3

Serial No. 164

DEPARTMENT OF COMMERCE

U. S. COAST AND GEODETIC SURVEY

E. LESTER JONES, DIRECTOR

UNITED STATES COAST PILOT

WEST INDIES

PORTO RICO AND VIRGIN ISLANDS

SECOND EDITION

VK
971
U537
2nd ed.
1921

PRICE, 75 CENTS

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WASHINGTON
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INTRODUCTORY.

DEPARTMENT OF COMMERCE,
U. S. COAST AND GEODETIC SURVEY,
Washington, D. C., November 1, 1921.

This volume covers the islands of Porto Rico and the Virgin Islands. It is based mainly upon the work of the United States Coast and Geodetic Survey, including the results of a special examination in 1920. The descriptions of the British Virgin Islands are taken mainly from the British Admiralty publication, The West Indies Pilot, Part II, 1920, with additions from Hydrographic Office Publications.

The first edition (Porto Rico, 1906) covered only the islands of Porto Rico, Mona, and Vieques, but this edition is enlarged to include the recently American possessions in the Virgin Islands and the British Virgin Islands. The present edition has been prepared by Paul C. Whitney, Chief, Coast Pilot Section, U. S. Coast and Geodetic Survey.

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

The aids to navigation are corrected to October 21, 1921.

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

E. LESTER JONES,
Director.

NOTE.

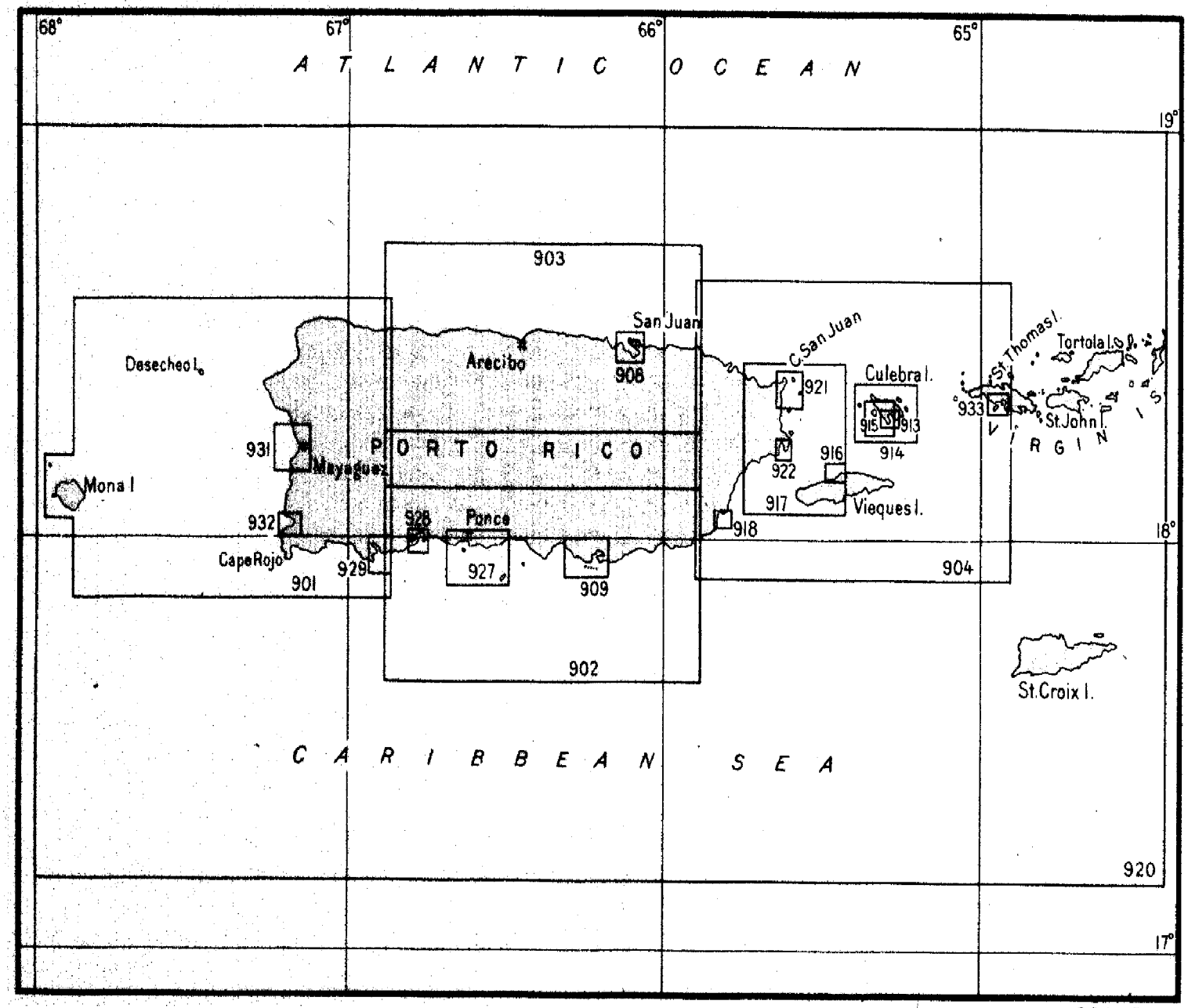
The courses and bearings given in degrees are *true*, reading clockwise from 0° at north to 360°, and are followed by the equivalent *magnetic* value in points in parentheses. General directions, such as northeastward, west-southwestward, etc., are magnetic.

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.


68°
67°
66°
65°
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18°
17°
ATLANTIC OCEAN
CARIBBEAN SEA
PORTO RICO
903
902
901
904
920
San Juan
Arecibo
908
Desecheo I.
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Mayaguez
Mona I
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Cape Rojo
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Vieques I.
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Culebra I.
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St. Thomas I.
Tortola I.
933
St. John I.
VIRGIN IS
St. Croix I.

C.& G.S. Print

UNITED STATES COAST PILOT.

WEST INDIES—PORTO RICO AND VIRGIN ISLANDS.

NAVIGATIONAL AIDS AND THE USE OF CHARTS.

The Coast and Geodetic Survey is charged with the survey of the coasts, harbors, and tidal estuaries of the United States and its insular possessions and issues the following publications relating to these waters as guides to navigation: Charts, Coast Pilots, Tide Tables, a catalogue of these publications, and Notice to Mariners, the last named published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey.

CHARTS bear three dates, which should be understood by persons using them: (1) The date (month and year) of the edition, *printed* on the late charts below the border in a central position, and on the older ones on the face of the chart; (2) the date of the latest correction to the chart plate, *printed* in the lower left-hand corner below the border; (3) the *date of issue*, *stamped* below the border and just to the left of the subtitle.

Charts show all necessary corrections as to lights, beacons, buoys, and dangers, which have been received to the *date of issue*, being hand corrected since the latest date printed in the lower left-hand corner. All small but important corrections occurring subsequent to the *date of issue* of the 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 general Tide Tables are issued for the Atlantic and Pacific coasts of the United States and its dependencies.

Agencies for the sale of the Charts, Coast Pilots, and Tide Tables of the Coast and Geodetic Survey are established in many ports of the United States and in some foreign ports. They can also be purchased in the office of the Coast and Geodetic Survey, Washington, D. C., or any of the 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, and the Great Lakes, are published by the Bureau of Lighthouses and may be purchased from its sale agencies or from the Superintendent of Documents, Washington, D. C. Notice to Mariners, relating to the same waters, is published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey. 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.

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 the sound signal, even in clear weather. Therefore too much confidence should not be felt as to hearing a fog signal. The apparatus, moreover, for sounding the signal may require some time before it is in readiness to act. A fog often creeps imperceptibly toward the land and is not observed by those at a lighthouse until it is upon them, whereas a vessel may have been in it for many hours while approaching the land. In such a case no signal may be sounded. When sound travels against the wind, it may be thrown upward; in such a case a man aloft might hear it when it is inaudible on deck. The conditions for hearing a signal will vary at the same station within short intervals of time; mariners must not, therefore, judge their distance from a fog signal by the force of the sound and must not assume that a signal is not sounding because they do not hear it.

Taken together, these facts should induce the utmost caution when nearing the land or danger in fog. The lead is generally the only safe guide and should be faithfully used.

Submarine Bells have an effective range of audibility greater than signals sounded in air, and a vessel equipped with receiving apparatus can determine the approximate bearing of the signal. These signals can be heard also on vessels not equipped with receiving apparatus by observers below the water line, but a bearing of the signal can not then be readily determined.

Tides.—A knowledge of the tide, or vertical rise and fall of the water, is of great and direct importance whenever the depth at low water approximates to or is less than the draft of the vessel and wherever docks are constructed so as to be entered and left near the time of high water. But under all conditions such knowledge may be of indirect use, as it often enables the mariner to estimate in advance whether at a given time and place the current will be running flood or ebb. In using the tables slack water should not be confounded with high or low tide nor a flood or ebb current with flood or ebb tide. In some localities the rise or fall may be at a stand while the current is at its maximum velocity.

The Tide Tables published by the Coast and Geodetic Survey give the predicted times and heights of high and low waters for most of the principal ports of the world and tidal differences and constants for obtaining the tides at all important ports.

Plane of Reference for Soundings on Charts.—For the Atlantic coast of the United States and Porto Rico the plane of 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.

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 recorded. By marking the soundings on tracing paper, according to the scale of the chart, along a line representing the track of the ship, and then moving the paper over the chart parallel with the course until the observed soundings agree with those of the chart, the ship's position will in general be quite well determined.

SUMNER'S METHOD.—Among astronomical methods of fixing a ship's position the great utility of Sumner's method 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.

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. 28, 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 amount of this error are provided by printing the date of constructing the compass and the annual change in variation near its edge.

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

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

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

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

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

It is very desirable that whenever an area of local magnetic disturbance is noted the position should be fixed and the facts reported as far as they can be ascertained.

USE OF OIL FOR MODIFYING THE EFFECT OF BREAKING WAVES.—Many experiences of late years have shown that the utility of oil for this purpose is undoubted and the application simple.

The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil skillfully applied may prevent much damage both to ships (especially of the smaller classes) and to boats by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows:

1. On free waves—i. e., waves in deep water—the effect is greatest.

2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain, as nothing can prevent the larger waves from breaking under such circumstances, but even here it is of some service.

3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when nothing else is obtainable; but all animal and vegetable oils, such as waste oil from the engines, have great effect.

4. A small quantity of oil suffices, if applied in such a manner as to spread to windward.

5. It is useful in a ship or boat, either when running or lying-to, or in wearing.

6. No experiences are related of its use when hoisting a boat at sea or in a seaway, but it is highly probable that much time would be saved and injury to the boat avoided by its use on such occasions.

7. In cold water the oil, being thickened by the lower temperature and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.

8. For a ship at sea the best method of application appears to be to hang over the side, in such a manner as to be in the water, small canvas bags, capable of holding from 1 to 2 gallons of oil, the bags being pricked with a sail needle to facilitate leakage of the oil. The oil is also frequently distributed from canvas bags or oakum inserted in the closet bowls.

The positions of these bags should vary with the circumstances. Running before the wind, they should be hung on either bow—e. g., from the cathead and allowed to tow in the water.

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

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

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

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

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

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

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

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

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

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

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

GENERAL INFORMATION—PORTO RICO AND VIRGIN ISLANDS.

The information contained in this volume relates to the coast and waters of Porto Rico and adjacent islands; and of the Virgin Islands. It also includes a description of Mona Passage, Vieques Sound, and Virgin Passage.

Climate.—These islands lie entirely within the tropics and they have the usual notheast-trade type of climate. The heat is tempered by the sea breezes and they are generally healthy. The mean monthly temperature at San Juan varies from 75.0° to 81.3° F. in February and August, respectively. The islands are well watered though the streams are small and of no importance to navigation. All the higher hills are heavily wooded and the islands have a general tropical appearance.

Winds.—Porto Rico and the Virgin Islands lie within the limits of strong northeast trades. Except when disturbed by some atmospheric depression, near or remote, these winds blow with the greatest regularity during the entire year, varying in direction between NE. and SE., winds from north of east prevailing from November to April and from south of east from May to October. On and near the island the trade wind usually blows from about 9 a. m. until sunset, attaining its greatest force in the afternoon. During the night it is replaced by a land breeze, blowing outward in all directions from the island and which is more pronounced on the leeward side.

Occasionally, during the period from November to April, the regular trade is interrupted by a period of calms or light variable winds, sometimes persisting for several days, such interruptions being coincident with the passage of an extensive barometric depression to the northward. Such a period is apt to be followed along the northern coast of the island by a heavy sea from northward, and this, in turn, after an interval varying in different cases from a few hours to two days, by a norther, after which the regular trades are resumed, blowing with extra force.

From July to October is the hurricane season, during which there are sometimes heavy gales. See West India Hurricanes.

Rainfall.—The rainfall in Porto Rico and the Virgin Islands varies greatly in different localities. The greatest amount is found in the interior of Porto Rico, on the northern side of the mountains, in a belt extending from Port Yabucoa and Cape San Juan to Mayaguez and Point Jiguero. The fall diminishes toward the north coast, where the average rainfall is 55 to 75 inches per year. On the south side of the island, from Aguirre to Boqueron Bay, the rainfall is not only less in places than on the north coast but is more erratic, droughts being so frequent as to render irrigation necessary. January, February, and March are the months of minimum rainfall, while there are tw maxima, generally June and October. Most of the rain falls in showers, and days of continuous rain are rare.

Fog does not occur around the islands, and except for rain squalls, mists, and haze, there is no thick weather. The mountains on Porto Rico, however, are very often obscured by clouds.

Anchorages are numerous, except on the north coast of Porto Rico, the first requirement under ordinary conditions being shelter from

the easterly trade winds. Strong northerly winds or a heavy sea from northward may occur from November to April. During the hurricane season gales occur from any direction.

Hurricane harbors.—The best hurricane harbors are San Juan, Guanica, Guayanilla, Jobos, Great harbors, and St. Thomas. The hurricane season is from July to October.

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

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

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

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

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

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

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

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

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

Aids to navigation.—The lighthouses and other aids to navigation are the principal guides, and mark the approach and channels to the important ports. The buoyage accords with the system adopted in United States waters. The principal coast lights are described in the text of this volume. For a complete description of all lighted aids, see the Light List, Atlantic and Gulf Coasts of the United States, published by the Lighthouse Service, which can be obtained from the Superintendent of Documents, Washington, D. C., price 20 cents, or from the agents listed in the weekly Notice to Mariners.

Pilotage is compulsory for certain vessels. There are pilots at the principal ports, who come off in small boats to vessels making signal outside the entrance. For pilot regulations and rates of pilotage see Appendix.

Towboats.—There is a seagoing towboat at San Juan. In some of the harbors there are large gasolene launches which sometimes assist lighters and vessels when inside.

Harbor control.—A captain of the port is appointed for each of the harbors of San Juan, Ponce, and Mayaguez, and they have charge of the anchorage and berthing of vessels in their respective harbors. The harbormaster has charge of the berthing of all vessels at St. Thomas. For harbor regulations see Appendix.

