter Cumberland River from westward. They are both narrow and crooked. The former is navigable for a draft of 8 feet at low water, and the latter for a draft of 7 feet, but neither creek is of importance.

Pilots may be obtained for St. Simons Bar, and there is one on Cumberland Island at High Bluff (locally Cumberland High Point). The pilot regulations and rates for St. Andrew Sound and Satilla River are the same as for St. Simon Sound and Turtle River. Pilotage is compulsory for certain vessels.

Towboats.—There are no regular towboats in St. Andrew Sound, but vessels desiring to tow up the Satilla River can get a towboat from Brunswick.

Anchorages.—The best anchorage is in the channel, on the western side of Little Cumberland Island. Here the depth ranges from 3½ to 4½ fathoms, and the holding ground is good. There is also good anchorage in the entrance to Jekyl Sound, westward of the southern end of Jekyl Island.

The mean rise and fall of tides in the sound is 6.8 feet.

DIRECTIONS.—Sailing vessels going to the mills on Satilla River are practically the only ones trading to St. Andrew Sound, and these enter St. Simon Sound and are towed through Jekyl Creek and up Satilla River. Shoals extend about 5 miles from shore in the vicinity of St. Andrew Sound, and the depth should not be shoaled to less than 5 fathoms (low water) until the sea buoy is sighted. The entrance is marked by a disused lighthouse tower on the north end of Little Cumberland Island and St. Andrew Sound light (white skeleton structure on Horse Shoe Shoal). Brunswick light vessel is the principal aid in the northern approach. With the aid of the chart vessels of about 10 feet draft should have no difficulty in entering St. Andrew Sound, on a rising tide with a smooth sea, by following the buoys. From St. Andrew Sound the channel to Satilla River leads northward and northwestward of Horse Shoe Shoal, and then across to the south bank of the river, and is marked by beacons and buoys for this distance. See the description of Satilla River preceding.

COAST FROM ST. ANDREW SOUND TO CUMBERLAND.

The stretch of coast line, extending in a southerly direction for 15¾ miles, is formed by the shores of Little Cumberland and Cumberland Islands. These two islands are separated only by stretch of marsh and a narrow winding creek, and appear as one from sea-

ward. **Little Cumberland Island** forms the southern boundary of St. Andrew Sound. Its north end is heavily wooded, has a bluff appearance, and is marked by a disused lighthouse tower. Cumberland Island is almost entirely covered by woods, though somewhat marshy to the westward, where it is separated from the mainland by extensive marshes, through which flow the waters of Cumberland and Brickhill Rivers, and Cumberland Sound. Its extreme southern point, forming the north side of the entrance to Cumberland Sound, shows a large clump of heavy trees with several conspicuous sand hills. To the northward of this there is a stretch of marsh a mile in width, through which flows **Beach Creek.** There are several buildings and water tanks which are conspicuous.

The entire outer coast line of the island shows a broad white sand beach backed by an almost continuous range of sand hills, and those by dense woods. For about 9 miles from the entrance to St. Andrew Sound this coast is bordered by dangerous shoals making off 3 to 5 miles. For the rest of the distance to the entrance of Cumberland Sound 3 fathoms may be taken within 1 mile of the beach, excepting at the entrance.

CUMBERLAND SOUND AND ST. MARYS ENTRANCE.

is 16 miles southward of St. Andrew Sound and 19 miles northward of St. Johns River. Amelia Island lighthouse is about 2 miles southward of the entrance. A standpipe in Fernandina, and a water tank on Cumberland Island, 1¾ miles above its south end, are also prominent. The sound extends northward, and, connecting with Cumberland River, forms an inland passage to St. Andrew Sound. It is also the approach to the city of Fernandina and the town of St. Marys.

The entrance, which is about 1 mile wide, has been improved by two jetties, which extend from the shore for a distance of 3 miles on the north side and 1½ miles on the south side. The bar, just outside of and between the jetties, has a buoyed channel, which in June, 1921, had a least depth of about 24 feet. The deepest draft taken from Fernandina over the bar is about 28 feet.

Amelia Island lighthouse is a white conical tower. The light is flashing white (flash 2.5 seconds, eclipse 7.5 seconds), 107 feet above the water, and visible 16 miles.

St. **Marys River** empties into Cumberland Sound from westward and is its principal tributary. The settlements on the river have telephone communication, and there is railroad communication at St. Marys and Crandall. A steamer from Fernandina makes regular trips to points on the river to Kings Ferry. The principal shipping points for lumber are **St. Marys,** 4 miles above the mouth of the river; **Crandall,** 10 miles; and **Kings Ferry,** 32 miles. The least depth is 15 feet to **Kings Ferry.** There is a depth of 4 feet to **Traders Hill,** 52 miles about its mouth. The A. C. L. Railroad bridge (closed) crosses the river 48 miles above the mouth. This bridge is 22 feet above high water. The S. A. L. Railroad drawbridge (57-foot opening) crosses the river 20 miles above its mouth.

Chart 157 shows St. Marys River to a point 3 miles above St. Marys. Above this point the channel follows the ebb-tide bends,

and vessels of about 10 feet draft should have no difficulty in going as far as Kings Ferry on a rising tide. The river is very crooked, some of the turns are sharp. The mean rise and fall of **tides** is about 5.9 feet at the entrance, 4.1 feet at the drawbrdige, 2.8 feet at **Kings Ferry**, and 1.4 feet at the closed bridge. **Towboats** can be had at Fernandina. Above the S. A. L. Railroad the water in St. Marys River is fresh and is used by vessels.

There are five private wharves at St. Marys having a docking space of 909 feet on the city water front and two having a docking space of 340 feet on North River, which lies on the north side of the city and empties into St. Marys River a short distance below the city. One of these latter wharves is equipped with a marine leg elevator for handling fish. All wharves have highway or street connection and are served by the Atlantic, Waycross & Northern Railway.

Amelia River enters the sound from southward just inside the entrance. The city of Fernandina is situated on the east bank about 2 miles above its mouth.

The city of **Fernandina** has railroad communication, and steamboat communication with Brunswick and St. Marys. Considerable lumber, phosphate, and some naval stores are shipped from the port in coastwise and foreign vessels. About 2⅝ miles above Fernandina is Kingsleys Creek, through which the South Amelia River is entered; the latter river extending southward to Nassau Sound forms an inland passage between the two sounds.

Bells River enters Amelia River from westward opposite the city of Fernandina. The former river joins St. Marys River about 1½ miles above the town of St. Marys and has a narrow and crooked channel.

Jolly River branches eastward from Bells River about 6 miles above the mouth of the latter and empties into Cumberland Sound at the mouth of St. Marys River.

Pilots are on the lookout for approaching vessels and will come out when pilot signals are set. Their headquarters are at **Old Fernandina**. Pilotage is compulsory for certain vessels. Pilots for the inland passages can be obtained at Fernandina. The pilot regulations and rates and harbor regulations for the port of Savannah have been adopted for the port of St. Marys.

Towboats.—Sailing vessels usually employ a towboat when crossing the bar or if bound up St. Marys River; towboats are to be had at Fernandina.

Quarantine.—The quarantine boarding station for Fernandina and St. Marys River is near Fort Clinch. Vessels bound to Fernandina must not proceed above the quarantine station until they have been visited by the health officer.

Hospital.—At Fernandina there is a relief station of the United States Public Health Service.

Anchorages.—There is good anchorage in the channel of Cumberland Sound and in the Amelia River up to the city of Fernandina. Vessels are forbidden to anchor in the Amelia River abreast of the city between Calhoun Street and the site of the creosote works.

Supplies.—Provisions and some ship chandler's stores can be had at Fernandina. Coal, both anthracite and bituminous, can be had at

the wharves in Fernandina. Fresh water can be obtained at the wharves and from water boats at Fernandina, and can be taken from the St. Marys River about 30 miles above its mouth.

Repairs.—There are no special facilities for repairs to vessels or machinery of steamers. Jacksonville and Savannah are the nearest places where vessels can be hauled out and where there are facilities for extensive repairs.

Wharves.—The facilities for loading and discharging vessels are good, the depth alongside the wharves at Fernandina is 16 to 29 feet, according to locality, and at St. Marys from 18 to 20 feet. At Fernandina four wharves are equipped with mechanical unloading devices and one of these is specially equipped for loading vessels with bulk cargo and has a capacity of 2,000 tons per hour. Nearly all the wharves are served by railroad tracks and have highway or street connection.

Storm warnings are displayed in Fernandina near the post office.

For **tides** see table, page 32, also the tide tables for the Atlantic Coast of the United States, published annually in advance by the Coast and Geodetic Survey, in which the tides are predicted for every day of the current year.

The **tidal currents** at the entrance have great velocity and are dangerous at times, especially on the flood. Local pilots state that the conditions are about as follows: Between the bell buoy and the end of the north jetty the flood current sets southwestward, and with northeasterly winds sets strongly in a direction about south-southwest. Under the worst conditions of the flood on spring tides and a northeast gale, the velocity near the end of the north jetty is estimated to be as much as 5 knots at times. On the flood an eddy current sets out close along the inside of the north jetty. The ebb current appears to set directly out across the bar. In the present position of the channel, near the north jetty, the worst conditions for entering are on the flood with northeasterly winds, when vessels, especially long ones, are liable to strike the inside of the north jetty. Normally slack water occurs about 30 minutes after high and low water. With freshets in St. Marys River the ebb current may run from about high water until about 1½ hours after low water.

DIRECTIONS.—The surveys indicate a movement of the bar, including the middle ground between the jetties, seaward at the rate of 200 to 400 feet per year and an increase in the general depths on the entire bar. The most important change affecting the marked channel is an easterly extension at the rate of about 200 feet a year of the easterly part of the shoal on the south side of the north jetty near buoy No. 4. The width of this part of the shoal from the north jetty is also increasing. In 1921 there was a depth of about 24 feet in the buoyed channel; but local knowledge is required to carry the best water, and the tidal currents have great velocity, especially the flood with northeast winds, and vessels of greater draft than about 15 feet are advised to take a pilot.

From northward.—From Brunswick light vessel a 206° true (SSW. ¼ W. mag.) course made good for 17 miles should lead to a position with Amelia Island lighthouse, or the standpipe in Fernandina, bearing 240° true (SW. by W. ¼ W. mag.). A 259° true (W. by S. mag.) course made good for 3¼ miles should then lead

to the whistling buoy off the entrance. On a clear day the lighthouse and standpipe will be visible about 9 miles. In thick weather, if uncertain of the position, keep in a depth of not less than 7 fathoms.

From southward.—From St. Johns gas and whistling buoy a 356° true (N. 3/8 W. mag.) course made good for 19¾ miles should lead to a position ½ mile eastward of the whistling buoy off the entrance. On this course the nun buoy off Nassau Sound entrance will be left about 2¼ miles on the port hand. This course leads over broken ground with least depths of 4½ and 4¾ fathoms, and deep-draft vessel should keep farther eastward in a depth of over 8 fathoms until off the entrance.

From 200 yards northward of the whistling buoy steer 262° (W. ¾ S. mag.) to a position northward of the bell buoy. Then steer southwestward for ⅞ mile to a position on the Tiger Island range (white structures), southeastward of buoy No. 4, passing between the gas buoy off the end of the north jetty and a can buoy, then follow the range, course 260° 30′ true (W. ⅞ S. mag.). When passing Fort Clinch keep a little northward of the range, and then round the northwest end of Amelia Island at a distance of about 300 yards.

Pass about 125 yards off the old wharf at the quarantine station, steer 168° true (S. by E. ⅛ E. mag.) for the water tower (standpipe) in Fernandina, and then follow the wharves at a distance of about 100 yards.

COAST FROM CUMBERLAND SOUND TO ST. JOHNS RIVER.

This stretch of the coast is formed by the shores of Amelia Island, Talbot and Little Talbot Islands, and Fort George Island.

Amelia Island lies very nearly north and south, having a length of 11¾ miles and a width varying from 1 to 2½ miles. It is low and flat or gently undulating, is heavily wooded along the coast line, but the western parts are marshy. The island is separated from the mainland by a broad stretch of marsh, through which flow the Amelia and South Amelia Rivers, connecting Cumberland Sound on the north with Nassau Sound on the south.

Seen from seaward Amelia Island presents no prominent natural features to distinguish it from other land in the vicinity. It shows a long line of dark woods, rather irregular in outline, with numerous trees rising conspicuously above the general level. In front of these woods is a range of sand hills partly covered with coarse grass and scrub, and in front of these a broad stretch of white sand beach. About 2 miles from its northern end the white tower of Amelia Island lighthouse, rising from a grove of large trees, forms a conspicuous landmark.

Nassau Sound is 10 miles southward of Amelia Island lighthouse and 6 miles northward of St. Johns River lighthouse. The entrance is obstructed by shifting shoals which extend about 1¼ miles seaward and form a shallow bar, through which there is a buoyed channel. **Nassau River** is navigable for some 15 miles to the S. A. L. Railroad closed bridge. Some lumber is towed inside to Jacksonville and Fernandina. **South Amelia River**, which enters the sound from northward, connects with **Kingsleys Creek**, and through the

latter has communication with Amelia River and Cumberland Sound. The depth through the this passage is about 7 feet. The mean rise and fall of tides is about 5.4 feet. **Sawpit Creek**, which enters the sound from westward, connects with Gunnisons Cut and Sister Creek, forming the inside passage to St. Johns River.

Little Talbot Island is a strip of low flat land about 3 miles in length and averaging about ¾ mile in width. It lies nearly in a north and south direction and is wooded along the outer coast, but is marshy to the westward. By this strip of marsh, through which several creeks flow, it is separated from Talbot Island. This island is 4¼ miles in length by 1½ miles in width. It is partly wooded and partly marshy, and is separated from the mainland by connecting streams, **Sawpit Creek** and **Gunnison Cut.** This last connects with **Fort George Inlet** and **Sister Creek,** affording an inside passage from Nassau Sound to St. Johns River, through which there is a depth of 7 feet at low water. Seen from seaward, Little Talbot Island shows a strip of dark woods with many conspicuous sand hills near the beach. Its south end runs off in a low point of bare sand bordering on Fort George Inlet, which is a narrow body of water separating Little Talbot and Talbot Islands from Fort George Island. Immediately to the southward of this inlet is **Fort George Island.** Its eastern shore, forming the coast line, shows a broad stretch of white sand beach, backed by a range of high sand hills. Near the north end of the island there is a conspicuous hill, called **Mount Cornelia.** It is 63 feet high and thickly wooded. On clear days it may be seen from a distance of 12 to 15 miles, affording an excellent landmark for the entrance to St. Johns River. Fort George Island is separated from the mainland by a stretch of marsh, through which flows **Sister Creek.**

ST. JOHNS RIVER.

This river, the largest and most important of eastern Florida, is about 244 miles in length. It rises near the Atlantic coast, in about latitude 28° 10′ N., flows in a northerly direction nearly parallel to the coast, and empties into the sea immediately north of St. Johns River lighthouse, in latitude 30° 24′ N. The river is the approach to the city of Jacksonville and a large number of towns and villages. The part of the river above Jacksonville is described under a separate heading.

The entrance of the river is between two converging jetties which extend out across the bar. The channel is under improvement to secure a depth of 30 feet from sea to Jacksonville; in 1921 there was a least depth of 29 feet in the channel to Arlington Cut, at which the least depth is 27 feet. The channel is 600 feet wide across the bar and 500 feet wide to the anchorage basin opposite Mayport. Thence to Jacksonville the channel is 300 feet wide, increasing to as much as 600 feet in the bends. The channel is well marked by range lights and buoys. With these aids it is not difficult for a stranger of 20 feet draft to navigate the river; all sailing vessels employ a towboat for crossing the bar and in the river as far as Jacksonville.

Mayport is a village on the south bank, 3 miles inside the entrance between the jetties. It has communication by rail, small craft, telephone and telegraph with Jacksonville. A draft of 19 to 22½ feet

can be taken to the railroad wharf. Some supplies and gasoline can be obtained; also pilots for the inland passage.

Pilot Town is a village on the north bank opposite Mayport.

The city of **Jacksonville** is on the north bank of the river, 24 miles above the entrance between the jetties. Large quantities of lumber, naval stores, and produce are shipped to northern and foreign ports. The city has railroad communication, and steamboat communication with northern ports and with up-river landings as far as Enterprise and Sanford, a distance of 128 miles.

Prominent features.—Mount Cornelia, 63 feet high and thickly wooded, is about 2 miles northward of the entrance. **St. Johns River lighthouse,** on the south side of the entrance, is a red brick, conical tower. The light is fixed white with a red sector from 45° to 187°, 77 feet above the water, and visible 15 miles. About 3¾ miles south of the entrance are the buildings of **Atlantic Beach,** a summer resort.

Pilots will generally be found cruising outside the bar, or they will come out to a vessel making signal for one. The bar pilots keep a lookout for approaching vessels. Up-river pilots can be obtained at Jacksonville. Bar pilotage is compulsory for certain vessels. For pilot rates, see Appendix.

Towboats are usually stationed at Mayport or Pilot Town ready to go out to any vessel making signal outside the bar; they can always be had at Jacksonville for towing up or down the river.

Quarantine.—The quarantine station is at Mayport. Vessels subject to visitation by the quarantine officer must wait to be boarded below the quarantine flag, which is displayed at the station. The local call for the quarantine officer is 1 long, 1 short, and 1 long blasts on a steam whistle.

Hospital.—At Jacksonville there is a relief station of the United States Public Health Service.

Anchorages.—Vessels waiting outside the bar generally anchor, if the wind and sea are not too heavy, in the vicinity of the gas and whistling buoy; or they can anchor, in about 6 fathoms, about 3 miles northeastward of St. Johns River lighthouse, with the end of the north jetty bearing about south.

The best and usual anchorage inside the mouth of the river is abreast Mayport, where a basin 800 feet wide with a least depth of 27 feet has been dredged on the west side of the channel.

Anchorage is not permitted in the river at Jacksonville between Hogan Creek and the Florida East Coast Railroad bridge, except for small craft on the south side of the river; large vessels can anchor below Hogan Creek. A good anchorage at Jacksonville for yachts is above the railroad bridge off Winter (Lancaster) Point.

Supplies.—Provisions can be obtained at Jacksonville and Mayport. Ship chandler's stores, anthracite and bituminous coal, and water can be obtained alongside the wharves at Jacksonville. Water can be had at the railroad wharf at Mayport.

Repairs.—There are a number of dry-docks and marine railways. The dimensions of the largest dock are: Length, 330 feet; width, 65 feet; depth over sill, 20 feet; capacity, 4,500 tons. The facilities for repairs to vessels and machinery of steamers are excellent.

Terminal facilities.—These consist of 28 general freight wharves, having a total frontage of 18,000 feet, 20 of which have both railway and highway connections; of 40 piers for general freight and boat-yard purposes, having a total berthing space of 22,000 feet, 29 of which have both railway and highway connections and 11 have high connections only. The municipal terminals at Talleyrand, about 3 miles below Jacksonville, consist of two piers. They are well equipped with railway tracks, connecting with all railways, a cotton compress, and mechanical freight-handling devices. The city also owns a modern pier in the business section. The piers have a total berthing space of 5,014 feet, with a depth of water of 18 to 30 feet. At the railroad wharf at Mayport there is a depth of 22½ feet. The facilities for loading and discharging cargoes are good.

Storm warning displays are made on one of the high buildings at Jacksonville, and are visible from the river. They are also displayed at Mayport, southwestward of St. Johns lighthouse, but do not show well to vessels at any distance outside the bar.

Tides.—For tides at Fernandina see the tide tables for the Atlantic coast of the United States, published annually in advance by the Coast and Geodetic Survey, in which the tides are predicted for every day of the current year. At the entrance between the jetties of St. Johns River the time of high and low water occurs 40 minutes earlier than at Fernandina. Proceeding up St. Johns River, the tide is later than at the entrance, as follows: Mayport, 25 minutes; Fulton, 45 minutes; Dame Point, 1 hour 10 minutes; Reddie Point, 1 hour 25 minutes; Jacksonville, 1 hour 45 minutes.

The mean rise and fall of the tides is as follows: Entrance between Jetties, 5.0 feet; Mayport, 4.2; Fulton, 3.0; Dame Point, 1.8; Reddie Point, 1.4; Jacksonville, 1.0.

Currents.—There are strong tidal currents in St. Johns River as far up as Dame Point. The currents at the entrance between the jetties require special attention. With northerly winds there is a strong southerly set on the flood at the end of the north jetty, and the conditions here are often dangerous, especially in heavy weather; in the event of a vessel becoming unmanageable, either by taking the ground or a break in the steering gear, she is almost certain to be driven on one of the jetties and become a total loss. The mean velocities in the channel at the strength of the current are as follows: Mayport, ebb 2.3 knots, flood 1.8; Long Island, ebb 1.7, flood 1.3; Dame Point, ebb 1.4, flood 1.3. The velocity of the flood is increased by northeasterly and easterly winds, and the ebb by southwesterly and westerly winds.

Slack water occurs later than the time of Mayport high and low waters, as follows: Entrance between jetties (estimated), high water 1 hour 10 minutes, low water 2 hours 0 minutes; Mayport, high water 1 hour 50 minutes, low water 2 hours 40 minutes; Fulton, high water 2 hours 30 minutes, low water 3 hours 10 minutes; New Berlin, high water 2 hours 50 minutes, low water 4 hours 0 minutes; Cummer Mill, high water 4 hours 50 minutes, low water 5 hours 50 minutes; Jacksonville, high water 4 hours 20 minutes, low water 5 hours 40 minutes.

The tidal currents set in the direction of the channel, except on the crossing from Fulton to the mouth of Clapboard Creek, where there

is some set on the ebb from the channel between Fulton and Le Barons Island, and on the flood into the sloughs northeastward of Le Barons Island.

DIRECTIONS.—The channel from sea to Jacksonville is a dredged cut from 300 to 600 feet wide, the tidal currents have considerable velocity, and strangers are advised to take a pilot. The ranges mentioned in the following directions mark the axis of the cut. Unless with a local pilot, vessels do not run the river at night; sailing vessels require a towboat.

In northeasterly gales there is generally a strong current setting southward across the entrance to the jetties. Vessels entering under such conditions must be prepared to counteract a sheer northward, as the bow enters under the north jetty, with the stern still under the influence of the cross current. Vessels have piled up on the jetty due to this condition.

1. *From northward.*—From Brunswick light vessel a 194° true (S. by W. ¼ W. mag.) course made good for 37½ miles will lead to St. Johns gas, whistling and submarine bell buoy. The principal danger in the northern approach to St. Johns River is the bar at the entrance of Nassau Sound, on which a number of vessels have been lost in recent years. In each case the vessel was standing in for the coast on a southwesterly course, obtained a sounding of over 9 fathoms (high water) in the deep hole a short distance outside the bar, and stranded before obtaining another sounding. A contributory cause for the disasters is the prevailing northerly current, which is felt until well inside the 10-fathom curve, except with northeasterly or northerly winds. The bar as marked off its northeast side by a nun buoy. St. Johns River is so well marked by the lighthouse, the jetties, and usually a number of vessels outside the bar, that it is unnecessary to get in dangerously close to the coast to recognize the entrance.

1A. *From southward.*—Approaching Cape Canaveral from southward, the 15-fathom curve is a good guide. Rounding Cape Canaveral in a depth of 15 fathoms will lead about 15 miles off the light and in sight of it on a clear night. Passing about 5 miles eastward of Hetzel Shoal gas and whistling buoy a 333° true (NNW. ½ W. mag.) course made good for 117 miles will lead to a position 2 miles eastward of St. Johns gas, whistling and submarine bell buoy; the course if made good leads within the limits of visibility of Mosquito Inlet and St. Augustine lights. On this course a set due to the prevailing current may be expected, except with northerly or northeasterly winds, of ½ to ¾ knot in a northerly direction parallel with the coast. Broken ground with least depths of 5 to 6 fathoms lies from 4 to 6 miles from the coast for a distance of 15 miles northward of St. Augustine lighthouse. A shoal about 430 yards long in an east and west direction, with a least depth of 25 feet, exists on the southern side of the approach from the sea to the passage between the jetties. From the center of the shoal St. Johns River lighthouse bears 273° true (W. ⅛ N. mag.), distant 3 13/16 miles. Depths of 38 to 40 feet are found between the shoal and the bank making off from St. Johns Point. With these exceptions the coast southward of St. Johns River is clear, and it is better to make the coast southward than northward of the entrance.

Bound southward from St. Johns River vessels, except deep-draft ones, can avoid the northerly set due to the prevailing current by following the coast at a distance of about 3 miles to abreast Mosquito Inlet lighthouse, and then shaping the course to pass outside of Hetzel Shoal gas and whistling buoy.

2. *From sea to Mayport.*—From St. Johns gas, whistling, and submarine bell buoy the course on the line of the *Wards Bank range lights* (skeleton structures, half black, half white) is 276° true (W. ½ N. mag.). When up to the outer black buoy off the bar keep northward of the range until up to the gas and bell buoy off the end of the North Jetty, and then follow the range closely, passing about midway between the north jetty and the black buoys.

When ⅜ mile inside the end of the jetty steer 255° true (WSW. ⅝ W. mag.) with *Crossover range lights* (skeleton structures, half black, half white) in line ahead. When nearly abreast gas and bell buoy No. 6 steer 289° true (WNW. ⅜ W. mag.) with *Fort George Island range lights* (white pile structures) a little open to northward. When abreast gas and bell buoy No. 1, starboard gradually and steer 245° true (SW. by W. ¾ W. mag.) with *Magic City range lights* (white skeleton structures) in line astern. When pass can buoy No. 3 starboard slowly and steer 201° true (S. by W. ⅞ W. mag.) with *Pilot Town range lights* (skeleton structures, red daymarks) in line astern. Anchorage can be had on the west side of the channel opposite Mayport.

3. *Mayport to Browns Creek.*—Pass about 100 yards from the railroad wharf, steer 230° true (SW. ⅜ W. mag.) for ½ mile until the *Mile Point lower range* (front, white pyramidal structure, black daymark; rear, white pyramidal structure, black and white daymark) is in line ahead, then steer 245° true (SW. by W. ¾ W. mag.) on this range until southward of gas buoy No. 10 and on *Mile Point middle range* (white structures, black daymarks, with white vertical stripe) ahead. Then steer 272° true (W. ⅛ N. mag.) on this range until southward of nun buoy No. 12 and on *Mile Point upper range* (front, pile structure, white daymark, black center; rear, skeleton structure, white daymark, black center) astern. The course is then 298° true (NW. by W. ⅝ W. mag.) on this range astern for ¼ mile until on *Training Wall range* (red skeleton structure), and then 306° true (NW. ¾ W. mag.) on this range ahead for 1⅛ miles until on *Short Cut range* astern; the back light of this range is St. Johns River lighthouse, and the front light is the rear light of the range leading into Sisters Creek (white pyramid structure).

Steer 271° true (W. mag.) with this range astern for ¼ mile, passing northward of gas buoy No. 11 and on *White Shells Cut lower range* (front, red daymark on pile, rear, white pyramidal structure) ahead. Steer 245° true (SW. by W. ¾ W. mag.) on this range ahead until ¼ mile from the front light of the range and on *White Shells Cut upper range* (front, red daymark on white pyramidal structure; rear, white pyramidal structure, black and white daymark) astern. Then steer 237° true (SW. by W. ⅛ W. mag.) on this range and pass southward of the front light of the *White Shells Cut lower range* (St. Johns Bluff light is ahead on this course), and then follow the south bank of the river at a distance of about 125 yards. When 300 yards past the rear light, steer about 338° true

(NNW. mag.) with *Little Marsh Island Channel range lights* in line ahead, keeping somewhat to the westward of range near the northern end of the cut.

Continue on this course until 400 yards from the front light and then steer 320° true (NW. ½ N. mag.) with two targets in line ahead, leaving light No. 6 (Little Marsh Island front) about 150 yards on the starboard hand. Then steer 300° true (NW. by W. ½ W. mag.) with *Clapboard Creek range lights* (front, red, square daymark; rear, white slatted daymark on pyramidal skeleton structure) in line ahead. On approaching the front light (No. 8) leave it nearly 100 yards on the starboard hand and follow the directions in section 4.

4. Browns Creek to Cedar Creek.—From light No. 8 follow the north bank of the river at a distance of about 100 yards, passing Vicks Island light, No. 3 (black daymark), beacon No. 5 and *New Berlin Cut range front light No. 10* (red, square daymark) at a distance of about 250 feet. Then bring this light in range astern with *New Berlin Cut range rear light* (white, pyramidal skeleton) on a 209° true (SSW. ½ W. mag.) course. Follow the bank at New Berlin at a distance of 100 yards, leave *Lower Quarantine Shoal light No. 7* (pile structure, black daymark) 75 yards on the port hand, and bring *Quarantine Island lower range* (front, black structure; rear, white structure, black daymark, white stripe) in line ahead on a 188° true (S. ⅝ W. mag.) course.

Pass about 100 yards westward from the front light (7A) and follow the curved channel westward around Dame Point, leaving *Dame Point light No. 14* and *No. 16* (close to Dame Point) about 100 yards on the starboard hand. Then bring *Quarantine Island upper range* (white skeleton structures, black daymark, white stripe) in line astern, course 326° true (NW. ⅞ N. mag.). When eastward of Petty Bank light No. 11, steer 317° true (NW. ⅛ N. mag.) with *Cedar Creek range lights* (front, square white daymark; rear, skeleton, white daymark) in line ahead.

When abreast *Dunn Creek light No. 13* (pile structure, black daymark), steer 307° true (NW. ¾ W. mag.) until *Cedar Creek range front light No. 20* (pile structure, white daymark) is abeam, distant 200 feet. Then steer 287° true (WNW. ½ W. mag.) until *Curved Channel light No. 15* (pile structure, black daymark) is abeam, distant 200 feet. Then steer 269° true (W. ⅛ S. mag.) until *Drummond Creek range front light* (pyramidal skeleton, white daymark) is 200 feet on the starboard beam. Then steer 250° true (WSW. ⅛ W. mag.) until *Cedar Creek light No. 17* (pile structure, black daymark) is abeam, distant 200 feet. Then follow the directions in section 5.

5. Cedar Creek to Jacksonville.—When light No. 17 is abeam, steer 238° true (SW. by W. ⅛ W. mag.) with *Drummond Creek range lights* (skeleton structures, white daymarks) in line astern, leaving beacon No. 22 (red pile structure) 200 yards on the starboard hand. When *Trout Creek range front light* (pile structure, white daymark) is abeam, distant 250 yards, starboard gradually and steer 196° true (S. by W. ⅜ W. mag.) with *Trout Creek range lights* (white, square daymarks) in line astern, leaving light No. 19 about 150 yards and light No. 19A about 100 yards on the port hand; the cut marked by

this range is through rock, and the sides of the cut are marked by buoys.

When 200 yards past light No. 19A, steer 173° true (S. ⅝ E. mag.) for ¼ mile and haul a little eastward to leave *Six Mile Creek light No. 19B* (black daymark) 125 yards on the port hand. Follow the east bank of the river at a distance of about 400 yards for nearly 1 mile, and then steer 195° true (S. by W. ¼ mag.), and leave lights Nos. 21 and 21A (pile structures, black daymarks) 100 yards on the port hand. When up to nun buoy 18 and *Six Mile Creek range lights* (front, white skeleton structure; rear, black skeleton structure) are in line ahead steer 128° true (SE. ⅝ E. mag.) for them. When ¼ mile from the front light port to meet the *City Limits range* (front, black daymark on pile structure; rear, black daymark, vertical stripe on skeleton structure). When the range is on, steer for it on a 176° true (S. ⅜ E. mag.) course, until *Arlington Cut range* (skeleton structures) comes on range astern. Then steer 195° true (S. by W. ¼ W. mag.) with the range astern until 200 yards southward of light 21A (black daymark on pile structure).

Then follow a mid-river course, passing northward of can buoys Nos. 17 and 19 and southward of gas buoy No. 22, to the wharves at Jacksonville.

ST. JOHNS RIVER ABOVE JACKSONVILLE.

Between Jacksonville and Palatka, a distance of 47 miles (all distances are nautical miles), the river has been improved by dredging a channel with a least depth of 10½ feet. This part of the river is comparatively easy to navigate with the aid of the chart. A draft of 9 feet can be taken to Welaka, 65 miles above Jacksonville; 7 feet to the head of Lake George, 85 miles; 6 feet to Sanford, 127 miles; and 5 feet to Lake Poinsett, 195 miles above Jacksonville, which is the present head of steamboat navigation. Lake Washington, 216 miles above Jacksonville, is the head of navigation.

Steamers make regular trips on the river between Jacksonville and Sanford. The principal traffic is in lumber, produce, and general merchandise. Schooners occasionally load lumber at Green Cove Springs and Palatka. There are numerous landings on the river, some of which are winter resorts, and others are centers of farming districts and orange groves. The more important places on the river are Green Cove Springs, Palataka, Welaka, Astor, and Sanford. The unimproved creeks tributary to St. Johns River are apt to be obstructed by logs and hyacinth.

McGirts Creek, 3 miles above the F. E. C. Railway bridge at Jacksonville, is crossed by two drawbridges near its mouth. A draft of about 5 feet can be taken across the bar above the bridges into the narrower part of the creek.

Doctors Lake, 11 miles above Jacksonville, has a depth of 7 to 8 feet in the entrance, and is occasionally used as a fresh-water anchorage.

Julington Creek, 13 miles above Jacksonville, has a least depth of 5 feet for a distance of 3 miles to the forks, and the same depth can be taken about 3 miles up both branches.

Black Creek, 18 miles above Jacksonville, is navigable for vessels of 6 feet draft about 15 miles to the village of **Middleburg**. The creek just inside its entrance is crossed by a drawbridge.

Green Cove Springs, a village on the west bank 20 miles above Jacksonville, has several sawmills. There is a depth of about 7 feet at the wharves.

Trout Creek and **Six Mile Creek** have a common entrance about 24 miles above Jacksonville. These creeks are navigable about 3 or 4 miles for boats of 6 feet or less draft.

Deep Creek, 36 miles above Jacksonville, is navigable for a draft of 7½ feet for a distance of about 4 miles to **Hastings,** a town on the railroad.

Rice Creek, 44 miles above Jacksonville, is navigable for small craft of 6 feet or less draft about 5 miles to the forks and a short distance up both branches. Two drawbridges cross the creek a short distance above its mouth.

Palatka is an important town and railroad center on St. Johns River, 48 miles above Jacksonville. There are large sawmills, a manufactory of wooden tanks, a machine shop, and a railway capable of taking out vessels 125 feet long and 8 feet draft. Supplies and fresh water can be had. The depths at the wharves between the bridges are 10 to 16 feet, and a channel 12 feet deep has been dredged to the wharves just above the upper bridge. The deepest draft loaded is 14 feet. Pilots for St. Johns River and tributaries can be had here.

Dunns Creek, 6½ miles above Palatka, is navigable for boats of 8 feet draft to **Crescent Lake,** a distance of 7½ miles, and thence up the lake 6½ miles to **Crescent City,** a town with railroad communication. Supplies, ice, and gasoline can be obtained, and there is a railway for small craft. A depth of 5 feet can be taken into **Haw Creek** at the head of Crescent Lake. The channel in Crescent Lake is marked by lights. A drawbridge crosses Dunns Creek ¾ mile above its entrance from St. Johns River. Some of the bends in the creek are sharp.

A drawbridge with a clear opening 80 feet wide crosses the river at Buffalo Bluff, 9¾ miles above Palatka.

Welaka is a village 18¼ miles above Palatka. Supplies, gasoline, and water can be obtained. A draft of 9 feet can be taken up St. Johns River to the wharf at Welaka.

Oklawaha River, 19 miles above Palatka, is extremely tortuous and obstructed by shoals, and the upper part above Silver Springs Run by hyacinth and eel grass. Improvements are in progress to obtain a channel 6 feet deep for a distance of 46 miles from St. Johns River to the mouth of **Silver Springs Run** and 6 miles up the latter to the village of **Silverspring,** 4 feet deep from the mouth of Silver Springs Run to **Leesburg,** 82 miles from St. Johns River, which is the head of steamboat navigation, and the construction of a lock and dam at Moss Bluff to retain the water level in Lake Griffin. In 1921 there was a channel 6 feet deep for a distance of 28 miles from St. Johns River, a practicable channel 4 feet deep to Silver Springs Run, and a channel 2 feet deep to Leesburg. Snags are liable to be encountered by boats. Leesburg and Silverspring have railroad communication. There is a downstream current in the river of about 1 knot. A pilot for the river can be obtained at Palatka and sometimes at Welaka.

Astor is a village with railroad communication 5 miles above Lake George and 42½ miles above Palatka.

Wekiva River, 72 miles above Palatka, is navigable for boats of 3½ feet draft to **Clay Springs,** a winter resort about 18 or 20 miles above its mouth.

Sanford is an important town and railroad center on the south side of **Lake Monroe,** 80 miles above Palatka.

The **channel** from Jacksonville to Palatka has been obtained partly by dredging; it is well marked by lights and beacons, and is comparatively easy to navigate with the aid of the chart. Some local knowledge is required above Palatka to follow the channel. In the upper part the river is narrow and tortuous in places, and difficulty may be experienced in making some of the bends; also vessels with masts may have some difficulty from overhanging trees.

A **pilot** for the river and its tributaries can be obtained at Jacksonville, Palatka, and Sanford.

Tides.—From Jacksonville to Palatka the mean rise and fall of tides is 0.9 foot, and the tidal action is felt to Lake George. When not affected by strong winds, the tidal currents have little velocity above Jacksonville. The winds have considerable effect on the water level and velocity of the currents. Northeast gales cause high water in the river above Jacksonville; westerly or southwesterly winds cause low water and increase the velocity of the ebb, and decrease or may interrupt the flood. The river water may be fresh at Jacksonville at low water with westerly winds; with northeasterly winds brackish water may extend up to Doctors Lake. The usual variation of water level in the upper river due to freshets is 3 feet.

COAST FROM ST. JOHNS RIVER TO CAPE FLORIDA.

From St. Johns River to Miami there is an inland waterway, which parallels the coast and which is good for a draft of 4 feet; this route is described in the **Inside Route Pilot, New York to Key West,** price 30 cents.

From St. Johns River to Cape Canaveral the coast trends south-southeastward for 125 miles, and is broken by three unimportant inlets. The coast shows an almost continuous range of sand hills backed by woods; the woods in the vicinity of Cape Canaveral and for a distance of 17 miles northward are farther back from the beach, and consequently are less distinct when seen from seaward.

The depths along this stretch of coast are irregular. Except off St. Johns River and St. Augustine and Mosquito Inlets, 5 to 7 fathoms can be taken as close as 1 mile and 3 fathoms as close as ⅜ mile to the beach until approaching Cape Canaveral. Broken ground, with spots having 5 to 6 fathoms over them, lies from 4 to 6 miles offshore, and from 12 to 16 miles north-northeastward of St. Augustine lighthouse. There is a channel with depths of 6½ to 7¼ fathoms inside the shoal and about 2 miles from the beach. The shoals are about 8 miles long in a southeasterly direction and about 2½ miles wide.

ST. AUGUSTINE INLET.

This inlet is the entrance to St. Augustine Harbor and the approach from sea to the city of St. Augustine. The inlet is about 30 miles southward of the entrance to St. Johns River and is marked on its southern side by St. Augustine lighthouse. The entrance to

the inlet is obstructed by a shifting shoal which extends 1½ miles seaward and form a dangerous bar over which the channel depth is about 7 feet at mean low water. The channel is marked by small buoys and by a perpendicularly striped sea buoy, which are shifted to the best water. Strangers should always take a pilot. Although there is good anchorage inside of the inlet it is not used as a harbor of refuge, because in strong easterly winds the sea makes the bar impassable even for small vessels.

Tolomato or North River enters the inlet from the northward just inside the point of the North Beach. It rises about 15 miles northward of the inlet, has an average width of ¼ mile, and depth of 15 feet for several miles from its mouth. It is important in being a part of the inland water route.

Matanzas River enters the inlet from the southward. It is about 15 miles long to Matanzas Inlet and separates Anatasia Island from the mainland. Above St. Augustine the river has a narrow channel with a depth of 10 feet for a distance of 8 or 10 miles.

San Sebastian River flows past the west side of St. Augustine and empties into Matanzas River 1½ miles south of the bridge. It is said to have a depth of 4 to 5 feet at the entrance, the best water leading along the north side of the entrance, and 7 feet inside as far as the highway bridge. Supplies may be taken at a wharf on this river on the west side of the city.

The city of **St. Augustine** is situated on the west bank of the Matanzas River opposite the north end of Anatasia Island. It is of no commercial importance, but a popular winter resort.

Prominent features.—St. Augustine lighthouse is a black and white, spirally banded, conical tower. The light is fixed white varied by a white flash of 5 seconds duration every 180 seconds. Radio towers about 200 yards northward of the station are prominent. A black water tank in St. Augustine shows up well seaward.

Supplies.—Provisions, water, gasoline, and some coal can be had here.

Repairs.—There are facilities for making minor repairs to hulls and machinery and ways for hauling out craft of 10 tons. The nearest place for general repairs is Jacksonville.

Storm warnings are displayed from a tower at Fort Marion, on the water front.

Tides.—The average rise and fall of tides is 4.5 feet, and high water occurs at the same time as at Fernandina.

DIRECTIONS.—When approaching St. Augustine Inlet, the shore should be given a berth of at least 1½ miles, so as to keep outside the sea buoy.

No stranger should attempt to enter without a pilot, as the channel shifts frequently, and no information as to buoys or courses would be reliable for any length of time. The master of a vessel bound for St. Augustine should telegraph to the harbormaster the probable date of her arrival off the bar, so that a pilot can be on the lookout for her.

Matanzas Inlet is 11 miles southward of St. Augustine lighthouse. It affords an outlet for Matanzas River, which extends northward to St. Augustine and southward, following the coast for a distance of 8 or 10 miles to Graham Swamp, in which it takes its rise. There

is a depth of 3½ feet on the bar at mean low water, but the channel in the mouth of the inlet is obstructed by a ledge of rock, over which the depths vary from 2 to 9 feet. Strangers should not attempt to use this inlet.

A canal runs southward from Matanzas Inlet for 21½ miles to Halifax River and parallels in general the coastline. It is part of the coastal inland waterway and is fully described in the Inside Route Pilot, previously referred to.

Mosquito Inlet is about 53 miles southward of St. Augustine lighthouse and 41 miles northwestward of Cape Canaveral lighthouse. About 1 mile northward of the entrance is Mosquito Inlet lighthouse, a red brick conical tower from which is shown a fixed white light, 159 feet high and visible 19 miles. The entrance, which is about ½ mile wide, is obstructed by shifting shoals, which extend about ¾ mile seaward and form a bar, over which there is a channel depth of about 6 feet. Buoys mark the best water and are shifted to conform to the channel changes. The inlet is easy to enter on a smooth sea, but in case of necessity the lighthouse keeper will pilot in or out. The average rise and fall of tides is 2.3 feet; high water occurs 15 minutes before high water at Fernandina.

Halifax River extends north from the inlet about 25 miles, running parallel to the beach, from which it is separated by a low strip of land only ¼ to ½ mile in width. **Ponce Park**, near the inlet, **Port Orange**, **Daytona**, and **Ormond**, stations on the Florida East Coast Railway, are the principal landings on the river. Opposite Daytona and on the outer beach are Daytona Beach and Sea Breeze. They show up well from seaward.

Hillsborough River extends southward from the inlet for a distance of 15½ miles to Mosquito Lagoon. The river in some places is narrow and crooked and requires careful steering and close attention to the channel stakes. A drawbridge crosses the river 1¾ miles above the inlet. The only place of any importance on the river is **New Smyrna**, a winter resort on the west bank 2 miles above the inlet. The draft that can be carried to the town is limited only by the depth on Mosquito Inlet bar. The depth at the city dock is 14 feet. This is piped with fresh water. Provisions, gasoline, and pilots for the inland water can be obtained here. There are strong tidal currents in front of the town.

COAST FROM MOSQUITO INLET TO CAPE CANAVERAL.

The distance from Mosquito Inlet to Cape Canaveral is 40 miles. The coast trends about southeast by south in nearly a straight line for 32 miles to False Cape; thence to Cape Canaveral, 9 miles, it trends south-southeasterly. It is bold to the vicinity of False Cape, between which and Cape Canaveral there are dangerous outlying shoals. Off Mosquito Inlet 10 fathoms will be found within 2 miles of the beach. Going southward the 10-fathom curve gradually works offshore to a distance of 10 miles off False Cape. For about 25 miles south of Mosquito Inlet the coast is formed by a very narrow strip of lowland lying between the sea and Hillsborough River and Mosquito Lagoon. Seen from seaward it shows a low line of sand hills partly covered with grass and scrub, with distant woods show-

ing over. The only natural object at all distinctive in appearance is **Turtle Mound**, a green hillock about 10 miles south of the inlet. This when seen from the northward and eastward is quite conspicuous, but from other points of view is less marked.

False Cape is the name given to a small part of the coast about 9 miles northward of Cape Canaveral, which it resembles when seen from seaward.

Cape Canaveral, where the coast makes a sharp bend westward, is low and sandy, and is marked by Cape Canaveral lighthouse.

Cape Canaveral lighthouse is a white and black, horizontally banded, conical iron tower. The light is flashing white (flash 5.0 seconds, eclipse 55.0 seconds), 137 feet above the water, and visible 18 miles. Vessels may communicate with the lighthouse by the International Signal Code.

Broken ground and shoals extend 13 miles northward and northeastward from Cape Canaveral, terminating in **Hetzel** and **Ohio Shoals**, which have a depth of 11 and 19 feet, respectively. Hetzel Shoal gas and whistling buoy (flashing white light) is moored in a depth of 11 fathoms off the northeast side of Hetzel Shoal, about 13½ miles 34° true (NE. by N. mag.) of Cape Canaveral lighthouse. A depth of 12 feet has been reported ⅝ mile northward of the gas buoy and 14 feet 4 miles northwestward of the buoy. Ohio Shoal buoy (can No. 1) is moored in a depth of 21 feet 2¼ miles southward of Hetzel gas and whistling buoy. The least depths found on the inner shoals range from 9 to 16 feet, the shoals are subject to some change in position and depth, and only small, light-draft craft can safely pass inside the outer shoals. In a heavy sea the shoals are marked by breakers, but with a smooth sea there is nothing to indicate them except the buoys marking Hetzel and Ohio Shoals and Cape Canaveral lighthouse.

The effect of the Gulf Stream may be expected well in on the shoals, and this should be kept in mind in approaching the shoals from southward, as a vessel will generally overrun her log. Approaching from southward 15 fathoms is a good depth by which to avoid the shoals, from northward 13 fathoms. Vessels are advised to use great care when navigating in the vicinity of the shoals off Cape Canaveral.

From Cape Canaveral to Lake Worth Inlet the coast trends generally south-southeastward for 104 miles and is broken by **Fort Pierce Inlet** and **St. Lucie Inlet**. **Indian River Inlet** and **Jupiter Inlet** are now closed. This section of the coast is formed almost entirely by a low, narrow strip of sand, covered with vegetation, which lies at a distance of 1 to 2 miles from the mainland, from which it is separated by the shallow waters of **Banana** and **Indian Rivers**, a part of the inland waterway. From seaward the coast shows a line of sand hills partly covered with grass and scrub palmetto. Behind all is the background of heavy woods on the mainland.

The coast between Cape Canaveral and Lake Worth Inlet has broken ground in places, which extends off a greatest distance of about 10 miles at Bethel Shoal (least depth 28 feet). **Bethel** shoal gas and whistling buoy (flashing white light) is moored in a depth of about 8 fathoms close eastward of the shoal and about 11 miles

from shore; it lies 47 miles southward of Cape Canaveral and the same distance northward of Jupiter Inlet lighthouse. For a distance of 25 miles southward of Bethel Creek house of refuge broken ground with 3 to 4 fathoms over it extends from 2½ to 5 miles offshore. The principal danger is St. Lucie Shoal, with 16 to 24 feet over it, which lies from 3 to 6 miles offshore, and 22 to 26 miles northward of Jupiter Inlet lighthouse. A red and black nun buoy lies off the northern end of the 18-foot curve. A shoal, on which the least depth found is 5¾ fathoms, lies 3 miles from shore off St. Lucie Inlet, 13 miles northward of Jupiter Inlet lighthouse. A depth of 6½ fathoms has been found on the shoal, which extends 3 miles from shore about 3 miles northward of Jupiter Inlet lighthouse. These shoals should be avoided by deep-draft vessels; the 15-fathom curve is a safe guide.

Jupiter Inlet lighthouse is a red-brick tower. The light is fixed white varied by a white flash of 3.6 seconds duration every 90 seconds, 146 feet above the water, and visible 18 miles. Near the lighthouse are a radio station and a storm-warning display station.

From Lake Worth Inlet to Cape Florida the coast trends generally southward for 62½ miles and is broken by Hillsboro and New River Inlets. This section of the coast is formed almost entirely by a low sand beach, with more or less conspicuous hills partly covered with grass and scrub palmetto, back of which it is wooded. Aside from the lighthouse the only prominent landmarks along this section of the coast are the large hotels and piers at **Palm Beach**, a popular winter resort, 14½ miles southward of Jupiter Inlet lighthouse.

The coast between Lake Worth Inlet and Cape Florida is fairly bold; the 20-fathom curve runs parallel to the beach, and for a greater part of the distance is less than 2 miles from it; inside this curve the shoaling is rapid, and 6 to 8 fathoms are found in places 1½ miles from the beach.

Hillsboro Inlet lighthouse is an octagonal, pyramidal, iron, skeleton tower, lower third white, upper two-thirds black. The light is flashing white (flash ¼ second, eclipse 9¾ seconds), 136 feet above the water, and visible 18 miles.

Cape Florida, 36 miles southward of Hillsboro Inlet lighthouse, is the southern point of Key Biscayne; it is marked by a disused lighthouse (red tower).

BISCAYNE BAY AND MIAMI.

Biscayne Bay is a large, shallow body of water, commencing in latitude 25° 55′ N. and extending in a southerly direction about 33 miles to Card Sound. For the first 10 miles the bay has a width of about 2 miles, and is separated from the Straits of Florida by a narrow peninsula, and Virginia Key, and Key Biscayne. For the remainder of the distance the average width of the bay is nearly 7 miles, and it is separated from Hawk Channel by a number of keys and coral banks, between which there are several narrow and shallow passages. A great part of the bay has depths of 9 and 10 feet, and there are a few places with depths of 13 to 15 feet; but near its head it is very shallow. A draft of 14 feet can be taken into the bay through what is known as Main Channel, and this draft can be taken to the city of Miami.

Biscayne Channel leads from Cape Florida Shoal light (about 2 miles southeastward of Cape Florida) in a northwesterly direction, and then west, through one of the slues between the reefs, into Biscayne Bay. This channel has been improved by dredging, but is narrow in places; it is marked by several beacons, and has a depth of 9 feet.

Snake River empties into the bay from northward and 4 feet can be brought through the inland waterway from the north.

Miami is on the west shore of Biscayne Bay, 9 miles below its head and 7 miles above Cape Florida. It is a popular winter resort, and is growing in commercial importance. A large number of yachts are present during the winter season. It is on the Florida East Coast Railway, which extends across the Florida Keys to Key West.

Supplies.—Provisions, ship chandlery, coal, fuel oil, fresh water, and gasoline may be obtained.

Repairs.—There are good facilities for repairing hulls and machinery of small craft and several marine railways, at the largest of which vessels of 200 tons and 8-foot draft can be hauled.

Quarantine.—There is a quarantine station at Miami.

Pilotage.—The pilot charges for the port of Miami are given in section 1300, General Statutes of Florida, given in the Appendix, page 185.

Harbor control.—The harbor master controls the anchorages and berths. On account of the harbor not being thoroughly dredged there are no specified anchorages.

Wharves.—There is 11 feet at the railroad wharf near the upper end of the water front. The city of Miami has constructed a pier a little north of the railroad wharf, dredged a turning basin 18 feet deep in front of the wharf, and connected it by a channel 12 feet deep and 100 feet wide with a basin in front of the railroad wharf. There are depths of 4 to 5 feet at the wharves from the clubhouse dock southward to the southerly wharf on the east side of the city. Improvements are contemplated along the city water front that will involve building a sea wall southward from a point south of the railroad wharf and filling in behind to reclaim several acres of ground. A wharf with 15 feet alongside is located near the eastern end of the causeway crossing the bay.

Miami River trends westward, through the southern part of the city of Miami to the Everglades, and is navigable for a draft of 6 feet into the drainage canal, about 3 miles above its mouth. The drainage canal leading to Lake Okechobee from Miami is navigable with difficulty for very small craft only at the present time. Dredging is now being carried on. For further information concerning the waterway across Florida see Inside Route Pilot, New York to Key West. Three drawbridges cross the river, to the lowest of which a draft of 8 feet can be carried. The main entrance is from well southward of the city and is marked by piles on both sides and a lighted range. To enter the river through this channel, bring the Miami River range on astern course 336° true (NNW. ¼ W. mag.) and follow the starboard land beacons to Brickell Point. A depth of 15 feet in a cut 60 feet wide can be taken into the river directly from the South Channel on a westsouthwesterly heading. The entrance is east of the Royal Palm Hotel and is marked by a lighted beacon and the cut by single pile beacons with white pointers.

Channels.—The bay in front of and just south of Miami is very shallow, except where channels have been dredged. One channel leads from the deeper water south of the city to a turning basin at the railroad wharf and another from the jettied channel entrance; both are marked by piles and beacons.

The main entrance to Miami from the sea is through a jettied channel east-southeastward from Miami. This channel had a depth of 14 feet in June, 1921, and work was still in progress. A channel 100 feet wide and 15½ feet deep leads from the entrance along the south side of a causeway to the railroad and city piers at Miami. The entrance is marked by buoys, and the channel across the bay by lights.

Miami Beach is located on the outside beach eastward of Miami. There is good anchorage for small craft eastward of Star Island.

Tides.—The mean rise and fall of tides is 1.2 feet. High water occurs at Miami 10 minutes before high water at Key West.

DIRECTIONS.—*Through the Main Channel.*—Vessels approaching Miami entrance from northward or southward outside of Hawk Channel should not shoal the water to less than 15 fathoms until off the entrance and Miami gas and bell buoy (flashing red) has been picked up. Passing 100 yards northward of the buoy steer 252° true (WSW. ¼ W. mag.) for 1¼ miles, when Miami entrance gas buoy (flashing white) should bear 291° true (WNW. ¼ W. mag.). Then steer 295° true (NW. by W. ⅞ W. mag.), passing close to it and enter the dredged channel between the rock jetties. Considerable tidal current may be expected between the jetties and careful steering will be necessary. Continue the course, being guided by the lights, beacons with finger boards pointing to the channel, and buoys marking the cut to the turning basin just off the municipal pier. The cut is close to a causeway which it parallels for the greater part across the bay.

Through Biscayne Channel.—Vessels up to 10 feet draft can come to the railroad or city wharf at Miami through a channel between the shoals south of Cape Florida to Key Biscayne Bay, thence up the bay to a dredged channel leading to the wharves. This channel is well marked by beacons and buoys.

The following directions are good for a draft of 8 feet to Miami; a draft of about 10 feet can be taken to the city, but requires local knowledge. The partly dredged channel from Cape Florida Shoal light through Biscayne Channel is well marked by beacons and lights. At times the currents have considerable velocity and require some attention.

Vessels can follow Hawk Channel to the perpendicularly striped buoy off the entrance; or, from outside, pass close to the bell buoy 2⅜ miles northward of Fowey Rocks lighthouse and steer 228° true (WNW. ½ W. mag.) for Cape Florida Shoal light (red house on piles) in range with Biscayne Channel light (red slatted structure on piles). Pass about 150 yards southwestward of Cape Florida Shoal light and haul a little northward, keeping in the channel marked by the beacons until up to Biscayne Channel.

The course through Biscayne Channel is about 271° true (W. mag.) with Biscayne Channel light (red structure) a little on the starboard hand. Leave the light about 200 feet on the starboard

hand, and then steer 310° true (NW. ½ W. mag.) for ⅝ mile until up to a lighted beacon.

Pass eastward of this beacon and steer 357° true (N. ⅜ W. mag.) for 2½ miles to lighted beacon No. "17" and then steer 12° true (N. by E. mag.) for 2½ miles to the lighted beacon at the entrance of the dredged channel. Then follow the dredged channel as marked by beacons to the turning basin in front of the municipal pier. From beacon No. 18 a lighted range leads through a dredged cut marked by beacons into the mouth of Miami River. See page 124.

FLORIDA KEYS AND REEFS.

The Florida Keys consist of a remarkable chain of low islands, beginning with Virginia Key, in about latitude 25° 45′ N., longitude 80° 09′ W., and extending in a circular sweep to Marquesas Keys, in latitude 24° 33′ N., longitude 82° 10′ W., a distance of nearly 145 miles. For a distance of nearly 100 miles they skirt the southeast coast of the Florida peninsula, from which they are separated by shallow bodies of water known as Key Biscayne Bay, Card Sound, Barnes Sound, and Florida Bay, which are connected in the order named. Biscayne Bay has a depth of 9 to 10 feet for a great part of its length; the other bodies of water are shallow, full of small keys and shoals, and of no commercial importance excepting as a cruising ground for small boats. Westward of Florida Bay the Florida Keys separate the Straits of Florida from the Gulf of Mexico.

No detailed description of the keys can be given and none is necessary. They are mostly of coral formation, all are low and for the most part covered with a dense growth of mangroves, though some are well wooded with pine, and on a few are groves of coconut trees. Pineapples are being largely cultivated on the keys. Nearly all of the keys along the Hawk Channel are inhabited, but the only place of importance is Key West.

A railroad has been built across the keys to Key West. The openings under the viaduct and bridges are indicated on the charts. There are two drawbridges, at **Indian Key** and **Moser Channel**, through which a depth of 5 to 7 feet can be taken from Hawk Channel to Florida Bay and the Gulf of Mexico. These channels are only used by small craft which trade among the keys, and should not be attempted by a stranger without a pilot. The route along the north side of the keys from Miami to Bahia Honda is described in the Inside Route Pilot, New York to Key West.

The currents have a velocity of 3 to 4 knots through the openings between the keys. See also p. 38.

Florida Reefs.—The Florida Keys are skirted on the side next to the straits throughout their whole extent by the Florida Reefs, a chain of dangerous reefs and shoals lying at an average distance of about 5 miles from the line of keys. Between the chain of reefs and keys there is a passage called Hawk Channel. The reefs are more dangerous from the fact that they are not marked by breakers in smooth weather and few show above water. On the outer edge of and between the reefs the water shoals abruptly.

In approaching the reefs from seaward warning of their proximity will usually be given by a difference in the color of the water, which will change from deep blue to light green. Too much dependence must not, however, be placed upon this warning. In clear weather the lighthouses and beacons make navigation along the reefs easy; in thick weather the lead must be relied upon for safety. Soundings in 50 fathoms will assure the navigator of being within about 2 to 3 miles of the reefs, and great caution should be used in approaching them closer. Fogs, however, are not frequent in this locality.

Fowey Rocks lighthouse is a brown, pyramidal, skeleton tower on pile foundation, inclosing a white dwelling and stair cylinder. The light is group flashing white, 2 flashes every 10 seconds with red sectors, 110 feet above the water, and visible 16 miles. Storm signals are displayed during daytime only.

Pacific Reef lighthouse is a white, square pyramidal skeleton structure. The light is a flashing white every 3 seconds, 45 feet above the water, and visible 12 miles.

Carysfort Reef lighthouse is a dark brown, pyramidal, skeleton tower on pile foundation, inclosing a dwelling and stair cylinder. The light is group flashing white, 3 flashes every 20 seconds, with red sectors, 100 feet above the water, and visible 16 miles. Storm signals are displayed during daytime only.

Molasses Reef light is a brown, square, pyramidal, skeleton structure. The light is flashing white every 5 seconds, 45 feet above the water, and visible 12 miles.

Alligator Reef lighthouse is a white, pyramidal, skeleton tower on black pile foundation, inclosing a white dwelling and stair cylinder. The light is group flashing white, four flashes of 0.5 second each separated by eclipses of 2 seconds each and followed by an eclipse of 7 seconds, 136 feet above the water, and visible 18 miles. The flashes show red within the limits of the red sectors. Storm signals are displayed during daytime only.

Sombrero Key lighthouse is a brown, pyramidal, skeleton tower on pile foundation, inclosing dwelling and stair cylinder. The light is group flashing white, 5 flashes every 15 seconds, with red sectors, 142 feet above the water, and visible 18 miles. Storm signals are displayed during daytime only.

American Shoal lighthouse is a dark brown, pyramidal, skeleton tower on pile foundation, inclosing dwelling and white stair cylinder. The light is flashing white (light 1.2 seconds, eclipse 3.8 seconds) with red sectors, 109 feet above the water, and visible 16 miles. Storm signals are displayed daytime only.

Key West lighthouse is a white conical tower. The light is occulting white, with red sectors, 91 feet above the water, and visible 14 miles.

Sand Key lighthouse is a brown, pyramidal, skeleton tower, on pile foundation, inclosing dwelling and stair cylinder. The light is group flashing, 2 flashes every 10 seconds, with red sectors, 109 feet above the water, and visible 16 miles. Storm warnings are displayed at this station.

Rebecca Shoal lighthouse is a white, square structure on a brown pile foundation. The light is a group flashing white, 3 flashes every 15 seconds, with a red sector, 66 feet above the water, and visible 14 miles.

Dry Tortugas lighthouse is a conical tower, lower half white, upper half black. The light is flashing white (light 1.0 second, eclipse 19.0 seconds), 151 feet above the water and visible 18 miles.

HAWK CHANNEL.

The navigable passage inside the Florida Reefs from Cape Florida to Key West, a distance of about 127 miles, is known as Hawk Channel. It varies in depth from 10 feet to 5¾ fathoms and is ¼ mile wide at its narrowest part.

Vessels drawing 10 feet, bound southward and westward, may use this channel with great advantage, avoiding entirely the adverse current of the Gulf Stream and finding comparatively smooth water in all winds, except when passing the large openings between the reefs in southerly winds; these openings are principally between Alligator Reef lighthouse and American Shoal lighthouse. Steamers, or sailing vessels with a leading wind, may run the courses through this channel without difficulty. Sailing vessels drawing more than 7 feet are advised not to try to beat through without a pilot.

Pilots can generally be found by anchoring off Miami and sending a boat up to the city, or they may be had at Key West and from the small vessels which will sometimes be found cruising among the reefs.

Strangers using this channel must anchor at night, which can be done where the bottom is soft. Where the bottom is hard the holding ground is bad, and vessels are liable to drag if it blows freshly. Following is a description of the anchorages, given in their order when approaching from northward:

Cape Florida Anchorage is a good anchorage for vessels of about 9 feet draft, and especially for small craft, just inside Cape Florida. To enter, follow the beacons of the Biscayne Channel (see directions for Biscayne Bay) until about 1 mile above Cape Florida Shoal light and the channel begins to bend westward, and then steer about 313° true (NW. ¼ W. mag.). Anchor about 250 yards westward of the south end of Cape Florida, with the disused light tower bearing northward of 69° true (ENE. mag.), in a depth of 12 to 20 feet.

Fowey Rocks Anchorage is about 1¼ miles westward of Fowey Rocks lighthouse, is fairly well sheltered, and can be reached by vessels of about 14 feet draft. Vessels of this draft may follow the directions for entering Hawk Channel and anchor ¼ mile westward of Fowey Rocks beacon (spindle V); or, from outside, pass close to the bell buoy 2⅜ miles northward of Fowey Rocks lighthouse and steer 288° true (WNW. ½ W. mag.) for Cape Florida Shoal light in range with Biscayne Channel light for 1¼ miles until up with a perpendicularly striped buoy. Then steer 182° true (S. mag.) to the anchorage.

Legare Anchorage lies between the reefs westward of Triumph Reef and 7 miles southwestward of Fowey Rocks lighthouse. The bottom is mostly hard, but there are some soft spots on which vessels may anchor and ride out a moderate gale. The entrances are not marked, and the anchorage is not used.

Bowles Bank Anchorage, with depths of 14 to 16 feet, soft bottom in places, is good in all winds, and lies ¼ to ½ mile north-northeast-

ward of Bowles Bank south buoy (nun, No. 4 B B), lying eastward of the north end of Elliott Key.

Caesar Creek Bank Anchorage, with depths of 10 to 12 feet, soft bottom, is good in all winds, and lies on the west side of the channel between Margot Fish Shoal and Caesar Creek Bank.

Key Largo Anchorage.—Northward and westward of the perpendicularly striped buoy off the north end of Key Largo, with Carysfort Reef lighthouse bearing about 150° true (SSE. ¾ E. mag.), soft bottom in 14 feet will be found and vessels may here anchor in safety without regard to the direction of the wind.

Turtle Harbor is a well-sheltered anchorage between the reefs lying northwestward of Carysfort Reef lighthouse. The entrance from the Straits of Florida is marked by buoys, and in smooth water a vessel of 15 feet draft should have no trouble in entering. The depth in the approach ranges from 4 to 6 fathoms and at the anchorage from 4 to 4½ fathoms. The sea buoy (nun, red, No. 2 "Turtle Harbor") lies 4¾ miles 30° true (NNE. ½ E. mag.) of Carysfort Reef lighthouse. From the sea buoy a 274° true (W. ¼ N. mag.) course for 2⅛ miles will lead to a perpendicularly striped buoy. Then steer 220° true (SW. ⅝ S. mag.) for about 1 mile, pass about 100 yards westward of can buoy No. 1 and the same distance eastward of nun buoy No. 2. A south-southwesterly course will then lead about midway between nun buoy No. 4 and can buoy No. 3, and then steer about 215° true (SW. by S. mag.) to an anchorage in the vicinity of a perpendicularly striped buoy.

Tavernier Key Anchorage.—Anchorage with soft bottom, in 16 to 20 feet, will be found with Tavernier Key bearing between west and northwest, distant from ¾ to 1 mile, or anchor in 13 to 15 feet from ½ to ¾ mile westward or northward of Triangles beacon.

Long Key Anchorage.—Soft bottom, in from 15 to 18 feet, will be found ¾ mile westward of Long Key Shoal buoy (nun, red, No. 12), but this anchorage is exposed to southerly winds.

Turtle Shoal Anchorage.—Fair anchorage in fine weather will be found in 4½ fathoms, soft bottom, ½ mile northwestward of East Turtle Shoal buoy (can, black, No. 11 E T), and also ½ mile northwestward of West Turtle Shoal buoy (nun, red and black horizontal stripes), in from 4 to 6 fathoms.

Knights Key Anchorage.—This is a good anchorage about ¾ mile southwestward of Knights Key, but it is exposed to southwesterly winds. To make this anchorage, bring Sombrero Key lighthouse astern on a 343° true (N. by W. ⅝ W. mag.) course; anchor in 3 to 5 fathoms, sticky bottom. The westerly edge of a red sector in Sombrero Key lighthouse leads to the anchorage. The west side of Knights Key should be given a berth of about ½ mile.

Hog Key.—A narrow channel with a least depth of about 6 feet has been dredged to Hog Key, and affords a secure harbor for launches and small craft. The entrance is about ⅜ mile southward of Knights Key, and is marked by private beacons. The color of the banks is the best guide in the narrow channel.

Moser Channel, with a least depth of 7 feet, leads from Hawk Channel through a drawbridge (106 feet opening) into Florida Bay. A strong current may be found in the vicinity of the bridge, sometimes reaching a velocity of about 4 knots at strength.

Bahia Honda Harbor is now abandoned as an anchorage for vessels, and the aids are removed. The currents through the bridge have a velocity of 3 to 4 knots.

Loggerhead Key Anchorage, with a depth of 15 feet, soft bottom, is about ¾ mile eastward of Loggerhead Key and about 1 mile northward of nun buoy No. 12LK. This is a fair anchorage in all but southerly winds. When going to the anchorage pass at least ¼ mile eastward of the buoy.

West Washerwoman Anchorage, with a depth of 3¾ fathoms, soft bottom, lies 1⅛ miles 295° true (WNW. mag.) of Nine-Foot Shoal light.

Saddle Hill Anchorage, with a depth of 4¼ fathoms, soft bottom, lies 1 mile 268° true (W. ⅜ S. mag.) of Pelican Key buoy (can, No. 19 PK). Between here and Key West there are no anchorages.

DIRECTIONS.—The following directions are good for a draft of 9 feet with daylight and moderately smooth sea. A draft of 11 feet has been taken through Hawk Channel, but it requires local knowledge and a smooth sea. A detailed description of the dangers in Hawk Channel is impracticable as well as useless. The navigator must rely wholly upon the charts and aids. The beacons and buoys can not always be distinguished by their color, as they are soon discolored by the sea birds which alight on them. There are also a number of beacons (spindles with vanes) which are intended for the guidance of vessels skirting along outside the reefs. The flood current has a northwesterly or northerly set, and the ebb a southerly or southeasterly set. The normal velocity of the currents is about ½ knot, but this may be increased considerably by strong winds. The currents have their greatest velocity abreast of the openings between the keys.

Biscayne Shoal to Fowey Rocks, 15 miles.—Pass ½ mile eastward of Biscayne Shoal gas and bell buoy No. 2, lying 1¼ miles offshore and 5¼ miles northward of Miami Entrance, and steer 187° true (S. ½ W. mag.) for 9 miles, passing about ½ mile westward of Miami gas and bell buoy, and to a perpendicularly striped can buoy, which lies 2⅞ miles 54° true (NE. ⅝ E. mag.) of Cape Florida disused light tower. Then steer 185° true (S. ⅜ W. mag.) for 6¼ miles, passing close to a perpendicularly striped buoy lying 1 mile east-southeastward of Cape Florida Shoal light, and to a perpendicularly striped buoy lying 1½ miles westward of Fowey Rocks lighthouse.

Fowey Rocks to Basin Hill beacon, 25 miles.—From the perpendicularly striped buoy, 1½ miles westward of Fowey Rocks lighthouse. steer 188° 30′ true (S. ⅝ W. mag.) for 2⅛ miles to nun buoy No. 2. Then steer 195° true (S. by W. ¼ mag.) for 3⅛ miles, leaving can buoy No. 3 about 100 yards on the port hand and to a position 100 yards eastward of nun buoy No. 4. Then steer 207° true (SSW. ¼ W. mag.) for 1⅜ miles to nun buoy No. 4 BB; Bache Shoal beacon (black, white slats) will then be over ⅜ mile distant on the port beam.

From nun buoy No. 4 BB steer 195° 30′ true (S. by W. ¼ mag.) for 6¼ miles; leave nun buoy No. 6 MF about 150 yards on the starboard hand, a red and black can buoy, marking a 7-foot shoal, 200 yards to port, a perpendicularly striped can buoy close-to, and nun buoy No. 6 about 150 yards on the starboard hand. From nun buoy

No. 6 steer 202° true (S. by W. 7/8 W. mag.) for 2 3/8 miles to nun buoy No. 6 OR. From nun buoy No. 6 OR steer 214° true (SSW. 7/8 W. mag.) for 9 1/8 miles; leave a perpendicularly striped can buoy close-to, and Basin Hill beacon (black structure, white slats) about 100 yards on the port hand.

Basin Hill beacon to Hen and Chickens Shoal buoy, 22 miles.—Passing 100 yards westward of Basin Hill beacon steer 210° true (SSW. 1/2 W. mag.) for 9 miles, leaving Grecian Shoals buoy (can, No. 5) about 3/4 mile on the port hand. On the course Mosquito Bank light (black, white slats) should be ahead. When the light is 1 mile distant, steer 224° true (SW. 1/4 S. mag.) leaving it about 1/4 mile on the port hand. Continue the course for 12 miles from Mosquito Bank light, leaving Triangles beacon (black structure, white slats) about 200 yards on the port hand, and Hen and Chickens Shoal buoy (nun, No. 8 HC) about 300 yards on the starboard hand. Vessels should keep northward of a line joining Mosquito Bank light and Triangles beacon to avoid a 6-foot spot about halfway between.

Hen and Chickens Shoal buoy to East Washerwoman Shoal Light, 32 1/2 miles.—Leaving Hen and Chickens Shoal buoy 300 yards on the starboard hand, steer 238° true (SW. by W. mag.) for 15 3/4 miles, leaving Alligator Shoal buoy (can, No. 11) about 3/4 mile on the port hand passing close to Lower Matecumbe Key buoy (white and black can), and passing Indian Key buoy (nun, No. 10 IK) and Long Key Shoal buoy (nun, No. 12) each about 1/4 mile on the starboard hand.

From Long Key Shoal buoy steer 246° true (SW. by W. 3/4 W. mag.) for 8 5/8 miles, passing close to Duck Key buoy (nun, perpendicular stripes), and leaving East Turtle Shoal buoy (can, No. 11 ET) about 400 yards on the port hand. Then steer 238° true (SW. by W. mag.) for 5 miles, to a position close to Jacobs Harbor Head buoy (black and white can); leave West Turtle Shoal buoy (nun, horizontal stripes) about 3/4 mile on the port hand, then steer 254° true (WSW. 3/8 W. mag.) for 3 3/4 miles to a position 1/2 mile northward of East Washerwoman Shoal (a light is to be reestablished on this shoal).

East Washerwoman Shoal to Key West—44 miles.—Passing 1/2 mile northward of East Washerwoman Shoal continue the 254° true (WSW. 3/4 W. mag.) course for 12 1/4 miles past the shoal, passing close to Pigeon Key Bank buoy and Bahia Honda Key buoy (perpendicular stripes).

From Bahia Honda Key buoy steer 258° 30′ true (WSW. 3/4 W. mag.) for 28 1/4 miles, leaving Newfound Harbor Keys buoy (black and white can) close aboard, Logger Head Key buoy (nun, No. 12 LK) about 3/8 mile on the starboard hand; West Washerwoman Shoal buoy (can, No. 17) about 1/2 mile on the port hand; Pelican Key buoy (can, No. 19 PK) about 1/8 mile on the port hand; Boca Chica buoy (black and white can) close aboard, and Hawk Channel Turn buoy (can, perpendicular stripes) close to.

Then steer 286° true (WNW. 3/4 W. mag.) for 2 miles. Give Whitehead Point Spit gas buoy a berth of 100 yards in rounding it, and steer 2° true (N. mag.). Pass about 100 yards westward of nun buoy No. 8 and then shape the course to give the breakwater and wharves a berth of about 100 yards.

KEY WEST HARBOR.

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 commercial 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 Railway, 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.

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. **East Triangle beacon** (red) is midway between the Entrance buoy of the Main Ship Channel and Key West lighthouse, and can be readily distinguished from outside the reefs. Northwestward of the harbor is a disused tower, formerly Northwest Passage lighthouse.

Channels.—There are several channels or approaches to the harbor, leading between the reefs and coral banks which surround it. These channels are easy to follow in a sailing vessel in the daytime with a leading wind, but it 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 16 to 18 feet over the coral heads and it is not recommended for vessels of over 15 feet draft. The course through the channel is 321° true (NW. ⅜ N. mag.) for Key West lighthouse.

Main Ship Channel has a depth of 30 feet and a least width of 300 feet. Is well marked by buoys, lights, and the main ship channel range. 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 on a bearing of Key West lighthouse 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, 1921, had a depth of 18 feet and width of 230 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.

Anchorages.—On account of the Government submarine cable, vessels are cautioned not to anchor within ½ mile of the beach on the south side of Key West Island between Fort Taylor and East Martello Tower. The best anchorage is in the inner or Man-of-War Harbor, where the depth is 4 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 ancorage, 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 depth 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.

Saddlebunch Harbor. 10½ miles eastward of Key West, affords hurricane anchorage for small boats of not greater than 6-foot draft. The entrance is a narrow channel 6 feet in depth between Pelican and Saddlebunch Keys. There are no aids, but the channel is clearly defined by shoals which bare at low water or show a light brown color when they are covered. The entrance course is 358° true (N. 3/8 W. mag.). When Pelican Key is abeam, the channel bends slightly eastward, passing close to Saddlebunch Key. Here it widens somewhat but affords a very limiting turning area. A channel with a least depth of 3 feet leads from the head of Saddlebunch channel past the northern end of Bird Key to an old borrow pit. The depths alongside the old pier extending from the railroad are 9 to 16 feet.

Boca Chica Channel, 4½ miles eastward of Key West, is used by small boats as a hurricane anchorage. Entrance is had by the channel south of Sandy Point. Although there are no aids the reefs on each side show up well and clearly define the channel. The only danger is a 4-foot rock close to midchannel.

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.

Pilots can always be had by making signal while outside the reefs. and a good lookout is kept for approaching vessels. Pilotage is compulsory for certain vessels. For pilot rates see Appendix. Pilots for Hawk Channel can be had at Key West.

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

Supplies.—A 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.

United States Public Health Service.—The Marine Hospital is open to foreign as well as American seamen.

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 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.

DIRECTIONS.—*Main Ship Channel.*—This channel has been examined by means of a wire drag and is used by all deep-draft vessels entering Key West.

There is a least depth of 30 feet on the range line, which is found ¾ mile inside the entrance gas buoy. There is a depth of 24 feet at this point 100 yards westward of the range line. The entrance gas and whistling buoy lies 4¼ miles eastward of Sand Key lighthouse.

The front light of the *Main Ship Channel range* is mounted on a white pyramidal beacon on the shore end of the causeway leading to Fort Taylor. The rear light of the range is mounted on an iron mast near the southeast corner of the Navy coal shed. Each of these beacons shows a fixed red light at night.

From entrance gas and whistling buoy steer 356° true (N. ⅝ W. mag.) with Key West Main Ship Channel range lights in line ahead. Leave can buoys Nos. 3 and 5 on the port hand (the latter marks the eastern edge of West Triangle) and nun buoy No. 2, and *Eastern Triangle light* (red structure). After passing Eastern Triangle light steer 338° true (NNW. ⅛ W. mag.) with Whitehead Point Spit gas buoy No. 6 a little on the starboard bow.