Supplies.—Provisions, ice, lumber, and some ship chandler's stores can be obtained at San Juan, Ponce, Mayaguez, and St. Thomas. Some provisions can be obtained at other places.

Water can be conveniently obtained at San Juan, Mayaguez, Ponce, Aguirre Central, and Ensenada, Guanica. Water can be obtained also from streams at many places, but it is more or less polluted and should be boiled before drinking.

Coal and fuel oil for vessels can be obtained at San Juan and St. Thomas.

Repairs.—There are machine shops at San Juan and Ponce, and ordinary repairs to machinery can be made. There are also small machine shops at other points in Porto Rico. The nearest dock is at St. Thomas; this is a floating dock, length 250 feet, length of keel 300 feet, inside breadth 72 feet, greatest draft 21 feet, capacity 3,000 tons.

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.

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

Small-craft warning.—A red pennant indicates that moderately strong winds are expected. No night display of small-craft warnings is made.

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

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

By night two red lights, one above the other, for winds beginning from the northeast; a single red light for winds beginning from the southeast; a red light above a white light for winds beginning from the southwest; and a white light above a red light for winds beginning from the northwest.

Hurricane warning.—Two red flags with black centers, displayed one above the other, or two red lights with a white light between displayed at night, indicate the expected approach of a tropical hurricane, or of one of those extremely severe and dangerous storms which occasionally move across the Great Lakes and northern Atlantic coast. These warnings are displayed at all stations on the Atlantic and Gulf coasts of the United States and on the following islands in the Atlantic: Jamaica, Santo Domingo, Turks Island, Bermuda, Haiti, Curacao, Porto Rico, St. Kitts, Dominica, Barbados, Trinidad, and Cuba.

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

PORTO RICO.—Aguadilla, Arecibo, Arroyo, Canovanas, Culebra, Fajardo, Guanica, Humacao, Jobos, Mayaguez, Ponce (Playa Town), San Juan (Signal Tower Weather Bureau), Vieques.

VIRGIN ISLANDS.—St. Thomas, Fort Christian Signal Station, Cowell Pt.

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 in the West Indies is 15 to 20 miles per hour and on the Atlantic coast between Hatteras and the island of Cuba 5 to 15 miles per hour. They cover simultaneously an approximate circular area from 150 to 500 miles in diameter. At the center, the area of lowest barometer, which is from 10 to 20 miles in diameter, comparative calm prevails; the seas within this center are violent and confused and, combined with the sudden shifts of wind which are encountered as the vessel passes through the center, makes this the most dangerous part of the hurricane and the one to be avoided.

Hurricanes form eastward of the Windward Islands or in the Caribbean Sea and take a westerly or northwesterly course. Some curve gradually northward, passing north of the island of Cuba and northeasterly along and eastward of the Atlantic coast of the United States. Others pass over or southward of Cuba and enter the Gulf of Mexico, and while in the Gulf usually curve northward or northeastward so as to strike the coast somewhere between Tampa, Fla., and the Rio Grande. Tracks of hurricanes are shown on pilot charts of the North Atlantic Ocean, published monthly by the United States Hydrographic Office.

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

Signs of approach.—First, a long heavy swell, a slight rise followed by a continuous fall of the barometer; second, 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 becomes more rapid. Rain in showers accompanies the squalls, and when closer to the center the rain is continuous and attended by furious gusts of wind; the air is frequently thick with rain and spume drift, making objects invisible at a short distance. A vessel on a line of the hurricane's advance will experience the above disturbances, except that as the center approaches the wind will remain from the same direction, or nearly so, until the vessel is close to or in the center.

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

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

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

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

Bearings of center.—Facing the wind, the storm center will be 8 to 12 points to the right; when the storm is distant it will be from 10

to 12 points, and when the barometer has fallen five or six tenths it will be about 8 points.

A line drawn through the center of a hurricane in the direction in which it is moving is called the axis or line of progression, and looking in the direction in which it is traveling the semcircle 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 simicircle the vessel is situated: If the wind shifts to the right, the vessel will be in the right hand or dangerous semicircle with regard to the direction in which the storm is traveling, in which case the vessel should be kept on the starboard tack and increase her distance from the center.

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

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

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

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

RADIO SERVICE.

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

Radio compass bearings are furnished to vessels upon request by the naval shore compass stations.

To obtain bearings the compass station should be called in the usual manner, using the 800-meter wave length, the call to be followed by the signal "QTE?," meaning "What is my true bearing?" When told by the compass station to "K" (go ahead) the ship's radio operator should follow the procedure outlined below:

(*a*) Transmit the ship's radio call for 30 seconds.

(*b*) Make dashes, each dash 5 seconds long, for one minute, with the ship's radio call after each dash.

(*c*) Terminate with the signal "K" (go ahead).

If satisfactory bearings are obtained the operator at the compass station will call the vessel in the usual manner and reply "QTE," followed by the true bearing in degrees (0 to 359) spelled out in words, and the name of the radio compass station from which the bearing was obtained; otherwise a repetition of the test will be requested.

The ship's operator should acknowledge receipt of the bearings by answering the compass station in the usual manner and repeat, in numerals, the bearings received. This procedure enables all stations concerned to check the bearings.

All United States naval shore radio compass stations keep watch and transmit on 800 meters for merchant vessels, and this wave length must be used for calling and answering and carrying on all communications with these stations.

Attention is invited to the fact that when a single bearing is furnished there is a possibility of an error of 180 degrees, as the operator at the compass station can not always determine on which side of his station the vessel lies; in such cases the decision is left to the commander of the vessel. (See page 15.)

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

Standard time.—The standard time of Porto Rico and the Virgin Islands is sixtieth meridian (west longitude) time.

TIDES AND CURRENTS.

The periodic *tides* in this locality are very small, the average mean rise and fall being approximately one foot. The actual fluctuations in the water level will therefore depend largely upon the winds and other meteorological conditions. Off the northern and western coasts

of Porto Rico the tide is chiefly semidiurnal, with high water occurring about 8 hours after the moon's upper or lower meridian passage. Along the coast of Porto Rico that borders the Caribbean Sea the tide is more or less diurnal and high water occurs from 10 to 10½ hours after the moon's upper meridian passage. At the Virgin Islands the tides are chiefly diurnal, the high-water interval referred to the upper transit of the moon being approximately 7½ hours.

The *currents* along the north and south coasts of Porto Rico are, as a rule, greatly influenced by the direction and strength of the trade winds. In general, there is a westerly drift, due to the prevailing easterly trade winds, the velocity of which is greatest near the island; a decided westerly set has been noticed near the 100-fathom curve on the south coast from Muertos Island to Cape Rojo. With variable winds or light trade winds it is probable that tidal currents are felt at times along the north and south coasts of Porto Rico. There are little or no currents in the passage northward of Muertos and Berberia Islands.

In Mona Passage and the various passages from the east coast of Porto Rico to Virgin Passage the tidal currents under normal conditions set each way about 6 hours, turning from south to north from 1 to 2 hours after the moon's meridian passage and from north to south from 1 to 2 hours after moonrise or moonset.

In Mona Passage on the northwest end of the bank, about 13 miles westward of Point Guanajibo, there is a velocity of about 1 knot at strength for both flood and ebb, and in the Guanajibo Channel, 1 mile westward of Fanduca Cay, a velocity of about 1¼ knots at strength. The current turns from southward to northward about 1 hour after the moon's meridian passage.

In Vieques Sound there are considerable tidal currents over the shoals in the western part and around Cabeza de Perro. In Fajardo Harbor a northerly current with a greatest velocity of nearly 1 knot has been observed. In San Juan and Cucaracha Passages tidal currents with an estimated greatest velocity of about 2 knots at strength have been reported. In the wider passages between Icacos Cay and Southwest Cay it is estimated that the greatest velocity of the currents does not exceed 1 knot. From Culebra Island the flood current sets toward East Point, Vieques Island, around which the tidal currents set with considerable velocity.

In Canal de Luis Pena the flood current from northwestward is deflected northward of Target Bay and thence sets toward the south end of Southwest Cay; there is little current off the entrance to Seine Bay on the flood. The ebb current sets northwestward directly through the canal. The velocity of the tidal currents is about 2 knots at strength.

In Vieques Passage the velocity at strength is about 1 knot for both flood and ebb and the current turns from southward to northward about 2 hours after the moon's meridian passage.

For more detailed information concerning the tides in this locality, the Tide Tables, which are published by the U. S. Coast and Geodetic Survey, should be consulted. The complete tide tables for the world are for sale at 75 cents per copy, but a reprint covering the Atlantic coast of North America may be obtained for 15 cents per copy. These tables may be purchased either directly from the office of the

Coast and Geodetic Survey, Washington, D. C., or from any of its agencies.

It contains a table of full daily predictions of the times and heights of high and low waters for certain standard or principal ports along the coast; full explanations for the use of this table are given on page 8. The use of Table 2 of the Tide Tables should be known to every navigator. By means of this table the predictions given for the standard ports are extended so as to enable one to obtain complete tidal data for each day for stations only a few miles apart for the greater part of the coast, and with almost the same accuracy as though full predictions were given for all of these points.

Instead of using the height differences of Table 2, however, a more accurate method is that of multiplying both high and low water heights at the standard port by the ratio of ranges for the given port to obtain the heights of the corresponding high and low waters. The ratio of ranges is given in Table 2 of the Tide Tables. The minus sign before the predicted heights in the Tide Tables indicates that the water is below the plane of reference, which is mean lower low water.

The time of high or low water at any given port in Table 2 is found by taking the time of the corresponding tide for that day from the standard port for reference and applying to it the time difference for the given port from the third column of Table 2, adding it if the sign is plus and subtracting if minus.

Caution.—In using the Tide Tables, slack water should not be confounded with high or low water. For ocean stations there is usually but little difference between the time of high or low water and the beginning of ebb or flood current; but for places in narrow channels, landlocked harbors, or on tidal rivers the time of slack current may differ by two or three hours from the time of high or low water stand, and local knowledge is required to enable one to make the proper allowance for this delay in the condition of tidal currents.

The figures given in Tables 1 and 2 of the Tide Tables are the times of high and low water, and these times are not necessarily the times of slack water.

VARIATION OF THE COMPASS.

The magnetic variations for 1922, and annual increase at points mentioned, are as follows:

Locality.	Compass variation.	Annual increase.
	° ′	′
Cape San Juan	4 00 W.	6
San Juan Harbor	3 45	6
Arecibo	3 20	6
Point Borinquen	3 10	5
Mayaguez	3 05	5
Mona Island (East Point)	2 40	5
Cape Rojo	3 00	5
Ponce	3 15	5
Jobos Harbor	3 30	6
Port Maunabo	3 45	6
Port Mulas	4 00	6
Culebrita Island	4 15	6
St. Thomas Harbor	4 25	6

PORTO RICO.

Porto Rico lies between the parallels of 17° 56′ and 18° 31′ N. latitude, and 65° 35′ and 67° 16′ W. longitude. It is nearly rectangular in shape, and has a greatest length of 95 miles east and west, and a width of 30 to 35 miles. The interior of the island is mountainous and very rugged. The highest mountains are nearer the south and east coasts of the island, and have elevations up to 4,400 feet. There are many fertile valleys, and on the coasts there are generally more or less narrow strips of lowland from which the higher land rises abruptly at a short distance inland.

The hydrographic characteristics form a parallel to the topographic features above mentioned. In general, there is a narrow bank of soundings close to the island, from the edge of which the bottom pitches off rapidly to great depths. The shoals frequently show in the daytime under favorable conditions by a difference in the color of the water over them.

Rivers.—There are several hundred streams, some of them of good size, but none are navigable except for boats and small craft. From the location of the mountain divides the streams on the south and east sides of the island are short and fall rapidly to the sea, while those on the north and west sides are longer and slope less rapidly.

Population.—By the census of 1920, Porto Rico had a population of 1,297,722 inhabitants.

Products.—Agriculture is the principal occupation of the inhabitants. Sugar, coffee, and tobacco are the great staples, and cotton, rice, corn, beans, sweet potatoes, and tropical fruits are also cultivated. Cattle are raised to some extent, some of which are exported to other West India Islands.

Trade.—The principal trade is with the United States. In 1920 the total imports amounted to $121,561,574, and total exports $158,322,083. The principal imports are iron, steel, and lumber products, cloths, provisions, flour, rice, and fish; the principal exports are sugar, coffee, tobacco, and fruits.

The port of entry is San Juan; the subports are Arecibo, Agurdilla, Mayaguez, Guanica, Ponce, Arroyo, Humacao, and Fajardo.

Wharves and lighters.—At San Juan, Guanica, and Ponce there are wharves at which vessels can lie to discharge and load. At other ports in Porto Rico vessels discharge and load by means of lighters.

Communication with New York, New Orleans, Europe, Venezuela, Mexico, and the West India Islands may be had by several lines of steamers which touch at some of the principal ports of Porto Rico.

Railroads.—A railroad is planned to encircle the island. This road is (1920) in operation from San Juan eastward to Carolina and westward through Arecibo, and Mayaquez to Ponce on the south coast, with connecting branches. There is also a railroad from Mameyes to Naguabo, through Fajardo. A railroad runs from Ponce eastward to Guayama.

Highways.—There are good highways in many parts of the island, and automobiles and carriages can be obtained at most of the towns.

The principal roads now maintained are as follows: There is a road around the island which passes through the important towns and villages near the coast; there are roads across the island from San Juan to Ponce, and from Arecibo to Ponce, and from the former road branches make off southeastward to Guayama and Humacao.

Telegraph.—There is communication by telegraph and telephone to all parts of Porto Rico, and by cable through Jamaica, St. Thomas, and St. Croix to other points.

Radio.—There are naval radio stations at San Juan and Cayey.

Quarantine.—National quarantine laws are enforced in Porto Rico by officers of the United States Public Health Service.

Marine Hospital.—There are relief stations of the United States Public Health Service at San Juan and Ponce.

Hurricane warning displays of the United States Weather Bureau are made at San Juan and other ports during the hurricane season. Advices regarding hurricanes that threaten Porto Rico are, moreover, sent to all parts of the island by telegraph and telephone. (See p. 26.)

NORTH COAST OF PORTO RICO.

Point Borinquen, the northwest point of Porto Rico, is steep to and may be rounded at a distance of ¾ mile. The extreme western part is low but is backed by steep wooded slopes about ½ mile inland. A rocky bluff over 200 feet high begins about ¾ mile southwestward of Point Borinquen lighthouse and extends northeast and eastward along the north coast of Porto Rico. Point Borinquen lighthouse (group flashing white every 30 seconds) is a gray cylindrical tower about 2 miles northeast of the extreme western end of the point. A brown scar in the cliff just beneath the lighthouse shows up to seaward, and is a conspicuous landmark.