Leave the gas buoy about 200 yards on the starboard hand and steer 2° true (N. mag.), passing can buoy No. 11 and nun buoy No. 8 at a distance of about 200 yards. Continue the course ⅜ mile past the latter buoy, and anchor in 4 to 5 fathoms. Or, from abreast nun buoy No. 8 steer 28° true (NNE. ¼ E. mag.) and give the breakwater at the naval station and wharves a berth of about 100 yards.

Northwest channel for vessels of 15 feet draft in the daytime.—When Northwest Passage disused lighthouse is distant 7 or 8 miles, bring it to bear 182° true (S. mag.) and steer for it, passing about 1¼ miles eastward of Smith Shoal gas and whistling buoy, and until up to the entrance gas and bell buoy. Northwest Bar light will then be in range with Sand Key lighthouse, the latter barely showing over Snipe Key.

Leaving the gas and bell buoy close-to on the port hand steer 175° true (S. 5/8 E. mag.) for Northwest Bar light and pass about midway between the red and black buoys until 3/8 mile from Northwest Bar light and abreast buoy No. 4. Then leave can buoys Nos. 5, 7, and 7A about 200 feet on the port hand, steer 115° true (ESE. mag.), and pass midway between buoys Nos. 9 and 6.

Passing about 100 years eastward of the latter buoy steer 136° true (SE. 1/8 E. mag.) for 2¼ miles to a perpendicularly striped nun buoy, passing about 50 yards eastward of gas buoy No. 6A and the same distance westward of buoy No. 11. Then steer 152° true (SSE. 3/4 E. mag.), pass about 100 yards westward of gas buoy No. 13, and continue the course to Inner Mid-channel buoy (flashing white). A 129° true (SE. 3/4 E. mag.) course will then lead in a depth of 15 feet over the southern end of Middle Ground, passing southward of buoy No. 15. Then steer more eastward and anchor, or stand for the city wharves, leaving buoy No. 13 on the port hand.

INLAND WATERS AND WATERWAYS BETWEEN CAPE HENRY, VA., AND BEAUFORT, N. C.

Inside the remarkable line of long, low, and narrow islands, already described as forming the seacoast of Virgina and North Carolina from Cape Henry to Cape Lookout, there exists a connected chain of navigable bodies of water by which the coast islands are separated from the main land. For directions, see page 138.

Southern Branch of Elizabeth River forms the northern approach to the two canals which afford passages from Chesapeake Bay to the inland waters of North Carolina. This branch is of considerable commercial importance. There are several large lumber mills and other manufactories at which vessels load, and the commerce using the canals also passes through the branch. Between the navy yard at Portsmouth and Deep Creek the branch is crossed by three railroad drawbridges. Two drawbridges cross the branch above Deep Creek. The least width of draw opening is 80 feet.

Between the first and second bridges the channel has been dredged 300 feet wide and 25 feet deep; between the second and third bridges, 200 feet wide and 22 feet deep, between the third and the entrance to the Albemarle & Chesapeake Canal, 12 feet. The channel for its whole length of 10½ miles is marked by buoys and beacons, and is not difficult to navigate as far as the entrance to Deep Creek. Above this to the entrance of the Albemarle & Chesapeake Canal most of the worse bends have been eliminated by dredging straight cuts through the marshes. These cuts are marked by beacons with hand pointing to the channel.

The **Albemarle & Chesapeake Canal** route is owned by the Government and is free of tolls. This canal connects the Southern Branch of Elizabeth River with North Landing River. This canal is 7¼ miles long and affords a passage for vessels of 10 feet draft. It is crossed by four drawbridges, all having draw openings. The depth of water in the canal is lowered by northerly winds and raised by southerly winds. Severe storms may cause a difference of 2 feet or more below or above the normal.

The following are extracts from the regulations prescribed by the Secretary of War for the use of the Government canals and water-

ways between Norfolk and Beaufort, N. C., copies of which may be obtained at the canal entrance:

The signal for a bridge is three long blasts of the whistle. Boats approaching other boats shall give the passing signals prescribed in the Pilot Rules of the Steamboat Inspection Service. No vessel shall obstruct the canal or approaches or tie up for some hours or days in the narrow parts of the waterways without proper authority. The limit of speed in the canals is 5 statute miles per hour for tows and vessels over 100 feet in length, and 6 statute miles for vessels less than 100 feet in length, and vessels approaching others must slacken speed. Rafts and tows must give to packets the side demanded by a proper signal. No refuse of any kind shall be placed in the canals or natural waterways or on the banks. Trespass on or injury to canal property is forbidden.

North Landing River is 10½ miles long in its narrow part from the Albemarle & Chesapeake Canal to light No. 1, 100 to 300 feet wide, and has a depth of 12 feet or more. Southward of light No. 1 the channel is a dredged cut, 250 feet wide and 12 feet deep, through the broad part of North Landing River, and 90 feet wide and 12 feet deep through Coinjock Bay, and a canal to the head of North River, a total distance of 19 miles.

Tides.—There are no tides in these waters, and the water level depends on the force and direction of the wind. Northerly winds lower the water and southerly winds raise it, there being at times a difference of 2 feet or more below or above the normal with strong, long-continued winds from one direction.

Munden is a post village and terminal of the Munden Branch of the Norfolk Southern Railroad on the east side of North Landing River, a little over 1 mile southward of light No. 2. From the dredged cut off the wharf a depth of 7½ feet can be carried to the wharf, which has a depth of 8 feet at its end and on the north side. It is partly in ruins.

Currituck is a small village on the west side opposite the mouth of North Landing River.

There is a station and dock of the Lighthouse Service at the entrance of Coinjock Bay, on the west side of the channel just southward of light No. 8.

Coinjock is a post village on the canal between Coinjock Bay and North River. Gasoline and some supplies may be obtained here, and storm warnings are displayed.

Currituck Sound is a narrow and shoal body of water extending from Albemarle Sound in a north-northwesterly direction for 25 miles, and is separated from the ocean by a narrow strip of sand beach. Currituck Beach lighthouse is situated on the eastern side of the sound about 7½ miles from its northern end. The lower part of the sound is navigable for boats of 4 to 5 feet draft for a distance of 11 miles above the entrance from Albemarle Sound, but the navigation is difficult on account of extensive shoals.

Back Bay and its connection with Currituck Sound extends a little over 10 miles northward from the northeastern end of the sound. The bay is shoal and navigable only for small boats. Northward of Back Bay is a shallow body of water known as North Bay.

North River is 4½ miles long in its narrower part from light No. 9 to light No. 10, and thence for 7 miles to the entrance at North River Point the river is wide and nearly straight. The river has a depth of 9 feet, with a dredged channel of 12 feet, from light No. 9 to Albemarle Sound. This channel is well marked by buoys, lighted beacons, and a lighted range across the bar at the entrance to the river.

The other route is via Southern Branch, Deep Creek, Dismal Swamp Canal, and Pasquotank River to Albemarle Sound and is good for a draft of 9 feet.

Southern branch of Elizabeth River is described under Albemarle & Chesapeake Canal route.

Deep Creek, which empties into the Southern Branch about 6 miles above Norfolk, is 2½ miles long to the entrance of the Dismal Swamp Canal. The creek has been improved by dredging a channel 100 feet wide and 10 feet deep from the Southern Branch to the canal. At the entrance of the creek there is a signboard directing the way to the Dismal Swamp Canal.

Dismal Swamp Canal (Lake Drummond Canal & Water Co.'s Canal) connects Deep Creek with the Pasquotank River. The northern lock of the canal is about 8½ miles above Norfolk. This canal is about 19 miles long, 60 feet wide, and 9 to 10 feet deep, with turnouts at distances of about 3 miles where vessels may pass each other. The two locks are 250 feet long and 39 feet wide. Four drawbridges cross the canal, and all have draw openings wider than the width of the locks; the settlements on its banks are the post villages of Deep Creek at the north entrance, Wallaceton, about 8 miles from the north entrance, and South Mills, about ⅓ mile inside the southern lock of the canal. The navigation of Deep Creek and a part of Pasquotank River requires local knowledge to carry the best water. Toll is collected at the northern lock.

The following are extracts from the rules and regulations of the Lake Drummond Canal & Water Co., a copy of which will be furnished by the company on application:

Vessels arriving at the locks are required to come to and make fast 150 feet from the gates. Sailing vessels will not be permitted to sail in the canal. Where they have centerboards they must be entirely hoisted up when under way. No vessel of any description shall pass through the canal at a rate exceeding 5 statute miles an hour, except by permission of the superintendent in writing. Vessels passing through the canal shall keep to the right. When a vessel is overtaken by another going in the same direction, the slower shall give the inner track to the faster, unless within 300 yards of a lock or bridge. Steamers shall pass each other on the right and shall give signals as required by United States laws, and shall come to a minimum speed in passing vessels. Vessels approaching a lock, bridge, or vessel shall give notice by giving three blasts of whistle, or by sounding a horn, or ringing a bell at a distance of at least 400 yards. Vessels navigating the canal at night shall carry regulation lights as prescribed by United States laws, and while lying in the canal vessels and rafts must show lights head and stern.

Turners Cut is a canal 3¾ miles long, 100 feet wide, and 10 feet deep, which extends in nearly a straight line from the Dismal Swamp Canal to Pasquotank River.

Pasquotank River has a length of 12½ miles from the southerly end of Turners Cut to Elizabeth City, and thence 15 miles to Wade Point lighthouse, at the entrance from Albemarle Sound. The upper

part of the river has been improved by dredging where necessary, and is good for a depth of 10 feet from Turners Cut to Albemarle Point lighthouse, at the entrance from Albemarle Sound. Local knowledge is required in places to keep in the best water. Two drawbridges cross the river, one about 3 miles above Elizabeth City and the other at the city.

Elizabeth City, on the west bank of Pasquotank River 15 miles above Wade Point lighthouse, is one of the important towns on the inland waters of North Carolina. It has railroad communication and communication by launch or steamer with adjacent waters. Anchorage can be had just below the city on the north side of the channel, eastward of a red buoy, in 7 to 12 feet of water.

The bulkheads, forming the water front, have a sufficient depth alongside, and a vessel can usually find a berth. Provisions, anthracite and bituminous coal, some ship chandlery, gasoline, and water can be obtained. The river water is suitable for boilers at and above Elizabeth City. The largest marine railway is about 200 feet long, with a capacity of 800 tons, and there are facilities for repairing machinery and the hulls of wooden vessels. Storm warnings are displayed.

New Begun Creek is the only tributary of any importance below Elizabeth City. It empties into the Pasquotank River from the westward 7¾ miles above Wade Point lighthouse. The controlling depth over the bar and a section of the creek is 5 feet. **Weeksville,** the principal town on the creek, is 3 miles from the mouth.

DIRECTIONS, INSIDE ROUTE FROM NORFOLK TO ALBEMARLE SOUND.

Local knowledge is required in a few places to carry the best water, but vessels drawing not over 10 feet, proceeding with care, and exercising extra caution in the few places mentioned, should be able to make the passage through the Albemarle & Chesapeake Canal or 9 feet through the Dismal Swamp Canal with the aid of the charts and these directions. Strangers are advised not to run at night.

The places requiring extra caution are the Southern Branch of Elizabeth River above the mouth of Deep Creek for the route by way of the Albemarle and Chesapeake Canal, and Deep Creek and parts of Pasquotank River by way of the Dismal Swamp Canal.

DIRECTIONS, ALBEMARLE & CHESAPEAKE CANAL ROUTE.

Norfolk to head of North Landing River, 18 miles.—The Southern Branch of Elizabeth River has a length of 6 miles to the mouth of Deep Creek and 10 miles to the western end of the Albemarle & Chesapeake Canal. Entering the Southern Branch between Portsmouth and Berkley, follow a mid-river course until through the first bridge. After passing through the draw, steer 199° true (SSW. ⅛ W. mag.). When up to black spar No. 3, steer 168° true (S. ½ E. mag.) for ¼ mile and up to red spar No. 2. Then steer 201° true (SSW. ⅜ W. mag.) through the draw of the second bridge.

When above the second bridge pass southeastward of a red buoy and steer 248° (WSW. ½ W. mag.) for ⅜ mile, passing the buoys at a distance of 100 feet. When between a red buoy and a black buoy, which marks the turn, and a red tank is on the port beam,

steer 184° true (S. 7/8 W. mag.) and pass about 150 feet off the wharves of the creosote works on the eastern side. Then pass between a red buoy and a lighted beacon, which marks the turn, steer 230° true (SW. 7/8 W. mag.), heading for the magazine wharf. Pass about 200 feet off the magazine wharf and haul southward and eastward, leaving the black buoys on the port hand, and pass about 200 feet off the lumber wharves on the southern side. When abreast the black buoy above them, steer 89° true (E. 3/8 S. mag.), heading midway between a red buoy and a small wharf on the northern side. When past the buoy, haul gradually southward for the draw of the third bridge, leaving another red buoy about 100 feet on the starboard hand. From just above the second to the third bridge the channel has been dredged 200 feet wide.

From the draw of the third bridge slightly favor the eastern bank for 1/4 mile, then favor the western bank for a distance of 1/2 mile, and then cross over so as to favor the eastern bank when abreast the mouth of Deep Creek.

From off the mouth of Deep Creek follow the eastern bank, passing eastward of the red and black horizontally striped buoy off the mouth of the creek and eastward of the red buoy above it. Then change course gradually to 188° true (S. by W. 1/4 W. mag.) and favor the west bank from the point on that side of the wharf of the burned mill just north of the fourth bridge.

Then pass through the draw and follow the west bank from the next point on that side to the black buoy just above it. Then haul over gradually so as to follow the east bank for a short distance above the next point on that side, and then follow the west bank from the point on that side, through the east draw of the fifth bridge, and to the bend 1/4 mile above the bridge.

Then go through a short dredged cut marked by single pile beacons at each end until past the red buoy, which lies in the next bend. Then keep near mid river and favor the west bank when passing the black buoy in the next bend and beacon on point. Then go through a dredged cut marked by single pile beacons and range until up to beacon 7 on the north shore.

Then be guided by the buoys into a dredged cut (the river bends to the northward). After passing through the cut cross the river, leaving beacon 9 to port and enter a long cut leading to the canal entrance, course 115° true (SE. by E. 1/4 E. mag.).

All boats are required to stop at the canal entrance (stone embankment) and furnish certain statistics. There is 8 feet of water alongside the embankment, and over the middle ground marked by buoys. No directions are necessary for the run through the canal; a good lookout should be kept for logs and snags. Careful steering will be required going through the railroad drawbridge, on account of the current there at certain stages of the tide.

North Landing River, Currituck Sound, Coinjock Bay and North River to Albemarle Sound, 42 miles.—North Landing River from the canal to light No. 1, a distance of 10 1/2 miles, is 100 to 300 feet wide and has a depth of 12 feet or more. It is crooked, but the bends are as a rule easy. Several of the worse bends have been eliminated by

dredging 12-foot channels through the marshy points. Vessels should keep in the middle of the river and give the points a good berth in rounding them. Some trouble may be experienced from snags or sunken logs. Two or three branches in the upper part of the river might confuse a stranger but with the aid of the chart no trouble will be had from this cause. About 1½ miles below the bridge at North Landing is the first cut-off. Take the left-hand channel, leaving a clump of pines to starboard; a wreck lies in the old river channel at the eastern end. A farm is on the right bank ¼ mile below the cut. Below the farm is another short cut across the marsh. The remains of an old wharf lie in the bend below West Neck Creek. Keep over on the eastern side to avoid the piles which do not show at high water. About 3 miles below the canal a branch (West Neck Creek) nearly as wide as the river leads eastward; some piles are driven partly across its mouth. About 1½ and 3½ miles below the canal branches lead westward, but noticeable only when approaching from southward.

Between light No. 1 and the head of North River, a distance of 19 miles, the channel is a dredged cut, 12 feet deep and 250 feet wide, to the entrance of Coinjock Bay and 12 feet deep and 90 feet wide from there to the head of North River. It is easily followed by means of the lights, which are placed at the turns, and the bush stakes which mark one side of the cut. Between lights Nos. 1 and 2 the bush stakes were on the western side of the cut, and between lights Nos. 2 and 8 on the eastern side, in 1921. Spoil banks are also visible on the western side between lights Nos. 7 and 8.

Passing eastward of light No. 1, the course is about 114° true (SE. by E. ⅜ E. mag.) for ½ mile to light No. 2, which is on the eastern side of the cut; then 153° true (S. by E. ⅞ E. mag.) for 2⅜ miles to light No. 3, which is on the western side; then 164° true (S. by E. mag.) for 5 miles, passing light No. 4 and to light No. 5, which is on the western side; then 133° true (SE. ¼ S. mag.) for 2⅜ miles to light No. 6, which is on the eastern side; then 163° true (S. by E. mag.) for 2⅛ miles to light No. 7, which is on the eastern side; and then 187° true (S. by W. ⅛ W. mag.) for 1 mile to light No. 8, which is on the western side at the entrance of a short canal and at a station of the Lighthouse Service.

From light No. 8 the course is 171° true (S. ⅜ E. mag.) for 2⅝ miles to abreast a light on the east side, and the sides of the cut are partly bare and easily followed. From here to North River the canal has a 204° true (SSW. ⅝ W. mag.) direction for 2¼ miles. The canal is crossed by a drawbridge at Cornjock, where gasoline can be obtained. Thence the dredged cut has a 216° true (SW. ⅜ S. mag.) direction for ½ mile to light No. 9 to be left to starboard, and is generally marked by bush stakes.

From the light No. 9 at the head of North River steer about 172° true (S. ¼ E. mag.) for 1½ miles in a dredged channel, generally marked by bush stakes on the western side, until up with a red buoy. Pass westward of the buoy, and then favor the north side for a distance of 1 mile until through the narrowest part of the river. Then keep in mid-river, and then favor slightly the point on the west side in making the turn westward. Then steer about 234° true (SW. by W ¼ W. mag.) and pass about 150 yards northward of the point on

the south side, where the river turns southward to a light. Then keep in mid-river, pass westward of a red buoy just above the light, pass 200 yards southwestward of the light, and steer 130° true (SE. mag.) for ¾ mile to a black buoy. In making the turn southward of the light keep well off of it to avoid a point of shoal. Then steer 143° true (SSE. ¾ E. mag.) through a dredged channel 12 feet in depth and to pass 100 feet westward of light No. 11. Then steer 162° true (S. by E. mag.) to pass 100 feet westward of light No. 12. Then steer 141° true (SE. by S. mag.) passing eastward of a black buoy marking a 6½-foot shoal spot and southward of the front light and structure of the North River Bar Range. Then bring the two lights (rear light and structure on wharf at Jarvisburg) in line astern on a 186° true (S. by W. mag.) course, and cross the bar into Albemarle Sound, on this range, to a perpendicularly striped bell buoy, then follow the directions on page 143. The range leads through a dredged cut which is 12 feet deep.

DIRECTIONS, DISMAL SWAMP CANAL ROUTE.

Deep Creek, 2½ miles.—Follow the directions on page 138 for the Southern Branch of Elizabeth River to the mouth of Deep Creek, and pass about 100 feet northward of the red and black horizontally striped buoy and nearly that distance southward of the red buoy in entering the creek. The channel in Deep Creek has been dredged about 100 feet wide and generally has little water on both sides of it. If near low water, the sides of the channel are generally indicated by the swash from the vessel's passage, and otherwise there is nothing to mark it. For a distance of 300 yards inside the entrance to the first bend the channel favors the north bank, and then for a farther distance of 300 yards until halfway to the next bend the channel favors the west bank. The channel then follows the middle of the creek, except in its widest part, ⅝ mile below the canal lock, where it follows the north bank.

Turners Cut is 3¾ miles long, and the only directions necessary are to keep in the middle. From the lock of the Dismal Swamp Canal it has a southerly direction for ⅜ mile, and then a southeasterly direction for 3⅜ miles to Pasquotank River. About ⅝ mile below the lock the river crosses the cut in a north and south direction. At the southerly end of the cut the river joins it from west-southwestward.

Pasquotank River from Turners Cut to Elizabeth City, 12½ miles.—In the following description the terms "right" and "left" banks are applied as seen when bound southward. Several branches, which enter from the right or western bank of the river, are liable to confuse a stranger; the rule is to keep to the left passage, bound southward. On account of some sharp bends in the narrow parts of the river and shoal water in the broader parts, strangers are advised to proceed with caution in its uncharted part above Elizabeth City. It is also advisable to keep the leads going on both sides, as the slope on either side of the channel is usually sufficient to make the difference in depth obtained with the two leads an indication of where the deeper water lies.

From Turners Cut to the point on the right bank just below Coopers Creek, a distance of 4½ miles, the river gradually widens

from 100 to 300 feet, and a mid-river course should be followed. At this point the river widens suddenly, and the channel, which is a dredged cut 150 feet wide with a least depth of about 7 feet on either side, favors the left bank, following it at a distance of about 300 feet until around the next point on the left bank about 5/8 mile farther down. Here the dredged channel leads between two buoys and takes a 148° true (SSE. 3/8 E. mag.) direction to a position 350 feet off **Shipyard Landing** (on the left bank 5½ miles below Turners Cut). Then change course gradually to 189° true (S. by W. ¼ W. mag.) and pass 100 feet off the point on the right bank just below Shipyard Landing. Continue the course to mid-river, and so continue in the narrower part of the river around the next bend until approaching Goat Island.

When 6¼ miles below Turners Cut pass in mid-channel northeastward of **Goat Island** which is ¼ mile long and has a black buoy at its upper and lower ends. Favor the left bank just below the island until abreast the mouth of the creek on the left bank. Then keep in mid-river. The Norfolk Southern Railroad bridge crosses the river 9⅝ miles below Turners Cut. The draw has a clear width of 48 feet. In rounding the sharp point 1 mile below the railroad bridge, the bight may be favored slightly just above and below the point to assist in making the turn, but keep near mid-river off the point itself. Then keep in mid-river, favor the log boom and lumber wharf on the right bank in rounding the next point on that side, and then favor slightly the right bank until through the lift bridge at Elizabeth City, which is 12½ miles below Turners Cut. Vessels may go alongside the wharves at Elizabeth City, either above or below the bridge. Anchorage is usually made around the bend below the bridge.

Pasquotank River from Elizabeth City to Albemarle Sound, 15 miles.—From the lift bridge favor the wharves of Elizabeth City, pass southward of a red buoy, and then steer 96° true (E. by S. mag.) for Hospital Point (on north shore) until in mid-river. Then steer 117° true (SE. by E. ⅛ E. mag.), pass 100 yards northward of Cobb Point light, and continue the course 2½ miles past the light to a position ⅝ mile off the western shore below Brick House Point. Then steer 136° true (SE. ½ S. mag.) for 7½ miles with Anson Point astern, keeping about in mid-river, leaving a red buoy nearly ¼ mile on the port hand, a black buoy ¼ mile on the starboard hand, and Poquoson Point light ¼ mile on the port hand. From a position ½ mile southward of Poquoson Point light steer 106° true (ESE. ⅛ mag.), give the shore a berth of over ½ mile, and pass 3/8 to ½ mile northward of Wade Point lighthouse. Then follow the directions on page 144. If bound westward in Albemarle Sound, and of 7 feet or less draft, vessels can cross the shoal at the entrance to the river on a 180° true (S. 3/8 W. mag.) course with Poquoson Point light astern.

ALBEMARLE SOUND

is 46 miles long, and has a width ranging from 11 miles near its eastern end to 3 miles about 9 miles from its western end. This sound has a good navigable depth for any vessel that can enter through the canals, and with its numerous tributaries forms the approach to a number of towns and landings, from and to which several

steamers, barges, and a number of small sailing vessels are engaged in the carrying trade.

The eastern end of the sound, which is separated from the Atlantic by the narrow beach about 15 miles northward of Bodie Island lighthouse, is connected northward with Currituck Sound, and southward with Croatan and Roanoke Sounds, and by the latter sounds with Pamlico Sound. The water in the sound westward of Laurel Point lighthouse is usually fresh or slightly brackish.

The shores of the sound are now and generally wooded; there are no prominent natural features. The more important towns on the tributaries of Albemarle Sound are: Elizabeth City, on the Pasquotank River; Hertford, on the Perquimans River; Edenton, on Edenton Bay; Winton, on the Chowan River; Plymouth and Jamesville, on the Roanoke River; Columbia, on the Scuppernong River; and there are also numerous landings.

Supplies can be obtained at these towns, and there are **marine railways** at Elizabeth City. The rise and fall of the water level depends on the direction of the winds.

A railroad trestle crosses Albemarle Sound about 5 miles from its western end. There is one draw opening for vessels, 1½ miles from the north shore, which is a lift bridge with a clear opening 140 feet wide, and is marked by a bell struck by hand during thick or foggy weather. There are also girder spans about ½ mile apart in the trestle, under which launches without masts can pass.

DIRECTIONS, ALBEMARLE SOUND.

The sound is comparatively free from dangers to vessels of the draft that navigate it. There are shoals making from the shore and the points along the shore of the sound. These can generally be avoided by giving the shore, and especially the points, a berth of at least 1 mile. From March to May, inclusive, the shoals in the sound are full of fish stakes and nets, especially along the north shore, where it is difficult to avoid them.

Directions for entering the sound by the inland passages through the canals and North and Pasquotank Rivers are given on pages 138 and 141.

HAVING COME FROM NORTHWARD THROUGH NORTH RIVER.

1. If bound to Croatan Sound.—When across the bar and up to the bell buoy, steer 161° true (S. by E. ¼ E. mag.) for 6½ miles. Then steer 145° true (SSE. ⅝ E. mag.) for 5 miles to a position about 250 yards eastward of the black buoy lying 1 mile north-northwestward of Croatan light. This light should be a very little on the starboard bow on this course. Then steer 152° true (SSE. mag.) for Croatan light, and on nearing it change the course and pass 125 yards westward of the light. Fish stakes are numerous in the vicinity of Croatan light. Then follow the directions on page 151.

2. If bound to Alligator River, from the bell buoy a 205° true (S. by W. ⅞ mag.) course made good for 11 miles will lead to a position ⅜ mile westward of Middle Ground buoy at the entrance to the river.

3. If bound to Bull Bay or Scuppernong River, make good a 246° true (WSW. ¼ W. mag.) course for 23 miles from the bell buoy.

Then, if bound into the bay, steer 220° true (SW. mag.) for the entrance buoy; or, if bound into Scuppernong River, 209° true (SSW. 7/8 S. mag.) until the entrance range is on. Then follow the directions on page 148.

4. If bound to Edenton Bay or Mackey Creek or into Chowan Rivers.—From the bell buoy a 254° true (W. by S. mag.) course made good for 29 miles will lead 2½ miles southward of Wade Point lighthouse, 1 mile southward of Reeds Point light, ¾ mile northward of Laurel Point lighthouse and ¾ mile southward of the red nun buoy off Bluff Point. After passing this buoy bring Laurel Point lighthouse astern on a 264° true (W. 1/8 S. mag.) course, which made good for 6½ miles will lead to the lift draw in the trestle crossing the sound. This draw is a conspicuous object for many miles. Then be guided by the direction under the proper headings on pages 147 and 148.

1A. HAVING COME FROM THE NORTHWARD THROUGH PASQUOTANK RIVER.

1. If bound to Croatan Sound.—When Wade Point lighthouse bears 265° true (W. mag.) distant 1 mile, steer 145° true (SSE. 5/8 E. mag.) for 14½ miles to a position about 200 yards eastward of the black buoy lying 1⅜ miles north-northwestward of Croatan lighthouse. The lighthouse should be made and kept a very little on the starboard bow on this course. Then steer 152° true (SSE. mag.) for Croatan lighthouse, and on nearing it change the course so as to pass 125 yards westward of the lighthouse. Fish stakes are numerous in the vicinity of the light.

2. If bound to Alligator River, bring Wade Point lighthouse to bear 270° true (W. ½ N. mag.) distance ½ mile and steer 187° true (S. by W. 1/8 W. mag.) for 11½ miles until up to Middle Ground buoy at the entrance to the river. Alligator River light will be almost ahead on this course.

3. If bound to Bull Bay or Scuppernong River, bring Wade Point lighthouse to bear 0° true(N. ½ E. mag.) distant ½ mile and steer to make good a 239° true (SW. by W. ¾ W. mag.) course for 19¾ miles. Then, if bound into the bay, steer 220° true (SW. mag.) for the entrance buoy; or, if bound into Scuppernong River, 209° true (SSW. 7/8 S. mag.) until the entrance range is on. Then follow the directions on page 148.

4. If bound to Edenton or Mackays Creek, or into Chowan River, bring Wade Point lighthouse to bear 0° true (N. ½ E. mag.), distant ½ mile, and steer 245° true (WSW. ¼ W. mag.) for 12¾ miles to a position 1 mile southward of Reed Point light. Then steer 254° true (W. by S. mag.) for 12½ miles to a position ¾ mile southward of the red nun buoy off Bluff Point. After passing this buoy bring Laurel Point lighthouse astern in a 264° true (W. 1/8 S. mag.) course, which made good for 6½ miles will lead to the lift draw in the trestle crossing the sound. This draw is a conspicuous object for many miles. Then be guided by the direction under the proper heading on pages 147 and 148.

Pasquotank River is on the north side of Albemarle Sound and is marked at its entrance by Wade Point lighthouse, which lies 4 miles westward of North River entrance. The deeper entrance is eastward of Wade Point lighthouse; but with a smooth sea vessels

of 7 feet draft can cross the shoal westward of the lighthouse, taking care, however, to give Wade Point a berth of over 1 mile, or to keep Poquoson Point light bearing westward of 0° true (N. ⅜ E. mag.). The river is more particularly described in connection with the inland passage on pages 137.

Flatty Creek, 3 miles westward of Wade Point, is 1 mile wide at its mouth, but is shoal and only used by fishermen. There is 2 feet of water over the bar and 3 to 4 feet inside.

Little River is on the north side of Albemarle Sound 10 miles westward of Wade Point lighthouse. The channel is about ¼ mile wide between the shoals at the entrance, and is buoyed. The river has a general northwesterly trend to the village of **Nixonton,** which is on the east bank 7 miles above the entrance. About 7½ feet is the deepest draft that can be taken up to the village. Spits, with little water over them and generally steep-to, make out some distance in places from the shores and especially off the points.

Directions.—Pass 100 yards eastward of the black buoy at the entrance, steer 282° true (WNW. ½ W. mag.) and pass close westward of buoy No. 2. Then keep near the middle of the river until abreast the point on the east bank just above Trueblood Point, and then favor the eastern bank to Nixonton.

Approaching from westward pass ½ mile southward of Reed Point light and steer 52° true (NE. by E. mag.) until up with the horizontally striped buoy lying southward of the entrance. Pass 200 yards eastward of this buoy, and steer about 344° true (N. by W. mag.) with the black buoy at the entrance on the port bow. Then follow the directions in the preceeding paragraph.

Perquimans River is on the north side of Albemarle Sound, its entrance lying 3 miles northwestward of Reeds Point light. For a distance of 10 miles to the town of **Hertford** the river is from ¾ to 1½ miles wide and has a navigable depth of 9 to 11 feet. The river then becomes narrow and crooked, but is navigable for vessels of 7 feet draft to the closed bridge at **Belvidere,** about 12 miles above **Hertford.** A drawbridge crosses the mouth of the narrow part of the river at Hertford, and the wharves of the town are above the bridge. The Norfolk Southern Railroad crosses the river over a drawbridge 1 mile above the town. The town ships some lumber by railroad and barges. Gasoline and other supplies can be obtained. There is a gasoline towboat.

Directions.—Pass about ⅜ mile southwestward of Reeds Point light and steer about 302° true (NW. ¾ W. mag.) for 4¼ miles to buoy No. 1, lying near the middle of the entrance to the river. Or, approaching from westward, pass ¼ mile southward and eastward of the horizontally striped buoy lying southward of the entrance, and steer 1° true (N. ½ E. mag.) with buoy No. 1 on the port bow.

Pass about 100 yards northeastward of buoy No. 1 and steer 296° true (NW. by W. ¼ W. mag.) for 2½ miles with Grassy Point a little on the port bow to a position 150 yards northeastward of buoy No. 3. Then steer 285° true (WNW. ¼ W. mag.) for 1¾ miles to a position 200 yards southwestward of Grassy Point light. Then steer 312° true (NW. ⅛ N. mag.) for about 5 miles, heading for Ferry Point which shows as a wooded head on the northeastern side of the

river. Anchor about 300 yards southwestward of Ferry Point in a depth of about 9 feet. There is not room for anchorage above this point.

The entrance to the narrow part of the river at Hertford is through a dredged channel 200 feet wide and 9 feet deep, which has a 301° true (NW. ¾ W. mag.) direction, the middle of the channel lying 200 yards from the point on the west side below the bridge. When on the line of the face of the bulkhead below the bridge, the course should be changed for the draw. Go through east draw. There are stumps on both sides of the dredged channel. A black buoy marks the edge of shoal on the west side.

Yeopim River is 5½ miles westward of Perquimans River. It is shoal and unimportant. There is 4 feet of water over the bar between Batts Island and Drummond Point. Some logging is done along the south shore.

Edenton Bay is a small bay on the northern side near the western end of Albemarle Sound, about 2 miles westward of the railroad trestle which crosses the sound. The entrance and channel are marked by buoys and range lights. The depth in the channel is 8½ to 10 feet, partly obtained by dredging. The large water tank just westward of the rear range light is the most prominent object seen from the sound. A brick chimney near the front range and a water tank on the east side of the bay are also prominent.

Edenton is a town at the head of the bay about 1½ miles above the entrance; it has railroad communication with Norfolk and the south, and small steamers trade to points in the sound and its tributaries. Some lumber is shipped by railroad and in barges. A towboat is stationed here. Supplies, ice, gasoline, coal, and water can be obtained. The river water is fresh and suitable for boilers. The wharf on which the front light is located has but little water alongside. Vessels can go to the wharves just westward of the range, and also to the railroad wharf at the northwest end of the harbor. The railroad wharf now in use is at the northeast end of the harbor, and is reached through a channel about 100 feet wide.

The inner anchorage, which is small and has a depth of 9 feet, is close eastward of the range line and about 250 yards southward of red buoy No. 6. The larger anchorage is on the west side of the range line and about midway between red buoys Nos. 2 and 4.

Pembroke Creek enters from the westward into Edenton Haror. A fish commission hatchery is located about ½ mile from its mouth, to which 5 feet can be carried. The creek is navigable for 3 miles to Wildcat bridge.

Directions.—From the lift draw in the trestle crossing Albemarle Sound steer 333° true (NNW. mag.) for nearly 3 miles, with buoy No. 2 at the entrance of Edenton Bay on the starboard bow. When the Edenton Harbor range lights, which show just eastward of a prominent water tank, are in line, bearing 14° true (N. by E. ¾ E. mag.), steer for them and be guided by the range and buoys until up to the wharves.

Chowan River empties into the western end of Albemarle Sound from northward, and with its tributaries is one of the largest rivers in North Carolina. For a distance of 17 miles above its mouth the river has an average width of about 1½ miles. In this part of the

river large areas of tree stumps, many of which are under water, are generally found on the shoals; **Stumpy Reach** is the name applied to the worst place between Colerain Landing and the mouth of Bennett Creek, a distance of 6 miles, where stumps occur on shoals with depths of about 12 feet or less. Above this the river is much narrower, but has a good channel with a depth of 9 feet for 50 miles above its mouth. **Colerain Landing** is on the west bank 12 miles above the entrance. The village of **Colerain** is on the hill ½ mile inland. **Winton,** a small town, is on the west bank of the river about 37 miles above its mouth. Regular water transportation is maintained between Edenton and Tunis at the Atlantic Coast Line crossing 2½ miles below Winton.

Meherrin River joins the Chowan from westward about 2½ miles above Winton. The river is navigable for vessels of about 7 feet draft for a distance of 9½ miles to the village of **Murfreesboro.** The width of the river is 100 to 350 feet. There are five small pile wharves on this river. There are no railroad connections with any of them, but ordinary county roads extend to them.

The junction of the Blackwater and Nottoway Rivers is about 13 miles above Winton. **Blackwater River** is navigable for vessels of 8 feet draft for a distance of 11 miles to the bridge at the town of **Franklin.** The width of the river is 100 to 250 feet.

Nottoway River is navigable for vessels of 8 feet draft when the river is not low for a distance of 13 miles to **Munroe Ferry.** A draft of 4 to 5 feet can be taken up to the ferry at any time of the year. The head of navigation for vessels is at the closed bridge of the Seaboard Air Line Railroad, 4½ miles above Munroe Ferry. Above this bridge navigation is limited by bars, snags, and closed bridges to flatboats and rafts of 2 feet or less draft.

DIRECTIONS.—Owing to the large areas covered with tree stumps, which are 4 to 5 feet under water, it is advisable for a stranger to take a pilot at Edenton or at the mouth of the river.

Salmon Creek is a small stream emptying into Chowan River close to Albemarle Sound. Avoca, a postoffice, is 1 mile from its mouth. A boat line runs to Edenton. The entrance of the creek is a good harbor for small boats of 6 feet or less draft.

Roanoke River empties into the southwestern end of Albemarle Sound. The shallow bight at the mouth of the river is known as Batchelors Bay, and near its eastern part, off the mouth of the river, is Roanoke River lighthouse. There are stumps on the shoals at the mouth of the river. Roanoke River from the confluence of **Staunton** and **Dan Rivers** is 170 miles long to its mouth, and is the approach to a number of small towns and villages to which steamboats run. The river is navigable eight months of the year for vessels of 8 feet draft to Palmyra. A depth of 10 feet at low water can be taken up to Hamilton all the year and 3 feet to Weldon, the head of navigation.

The principal landings on the river and their approximate distances above its mouth are: **Plymouth,** 6 miles; **Jamesville,** 15½ miles; **Williamston,** 31 miles; **Hamilton,** 54 miles; **Palmyra,** 72 miles; **Edwards Ferry,** 90 miles; **Halifax,** 102 miles, and **Weldon,** 112 miles.

The river is subject to frequent and sudden freshets, which overflow large areas of the lowland on both of its banks. Sailing vessels seldom go above Plymouth unless they are towed, the upper part

of the river, on account of its width and crooked course, being navigated by steamers. It is advisable for a stranger to take a pilot at Edenton.

DIRECTIONS.—After passing through the draw of the trestle across the sound steer 254° true (W. by S. mag.) for the can buoy in Batchelors Bay. From this point vessels approaching the limit of draft are advised to take a pilot. They may be obtained at Edenton.

Mackey Creek is on the south side of Albemarle Sound just westward of the railroad trestle which crosses the sound. A channel 140 feet wide and 9 feet deep was dredged through the bar at the entrance, but it has narrowed and shoaled a little. It is marked on each side by rows of piles. There are stumps in places on the shoals at the mouth of the creek. Mackeys is a post village ½ mile above the entrance. A railroad bridge (width of draw 35 feet) crosses the creek just inside the entrance and a highway bridge (width of draw 31 feet) crosses at Mackeys. The creek is navigable for vessels to a closed bridge 8 miles by water or 3½ miles by land above Mackeys; to this bridge the creek is 180 to 90 feet wide and 20 to 12 feet deep. Above this bridge to a dam at the post office of Roper, a distance of 2½ miles by water or ½ mile by land, the creek is 90 to 30 feet wide and 12 to 3 deep.

Bull Bay is the western part of the bight in the south shore of Albemarle Sound southeastward of Laurel Point lighthouse. A buoyed channel leads through the shoals which obstruct the entrance, but a stranger should sound out the channel before attempting it. Several small creeks empty into the western side of the bay, none of which is navigable for boats. A channel, with a depth of 8 feet when the water is high, leads through flats to the entrances of these creeks.

Scuppernong River empties into the eastern end of Bull Bay from southeastward. This river has been improved and is navigable for vessels of 7 feet draft a distance of about 20 miles to **Spruill Bridge**, and 5 feet can be carried 2½ miles farther to the head of navigation at the town of **Cherry**. **Columbia**, to which a draft of 10 feet can be taken, is a village 4½ miles above the mouth of the river. Columbia has communication by railroad and steamer, and some supplies, anthracite coal, and gasoline can be obtained. Storm warnings are displayed.

Four drawbridges cross the river between Columbia and Cherry, the two at Columbia having clear openings 39 feet wide, and those above 30 feet. A closed bridge 6 feet above low water crosses at Cherry. A channel 150 feet wide and 10 feet deep leads through the bar at the entrance from Bull Bay. This channel is marked by buoys and range lights. The buoy at the entrance of the channel lies 4⅜ miles 134° true (SE. ¼ S. mag.) of Laurel Point lighthouse.

DIRECTIONS.—Having come up on to the entrance range (see page 144) steer 132° true (SE. ⅛ S. mag.) through the dredged cut keeping Scuppernong River range lights in line ahead, and passing the buoys marking the eastern side of the cut at a distance of about 75 feet. Pass 100 feet northeastward of the front light, and steer 112° true (SE. by E. ⅝ E. mag.) for 1½ miles. Round the point on the southwestern bank in mid-channel, slightly favor, if either, the west bank until the reach eastward is open, avoiding two shoals just before reaching the

change of course, and then pass in mid-channel northward of the old mill. Then favor the north bank, round the next point in mid-channel, and then favor the east bank to the draw of the highway bridge, which is close to the bulkhead at Columbia.

Alligator River is on the south side of Albemarle Sound, 11 miles westward of Croatan lighthouse. The entrance is full of shoals through which there is a channel, with a depth of 10 feet, marked by a buoy and Alligator River light. For a distance of about 18 miles above its mouth the river has a south direction, is 2 to 3 miles wide, and has general depths of 8 to 11 feet. Above this the river has a length of about 24 miles, is narrow and crooked, and has a depth of 6 feet or more nearly to its head, its upper part, however, being too narrow to turn in. Logs are towed from the river in barges and rafts. On the eastern side just inside the mouth of the river is the entrance to **East Lake** and **South Lake**, which have general depths of 6 to 8 feet. East Lake post office is a small settlement 3¼ miles southward of Alligator River light. It has boat communication with Manteo.

Little Alligator River empties into Alligator River from westward just inside the entrance. This river has a narrow, crooked channel with a depth of 6½ feet. **Fort Landing** is a post village on the west bank of Little Alligator River about 2 miles above the mouth. A draft of 5 feet can be taken about 4 miles above Fort Landing.

From Whipping Creek there is a boat passage 14 miles long to Long Shoal River.

DIRECTIONS.—Having come up to a position ⅜ mile westward of Middle Ground buoy (see page 143 and 144), steer about 181° true (S. ½ W. mag.), and pass about 300 yards eastward of Alligator River light. Then steer 198° true (SSW. mag.), passing about ½ mile off Sandy Point and westward of Sandy Point Shoal, and be guided by the chart.

CROATAN AND ROANOKE SOUNDS.

Croatan Sound, west of Roanoke Island, connects Albemarle and Pamlico Sounds, and is used by vessels bound through the sounds. A channel of 12 feet has been dredged through Croatan Sound and is well marked. Strangers should not attempt to pass through Croatan Sound at night. Fish stakes and nets are numerous in season, especially at the northern and southern ends of the sound. For directions see page 151.

Roanoke Marshes is the name applied to the point and fishing station westward of Roanoke Marshes lighthouse. A crooked slough, from 50 to 100 yards wide, leads in a north and south direction across the point, and the fishing station with a number of small wharves is on this slough. A small vessel can enter either end of the slough and make fast to the steep banks or at the wharves, with good shelter. The least depth at either entrance is 7 feet, and the depth in the slough varies from 12 to 16 feet. Both entrances are sometimes nearly blocked by fish stakes, but there is a narrow, clear passage. The north entrance is westward of the islet lying northward of the island on which the huts are located. A mid-channel course should be followed in the slough, and care is required when passing the opening between the islet and the island.

There is a good boat harbor in **Peter Mashoes Creek**, west-northwesterly of Croatan lighthouse. Gasoline and some supplies can be

obtained at **Mashoes**, just inside the entrance. Gasoline may be obtained at **Manns Harbor**, westward of Blockade Shoal light.

Wanchese is a post village near the south end of Roanoke Island, and has a landing near the mouth of Oyster Creek, 2¾ miles northeastward of Roanoke Marshes lighthouse. There are stores, and gasoline is obtainable. There is telephone communication from the dock. There is a railway on the creek for hauling out boats of 4 feet draft and 50 feet length. To enter bring Oyster Creek lighted beacon on range with Bodie Island lighthouse (high tower on outside beach) and pass 200 yards southward of the beacon. There is 9 feet off the end of the dock. There is a good anchorage for small craft.

Roanoke Sound lies between Roanoke Island and the outside beach (Bodie Island) which separates it from the ocean. A depth of 5½ feet can be carried from Albemarle Sound, through the northern part of Roanoke Sound, and through a dredged channel, 100 feet wide, into Shallowbag Bay to the wharves of the village of Manteo. **Shallowbag Bay** is a good anchorage for small craft of less than 6 feet draft. There is communication by steamer with Elizabeth City and by power boats with the neighboring villages, and facilities for hauling out vessels of 20 tons weight and 4 feet draft.

Nags Head is a summer resort on the east side of Roanoke Sound, eastward of the north end of Roanoke Island. There is a depth of 6 feet at the end of the wharf.

There is a narrow channel, through which a draft of 4 feet can be carried close to the eastern side of Roanoke Island from Shallowbag Bay to Pamlico Sound. It is marked at its southern end, but is used considerably by local boats. The best water lies 150 yards off the island from Shallowbag Bay to the mouth of Broad Creek, and about ⅜ mile off from the south side of Broad Creek to the south end of the island.

Tides in Croatan and Roanoke Sounds depend entirely on the winds which may, under exceptional conditions, lower or raise the level as much as 1½ feet from the normal; easterly winds lower the water and westerly winds raise it. Strong northerly or southerly winds produce currents, which are especially marked when the wind shifts suddenly to the opposite point.

DIRECTIONS.—*To enter Roanoke Sound from northward*, pass northward of Collington Island Shoal light at a distance not greater than ¼ mile, and steer 101° true (ESE. ½ E. mag.) for 5 miles to Nags Head light, giving Roanoke Island a berth of over ⅝ mile. Pass northward and close eastward of Nags Head light and steer about 162° true (S. by E. ⅛ E. mag.) for 1½ miles to Baum Point light. Pass 50 feet eastward of the light and steer about 217° true (SW. ¼ S. mag.) for ⅝ mile, then steer westward, passing close southward of a local beacon, and then northwestward to the wharves. The channel is sometimes marked by bush stakes in addition to the lights. Strangers of 4 feet or less draft should have no trouble in entering. Anchorage can be had southeastward of the wharf at a distance not greater than ¼ mile; also in the bay between the wharf and Ballast Point. A channel 100 feet wide has been dredged along the wharves.

Pamlico Sound is the largest body of water in North Carolina, and is separated from the Atlantic by a narrow beach extending from Bodie Island lighthouse to Cape Hatteras, a distance of about 35 miles, and thence in a west-southwesterly direction for about 35 miles. From Croatan Sound to the mouth of Neuse River the distance through the middle of Pamlico Sound is about 65 miles; the greatest width of the sound is about 24 miles. Oregon, New Hatteras, and Ocracoke Inlets pierce the narrow beach, giving access to the ocean; but all are blocked by inside bars with little depth over them. They are described in another part of this volume.

The northern and western shores of the sound are irregular, being broken by numerous small bays and by two large rivers, Pamlico River and Neuse River. The general depth of water in the middle of the sound is between 3 and 4 fathoms, but shoals in many places extend miles from the shore; northward of Ocracoke Inlet, Bluff Shoal, with 7 to 12 feet over it, extends completely across the sound.

Strong winds from any direction raise in the exposed parts of the sound, a short, choppy sea, uncomfortable to small craft and even dangerous to open boats; but protected anchorage for small craft may be found in the many bays along the northern shore and along the southern shore in several sloughs which lead to sheltered berths in the lee of shoals. Middleton Anchorage and the anchorage in the bight formed by the hook of Royal Shoal can be made either day or night and are used.

Tides except at the inlets, where there is a rise and fall of about 2 feet, are due entirely to winds and are small, except under the influence of strong winds. Easterly and westerly winds produce the greatest change in water level, which rarely exceeds 2 feet. There are no noticeable currents except in the vicinity of the inlets.

Directions, Croatan and Pamlico Sounds.—*From Croatan lighthouse to mouth of Neuse River*, having come through Albemarle Sound as directed on pages 143 or 144 and being 125 yards westward of Croatan lighthouse (white house on pile, fixed white, red sector; fog signal bell), steer 135° true (SE. ½ S. mag.) for 4¼ miles to a position westward of a red nun buoy ½ mile south-southeastward of Blockade Shoal lighted beacon, passing westward of a number of red spars and the lighted beacon. This course is through a dredged channel 12 feet deep. Then steer 168° true (S. ½ E. mag.) for 5 miles through a dredged channel marked on its eastern edge by red spar buoys, to a position 50 to 100 yards eastward of Roanoke Marshes lighthouse.

Then bring Roanoke Marshes lighthouse astern on a 177° true (S. ¼ W. mag.) course, passing eastward of a horizontally striped buoy and well westward of another horizontally striped buoy, and to a position between a red and a black buoy 1½ miles southward of the lighthouse. Then steer 167° true (S. ⅝ E. mag.) for 5½ miles, giving the shore a berth of about 1½ miles, until Stumpy Point bears 254° true (W. by S. mag.). Then steer 178° true (S. ¼ W. mag.) for 10 miles until Long Shoal lighthouse bears 310° true (NW. mag.) distant 2⅜ miles.

Then make good a 225° true (SW. ½ W. mag.) course for 27½ miles to a position ¼ mile southward of Bluff Shoal lighthouse. Then make good a 246° true (WSW. ¼ W. mag.) course for 12 miles

to a position ½ mile southward of Brant Island Shoal lighthouse. Then make good a 259° true (W. ⅝ S. mag.) course for 10½ miles to a position 1 mile westward of Point of Marsh light to the mouth of the Neuse River. On this course Neuse River lighthouse (house on piles) should be picked up ahead with Point of Marsh light a little on the port.

Long Shoal River is a good anchorage for vessels of 8 feet or less draft. The entrance, which is about 1½ miles wide, lies on the north shore of Pamlico Sound, 7½ miles westward of Long Shoal lighthouse. Shoals with 1 to 2 feet over them lie on either side of the entrance and break the sea from southward. The channel has a depth of 9 feet to an anchorage above buoy No. 2, a depth of about 7 feet for 1½ miles, and 5 feet for a distance of 3 miles above buoy No. 2. The eastern point of Pingleton Shoal is marked by a lighted beacon, and the points of the shoals in the entrance are marked by buoys, and a stranger should have no difficulty in entering during the daytime.

DIRECTIONS.—*From eastward* give Long Shoal lighthouse a berth of 2¼ miles when southeastward of it, and when it bears 321° true (NW. by W. mag.) steer 282° true (WNW. ½ W. mag.) for 9 miles, or vessels of 7 feet or less draft with a smooth sea can cross Long Shoal about ⅜ mile northwestward of the lighthouse, and from a position ¾ mile westward of the lighthouse steer 272° true (W. ⅝ N. mag.) for 7 miles with the lighthouse a little on the starboard quarter. Either course will lead to a position ⅜ mile southward of red buoy No. 2 on the eastern side of the entrance.

Then steer 344° true (N. by W. mag.) and pass 200 yards westward of buoy No. 2 and the same distance eastward of black buoy No. 3. The course continued will lead in the best water until above the shoal which makes off from the eastern shore northward of Pains Bay, and then keep near mid-river. Anchor on the sailing line, the depths shoaling from 11 feet abreast buoy No. 2 to about 8½ feet abreast buoy No. 3. Vessels of a greater draft than 7 feet should not go above buoy No. 3. There is also good anchorage, exposed only to southeasterly winds, southward of buoy No. 2 and eastward of Pingleton Shoal.

From westward pass ½ mile southeastward of Gull Shoal lighthouse and steer 25° true (NNE. ⅝ E. mag.) for 11¾ miles. Pass about ⅜ mile southeastward and eastward of the lighted beacon marking the southerly end of Pingleton Shoal, and steer about 330° true (NNW. ¼ W. mag.) for 1⅜ miles to a position 200 yards westward of red buoy No. 2. Then steer 344° true (N. by W. mag.) as in the preceding paragraph.

Cape Channel, leading from Pamlico Sound through the shoals westward of the outer beach, separating the sound from the ocean, leads to the town of Buxton, 2 miles northward of Cape Hatteras. The channel is used a great deal by local fishermen. Buxton and Frisco are small towns near Cape Hatteras. There are no wharves, and anything but a light draft boat has to anchor well offshore. The channel for a distance of 3 miles from the entrance light has a depth of 8 feet or more.

DIRECTIONS.—From a position 2⅜ miles eastward of Long Shoal lighthouse make good a 180° true (S. ½ W. mag.) course for 13¾ miles to a horizontally stripped can buoy, or from Bluff Shoal lighthouse a 70° true (ENE. ¾ E. mag.) course for 21½ miles will lead to the same buoy. Then steer 133° true (SE. ⅜ S. mag.) for 2¼ miles to a position 100 feet southward of North Point light (black slatted pile structure). Round the light and steer 35° true (NE. ⅜ N. mag.), passing a black spar, to a position 75 feet northward of Muddy Slue light (red slatted structure). Then steer 98° true (ESE. ¾ E. mag.) and be guided by the buoys. The best anchorage is just eastward of Mid-Channel can buoy, but there is a smaller anchorage inshore of the black and white nun buoy near the ice house.

Far Creek just northward of Middleton anchorage, leads to **Englehard**, where gasoline may be obtained. The mouth of the creek is marked by a lighted beacon. Four feet can be carried to the landing.

Middleton Anchorage is a broad, open bight in the northern shore of Pamlico Sound, about 6 miles northward of Gulf Shoal lighthouse. The anchorage has depths of 9 to 13 feet and is sheltered from eastward by Gibbs Shoal, which has from 1 to 4 feet over it. There is no shelter from southeasterly or southerly winds. The anchorage is large and easy of access, and is used to some extent by tows and other vessels. **Middleton** is situated a short distance inland from the anchorage and is reached by light-draft boats by going up Middle Creek. Vessels must pass south of the black buoy on the southeast end of Gibbs Shoal in entering.

DIRECTIONS.—*From northeastward.*—From a position 2⅜ miles southeastward of Long Shoal lighthouse steer 250° true (WSW. ⅝ W. mag.) for 13 miles; or, vessels of 7 feet draft with a smooth sea can cross Long Shoal about ⅜ mile northwestward of the lighthouse, and steer 238° true (SW. by W. ⅝ W. mag.) for 12 miles. Either course will lead to a position ¼ mile southward of the black buoy on the southeasterly end of Gibbs Shoal. Then steer about 265° true (W. mag.) for 1 mile, and then steer 310° true (NW. mag.). Anchor about ¾ to 1 mile from shore in a depth of 11 to 12 feet. On all sides of the anchorage the shoals rise abruptly from depths of 9 to 11 feet.

From westward.—Passing about ½ mile eastward of Gull Shoal lighthouse, a 350° true (N. ½ W. mag.) course will lead to the anchorage.

At night.—Pass well southward of Gibbs Shoal, and bring Gull Shoal light astern on a 354° true (N. ⅛ W. mag.) course, which will lead to the anchorage. The low, marshy shore, which extends long distances in front of the woods in places, does not generally show at night.

Small vessels of less than 5 feet, in rough weather, prefer to pass inside of Gull Shoal lighthouse if bound southwestward from Middleton anchorage, by entering Wyesocking Bay (see p. —), then passing westward of Gull Rocks, between them and Hog Island Point, where there is 5 feet of water.

Wyesocking Bay makes into the north shore of Pamlico Sound northwestward of Gull Shoal lighthouse. It is a convenient anchorage for small craft of 6 feet or less draft when following the north

shore of the sound. The entrance is obstructed by shoals, through which a buoyed channel leads into the bay northward of Gull Shoal. **Gull Rock**, which just shows above water, is a part of the shoals on the south side of the bay. Buoy No. 2 at the entrance lies 1¾ miles 319° true (NW. ¾ N. mag.) of Gull Shoal lighthouse. Anchorage in 10 to 11 feet can be had ½ to 1 mile northwestward of this buoy, on the west side of a shoal with about 4 feet over it which extends from the buoy to the shore.

A canal dug to 6 feet leads from Old Bay, an arm of Wyesocking Bay, to **Nebraska**, a village 2 miles inland, where gasoline and supplies may be obtained.

A canal leads also to **Mattamuskeet Lake** in the interior.

DIRECTIONS.—To enter the bay pass about 200 yards southward of buoy No. 2 and steer 277° true (W. by N. mag.) for 1¼ miles to a position 100 yards southward of buoy No. 4. Then steer 305° true (NW. ½ W. mag.) and anchor in 7 to 8 feet, ⅜ to ½ mile off the west side of Long Point, with its southerly end bearing eastward of 108° true (ESE. mag.). Above this anchorage the head of the bay has depths of 3 to 5 feet.

The mouth of the canal to Nebreaska is marked by pile dolphins on each side of the dredged channel leading to the cut in the marsh. The 305° course will lead a little south of the entrance.

Bluff Point, low and marshy, separates **East Bluff** and **West Bluff bays**, two unimportant bights, southwestward from Wyesocking Bay. Extending southward from Bluff Point is a large area of shoal water, a tongue of which, called **Bluff Shoal**, extends across Pamlico Sound. The soundings on it are from 7 to 12 feet and the best crossing is marked by **Bluff Shoal lighthouse** (house on piles). A shoal with 4 feet of water over it lies 2 miles south-southwestward of Bluff Point. It is marked by a nun buoy.

Juniper Bay makes into the north shore of Pamlico Sound 1½ miles eastward of Great Island. The entrance is about 1½ miles wide, but toward its head the bay narrows gradually and 3 miles above the entrance it is a narrow, crooked stream. Shoals make off from both shores, but the middle of the bay has a depth of 7 to 10 feet. At the head of the bay is a boat canal which communicates with **Mattamuskeet Lake**. There is considerable traffic to the farms on the bay in small craft of 5 feet or less draft, which use the inside route through Swan Quarter Narrows and Bay, and the canal to Deep Bay, in making the passage to and from Belhaven.

Swan Quarter Bay makes into the north shore of Pamlico Sound westward of Great Island. At its entrance the bay is about 2 miles wide, but it contracts gradually toward its head, which is distant about 4½ miles above the entrance. A depth of 8 to 11 feet can be taken up to abreast the town of **Swan Quarter** through the channel, which is marked by range lights and buoys. The bay is full of oyster beds.

Great Island is low and grassy, and has a few houses at its northern end. **Swan Quarter Narrows**, the channel northward of the island, is good for vessels of 6 feet draft.

A canal 50 feet wide and 6 feet deep connects Swan Quarter Bay with Deep Bay. From Deep Bay the canal trends 49° true (NE. ¾ E. mag.) through the land to Swan Quarter Canal light, passing

northward of it, and then trends 80° true (E. ½ N. mag.) for Swan Quarter range rear light to the channel of Swan Quarter Bay.

A canal 30 feet wide and 7 feet deep has been dredged ½ mile in an east-northeast direction from Swan Quarter Bay to Swan Quarter. The canal entrance is on the eastern side of the bay 1⅛ miles above Swan Quarter range rear light, and is marked by a lighted beacon (red structure); dredged material shows on the shore northward of the canal entrance.

DIRECTIONS.—Local vessels up to 6 feet draft use the canal to Deep Bay (see below) in making the passage to or from points on Pamlico River and Belhaven, and use Swan Quarter Narrows when coming from or bound eastward. Strangers in vessels of deeper draft should enter by the deeper channels which lead between the extensive shoals southward of the bay. The following are directions from eastward:

Passing on either side of Bluff Shoal lighthouse at a distance of about ¼ mile, bring it astern on a 296° true (NW. by W. ¼ W. mag.) course for 12 miles, passing 1 mile southwestward of Great Island light (red and black pile structure). Pass 1 mile southwestward and westward of Great Island, and steer 336° true (N. by W. ¾ W. mag.) on the line of the Swan Quarter range lights, passing close to the perpendicularly striped buoy in the entrance. Pass 200 yards eastward of the front light, steer 326° true (NNW. ½ W. mag.), and pass about 200 yards south-southwestward and 150 yards westward and northwestward of the rear light. Then steer 35° true (NE. ½ N. mag.) for about ½ mile, and then follow the curve of the channel northward and pass about 100 yards eastward of Buoy No. 3.

Anchorage in a depth of 11 feet can be had about ¼ mile eastward or northeastward of the front light; above the front light anchorage can be selected in the channel, which is good for a depth of 8 feet to buoy No. 3.

Rose Bay makes into the north shore of Pamlico Sound at the entrance of Pamlico River. The entrance is about 1¾ miles wide, but shoals making off from both sides leave the channel about ⅝ mile wide. The depth in the channel is 9 feet or more for a distance of 4 miles above the entrance; the principal shoals are marked by lights or buoys for this distance, above which the channel is narrow, crooked, and is good for a depth of 6 feet. Rose Bay, Deep Bay, and the canal to Swan Quarter Bay form an inside route that is generally used by local vessels up to 6 feet draft. The canal is described with Swan Quarter Bay.

DIRECTIONS.—Approaching from southward, bring Pamlico Point lighthouse astern on a 3° true (N. ⅝ E. mag.) course; approaching from westward give the shore a berth of ½ mile, and pass southward of the fish stakes on the shoals westward of the entrance. Pass ¼ mile westward and 250 yards northwestward of Judith Island light, steer 55° true (NE. by E. ¼ E. mag.), and leave buoy No. 1 about 50 yards on the port hand. When past this buoy steer 27° true (NNE. ¾ E. mag.) and be guided by the buoys; anchor southward of buoy No. 3.

To Deep Bay.—From buoy No. 1 steer 75° true (E. by N. mag.) for 1 mile, and then steer 122° true (SE. ¾ E. mag.) for 1¼ miles to

a position 250 yards southward of Upper Island Point light. A 93° true (E. 5/8 S. mag.) course will then lead to the entrance of the canal which leads to Swan Quarter Bay. A lighted beacon is to be left to starboard in entering the canal.

Mouse Harbor, Big Porpoise Bay, and Middle Bay are small, shallow bays on the western side of Pamlico Sound between Pamlico Point, at the entrance of Pamlico River, and Jones Bay. There are no aids to assist a stranger. They are frequented only by the boats of local fishermen.

Jones Bay makes into the western shore of Pamlico Sound just northward of the entrances of Bay and Neuse Rivers. The bay is navigable for vessels of 7 feet draft for a distance of 5 miles above its mouth. The entrance is somewhat obstructed by shoals, through which a buoyed channel leads into the bay. On the north side, near the head of the bay, is the post village **Hobucken**, the small-craft landings for which are in the cove 3/4 mile above **Drum Creek.** When the water is high small boats can be taken through the old canal from **Ditch Creek to Bay River.**

DIRECTIONS.—*From eastward.*—With a smooth sea a depth of 6 feet can be taken across Brant Island Shoal by passing about 250 yards southward of Brant Island Slue light pile structure on a southwesterly course. From a position 1/2 mile southwestward of this light steer 280° true (WNW. 3/4 W. mag.) for 6 miles, and pass about 200 yards southward of buoys Nos. 2 and 4. Or, from a position 1/4 mile southwestward of Brant Island Shoal lighthouse make good a 289° true (WNW. mag.) course for 10 3/4 miles and pass 3/8 mile southward of buoy No. 2 and 200 yards southward of buoy No 4.

Round buoy No. 4 at a distance of 200 yards, steer 33° true (NE. 3/4 N. mag.), and pass 200 yards southward and eastward of buoy No. 1. Anchor 1/4 to 1/2 mile northwestward of buoy No. 1, above which there are no aids. About 1 mile above buoy No. 1 a spit extends nearly halfway across the bay from the point on the southwest side of the entrance, and otherwise the channel is near the middle.

From westward.—Avoid the shoal, which extends over 1 mile southeastward from Bay Point; *Bay Point light* is on its southerly end, and the shoal extends a short distance eastward and nearly 3/4 mile northeastward from the light. A 317° true (NW. 1/2 N. mag.) course, heading for the westerly point at the entrance of Jones Bay, will lead eastward of this shoal and up to buoy No. 4.

Cedar Island Bay is a large, irregularly shaped body of water making into the western shore of Pamlico Sound southward of Neuse River entrance. The shores of the bay and its numerous branches are marshy, and it is of no importance except for its oyster beds. A depth of 9 feet can be taken into the principal arms of the bay through narrow and crooked channels. **Cedar Island Bay light** marks the northwest side of the channel at the entrance of the bay, and is located in a depth of 8 feet on the end of the shoal which extends south-southeastward from Swan Islands. From the south branch of the bay next eastward of Long Bay there is a canal dredged to 6 feet deep and 60 feet wide into **Thoroughfare Bay** and thence into Core Sound.

Royal Shoal.—In the bight formed by the hook of Royal Shoals vessels and tows sometimes anchor when the sea is too rough to make headway in the sound. The shoal, which has from 2 to 4 feet over it, and is bare in one place, breaks the sea so as to leave comparatively smooth water at the anchorage. The depth is 9 to 14 feet and the holding ground good.

DIRECTIONS.—From the vicinity of Bluff Shoal lighthouse pass ½ mile northward and westward of Northwest Point Royal Shoal unused lighthouse and then steer about 198° true (SSW. mag.).

When Southwest Point Royal Shoal lighthouse bears 130° true (*SE.* mag.), steer 142° true (SE. by S. mag.), and give the lighthouse a berth of about ¾ mile in rounding it until it bears westward of north.

Pass ½ mile eastward of the lighthouse on a north-northeasterly course; anchorage can be selected from ¾ to 1½ miles eastward or northeastward of the lighthouse in a depth of 10 to 14 feet.

Core Sound is a narrow and shoal body of water extending along and just inside the beach for a length of 27 miles, from the southwest end of Pamlico Sound to a point inside Cape Lookout. At its western end Core Sound joins a similar body of water, known as Back Sound, and a narrower body, north of Harkers Island, known as The Straits, both of which connect with Beaufort Harbor and Inlet, forming an inland waterway for boats of 4 feet draft between Pamlico Sound and Beaufort Harbor, about 5 miles shorter than the deeper route by way of Neuse River and Adams Creek. Core Sound varies in width from 2 to 3 miles, and has a general southwesterly trend. It is nearly filled with shoal banks, over which the depth ranges from 2 to 4 feet; but a channel, from 7 to 10 feet deep, winds through the sound and is continuous except at three places, where bars of 5 feet depth must be crossed. These bars are situated as follows: Harbor Island Bar, at the entrance of Pamlico Sound; Piney Point Bar, off Piney Point, about 15 miles down the sound; and Yellow Shoal, off Bells Point, 6 miles farther southwestward.

Wainwright Slue is a small anchorage at the entrance to Core Sound about 1 mile eastward of Harbor Island Bar lighthouse. It is marked by two buoys, and shelter from the sea is afforded by the surrounding shoals, which have from 2 to 3 feet over them. The depths range from 9 to 19 feet, and vessels anchor in the entrance, or farther in so as to get the best protection from the sea.

Thoroughfare Bay, on the north side of Core Sound, is connected with Cedar Island Bay by a canal 6 feet deep, and this forms a boat route into Pamlico Sound near the mouth of Neuse River.

Back Sound trends about westward from Core Sound for 6 miles to Beaufort Harbor and varies in width from over 2 miles to ½ mile. Passage to Core Sound, except for very light draft boats, is blocked by a shoal at the junction of the two sounds, over which there is but 3½ feet of water.

The Straits parallel Back Sound north of Harkers Island and Middle Marshes, and offer a through deep passage from Core Sound to the western end of Back Sound. The width is from ⅜ to ¾ mile, but the clear channel is only 100 yards at places.

Marshallburg is a small town at the eastern end of The Straits. There are wharves and gasolene can be obtained.

A channel 5 feet deep has been dredged through Taylors Creek from Lenoxville Point, at the western end of The Straits, close along the mainland inside a row of marshy islands to the wharves at Beaufort.

A mail boat passes through Core Sound, stopping at the principal settlements, en route between Beaufort and Ocracoke.

Tidal currents of 1 to 2 knots may be found in the lower part of Core Sound.

DIRECTIONS (*Pamlico Sound to Beaufort Harbor by way of Core Sound*).—The depths in Core Sound are affected by the winds, northerly and northeasterly winds causing high water, and westerly and southwesterly winds low water. Four feet is the maximum draft that can be carried through by a stranger. The route through Adams Creek Canal is preferred.

The channel through Core Sound and The Straits is marked on each side by lights on red or black structures. The red structures are left to starboard and the black to port going westward. The aids must be relied upon to keep in the best water, and the following general directions are intended only to assist in finding them. As a general rule run from beacon to beacon. Chart 421 is the best guide.

From Long Shoal lighthouse steer 224° true (SW. ¼ W. mag.) for 32¾ miles to a position ½ mile northwest of Royal Shoal northwest unused lighthouse (old tower), leaving Gull Shoal lighthouse 1⅛ miles to starboard and Bluff Shoal lighthouse 1¼ miles to port. Then steer 197° true (S. by W. ⅞ W. mag.) for 9 miles to a position 600 yards east-northeastward of Harbor Island Bar lighthouse with the lighthouse ahead. The channel over Harbor Island Bar has a depth of 4 feet and is indefinite.

From Harbor Island Bar lighthouse the channel trends about 186° true (S. ⅞ W. mag.) for 3⅝ miles to East Drum Shoal light (black structure), passing westward of Harbor Island (marked by a house) and Goulds Lump light (black structure), there are a few stakes on the east side of the channel; thence about 251° true (WSW. ⅝ W. mag.) for 1⅜ miles to West Drum Shoal light (black structure); thence about 217° true (SW. ⅜ S. mag.) for 1⅝ miles to Lewis Creek light (black structure); thence 223° true (SW. ¼ W. mag.) for 3½ miles to White Point light (red structure); Halls Point light is left ¼ mile to starboard on this course; thence 250° true (WSW. ⅝ W. mag.) for ½ mile to Atlantic light (black structure); thence 222° true (SW. ⅛ W. mag.) for 2⅜ miles, passing Steep Point Light (red structure) and to Mill Point light (black structure); thence 260° true (W. ½ S. mag.) for ½ mile to Nelson Bay light (black structure); and thence 220° true (SW. mag.) for 1⅞ miles to Piney Point light (black structure).

From Piney Point light the channel trends west-southwestward for ½ mile to Bretts Point light (black structure); and thence west-northwestward and then southwestward over Piney Point Bar, where it is marked by Bretts Bay light (red structure) and Kings Point light (black structure).

From Kings Point light the channel trends 205° true (SSW. 5/8 W. mag.) for 3¾ miles, passing Davis Shore light (red structure) and to Davis Island light (black structure); thence 243° true (WSW. mag.) for 1⅜ miles to Jarrets Bay light (black structure); and thence 160° true (S. by E. ⅜ E. mag.) for 1¼ miles to Bells Point light (black structure).

From Bells Point light the channel trends 247° true (WSW. ⅜ W. mag.) to Straits Entrance light (black structure), and continues westward through The Straits. The distance from Bells Point light to The Straits is 2 miles, and thence through The Straits to the west end of Harkers Island is 3½ miles. The channel is narrow but well marked by lighted beacons on each side. Marshallburg is a small town at the eastern end of The Straits. There are wharves, and gasoline can be obtained. From North River light (black structure abreast the west end of Harkers Island) the channel crosses in a south-southwest direction to Shepherd Shoal light (red structure); thence westward to Middle Marshes light (red structure).

From this point boats desiring to go to Beaufort Inlet can continue for ⅜ mile past Middle Marshes light, then steer about 243° true (WSW. mag.) to Shackleford Point. Thence the channel trends west-northwestward to the main channel of Beaufort Harbor and is not marked.

But the more protected route, dredged to a depth of 5 feet and width of 40 feet, leads through Taylors Creek, close along the mainland to the wharves at Beaufort. The entrance is ¼ mile north-northwestward of Middle Marshes light, and is marked by a light on the east side. Pass close westward of Middle Marshes light and the light at the entrance and head for the wharf at Lenoxville Point until close to it. From here the channel leads westward, close along shore inside all of the islands, is marked by beacons at some of the turns and by spoil banks in places, and is easily followed.

Pamlico River empties into the northwestern part of Pamlico Sound from northwestward. The town of **Washington**, on the east bank, 31 miles above the entrance, is considered the head of navigation for sailing vessels. A channel 200 feet wide and 9½ feet deep leads to the town, which ships lumber in barges and small schooners, and supplies to the villages and settlements on the shores of Pamlico Sound. There are marine railways at Washington, and bituminous coal, gasoline, water, and ice can be obtained. The river is crossed by three drawbridges at Washington. There is a relief station of the Public Health Service, and storm warnings are displayed. The water in the river above Core Point is usually fresh enough to use in the boilers of steamers.

Below Washington several navigable rivers and creeks empty into Pamlico River, the most important of which are Pungo River, Goose Creek, South Creek, Bath Creek, and Durham Creek.

Pungo River empties into Pamlico River from northward about 4 miles above the entrance. The channel is well marked by buoys and lights, and can be readily followed by a stranger for a distance of 15 miles. It then becomes narrow, but has a least channel depth of about 8 feet to Leachville, a village 18½ miles above its mouth; a drawbridge crosses the river at Leachville. A number of nav-

igable creeks empty into Pungo River, from which logs are towed to Belhaven. The most important are Pungo Creek and Slade Creek.

Slade Creek empties into Pungo River from eastward 4 miles above Wade Point. A depth of 7 feet can be taken 2 miles above the entrance, and 4 feet 1½ miles farther.

Pungo Creek empties into Pungo River from westward 1¼ miles southwestward of Belhaven. A drawbridge crosses the narrow part of the creek 2¼ miles above the entrance. A depth of 7 feet can be taken just above the bridge, and 6 feet about 2 miles farther.

Pantego Creek empties into Pungo River from northward 8½ miles above Wade Point. On the eastern bank, just inside the entrance of the creek, is the town of **Belhaven**, which is the terminus of a railroad, and ships lumber and oysters by rail and lumber in barges. The channel of the creek has a depth of 9 feet to Belhaven and 8 feet can be taken 2¼ miles above its entrance. Gasoline, ice, water, and generally some coal can be had at Belhaven. There is a depth of 9 feet at the railroad wharf, and but little depth at the other wharves. A drawbridge crosses just above Belhaven.

Goose Creek empties into Pamlico River from southward about 6½ miles above its entrance. The entrance to the creek is obstructed by shoals, through which a narrow but deep channel, marked by buoys and Reeds Hammock light, leads into the creek, which has a channel depth of 11 feet for a distance of 3 miles. **Campbell Creek, Upper** and **Lower Spring Creek, Eastham Creek, Snode Creek,** and **Dixon Creek** are navigable tributaries of Goose Creek. Logs are towed from the creek. **Reeds Hammock light,** on the northwest side of the channel at the entrance, is located in a depth of about 9 feet near the end of the shoal which extends ½ mile east-southeastward from the western point at the entrance. The shore eastward and westward of the entrance should be given a berth of over ½ mile until the light bears between south and west-southwest.

South Creek empties into Pamlico River from southward about 9 miles above its entrance. The deeper entrance leads southward of Indian Island and the shoal connecting the island with Hickory Point and is buoyed. **Indian Island Slue** is a dredged cut, good for vessels of 5 feet draft, across the shoal between Indian Island and Hickory Point. The course through the cut is 178° true (S. ⅛ W. mag.), passing close to the two buoys which mark it, and about 100 yards eastward of Indian Island Slue light.

South Creek has a least channel depth of 8 feet for a distance of 4 miles above Hickory Point. **Aurora,** a village on the railroad 6½ miles above Hickory Point, is reached through a dredged channel 100 feet wide and 7 feet deep. The dredged channel follows the line of deepest water as shown on the chart, but local knowledge is needed to carry the best water above Point of Marsh. A drawbridge with a clear width of 20½ feet crosses the river just above Aurora, and a railroad bridge, which is practically the head of navigation, crosses at Royal, 1¼ miles above Aurora.

Bond Creek is on the south side of South Creek southward of Hickory Point. It has a depth of 7 feet to the wharf at the sawmill and post office of South Creek. To enter, pass northward and ¼ mile westward of buoy No. 1; then steer 207° true (SSW. ¾ W. mag.) for the entrance and be guided by the buoys to the wharf.

North Creek empties into Pamlico River from northward about 12 miles above Pamlico Point lighthouse. Its buoyed channel is good for a depth of 7 feet. Some lumber is shipped out.

Durham Creek empties into Pamlico River from southward about 17½ miles above its mouth and 2½ miles westward of Rumley Marsh light. The creek is navigable for a draft of 5 feet nearly to **Bonners Bridge**, a distance of 4 miles above its mouth. A sawmill and wharf, with 6 feet at its end, are located on the west side ½ mile above the entrance. There are no aids except a private beacon, which marks the west side of the narrowest part of the channel at the entrance.

Bath Creek empties into Pamlico River from northward, 3½ miles northwestward of Rumley Marsh light. A draft of 6½ feet can be taken to the village of Bath, about 1¾ miles above its mouth, and a draft of 5 feet can be taken about 4 miles above the entrance. A drawbridge crosses the creek at the upper end of Bath. The most difficult place in the channel to Bath is in the narrowest part of the entrance, where a shoal which shows by the grass on it extends halfway across from the west side, and rises abruptly from the channel. The eastern end of this shoal is marked by a lighted beacon.

Blount Creek empties into Pamlico River from southward, 2½ miles westward of Mauls Point light. A draft of 6 feet can be taken into the creek, and 4 feet can be taken about 4 miles above the drawbridge which crosses about ⅜ mile above the entrance.

Tar River, which is the continuation of Pamlico River above Washington, has a channel 3 feet deep to **Greenville**, 19 miles; 20 inches deep to **Tarboro**, 43 miles; and the river is clear of snags to **Little Falls**, 77 miles. The head of navigation is **Dunbar Bridge**, 94 miles above Washington. Above Greenville to **Fishing Creek** the river is navigable for light-draft steamers of 3 to 5 feet only 4 to 6 months during the winter season. Fishing Creek is a branch of Tar River, 49 miles above Washington; is obstructed by a snag 2 miles above its mouth and above it is in bad condition. Navigable stages of 3 to 5 feet are generally available for 4 to 6 months of the winter season.