From Point Borinquen lighthouse to Arecibo lighthouse the coast trends in a general easterly direction. It is little indented, and there are no sheltered anchorages; there are numerous rocky cliffs, with sand beaches and dunes between them. The prominent features of this part of the coast are the high hills in the interior and high cliffs along the coast. The hills begin about 1 mile west of Arecibo, and are mostly smooth, grassy slopes, backed by conical wooded hills from 100 to 800 feet high. Rocky cliffs, 150 to 300 feet high, extend along the coast from a little westward of Camuy River to Point Borinquen. These cliffs terminate at the water in places, and are nowhere more than ½ mile back. The railroad extends from Arecibo to Aguadilla, and a good highway connects the towns along this coast.

The coast east of Point Borinquen lighthouse is but little indented and is a low strip between ¼ and ½ mile wide, from which bushy cliffs rise abruptly to elevations of 170 to 260 feet. The low points at the water are rocky bluffs.

Point Sardina, ½ mile northward of Isabela, is low and rocky, and there is a sandy cove on its west side where a boat landing may be made at times.

Isabela is a post village on the highland nearly 7 miles eastward of Point Borinquen lighthouse, and shows well from seaward. A road

leads to the water in front of the village. The red water tank at the village is prominent. *Quebradillas* is a town in the highlands, 1 mile eastward of Guajataca River.

Guajataca River, 4 miles eastward of Isabela, is a deep gulch, which shows when off it. Between Point Penon, to the eastward, and Guajataca River the cliffs terminate at the water and there is no beach.

Point Penon, 5 miles eastward of Guajataca River, is a slight projection with lower land between it and the foothills, about ¼ mile back, and a rocky islet close-to. A rocky islet, with a number of bare rocks near it, lies close to shore about ¾ mile eastward of the point. **Hatillo** is a town on the railroad 1 mile eastward of Camuy.

PORT ARECIBO.

This port is on the north coast of Porto Rico, 26 miles eastward of Point Borinquen lighthouse and 33 miles westward of San Juan Harbor. It is an open bight formed by a recession of the coast about ½ mile on the west side of Point Morrillos. The anchorage for vessels is exposed to the sea and swell from outside, and affords no shelter. Steamers frequently call to load coffee and sugar. Vessels discharge and load by means of lighters, which come off from the mouth of the river.

Point Morrillos is formed by two hills about 70 feet high. **Arecibo lighthouse** (fixed white light exhibited from a white tower) is on the northern hill close to shore, and about 350 yards from the western end of the point. The southern hill, ¼ mile southward of Arecibo lighthouse, has a bluff on its southern side where the Arecibo River enters.

Four rocks, which show above water, are found in a distance of 400 yards southwestward from Point Morrillos. **Cosinera Rock,** the southwesternmost, is a small, flat-topped ledge just above high water. **Tres Hermanos** is the local name of the other three rocks. The two outer ones, lying 150 yards northeastward of Cosinera Rock, are close together and about 3 feet high. The other rock, lying midway between the two rocks and the point, is a small ledge just above high water. There are depths of 6½ to 7 fathoms 150 yards westward of the three westernmost rocks. The passages between the rocks are used by the lighters only.

Resuello Rock is awash at high water, and lies about ¼ mile from shore off the western end of Arecibo, and a little over ¾ mile westward from Cosinera Rock. There is little water between it and the shore. The soundings taken indicate that there may be a shoal outside of it, and the rock should be given a good berth.

The 5-fathom curve is about ⅜ mile, and the 3-fathom curve between 400 and 500 yards, from shore between Cosinera Rock and the eastern end of Arecibo.

Arecibo is a town on the shore 1 to 1½ miles southwestward of the lighthouse, and is of considerable importance as a receiving and shipping port. In 1920 the population was 10,039. The cathedral and the theater (large white building) are the most prominent buildings in the town. The town has communication by telephone and telegraph, and by railroad, eastward and westward. There is also a good highway across the island to Ponce and along the north coast.

Arecibo River enters at the eastern end of the bight, on the south side of the bluff ¼ mile southward of Arecibo lighthouse, and has a depth of 3 feet on the bar. There are warehouses just inside the mouth of the river, from which lighters go out to vessels. After heavy rains the river sometimes breaks through temporarily at the eastern end of Arecibo.

Improvements now in progress, contemplate dredging an opening into the lagoon southward of the lighthouse and building warehouses on its south shore, connecting the warehouses with Arecibo by a railroad.

A pilot may be obtained by making signal.

ANCHORAGES.—The usual anchorage for large steamers is with Arecibo lighthouse bearing 87° true (E mag.), distance ½ mile, and with Cosinera Rock, distant ¼ mile, and in line with the bluff on the north side of the mouth of the river, bearing 116° true (SE by E ⅜ E mag.) in 8 to 9 fathoms, sandy bottom.

The smaller steamers anchor about 150 yards from Cosinera Rock, with the rock in line with Arecibo lighthouse, bearing 70° true (ENE ½ E mag.) in 6 fathoms.

There is little current at these anchorages and vessels lie head to the wind, tailing away from the rocks in the daytime.

For a distance of 250 yards eastward and southeastward of Cosinera Rock there are depths of 3 to 4 fathoms, the water then gradually shoaling to the shore eastward and southward. From May to August small vessels with a local pilot sometimes anchor in the bight southeastward of Cosinera Rock.

QUARANTINE.—National quarantine regulations are enforced.

DIRECTIONS.—Approaching from either direction give the coast a berth of 3 miles until off the port. From westward, steer for Arecibo lighthouse on a 133° true (SE ⅛ S mag.) course until the cathedral in Arecibo bears about south-southwest; from eastward, steer for the cathedral on a 200° true (SSW ¼ W mag.) course until the lighthouse bears about southeast. Then steer 176° true (S mag.) heading for 3 stacks almost in line and about ½ mile southeastward of Arecibo (northern stack yellow brick and two southern ones iron), and proceed with care to the anchorage.

Anchor in 7 to 10 fathoms before Point Carocoles (1½ miles eastward of the lighthouse) is shut out by Point Morrillos. The anchorage is from ½ to not over ¾ mile from Arecibo lighthouse, bearing about east, and from 300 yards to not over ½ mile from Cosinera Rock.

From Port Arecibo to San Juan Harbor, the coast has an easterly trend for 33½ miles. For nearly 16 miles to Point Puerto Nuevo, it consists of sand beaches and sand dunes, with occasional rocky bluffs; thence to San Juan, of numerous hummocks and rocky bluffs, varying in height up to 130 feet, and short intervening sand beaches. The coast is indented by a number of bights and coves, none of which afford sheltered anchorage. A line of breakers is found from ¼ to ½ mile offshore, inclosing numerous lone rocks. Beginning at San Juan and extending westward, there is a range of conical hills a short distance inland.

Point Morrillos, the eastern head of Port Arecibo, has two hills about 70 feet high, the northern one of which is marked by Arecibo Light-

house (white hexagonal tower attached to square flat-roofed dwelling).

Point Caracoles, 1½ miles eastward of Arecibo lighthouse, is a rocky bluff 70 feet high, with two islets close westward.

Point Las Tunas, 3½ miles eastward of Arecibo lighthouse, is the westernmost of numerous high, rocky, bluff hummocks which form the coast for 1¼ miles . There are some prominent high, rugged rocks near the coast 2 miles eastward of the point.

Point Palmas Altas, 8 miles eastward of Arecibo lighthouse, is about 35 feet high, and there are numerous rocks for a distance of ⅝ mile westward of it. A boat landing can be made at times in the bight on the west side of the point. Steamers load sugar from lighters. The usual anchorage is with a private beacon, Point Palmas Altas bearing 154° true (S by E ⅞ E mag.) and the hummock westward of Point Manati bearing 107° true (ESE ⅛ E mag.) in 7½ fathoms, sandy bottom. The anchorage is open and generally a sea makes in. Some sand dunes with white patches lie 1½ miles westward of it.

Manati River entrance lies between two hills which rise on either side to heights of 130 feet. A number of houses show on the slope on its western side. Between Manati River and Point Palmas Altas, a distance of 1½ miles, there are some prominent high, bare rocks.

Barceloneta is a town on the west bank of Manati River, and on the railroad 1 mile inland. **Manati** is a town on the railroad about 4 miles southeastward of Barceloneta and 3 miles inland.

Point Manati, ½ mile eastward of Manati River, is prolonged westward for ¼ mile by two rocky islets, and there are numerous rocky islets close to shore for a distance of ¾ mile eastward of the point.

Between Point Chivato and Point Manati, a distance of 5 miles, the coast recedes about 1 mile, forming an open bay. The shore of the eastern part of the bay is low and in places marshy, its western part is a ridge 130 to 170 feet high, backed by conical hills.

Point Chivato is low, rounding, and not distinctive as seen from westward. A rock awash lies 600 yards northward of the point.

Point Puerto Nuevo, 3½ miles westward of Point Cerro Gordo, is low and not distinctive. Rocky islets extend 1 mile westward from the point; they lie about ¼ mile from shore, and show against the sandy beach behind them. A boat landing can be made at times inside the rocks west of the point.

Vega Baja is a town on the railroad on the west bank of Cibuco River, about 3 miles inland. A large yellow mill with red stack shows above the trees in this vicinity.

Garzas Islets are bare rocks which show only when close in, and lie close to a point 2½ miles westward of Point Cerro Gordo. The point behind Garzas Islets is a grassy hill, terminating westward in a bluff head, and is prominent. **Cibuco River** empties into the cove on the west side of Garzas Islets; its entrance is blocked by reefs.

Point Cerro Gordo, 4 miles westward of Point Fraile, has a prominent ridge 135 feet high, which extends eastward about 1 mile. There are scattering bushes and trees on the ridge, and bluffs at the water. Some houses show in the cove just west of Point Cerro Gordo; a boat landing can be made here at times.

Point Fraile, 1 mile westward of Guayanaba River, is a grass-covered ridge 65 feet high, with a small bluff at its western end. A depth of 14 fathoms was found ⅜ mile northward of Point Fraile.

Guayanabo River, 4 miles westward of Point Salinas, is marked by a break in the foothills. **Dorado** is a town on the west bank of the river, 1¼ miles above its mouth; some of the houses show from seaward. **Toa Baja** is a town on the east bank of the river, 1 mile above Dorado.

A small rock, about 2 feet high, lies 1¼ miles west-northwestward from Point Salinas; there are depths of 9 to 10 fathoms 250 yards northward of the rock.

Point Salinas, 3 miles westward of San Juan Harbor, is a low, narrow neck, nearly 1 mile long, at the northern end of which is a hill about 65 feet high, with a bluff seaward face. There is an islet close to the eastern side and another close to the western side of the point. Depths of 9 to 11 fathoms were found ⅜ mile northward of it.

The principal towns between Arecibo and San Juan are **Barceloneta, Manati, Vega Baja, Dorado, Toa Baja,** and **Bayamon**, all on the railroad, which parallels the coast at distances of 1½ to 3 miles. These towns have communication by telegraph and telephone.

SAN JUAN HARBOR.

This is the most important commercial port in Porto Rico and the only harbor on the north coast which affords protection in all weather. Its entrance lies about 30 miles westward of Cape San Juan and 60 miles eastward of Point Borinquen. The harbor is about 3 miles long in a southeasterly direction, and varies in width from ¾ mile to 1¼ miles; but the entire southwestern side is occupied by extensive shoals. The southwest shore is divided into two large bights by Catano Point, which extends over ½ mile northeastward into the harbor. The northern side of the harbor is formed by San Juan Island, which is generally bold and rocky, while the west, south, and east shores of the harbor are low, with mangrove swamps in places. Lying about 1 mile south of the harbor and extending westward, there is a range of prominent, conical, rocky and wooded hills, which give a bold appearance to parts of the south shore of the harbor.

San Juan Island is 2¼ miles long east and west, and is separated from Porto Rico by the narrow Cano de San Antonio. The western and higher part of the island is occupied on its southern slope by the city of San Juan. Only the higher part of the city can be seen from seaward, as the summit ridge of the island (nearly 100 feet high) is near its north shore. At each end of the city this ridge is occupied by large stone forts, between which is a continuous high wall and some minor works which rise abruptly from the water. **San Cristobal** is on the summit of the ridge at the east end of the city. **Morro Castle** is on the extreme western point of the island, at the harbor mouth, and is surmounted by Port San Juan lighthouse (flashing white). The city wall also extends from Morro Castle along the harbor side of the island to the **Palace** (large and prominent), and then eastward toward the landing place. Two poles of the naval radio station, and a tobacco factory, a large flat-topped white building, are on the island ½ mile from its eastern end.

Cabras Island, on the west side of the entrance, is 800 yards westward of Morro Castle and ½ mile off Palo Seco Point. It is ½ mile long

and 35 feet high, and there are several small buildings on it which are used as leper hospitals. Several large bare rocks lie close to the east end of the island, and a reef extends 250 yards eastward of them. The water is very shoal between the island and Palo Seco Point; **Fort Canuelo,** a small stone structure, is on this shoal about 400 yards from shore.

Cano de San Antonio leads eastward from San Juan Harbor, at the eastern end of the city, and separates San Juan Island from the main shore. It is frequented by small craft only. Two highway bridges and two railroad bridges cross the channel from the eastern end of San Juan Island; these have no draw, and are only about 4 feet above high water.

Cano de Martin Pena is a narrow slough from the extreme eastern end of the harbor, and is the entrance to a system of lakes and connecting lagoons which extend eastward about 8 miles. A draft of 4 feet at high water can be taken into the channel from San Juan Harbor. A drawbridge (30′ clear width in draw) crosses the mouth of the slough.

San Juan is the capital and leading commercial port of Porto Rico. It has well-paved streets, a system of waterworks, electric street cars, and is lighted by electric lights at night. The population in 1920 was 70,707.

A Government reservation occupies the east side of the south end of the city, and contains the lighthouse depot, army engineers' offices, Public Health Service, and other governmental activities.

The customhouse northward of the New York and Porto Rico S. S. Company's pier is a prominent building facing the harbor.

Wharves.—There is a depth of 16 feet alongside the lighthouse wharf. The quay in front of the customhouse is usually occupied by small craft. The New York and Porto Rico S. S. Company's wharf projects about 500 feet into the harbor, as well as the Red D and Bull Insular Lines wharf, just eastward, and have depths of 20 to 30 feet alongside. The quay eastward of these piers has depths of 19 to 24 feet alongside and vessels haul in close enough to discharge and load. The American Railroad pier lies ¼ mile eastward of the above piers and vessels load at it to 24 feet. The San Antonio piers are farther eastward, at the mouth of Cano de San Antonio. A concrete pier is under construction between the American Railroad pier and the latter piers.

Catano is a post village on the south side of the harbor westward of Catano Point. A ferry plies between San Juan and Catano in connection with a railroad which extends from Catano to Bayamon, a distance of 4 miles.

Santurce is the suburban residence section of San Juan and is connected with it by an electric street railway.