Tides.—There are practically no tides, the variations in water level being due principally to winds. Easterly winds cause high water and westerly winds low water, the maximum variation with heavy gales amounting to about 2 feet above or below the normal in the lower part of the river and 3 or 4 feet, or even more at Washington. Freshets of 10 to 20 feet occur in the upper reaches of the river above Washington, but have little effect at and below the town.

DIRECTIONS (*Pamlico River to Washington*).—Directions from Croatan Sound through Pamlico Sound are given on page 151.

From a position ¼ mile southward of Bluff Shoal lighthouse steer 275° true (W. ¾ N. mag.) for 11¼ miles, passing ¾ mile southward of the horizontally striped buoy at the southeasterly end of Lower Middle and 1 mile southward of the lighted beacon at the southwesterly end of Inner Middle. When this beacon is abeam, steer 308° true (NW. ¼ W. mag.) for 9½ miles, passing ½ mile northeastward of *Pamlico Point lighthouse* (house on piles; fixed white).

When *Pamlico Point lighthouse* bears 176° true (S. mag.), steer 294° true (NW. by W. ½ W. mag.) for 6¼ miles to a position ¾ mile

south-southwestward of Pungo River light (red and black slatted pile structure). Then steer 284° true (WNW. 3/8 W. mag.) for 10 miles to a position 300 yards southward of *Rumley Marsh light*, red slatted pile structure. Then steer 291° true (NW. by W. 3/4 W. mag.) for 4 miles to a position 1/4 mile northward of the black spar buoy off Core Point. Then steer 286° true (WNW. 1/4 W. mag.) for nearly 4 miles to a position 200 yards northward of *Mauls Point light.*

From a position 200 yards northward of *Mauls Point light* steer 281° true (WNW. 5/8 W. mag.) for 1 5/8 miles until abreast buoy No. 6, and then steer 297° true (NW. by W. 1/4 W. mag.) for 1 1/4 miles to a position 300 yards southward of buoy No. 8. Then steer 315° true (NW. 3/8 N. mag.), pass a little over 1/4 mile off Hills Point, and continue the course to a position 100 feet southwestward of *Hills Creek light* (red structure), at the entrance to the dredged cuts.

Then steer 303° true (NW. 3/4 W. mag.) to a position 100 feet southwestward of *Fork Point light* (red structure). Then steer 321° true (NW. 7/8 N. mag.) for the high black water tank in Washington showing midway between *McWilliams Point Shoal light* (red structure) and *Rodman Point Shoal light* (black structure), and pass these lights at a distance of 100 feet. (In hazy weather a water tank at Austin Point may be seen before the one in Washington.) From a position 100 feet northeastward of *Rodman Point Shoal light* steer 309° true (NW. 1/8 W. mag.) and pass 100 feet northeastward of *Windmill Point Shoal light* (black structure). Then steer 326° true (NNW. 1/8 W. mag.) for the draw, pass preferably through the eastern opening, and continue the course to the wharves, which should be followed at a distance of about 150 feet. Vessels should go to the wharves. A dredged channel leads eastward from the main channel, 300 yards above Rodman Point Shoal light, thence parallel to the shore to the dock of the chemical factory near Austin Point.

Directions (*Pungo River to Belhaven*).—Having followed the directions from Pamlico River above, pass 1/2 mile northeastward of Pamlico Point lighthouse and steer 310° true (NW. 1/8 W. mag.) for 7 miles to the middle of the entrance of Pungo River, or, coming down Pamlico River, pass southward of the horizontally striped buoy off Wade Point, and about 1/2 mile southward and eastward of *Pungo River light* (on southeast end of shoal off Wade Point).

Then steer 344° true (N. by W. 1/8 W. mag.) for *Woodstock Point light* and pass 1/4 to 3/8 mile westward of buoy No. 2 off Currituck Point and 200 yards eastward of buoy No. 1 off Grassy Point. Then steer 336° true (N. by W. 3/4 W. mag.) and pass 300 yards westward of buoy No. 4. Then steer 349° true (N. 5/8 W. mag.) to a position 200 yards eastward of *Woodstock Point light.* Then steer 328° true (NNW. 1/2 W. mag.), pass 250 yards westward of buoy No. 8, and to a position 350 yards southwestward of *Pantego Creek light* (red slatted structure). Then steer 319° true (NW. 3/4 N. mag.) for the outer end of the upper wharf house of Belhaven; anchor in mid-channel below the buoys, or continue past them and anchor in mid-channel just above the railroad wharf.

Bay River empties into the western part of Pamlico Sound from westward, the entrance being just north of the mouth of Neuse River and about 5 miles north-northeastward of Neuse River lighthouse. The entrance is marked by Maw Point Shoal and Bay Point

lights. The channel for a distance of 11 miles above the entrance is marked by buoys and lighted beacons, has a depth of 9 feet or more, and can be readily followed. Above this point the channel is a dredged cut 150 feet wide and 9 feet deep to a point ⅝ mile below Stonewall, and thence 100 feet wide and 9 feet deep to Bayboro, which is practically the head of navigation; the dredged cuts are marked by range beacons, but some local knowledge is needed to follow them. **Vandemere** is a village and railroad terminal, 8 miles above the entrance of Bay River; there is a depth of 8 feet at the end of the railroad wharf. **Stonewall** and **Bayboro** are villages, with railroad communication, on the river 13 and 14 miles above the entrance; lumber is shipped from the sawmills at these places, and there is a fertilizer factory at Bayboro.

DIRECTIONS—*From eastward.*—With a smooth sea a depth of 6 feet can be taken across Brant Island Shoal by passing about 250 yards southward of *Brant Island Slue light* on a southwesterly course. From a position ½ mile southwestward of this light steer 266° true (W. mag.) for 6 miles; or, from a position ¼ mile southwestward of Brant Island Shoal lighthouse, make good a 281° true (WNW. ⅝ W. mag.) course for 10¾ miles. Either course should lead to a position ¼ mile southward of *Bay Point light.* Then steer 291° true (NW. by W. ¾ W. mag.) for 2½ miles, and pass about 100 yards northward of *Pine Tree Shoal light* (black structure).

From a position ¼ mile northwestward of the lighted beacon steer 266° true (W. mag.) for 1 mile, giving the southern shore a berth of about ½ mile, and then keep near the middle of the river, giving the buoys a berth of over 100 yards until westward of buoy No. 6. (*If bound for Vandemere*, after passing Petty Point and ¼ mile northeastward of Bell Point lighted beacon steer 318° true (NW. ⅝ N. mag.) for the railroad wharf.) Then give the northern shore of *Mason Bay* a berth of ¼ mile, and follow the buoys at a distance of 75 to 100 yards. Anchorage can be selected in the channel of the river up to the entrance of the dredged cuts about 150 yards northwestward of buoy No. 11, but above this point there is not room for anchorage except for small craft.

From westward.—Pass ½ mile eastward and northeastward of Maw Point Shoal light, and steer 322° true (NW. by N. mag.) for 1½ miles to a position about 300 yards northeastward of buoy No. 3. Then steer 304° true (NW. ⅝ W. mag.) for 1¾ miles and pass about 100 yards northeastward of buoy No. 5. Then follow the directions in the preceding paragraph.

Neuse River empties into the western end of Pamlico Sound and is one of the important rivers of North Carolina. For a distance of 25 miles above its mouth the river has a width varying from 5 to 1¾ miles and a channel depth of over 13 feet; above this the channel has a depth of 11 feet to Newbern. From the entrance of the river to Newbern the channel is marked by lights and buoys.

Newbern is a city on the west bank of Neuse River, 34 miles above the entrance. It ships lumber in barges and fish and farm produce by railroad. There is a marine railway 110 feet long, with a capacity of 500 tons, and anthracite and bituminous coal, gasoline, water, and ice can be obtained. There is a relief station of the United States Public Health Service, and storm warnings are displayed. The river

water is slightly brackish at Newbern except during freshets. The quarantine officer is at Newbern; the quarantine station and anchorage is about 2 miles below.

Turnagain Bay is on the south side of Neuse River, south-southeastward of Neuse River lighthouse. It has a depth of 9 feet or more in a narrow channel for a distance of 3 miles above the entrance; the entrance is marked by private buoys. The old canal to Long Bay is closed.

Broad Creek entrance is on the north side of Neuse River, 1¾ miles westward of Neuse River lighthouse. Lower Broad Creek light (black slatted structure) marks the west side of the channel at the entrance. **Pamlico** is a post office and sawmill on the south side of Broad Creek, 2½ miles above the entrance. Vessels load to a depth of 6 feet on the eastern side of the slab wharf at the sawmill and anchor off the mouth of **Tar Creek** to load to 8 feet. To enter Broad Creek, pass 100 yards eastward and northward of Lower Broad Creek light, and steer 266° true (W. mag.) until past the point of the shoal, which shows by discolored water, on the starboard hand; then steer northwestward, slightly favoring the western bank until abreast the turning point on that side, and then keep in mid-creek.

South River is on the south side of Neuse River, 6 miles south-southwestward of Neuse River lighthouse. The channel at the entrance is marked by buoys, and on its west side by South River light. The channel has a depth of 10 feet or more for 5½ miles, and 8 feet for 7 miles, above the entrance. To enter South River, steer 153° true (SSE. mag.) for South River light in range with the southernmost point that shows on the east side of the creek until up with buoy No. 1, and then change the course so as to pass 100 yards eastward of the light. When 100 yards past the light, change the course gradually to 193° true (S. by W. ½ W. mag.), giving the edge of the bank, which shows by discolored water and is steep-to, on the west side of the channel a berth of 75 to 100 yards, and pass 100 yards westward of buoy No. 3. Then keep in mid-river. There is a sawmill at Coffee Creek, a small bight on the east side of the river about 2½ miles from the entrance beacon. The depth in the creek is 4 feet and there are a few old wharves on the south side.

Oriental is a post village and railroad terminus on the eastern side of Smith Creek, north side of Neuse River, 8½ miles westward of Neuse River lighthouse. Supplies, gasoline, ice, and water can be obtained here, and repairs to gasoline engines made. There is a depth of 8 feet in the channel and about 8 feet at the principal wharves. A sand spit of dredged material extends southwestward to the channel from the eastern point at the entrance, and the cove northward of it has been dredged to a depth of 10 feet. The best anchorage is in this cove, but vessels of 7 feet draft can anchor westward of the sawmill wharf toward the entrance of **Green Creek**. There is a marine railway capable of hauling vessels to 50 feet in length.

A depth of about 7½ feet can be taken into Green Creek to the wharves of Oriental by steering about 308° true (NW. ¼ W. mag.) for Chadwicks Point Shoal light. Pass 100 feet westward of the light and steer 341° true (N. by W. ½ W. mag.) for the end of the sawmill wharf. Avoid the shoal making out from the sand spit at the

entrance to the harbor. After passing this spit the cove may be entered for an anchorage. There are two small wharves on the north side of this bight. Gasoline can be obtained in the cove. If going to the railroad wharf continue the course to avoid a shoal, with little water over it, which extends over halfway across from the old mill on the western side, the end of the shoal lying 100 yards southwestward of the southeast end of the railroad wharf.

Adams Creek entrance is on the south side of Neuse River, 10 miles above Neuse River lighthouse, and southward of the town of Oriental, on the opposite side of the river. It is a part of the principal route between Pamlico Sound and Beaufort Harbor. A channel with a present depth of 12 feet has been dredged through Adams Creek, and thence through a canal and dredged channels in **Core Creek** and **Newport River** to Beaufort Harbor. This channel is well marked and easily followed in the daytime and is good for vessels of 10 feet draft. The distances through the channel are as follows: Adams Creek entrance to north end of canal 5 miles, to south end of canal 10½ miles, to Morehead City bridge 17 miles. Two drawbridges cross the channel, one with a clear opening 60 feet wide over the canal 1 mile from its south end, and Morehead City bridge with a clear opening 50 feet wide. For directions, see page 167.

Clubfoot Creek empties into Neuse River from southward about 14 miles above Neuse River lighthouse. Clubfoot Creek light is located in a depth of 6 feet, on the eastern side of the entrance. The channel in the entrance, southward of the light, is narrow, with shoals which rise abruptly on both sides. There is a depth of 9 feet through the entrance, 7 feet for 2½ miles, and 5 feet for 3½ miles above Clubfoot Creek light. **North Harlowe** is a post office on the west side of the creek, and there are two sawmills on the east side. From the creek there is a passage, good for a depth of 3½ feet at high water, through the **Clubfoot Canal** and **Harlowe Creek** to Beaufort Harbor. To enter Clubfoot Creek, pass 200 yards westward and southwestward of Clubfoot Creek light, steer about 143° true (SE. by S. mag.), slightly favor the east bank until approaching the old mill wharves on the west side northward of **Nitchell Creek**, and then keep in midcreek.

Hancock Creek is on the south side of Neuse River, nearly 3 miles west-southwestward of Wilkinson Point Shoal light. A depth of about 4 feet can be taken into the creek.

Slocum Creek is on the south side of Neuse River, 4½ miles westward of Wilkinson Point Shoal light. A draft of 6½ feet is loaded at the old sawmill just inside the entrance. There is a depth of 4½ feet in the channel of the creek to the forks, a distance of 4½ miles, and up the west branch for 2½ miles farther to **Havelock**, a post office on the railroad. There is a light (red slatted pile structure) at the entrance, and otherwise the chart is the guide.

Beard Creek is on the northeast side of Neuse River, 4 miles northwestward of Wilkinson Point Shoal light. A depth of 5 feet can be taken about 4½ miles up the creek to the county bridge.

Goose Creek is on the northeast side of Neuse River, 6 miles below Newbern. A depth of 7 feet can be taken about 4½ miles up the creek.

Upper Broad Creek is on the northeast side of Neuse River, 5 miles below Newbern. A depth of 7½ feet can be taken about 10 miles

up the creek to Tuly Landing, and 5 feet about 1 mile farther to the head of navigation at the county bridge.

Neuse River above Newbern has a low-water depth of 3½ feet to **Village Creek**, 22 miles; 2½ feet to the mouth of **Contentnia Creek**, 28 miles; and 1 foot to **Seven Springs**, 64 miles. The river above **Maple Cypress** is navigable only during freshet stages of more than 3 or 4 feet. Kinston is reached by light-draft steamers only during freshet stages of variable duration, extending over 6 or 8 months of the year.

Waynesboro Landing (Goldsboro), 85 miles above Newbern, is practically the head of navigation, the river being occasionally cleared of obstructions to that point. Boats have gone up as far as **Smithfield**, 130 miles above Newbern.

Swift Creek, a branch of Neuse River 7 miles above Newbern, has been cleared of obstructions for a distance of 12 miles to the village of **Vanceboro**, the head of navigation, and has minimum width of 50 feet and a depth of 5 feet or more.

Contentnia Creek, a branch of Neuse River, 28 miles above Newbern, is navigable for light-draft steamers during freshet stages for 28 miles to **Snow Hill**, which is practically the head of navigation. Boats occasionally go up as far as **Fools Bridge**, 9 miles above Snow Hill, and have gone up as far as **Speights Bridge** (closed), 16 miles above Snow Hill.

Trent River empties into the Neuse at the southern end of the city of Newbern. Its least channel depth for a distance of 16 miles to **Polloksville** is 9 feet; to **Quaker Bridge**, 24 miles above Newbern, 6 feet; and to **Trenton**, 33 miles above Newbern, 4 feet. At Newbern the river is crossed by two bridges with draws about 35 feet wide.

Tides.—There are practically no tides, the variations in water level being due principally to winds. Easterly winds cause high water, and westerly winds low water, the maximum variations with heavy gales amounting to about 2 feet above or below the normal in the lower part of the river and about 3 or 4 feet at Newbern. Freshets of 10 to 20 feet occur in the upper reaches of the river above Newbern, but have little effect at and below the town.

DIRECTIONS (*Neuse River and Adams Creek*).—Directions through Pamlico Sound to Neuse River are given on page 151. The following directions are good for a depth of 9 feet to Newbern:

Having come to a position 1 mile westward of Point of March light, as directed on page 151, make good a 236° true (SW. by W. ⅜ W. mag.) course for 9 miles, passing ¾ mile southward of Neuse River lighthouse, ¼ mile southward of the red nun buoy marking Gum Thicket Shoal, and to a position ¼ mile northward of Garbacon Shoal light (black slatted pile structure).

From a position ¼ mile northward of Garbacon Shoal light steer 238° true (SW. by W. ½ W. mag.) for 5 miles, giving the north shore a berth of about 1 mile, and then steer 255° true (W. by S. mag.) for 2½ miles to a position ¼ mile southward of Wilkinson Point Shoal light (red slatted pile structure). Then steer 290° true (NW. by W. ⅞ W. mag.) for 8 miles to Otter Creek light (black slatted pile structure).

Pass 50 yards westward of Otter Creek light and steer 319° true (NW. ¾ N. mag.) for 1⅞ miles, passing ¼ mile eastward of spar buoys, marking the dredged cut and to a position 50 yards east-

ward of Hampton Shoal light (black structure). Then steer 332° true (NNW. ⅜ W. mag.) for 3¾ miles, heading for Fort Point Channel light (red structure), passing 150 yards eastward of Johnston Point light (black structure). Pass 150 yards southwestward of this light and steer 277° true (W. by N. mag.) for Lower Green Spring light to a position 100 feet southwestward of buoy No. 12. Then steer 304° true (NW. ⅝ W. mag.) for an iron stack at the fertilizer factory in range with a brick stack in the western part of Newbern until up with Upper Green Spring light (red structure). Pass 50 yards westward of this light and steer 332° true (NNW. ⅛ W. mag.) for a square brick stack at the southeasterly end of Newbern. A buoyed channel 300 feet wide leads northward in Neuse River close to the wharves on the eastern side of the city until above the second drawbridge. *Anchorage* can be had on the south side of the city, in the mouth of Trent River, below the first bridge, in 10 to 18 feet.

Adams Creek to Beaufort Harbor.—From a position ¼ mile northwestward of Garbacon Shoal light steer 212° true (SW. ¾ S. mag.) for 2½ miles, heading for the point on the south side of the river westward of Adams Creek. When Adams Creek light (red slatted pile structure) bears 154° true (SSE. mag.) distant ¾ miles, steer this course and pass 75 feet eastward of the light.

The dredged cuts are 250 feet wide in Adams Creek to Isaacs Creek light, thence 125 feet wide to North Entrance Canal light, 90 feet wide in the canal to Core Creek, 125 feet wide in Core Creek, and thence 250 feet wide to Beaufort Harbor.

Passing 75 feet eastward of Adams Creek light, steer 168° true (S. ¾ E. mag.). Leave the black buoy 125 feet on the port hand and slowly change the course to 133° true (SE. ¼ S. mag.) for 1⅜ miles with Dumpling Creek range lights (white daymarks) in line ahead.

Leave Dumpling Creek range front light on the port hand and steer about 147° true (SSE. ½ E. mag.) for ⅝ mile to a position close westward of Cedar Creek range front light.

Then bring Cedar Creek range lights in line astern on a 206° true (SSW. ¾ W. mag.) course for 1¾ miles to a position close westward of Isaacs Creek light; a single light serves as the rear range for both Dumpling Creek and Cedar Creek ranges.

Leave Isaacs Creek light on the port hand and steer 241° true (SW. by W. ¾ W. mag.) for North Entrance Canal light (white daymark). This course should lead about 125 feet off the notice board on the north bank and then near mid-creek. Leave North Entrance Canal light about 60 feet on the starboard hand, steer 216° true (SW. ½ S. mag.) and keep in mid-creek or favor the west bank slightly in rounding the next point on the east side.

Keep in mid-channel through the canal, the limit of speed being 5¼ miles (6 statute miles) per hour for vessels without tows and of less than 100 feet in length. A highway drawbridge crosses the canal 1⅛ miles northward of the southern end. Take east draw.

Core Creek and Beaufort Harbor.—From the south end of the canal steer 184° true (S. ¾ W. mag.) for ⅜ mile in the first section of the dredged cut to a position 75 yards eastward of Core Creek upper light; the grass marks the east side of this dredged cut, but on the west side is a flat bare at low water. Then steer 178° true (S. ⅛ W.

mag.) for 1¾ miles with Core Creek range lights in line ahead, to a position westward of a red buoy; the sides of the cut are flats bare at low water and visible at all times.

Leave the red buoy about 100 feet on the port hand and steer 146° true (SSE. ⅝ E. mag.) for 1 mile with Russells Creek light a little on the port bow. Leave Russells Creek light 125 feet on the port hand and steer 199° true (SSW. mag.) for 1¼ miles. Leave Newport Marshes upper light about 125 feet on the starboard hand and steer 226° true (SW. ⅜ W. mag.). Pass midway between Newport Marshes lower light and a fish factory wharf south of it, steer 201° true (SSW. ¼ W. mag.) for the end of the wharf house which shows over the bridge a little to the right of the draw until past a nun buoy on the port hand, and steer for the draw when less than 300 yards from it.

From the draw steer 178° true (S. ⅛ W. mag.) to a position 100 yards eastward of a horizontally striped buoy, and then steer 165° true (S. by E. mag.) until approaching the marsh on the southern side. Then steer southeastward, follow the marsh at a distance of 125 yards, and leave buoy No. 6 on the port hand. When past this buoy give the shore a berth of over 150 yards and steer about 107° true (ESE. ⅛ E. mag.) to a position about 100 yards westward of buoy No. 4. Then steer about 143° true (SSE. ⅞ E. mag.) to a position midway between a bell buoy and red and black buoy northward, then gradually haul southward and bring Bird Island range lights in line astern, course 212° true (SW. ¾ S. mag.). Hold this course until up to can buoy "3," then bring Fort Mason range lights in line astern, course 180° true (S. ⅜ W. mag.) to the Entrance gas buoy, from which a course can be shaped as desired.

Directions for entering Beaufort Harbor from the sea will be found on page 53.

APPENDIX.

COAST PILOTS AND FIELD STATIONS OF THE COAST AND GEODETIC SURVEY.

Coast Pilots.

	Price.
U. S. Coast Pilot, Atlantic Coast, Section A, from St. Croix River to Cape Cod	$0.75
U. S. Coast Pilot, Atlantic Coast, Section B, from Cape Cod to New York, including Long Island Sound	.75
U. S. Coast Pilot, Atlantic Coast, Section C, Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays	.75
U. S. Coast Pilot, Atlantic Coast, Section D, Cape Henry to Key West (this volume)	.75
U. S. Coast Pilot, Atlantic Coast, Section E, Gulf of Mexico, from Key West to the Rio Grande	.75
U. S. Coast Pilot, West Indies, Porto Rico, and Virgin Islands	.75
Inside Route Pilot, coast of New Jersey	.30
Inside Route Pilot, New York to Key West	.30
Inside Route Pilot, Key West to New Orleans	.30
U. S. Coast Pilot, Pacific Coast, California, Oregon, and Washington	.75
U. S. Coast Pilot, Pacific Coast, Alaska, Part I, from Dixon Entrance to Yakutat Bay	.75
U. S. Coast Pilot, Pacific Coast, Alaska, Part II, Yakutat Bay to Arctic Ocean	.75
Coast Pilot Notes on Hawaiian Islands	.30
U. S. Coast Pilot, Philippine Islands, Part I, Luzon, Mindoro, and Visayas	75
U. S. Coast Pilot, Philippine Islands, Part II, Palawan, Mindanao, and Sulu Archipelago	75

Field Stations.

Boston, Mass., appraiser's stores, 408 Atlantic Avenue.
New York, N. Y., room 503, customhouse.
New Orleans, La., room 314, customhouse.
San Francisco, Calif., room 509, customhouse.
Seattle, Wash., room 202, Burke Building.
Manila, P. I., Intendencia Building.

At these stations 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.

Light Lists and Buoy Lists are kept for sale and Notices to Mariners for free distribution to mariners.

The field stations are also sales agencies for the Coast and Geodetic Survey publications.

A chart catalogue, giving lists of charts, coast pilots, tide tables, and agencies of the Coast and Geodetic Survey, can be obtained from any of the field stations, or will be sent, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C. Frequent changes occur in the agencies, and the list of agencies is published in the first notice each month of the Notices to Mariners.

PILOTAGE AND HARBOR FEES.

North Carolina.

[Extracts from Chapter 104, Revised Laws of North Carolina, 1905.]

4962. Rates of pilotage for Hatteras and Ocracoke.—Branch pilots of Ocracoke or Hatteras shall be entitled to receive of the commander of such

vessel as they may have in charge the following pilotage, namely: For every vessel of sixty and not over one hundred and forty tons burden, from the other side of the bar, at any place within the limits of the pilot ground, to Beacon Island road, or Wallace's channel, ten cents for each ton, and the further sum of two and a half cents for each ton over one hundred and forty, and two dollars for each vessel over either of the swashes (that is, over said swashes either to or from Beacon Island road, or Wallace's channel, or over any shoal lying intermediate between either of said swashes and Beacon Island road of Wallace's channel); for every ship or vessel from the mouth of the swash to either of the ports of New Bern or Washington, one dollar per foot, and for every ship or vessel from the same place to the port of Edenton, twelve dollars; and to the port of Elizabeth City, ten dollars; and the same allowance down as up, and outward as inward.

4969. RATES OF PILOTAGE FOR OLD TOPSAIL INLET AND BEAUFORT HARBOR.—The pilotage for Old Topsail inlet and Beaufort harbor shall be as follows: For vessels drawing eight feet and under, two dollars per foot; ten feet and over eight, two dollars and fifty cents per foot; twelve feet and over ten, three dollars and fifty cents per foot; all over twelve feet, four dollars per foot. The above fees to be collectible in Beaufort harbor from Middle marsh to Lewis thoroughfare. For every vessel piloted without these bounds an additional charge of fifty cents per foot may be charged. The commissioners shall have the same printed or written on every license or branch issued by them, and every pilot shall exhibit his license to the master of every vessel he has in charge, when demanded by said master. No vessel entering Old Topsail inlet without a pilot shall be required to take one on going to sea; nor shall any vessel be required to take a pilot that has to enter the harbor in distress. (*As amended 1909.*)

4970. VESSEL UNDER SIXTY TONS NOT LIABLE FOR PILOTAGE.—No pilot, acting under the authority of the commissioners of navigation for Old Topsail inlet, shall be entitled to pilotage for any vessel under sixty tons burden, unless such vessel shall have given a signal for a pilot, or otherwise shall have required the assistance of a pilot.

4972. RATES OF PILOTAGE FOR BOGUE INLET.—The branch pilots for Bogue Inlet shall be entitled to receive of the commander of such vessel as they may have charge of, the following pilotage, namely: For bringing any vessel into the said inlet, drawing less than seven feet, from the outside of the bar to the anchorage before the town, or the customary place in Hill's channel, one dollar per foot; for a vessel drawing more than seven feet, one dollar and fifty cents per foot; and the same fees for pilotage outward as inward.

4978. PILOTS REFUSED, ENTITLED TO PAY.—If a branch pilot shall go off to any vessel bound in, and offer to pilot her over the bar, the master or commander of such vessel, if he refuses to take such pilot, shall pay to such pilot, if not previously furnished with one, the same sum as is allowed by law for conducting such vessel in, to be recovered before a justice of the peace, if the sum be within his jurisdiction: Provided, that the first pilot, and no other, who shall speak such vessel so bound in shall be entitled to the pay provided for in this section.

4980. RATES OF PILOTAGE ANNEXED TO COMMISSION.—The commissioners of navigation for the several ports of this state shall annex to the branch or commission, by them given to each pilot, a copy of the fees to which such pilot is entitled.

CAPE FEAR RIVER—PILOTAGE.

All vessels, coastwise or foreign, over sixty (60) gross tons, shall take a State-licensed pilot from sea to Southport, and from Southport to sea, and the rates of pilotage shall be the rates given in column No. 1 below, designated "From sea to Southport, or vice versa;" the employment of pilots from Southport to Wilmington and from Wilmington to Southport is optional, but any vessel taking a pilot from Southport to Wilmington, or from Wilmington to Southport, shall employ only a State-licensed pilot, and the rates of pilotage shall be the rates given in column No. 2, designated "From Southport to Wilmington, or vice versa."

Column No. 1: Rate from sea to Southport, or vice versa. (Draft in feet and inches.)		Column No. 2: Rate from Southport to Wilmington, or vice versa. (Draft in feet and inches.)		Column No. 1: Rate from sea toS outhport, or vice versa. (Draft in feet and inches.)		Column No. 2: Rate from Southport to Wilmington, or vice versa. (Draft in feet and inches.)	
6 and under.....	$10.76	6 and under.....	$6.46	20 and under....	78.30	20 and under.....	46.98
7 and under.....	13.06	7 and under.....	7.84	20-6 and under..	82.81	20-6 and under...	49.69
8 and under.....	14.83	8 and under.....	8.89	21 and under....	87.50	21 and under.....	52.50
9 and under.....	16.09	9 and under.....	10.01	21-6 and under..	93.75	21-6 and under...	56.25
10 and under....	21.08	10 and under.....	12.64	22 and under....	100.00	22 and under.....	60.00
11 and under....	25.55	11 and under.....	15.33	22-6 and under..	106.25	22-6 and under...	63.75
12 and under....	28.58	12 and under.....	17.14	23 and under....	114.06	23 and under.....	68.44
12-6 and under..	30.30	12-6 and under...	18.18	23-6 and under..	121.88	23-6 and under...	73.12
13 and under....	31.84	13 and under.....	19.11	24 and under....	131.25	24 and under.....	78.75
13-6 and under..	34.15	13-6 and under...	20.49	24-6 and under..	147.73	24-6 and under...	88.73
14 and under....	38.91	14 and under.....	23.35	25 and under....	157.88	25 and under.....	94.89
14-6 and under..	42.74	14-6 and under...	25.64	25-6 and under..	168.14	25-6 and under...	101.18
15 and under....	45.08	15 and under.....	27.04	26 and under....	178.57	26 and under.....	107.59
15-6 and under..	47.17	15-6 and under...	28.30	26-6 and under..	189.15	26-6 and under...	114.13
16 and under....	50.32	16 and under.....	30.19	27 and under....	199.90	27 and under.....	120.80
16-6 and under..	54.13	16-6 and under...	32.48	27-6 and under..	210.79	27-6 and under...	127.57
17 and under....	57.34	17 and under.....	34.41	28 and under....	221.85	28 and under.....	134.45
17-6 and under..	61.02	17-6 and under...	36.72	28-6 and under..	233-06	28-6 and under...	141.43
18 and under....	64.05	18 and under.....	38.55	29 and under....	244.44	29 and under.....	148.52
18-6 and under..	67.17	18-6 and under...	40.34	29-6 and under..	255.97	29-6 and under...	155.71
19 and under....	71.72	19 and under.....	43.04	30 and under....	267.66	30 and under.....	163.36
19-6 and under..	74.96	19-6 and under...	44.99				

Every pilot, when he has brought any ship or vessel to anchor, is required to moor such ship or vessel, or to give proper directions for the mooring of the same, and for her safe riding at such mooring. He shall also make known to the Captain of such vessel the law requiring lights on board.

It shall be the duty of every pilot to inform the Masters of vessels of their duty to report to the Harbor Master, after arrival at Wilmington.

All vessels crossing the Bar, either in or out, shall be required to pay full pilotage to the pilot offering his services, whether such craft be in tow or otherwise, and any pilot neglecting or detaining a vessel under his charge unnecessarily, shall suffer the severest penalty of the law. Any person without the authority of the Board of Commissioners attempting to pilot a vessel or charging for such services, shall pay a penalty of double the pilotage fee.

Any vessel hoisting her colors for a pilot, shall be compelled to pay the first pilot offering his services full pilotage, whether such pilot is employed or not.

Every Master of a vessel who shall detain a pilot after the time appointed, so that he can not proceed to sea, though wind and water should permit, shall pay such pilot four dollars per day during the time of his actual detention; and if any vessel, which shall be boarded by a pilot without or within any of the inlets shall, by violence of the weather or otherwise, be driven to sea, the Master or owner of such vessel shall allow and pay the pilot four dollars per day for every day he shall be on board, besides the fee of pilotage.

All vessels at anchor or under way within the Bar of Cape Fear River at night shall exhibit a light in some conspicuous place, at least ten feet above the deck, so as to be seen by vessels or steamboats passing up or down the river, under a penalty of One Hundred Dollars for each and every neglect, and shall also be liable for all damages or the amount of injury sustained by any vessel or boat coming in contact, to be recovered for the benefit of the injured party. And it shall be the duty of the pilots to notify the Master of each vessel coming over the Bar of the existence of this order.

When any pilot properly equipped shall see any vessel on the coast having a signal for a pilot or shall hear a gun of distress fire off the coast and shall neglect or refuse to go to the assistance of such vessel, such pilot shall forfeit and pay One Hundred Dollars, one-half to the informer the other half to the Master, unless such pilot is actually in charge of another vessel.

Authority is vested in each Commissioner to hear and determine all matters of dispute between pilots and Masters of vessels, or between pilots themselves, respecting the pilotage of vessels—appeal in certain cases to be allowed.

Any pilot running a vessel ashore, by which means any injury or detention is sustained by such vessel, shall report the same without delay to the Chairman of this Board.

No vessel under sixty tons shall be compelled to take a pilot or pay pilotage unless a signal for a pilot shall be made.

No pilot shall leave a vessel on the river without the consent of the Master, and when any detention shall occur, by fault of the Master of any vessel, the pilot shall be entitled to Four Dollars per day for every day so detained.

It shall be the duty of every pilot bringing a vessel into port, as aforesaid, and before leaving her, to furnish or cause to be furnished to the Master or Commander of such vessel his name in writing. Penalty, Twenty Dollars for every neglect of this regulation.

No division of pilotage is permitted by any pilot on any terms, except for service rendered by another pilot under the regulations of the Board of Commissioners, and no commission nor reduction of the rates, nor rebates of rates, will be permitted under a penalty of Fifty Dollars, for each and every offense.

No pilot will be permitted to leave his station to go to a neighboring port for the purpose of piloting a vessel bound from that port for the Cape Fear River unless under peculiar circumstances, at the discretion of the Chairman of this Board. And every licensed pilot is expected and required to provide the means of boarding and leaving vessels at sea by pilot boats or cutters. Arrangements with tug boats or fishing boats or any other means of approaching or leaving vessels at sea will not be permitted under penalty of the revocation of license at the discretion of the Board.

Harbor regulations.—All vessels of 100 tons net register and over shall pay the Harbor Master of the Port of Wilmington the following fee, according to tonnage, which will entitle the vessel to the Harbor Master's services prescribed by the Port and Harbor Regulations, without further charge, while the vessel remains in port:

Steamers, 100 tons and under 500 net register	$3.00
Steamers, 500 tons and under 700 net register	5.00
Steamers, 1000 tons and under 1500 net register	10.00
Steamers, 3000 tons and over	12.00
Sailing vessels, under 500 tons net register	3.00
Sailing vessels, 500 tons and under 1000 net reg	4.00
Sailing vessels, 1000 tons and over	5.00

It shall be the duty of the Harbor Master, in addition to such other duties as may be imposed on him from time to time, personally to see that all the regulations of this port looking to the safety and convenience of the vessels arriving, remaining in and leaving the same, shall be properly observed and kept; to this end he is required from time to time, and as often as may be necessary, to inspect the wharves, docks and places of anchorage in this port, and observe the location of the vessels using the same.

The master or Consignee of any vessel wishing to move shall give the Harbor Master sufficient notice to enable him to give her a clear berth. The Harbor Master must be the judge of the time required.

The Harbor Master may remove any vessel or vessels moored to the ends of the wharves, or on either side of a dock, or lying in any part of a dock, which may be necessary, in his opinion, to expedite and render more safe and convenient the entrance or departure of any other vessel or vessels hauling at the time in or out of the said dock.

The Harbor Master shall cut the fast or fasts of any vessel, or cause the same to be cut or cast loose, when the Captain or person in charge of such vessel refuses or neglects to slack her fasts, and to remove his vessel for the proper accommodation of another vessel passing into or out of her berth; or who shall refuse to give up the inside berth, or to remove and moor his vessel in conformity with the foregoing regulations, or with the orders of the said Harbor Master.

Whenever the Harbor Master shall require the services of a tug to enforce an order for the removal of a vessel against the will of the Master, the charge of the tug for such service may be guaranteed to be paid by the Board; but it shall be the duty of the Harbor Master to collect the costs, fines, and fees for such removal from the offending vessel by warrant in the name of the Board. The Harbor Master will see that due notice of this section is served on the masters of all vessels.

Vessels when not engaged in loading or discharging cargo, shall give place to such vessels that are ready to receive or deliver freight. And if the Captain or person in charge of any vessel refuse to move said vessel when notified by the owners or agents of the wharf at which she is lying, the Harbor Master

shall order him to haul to some other berth, or into the stream; and should the Captain or person in charge refuse to obey the orders of the Harbor Master, then the Harbor Master shall himself move the vessel at the owner's expense, by use of steam tug, if necessary, and shall be entitled to the usual fee, to be recovered from the owners of the offending vessel.

The Harbor Master shall determine also how far and in what instances it is the duty of Masters and others having charge of ships and vessels, to accommodate each other in their respective berths and situations.

The Harbor Master shall supervise the anchorage or mooring of vessels at this port, so as to prevent confusion and collision; and shall designate the wharves at which they may discharge their passengers and cargoes; and require their removal from the wharves when not thus engaged, so as to make room for other vessels.

All differences between the Masters of vessels moored at the same wharf or in adjacent docks, and of vessels in the stream, with respect to the location and space occupied by their respective vessels, or the interfering with each other at their moorings, shall be referred to, adjusted and settled by the Harbor Master upon proper representation thereof.

No vessel shall anchor in the river, or extend her fasts so as to interrupt the navigation of said river, or the passage of the ferry boats to and from the usual place of landing on either side of the river, under the penalty of Fifty Dollars for each and every offence shall continue, after notice from the Harbor Master.

No vessel shall extend her hull, bowsprit, yards, rigging or fasts so as to interrupt the passage into or out of the public docks, under the penalty of Five Dollars for each and every hour said offence shall continue, after notice from the Harbor Master.

No Master or Commander of a vessel shall disobey or neglect such orders and directions as may be given by the Harbor Master, in times of gales of wind, relating to the safety of vessels in the harbor, under the penalty of One Hundred Dollars for each and every offence, to be paid by the Master or Commander of said vessel.

No vessel, flat or barge, having on board grain, fish-scrap, or articles evidently in a state of putrefaction, or offensive shall haul to or lay at any wharf, but shall anchor in the lower anchorage basin, opposite Kidder's Mill, until the order of the Board shall be known, under the penalty of One Hundred Dollars for each and every hour said offence shall continue after notice from the Harbor Master. Nor shall any vessel discharge offensive bilge water within the limits of the city of Wilmington, under a penalty of Fifty Dollars.

Should any hulk, raft, flat or other obstructive substance become sunken, from any cause, in the river, the same shall be immediately removed, under a penalty of Five Dollars for each and every day such nuisance shall remain, after notice from the Harbor Master, to be paid by the parties interested or concerned; and in case exertions are not immediately made for the removal aforesaid, the Commissioners may exercise their discretion of using other means of abating the nuisance, even to the confiscation or condemnation of such obstructions.