Prominent features.—Morro Castle, with Port San Juan lighthouse on its summit, marks the eastern side at the entrance and is unmistakable. Cabras Island and the bare rocks near it are on the west side of the entrance, 800 yards westward of Morro Castle, and will be readily distinguished. A large black water tank about ½ mile eastward of Morro Point is very prominent and when approaching from the northward can be seen before the lighthouse is visible.

Farther eastward are the two radio towers, and 2¾ miles eastward of San Juan Lighthouse is a prominent light gray building (Condado Hotel) close to the north coast.

Channels.—The channel is marked by range lights and buoys, and has a depth of 30 feet to the anchorage southward of Puntilla Point. At the entrance the channel is about 250 yards wide, with a depth of 35 feet. Just inside the entrance there is a sharp turn in the channel, which is not difficult to make in entering, as there is sufficient room southward of the channel until up with black buoy No. 5; but in going out care should be exercised, particularly with long vessels, and in a strong northerly breeze, not to get over toward Colnas Shoal.

Along the southwest front of the city, from black buoy No. 5 to Puntilla Point, the channel, with a depth of 30 feet or more, is about 150 yards wide. The turn in the channel south of Puntilla Point for vessels going up to the wharves is very sharp and large vessels sometimes employ a tug or drop an anchor to assist in making it.

The channel along the southeast front of the city is about 350 yards wide, with depths of 22 to 32 feet, and is included between the city and the red buoys marking Punta Larga Shoal.

The channel leading southeastward to the quarantine station on Miraflores Island has depths of 23 to 25 feet to Largo Shoal, and thence shoals gradually to a depth of 17 feet off the quarantine station. The channel is buoyed to Largo Shoal and is frequently used as an anchorage.

Pilotage is compulsory for certain vessels. Pilots come out in small boats, if not too rough, and meet vessels just outside the entrance. The rates of pilotage and extracts from the rules and regulations relating to pilots and pilotage are given in the Appendix.

Tugboats.—There is a commercial tugboat employed in connection with the coaling dock, which may be obtained for towage and assistance in the port. There is also a Government tug stationed at San Juan, which is employed on Government activities.

Anchorages.—The most convenient anchorage for vessels of about 15 feet or less draft is eastward of the New York and Porto Rico steamship wharf, close to the north side of Punta Larga Shoal, where the depths are 19 to 22 feet.

Foreign vessels and large deep-draft vessels not going to one of the wharves anchor southward of Puntilla Point, where there is an area 400 yards in diameter with depths of 23 to 33 feet.

The channel southeastward of Puntilla Point, as far as Largo Shoal, is well buoyed and is frequently used as an anchorage. The depths as far as Largo Shoal are 23 to 25 feet.

Dredging operations now under way will increase the anchorage area by removing the major portion of Punta Larga Shoal.

Marine Hospital.—There is an officer of the U. S. Public Health Service stationed at San Juan. Patients are taken care of in a contract hospital, in accordance with the regulations of the Service.

Supplies.—Provisions, ice, lumber, and ship chandlers' stores can be obtained in San Juan, and water at the wharves and from water boats.

A large supply of coal is kept on hand at the coal dock, located just east of the San Antonio docks. It may be obtained at the dock or delivered alongside in lighters.

Repairs.—There is a small marine railway on Cano de San Antonio, which can take out small local craft. There are machine shops in San Juan and ordinary repairs to machinery can be made. The nearest dock for vessels is at St. Thomas.

Reporting station.—There is a signal station on San Cristobal Castle, from which the approach of vessels is signaled to the city. Vessels can communicate with the station by the use of International Code Signals. There is a radio station of the United States Navy Department on San Juan Island, eastward of San Cristobal Castle.

Tidal indicator.—A tidal indicator is maintained by the Army engineers off the quay on the east side of Puntilla Point.

Winds.—The prevailing winds are the easterly trades, which generally blow freshly during the day. The lowland eastward of the city permits the cool trades to be felt throughout the harbor. At night the trade wind generally dies down and a light southerly breeze comes off the land. Except for hurricanes, which occur at irregular and, as a rule, long intervals, heavy northerly winds are the most troublesome, piling up a heavy sea and breakers in the harbor mouth.

Dangers.—**Colnas Shoal** extends 250 yards eastward and 500 yards southeastward from the rock at the east end of Cabras Island, and is generally defined by breakers. From the northeastern end of the shoal, a ledge with a least depth of 18 feet extends 250 yards eastward. The end of the ledge is marked by the Entrance buoy (nun). A little over 300 yards southward of Entrance buoy the eastern point of the shoal is marked by a nun buoy.

Santa Elena Shoal extends 150 yards westward of Morro Point (Castle), and 250 yards westward from the shore just inside of Morro Point. The depths over the shoal are 14 to 18 feet, increasing to 20 and 22 feet close eastward of the Entrance buoy (No. 1, occult. white). The western point of the southern end of the shoal is marked by Santa Clara Shoal gas buoy (flashing white).

Bajios Reefs are the continuation southward of Colnas Shoal, and are unmarked but are sometimes defined by breakers. These reefs have general depths of 2 to 5 feet over them, and extend nearly ½ mile eastward from Palo Seco Point. The edge of the reefs is steep-to, and lies from 450 to 600 yards southwestward of the channel line defined by the Anegada Shoal range.

San Agustin Shoal is a part of the shoals which limit the northeast side of the channel from Santa Elena Shoal to Puntilla Shoal. It has depths of 4 to 12 feet, and makes out 250 yards from the shore at the Palace, and the same distance from the next point westward off which the edge of the shoal is marked by a can buoy.

Puntilla Shoal extends nearly 200 yards southward of Puntilla Point and the same distance off its southwest side, connecting with San Agustin Shoal. It has depths of 1 to 3 feet and is marked by a black can buoy, and a light (occulting white) on its southwest side, and a can buoy and a light (occulting red) at its southern end.

Tablazo Shoal, with 10 to 12 feet of water over it, lies a little southwest of the channel abreast Puntilla Point, and is a part of the flat, with 13 to 15 feet of water over it, which forms the southern

side of the channel from abreast St. Agustin Shoal to Anegado Shoal. The edge of the shoal is marked by three red nun buoys.

Punta Larga Shoal extends nearly ½ mile westward from Isla Grande, and forms the southeastern limit of the inner harbor of San Juan. It is bare in places at low water, and has depths of 2 to 8 feet near its edges. Dredging operations now under way will remove a large portion of this shoal, thereby increasing the anchorage area for deep-draft vessels.

Anegada Shoal lies ⅜ mile north-northeastward from Catano Point, and is partly bare at low water. Its north end is marked by a nun buoy, and the northwest end is marked by the front light (red pyramidal house on piles) of the Anegada Shoal range.

Yaboa Shoal lies a little over 300 yards northeastward of Anegado Shoal, and from 300 to 550 yards westward of the south point of Isla Grande. The shoal is partly bare at low water, and is marked at its southern end by a can buoy. There is foul ground between the shoal and Isla Grande.

Largo Shoal lies from ⅛ to ⅜ mile eastward of Anegado Shoal, and has depths of ½ to 4 feet. It is marked on its northern side by a nun buoy.

Miraflores Island should be given a berth of over 200 yards.

Miraflores Shoal, with a least depth of 6 feet, lies 250 yards westward of the quarantine wharf.

Capitaneja Shoal has a least depth of ½ foot, is about 200 yards in diameter, and lies 400 yards south-southwestward from the south point of Miraflores Island.

DIRECTIONS, SAN JUAN HARBOR.—The harbor is easy of access for steamers during daylight, but strangers should not attempt to enter at night.

In approaching San Juan from the northward or eastward during daylight, the black water tank and radio towers are unmistakable when several miles offshore, and when closer in the grey and yellow walls of Morro Castle will be recognized. At night the lighthouse and the electric lights of San Juan will be seen from a distance of more than 18 miles in clear weather. In approaching the entrance from westward, Point Salinas when first seen will show as an island, and should not be mistaken for Cabras Island on the west side of the entrance.

Cantano range lights show in the daytime from off the entrance, and the range as daymarks assists in steadying the vessel for the narrow channel between the buoys at the entrance.

The turn around gas buoy No. 3 is rather sharp, and care is required in making it, especially by vessels when leaving the harbor.

With the trade wind southward of southeast, which sometimes occurs, especially during the summer, sailing vessels are at times held off the entrance several days before they can enter under sail. Ordinarily, however, the trade wind blows freshly from about east or east-northeast, and sailing vessels can stand into the entrance and up the channel into the harbor. To prevent being becalmed when under the high land of Morro Castle and the city, it is usual to take in the lower sails first and leave the upper sails set until up to the anchorage. There is no room in the channel for beating, and with the wind southward of east a sailing vessel, unless very handy, will

find it difficult to work in very far. Signals for a tug will be relayed by St. Christobal Signal Station.

Entering and to an anchorage.—Give the coast a berth of about 3 miles until nearing the entrance, and then shape the course to pass about 1 mile northward of Morro Castle. When Port San Juan Lighthouse on Morro Castle bears about south stand in for the entrance with Catano range lights (white structures) in line, bearing 188° true (S by W mag.) and keep close on the range until inside the entrance buoys.

Pass westward of black buoy No. 3 (occulting white) and steer 136° true (SE ⅜ S mag.) with Anegado Shoal range lights in line (red structures). When up to Can buoy No. 7 (light close by) edge off to the southward and anchor about 400 yards southward of Puntilla Point, southward of the line of the Anegao Shoal range, in 27 to 30 feet of water.

To the docks.—Pass southward and eastward of can buoy No. 9 (light close by) and then haul northward between the lighthouse depot and the red buoys marking Punta Larga Shoal; this turn is sharp and difficult for large vessels. Follow the water front at a distance of about 250 yards to the desired pier.

To anchor in the channel leading toward the quarantine station.—When abeam of Puntilla Point (lighthouse depot) steer 117° true (SE by E ¼ E mag.) and select anchorage in the channel as marked by the buoys. The depths are 23 to 25 feet until up to Largo Shoal buoy No. 4, and thence shoals gradually to about 17 feet off the quarantine station

From the entrance to San Juan Harbor the coast has a general easterly trend for 13 miles to Point Vacia Talega and a general east northeasterly direction for 17 miles to Cape San Juan. It is indented by a number of coves, none of which afford an anchorage, and is a sand beach with the exception of bluffs at Cape San Juan, Luquillo, and Point Vacia Talega. The beach is fringed with coral reefs and breakers, inclosing bare rocks, to a distance varying from ½ to 1 mile in places. The lowland, extending inland 2 to 4 miles to the foothills of the Luqillo Mountains, does not show well from seaward, and the coast appears bold.

The principal towns and villages between San Juan and Fajardo are **Rio Piedras, Carolina,** and **Canvanas,** 3 miles inland; **Loiza,** at the mouth of the Loiza River; **Rio Grande** and **Mameyes,** 2 miles inland, and Luquillo, at the mouth of Luquillo River. These towns are connected by a good road, and have communication by telegraph and telephone. There is a railroad from San Juan to Rio Piedras and Carolina and between Mameyes and Fajardo.

Luquillo Mountains occupy the northeast part of the island, and are the great prominent feature in clear weather for this part of the coast. They are three high closely connected peaks, the highest of which is **Yunque Peak,** 3,485 feet, and lie 5 miles inland and 10 miles from the eastern end of the island.

Point Cangrejos, 7½ miles eastward of San Juan, is low and has a scattering grove of cocoanut trees. A reef extends ⅜ mile northward and nearly ⅝ mile northwestward from the point. There are several bare, rocky islets near the edge of the reef, which are prominent in approaching from eastward. Reefs extend from these islets

to San Juan Island, a distance of 5½ miles, and lie from ½ to 1 mile offshore.

Point Vacia Talega is 17 miles westward of Cape San Juan and 13 miles eastward of San Juan Harbor. There are low bluffs at the water, from which the land rises gradually to a brush-covered ridge, 40 to 60 feet high, and then drops suddenly to low land behind it. This feature shows from both eastward and westward, and is distinctive.

Carolina, the most important town between San Juan and Fajardo, is 2 miles westward of Canovanas. It is the eastern terminus of the railroad from San Juan.

Loiza River, 1¾ miles eastward of Point Vacia Talega, shows as a wide gap in the trees. **Loiza** is a post village on the eastern side of the river near its mouth. **Canovanas** is an important town on Loiza River 3 miles above Loiza.

Point Uvero, 2½ miles westward of Point Miquillo, shows from westward only. It then appears low and sandy at the end, backed by extensive groves of cocoanut trees which extend westward to the Loiza River.

Rio Grande empties at the head of the deep bight on the west side of Point Miquillo. The river is small, but is navigable for small craft for 3 miles to the town of Rio Grande. It can be entered only with a smooth sea.

Point Miquillo, 1 mile westward of Point Picua and 10 miles westward of Cape San Juan, is marked at its end by a small cluster of cocoanut trees; the rest of the point is covered with brush. A least depth of 7 fathoms, with a possibility of less, was found about 1⅝ miles northward of Point Miquillo, and 15 to 20 fathoms a little farther northward.

Comezon Cove, between Point Miquillo and Point Picua, is about 1 mile long and ¾ mile wide at the entrance, narrowing to its head. There are reefs across the entrance and in the cove.

Point Picua, 3 miles westward of Point Embarcaderos, is covered by an extensive grove of cocoanut trees. Reefs, bare at low water, extend ⅜ mile off the point.

A rock, with a least depth of 15 feet, lies 1.6 miles 29° true (NE by N mag.) from Point Picua and is marked on its north side by a whistling buoy. For a distance of about ½ mile westward of the rock there are scattered rocks with 3¾ to 6 fathoms of water over them, but the general depth of the surrounding water is 9 to 15 fathoms. The rock breaks in a moderate swell.

Point Embarcaderos, nearly 1 mile northwestward of Luquillo, is not easily distinguished, except from westward. There is a square brick stack a little westward of the point. Small craft can anchor inside the reef on the west side of the point, but no directions can be given for strangers. The depths ⅝ mile off the point are 6¾ to 10 fathoms. The mouth of Mameyes River is closed by sand dunes.

Luquillo is a post village on the beach 4¼ miles westward of Point San Diego. The nearest boat landing is on the west side of Point Embarcaderos. Just eastward of Luquillo is a small knoll about 56 feet high, at the western end of which is a prominent reddish bluff.

Point San Diego, 1½ miles westward of Cape San Juan, is a sharply projecting point, with several knolls and bare bluffs on its eastern side, and a lagoon westward of the knolls. The depths ⅝ mile off the point are 6¾ to 10 fathoms.

Yegua Cove, between Cape San Juan and Point San Diego, is about ¾ mile in extent, and is obstructed by reefs.

Cape San Juan (see fig. 2), the northeast point of Porto Rico, is a hill 220 feet high, on the summit of which is **Cape San Juan lighthouse,** a cylindrical tower in front of a rectangular dwelling. The light is a group flashing white (two flashes every 20 seconds). From the lighthouse the cape slopes northward for ⅜ mile, and terminates at the sea in bluffs about 100 feet high. The north side of the cape is steep-to, but eastward of the lighthouse the 5-fathom curve is about ¼ mile from shore.

CORDILLERAS REEFS, AND REEFS AND ISLANDS EASTWARD TO CULEBRA.

These are a chain of small islands and bare rocks which extend in an east-southeast direction from about ¾ mile off Cape San Juan to Southwest Cay, a distance of about 17 miles, and form the north side of Vieques Sound. The chain is practically steep-to on the north and south sides, especially eastward of Hermanos Passage; westward of Hermanos Passage all dangers will be avoided by giving the islets and bare rocks a berth of ½ mile when northward or southward of them. The navigable passages through the chain are, San Juan, Cucaracha, Hermanos, and Barriles, and the passages between the cays from Cactus Cay to Culebra Island.

Las Cucarachas, the westernmost of Cordilleras Reefs, lie a little over ¾ mile north-northeastward from Cape San Juan, and are a small group of rocks about 15 feet high. They are marked by an unwatched light exhibited from a grey cylindrical concrete tower and showing a flashing white light every 10 seconds. A rock awash at high water lies 300 yards northwestward of them, and a shoal with 22 to 26 feet of water extends ⅝ mile 304° true (NW ⅝ W mag.) from the rock awash. A ridge with depths of 32 to 41 feet extends west-northwesterly from the shoal to a distance of 2¼ miles. Lying about ⅜ mile southward of this ridge, and extending westward of it to a position 2 miles northward of Point Embarcaderos, is another ridge with least depths of 6¾ to 8 fathoms. The course to or from San Juan Passage leads over this ridge, on which there is usually a heavy swell. With a very heavy swell, the sea has been known to break on these ridges.

San Juan Passage, between Cape San Juan and Las Cucarachas, is nearly ¾ mile wide, and is one of the principal channels leading into Vieques Sound. The depths in the passage are 8 to 11 fathoms, and in the western approach 6¾ to 8 fathoms. Sailing directions through the passage are given on page 70.

Cucaracha Passage, between Las Cucarachas and Los Farallones, is a little over ½ mile wide. It may be used by vessels of any draft, and is the best passage for sailing vessels to enter the northwest end of Vieques Sound with the usual easterly trade winds. The best depths in the passage (7 to 8 fathoms) are found on its eastern side for a distance of ⅜ mile westward of Los Farallones. On the west

side the 6-fathom curve is found about ¼ mile east-southeastward from Las Cucarachas, shoaling thence to 22 feet about 125 yards from them. A 188° true (S by W mag.) course passing ¼ mile westward of Los Farallones, or a 218° true (SW ¼ S mag.) course for Cape San Juan lighthouse, will lead through Cucaracha Passage in a least depth of about 7½ fathoms.

Los Farallones, lying ⅝ mile eastward of Las Cucarachas and ½ mile northwestward of Icacos Cay, is a group of rugged bare rocks about 30 feet high. There is deep water close to the north and west sides of the rocks, but a shoal, with a number of bare rocks on it, extends to Icacos Cay. A reef, on which the sea always breaks, lies ¼ mile southward of Los Farallones; it extends nearly ⅜ mile westward from the northwest end of Icacos Cay, and the western end of the reef should be given a berth of over 300 yards.

Icacos Cay, the largest one of the chain, lies 1¼ miles eastward of Cape San Juan. It is ¾ mile long, ⅜ mile wide, hummocky in appearance, with a greatest elevation of about 40 feet, and covered with a scrubby growth.

Ratones Cay, 250 yards eastward of Icacos, is 250 by 400 yards in extent, and about 60 feet high. There are a number of bare rocks off its north side, and a reef awash between it and Icacos. A reef awash extends 400 yards southwestward from Ratones to a bare rock about 10 feet high. There is a channel 400 yards wide, with depths of 16 to 20 feet, between Ratones Cay and the bare rocks northwestward of Lobos Cay.

Lobos Cay, ½ mile east-southeastward from Ratones, is 350 by 650 yards in extent, and 25 to 30 feet high. Off its north side are several high bare rocks and islets, the highest 75 or 80 feet. From Lobos to Diablo Cay, a distance of 2¼ miles, there is a chain of numerous bare rocks and islets, some of them as much as 30 feet high.

Diablo Cay, 2¼ miles east-southeastward from Lobos Cay, is 650 yards long and generally low, but there is a grassy hummock about 40 feet high on its eastern end; there are white beaches on its north and south side. There are numerous bare rocks close to the north side of the cay and extending westward to Lobos Cay; also for a distance of ⅝ mile eastward of it. The easternmost rock is detached, about 30 feet high, and a good mark. A single line of soundings through the gap between this rock and Hermanos Reef gave a depth of 5¾ fathoms, but numerous light patches were seen giving it a dangerous appearance.

Hermanos Reef, 1⅜ to 2⅜ miles east-southeastward from Diablo Cay, is four small bare rocks—the western one about 2 feet high, the eastern one about 6 feet high, and two rocks, close together, and 4 or 5 feet high, nearly midway between the end rocks.

Hermanos Passage is 2 miles wide between the bare rocks of Hermanos and Barriles reefs. With care it is considered safe for vessels of 24 feet or less draft, but vessels rarely have occasion to use it. The deepest part of the passage is between ½ and 1 mile eastward of Hermanos Reef east rock. There are two ridges across the passage about ¼ mile apart. Depths of 5½ to 7 fathoms were found on them in the deepest part of the passage, and spots with less depths, as follows: The 5-fathom curve is ⅜ mile east-southeastward from Hermanos Reef east rock; a depth of 28 feet was found ⅞ mile, and

18 feet at ½ mile, 284° true (WNW ½ W mag.) from Barriles Reef west rock. Outer Piraguas Rock bearing 203° true (SSW ½ W mag.), passing 1¼ miles westward of Barriles Reef west rock and ¾ mile eastward of Hermanos Reef east rock, will lead through Hermanos Passage in a depth of 33 feet.

Barriles Reef is 1⅜ miles long east and west, and is a chain of about fifteen bare rocks, mostly 2 to 4 feet high. There is a rock about 10 feet high near the middle of the reef, and another about 15 feet high at the eastern end of the bare rocks. The easternmost rock is awash, and lies ¼ mile eastward of the bare rocks.

Barriles Passage is 2 miles wide between the easternmost rock (awash) of Barriles Reef and Cactus Cay, and may be used by vessels of any draft, the deepest water favoring the eastern side. The eastern part of the passage, between ¼ and 1¼ miles westward of Cactus Cay, has depths of 8 to 9 fathoms; a depth of 31 feet was found 400 yards westward from Pillar Rock, Cactus Cay. On the west side, depths of 5½ and 6½ fathoms were found between 650 yards and ¾ mile eastward of the rock awash (eastern end of Barriles Reef), and a depth of 28 feet was found 650 yards southeastward from it.

CULEBRA AND ADJACENT ISLANDS.

Culebra Island, 16 miles eastward of Porto Rico, is about 6 miles in length east and west. Its greatest width of 3 miles is found near the eastern end, but to the northwest it terminates in a point. It is of moderate elevation, broken and ragged, the hills are generally covered by a scrubby growth 20 to 30 feet high, and near the center Mount Resaca rises to a height of 650 feet. Dolphin Head, 550 feet high, a conspicuous hill, comparatively steep-to on its southeastern face, lies about midway between Mount Resaca and Point Negra. The northern shore is bold and steep-to, the 20 fathom curve lying approximately parallel to it at a distance of 1½ miles. A coral ledge with 5½ to 9 fathoms of water on it extends westward from Northeast Cay to within 1½ miles of Northwest Point. Within this coral ledge the water again deepens to 12 and 13 fathoms. Great Harbor and Mangrove Harbor indent the southeastern side of the island. (Fig. 1.)

In 1920 Culebra Island had a population of 704. The principal product of the island is cattle. Vegetables and some tropical fruits are grown only in sufficient quantities for local consumption. The rainy season lasts from June to October, but the rainfall is not as heavy as in Porto Rico. There are no fresh-water streams, and rain water stored in cisterns forms the principal water supply. There is no fresh water available for vessels.

The principal harbor is Great Harbor, one of the most secure in the Leeward Islands.

The Washer lies nearly 2⅓ miles northwestward from Northwest Point, and is two small rocks about 200 yards apart—the northwest one about 2 feet high, the southeast one awash at high water. **Washer Passage**, between Fungy Bowl and The Washer, is clear and has depths of 12 to 14 fathoms.

Fungy Bowl is a prominent, bare, round, whitish rock, 145 feet high, with rugged perpendicular sides, lying ⅝ mile south-southeastward from The Washer. The channel between Fungy Bowl and The

Twins has a depth of 9 fathoms in the middle, and is clear if they be given a berth of over 200 yards.

Twin Pass is between Pilot Rock and the **Twins**; the latter is a rock about 50 yards in diameter and 20 feet high, with a small, low rock close to its southwest side, and lies nearly 7/8 mile westward of Pilot Rock. High Breaker is the name applied to a sunken rock with 7 feet of water over it, which lies 1/4 mile southeastward from The Twins, and breaks when there is much sea. The safest and best channel is between High Breaker and Pilot Rock; it has depths of 10 to 12 fathoms, and there is generally a leading wind through either way.

Pilot Rock Channel, between Northwest Point and Pilot Rock, has a clear width of about 3/8 mile, and a depth of 12 fathoms. In taking this channel, avoid the reef extending 200 yards north-northwestward from the high, bare rock close to Northwest Point. **Pilot Rock** is 100 yards in diameter and 30 feet high; its south end should be given a berth of over 100 yards.

Northwest Point, Culebra Island, is the end of the ridge making northwest, and is projecting and prominent. Immediately off the point are three rocky islets, from the southernmost of which a reef extends northwestward for a distance of 200 yards, contracting slightly Pilot Rock Channel.

From Northwest Point to Flamingo Point the coast line consists of sandy beaches between rocky bluffs. **Flamingo Bay** is contracted by coral reefs and is of no importance.

From Flamingo Point to Duck Point the shore line is generally bold and rocky, with sand beaches in the coves and with occasional coral reefs fringing the shore. **Scrub Cay**, 20 feet high, is located off the projecting point, which separates Surf Bay from Swell Bay. **Speck Rock** is low and bare. Between Duck Point and Point Negra there is a fringing coral reef extending offshore about 100 yards. Two breaks in the reef form boat landings to the beach. **Point Negra**, the eastern point of Culebra, is a pointed rocky bluff.

Northeast Cay, about 1/2 mile from the northeastern shore of Culebra Island, is somewhat oval shaped, 1 1/4 miles long east and west, 1/2 mile broad through the center, 340 feet high, and covered with a thick scrubby growth. There is a protected boat landing on the south shore near the eastern point. About 300 yards to the northward of the eastern point is **Bird Cay**, a rocky islet, 60 feet high. About 3/4 mile to the northeastward of Bird Cay are **Shark** and **Whale Rocks**, two small rocky islets, 20 and 10 feet high, respectively. **Palada Cays**, two rocky islets, 79 and 82 feet high, lie 3/8 mile southeast from Shark Rock. The western cay is flat and grass covered on top; the eastern cay is pointed on top and has little grass.

Culebrita Island, lies southeastward of Northeast Cay, and about 3/4 mile eastward of Culebra. It is of irregular shape, 1 mile in length, northwest and southeast, nearly 2/3 mile in breadth. It is formed by three hills with low land between them, and is covered with a scrubby forest growth. The southern hill, 230 feet high, is marked by Culebrita lighthouse, a gray, cylindrical tower, on a flat-roofed building. The light is fixed white. The high land of Northeast Cay obscures the light from 125° to 142°. The western hill is 100 feet high. The northeastern hill is 190 feet high. **Cape Passage**, its eastern end, is a

high bare cliff. **Ladrone Cay** lies 600 yards northwestward of Pond Point, and is on an extensive coral reef making off from Culebrita Island. It is 30 feet high and grass covered.

Northeast Cay, Culebrita Island, and the adjacent cays and reefs, form a protected passage around the eastern end of Culebra and several well-protected anchorages. **The Sound** is a clear space, 1½ miles in length and ½ mile in breadth, between Culebra Island and Culebrita Island and the extensive coral reef making off to the southward. The average depth in The Sound is from 7 to 14 fathoms, but the navigable area is somewhat contracted by the **Middle Ground**, a shoal in the northern approach, the shallowest part of which, 2¼ fathoms, lies ¾ mile 30° true (NE by N mag.) from Point Negra, the easterly extremity of Culebra Island. The **Weather Channel**, between Northeast and Ladrone Cays, carries 5¾ to 8 fathoms; the Lee Channel, between Northeast Cay and Culebra Island, carries 9 to 12 fathoms until up to the Middle Ground. In the South Channel the bottom is very uneven, the depth varying from 5¼ to 14 fathoms.

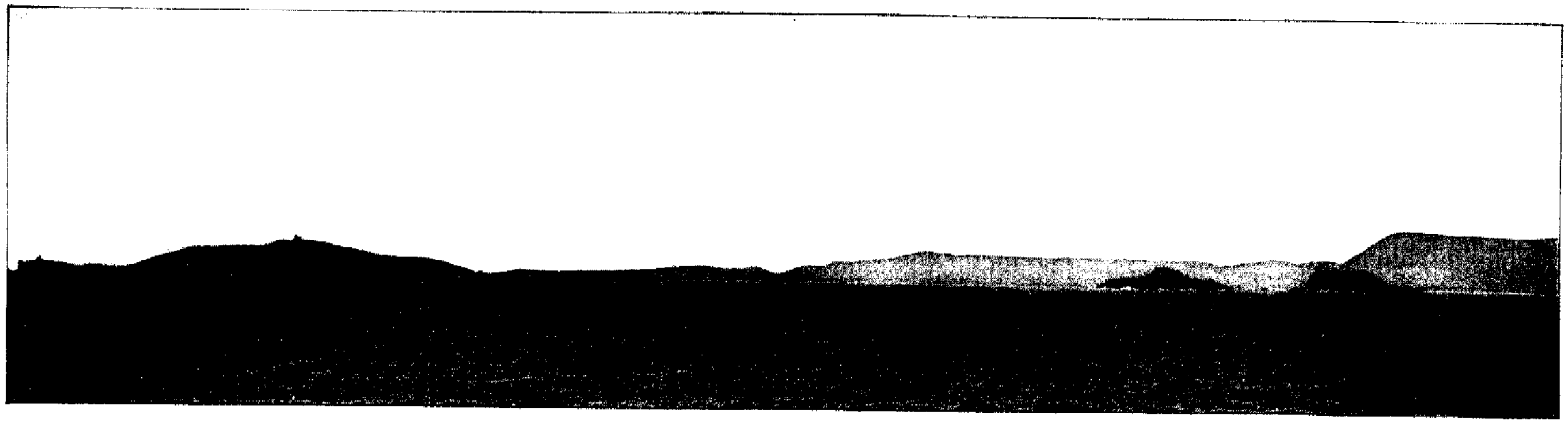
Currents.—Between Northeast and Palada Cays the flood sets to the southward with a velocity of 1½ knots, and the ebb sets with equal force in the opposite direction. In South Channel the flood sets southwestward and the ebb northeastward at about 2 knots an hour.