The Harbor Master shall have power to regulate all fires which are burning or kindled on rafts, decks of flat boats, or lighters, and any owner or agent of the owner, refusing to obey the orders of the Harbor Master, shall be liable to a fine of Fifty Dollars for every violation.

Any person encumbering private or public docks, or wharves, with logs, boats, dilapidated hulks, or other trash or nuisance, shall forfeit and pay a fine of Five Dollars, if not removed immediately upon notice from the Harbor Master, and Five Dollars for every additional day the nuisance remains. And when the owner cannot conveniently be found, the Harbor Master shall take the most speedy method to clear the dock, or wharf. This order applies particularly to those who use the public docks for fastening or mooring row boats, launches, and the like, for more than three hours at a time, and to those who use the public docks for landing drift wood, etc.

All flats, lighters or other boats or vessels, employed within the limits of the City of Wilmington, propelled wholly or in part by gigs or poles, are hereby prohibited from using upon the ends of said gigs or poles, iron or other metal points so sharpened as to make indentation into wood. And in case of any vessel, steamer or package of goods, receiving damage from the use of such gigs

or poles, the owners or agent of the owners of the offending flat or lighter, shall be liable for the full amount of damage arising therefrom. And any person or persons employed as crew of said flat or lighter, who shall violate this ordinance, shall be fined not less than Five Dollars for each and every offence.

Any person casting loose or adrift, any vessel, any flat, raft or raft of turpetine, or any boat or vessel, without the consent of the Harbor Master, had and obtained, shall be punished by a fine of Ten Dollars for each and every offence. One-half of the said fine shall, when collected, be paid to the person or persons giving information to the Harbor Master.

Any Master or other person having charge of any vessel, flat or raft, who shall refuse or neglect to obey the directions of the Harbor Master in any matters within his authority, or shall molest, resist or oppose the Harbor Master in the execution of any of the duties of his office, such Master or other person, having charge of any vessels, flat or raft, or any person whatsoever, shall upon conviction, of every such offence, forfeit any pay a sum not exceeding One Hundred Dollars.

Every ship, vessel or steamer lying in one of the docks or moored to a wharf should keep a light burning on board thereof, from dark until daylight; said light to be suspended conspicuously midships, fifteen feet above the deck of the vessel. The Master, owner or other person having charge of any ship, vessel or steamer, making default herein, may be liable to a penalty of Five Dollars for every offence.

If any person shall hinder, delay, obstruct or in any manner wilfully interfere with the Harbor Master of Wilmington in the discharge of his duty, he shall be guilty of a misdemeanor, and be fined not more than Fifty Dollars or imprisoned not more than thirty days. Vessels under way in the harbor shall not exceed a speed of six miles an hour from Redcross to foot of Nunn Street.

South Carolina—Port of Georgetown—Pilotage.

6 feet and under	$16.00	13 feet and under	$54.00
7 feet and under	19.00	13½ feet and under	60.00
8 feet and under	22.00	14 feet and under	66.00
9 feet and under	25.00	14½ feet and under	72.00
10 feet and under	28.00	15 feet and under	80.00
10½ feet and under	32.00	15½ feet and under	90.00
11 feet and under	36.00	16 feet and under	100.00
11½ feet and under	40.00	16½ feet and under	110.00
12 feet and under	44.00	17 feet and under	120.00
12½ feet and under	48.00	17½ feet and under	130.00

PORT OF CHARLESTON—REGULATIONS.

Pilots.

1. Every pilot, before leaving any vessel which he shall have brought into port, shall furnish the Master or Commander thereof with a copy of the Port Regulations, for which he shall take a receipt.

2. And it shall be the duty of every Pilot bringing a vessel into this port as aforesaid, and before leaving her, to furnish or cause to be furnished to the Master or Commander of such vessel his name in writing, and the name of the street, and number of his residence; and also the name and number of the pilot boat to which he is then attached. Penalty, twenty dollars for every neglect of this regulation.

3. It shall be the duty of every Pilot to inform the masters of vessels of their duty to report at the Harbor Master's office within twenty-four hours after their arrival at the city.

The Harbor-Master.

1. It shall be the duty of the Harbor-Master, in addition to such other duties as may be imposed on him from time to time, personally to see that all the regulations of this port looking to the safety and convenience of the vessels arriving, remaining and leaving the same, shall be properly observed and kept; to this end he is required from time to time, and as often as may be necessary, to inspect the wharves, docks and places of anchorage in this port, and observe the location of the vessels using the same.

2. His jurisdiction is concurrent over the Harbor of Charleston and its tributaries within the radius of 5½ miles from southeast point of White Point Garden. He is required to keep the channel-way and track of steamers clear. It is his duty to berth vessels at appropriate wharves and in docks; and when called upon by the proprietor or occupant of any wharf or dock to change the berth of any vessel lying at such occupant's premises; it is made his duty to move such vessel to some other wharf, or to a safe anchorage in the stream. He is charged with the execution of any Police Regulations which may hereafter be adopted for the better government of the Harbor.

3. The Master or Consignee of any vessel wishing to move shall give the Harbor-Master sufficient notice to enable him to give her a clear berth. The Harbor-Master must be the judge of the time required.

4. The Harbor-Master may remove any vessel or vessels moored to the ends of the wharves, or on either side of a dock, or lying in any part of a dock, which may be necessary, in his opinion, to expedite and render more safe and convenient the entrance or departure of any other vessel or vessels hauling at the time in or out of the said dock.

5. The Harbor-Master shall cut the fast or fasts of any vessel, or cause the same to be cut or cast loose, when the Captain or person in charge of such vessel refuses or neglects to slack her fasts, and to remove his vessel for the proper accommodation of another vessel passing into or out of her berth; or who shall refuse to give up the inside berth, or to remove and moor his vessel in conformity with the foregoing regulations, or with the orders of the said Harbor-Master.

6. Whenever the Harbor-Master shall require the service of a tug to enforce an order for the removal of a vessel against the will of the Master, the charge of the tug for such service may be guaranteed to be paid by the Board; but it shall be the duty of the Harbor-Master to collect the costs, fines and fees for such removal from the offending vessel by warrant in the name of the Board. The Harbor-Master will see that due notice of this section is served on the masters of all vessels.

7. Vessels when not engaged in loading or discharging cargo, shall give place to such vessels as are ready to receive or deliver freights. And if the Captain or person in charge of any vessel refuse to move said vessel when notified by the owners or agents of the wharf at which she is lying, the Harbor-Master shall order him to haul to some other berth, or into the stream; and should the Captain or person in charge refuse to obey the orders of the Harbor-Master, then the Harbor-Master shall himself move the vessel at the owner's expense, by use of steam-tug, if necessary, and shall be entitled to a fee of $5.00, to be recovered from the owners of the offending vessel.

8. The Harbor-Master shall determine also how far and in what instances it is the duty of Masters and others having charge of ships and vessels, to accommodate each other in their respective berths and situations.

9. The Harbor-Master shall supervise the anchorage or mooring of vessels at this port, so as to prevent confusion and collision; and shall designate the wharves at which they may discharge their passengers and cargoes; and require their removal from the wharves when not thus engaged, so as to make room for other vessels.

10. All differences between the Masters of vessels moored at the same wharf or in adjacent docks, and of vessels in the stream, with respect to the location and space occupied by their respective vessels, or the interfering with each other at their moorings, shall be referred to, adjusted and settled by the Harbor-Master upon proper representation thereof.

General Rules.

1. No wharf shall be run out, made, altered, enlarged or extended beyond the prescribed limits. And no person, shall make, alter or extend any wharf without laying before the Board of Harbor Commissioners a plan in duplicate of said wharf, and obtaining the written approval of the Board to the same. One copy of the plan, when approved, shall be filed with the Secretary of the Board, and the other returned to the person presenting it. Before an application for permission to alter, extend or enlarge any wharf is considered by the Board of Harbor Commissioners, the owner or representative of said property shall give notice in the daily papers of Charleston, one week previously that such application is to be made. The notice to appear at least twice.

2. Any one offending against this section shall forfeit and pay the sum of twenty dollars for every such offence, and shall moreover be fined in the sum of twenty dollars for every day such wharf or obstruction shall remain.

3. Whenever it becomes necessary to use a conveyance or to incur any expense in visiting localities with a view to defining lines for the construction of wharves or other improvements, such expense shall be borne by the parties making applications for permits, for whose benefits the lines are to be defined.

4. The Harbor-Master has full authority, and he is hereby required so to regulate the manner in which a vessel shall lie at any of the public wharves, that the facilities for discharging and receiving cargoes may be afforded as generally as may be practicable, and as will best promote the public interest. Any person having charge of any vessel who shall refuse or neglect to obey the Harbor-Master in carrying out this section shall forfeit and pay a fine of $5 for each and every offence.

6. No vessel, having gunpowder, dynamite or nitro-glycerine, or any other explosive substance on board shall approach any wharf nearer than 100 fathoms. Such vessels shall anchor out of the way of passing steamers, and shall keep a red flag flying in main rigging, while receiving or discharging powder. The handling of powder, dynamite, nitro-glycerine, or any other explosive substance to and from vessels in the harbor must be under the supervision of the Harbor Master, whose duty it is to see that every precaution against danger of ignition or explosion is adopted and rigidly observed.

7. Vessels must lie with their heads up the dock, and those in the first berth must haul far enough to bring their sterns past the end of the wharf, unless prevented from lying so by the form or situation of the wharf or dock, or by position of the other vessels near them.

8. Every vessel lying in a dock or at the end of a wharf must have her yards "cock billed," and bumkins taken in (if removable). Such of the anchors as might interfere with vessels hauling past, or while lying in their berths, to be taken on board, or so placed as to be out of the way.

9. No vessel shall take or keep such a position in or near any dock as to prevent other vessels from getting in or out of the same.

10. No vessel shall take or keep a berth at any wharf, or in a dock, contrary to the Harbor Master's directions, he being vested with full power and authority to regulate and fix the berths of all vessels.

11. *Every Master or commander of a vessel, excepting regular lines or vessels trading within the limits of the State, is required by law to repair to the Harbor Master's office, within 24 hours after his arrival, and there report the name, tonnage and description of his vessel, the nation to which she belongs, and the name of the Pilot that brought her into port, and the number of his boat. And if any Master or commander of any such vessel shall neglect to repair to the Harbor Master's office, or refuse or neglect to deliver to the Harbor Master the said report within the time above limited, he shall for each and every offense pay to the use of the Harbor Commissioners a sum not exceeding fifty dollars.*

12. No ballast, stone, dirt or rubbish shall be thrown from any vessel into the docks or stream. And every vessel landing or taking in ballast must use proper means to prevent any part of the same from falling into the dock. And all vessels landing ballast on a wharf must keep a clear passage-way alongside the vessel, and so place the ballast as to prevent it sliding into the dock. The posts to which the vessels make fast must likewise be kept clear of ballast, or other obstructions.

13. Every vessel exceeding 25 tons register must always have on board a ship-keeper, or person capable of taking care of her.

14. No vessel shall be graved at any wharf, or in any of the docks where vessels load or discharge.

15. Every vessel hauling past, or lying alongside and made fast to another vessel, shall put out in a proper manner, good and sufficient fenders, and keep the same so placed as to prevent injury to the vessel she shall be alongside of; and shall likewise so place and keep her moorings as to prevent injury to the said vessel. And if discharging or taking in a cargo athwart another vessel's decks, she must also keep her plank or staging so fixed as not to cause injury.

16. That every ship, vessel or steamer lying in one of the docks or moored to a wharf must keep a light burning on board thereof, from dark until daylight; said light to be suspended conspicuously midships, fifteen feet above the deck of the vessel. The Master, owner or other person having charge of any ship,

vessel or steamer, making default herein, shall be liable to a penalty of Five Dollars for every offence.

17. The place for depositing ballast to be discharged from vessels arriving from infected ports is at Quarantine Wharf.

18. The discharge into the Ashley River of phosphate washings is prohibited, and the washing water must be allowed to flow back to the river only after the contained sediment has had time to become reasonably well deposited. In Charleston Harbor, the deposit of material will be permitted only along the shore of Hog Island, in said harbor, and not more than one-quarter of a mile from said Island, or in Ashley River along the James Island shore, in water not more than 12 feet deep at the time of dumping. It is ordered that all such material be dumped thereon, and no where else. Every violation of this rule shall be subject to a penalty for each and every offense of not less than Fifty Dollars, nor more than One Hundred Dollars, to be recovered according to law of the Master or owner of the offending tug or vessel.

19. Should any hulk, raft, flat or other obstructive substance become sunken from any cause, in or near any dock or wharf, or within the harbor and its tributaries, where it might be of danger to navigation, the same shall be immediately removed, under a penalty of Five Dollars, for each and every day such nuisance shall remain, after notice from the Harbor-Master, to be paid by the parties interested or concerned; and in case exertions are not immediately made for the removal aforesaid, the commissioners may exercise their discretion of using other means of abating the nuisance, even to the confiscation or condemnation of such obstructions.

FEES OR TAXES.

1. For the purpose of meeting the expenses attendant upon the execution of the foregoing regulations and providing for the safety and proper accommodation of vessels at this port, the following tax or fee is imposed upon all vessels arriving here, and will be collected by the Harbor-Master upon their arrival in such manner as shall be most expeditious:

COASTWISE:	
Steamships, monthly	$6.00
Barges and schooners, per trip	2.00
Brigs, per trip	2.50
FOREIGN:	
Steamships, per trip	12.00
Barks, per trip	6.00
Brigs, per trip	3.00

Rates of pilotage for Charleston, S. C.

Draft (feet and under).	Amount.	For bunker coal.	In for orders.	Draft (feet and under).	Amount.	For bunker coal.	In for orders.
6	$15.00		$14.00	20	$120.00	$64.50	$78.00
7	17.50		16.00	20½	125.00	66.00	
8	20.00	$14.25	18.00	21	130.00	67.50	87.00
8½		20.00		21½	135.00	69.00	
9	22.50	21.00	20.00	22	140.00	70.50	100.00
9½		22.00		22½	145.00	72.00	
10	25.00	23.00	21.00	23	150.00	73.50	114.00
10½		24.00		23½	155.00	75.00	
11	30.00	25.00	29.00	24	160.00	76.50	131.00
11½	35.00	32.50		24½	165.00	78.00	135.00
12	40.00	33.75	32.00	25	170.00	79.50	140.00
12½	45.00	35.00		25½	175.00	81.50	145.00
13	50.00	36.25	35.00	26	180.00	82.50	150.00
13½	55.00	37.50		26½	185.00	84.00	154.00
14	60.00	38.75	42.00	27	190.00	85.50	159.00
14½	65.00	48.00		27½	195.00	87.00	164.00
15	70.00	49.50	48.00	28	200.00	88.50	168.00
15½	75.00	51.00		28½	205.00	90.00	173.00
16	80.00	52.50	54.00	29	210.00	91.50	178.00
16½	85.00	54.00		29½	215.00	93.00	182.00
17	90.00	55.50	61.00	30	220.00	94.50	187.00
17½	95.00	57.00		30½	225.00	96.00	
18	100.00	58.50	67.00	31	230.00	97.50	
18½	105.00	60.00		31½	235.00	99.00	
19	110.00	61.50	75.00	32	240.00	100.50	
19½	115.00	63.00					

Moves, etc.

From anchorage or city up Cooper River	$8.00
Down Cooper River to city or anchorage	8.00
From anchorage or city up Ashley River	8.00
Down Ashley River to anchorage or city	8.00
From city to quarantine or roads	4.00
From quarantine or roads to city	4.00
Docking when requested	4.00
Streaming when requested	4.00
Detention per day	4.00

All American barges and vessels in coastwise trade and under enrollment, in tow, under 6 feet, exempt.

All American barges and vessels in coastwise trade and under enrollment, 10 feet or under, will be allowed one-half pilotage. Pilots carried off shall receive maintenance and accommodation of Masters, four dollars per day absence from port, and expenses back to port.

If vessels has laid sixteen hours outside of the bar and proceeds, shall give maintenance and expenses back to port.

THE ANCHORAGE GROUNDS.

I. GENERAL ANCHORAGE.

The anchorage grounds shall include all the navigable portions of that harbor, and the portions of Cooper, Ashley, and Wando Rivers adjacent thereto, except the following:

Areas of prohibited anchorage.

(*a*) That portion of Cooper River which is bounded on the north by a true east and west line through the North Customhouse Wharf, on the east by Shutes Folly Island, on the south by a true east and west line through the south shore of Shutes Folly Island, and on the west by the water front of Charleston.

(*b*) A ship channel between the jetties and the Navy Yard 600 feet wide (or as much wider as an improved channel may hereafter be dredged), following the established ranges and usual courses and passing east of Drum Island. Between the North Customhouse Wharf and the Charleston Dry Dock & Machine Co.'s dock, this shall include all the area between the eastern limit of said channel and the eastern water front of Charleston.

(*c*) A ship channel 600 feet wide from the vicinity of the Charleston Dry Dock & Machine Co.'s dock north through Town Creek Channel, following the established ranges and usual courses and connecting at both ends with the main channel.

(*d*) A ship channel in Ashley River from its mouth to Standard Wharf, 200 feet wide, following the established ranges and usual courses, and widened at the eastern end to connect with the main channel in Cooper River.

(*e*) The commonly used channel in Wando River, with width of 200 feet.

(*f*) A channel 200 feet wide in Hog Island Channel from Cooper River to the Mount Pleasant ferry terminal, having its northern limit along the line of lighted beacons in Hog Island Channel.

(*g*) An area 1,200 feet wide extending from Ripley Shoal Light toward the head of the Seaboard Air Line Wharf (foot of Hasell Street) to its junction with the prohibited area described in (*a*) above.

(*h*) An area 1,200 feet wide extending from Ripley Shoal Light to Fort Sumter Light, with its axis connecting those structures.

(*i*) An area 1,200 feet wide extending from Fort Sumter Light to Old Fort Moultrie, with its axis connecting the centers of those structures.

II. ANCHORAGE FOR EXPLOSIVES.

Vessels carrying gunpowder or other explosives in bulk may anchor only in that section of the Wando River which lies on the west side of that river, between a point opposite the south end of Daniel Island and a point about one mile to the north: *Provided*, That vessels carrying high explosives in bulk[1] shall not

[1] The term "high explosives in bulk" shall be construed to mean high explosives packed in boxes, barrels, or kegs, and not loaded in ammunition or shells. The standard definition of the term "high explosives" will be that contained in paragraph 1503 of the regulations of the Interstate Commerce Commission for the transportation of explosives by rail, viz: "High explosives are all explosives more powerful than ordinary black powder, except smokeless powder and fulminates. Their distinguishing characteristic

anchor within 400 yards of each other, but this provision is not intended to prohibit lighters from tying up alongside ships for the transfer of cargo.

RULES AND REGULATIONS.

1. Excepting in cases of great emergency, no vessel shall be anchored in the prohibited areas above mentioned and described.

2. Anchors must not be placed within the areas of prohibited anchorage, but vessels may be so anchored as to swing into these areas, provided that they are so placed, with reference to the customary winds, tides, and currents of the harbor, that they will so swing only during slack water.

3. Vessels must be anchored in such way as not to interfere with the free navigation of channels of the port, including Cooper, Ashley, and Wando Rivers, or to obstruct the approach to any pier or entrance to any slip, or to impede the movement of any ferryboat.

4. Except in cases of great emergency, no craft shall be so anchored that it can swing within 400 feet of any wharf or pier on the eastern water front of Charleston, S. C.

5. Except in cases of great emergency, no light vessel (vessel not laden) nor small craft shall be anchored in Cooper River north of an east and west line through the North Customhouse Wharf unless proper anchorage space is not available elsewhere in the harbor, including the connected rivers.

6. Dragging of anchors in or across the areas described above, under (*a*) to (*i*) inclusive, is prohibited.

7. Vessels which, through force of great emergency, are anchored contrary to the above rules shall be shifted to new berths in accordance with such rules at the earliest opportunity.

8. A vessel, upon notification from the Captain of the Port to shift its position on anchorage grounds or out of areas of prohibited anchorage, must get under way at once or signal for a tug, and must change position as directed with reasonable promptness.

9. Vessels carrying explosives shall be anchored only within the anchorage ground described above under the heading "Anchorage for Explosives," which may be used also by vessels carrying other classes of freight when proper anchorage space is not available elsewhere in the harbor, including the connected rivers.

10. Vessels carrying explosives shall be at all times in charge of competent persons, and must display by day a red flag, of at least 16 square feet, at the masthead, or at least 10 feet above the upper deck if the vessel has no mast; at night a red light shall be displayed in the same positions specified for the

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is their susceptibility to detonation by a blasting cap. Examples of high explosives are the dynamites(picric acid, picrates, chlorate powders, nitrate of ammonia powders, dry trinitrotoluol, dry nitrocellulose (guncotton), and fireworks that can be exploded en masse." Unless they are loaded in the same vessels with articles enumerated in the rate quoted above, picric acid 10 per cent wet, and trinitrotoluol 10 per cent wet, and nitrocellulose (guncotton) 20 per cent wet will not be classified as high explosives. The term "high explosives in bulk" does not include such articles as benzol, toluol, smokeless powder, black powder, small-arms ammunition, ammunition for cannon with explosive projectiles, expxlosive projectiles or torpedoes, percussion fuses, time fuses, combination fues, tracer fuses, cordeau detonant, primers for cannon and small arms, blasting caps, detonating fuses, and fulminate of mercury in bulk. Blasting caps, detonating fuses, and fulminate of mercury in bulk will be considered as constituting a distinct class by themselves. The Act of Congress approved March 4, 1921, imposes certain restrictions upon the transportation of explosives by common carriars engaged in interstate or foreign commerce, and also provides that "The Interstate Commerce Commission shall formulate regulations for the safe transportation within the limits of the jurisdiction of the United States of explosives and other dangerous articles, including inflammable liquids, inflammable solids, oxidizing materials, corrosive liquids, compressed gasses, and poisonous substances, which shall be binding upon all common carriers engaged in interstate or foreign commerce which transport explosives or other dangerous articles by land or water, and upon all shippers making shipments of explosives or other dangerous articles via any common carrier engaged in interstate or foreign commerce by land or water." Other vessels will be governed by the following rules: (*a*) Where blasting caps, detonating fuses, and fulminate of mercury in bulk are loaded on the same vessel with high explosives, they must be in a different compartment, the distance in a straight line from the compartment containing them to the explosives to be not less than 25 feet. (*b*) In transferring high explosives in bulk, blasting caps, detonating fuses, and fulminate of mercury from one vessel to another they must be handled by hand or regulation chute and mattress. If difference in elevation between vessels or condition of weather renders it impossible to transfer or load by hand or chute, mechanical hoists and a special crate or basket may be used. Explosives transferred in this manner must not be handled roughly. They must be hoisted and lowered carefully and only deposited or lowered on a mattress.

red flag. No smoking will be permitted on or near such vessels, and no persons under the influence of liquor will be allowed on board any vessel, barge, or scow carrying explosives, nor will they be allowed to approach such vessels.

11. Nothing in these rules and regulations shall be construed as relieving the owner or person in charge of any vessel from the penalties of the law for obstructing navigation, or for obstructing or interfering with range lights, or for not complying with the navigation laws in regard to lights, fog signals, etc.

Rates of pilotage for the harbors and bars of Port Royal and St. Helena and inland waters.

6	feet	$18.00	18½	feet	$112.00
7	feet	21.00	19	feet	120.00
8	feet	24.00	19½	feet	128.00
9	feet	27.00	20	feet	136.90
10	feet	31.00	20½	feet	143.50
11	feet	35.00	21	feet	152.50
12	feet	40.00	21½	feet	161.50
12½	feet	43.50	22	feet	170.50
13	feet	47.00	22½	feet	180.00
13½	feet	51.00	23	feet	190.50
14	feet	55.00	23½	feet	201.00
14½	feet	60.00	24	feet	212.00
15	feet	66.00	24½	feet	223.00
15½	feet	71.00	25	feet	235.00
16	feet	76.50	25½	feet	249.00
16½	feet	82.50	26	feet	264.00
17	feet	89.00	26½	feet	280.00
17½	feet	97.00	27	feet	297.00
18	feet	104.50			

Each drop, $10; detention, $4 per day; dockage, $4.

From Port Royal to Wilsons Mill	$12.00
From Port Royal to Sewardville	12.00
From Port Royal to Bull River (without steam)	30.00
From Port Royal to Bull River (with steam)	15.00
From Beaufort to Bull River (without steam)	25.00
From Beaufort to Bull River (with steam)	12.50
From Beaufort or Port Royal to Callbogue	25.00

HARBOR REGULATIONS FOR THE PORT OF SAVANNAH, GA.

Every pilot, when he has brought any ship or vessel to anchor, is required to moor such ship or vessel, or to give proper directions for the mooring of the same, and for her safe riding at such mooring. He shall also make known to the captain of such vessels the laws requiring lights on board.

It shall be the duty of every pilot to inform the masters of vessels of their duty to report to the Harbor Master's office within 24 hours after arrival at the city.

Pilots are directed to moor all vessels which stop at Five Fathom to lighten or discharge, as near the south shore as may be safe, that an open passage may be left to northward for vessels to pass and repass. No vessel shall discharge or load any of her cargo in the river opposite the city, except at the wharves. No anchor is allowed in the river when the vessel is made fast to the wharf.

All masters of vessels, as soon as they come to anchor shall rig in their jig-boom, spanker-boom and main-boom; and all vessels shall brace their lower and top sail yards on starboard braces, take in the boom-kins and davits, lay their sprit sail yards fore and aft, rig in their martingale, take in all boom-irons, and cock-bill their anchors. These regulations must be observed while lying at the wharf, or at anchor in any part of the river. The master of any vessel, or his representatives, refusing to move his vessel, when ordered to do so by the Marbor Master or Deputy, the vessel shall be moved, if necessary, with tug or tugs, and proper crew employed, at expense of said vessel.

Master or consignee of any vessel wishing to move shall give the Harbor Master sufficient notice to enable him to give her a clean berth. The Harbor Master must be the judge of the time required.

No vessel shall be moved, after being placed at the wharf, without permission of the Harbor Master.

No vessel, other than regular packets, arriving at the city, shall be docked without permission from the Harbor Master.

All vessels, except regular packets, in ballast, waiting for freight, light, or occasionally taking in, discharging or retailing a cargo at any wharf, shall

give the inside berth to a loaded vessel that wants to discharge forthwith; and every such vessel shall likewise give inside berth to a vessel that wants to take on her cargo immediately. Any vessel, except regular packets, taking in a cargo at any wharf, shall give the inside berth to a loaded vessel, if, at the time of application for such berth, there be no other vacant or equally suitable berth for such loaded vessel.

Every vessel hauling past or lying alongside and making fast to another vessel shall put out, in a proper manner, good and sufficient fenders, and keep the same so placed as to prevent injury to the vessel she may be alongside of and shall likewise so place her moorings as to prevent injury to said vessel, and if discharging or taking in a cargo athwart another vessel's deck, she must also keep her plank or staging so fixed as not to cause injury.

Masters of vessels shall not permit ballast, rubbish or dirt of any kind to be thrown into the river or harbor. All ballast or coal shall be thrown ten feet back, clear of the heads of the wharves; a heavy sail or tarpaulin must be put between the vessel and the wharf, extending under and five feet on each side of the stage to prevent any from falling into the river. The sweepings from the deck, or ashes from the caboose or rubbish of any kind, must be put upon the wharf and carted away.

No vessel, while laying alongside the wharf or another vessel, shall be smoked for the purpose of destroying rats, but must first be hauled in the stream and kept constantly afloat so as to be easily removed in case of taking fire.

No tar, pitch or turpentine shall be boiled on any vessel's deck, or within 60 yards of any vessel or warehouse. Notice in all cases to be given to the Harbor Master.

No raft of timber or lumber shall be broken up in the front river below low-water mark, except that rafts of oak or cypress may be broken up on north side of river, in accordance with provisions of Ordinance passed in Council March 25, 1885. No raft shall be permitted to lie more than 48 hours afloat in the river, nor shall any stave, wood or shingle raft be landed at the heads of the wharves.

No vessel lying at any of the wharves on the Southern side of the river between Habersham's Mill and the eastern extremity of the city, shall be permitted to take on board any timber or lumber from rafts alongside, unless the owner or lessee of the wharf at which the vessel lies shall consent thereto, and procure the consent of the owner or lessee of the adjacent wharves, which consent shall be in writing and filed with Harbor Master. In cases where it would not be safe to remove empty vessels, the Mayor will give permission to load a few sticks of timber at wharf, said sticks to be secured by chains and dogs after the raft shall have been broken up.

No person shall encumber the wharves with Cotton, Coal, Bricks, Lumber, Stone, or other heavy articles, so as to prevent the use of said wharf to vessels wishing to load or discharge cargoes.

Not more than two vessels of one hundred tons or more register shall be allowed to lay alongside at any wharf in the city so long as there shall be another wharf vacant, or with only one vessel thereat, except under special permit from the Harbor Master, approved by the Mayor.

No vessel or boat laying alongside of any other vessel or wharf shall have a fire in the caboose, or any other place on or under deck of said vessel or bzoat, except in an iron caboose, and such caboose or other fire-place be well and safely covered and surrounded with a good and sufficient caboose house, hut or other covering or enclosure.

All vessels overlaying the city wharves and docks must pay proportional wharfage. No rafts shall be kept across or in them for the purpose of loading, except by permission.

No shingle or sand ballast, or rubbish of any description, shall be landed without permission of the Harbor Master.

Any vessel will be admitted to a berth or be allowed to change from one berth to another on application to the Harbor Master.

No Master, or other person having charge of any ship or vessel shall refuse or neglect to obey the directions of the Harbor Master, or his assistant, in any matters within his or their authority, or shall molest, resist or oppose the Harbor Master, or his assistant, in the execution of any of the duties of his or their office.

The master of any vessel laying at anchor in any part of the river at night, shall cause a good and sufficient light to be shown in some part of the rigging

of such vessel, at least 20 feet above her deck, which light shall be kept burning during all hours of the night.

Every vessel must always have on board a ship keeper, or other person capable to take charge of her.

In case of any dispute or difference of opinion arising between or amongst masters of vessels, or others concerned under the foregoing Harbor Regulations, the same should be settled by the arbitration of the Harbormaster, on the application to him of those interested.

That any person violating any of the regulations contained in the foregoing sections, upon conviction thereof in the Police Court shall be fined in a sum not exceeding One Hundred Dollars, or be imprisoned not more than Thirty Days, either or both, in the discretion of the Officer presiding in said court.

An Ordinance to lessen the danger from fire in the Port and the City of Savannah.

That hereafter it shall be the duty of every owner, agent, master, or captain of any vessel, boat, tug, or craft propelled in whole or in part by steam; or in which any steam engine or steam boiler is, or is used, immediately upon the arrival of such vessel at any wharf, dock, or pier within the port of Savannah, to cover all funnels and smokestacks securely with a first class spark arrester.

That it shall be the duty of every person owning or operating any steam locomotive, steam engine, donkey engine, or stationary engine on or about the wharves, docks, or piers of the City of Savannah, or on or about any yard or warehouse where any cotton or naval stores are stored in the City of Savannah, to cover the smokestack of each and every such steam locomotive, steam engine, donkey engine, or stationary engine securely with a first-class spark arrester.

That it shall be the duty of every owner, agent, master, or captain of any vessel, boat, tug, or craft, propelled in whole or in part by steam, immediately upon its arrival in this port, to couple its fire hose and have the same ready for immediate use at all times while in this port; provided, said vessel, boat, tug, or craft is loading or discharging a cargo of cotton or naval stores, and sufficient steam shall be kept up night and day on the donkey engine or on one of the main boilers to enable a full stream of water to be turned into any compartment of such boat, tug, vessel, or craft at any time; and in the event that such vessel, boat, tug, or craft shall not be provided with sufficient hose to reach each and every hatch of said vessel, boat, tug, or craft, then it shall be the duty of the owner, agent, master, or captain thereof to immediately supply said vessel, boat, tug, or craft with sufficient hose so to do.

That it shall be the duty of every agent, owner, master, or captain of any vessel, while loading or discharging a vessel in this port to protect or have protected all hatch combings, so that the cargo of cotton or naval stores so loaded or unloaded shall not come in contact with the combings.

That it shall be unlawful for any person to smoke any pipe, cigar, or cigarette on the deck or in the hold of any vessel while loading or unloading at this port.

That it shall be unlawful for any person to have, carry, take or use any light or lantern in the hold or holds of any vessel loading or unloading in this port, except such light be a closed and locked lantern.

That it shall not be lawful while any vessel is engaged in loading cotton or naval stores, or before her load is complete, in this port, for any person to paint in or about any part of said hold of said vessel.

That it shall be the duty of every master of any vessel while in this port, and while loading and unloading, to see that as soon as work is stopped for the day all hatches are put on and covered with tarpaulin.

That it shall be the duty of every master, captain, agent, or owner of every vessel of every sort and description, propelled in whole or in part by steam, while loading or unloading cotton or naval stores in this port, to place and keep at or near each hatch, a barrel filled with water, to be used only in case of fire, to which said barrel shall be attached two buckets, to be used only in case of fire.

That any person violating any provision of this ordinance shall, upon conviction before the police court of the City of Savannah, be subject to a fine not to exceed One hundred dollars and imprisonment not to exceed thirty days, either or both, in the discretion of the court.

All persons engaged in lightering, or otherwise transporting cotton, hay, straw, or other inflammable merchandise (naval stores excepted) on the Savannah River, or other waters within the limits over which the said Mayor and Aldermen of the City of Savannah have jurisdiction be, and they are hereby

required to cover the same, while on lighters or other crafts, with tarpaulins or other more permanent and substantial material; and that each failure to do so shall be considered a violation of this ordinance, and be punished as hereinafter provided.

It shall be unlawful for any person to make or to use matches in any way in the holds of the vessels of any description, or on the decks of the same during the time said vessels may be taking in or unloading cargoes of cotton, naval stores, hay oil, or other inflammable merchandise.

Speed of vesels: No steamer shall, while pasing along the line of the wharves of this City, exceed in speed four 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 slowly," using every precaution to avoid unnecessary suction until the vessels in her immediate vicinity are passed by. In passing near the dredge and dredge flats employed at any point on the river between the Western limits of the city and Tybee, steamers must be slowed down and where necessary stopped and worked as above specified, until the dredge or flats are passed.

No steamer while passing the line of Quarantine wharves opposite the eastern end of Long Island, shall exceed a speed of five miles per hour.

The harbor fees, as established by ordinance, shall be as follows: By each transient Brig or Schooner, four ($4) dollars. By each transient Ship or Bark, six ($6) dollars. By each transient Steamship, fifteen ($15) dollars. By each coastwise Steamship running regularly to this port, six ($6) dollars per month. By each Bark, Barkentine, Brig, Schooner or Sea Going Barges engaged in the coastwise trade, four ($4) dollars; each transient tug engaged in towing, eight ($8) dollars, payable not more than twice in every twelve months. By each sailing Vessel or Steamer plying inland, measuring forty feet or more, two cents per foot over all measurement, payable quarterly in advance.

An Ordinance to Prohibit the Discharge of Refuse Oil in the Savannah River.

It is unlawful for any person, firm or corporation, or master of any ship, to discharge, throw, or dump refuse oil into the Savannah River, in the Savannah Harbor, or into any of the streams flowing therein, or into any of the docks, or alongside any of the piers, or along the shores or banks of said river refuse oil of any character.

That any person, firm or corporation, or master of any vessel, violating the provisions of this ordinance shall upon conviction before the Police Court of the City of Savannah be fined in sum not more than $100.00, or to be imprisoned not more than 30 days, either or both, or any part of either or both, in the discretion of the Court.

Savannah rates of pilotage.

[Effective May 1, 1918.]

Draft (feet and under).	Bar to Cockspur.	Cockspur to Savannah.	Total.	Draft (feet and under).	Bar to Cockspur.	Cockspur to Savannah.	Total.
6	$14.70	$9.05	$23.75	22	$100.00	$60.00	$160.00
7	16.60	10.30	26.90	23	114.05	68.45	182.50
8	18.75	11.25	30.00	24	131.25	78.75	210.00
9	20.65	12.45	33.10	24½	135.95	81.55	217.50
10	24.70	15.30	40.00	25	140.65	84.35	225.00
11	29.40	17.50	46.90	25½	145.30	87.20	232.50
12	32.50	19.40	51.90	26	150.00	90.00	240.00
13	35.65	21.85	57.50	26½	154.70	92.80	247.50
14	42.80	25.95	68.75	27	159.40	95.60	255.00
15	48.75	29.35	78.10	27½	164.05	98.45	262.50
16	54.40	32.45	86.85	28	168.75	101.25	270.00
17	61.25	36.85	98.10	28½	173.45	104.05	277.50
18	67.50	41.25	108.75	29	178.10	106.90	285.00
19	75.65	45.60	121.25	29½	182.80	109.70	292.50
20	78.15	46.85	125.00	30	187.50	112.50	300.00
21	87.50	52.50	140.00				

Note.—All vessels drawing seventeen (17) feet or less, when loaded, shall pay 25 per cent less than the above rates.

Detention of pilots per day, $4.32.

Move.

Draft (feet).	Tybee to Savannah or Savannah to Tybee.	Venus Point to Savannah or Savannah to Venus Point.	4-Mile Point to Savannah or Savannah to 4-Mile Point.	5-Fathom to Savannah or Savannah to 5-Fathom.
8	$8.00	$8.00	$6.00	$4.00
9	10.00	10.00	8.00	6.00
10	10.00	10.00	8.00	6.00
11	11.00	11.00	10.00	8.00
12	11.00	11.00	10.00	8.00
13	12.00	11.00	10.00	8.00
14	14.00	14.00	12.00	10.00
15	17.00	15.00	13.00	10.00
16 and upwards	18.00	16.00	14.00	12.00

From Quarantine to Savannah same as from Tybee to Savannah.

Doboy and Sapelo Bar, and Darien and Sapelo River—Pilotage.

Draft in feet.	Bar pilotage to upper buoy or safe anchorage.	River pilotage from upper buoy or safe anchorage to Darien or any other landing.	Total.	Draft in feet.	Bar pilotage to upper buoy or safe anchorage.	River pilotage from upper buoy or safe anchorage to Darien or any other landing.	Total.
6	$11.00	$8.00	$19.00	16½	$48.00	$34.00	$82.00
7	12.00	9.00	21.00	17	52.00	37.00	89.00
8	13.00	10.00	23.00	17½	54.00	39.00	93.00
9	16.00	12.00	28.00	18	58.00	41.00	99.00
10	18.00	13.00	31.00	18½	60.00	43.00	103.00
11	21.00	14.00	35.00	19	64.00	46.00	110.00
12	23.00	19.00	42.00	19½	67.00	48.00	115.00
12½	26.00	21.00	47.00	20	70.00	49.00	119.00
13	31.00	23.00	54.00	20½	75.00	50.00	125.00
13½	34.00	25.00	59.00	21	82.00	53.00	135.00
14	35.00	26.00	61.00	21½	90.00	55.00	145.00
14½	36.00	27.00	63.00	22	105.00	57.00	162.00
15	41.00	30.00	71.00	22½	120.00	60.00	180.00
15½	43.00	31.00	74.00	23	135.00	62.00	197.00
16	46.00	33.00	79.00				

Drop, $7; every day's detention, $3; foreign vessels, 50 per cent additional to the above rates.

PORT OF BRUNSWICK, GA.—PILOTAGE.

For the bar of St. Simons and Turtle River and the bar of St. Andrews and Satilla River:

Feet.	Pilotage.	Feet.	Pilotage.	Feet.	Pilotage.
6	$16.75	14½	$67.00	22½	$160.00
6½	18.75	15	71.00	23	182.00
7	20.25	15½	74.00	23½	200.00
7½	21.75	16	79.00	24	206.00
8	23.00	16½	82.25	24½	212.00
8½	24.50	17	87.00	25	218.00
9	26.00	17½	89.50	25½	224.00
9½	27.75	18	93.00	26	232.00
10	31.75	18½	99.00	26½	240.00
10½	37.00	19	105.00	27	248.00
11	39.00	19½	111.00	27½	256.00
11½	41.25	20	117.00	28	264.00
12	43.75	20½	123.00	28½	272.00
12½	46.75	21	129.00	29	280.00
13	49.25	21½	135.00	29½	288.00
13½	52.25	22	145.00	30	296.00
14	58.03				

Drop or shifting, $1 per foot; detention per day, $4.

FLORIDA.

[Extracts from the General Statutes of Florida, 1906.]

1300. RATES OF PILOTAGE.—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 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 14 to 20 feet, five dollars per foot; for vessels or steamers 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.

1326. COMPENSATION.—Harbor masters respectively shall receive from the master, owner or consignee of vessels coming into the port for which he is appointed as aforesaid for the services rendered by himself or his deputy, under the provisions of this section, not exceeding the sum of twenty dollars for each vessel, according to the amount and value of the services rendered.

PORT OF JACKSONVILLE, PILOTAGE.

[Extracts from the Rules and Regulations.]

1. The master of any vessel entering the port of Jacksonville, who does not accept the services of a pilot shall be compelled to pay the full legal rates of pilotage.

7. Any pilot detained on board of any vessel by the master or quarantine officer, shall receive for each and every day's services the sum of five dollars per day over and above his pilotage.

12. The rates of pilotage to be charged and collected by the pilots on the St. Johns Bar, on all steamers and vessels entering the port of Jacksonville, shall be as follows:

$2.50 per foot draft, into Mayport.
$3.00 per foot draft, out of Mayport.

Vessels desiring to take pilots from Mayport to Jacksonville, $1.50 per foot draft each way.

PORT OF KEY WEST.

[Extracts from the Rules and Regulations.]

SEC. 1. 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 vessel be spoken outside the following limits:

If she be entering 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 entering 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 given in section 1300 preceding.

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.

INTERNATIONAL RULES TO PREVENT COLLISIONS OF VESSELS.

I. Enacting Clause, Scope, and Penalty.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following regulations for preventing collisions at sea shall be followed by all public and private vessels of the United States upon the high seas and in all waters connected therewith navigable by seagoing vessels.

Art. 30. Nothing in these rules shall interfere with the operation of a special rule, duly made by local authority, relative to the navigation of any harbor, river, or inland waters.

PRELIMINARY DEFINITIONS.

In the following rules every steam vessel which is under sail and not under steam is to be considered a sailing vessel, and every vessel under steam, whether under sail or not, is to be considered a steam vessel.

The words "steam vessel" shall include any vessel propelled by machinery.

A vessel is "under way," within the meaning of these rules, when she is not at anchor, or made fast to the shore, or aground.

II. Lights and So Forth.

The word "visible" in these rules when applied to lights shall mean visible on a dark night with a clear atmosphere.

Article 1. The rules concerning lights shall be complied with in all weathers from sunset to sunrise, and during such time no other lights which may be mistaken for the prescribed lights shall be exhibited.

STEAM VESSELS—MASTHEAD LIGHT.

Art. 2. A steam vessel when under way shall carry—(a) On or in front of the foremast, or if a vessel without a foremast, then in the fore part of the vessel, at a height above the hull of not less than twenty feet, and if the breadth of the vessel exceeds twenty feet, then at a height above the hull not less than such breadth, so, however, that the light need not be carried at a greater height above the hull than forty feet, a bright white light, so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side, and of such a character as to be visible at a distance of at least five miles.

STEAM VESSELS—SIDE LIGHTS.

(b) On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least two miles.

(c) On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side, and of such a character as to be visible at a distance of at least two miles.

(d) The said green and red side lights shall be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent these lights from being seen across the bow.

STEAM VESSELS—RANGE LIGHTS.

(e) A steam vessel when under way may carry an additional white light similar in construction to the light mentioned in subdivision (a). These two lights shall be so placed in line with the keel that one shall be at least fifteen feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance.

STEAM VESSELS WHEN TOWING.

ART. 3. A steam vessel when towing another vessel shall, in addition to her side lights, carry two bright white lights in a vertical line one over the other, not less than six feet apart, and when towing more than one vessel shall carry an additional bright white light six feet above or below such lights, if the length of the tow measuring from the stern of the towing vessel to the stern of the last vessel towed exceeds six hundred feet. Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white light mentioned in article two (a), excepting the additional light, which may be carried at a height of not less than fourteen feet above the hull.

Such steam vessel may carry a small white light abaft the funnel or aftermast for the vessel towed to steer by, but such light shall not be visible forward of the beam.

SPECIAL LIGHTS.

ART. 4. (a) A vessel which from any accident is not under command shall carry at the same height as a white light mentioned in article two (a), where they can best be seen, and if a steam vessel in lieu of that light two red lights, in a vertical line one over the other, not less than six feet apart, and of such a character as to be visible all around the horizon at a distance of at least two miles; and shall by day carry in a vertical line one over the other, not less than six feet apart, where they can best be seen, two black balls or shapes, each two feet in diameter.

(b) A vessel employed in laying or in picking up a telegraph cable shall carry in the same position as the white light mentioned in article two (a), and if a steam vessel in lieu of that light three lights in a vertical line one over the other not less than six feet apart. The highest and lowest of these lights shall be red, and the middle light shall be white, and they shall be of such a character as to be visible all around the horizon at a distance of at least two miles. By day she shall carry in a vertical line, one over the other, not less than six feet apart, where they can best be seen, three shapes not less than two feet in diameter, of which the highest and lowest shall be globular in shape and red in color, and the middle one diamond in shape and white.

(c) The vessels referred to in this article, when not making way through the water, shall not carry the side lights, but when making way shall carry them.

(d) The lights and shapes required to be shown by this article are to be taken by other vessels as signals that the vessel showing them is not under command and can not therefore get out of the way.

These signals are not signals of vessels in distress and requiring assistance. Such signals are contained in article thirty-one.

LIGHTS FOR SAILING VESSELS AND VESSELS IN TOW.

ART. 5. A sailing vessel under way and any vessel being towed shall carry the same lights as are prescribed by article two for a steam vessel under way, with the exception of the white lights mentioned therein, which they shall never carry.

LIGHTS FOR SMALL VESSELS.

ART. 6. Whenever, as in the case of small vessels under way during bad weather, the green and red side lights can not be fixed, these lights shall be kept at hand, lighted and ready for use; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such manner as to make them most visible, and so that the green light shall not be seen on the port side nor the red light on the starboard side, nor, if practicable, more t' an two points abaft the beam on their respective sides. To make the use of these portable lights more certain and easy the lanterns containing them shall each be painted outside with the color of the light they respectively contain, and shall be provided with proper screens.

LIGHTS FOR SMALL STEAM AND SAIL VESSELS AND OPEN BOATS.

ART. 7. Steam vessels of less than forty, and vessels under oars or sails of less than twenty tons gross tonnage, repectively, and rowing boat, when under

way, shall not be required to carry the lights mentioned in article two (a), (b), and (c), but if they do not carry them they shall be provided with the following lights:

First. Steam vessels of less than forty tons shall carry—

(a) In the fore part of the vessel, or on or in front of the funnel, where it can best be seen, and at a height above the gunwale of not less than nine feet, a bright white light constructed and fixed as prescribed in article two (a), and of such a character as to be visible at a distance of at least two miles.

(b) Green and red side lights constructed and fixed as prescribed in article two (b) and (c), and of such a character as to be visible at a distance of at least one mile, or a combined lantern showing a green light and a red light from right ahead to two points abaft the beam on their respective sides. Such lanterns shall be carried not less than three feet below the white light.

Second. Small steamboats, such as are carried by seagoing vessels, may carry the white light at a less height than nine feet above the gunwale, but it shall be carried above the combined lantern mentioned in subdivision one (b).

Third. Vessels under oars or sails of less than twenty tons shall have ready at hand a lantern with a green glass on one side and a red glass on the other, which, on the approach of or to other vessels, shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side.

Fourth. Rowing boats, whether under oars or sail, shall have ready at hand a lantern showing a white light which shall be temporarily exhibited in sufficient time to prevent collision.

The vessels referred to in this article shall not be obliged to carry the lights prescribed by article four (a) and article eleven, last paragraph.

LIGHTS FOR PILOT VESSELS.

ART. 8. Pilot vessels when engaged on their station on pilotage duty shall not show the lights required for other vessels, but shall carry a white light at the masthead, visible all around the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed fifteen minutes.

On the near approach of or to other vessels they shall have their side lights lighted ready for use, and shall flash or show them at short intervals, to indicate the direction in which they are heading, but the green light shall not be shown on the port side nor the red light on the starboard side.

A pilot vessel of such a class as to be obliged to go alongside of a vessel to put a pilot on board may show the white light instead of carrying it at the masthead, and may, instead of the colored lights above mentioned, have at hand, ready for use, a lantern with green glass on the one side and red glass on the other, to be used as prescribed above.

Pilot vessels when not engaged on their station on pilotage duty shall carry lights similar to those of other vessels of their tonnage.

A steam pilot vessel, when engaged on her station on pilotage duty and in waters of the United States, and not at anhcor, shall, in addition to the lights required for all pilot boats, carry at a distance of 8 feet below her white masthead light a red light, visible all around the horizon and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least two miles, and also the colored side lights required to be carried by vessels when under way.

When engaged on her station on pilotage duty and in waters of the United States, and at anchor, she shall carry in addition to the lights required for all pilot boats the red light above mentioned, but not the colored side lights. When not engaged on her station on pilotage duty, she shall carry the same lights as other steam vessels.

LIGHTS, ETC., OF FISHING VESSELS.

ART. 9. Fishing vessels and fishing boats, when under way and when not required by this article to carry or show the lights hereinafter specified, shall carry or show the lights prescribed for vessels of their tonnage under way.

(a) Open boats, by which is to be understood boats not protected from the entry of sea water by means of a continuous deck, when engaged in any fishing at night, with outlying tackle extending not more than one hundred and fifty feet horizontally from the boat into the seaway, shall carry one all-round white light.

Open boats, when fishing at night, with outlying tackle extending more than one hundred and fifty feet horizontally from the boat into the seaway, shall carry one all-round white light, and in addition, on approaching or being approached by other vessels, shall show a second white light at least three feet below the first light and at a horizontal distance of at least five feet away from it in the direction in which the outlying tackle is attached.

(b) Vessels and boats, except open boats as defined in subdivision (a), when fishing with drift nets, shall, so long as the nets are wholly or partly in the water, carry two white lights where they can best be seen. Such lights shall be placed so that the vertical distance between them shall be not less than six feet and not more than fifteen feet, and so that the horizontal distance between them, measured in a line with the keel, shall be not less than five feet and not more than ten feet. The lower of these two lights shall be in the direction of the nets, and both of them shall be of such a character as to show all around the horizon, and to be visible at a distance of not less than three miles.

Within the Mediterranean Sea and in the seas bordering the coasts of Japan and Korea sailing fishing vessels of less than twenty tons gross tonnage shall not be obliged to carry the lower of these two lights. Should they, however, not carry it, they shall show in the same position (in the direction of the net or gear) a white light, visible at a distance of not less than one sea mile, on the approach of or to other vessels.

(c) Vessels and boats, except open boats as defined in subdivision (a), when line fishing with their lines out and attached to or hauling their lines, and when not at anchor or stationary within the meaning of subdivision (h), shall carry the same lights as vessels fishing with drift nets. When shooting lines, or fishing with towing lines, they shall carry the lights prescribed for a steam or sailing vessel under way, respectively.

Within the Mediterranean Sea and in the seas bordering the coasts of Japan and Korea sailing fishing vessels of less than twenty tons gross tonnage shall not be obliged to carry the lower of these two lights. Should they, however, not carry it, they shall show in the same position (in the direction of the lines) a white light, visible at a distance of not less than one sea mile on the approach of or to other vessels.

(d) Vessels when engaged in trawling, by which is meant the dragging of an apparatus along the bottom of the sea—

First. If steam vessels, shall carry in the same position as the white light mentioned in article two (a) a tricolored lantern so constructed and fixed as to show a white light from right ahead to two points on each bow, and a green light and a red light over an arc of the horizon from two points on each bow to two points abaft the beam on the starboard and port sides, respectively; and not less than six nor more than twelve feet below the tricolored lantern a white light in a lantern, so constructed as to show a clear, uniform, and unbroken light all around the horizon.

Second. If sailing vessels, shall carry a white light in a lantern, so constructed as to show a clear, uniform, and unbroken light all around the horizon, and shall also, on the approach of or to other vessels, show where it can best be seen a white flare-up light or torch in sufficient time to prevent collision.

All lights mentioned in subdivision (d) first and second shall be visible at a distance of at least two miles.

(e) Oyster dredgers and other vessels fishing with dredge nets shall carry and show the same lights as trawlers.

(f) Fishing vessels and fishing boats may at any time use a flare-up light in addition to the lights which they are by this article required to carry and show, and they may also use working lights.

(g) Every fishing vessel and every fishing boat under one hundred and fifty feet in length, when at anchor, shall exhibit a white light visible all around the horizon at a distance of at least one mile.

Every fishing vessel of one hundred and fifty feet in length or upward, when at anchor, shall exhibit a white light visible all around the horizon at a distance of at least one mile, and shall exhibit a second light as provided for vessels of such length by article seven.

Should any such vessel, whether under one hundred and fifty feet in length or of one hundred and fifty feet in length or upward, be attached to a net or other fishing gear, she shall on the approach of other vessels show an additional white light at least three feet below the anchor light, and at a horizontal distance of at least five feet away from it in the direction of the net or gear.

(h) If a vessel or boat when fishing becomes stationary in consequence of her gear getting fast to a rock or other obstruction, she shall in daytime haul down the day signal required by subdivision (k); at night show the light or lights prescribed for a vessel at anchor; and during fog, mist, falling snow, or heavy rain storms make the signal prescribed for a vessel at anchor. (See subdivision (d) and the last paragraph of article fifteen.)

(i) In fog, mist, falling snow, or heavy rain storms drift-net vessels attached to their nets, and vessels when trawling, dredging, or fishing with any kind of drag net, and vessels line fishing with their lines out, shall, if of twenty tons gross tonnage or upward, respectively, at intervals of not more than one minute make a blast; if steam vessels, with the whistle or siren, and if sailing vessels, with the foghorn, each blast to be followed by ringing the bell. Fishing vessels and boats of less than twenty tons gross tonnage shall not be obliged to give the above-mentioned signals; but if they do not, they shall make some other efficient sound signal at intervals of not more than one minute.

(k) All vessels or boats fishing with nets or lines or trawls, when under way, shall in daytime indicate their occupation to an approaching vessel by displaying a basket or other efficient signal where it can best be seen. If vessels or boats at anchor have their gear out, they shall, on the approach of other vessels, show the same signal on the side on which those vessels can pass.

The vessels required by this article to carry or show the lights hereinbefore specified shall not be obliged to carry the lights prescribed by article four (a) and the last paragraph of article eleven.

LIGHTS FOR AN OVERTAKEN VESSEL.

ART. 10. A vessel which is being overtaken by another shall show from her stern to such last-mentioned vessel a white light or a flare-up light.

The white light required to be shown by this article may be fixed and carried in a lantern, but in such case the lantern shall be so constructed, fitted, and screened that it shall throw an unbroken light over an arc of the horizon of twelve points of the compass, namely, for six points from right aft on each side of the vessel, so as to be visible at a distance of at least one mile. Such light shall be carried as nearly as practicable on the same level as the side lights.

ANCHOR LIGHTS.

ART. 11. A vessel under one hundred and fifty feet in length when at anchor shall carry forward, where it can best be seen, but at a height not exceeding twenty feet above the hull, a white light, in a lantern so constructed as to show a clear, uniform, and unbroken light visible all around the horizon at a distance of at least one mile.

A vessel of one hundred and fifty feet or upwards in length when at anchor shall carry in the forward part of the vessel, at a height of not less than twenty and not exceeding forty feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall be not less than fifteen feet lower than the forward light, another such light.

The length of a vessel shall be deemed to be the length appearing in her certificate of registry.

A vessel aground in or near a fairway shall carry the above light or lights and the two red lights prescribed by article four (a).

SPECIAL SIGNALS.

ART. 12. Every vessel may, if necessary in order to attract attention in addition to the lights which she is by these rules required to carry, show a flare-up light or use any detonating signal that can not be mistaken for a distress signal.

NAVAL LIGHTS AND RECOGNITION SIGNALS.

ART. 13. Nothing in these rules shall interfere with the operation of any special rules made by the Government of any nation with respect to additional station and signal lights for two or more ships of war or for vessels sailing under convoy, or with the exhibition of recognition signals adapted by shipowners, which have been authorized by their respective Governments and duly registered and published.

STEAM VESSEL UNDER SAIL BY DAY.

ART. 14. A steam vessel proceeding under sail only, but having her funnel up, shall carry in daytime, forward, where it can best be seen, one black ball or shape two feet in diameter.

III. SOUND SIGNALS FOR FOG, AND SO FORTH.

PRELIMINARY.

ART. 15. All signals prescribed by this article for vessels under way shall be given:

First. By "steam vessels" on the whistle or siren.

Second. By "sailing vessels" and "vessels towed" on the foghorn.

The words "prolonged blast" used in this article shall mean a blast of from four to six seconds duration.

A steam vessel shall be provided with an efficient whistle or siren, sounded by steam or by some substitute for steam, so placed that the sound may not be intercepted by any obstruction, and with an efficient foghorn, to be sounded by mechanical means, and also with an efficient bell. In all cases where the rules require a bell to be used a drum may be substituted on board Turkish vessels, or a gong where such articles are used on board small seagoing vessels. A sailing vessel of twenty tons gross tonnage or upward shall be provided with a similar foghorn and bell.

In a fog, mist, falling snow, or heavy rainstorms, whether by day or night, the signals described in this article shall be used as follows, namely:

STEAM VESSEL UNDER WAY.

(a) A steam vessel having way upon her shall sound, at intervals of not more than two minutes, a prolonged blast.

(b) A steam vessel under way, but stopped, and having no way upon her, shall sound, at intervals of not more than two minutes, two prolonged blasts, with an interval of about one second between.

SAIL VESSEL UNDER WAY.

(c) A sailing vessel under way shall sound, at intervals of not more than one minute, when on the starboard tack, one blast; when on the port tack, two blasts in succession; and when with the wind abaft the beam three blasts in succession.

VESSELS AT ANCHOR OR NOT UNDER WAY.

(d) A vessel when at anchor shall, at intervals of not more than one minute, ring the bell rapidly for about five seconds.

VESSELS TOWING OR TOWED.

(e) A vessel when towing, a vessel employed in laying or in picking up a telegraph cable, and a vessel under way, which is unable to get out of the way of an approaching vessel through being not under command, or unable to maneuver as required by the rules, shall, instead of the signals prescribed in subdivisions (a) and (c) of this article, at intervals of not more than two minutes, sound three blasts in succession, namely: One prolonged blast followed by two short blasts. A vessel towed may give this signal and she shall not give any other.

SMALL SAILING VESSELS AND BOATS.

Sailing vessels and boats of less than twenty tons gross tonnage shall not be obliged to give the above-mentioned signals, but, if they do not, they shall make some other efficient sound signal at intervals of not more than one minute.

SPEED IN FOG.

ART. 16. Every vessel shall, in a fog, mist, falling snow, or heavy rain storms, go at a moderate speed, having careful regard to the existing circumstances and conditions.

A steam vessel hearing, apparently forward of her beam, the fog signal of a vessel the position of which is not ascertained shall, so far as the circumstances of the case admit, stop her engines, and then navigate with caution until danger of collision is over.

IV. Steering and Sailing Rules.

PRELIMINARY.

Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing of an approaching vessel. If the bearing does not appreciably change, such risk should be deemed to exist.

SAILING VESSELS.

Art. 17. When two sailing vessels are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other, as follows, namely:

(a) A vessel which is running free shall keep out of the way of a vessel which is closehauled.

(b) A vessel which is closehauled on the port tack shall keep out of the way of a vessel which is closehauled on the starboard tack.

(c) When both are running free, with the wind on differest sides, the vessel which has the wind on the port side shall keep out of the way of the other.

(c) When both are running free, with the wind on different sides, the vessel which is to the windward shall keep out of the way of the vessel which is to the leeward.

(e) A vessel which has the wind aft shall keep out of the way of the other vessel.

STEAM VESSEL.

Art. 18. When two steam vessels are meeting end on, or nearly end on, so as to involve risk of collision, each shall alter her coarse to starboard, so that each may pass on the port side of the other.

This article also applies to cases where vessels are meeting end on, or nearly end on, in such a manner as to involve risk of collision, and does not apply to two vessels which must, if both keep on their respective courses, pass clear of each other.

The only cases to which it does apply are when each of the two vessels is end on, or nearly end on to the other; in other words, to cases in which, by day, each vessel sees the masts of the other in a line, or nearly in a line, with her own; and by night, to cases in which each vessel is in such a position as to see both the side lights of the other.

It does not apply by day to cases in which a vessel sees another ahead crossing her own course; or by night, to cases where the red light of one vessel is opposed to the red light of the other, or where the green light of one vessel is opposed to the green light of the other, or where a red light without a green light, or a green light without a red light, is seen ahead, or where both green and red lights are seen anywhere but ahead.

TWO STEAM VESSELS CROSSING.

Art. 19. When two steam vessels are crossing, so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way of the other.

STEAM VESSEL SHALL KEEP OUT OF THE WAY OF SAILING VESSEL.

Art. 20. When a steam vessel and a sailing vessel are proceeding in such directions as to involve risk of collision, the steam vessel shall keep out of the way of the sailing vessel.

COURSE AND SPEED.

Art. 21. Where, by any of these rules, one or two vessels is to keep out of the way, the other shall keep her course and speed.

Note—When, in consequence of thick weather or other causes, such vessel finds herself so close that collision can not be avoided by the action of the giving-way vessel alone, she also shall take such action as will best aid to avert collision. [See articles twenty-seven and twenty-nine.]

CROSSING AHEAD.

ART. 2. Every vessel which is directed by these rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.

STEAM VESSEL SHALL SLACKEN SPEED OR STOP.

ART. 23. Every steam vessel which is directed by these rules to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed or stop or reverse.

OVERTAKING VESSELS.

ART. 24. Notwithstanding anything contained in these rules every vessel, overtaking any other, shall keep out of the way of the overtaken vessel.

Every vessel coming up with another vessel from any direction more than two points abaft her beam—that is, in such a position, with reference to the vessel which she is overtaking that at night she would be unable to see either of that vessel's side lights—shall be deemed to be an overtaking vessel; and no subsequent alteration of the bearing between the two vessels shall make the overtaking vessel a crossing vessel within the meaning of these rules, or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

As by day the overtaking vessel can not always know with certainty whether she is forward of or abaft this direction from the other vessel she should, if in doubt, assume that she is an overtaking vessel and keep out of the way.

NARROW CHANNELS.

ART. 25. In narrow channels every steam vessel shall, when it is safe and practicable, keep to that side of the fairway or mid-channel which lies on the starboard side of such vessel.

RIGHT OF WAY OF FISHING VESSELS.

ART. 26. Sailing vessels under way shall keep out of the way of sailing vessels or boats fishing with nets, or lines, or trawls. This rule shall not give to any vessel or boat engaged in fishing the right of obstructing a fairway used by vessels other than fishing vessels or boats.

GENERAL PRUDENTIAL RULE.

ART. 27. In obeying and constructing these rules due regard shall be had to all dangers of navigation and collision, and to any special circumstances which may render a departure from the above rules necessary in order to avoid immediate danger.

SOUND SIGNALS FOR PASSING STEAMER.

ART. 28. The words "short blast" used in this article shall mean a blast of about one second's duration.

When vessels are in sight of one another, a steam vessel under way, in taking any course authorized or required by these rules, shall indicate that course by the following signals on her whistle or siren, namely:

One short blast to mean, "I am directing my course to starboard."

Two short blasts to mean, "I am directing my course to port."

Three short blasts to mean, "My engines are going at full speed astern."

PRECAUTION.

ART. 29. Nothing in these rules shall exonerate any vessel, or the owner or master or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper lookout, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

ART. 30. Nothing in these rules shall interfere with the operation of a special rule, duly made by local authority, relative to the navigation of any harbor, river, or inland waters.

DISTRESS SIGNALS.

ART. 31. When a vessel is in distress and requires assistance from other vessels or from the shore the following shall be the signal to be used or displayed by her, either together or separately, namely:

In the daytime—

First. A gun or other explosive signal fired at intervals of about a minute.

Second. The international code signal of distress indicated by N C.

Third. The distance signal, consisting of a square flag, having either above or below it a ball or anything resembling a ball.

Fourth. A continuous sounding with any fog-signal apparatus.

At night—

First. A gun or other explosive signal fired at intervals of about a minute.

Second. Flames on the vessel (as from a burning tar barrel, oil barrel, and so forth).

Third. Rockets or shells throwing stars of any color or description, fired one at a time, at short intervals.

Fourth. A continuous sounding with any fog-signal apparatus.

Meteorological table compiled by the United States Weather Bureau.

NORFOLK, VA. OBS. STATION, LAT. 36° 51′ N., LONG. 76° 17′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0–10.	Precipitation.			Wind.											Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.										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	30.13	30.94	29.00	1.94	40.4	48.5	33.2	15.3	80	5	75	76	5.4	3.37	12	2.22	10.4	67	9	12	3	6	9	11	6	6	0	3.0	2.3
February	30.11	30.83	29.04	1.79	41.8	49.9	34.1	15.8	81	2	79	76	5.2	3.75	11	3.45	11.1	62	10	9	3	7	8	7	7	5	0	3.3	2.2
March	30.03	30.91	29.03	1.88	47.7	56.8	39.7	17.1	92	14	78	76	5.2	4.28	12	2.78	10.8	60	9	9	5	8	11	9	5	6	0	3.9	0.8
April	30.01	30.59	29.28	1.31	56.0	65.2	47.5	17.7	95	24	71	74	4.8	3.79	11	5.15	10.9	69	6	8	5	8	14	8	5	6	0	2.8	0.7
May	30.00	30.55	29.37	1.18	66.2	75.3	57.5	17.8	98	38	60	76	4.9	4.07	12	3.78	9.6	62	6	8	7	10	11	11	4	5	0	1.5	1.2
June	30.00	30.44	29.46	0.98	74.4	83.1	66.1	17.0	102	49	53	78	4.8	4.33	10	5.97	8.3	75	6	8	6	12	12	10	3	3	0	1.4	1.0
July	30.00	30.38	29.61	0.77	78.4	87.2	70.7	16.5	102	57	45	79	4.9	5.80	13	3.60	8.8	66	4	6	6	9	14	16	4	3	0	2.4	0.5
August	30.00	30.39	29.68	0.71	76.7	84.4	69.9	14.5	105	56	49	82	5.0	5.97	12	6.03	8.1	62	5	9	7	8	14	12	4	3	0	0.9	0.7
September	30.06	30.44	29.35	1.09	71.7	79.1	65.1	14.0	100	40	60	81	4.5	4.06	9	4.23	8.4	55	8	14	5	10	10	6	4	3	0	0.8	0.8
October	30.07	30.57	29.37	1.20	61.3	68.8	54.1	14.7	91	31	60	78	4.3	3.91	9	6.29	8.9	60	10	12	5	8	10	8	4	5	0	1.2	2.3
November	30.11	30.72	29.15	1.57	51.2	58.8	43.8	15.0	81	20	61	76	4.7	2.72	9	5.48	9.4	50	11	9	3	5	10	10	6	6	0	1.2	1.1
December	30.13	30.81	29.32	1.49	43.0	50.5	35.4	15.1	75	5	70	75	4.9	3.49	10	2.52	8.9	74	13	10	3	4	8	10	8	6	0	3.3	2.3
Mean	30.05	.....	.....	.....	59.1	65.6	51.4	15.9	....	....	....	78	4.9	.....	.....	.....	9.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	49.54	130	.....	.....	.....	97	114	58	95	131	118	60	57	0	25.7	15.9

Meteorological table compiled by the United States Weather Bureau—Continued.

HATTERAS, N. C. OBS. STATION, LAT. 35° 15′ N. LONG. 75° 40′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0–10.	Precipitation.			Wind.											Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.										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	30.14	30.78	29.06	1.72	45.8	51.6	39.5	12.1	73	11	62	85	5.2	4.94	13	2.82	16.4	72	14	10	3	2	5	13	8	7	0	4.6	0.9
February	30.11	30.74	29.26	1.48	46.6	52.0	39.6	12.4	73	11	62	84	5.2	4.48	11	4.34	17.8	68	12	10	4	3	4	9	6	8	0	4.1	1.5
March	30.04	30.75	29.24	1.51	51.4	57.4	45.1	12.3	82	25	57	84	4.8	5.47	13	1.82	16.4	67	10	13	5	3	7	13	5	6	0	4.4	0.9
April	30.01	30.59	29.10	1.49	58.0	63.6	51.8	11.8	80	31	49	80	4.4	4.40	11	3.24	16.0	80	6	12	5	3	7	16	6	5	0	3.1	0.9
May	30.01	30.48	29.20	1.28	67.1	72.8	61.9	10.9	88	46	42	82	4.2	4.14	10	4.72	13.6	56	6	12	5	5	6	19	6	3	0	1.0	0.1
June	30.01	30.37	29.49	.88	74.4	79.2	69.2	10.0	91	55	36	84	4.3	4.33	11	6.81	13.1	64	6	12	6	5	7	18	4	2	0	1.3	0.1
July	30.01	30.33	29.33	1.00	78.6	82.9	73.2	9.7	93	60	33	84	4.3	6.13	12	3.42	12.6	62	3	8	5	3	11	25	5	2	0	1.4	0.1
August	30.00	30.32	29.54	.78	78.2	82.7	73.1	9.6	92	62	30	84	4.4	5.84	13	4.34	11.3	105	5	11	5	4	6	23	6	2	0	1.2	0.0
September	30.06	30.48	29.37	1.11	74.7	79.2	70.1	9.1	91	50	41	82	4.1	5.33	10	6.74	12.6	74	7	22	5	4	5	9	5	3	0	1.2	0.1
October	30.06	30.48	29.37	1.11	66.0	70.3	60.4	9.9	90	41	49	82	4.1	6.01	10	3.53	14.9	76	10	20	4	4	5	8	5	6	0	1.4	0.5
November	30.11	30.67	29.09	1.58	56.7	61.3	50.4	10.9	79	27	52	82	4.4	4.67	8	3.38	15.4	68	17	12	2	2	3	10	8	6	0	2.2	0.4
December	30.13	30.67	29.34	1.33	48.8	53.9	41.8	12.1	75	8	67	84	4.8	5.11	12	2.55	15.8	72	18	11	1	1	4	8	10	9	0	5.7	0.9
Mean	30.06	.....	.....	.....	62.2	67.2	56.3	10.9	....	....	....	83	4.5	.....	.....	.....	14.7	.....	....	....	....	....	....	....	....	....	....	....	....
Total	.....	.....	.....	.....	.....	.....	.....	.....	....	....	....	.....	.....	60.85	134	.....	.....	.....	114	153	50	39	70	171	74	59	0	31.6	6.4

Meteorological table compiled by the United States Weather Bureau—Continued.

WILMINGTON, N. C. OBS. STATION, LAT. 34° 14′ N., LONG. 77° 57′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0-10.	Precipitation.			Wind.											Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.										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	30.14	30.91	29.18	1.73	45.6	55.9	38.0	17.9	80	9	71	77	5.1	3.50	11	4.56	8.7	47	10	11	3	3	6	12	12	5	0	0.2	1.2
February	30.12	30.76	29.07	1.69	47.7	57.4	39.4	18.0	81	5	76	76	5.2	3.39	10	3.23	9.8	51	10	10	5	2	4	10	11	4	0	0.3	1.3
March	30.05	30.77	29.18	1.59	53.7	64.0	45.6	18.4	94	20	74	78	4.8	3.59	11	5.26	9.7	54	7	12	4	4	8	12	10	5	0	0.4	0.9
April	30.03	30.61	29.30	1.31	60.4	70.2	52.2	18.0	90	28	62	74	4.4	2.86	9	2.72	9.8	60	5	9	4	2	10	15	10	5	0	0.3	0.8
May	30.01	30.47	29.39	1.08	69.1	78.4	61.3	17.1	97	38	59	78	4.5	4.03	9	2.90	8.6	52	5	10	6	4	7	18	10	2	0	0.0	0.9
June	30.01	30.39	29.41	0.98	75.5	84.3	68.5	15.8	100	51	49	80	5.0	5.62	12	7.03	7.9	71	4	10	7	4	7	15	10	3	0	0.1	0.6
July	30.02	30.35	29.14	1.21	78.7	87.1	72.1	15.0	103	54	49	82	5.2	6.97	14	7.33	7.6	50	3	8	4	5	9	21	10	2	0	0.0	0.3
August	30.00	30.31	29.46	0.85	77.6	86.1	71.1	15.0	99	56	43	85	5.3	6.51	15	8.04	6.7	68	4	11	5	3	7	19	11	2	0	0.0	0.3
September	30.05	30.48	29.12	1.36	73.1	82.0	66.1	15.9	96	42	54	84	4.7	5.27	9	7.30	7.1	64	10	18	6	3	6	8	7	2	0	0.0	1.1
October	30.06	30.67	29.09	1.58	63.3	73.0	55.2	17.8	93	31	62	80	4.0	3.74	8	4.51	7.9	72	12	18	5	4	6	6	6	5	0	0.0	2.6
November	30.12	30.73	28.98	1.75	54.1	64.5	45.8	18.7	83	20	63	78	4.3	2.45	8	2.91	7.7	48	13	13	4	2	5	9	10	4	0	0.1	0.9
December	30.15	30.76	29.22	1.54	47.2	57.5	39.0	18.5	78	6	72	77	4.7	3.12	10	2.98	8.1	48	13	13	2	1	5	9	13	5	1	0.1	2.0
Mean	30.06	.....	.....	.....	62.2	71.7	54.5	17.2	....	....	....	79	4.8	.....	.....	.....	8.3	.....	....	....	....	....	....	....	....	....	....	....	....
Total	.....	.....	.....	.....	.....	.....	.....	.....	....	....	....	.....	.....	51.05	126	.....	.....	.....	96	143	55	37	80	154	120	44	1	1.5	12.9

Meteorological table compiled by the United States Weather Bureau—Continued.

CHARLESTON, S. C. OBS. STATION, LAT. 32° 47′ N., LONG. 79° 56′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0–10.	Precipitation.			Wind.										Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.										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	30.15	30.83	29.17	1.66	49.3	57.5	42.6	14.9	80	10	70	78	5.0	3.45	10	3.98	10.7	47	10	10	3	4	5	14	9	7	0	0.2	2.7
February	30.12	30.66	29.20	1.46	51.7	59.2	44.3	14.9	80	7	73	78	4.9	3.41	10	3.18	11.9	56	7	9	4	3	6	10	9	8	0	0.5	2.2
March	30.06	30.71	29.33	1.38	57.2	65.5	50.4	15.1	94	24	70	78	4.6	3.72	10	3.14	10.9	55	7	11	6	3	9	13	6	7	0	0.6	2.0
April	30.03	30.79	29.29	1.50	63.8	71.7	57.0	14.7	92	32	60	74	4.2	2.99	8	8.30	11.6	67	6	7	6	5	12	12	7	5	0	0.6	0.4
May	30.01	30.46	29.48	0.98	72.4	79.6	65.9	13.7	98	45	53	76	4.4	3.47	9	5.88	11.0	53	4	9	8	5	12	12	7	5	0	0.5	0.3
June	30.01	30.35	29.31	1.04	78.5	85.5	72.4	13.1	101	51	50	78	5.1	5.39	11	5.95	10.3	58	5	8	7	6	14	12	5	3	0	0.3	0.1
July	30.03	30.36	29.02	1.34	81.3	88.0	75.3	12.7	104	64	40	79	5.0	7.26	12	7.58	9.7	64	3	6	4	6	16	16	8	3	0	0.5	0.1
August	30.01	30.28	29.33	0.95	80.3	87.0	74.6	12.4	100	62	38	81	5.3	6.97	13	5.89	9.2	106	4	6	6	4	13	18	8	3	0	0.0	0.2
September	30.04	30.43	29.27	1.16	76.2	82.7	70.8	11.9	100	49	51	82	4.8	5.46	10	7.00	10.6	62	12	14	8	6	7	5	4	4	0	0.2	0.5
October	30.06	30.59	28.91	1.68	67.1	74.3	60.5	13.8	95	37	58	78	3.9	3.93	8	9.55	11.5	64	15	16	5	4	6	7	4	5	0	0.2	1.4
November	30.12	30.70	29.14	1.56	58.1	65.9	50.7	15.2	83	26	57	78	4.2	2.87	8	5.84	9.9	54	12	12	4	3	6	8	8	7	0	0.1	0.9
December	30.15	30.74	29.28	1.46	51.3	59.0	44.1	14.9	79	12	67	77	4.7	3.15	9	3.46	10.1	50	12	12	3	3	5	8	10	9	0	0.2	2.1
Mean	30.07	.....	.....	.....	65.6	73.0	59.0	13.9	.....	.....	.....	78	4.7	.....	.....	.....	10.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	52.07	118	.....	.....	.....	97	120	64	52	111	135	85	66	0	3.9	12.9

Meteorological table compiled by the United States Weather Bureau—Continued.