Lee Channel, between Northeast Cay and Culebra Island, is ½ mile wide and has no danger in it until the Middle Ground is approached. The shore line is bold until within ¼ mile of Duck Point; thence to Point Negra it is fringed with a reef. About 600 yards eastward of Duck Point there is a coral patch, with a depth of 28 feet, and about 900 yards east-southeastward of the same point there is a 29-foot shoal patch. The entrance to The Sound from the northward between Northeast Cay and Ladrone Cay may be approached from three different directions. Weather Channel, the southernmost of these, between Palada Cays and Culebrita, is the most direct, but difficult for a stranger as no marks can be given. The second, or middle passage is between Palada Cays on the south side and Shark and Whale Rocks on the north. The western and safest passage is between the latter rocks and Northeast Cay. A reef extending nearly 700 yards to the southeastward of Northeast Cay and a shoal ledge running off about 400 yards northeastward of Ladrone Cay, contract the channel between the 5 fathom curves to less than 200 yards.

South Channel leads southward from The Sound and is well protected by Culebrita Reef, to the eastward. **Puercas Heads** consist of a number of shoals lying parallel to and in the fairway of South Channel; they are about 1 mile in length and nearly awash in places. Two can buoys mark the westerly edge of Puercas Heads. **Los Crespos**, a group of small shoals about 300 yards in extent, with a least depth of 7 feet, are the continuation southwestward of the Puercas Heads; the northeastern extremity is marked by a can buoy.

Directions for the Sound.—To enter by the Lee Channel presents no difficulties. Keep midway between Northeast Cay and Culebra until nearly abreast of Duck Point. Then draw in toward the Culebra side to avoid the Middle Ground, the lower end of which is marked by a can buoy. The fringing reef making off from Point Negra may be avoided by giving the shoal a berth of over

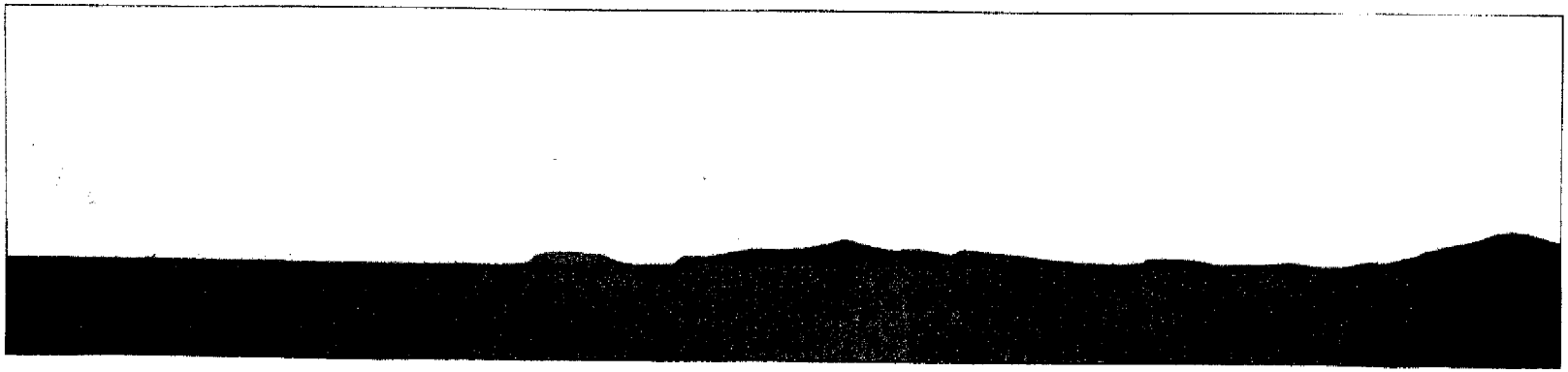
Dolphin Head.



SSW. ⅜ W., 3 miles, Culebrita Island.

Palada Cays.

FIG. 1.—CULEBRA ISLAND, FROM NORTHEASTWARD.

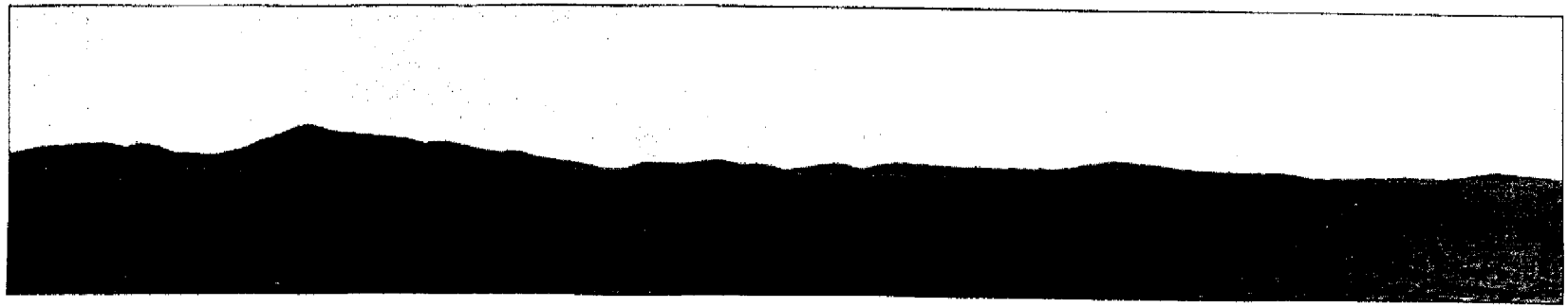


Icacos Cay.

Palominos Id.

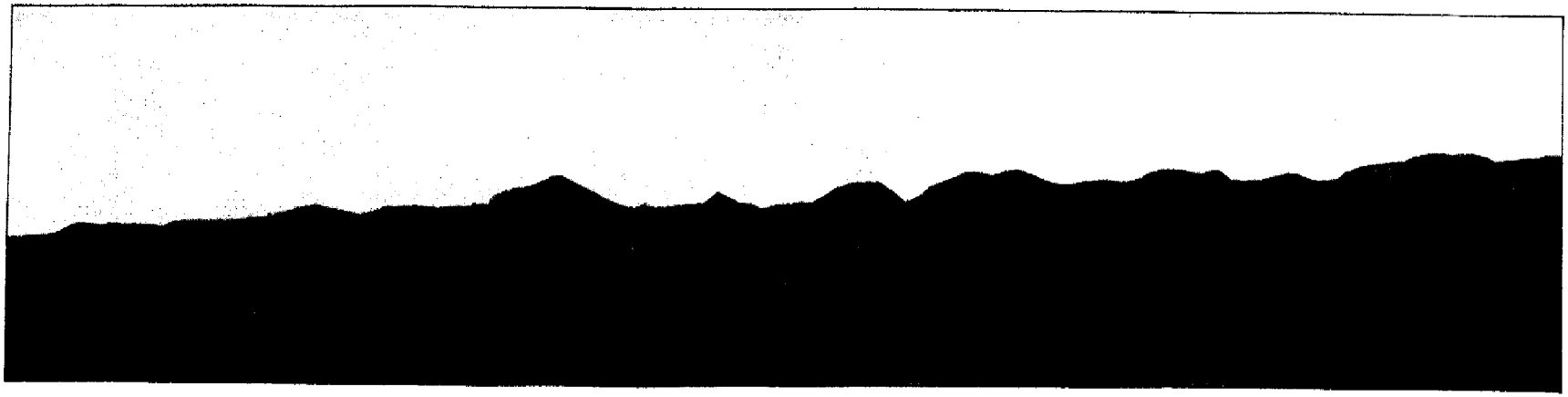
Lighthouse, SE., by S., 3½ miles.

FIG. 2.—CAPE SAN JUAN, FROM NORTHWESTWARD.



Mt. Jalobre. East Pt., NNE. ½ E., 3¼ miles.

FIG. 3.—EAST END OF VIEQUES ISLAND, FROM SOUTHWARD.



Pt. Jiguero, NNW. ¼ W. Hill (151 meters) N. Atalaya Pk., NE. ⅝ E.

FIG. 4.—POINT JIGUERO TO ATALAYA PEAK, FROM SOUTHWARD.

300 yards. This reef can be distinctly seen. The best anchorage is with the extreme western end of Ladrone Cay touching the eastern side of Bird Cay, and the southeastern extremity of Culebrita bearing about eastnortheast. Vessels can anchor closer under the lee of Culebrita, according to draft.

2. *Through Weather Channel.*—To approach the entrance by the western passage steer toward Northeast Cay and, having passed Whale and Shark Rocks at a distance of 300 yards, bring the western extremity of Ladrone Cay to touch the extremity of Point Negra and steer for them until Dolphin Head bears 240° true (SW by W ¾ W mag.), then steer for it; when Sandy Point opens out clear of Pond Point, the northern extremity of Culebrita, haul up gradually for Point Negra, passing westward of the can buoy off southern Middle Ground.

3. *Through the South Channel.*—Vessels leaving The Sound by the South Channel after passing Point Negra should keep well over toward Water Cay to avoid Puercas Heads. When Point Vaca with Mount Resaca on range bears 322° true (NW by N mag.) and past can buoy No. 5, bring Mount Resaca astern and steer out on this back range until past the red nun buoy off the southwestern point of Culebrita Reef, when the course can be shaped for sea.

Mangrove Harbor is a small but well-sheltered bay about ¾ mile long and ¼ mile wide, lying between Point Negra on the north and Water and Battle Cays on the south. The entrance is contracted by reefs on both sides to a navigable width of about 250 yards. The depth in the entrance is 7 to 8 fathoms, which gradually decreases within the harbor to 4 fathoms, sand and mud bottom; the head of the harbor is shallow.

DIRECTIONS.—To enter Mangrove Harbor, bring Mount Resaca to bear 299° true (NW by W mag.), with a group of buildings on the ridge at the head of the harbor on range and steer in midway between the reefs until up to Battle Cay and round to an anchor. Sailing vessels to leave the harbor may have to warp up under the weather reef.

The Basin, on the southern side of Mangrove Harbor, westward of Water Cay, is a bight about 600 yards long and 200 yards wide, with 4 fathoms of water, and is entered by a narrow opening westward of Battle Cay, across which there is a bar with a depth of 11 feet; it is well sheltered from all winds.

Water Cay is 30 feet high, wooded, and presents a prominent bluff face to the southeast.

Point Vaca, the eastern point of Mosquito Bay, terminates in a prominent bluff.

Mosquito Bay is a small bay about 700 yards deep and 1,250 yards wide between Point Vaca and the point about 250 yards southeastward of Point Carenero. Inside Snapper Shoal, which partly blocks the entrance, the depths are 6 to 7 fathoms. Its northwestern side is bordered by coral reefs, dry at low water, extending more than 200 yards from the shore. Being open to the southward, a heavy swell frequently sets in from that quarter.

Great Harbor, the most secure anchorage in the vicinity of Culebra Island, has its entrance between Point Carenero and Point Colorado.

It is about 1½ miles in length and in some parts ½ mile in breadth, but of irregular shape and with several small bays indenting its shores. The channel between the entrance reefs is about 100 yards wide, well buoyed, and has a least depth of 28 feet on the Inner Harbor Range. The shores of the harbor are hilly and largely covered with a scrubby forest growth, excepting where cleared for houses or planting.

San Ildefonso is on the hillside on the northeastern side of the harbor. There is a wharf in front of the village, but it is in bad repair. There are scattering houses on the hill back of Point Cabras. The village of **Culebra** is near the head of the harbor and can be seen from the outside, where Seine Bay bears about northeast. A boat channel has been cut from Seine Bay through the isthmus to the head of Great Harbor.

Supplies.—Only a small amount of supplies, such as fruit, vegetables, and eggs can be obtained, and there are no facilities for obtaining water. There is no stock of coal.

Yellow Shoal is about 500 yards in length and has a least depth of 8 feet of water. Its southwestern extremity is marked by a red nun buoy, lying 1,250 yards 88° true (E ¼ S mag.) from Point Soldado.

Grouper Shoal, about 500 yards northward of Yellow Shoal, has 4 feet least water and is about 700 yards in length east and west. Its eastern extremity is marked by a black can buoy. About 200 yards westward of its outer limit is another shoal, with 20 feet of water. A shoal, with 21 feet of water, lies about 250 yards west-southwestward from here with a 24-foot shoal close to it.

Shrimp Shoal, about 300 yards in length east and west, with a least depth of 9 feet, lies 350 yards southward from Point Vaca. A red nun buoy marks the southern edge of it.

Snapper Shoal, lying 600 yards westward of Point Vaca, has 8 feet least water. A shoal with a depth of 20 feet, lying westward of it, is marked on its southwestern edge by a red nun buoy.

Middle Ground, with 22 feet least water, lies ¼ mile west-southwestward from Snapper Shoal. A black can buoy marks its western edge.

A white diamond-shaped beacon is erected on the extremity of Point Colorada and a square white beacon 750 yards 296° true (NW by W ⅜ W mag.) from it. These two beacons in range lead between Shrimp and Grouper shoals as far as Middle Ground.

A white diamond shaped beacon is erected at the head of the harbor, ¼ mile westward of San Ildefonso, and a square white beacon 1,200 yards 323° true (NW by N mag.) from it. These two beacons in range lead through the entrance channel to Great Harbor from their intersection with the Point Colorada Range.

Directions, Great Harbor.—Vessels approaching from southward should bring the left tangent of Point Vaca to bear 8° true (N by E mag.) before the southern end of Southwest Cay closes behind Point Soldado, and steer for it until close up to Shrimp Shoal buoy. Then swing on to Point Colorada Range, course 296° true (NW by W ⅜ W mag.). When nearly up to the Middle Ground buoy, steer in on the inner harbor range, course 323° true (NW by N mag.) between the red and black buoys marking the entrance reefs. When Point Carenero bears about east open the range to the westward and anchor according to draft. It will probably be necessary for sailing vessels to warp out.

From the southeastward bring Point Vaca in range with Mount Resaca, bearing about 322° true (NW by N mag.) and continue on this course past Los Crespos Shoal Buoy, until Point Colorada Range comes on; then follow as directed above.

Grampus Shoals is a group of small coral heads rising from a bank of 10 fathoms and lying from 2 to 4 miles from the southeastern extremity of Culebra. The southern head, on which there is a depth of 3¾ fathoms, lies with Point Soldado in range with the southern extremity of Southwest Cay, bearing 293° true (NW by W ⅝ W mag.). About ¾ mile northeastward from this is a small cluster of heads with as little as 3½ fathoms on them; these are the most eastern, and lie about 4 miles 163° true (S by E ⅛ mag.) from Cape Passage, Culebrita Island. The southern of the innermost or western heads, with 3 fathoms of water, lies about 3¼ miles 105° true (ESE ¼ E mag.) from Point Soldado.