JACKSONVILLE, FLA. OBS. STATION, LAT. 30° 20′ N., LONG. 81° 39′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0–10.	Precipitation.			Wind.											Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.										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	30.15	30.66	29.49	1.17	53.9	64.1	46.5	17.6	81	15	66	82	5.1	3.12	9	3.09	9.2	59	11	11	3	6	6	10	7	8	0	1.2	3.0
February	30.12	30.60	29.37	1.23	56.9	66.5	48.6	17.9	86	10	76	79	5.0	3.43	9	4.16	10.1	75	7	8	4	5	5	10	6	11	0	2.0	2.2
March	30.06	30.64	29.42	1.22	61.9	72.4	54.2	18.2	91	26	65	78	4.3	3.52	8	4.47	9.9	68	7	10	5	10	5	9	7	9	0	1.2	0.7
April	30.04	30.43	29.32	1.11	67.6	77.7	59.5	18.2	92	34	58	74	4.1	2.72	7	4.81	10.0	58	5	8	8	14	6	9	4	6	0	1.6	0.5
May	30.00	30.41	29.55	0.86	74.2	83.8	66.2	17.6	98	46	52	76	4.2	4.25	9	9.06	9.3	64	3	12	8	13	7	9	5	5	0	1.4	0.1
June	30.01	30.26	29.53	0.73	79.0	88.4	71.9	16.5	101	54	47	80	5.0	5.53	13	7.66	9.0	68	5	8	6	13	9	12	5	2	0	0.8	0.1
July	30.03	30.29	29.71	0.58	80.9	90.4	74.0	16.4	104	66	38	81	5.1	6.20	15	4.55	8.9	60	3	5	6	11	12	18	5	2	0	1.8	0.0
August	30.01	30.27	29.04	1.23	80.1	89.7	73.7	16.0	101	64	37	83	5.0	6.21	15	6.18	8.5	56	3	5	5	15	9	16	6	3	0	1.6	0.2
September	30.00	30.25	29.19	1.06	77.3	85.8	71.2	14.6	99	49	50	84	5.1	8.03	13	9.86	8.8	70	11	16	9	10	4	4	2	4	0	0.3	0.4
October	30.02	30.49	29.04	1.45	69.6	78.3	62.9	15.4	95	37	58	82	4.6	5.06	10	5.15	9.7	64	16	17	7	7	3	3	3	6	0	0.3	1.1
November	30.10	30.54	29.35	1.19	61.3	71.0	53.8	17.2	86	26	60	82	4.5	2.19	8	3.75	8.7	47	17	12	5	4	3	6	5	8	0	0.6	1.6
December	30.14	30.61	29.45	1.16	55.2	65.1	47.3	17.8	82	14	68	82	4.8	2.99	8	4.97	8.9	54	16	10	3	5	5	7	6	10	0	0.9	3.5
Mean	30.06	.....	.....	.....	68.2	77.8	60.8	17.0	.....	.....	.....	80	4.7	.....	.....	.....	9.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	53.25	124	.....	.....	.....	104	122	69	113	74	113	61	74	0	13.7	13.4

Meteorological table compiled by the United States Weather Bureau—Continued.

JUPITER, FLA. OBS. STATION, LAT. 26° 57′ N., LONG. 80° 07′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0-10.	Precipitation.			Wind.											Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.										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	30.48	29.66	0.82	64.3	72.4	58.4	14.0	83	24	59	81	4.9	3.58	10	6.38	10.7	45	8	5	8	9	5	6	6	15	0	0.3	0.2
February	30.08	30.45	29.54	0.91	66.3	73.4	59.1	14.3	87	27	60	80	4.8	3.05	8	3.62	10.8	51	10	4	4	8	6	8	4	12	0	0.4	0.2
March	30.05	30.39	29.56	0.83	69.4	76.5	62.6	13.9	89	33	56	78	4.1	3.12	7	4.97	11.3	46	7	5	10	11	9	6	6	8	0	0.1	0.2
April	30.04	30.34	29.61	0.73	72.2	78.9	65.3	13.6	90	39	51	76	4.2	2.63	7	4.25	11.2	60	5	6	7	10	8	9	8	7	0	0.4	0.2
May	29.98	30.28	29.64	0.64	76.4	82.4	69.9	12.5	93	53	40	79	4.6	4.76	10	8.76	10.2	48	3	7	11	14	9	9	7	2	0	0.1	0.0
June	30.01	30.25	29.63	0.62	79.6	85.2	73.3	11.9	95	64	31	83	5.5	6.93	14	9.26	8.9	49	2	5	10	14	10	9	7	3	0	0.2	0.1
July	30.03	30.25	29.76	0.49	81.0	87.0	74.7	12.3	96	67	29	82	4.9	5.37	14	3.40	8.1	40	3	2	7	16	10	13	7	4	0	0.1	0.0
August	30.00	30.19	29.20	0.99	81.5	87.6	75.0	12.6	96	68	28	83	4.8	5.85	15	4.92	8.1	60	2	3	8	15	8	15	8	3	0	0.2	0.0
September	29.96	30.16	29.30	0.86	80.6	85.8	74.4	11.4	93	61	32	82	5.5	9.56	17	6.67	9.3	78	5	9	14	14	6	5	4	3	0	0.3	0.0
October	29.96	30.30	29.18	1.12	76.8	81.8	70.7	11.1	94	48	46	80	5.4	9.48	15	13.18	11.7	72	8	18	13	6	4	4	3	6	0	0.9	0.2
November	30.05	30.32	29.71	0.61	71.6	78.4	65.7	12.7	87	36	51	79	4.9	3.05	9	5.06	11.1	42	8	8	12	7	2	4	5	14	0	0.0	0.3
December	30.10	30.48	29.63	0.85	66.3	73.2	59.6	13.6	86	24	62	81	5.0	2.87	9	5.75	10.5	38	9	5	8	8	4	6	7	15	0	0.0	0.4
Mean	30.03	.....	.....	.....	73.8	80.2	67.4	12.8	....	....	....	80	4.9	.....	.....	.....	10.2	.....	....	....	....	....	....	....	....	....	....	....	....	....
Total	.....	.....	.....	.....	.....	.....	.....	.....	....	....	....	.....	.....	60.25	135	.....	.....	.....	70	77	112	132	81	94	72	92	0	3.0	1.8

Meteorological table compiled by the United States Weather Bureau—Continued.

MIAMI, FLA. OBS. STATION, LAT. 25° 48′ N., LONG. 80° 12′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0–10.	Precipitation.			Wind.											Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.										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.		
January	30.12	30.45	29.71	0.74	67.3	75.0	58.2	16.8	85	29	56	79	5.2	3.45	9	1.93	9.4	35	6	5	14	10	6	4	4	13	0	0.0	0.3
February	30.09	30.49	29.61	.88	68.8	76.8	59.5	17.3	88	27	61	78	5.0	2.70	6	1.99	9.2	38	5	3	8	9	6	5	5	15	0	0.0	0.6
March	30.10	30.41	29.71	.70	72.0	79.7	64.0	15.7	92	34	58	75	4.9	2.72	7	9.04	9.5	34	6	6	13	12	7	4	4	10	0	0.0	0.1
April	30.04	30.36	29.67	.69	74.2	82.5	65.6	16.9	93	45	48	72	5.1	2.59	7	3.22	9.9	36	5	7	17	12	7	3	3	6	0	0.0	0.2
May	30.00	30.22	29.66	.56	78.6	86.1	70.5	15.6	94	50	44	74	5.8	6.37	11	5.26	9.3	43	2	7	19	15	6	4	4	5	0	0.1	0.0
June	30.02	30.20	29.72	.48	80.4	87.8	73.5	14.3	94	61	33	76	6.5	7.89	12	3.96	7.8	40	2	7	18	14	7	5	4	3	0	0.1	0.0
July	30.06	30.24	29.86	.38	81.9	89.2	74.8	14.4	96	67	29	76	6.2	7.24	15	2.38	7.3	36	2	5	16	18	6	6	5	4	0	0.0	0.0
August	30.05	30.26	29.77	.49	82.0	89.7	74.8	14.9	96	67	29	76	5.9	7.60	14	6.12	7.9	40	2	5	23	17	4	4	2	5	0	0.1	0.0
September	29.98	30.16	29.65	.51	81.5	88.5	74.4	14.1	95	62	33	79	6.1	9.61	17	6.67	8.2	46	6	9	19	11	4	4	2	5	0	0.1	0.0
October	29.98	30.24	29.57	.67	77.8	85.0	70.6	14.4	93	53	40	78	6.1	10.54	15	6.08	9.2	38	8	13	20	8	2	2	2	7	0	0.0	0.0
November	30.07	30.40	29.71	.69	72.0	80.3	66.6	13.7	88	36	52	74	5.7	2.55	10	7.74	10.7	44	7	15	14	5	3	2	3	11	0	0.0	0.0
December	30.10	30.39	29.83	.56	68.0	76.2	60.7	15.5	91	32	59	80	5.4	2.24	7	1.65	8.2	38	10	5	10	10	5	3	4	15	0	0.0	0.9
Mean	30.05	.....	.....	.....	75.4	83.1	67.8	15.3	.....	.....	.....	76	5.7	.....	.....	.....	8.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	65.50	1.30	.....	.....	.....	61	87	191	141	63	46	42	99	0	0.4	2.1

Meteorological table compiled by the United States Weather Bureau—Continued.

KEY WEST, FLA. OBS. STATION, LAT. 24° 33′ N., LONG. 81° 48′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0-10.	Precipitation.			Wind.										Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.										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	73.7	65.0	8.7	90	41	49	82	4.5	1.98	7	3.97	10.8	58	9	19	15	9	3	1	1	5	0	0.2	0.0
February	30.07	30.47	29.60	0.87	70.8	75.4	66.1	9.3	87	44	43	80	3.9	1.64	6	2.99	10.9	50	11	13	12	8	3	2	2	5	0	0.4	0.1
March	30.05	30.47	29.70	0.77	72.8	77.8	68.3	9.5	89	48	41	77	3.4	1.48	4	4.52	10.6	56	10	12	18	12	3	1	1	5	0	0.4	0.0
April	30.02	30.37	29.63	0.74	75.5	80.5	71.3	9.2	91	54	37	74	3.5	1.30	4	3.23	10.6	49	9	9	19	12	2	2	1	6	0	0.7	0.0
May	29.97	30.25	29.68	0.57	79.0	84.0	74.6	9.4	93	63	30	74	4.2	3.36	8	5.83	9.0	54	6	8	22	15	3	2	1	5	0	0.2	0.0
June	29.99	30.26	29.62	0.64	82.2	87.0	77.2	9.8	100	69	31	76	5.3	4.25	12	5.48	8.0	50	3	5	21	18	6	3	1	3	0	0.0	0.0
July	30.03	30.24	29.77	0.47	83.7	88.7	78.5	10.2	100	68	32	74	5.1	3.59	13	7.46	7.8	52	2	5	19	22	6	3	2	3	0	0.2	0.0
August	29.98	30.22	29.67	0.55	83.8	88.8	78.3	10.5	100	68	32	74	5.2	4.69	15	4.04	7.2	50	2	4	29	19	3	2	1	2	0	0.1	0.0
September	29.94	30.17	29.13	1.04	82.5	87.4	77.3	10.1	97	69	28	78	5.4	6.79	16	11.95	8.0	110	3	12	23	12	5	2	1	2	0	0.3	0.0
October	29.94	30.28	28.47	1.81	78.7	83.0	74.7	8.3	92	59	33	78	4.8	5.38	13	11.23	11.4	100	5	23	17	8	3	2	1	3	0	0.3	0.0
November	30.02	30.45	29.65	0.80	74.3	78.3	70.4	7.9	91	51	40	80	4.1	2.36	8	8.86	11.1	52	10	26	12	5	1	1	1	4	0	0.5	0.0
December	30.08	30.52	29.63	0.89	70.1	74.4	66.0	8.4	88	44	44	81	4.4	1.84	7	3.93	11.0	56	11	26	9	8	3	1	1	3	0	0.2	0.2
Mean	30.02	.....	.....	.....	76.8	81.6	72.3	9.3	.....	.....	.....	78	4.5	.....	.....	.....	9.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	38.66	113	.....	.....	.....	81	162	216	148	41	22	14	46	0	3.5	0.3

INDEX.

A.

	Page.
Abbeville	99
Adams Creek, Neuse River	165
Adams Creek, Ossabaw Sound	91
Agencies of the Coast and Geodetic Survey	169
Aids to Navigation	17
Albemarle and Chesapeake Canal	135
Albemarle Sound	142
Alligator Bay	58
Alligator Reef lighthouse	127
Alligator River	149
Altamaha River	99
Altamaha Sound	99
Amelia Island	110
Amelia Island lighthouse	107
Amelia River	108
American Shoal lighthouse	127
Anchorages:	
Beaufort Harbor, N. C	53
Cape Fear River	61
Charleston Harbor	74
Cumberland Sound	108
Doboy Sound	97
Key West	133
Port Royal Sound	83
St. Andrew Sound	106
St. Johns River	112
St. Simon Sound	102
Sapelo Sound	95
Tybee Roads and Savannah River	86
Winyah Bay	68
Appendix I	169
Archers Creek	82
Ashepoo River	79
Ashley River	73
Atlantic Beach	112
Atwood River	96
Aster	118
Augusta	85
Aurora	160
Avoca	147

B.

	Page.
Back Bay, Currituck Sound	136
Back River, Doboy Sound	97
Back River, St. Simon Sound	102
Back Sound	157
Bacons Bridge	73
Bahama Islands and Banks	43
Bahia Honda Harbor	130
Bald Head lighthouse	63
Banana River	122
Bannerman Bridge	61
Barbour Island River	94
Barnwell Place light	88
Barrows Bluff	99
Batchelors Bay	147
Bath	161
Bath Creek	161
Battery Creek	82
Batts Island	146
Baum Point light	150
Bayboro	163
Bay Point	81
Bay Point light	163
Bay River	162
Beach Creek	107
Bear Inlet	57
Bear River	92
Beard Creek	165
Beaufort Harbor, N. C	52, 160, 205
Beaufort, N. C	52
Beaufort River, S. C	82
Beaufort, S. C	80, 171
Bees Ferry	73
Belfast	92
Belfast River	92
Belhaven	160
Bells River	108
Belvidere, N. C	145
Bennett Creek	147
Bethel Shoal	122
Bight, The	88
Big Porpoise Bay	156
Big Tom Creek	92
Biscayne Bay	123
Biscayne Channel	124
Black Bank River	100
Black Creek, St. Johns River	117
Black River, Cape Fear River	61
Black River, Pedee River	67
Blackwater River	147
Bloody Point range	88
Blount Creek	161
Bluff Point	154
Bluff Shoal, N. C	154
Bluffton	84
Bocachica Channel	133
Bodie Island lighthouse	48
Bogue Banks	55
Bogue Inlet	56
Bogue Inlet to New River Inlet	56
Bogue Sound	55
Bohicket Creek	77
Bond Creek	160
Bonners Bridge	161
Bowles Bank Anchorage	128

Page.
Bradley River 92
Branch Hydrographic Office 86
Breach Inlet 72
Brickhill River 106
Brick House Point 142
Brickyard Creek 78
Broad Creek 164
Broad Creek, Bogue Sound 55
Broad Creek, Roanoke Sound 150
Broad River 82
Brown Inlet 57
Browns Landing 61
Brunswick 101
Brunswick Harbor 101
Brunswick Harbor range 104
Brunswick light vessel 33, 100
Brunswick River 101
Buck Head Creek 92
Bucksport 67
Buffalo Bluff 118
Bull Bay, N. C 148
Bull Bay, S. C 71
Bull Breakers 71
Bull River 78
Buoyage, System of 17
Burnside River 90
Burnt Fort 105
Buttermilk Sound 99
Buxton 152
Buzzard Bay 59
Buzzards Roost Creek 96

C.

Cæsar Creek Bank Anchorage 129
Caines Landing 67
Calibogue Sound 84
Camden 70
Campbell Creek 160
Can Patch Creek 92
Cape Canaveral 122
Cape Canaveral lighthouse 122
Cape Channel 152
Cape Fear 60
Cape Fear lighthouse 60
Cape Fear River 61, 206
Cape Fear Swash 60
Cape Florida 123
Cape Florida Anchorage 128
Cape Hatteras 48
Cape Hatteras lighthouse 48
Cape Henry 47
Cape Henry lighthouse 47
Cape Lookout 50
Cape Lookout lighthouse 51
Cape Lookout Shoals 51
Cape Lookout Shoals light vessel 33, 51
Cape Romain Harbor 71
Cape Romain lighthouse 71
Cape Romain Shoal 70
Capers Inlet 71
Capers Island 81
Carolina City 55
Carrs Neck 93
Carysfort Reef lighthouse 127
Cedar Creek range 116

Page.
Cedar Island Bay 156
Cedar Island Bay light 156
Charleston 74
Charleston Harbor 72
Charleston lighthouse 72
Charleston light vessel 33, 72
Chart, index 19
Chechessee River 83
Cheraw 67
Cherry 148
Chicamacomico Woods 48
Chisolm 78
Chowan Creek 79, 82
Chowan River 146
Clapboard Creek range 116
Clay Springs 119
Clear Run 61
Clubb Creek 101
Clubfoot and Harlowe Canal 166
Clubfoot Creek 165
Coanjock 136
Coanjock Bay 136
Coast:
Cape Fear to Winyah Bay 65
Cape Henry to Cape Lookout 47
Cape Lookout to Cape Fear 54
St. Johns River to Cape Florida 119
Winyah Bay to Charleston Harbor 70
Coast Guard stations 30
Coast Pilots, list of 169
Coffee Creek 164
Colerain Landing, N. C 147
Colleton River 83
Columbia, N. C 148
Columbia, S. C 70
Combahee Bank 80
Combahee River 79
Congaree River 70
Connegan River 96
Contentnia Creek 166
Contents, Table of III
Conway 67
Cooper River, Calibogue Sound 85
Cooper River, Charleston 73
Coopers Creek 141
Coosaw River 78
Coosawhatchie River 82
Core Creek 165, 167
Core Sound 157
Corncake Inlet 59
Crandall 107
Crescent City 118
Crescent Lake 118
Croatan Sound 149
Crooked River 105
Croom Bridge 61
Crossover range 115
Cumberland Island 106
Cumberland River 105
Cumberland Sound 107
Currents:
Bahama Banks 43
Beaufort Harbor, N. C 53
Brunswick light vessel 33
Cape Fear River 62

Currents—Continued Page.
Cape Henry to Key West 32
Cape Lookout Shoals light vessel 33
Charleston Harbor 75
Charleston light vessel 33
Coast 32
Core Sound 158
Diamond Shoal light vessel 32
Doboy Sound 98
Florida, Straits of 38, 41
Frying Pan Shoals light vessel 33
Gulf Stream 34
Hatteras Inlet 50
Key West Harbor 134
Martins Industry gas buoy 33
North Edisto River 77
North Equatorial 43
Ocracoke Inlet 51
Ossabaw Sound 91
Port Royal Sound 83
Providence Channels 44
Rebecca Shoal 42
Savannah River 87
St. Johns River 112
St. Marys Entrance 109
St. Simon Sound 103
Wassaw Sound 90
Winyah Bay 68
Wind 35
Currituck 136
Currituck Beach lighthouse 48
Currituck Sound 136
Curved Channel light 116

D.

Dales Creek 79
Dame Point 116
Dan River 147
Darien 97
Darien River 97
Daufuskie Island range 85
Dawho River 77
Daytona 121
Daytona Beach 121
Deep Bay, N. C 155
Deep Creek, Va 137, 141
Deep Creek, St. Johns River 118
Delaroche Creek 106
Dewees Inlet 71
Diamond Shoal 48
Diamond Shoal light vessel 32, 49
Directions:
Adams Creek 167
Albemarle Sound 143
Albemarle and Chesapeake Canal route 138
Alligator River 149
Bahama Bank 44
Bay River 163
Beaufort Harbor, N. C 53, 160
Biscayne Bay 125
Calibogue Sound 85
Cape Channel 153
Cape Fear River 63
Charleston Harbor 75

Directions—Continued. Page.
Core Creek 167
Core Sound 158
Croatan Sound 151
Cumberland Sound 110
Dismal Swamp route 141
Doboy Sound 97
Edenton Bay 146
Fernandina Harbor 110
Florida, Straits of 43
Great Bahama Bank 46
Great Bahama Bank, western edge 45
Hawk Channel 130
Jones Bay 156
Key West Harbor 134
Little River, Albemarle Sound 145
Long Shoal River 152
Miami 125
Middleton Anchorage 153
Neuse River 166
Pamlico River 161
Pamlico Sound 151
Pasquotank River 141
Perquimans River 145
Port Royal Sound 83
Providence Channels 45
Pungo River 162
Roanoke River 148
Rose Bay 154
Royal Shoal Anchorage 157
St. Andrew Sound 106
St. Augustine Inlet 120
St. Catherines Sound 93
St. Helena Sound 80
St. Johns River 113
St. Marys Entrance 109
St. Simon Sound and Brunswick Harbor 103
Sapelo Sound 95
Scuppernong River 148
Steamship routes—
Cape Hatteras to Jupiter 37
Chesapeake Bay to Cape Hatteras 36
Delaware Bay to Cape Hatteras 36
Fowey Rocks to Sand Key 40
Jupiter to Fowey Rocks 39
New York to Cape Hatteras 36
Providence Channels 43
Sand Key to Dry Tortugas 41
Straits of Florida to Cape Hatteras 42
Swan Quarter Bay 155
Tybee Roads and Savannah River 87
Wassaw Sound 90
Winyah Bay 69
Dismal Swamp Canal 137
Ditch Creek 156
Dixon Creek 160
Doboy Island 97
Doboy Sound 96
Doctors Lake 117
Dog Rocks 44

Page.
Double Headed Shot Keys 44
Drum Creek 156
Drummond Point 146
Dry docks 21
Dry Tortugas lighthouse 128
Dunbar Bridge 161
Dunns Creek 118
Duplin River 96
Durham Creek 161

E.

East Bank 70
East Bluff Bay 154
East Lake 149
East River 101
Eastern Triangle light 134
Eastham Creek 160
Edenton 146
Edenton Bay 146
Edenton Harbor range 146
Edisto River 77
Edwards Ferry 147
Eight Mile Swash 66
Elba Island light 88
Eldorado Shoal 45
Elizabeth City 138
Elizabeth River, Southern Branch 135
Elizabethtown 61
Englehard 153
Estherville-Minim Creek Canal 67
Eulonia 94

F.

False Cape, Fla 122
False Cape, Va 47
Fancy Bluff Creek 101
Far Creek 153
Fayetteville 61
Fernandina 108
Fernandina Harbor 108
Ferry Point 145
Fishing Creek 161
Five Fathom Creek 71
Flatty Creek 145
Florida Keys and Reefs 39, 126
Florida Passage 92
Florida, Straits of 38
Floyds Creek 106
Fog 21, 195
Fools Bridge 166
Fort George Inlet 111
Fort George Island 111
Fort George Island range 115
Fort Jackson 89
Fort Landing 149
Fort Pierce Inlet 122
Fort Sumter 72
Fort Sumter lighthouse 76
Fort Taylor 132
Fowey Rocks Anchorage 128
Fowey Rocks lighthouse 127
Franklin 147
Frederica River 101
Freshets, Cape Fear River 62

Page.
Freshets, Savannah River 87
Fripps Inlet 81
Frisco 152
Front River 95
Frying Pan Shoals 60
Frying Pan Shoals light vessel 33, 60

G.

Gales 23
Gales Creek 55
Gallant Channel 53
Gallivant Bridge 67
Garon Bridge 73
Georgetown 67
Georgetown lighthouse 66
Gibbs Shoal 153
Gingerbread Ground 44
Goat Island 142
Goldsboro 166
Goose Creek, Neuse River 165
Goose Creek, Pamlico River 160
Grassy Point 145
Great Bahama Bank 44
Great Island 154
Green Cove Springs 118
Green Creek 164
Greenville 161
Greggs 73
Gulf Stream 34
Gull Rock 154
Guthries Point 55
Gunnisons Cut 111

H.

Halifax 147
Halifax River 120
Hamilton 147
Hampton River 100
Hancock Creek 166
Harbor Island Bar 158
Harbor masters and regulations:
Brunswick 102
Cape Fear River 62, 172
Charleston 74, 174
Savannah 86, 180
Harbor River, St. Helena Sound 79
Harbors and harbor entrances 16
Harelock 165
Harlowe Creek 165
Hastings 118
Hatteras Inlet 49, 205
Hatteras Shoals 48
Haw Creek 118
Hawk Channel 123
Hawkinsville 99
Haws Narrows 61
Hector, wreck of 70
Hemmingway Bridge 67
Hertford 145
Hetzel Shoal 122
Hickory Point 160
Hillsboro Inlet lighthouse 123
Hillsborough River 121
Hilton Head Island 81

Page.
Hobucken 154
Hog Island Point 153
Hog Key 129
Hopewell Point 105
Horseshoe Shoal Channel range 64
Hospital, Marine 20
Hospital Point, N. C 142
Hudson Creek 96
Huggins Island 56
Hunting Island lighthouse 78
Hunting Island, Bogue Sound 56
Hurricanes, West India 23
Hydrographic Office 86

I.

Index chart 19
Indian Island Slue 160
Indian Key 126
Indian River 122
Indian River Inlet 122
Inland waters and waterways between Cape Henry, Va., and Beaufort, N. C 135
Introduction V
Isle of Hope 90
Isle of Palms 72

J.

Jacksonboro 77
Jacksonville, Fla 112
Jacksonville, N. C 58
Jamesville 142
Jekyl Creek 105
Jekyl Island range 103
Jekyl Sound 105
Johnsons River 82
Jointer Creek 105
Jolly River 108
Jones Bay 156
Jones Creek 66
Jones Island range 88
Julington Creek 117
Juniper Bay 154
Jupiter Inlet 122
Jupiter Inlet lighthouse 123

K.

Key Largo Anchorage 129
Key West 132
Key West Harbor 132
Key West lighthouse 127
Key West Main Ship Channel range 134
Kilkenny Creek 92
Kings Bluffs 61
Kings Ferry 107
Kingsleys Creek 110
Kinston 166
Knights Key Anchorage 129
Kornegays Bridge 61

L.

Lake George 117
Lake Griffin 118
Lake Monroe 119

Page.
Lake Okechobee 124
Lake Poinsett 117
Lake Waccamaw 67
Lake Washington 117
Lake Worth Inlet 122
Lambs 73
Laurel Point 148
Lazaretto Creek 89
Leachville 159
Leesburg 118
Legare Anchorage 128
Legareville 77
Lenoxville Point 53
Life-Saving Stations 30
Lighthouses, reference to list 17
Lisbon 61
Little Alligator River 149
Little Bahama Bank 43
Little Cumberland Island 107
Little Falls 161
Little Marsh Island Channel range 116
Little Mud River 99
Little Ogeechee River 91
Little Pedee River 67
Little River, Albemarle Sound 145
Little River Inlet 66
Little River, town 66
Little Rock 67
Little Satilla River 105
Little Talbot Island 111
Local magnetic disturbance 10
Lockwoods Folly Inlet 65
Lockwoods Folly River 65
Loggerhead Key Anchorage 130
Long Bay, Outer Coast 65
Long Island Crossing range 88
Long Key Anchorage 129
Long Shoal River 152
Lookout Bight 51
Lower Flats range 88
Lower Spring Creek 160
Lucy Point Creek 79
Lumber City 99

M.

McGirts Creek 117
McQueen Inlet 94
McWilliams Point Shoal light 162
Mackays Creek, Calibogue Sound 85
Mackay River, St. Simon Sound 101
Mackeys 148
Mackey Creek, Albemarle Sound 148
Macon 99
Magic City range 115
Magnolia Garden 73
Main Ship Channel, Key West 134
Man of War Harbor 133
Manns Harbor 150
Manteo 150
Map, index 19
Maple Cypress 166
Marine Hospital 20
Marine Railways 21
Marshallburg 158
Martins Industry 33, 79
Mashoes 150

Page.
Masonboro Inlet 59
Matanilla Shoal 37
Matanzas Inlet and River 120
Mattamuskeet Lake 154
Maw Point Shoal 163
May Hall Creek 97
May River 84
Mayport 111
Medway River 92
Meherrin River 147
Meteorological tables 213–219
Miami 124
Miami Beach 125
Miami River 124
Middle Bay 156
Middle Creek 153
Middle Ground, Winyah Bay 68
Middle Ground Channel 68
Middle Ground Channel range 69
Middleburg 117
Middleton 153
Middleton Anchorage 153
Mile Point ranges 115
Milledgeville 99
Mingo Creek 67
Molasses Reef lighthouse 127
Montgomery 91
Morehead City 53
Morgan River 79
Moser Channel 126, 129
Mosquito Bluff 99
Mosquito Inlet 121
Mosquito Inlet lighthouse 121
Mosquito Lagoon 122
Moss Bluff 118
Moultrieville 72
Mount Cornelia 111
Mount Pleasant range 76
Mouse Harbor 156
Mud River, Sapelo Sound 95
Munden 136
Munroe Ferry 147
Murfreesboro 147
Murrells Inlet 66
Myrtle Beach 66

N.

Nags Head 150
Navigation laws 20
Nassau River 110
Nassau Sound 110
National Quarantine 20
Nebraska 154
Neuse River 163
New Begun Creek 138
New Berlin Cut range 116
New Channel range 88
New Cheehaw Creek 79
Newell Creek 92
New Inlet, N. C 48
New River, N. C 56, 58
New River Inlet, Fla 123
New River Inlet, N. C 57
New River Inlet to Wrightsville 58
New Smyrna 121

Page.
New Teakettle Creek 96
New Topsail Inlet 58
Newbern 163
Newport River, N. C 52, 165
Nitchell Creek 165
Nixonton 145
Norfolk to Beaufort, N. C 135
Norfolk to Key West inside V
North Creek 161
North Bay, Currituck Sound 136
North Edisto River 77
North Equatorial Current 43
North Harlowe 165
North Inlet 66
North Jetty Channel 68
North Landing River 136
North Newport River 92
North River, Albemarle Sound 137
North River, Doboy Sound 96
North or Tolomato River 120
North Wimbe Creek 79
Northeast Branch, Cape Fear River 61
Northers 21
Northwest Channel, Key West 132
Northwest Providence Channel 45
Nottoway River 147

O.

Ocmulgee River 99
Oconee River 99
Ocracoke 50
Ocracoke Inlet 50
Ocracoke lighthouse 50
Odingsell River 90
Ogeechee River 91
Ohio Shoal 122
Oklawaha River 118
Old Bay 154
Old Cheehaw Creek 79
Old Fernandina 108
Old Romerly Marsh Channel 90
Old Teakettle Creek 96
Old Topsail Inlet 58
One Mile Cut 97
Onslow Bay 54
Oregon Inlet 48
Oriental 164
Ormond 121
Ossabaw Sound 91
Ossabaw Sound to St. Catherines Sound 91
Owens Ferry 105
Oyster Creek light 150

P.

Pacific Reef lighthouse 127
Palatka 118
Palm Beach 123
Palmyra 147
Pamlico 164
Pamlico River 159
Pamlico Sound 151
Pantego Creek 160
Parrott Creek 79
Parsons Cut 90

Page.
Pasquotank River 137
Pedee River 67
Pembroke Creek 146
Peter Mashoes Creek 149
Petit Chow Island 89
Perquimans River 145
Philips Island 81
Pilot Town 111
Pilot Town range 115
Pilots 17, 169
Beaufort Inlet 53, 170
Cape Fear River 170
Charleston Harbor 74
Doboy Sound 97
Florida 185
Hatteras Inlet 170
Hawk Channel 123
Key West Harbor 133
Ocracoke Inlet 169
Old Topsail Inlet 170
Ossabaw Sound 91
St. Andrew Sound 106
St. Catherines Sound 93
St. Helena Sound 79
St. Johns River 112, 119, 185
St. Marys Entrance 108
St. Simon Sound 102, 184
Sapelo Sound 95, 184
Savannah River 86, 183
Winyah Bay 68, 174
Piney Point Bar 158
Pingleton Shoal 152
Pivers Island 53
Plane of Reference 9
Plantation Creek 101
Plantation Creek range 103
Platt Shoals 48
Plymouth 147
Pocotaligo River 82
Point Caswell 61
Polloksville 166
Ponce Park 121
Port Orange 121
Poquoson Point 142
Port Royal 83
Port Royal Sound 82
Portsmouth, N. C 50
Price Inlet 71
Pritchard Island 81
Pritchard Inlet 81
Proctor Place light 89
Providence Channels 43
Public Health Service 20
Pungo Creek 160
Pungo River 159

Q.

Queen Inlet 58
Quaker Bridge 166
Quarantine Anchorage, Charleston 74
Quarantine Anchorage, Key West 133
Quarantine Island light 116
Quarantine Island lower range 116
Quarantine, National 20
Queens Bess Creek 92

R.

Page.
Radio compass bearings 25
Radio compass stations 27
Radio fog signals 28
Radio Service 25
Rattlesnake Shoal 72
Rebecca Shoal lighthouse 127
Reeds Hammock light 160
Reeds Point light 145
Reeves Ferry 67
Reids Creek light 52
Repairs 20
Rice Creek 118
Rich Inlet 58
Ridgeville 96
Roanoke Marshes 149
Roanoke River 147
Roanoke Sound 150
Rockdedundy River 97
Rockville 77
Rodman Point Shoal light 162
Romerly Marsh Creek 90
Romerly Marshes 90
Roper 148
Rose Bay 155
Royal 160
Royal Shoal Anchorage 157
Rules of the Road 186

S.

Saddle Bunch Harbor 133
Saddle Hill Anchorage 130
St. Andrew Sound 104
St. Andrew Sound light 106
St. Augustine 120
St. Augustine Creek 89
St. Augustine Inlet 119
St. Augustine lighthouse 120
St. Catherines Sound 92
St. Helena Sound 78
St. Johns Bluff light 115
St. Johns River 110
St. Johns River above Jacksonville 117
St. Johns River lighthouse 112
St. Lucie Inlet 122
St. Lucie Shoal 123
St. Marys 108
St. Marys Entrance 107
St. Marys River 107
St. Simon Island 100
St. Simon lighthouse 101
St. Simon Mills 101
St. Simon range 103
St. Simon Sound and Brunswick Harbor 100
Salmon Creek 147
Salt Key Bank 44
Sampit River 67
Sampit River range 69
Sams Point 79
San Sebastian River 120
Sand Key lighthouse 127
Sanford 119
Santaren Channel 46
Santee River 70

Page.
Sapelo 96
Sapelo lighthouse 96
Sapelo River 94
Sapelo Sound 94
Satilla River 105
Savannah 86
Savannah River 85
Sawpit Creek 111
Scuppernong River 148
Scuppernong River range 148
Sea Breeze 121
Seven Springs 166
Shallotte 65
Shallotte Inlet and River 65
Shallowbag Bay 150
Shark Shoal light 52
Sheep House Hill 47
Shellbine Creek 106
Shipyard Creek 73
Shipyard Landing 142
Silver Lake 50
Silver Springs Run 118
Silverspring 118
Sister Creek 110
Six Mile Creek, Fla 118
Skidaway River and Narrows 90
Skippers Narrows 92
Skull Creek 83
Skull Inlet 81
Slade Creek 160
Slocum Creek 165
Smith Creek, Neuse River 164
Smithfield 166
Smiths Mills 67
Snake River 124
Snode Creek 160
Snow Hill 166
Sombrero Key lighthouse 127
South Amelia River 110
South Brunswick River 101
South Channel range 76
South Creek, Pamlico River 160
South Edisto River 77
South Jetty Channel 68
South Jetty Channel range 69
South Lake 149
South Mills 137
South Newport River 94
South River, Doboy Sound 97
South River, Neuse River 164
Southeast Channel, Key West 132
Southern Branch, Elizabeth River 135
South Mills 137
Southport 61
Southwest Channel, Key West 132
Speights Bridge 166
Spring Creek, Upper and Lower 160
Springfield Landing 73
Spruill Bridge 148
Star Island 125
Station Creek 79, 82
Staunton River 147
Stella 57
Stonewall 163
Stono Inlet 77
Stono River 77

Page.
Storm Warnings 21, 22
Story River 79
Straits of Florida 38
Strawberry 73
Stumpy Reach 147
Supplies 20
Supply 45
Swan Point 58
Swan Quarter 154
Swan Quarter Bay 154
Swan Quarter Narrows 154
Swansboro 56
Swift Creek 166
System of Buoyage 17

T.

Talbot Island 110
Tar Creek 164
Tar River 161
Tarboro 161
Tavernier Key Anchorage 129
Taylors Creek 53
Teaches Hole Channel 50
Tee 73
The Bight 88
The Straits 157
Thoroughfare Bay 156, 157
Three Mile Cut 97
Thunderbolt 89
Tidal Currents, *see* Currents.
Tides:
Albemarle and Chesapeake Canal 135
Altamaha Sound 99
Bahama Banks 46
Bogue Inlet 57
Cape Canaveral 32
Cape Fear River 32, 62
Cape Florida Anchorage 32
Charleston 32, 75
Corncake Inlet 60
Croatan and Roanoke Sounds 150
Doboy Sound 98
Fernandina 32
Hatteras Inlet 50
Hatteras Shoals 32
Key West Harbor 32, 134
Lookout Bight 32
Neuse River 166
New River Inlet 58
North Edisto River 77
Ocracoke Inlet 50
Ossabaw Sound 91
Pamlico River 139
Pamlico Sound 161
Port Royal Sound 83
St. Andrew Sound 106
St. Augustine Inlet 120
St. Catherines Sound 93
St. Helena Sound 80
St. Johns River 32, 112, 113, 119
St. Marys River 109
St. Simon Sound 32, 103
Sapelo Sound 95
Satilla River 105
Savannah River 86

Tides—Continued. Page.
South Edisto River 77
Table of 32
Tortugas 32
Turtle Harbor 32
Tybee Roads and Savannah River 32, 86
Wassaw Sound 90
Winyah Bay 30, 67, 68
Todds Creek 106
Tolomato River 120
Towboats, *see* name of port and 20
Town Creek, Charleston 73
Town Creek, Winyah Bay 66
Town Marsh 52
Traders Hill 107
Training Wall range 115
Trenchard Inlet 81
Trenton 166
Trent River 166
Trout Creek 118
Tubbs Inlet 65
Tulifiny River 82
Tunis 147
Turnagain Bay 164
Turner Creek 89
Turners Cut 141
Turtle Harbor 129
Turtle Mound 122
Turtle River 101
Turtle Shoal Anchorage 129
Tybee Beach 89
Tybee Creek 89
Tybee Island 89
Tybee lighthouse 85
Tybee River 89
Tybee range 88
Tybee Roads 85

U.

Upper Broad Creek 165
Upper Flats range 88
Upper Spring Creek 160
Use of charts 3
Use of oil 10

V.

Vanceboro 166
Vandemere 163
Variation, change of 31
Variation of the Compass 30
Venus Point 87
Vernon River 91
Village Creek, Ga 100
Village Creek, Neuse River 166
Virginia Beach 47

W.

Page.
Waccamaw River 67
Wadboo Bridge 73
Wadmelaw River 77
Wainwright Slue 157
Waiters Island 66
Walburg Creek 92
Wallace Channel 50
Wallaceton 137
Walterboro 79
Wanchese 150
Wando 73
Wando River 73
Wappoo Creek 74
Wash Hill 47
Washington 159
Wassaw Creek 90
Wassaw Sound 89
Wateree River 70
Waverly 106
Waynesboro Landing 166
Weeksville 138
Welaka 118
Weldon 147
Wekiva River 119
West Bluff Bay 154
West India Hurricanes 23
West Washerwoman Anchorage 130
Western Bar Channel 65
Western Channel 68
Whale Branch 78
Wharves, *see* Description of harbor.
Whipping Creek 149
Whites Landing 65
White Oak River, Ga 105
White Oak River, N. C 57
Wiggins 79
Williamston 147
Williman Creek 78
Wilmington 61
Wilmington River 90
Wimble Shoals 48
Windmill Point Shoal light 162
Winter Point 112
Winton 147
Winyah Bay 67
Winyah Bay South Jetty light 67
Wither Swash 66
Woodbine 105
Wreck Point 51
Wrightsville Beach 59
Wrightsville Inlet 59
Wyesocking Bay 153

Y.

Yeopim River 146