A red nun buoy marked "Grampus Shoals" lies in about 10 fathoms on the southern side of Grampus Shoals.

A black can buoy marks the northern edge of the innermost or western head of these shoals.

Grampus Channel lies between this western knoll and the long line of reefs extending south-southwestward from Culebrita; it is a clear navigable channel nearly 1 mile wide and is marked by buoys.

In the Grampus Channel the tidal current sets diagonally across, the flood to the southward and westward and the ebb to the northward and eastward.

Directions.—To pass to the southward of Grampus Shoals keep on or southward of the line of Sail Rock and Signal Hill on St. Thomas Island until Palada Cays show eastward of Cape Passage, the northeast point of Culebrita Island. Grampus Shoal will then be cleared and the course can be shaped as desired.

Point Soldado, the southern point of Culebra Island, is wooded and terminates in a rocky bluff about 35 feet high. It is prominent when seen from the eastward or westward, from which directions it appears as a ridge. **Snug Bay**, 1½ miles northwestward of Point Soldado, is a well-sheltered boat harbor; **Seine Bay**, the next cove northwestward of it, has excellent seine fishing, and a good beach. It is connected by a boat channel with Great Harbor. **Scorpion Point**, the first prominent point westward of Seine Bay, is low and protruding.

Southwest Cay is 1¼ miles long north and south, and its wooded peak is 475 feet high. Its north and south ends are high, and joined to the island by low necks. Except when the trade wind is northward of northeast, a fairly smooth anchorage can be had in 8 to 9 fathoms about ¼ mile off the northwest side of Southwest Cay, with Pillar Rock in line with the north end of Yerba Cay, bearing 289° true (WNW mag.), and the northwest point of Southwest Cay bearing 210° true (SW by S mag.).

There is good anchorage, with the ordinary trade winds, between Southwest Cay and Culebra Island, or farther southeastward, and there are no dangers if Culebra Island between Point Soldado and Scorpion Point be given a berth of ¼ mile. There is a rocky patch with 7 fathoms ½ mile westward of Scorpion Point which should be avoided in anchoring. A good berth will be found in 13 fathoms

with Fungy Bowl in line with the north end of Southwest Cay, and Scorpion Point bearing 98° true (E by S mag.), distant 700 yards. Sailing vessels anchoring northward of this will have some difficulty getting underway on account of baffling winds and strong tidal currents. Small steamers will find a more comfortable anchorage nearer Culebra Island between Scorpion and Stream Points; one of the best is in 5 to 7 fathoms in the middle of the entrance to Firewood Bay, eastward from the north point of Southwest Cay.

Approaching the anchorage between Southwest Cay and Culebra Island from northwestward, the best route for large deep-draft vessels is to pass westward of The Washer, enter Vieques Sound either between Cross and Cactus cays or through Barriles Passage, and pass southward of Southwest Cay. The best channels for sailing vessels are those westward of The Sisters, on account of the variable winds, narrow passages, and greater velocity of the tidal currents between The Sisters and Culebra Island.

Canal de Luis Pena, between the north end of Southwest Cay and Stream Point, is 700 yards wide. There is a coral head with 21 feet of water a little southward of the middle of the passage, and two other heads with 27 and 29 feet of water in it. The strong currents and baffling winds render the passage scarcely safe for sailing vessels. For tidal currents, see page 30. **Stream Point**, on Culebra Island, has a hill 75 feet high, with reddish bluffs, at the end, and a low neck behind it; there are two low, detached rocks near its end.

The channels between Northwest Point of Culebra and the islets and rocks westward of it are safe and easy to navigate in the daytime, as most of the dangers show above water.

The Sisters lie from ⅜ to 1 mile northwestward of Southwest Cay, and are three islets, as follows:

Yerba Cay, the northernmost, is 65 feet high, and has a smooth grassy slope on the east side and rocky bluffs on the west side. The passage between Yerba and Mono cays is 400 yards wide, with 7 to 8 fathoms in the middle.

Mono Cay, the southwesternmost and smallest of The Sisters, is 45 feet high, grassy on top, and rocky on the sides; there is a low rock close to its southeast side. The passage between Mono and Agua cays should be avoided.

Agua Cay, the southeasternmost of The Sisters, is low in the middle, and 40 feet high at its eastern and higher part. It is rocky, and there are many large bowlders scattered over and near it. A shoal with 5 feet at its end extends nearly 200 yards westward of it toward Mono Cay, and the passage between these cays should be avoided. The passage between Agua and Southwest cays is ⅜ mile wide, and has depths of 7 to 7½ fathoms.

Black Rock, ⅜ mile southeastward from Cross Cay, is a small irregular ledge with a number of heads, the highest 15 feet. The passage between Black Rock and The Sisters is ¾ mile wide, with depths of 5½ to 9 fathoms.

Cross Cay is triangular in shape, ½ by ¼ mile in extent, 135 feet high at its west end and covered with scrub and grass. The three points of the cay are high with rocky bluffs, and joined by lower land in the middle. The passage between Cross Cay and Black Rock is clear and over ⅜ mile wide, with 13 to 14 fathoms in the middle.

Cactus Cay is the westernmost of the chain of islets which extend 3¼ miles west-northwestward from Southwest Cay. Its greatest diameter is about 400 yards, and it is 95 feet high; there is a bare ledge close to its northwest end. **Pillar Rock** is a detached, bare pinnacle, 75 feet high, on the south end of Cactus Cay. The passage between Cactus and Cross cays is clear and nearly ¾ mile wide, with about 13 fathoms in the middle.

VIEQUES ISLAND.

This island lies nearly 6 miles from the nearest point of the east coast of Porto Rico, and forms the south side of Vieques Sound. It is 18 miles long east and west, and has a greatest width of 3½ miles near its middle. A range of hills extends the entire length of the island, and there is a prominent hill at each end—**Mount Pirata** (981 feet) near its western end, and **Mount Jalobre** (450 feet) 3 miles from East Point. The island is wooded in places, especially its eastern half and Mount Pirata, but some of the hills are cultivated with sugar cane to their summits. (See fig. 3.)

The population of the island by the census of 1920 is 11,651. The principal products are sugar, horses, and cattle. Vegetables and tropical fruits are grown in sufficient quantities for local consumption. The rainy season lasts from May to October, but the rainfall is less than in the adjacent parts of Porto Rico. The island is subject to drought, and rain water stored in cisterns forms the principal water supply. During normal rain conditions, both the north and south sides of the island westward of Port Mulas have springs and streams, but there is no fresh water convenient for vessels.

There is no harbor on Vieques Island. Vessels frequently call to discharge or load at Port Mulas, and occasionally at Port Real and the west end of the island. There is a heavy surf on the north coast when the trade wind is northward of east, and landing is impossible on the open coast. Boats can generally land at the west end of the island; at Mosquito Landing, Port Mulas, Port Negro, Cano Hondo, Port Salinas, and East Point, on the north coast; and at all the boat harbors and said beaches on the south coast when the wind is northward of east.

Port Mulas is an open bight on the west side of Point Mulas, north coast of Vieques Island, 8 miles eastward of Point Arenas and 10 miles westward of East Point. It is a poor anchorage, with little or no shelter, for vessels. For a distance of 600 yards off Isabel Segunda the port is shoal and has spots with 5 to 9 feet. Small craft of 6 feet or less draft can anchor near the shore, from 200 to 400 yards southward of the lighthouse, with fairly good shelter during ordinary weather. With northerly winds a heavy sea makes into the port, and small craft anchored here are sometimes driven ashore at such times.

Isabel Segunda (post office **Vieques**) is the principal town of the island, with a population of 3,424, and has daily launch and mail service to Playa de Fajardo. Playa de Humacao is the subport of entry. The principal exports are sugar and cattle. Boats can land at a small pier 300 yards southward of the lighthouse. There are grocery and drug stores in the town. There is communication by heliograph

with the east coast of Porto Rico, and thence by telegraph with other points.

Prominent features.—**Point Mulas** is a low bluff surmounted by *Point Mulas lighthouse* and small houses eastward of the lighthouse. The buildings and square brick stack of *Santa Maria* sugar mill are 5/8 mile eastward of the lighthouse. An old brick fort with yellow building stands on a hill 1/2 mile southeastward of the lighthouse. There is a grassy hill 225 feet high, with a few trees near its summit, at the south end of Isabel Segunda. **Martineau Hill**, a prominent wooded dome 594 feet high, is near the north coast, 2 1/4 miles southwestward from the lighthouse. **Caballo Blanco** is a low, grassy islet 1 3/4 miles northwestward from the lighthouse.

The approach to Port Mulas from the westward and northwestward is obstructed by several small shoals lying about 1 1/2 miles from the shore. **Comandante Shoal**, about 600 yards in extent with from 10 to 17 feet of water over it, lies about midway between Caballo Blanco and the shore southward of it. **Corona Reef**, awash and 600 yards long east and west, lies about 1 1/4 miles west-southwestward of Caballo Blanco, with from 4 1/2 to 7 fathoms of water in the channel between them. **Mosquito Reef**, awash, lies 1/4 mile to the westward of Corona Reef. They are both steep-to, and the sea always breaks on them. A shoal with a depth of 17 feet lies nearly 1/2 mile west-northwestward from Mosquito Reef, and a spot with a depth of 25 feet lies 600 yards northward from Corona Reef. Another spot with a depth of 16 feet lies 500 yards southward of Corona Reef. There are also a number of small shoals, with deep water close-to, westward and southward of the reefs. **Merail Shoal**, with a least depth of 6 feet, lies 3/4 mile southward of Corona Shoal.

Pilot.—There is a pilot at Isabel Segunda.

Anchorage.—Vessels of the deepest draft can anchor about 3/4 mile northwestward or northward of the lighthouse in 7 to 8 fathoms, and smaller vessels can select anchorage with the lighthouse bearing between southeast and east, distant 1/4 mile or more, in 22 to 30 feet.

The larger steamers (20 feet or less draft), having cargo to discharge or load, anchor about 600 yards from the lighthouse, bearing 120° true (SE by E mag.), with the points on the north coast eastward of it in line, bearing 80° true (E 1/2 N mag.), in 30 feet. Coasting steamers of 12 feet or less draft anchor about 300 yards from the lighthouse, bearing 97° true (E by S mag.), with the grassy hill (few trees near summit) near the south end of the town bearing 160° true (S by E 1/2 E mag.), in 21 to 22 feet of water.

Caballo Point, 2 3/4 miles eastward of Point Mulas, is rocky and steep-to.

Port Negro is a boat landing 5 miles eastward of Point Mulas lighthouse and 2 miles westward of Cucaracha Rock. It can be entered only by small craft with local knowledge. The entrance through the reefs is about 100 yards wide, with depths of 6 to 18 feet, and is generally indicated by the breakers on either side. There is little anchorage space in the port, the most of it being foul. **Point Brigadier**, 5/8 mile westward of the entrance, is marked by a large, rugged, bare rock close-to.

Port Diablo, ½ mile southwestward of Cucaracha Rock, affords neither anchorage nor shelter even for small craft, but a boat landing can sometimes be made in good weather. **Cucaracha Rock** is two small rocks, close together, and about 3 feet high. It lies nearly ⅜ mile from shore and the depths inside it are 6 to 14 feet.

Cano Hondo extends ⅝ mile eastward of Cucaracha Rock to Yalli Islet and the reefs forming Port Salinas. It is open northward and has depths of 3 to 7 fathoms. There is no sheltered anchorage except for small craft, which can anchor at its southeast end, on the southwest side of Yalli Islet; boats can generally land here. **Yalli Islet,** lying 250 yards from shore, is about 15 feet high; there is a narrow channel south of it, with a depth of 8 feet in the middle, leading into Port Salinas.

Port Salinas, 2¼ miles westward of East Point, has an anchorage space ¼ mile in extent, with depths of 12 to 24 feet. It affords good shelter for small craft with local knowledge, but should not be attempted by strangers. The port is protected on the north by a reef ⅝ mile long, the highest part of which is awash at high water. There is an entrance from westward a little over 100 yards wide between the reef and Yalli Islet and another from eastward between the reef and reefs which fringe the shore. About ¾ mile eastward of Yalli Islet there is a high, bluff point, just eastward of which are bare white cliffs with strata dipping eastward.

East Point is moderately low and grassy, with rocky bluffs at the water. A boat landing can generally be made in the bight on its north side. A reef extends nearly across and the entrance is close to the bare rocks at the western point of the bight.

Salina del Sur, on the south coast, 2 miles westward of East Point, is a bay about ½ mile in diameter and affords a boat landing with the wind northward of east. **Alcatraz Rock** is low and bare and has several rocks on it 10 to 15 feet high; it lies off the bay, ⅜ mile from the points at the entrance. A larger islet, about 40 feet high and wooded on top, with a large bare rock close to its southeast end, lies ¼ mile off the western point at the entrance. There is anchorage in the western half of the bay in 3 or 4 fathoms, sheltered from winds northward of east. The clearer entrance is between Alcatraz Rock and the island off the western point of the bay. For a distance of 1 mile westward of the island shoals with 18 feet and less extend nearly ½ mile from shore.

Ensenada Honda, on the south coast, 6 miles westward of East Point, is a bay about 1¼ miles in diameter, in which are several bare rocks and reefs awash. The bay is rough with southeasterly winds, but with the wind northward of east it affords good boat landings on the sand beaches. Owing to the foul ground in the bay it should be avoided by vessels without local knowledge. A reef, bare at low water, lies ¼ to ⅜ mile southward of the western point of the entrance.

A reef with 2 to 18 feet of water over it extends nearly ½ mile from shore ¾ to 1¼ miles eastward of Port Ferro lighthouse.

Port Ferro is a boat harbor 9 miles westward of East Point. Its entrance is 250 yards wide, with high land on both sides, and is prominent. There is a wreck, partly showing above water, a little inside

the narrowest part of the entrance and the least depth (6 to 8 feet) in the entrance is found just inside the wreck. **Port Ferro lighthouse** (white tower on square-roofed dwelling) stands on the summit of a rocky bluff ¼ mile southward of the entrance to Port Ferro.

Port Mosquito is a boat harbor, the entrance to which is narrow with a depth of 2 to 3 feet, and lies 1 mile westward of Port Ferro lighthouse.

Ensenada Sombe is on the south coast of Vieques Island 2¼ miles westward of Port Ferro lighthouse. It is about ⅝ mile in diameter and affords anchorage in 3 to 4 fathoms exposed to winds from southeast to southwest. A shoal extends 200 yards westward from the eastern point of the bay and a shoal with 16 feet over it lies westward of the middle of the entrance. The depths in the southern half of the bay are 3 to 4½ fathoms.

Port Real, on the south coast 3 miles westward of Port Ferro lighthouse, is a good anchorage with the wind eastward of southeast, but is exposed to southerly and westerly winds. Steamers occasionally call to load sugar. The port is protected on the east by **Real Cay,** ¼ mile long and about 80 feet high. A head, similar to Real Cay, lies 300 yards eastward of it, and is connected with the shore by a low spit.

The channel into Port Real has depths of over 5 fathoms until up with Real Cay. The anchorage is from 200 to 400 yards northwestward of Real Cay, in 3 to 5 fathoms.

The principal outlying danger is a shoal, with 14 to 17 feet and 5 to 8 fathoms around it, lying ¾ mile from shore and ⅞ to 1⅜ miles westsouthwestward from the south end of Real Cay; its eastern end is marked by a can buoy and its western end by a nun buoy. A spot with 24 feet lies 800 yards southwestward from the southern end of Real Cay. A shoal with 15 feet of water lies ¼ mile from shore and ⅝ mile west from the north point of Real Cay.

Point Vaca lies 3 miles westward of Port Real, and has outlying rocks a short distance off it.

Point Arenas, the northern point at the western end of Vieques Island, is low and covered with a scrubby growth, and there is a white spit at its end. There are three salt-water ponds on the point. There are no dangers south of the point, but Arenas Bank extends 3¼ miles north-northwestward.

There is a smooth anchorage, except with southeasterly winds, at the west end of Vieques Island southward of Point Arenas. Steamers occasionally call to load sugar. About 700 yards southeastward of Point Arenas, there are a warehouse, and a small wharf at which the lighters land. A sugar railroad leads to **Playa Grande,** a sugar mill 2¾ miles westward of Port Real. **Point Boca Quebrada,** 1 mile southward of Point Arenas, is low and wooded, and terminates in a dry ledge outside of a white sand beach.

To anchor southward of Point Arenas, steer for the warehouse on a 64° true (ENE mag.) course, and anchor when about ¾ mile from it, with Point Boca Quebrada bearing 131° true (SE mag.), in 30 feet of water.

Mosquito Landing, 3½ miles eastward of Point Arenas, consists of a few small houses on the beach, and a sugar mill a little westward. The beach is a hard sand, and boats can generally land. For a distance of ½ to ⅝ mile off the landing the bottom is irregular with

depths of 6 to 12 feet, and the 6-fathom curve is about 1 mile from shore. Coasting steamers occasionally anchor off the landing to load sugar.

Mosquito Reef.—During ordinary weather there is a fairly smooth anchorage ¼ mile south of Mosquito Reef, in 6½ fathoms, sandy bottom. There are a number of spots with 14 to 17 feet in the approaches to the anchorage, and vessels of a greater draft than 12 feet should not use it without local knowledge.

VIEQUES SOUND

extends from the east coast of Porto Rico to Virgin Passage, between Cordilleras, Hermanos, and Barriles reefs and Culebra Island on the north, and Vieques Island on the south. It has a length of 20 to 22 miles east and west, and a width of 8 to 15 miles north and south. The eastern part of the sound is clear, with the exception of Grampus Shoals, and has general depths of 10 to 17 fathoms. The western part has numerous shoals and reefs, some of which lie some distance from shore.

With a heavy sea outside, vessels from San Juan bound to Culebra Island or St. Thomas frequently enter through San Juan Passage and go through Vieques Sound, thus taking advantage of comparatively smooth water; this route is good for vessels of any draft. The route along the east coast of Porto Rico has a depth of 28 feet, and is used by vessels of 22 feet or less draft when coasting around the island; sailing directions for this passage are given on page 70. Large deep-draft vessels, bound from San Juan to the south coast of Porto Rico, enter through San Juan Passage, pass through Vieques Sound, and around East Point of Vieques Island. Vessels from northeastward, bound for the southeast or south coasts of Porto Rico, usually go through Virgin Passage and south of Vieques Island; but, entering from Virgin Passage or through Barriles Passage, the route through Vieques Sound and Vieques Passage has a depth of 30 or 31 feet, and may be taken in the daytime by vessels of 24 feet or less draft.

Anchorages.—The best anchorages in Vieques Sound for large, deep-draft vessels are Fajardo Roads, between Palominos Island and Cape San Juan, and the anchorage between Southwest Cay and Culebra Island. These are easy of access for both steamers and sailing vessels. There is no desirable anchorage on the south side of Vieques Sound; Port Mulas is an exposed roadstead, and is used only by vessels which call to discharge or load. Ensenada Honda, on the east coast of Porto Rico, is a good harbor, but is of no commercial importance and little used. These anchorages are described elsewhere in this volume.

Port of entry.—San Juan is the port of entry for Porto Rico. The subports for Vieques Sound are Playa de Fajardo for Culebra Island and Playa de Humacao for Vieques Island.

Supplies.—Some provisions can be had at Fajardo and Port Mulas. Good fresh water can not be conveniently obtained in Vieques Sound. Provisions, water, ice, and ship chandler's stores can be had at San Juan and Ponce, and coal and fuel oil at San Juan.

Repairs.—Ordinary repairs to machinery can be made at San Juan and Ponce. The nearest dock for vessels is at St. Thomas.

Communication by telegraph may be had at Fajardo and Port Mulas, and by wireless telegraph with San Juan.

For winds, tides, currents, variation of the compass, and other general information, see pages 23 to 31.

Islands and shoals.—Palominos Island, 3½ miles southeastward of Cape San Juan, is ½ mile long north and south, 165 feet high, and shows as a smoothly rounded, grassy hill, somewhat flat on top. The northwest point of the island is narrow, rocky, and low where it joins the island. A reef, partly bare at low water, extends 250 yards off the north side of the point, and a shoal extends to a distance of ¼ mile north from the point. Reefs extend 600 yards westward from the south end of the island, and southward to Little Palominos. Shoals, with little water and steep-to, extend ½ mile eastward from Palominos and Little Palominos islands.

There is a smooth anchorage for small vessels during ordinary weather on the west side of the northern part of Palominos. A good berth is with the northwest point bearing north, distant 350 to 400 yards, the low neck where the point joins the island bearing northeast and the south end of the first sand beach south of the neck bearing east, in 6 to 7 fathoms, sandy bottom. Care should be taken to give the shore a berth of over 200 yards and to avoid two rocks, with 4 and 5 feet of water on them, which lie 350 and 500 yards from the island.

Little Palominos Island is low, sandy, and partly covered with a scrubby growth. It is surrounded with shoals to a distance of about 400 yards.

Largo Shoals are narrow ridges 1¾ miles long in a general north and south direction, and steep-to on all sides. The southern end of the shoals lies 1⅞ miles east-southeastward from Ramos Cay, and the northern end 1 mile west-southwestward from Little Palominos Island. The southern half of the shoals is awash at low water, and the sea always breaks on it; the northern half has depths of 5 to 15 feet, and the sea rarely breaks on it. The line of Mount Pirata on Vieques Island and the summit of Cabeza de Perro leads about ¼ mile westward of the shoals. At night the breakers show as a line of white and are easily distinguished.

Blake Shoal, with a least depth of 21 feet, lies 1¾ to 2¼ miles eastward from Palominos Island, and ⅞ to 1¼ miles southward from Diablo Cay. It is marked by two buoys, a red nun at its north end and a black can at its south end. The line of the north side of Palominos Island and the high hill on Cape San Juan southward of the lighthouse, bearing 278° true (W by N mag.) leads close northward of the shoal, and the southern high head of Palominos Island in line with the same high hill, bearing 285° true (WNW ⅜ W mag.) leads southward of it.

A shoal area, 1¼ miles long east and west, lies southward of Largo Shoals. There are spots on this area with 26 feet, and a least depth of 23 feet was found at its western end. The line of Mount Pirata and the eastern end of Cabeza de Perro leads westward of it. The western extremity is marked by a can buoy.

Lavandera Rocks.—West Lavandera, nearly 1¼ miles northeastward from the eastern end of Cabeza de Perro, consists of two rocks, close together, about 1 foot above high water, and on which the sea always

breaks. It is near the middle of the west side of a shoal about 7/8 mile long and 1/4 to 3/8 mile wide, with depths of 14 to 17 feet, but a rock with 4 1/2 feet was found 400 yards north of West Lavandera. A narrow shoal, marked by a can buoy, with 21 feet of water on it, lies 3/8 to 3/4 mile northwestward from West Lavandera. East Lavandera Rock, awash at low water and on which the sea always breaks, lies 1 1/8 miles eastward from West Lavandera and 1/2 mile west-southwestward from Inner Piraguas Rock. A shoal with 17 to 23 feet of water extends 1/4 mile northward from East Lavandera.

Inner Piraguas Rock, lying 1/2 mile east-northeastward from East Lavandera Rock and 2 3/4 miles east-northeastward from Cabeza de Perro, is an irregular rock 15 feet high, which shows as two rocks, close together, connected by a ledge above water. Vessels should keep northward of the rock and give it a berth of over 300 yards.

Outer Piraguas Rock, lying 1 1/4 miles westward from Inner Piraguas Rock, is a pinnacle 15 feet high, with a rock awash about 60 yards southeastward of it. Vessels should pass eastward and northward of the rock, giving it a berth of over 200 yards.

North Chinchorro Shoal is a narrow ridge with 11 feet of water on it lying 5/8 to 1 1/2 miles southward from Outer Piraguas Rock.

South Chinchorro Shoal lies 1 3/4 to 2 5/8 miles southward from Outer Piraguas Rock. There is a patch awash at low water near the middle of the shoal on which the sea always breaks.

A broken line of shoals with 20 to 28 feet of water extends southward from South Chinchorro Shoal. The southern end of these shoals is marked by a nun buoy lying 6 miles 184° true (S 5/8 W mag.) from Outer Piraguas Rock.

Hodgkins Shoal is a narrow ridge 1 1/4 miles long north and south, and has a least depth of 28 feet. This depth lies 2 miles east-southeastward from Outer Piraguas Rock.

Descubridor Rock or Shoal, 1 1/2 miles eastward from Cabeza de Perro, is 3/8 mile long north and south. It has depths of 16 to 20 feet, but a depth of 6 feet is reported.

A shoal, with a least depth of 9 feet, lies 1 5/8 miles 148° true (SSE 1/2 E mag.) from the eastern end of Cabeza de Perro. It is about 600 yards long north and south and is marked at its north end by a black gas buoy (flashing white). A shoal with 11 feet of water on it lies nearly 1/2 mile northeastward, and another with 9 feet of water lies about 1/2 mile east-southeastward from the buoy.

A small patch with 24 feet of water lies 1 3/4 miles south-southeastward from the eastern end of Cabras Island, and 1 5/8 miles northeastward from the gas buoy off Arenas Bank.

Arenas Bank is a continuation northwestward of a shoal which fringes the north side of Vieques Island to a distance of about 1 mile nearly eastward to Port Mulas. The western edge of the shoaler part of the bank extends 3 1/4 miles north-northwestward from Point Arenas to its outer end, where it is marked by a gas buoy (occulting white). There are spots with depths of 5 feet on the bank for 3/4 mile northward of Point Arenas, and thence to the gas buoy the depths are 9 to 12 feet. For a distance of 1 1/2 miles inside the buoy the bank is steep-to with about 7 fathoms on both sides. The 4-fathom curve on the west side of the bank extends nearly 2 miles northwestward from Point Boca Quebrada, and then extends north-

ward to the gas buoy. The bank sometimes shows by discolored water and rips. The line of Point Puerca and the east end of Pineros Island bearing 21° true (NNE¼ E mag.) leads ⅜ mile westward of the gas buoy and the end of the bank.

EAST COAST OF PORTO RICO.

Cape San Juan (see fig. 2), the northeast point of Porto Rico, is a hill 220 feet high, on the summit of which is Cape San Juan lighthouse (cylindrical tower on front of blue rectangular dwelling). The light is a group flashing white, two flashes every 20 sceonds. From the lighthouse the cape slopes northward for ⅜ mile, and terminates at the sea in bluffs about 100 feet high. The north side of the cape is steep-to, but eastward of the lighthouse the 5-fathom curve is about ¼ mile from shore.

Playa Cuaba lies ¼ mile southeastward of Cape San Juan lighthouse back of a narrow break in the fringing reef, where boats can land in good weather. The houses of this village show to the eastward.

There is a small cove ⅜ mile northward of Point Gorda which affords a shelter and landing place for boats. The entrance, between reefs, is narrow and near the north side of the cove. **Playa Canalejo** is at the head of the cove.

Point Gorda, 1½ miles southward from Cape San Juan, is a prominent high head, mostly cleared. A hill 360 feet high lies ⅜ mile westnorthwest from the point; it is the northern end and highest part of a high ridge, mostly cleared, which extends southwestward nearly to Playa de Fajardo.

Point Bateria, ⅝ mile northward of Playa de Fajardo, is a black rocky cliff, 70 feet high, from which a grassy ridge makes inland. Inside of Point Bateria is **Playa Sardinera.**

Laja Shoal, with depths of 7 to 10 feet, lies ½ mile southeastward from Point Gorda. It is marked by two buoys—a black can at its northern end and a red nun at its southern end. A shoal with 25 to 28 feet of water over it extends ⅜ mile northward of Laja Shoal, and lies 600 to 800 yards eastward of Point Gorda.

Zancudo Cay is the southern, and **Obispo Cay** the northern of the two islands forming the east side of Fajardo Harbor. Each one is about 300 yards in diameter, low, and covered with mangroves and palm trees. They are about 200 yards apart, and are surrounded with reefs to a distance of 250 yards or more. **Mata Caballos Reef** extends ¼ mile southwestward from Zancudo Cay; **Corona Carrillo,** ⅜ mile southeastward from the south point of Zancudo Cay, is a reef 200 yards in diameter, from which a shoal with 13 to 17 feet extends 350 yards southward; and **Roncador Reef** lies ⅜ mile east-northeastward from Obispo Cay. These reefs have a few bare heads in places, and the sea always breaks on them. A shoal with 17 feet of water lies 250 yards eastward of it. A spot with 15 feet of water lies 250 yards northward of Roncador Reef, and nearly ⅜ mile northeastward from the northwest end of Obispo Cay; the spot is marked by a can buoy.

A reef extends nearly 300 yards northward and westward of Obispo Cay. A small spot with 11 feet lies 300 yards westward from the southwest point of Obispo Cay, and is marked by a red and black can buoy.

River Shoal (Bajo del Rio) is the local name for the bank, with little water, which makes off ¼ mile from Point Fajardo, Fajardo River, and the shore to the southward. The water deepens very gradually northward of the shoal, but its eastern side is nearly steep-to in places.

FAJARDO HARBOR AND ROADS.

Fajardo Harbor lies on the east coast of Porto Rico, about 3 miles southward of Cape San Juan. It affords good shelter for vessels of about 17 feet or less draft; deeper draft vessels can anchor at the entrance to or a little northward of the harbor in 24 to 28 feet, and there is not much sea during ordinary weather. The deepest draft of the vessels calling at the port to discharge or load is about 21 feet. The harbor is about ½ mile in diameter, and is formed on the east by Obispo and Zancudo cays and the reefs surrounding them.

Fajardo Roads is the name applied to the northwestern end of Vieques Sound between Cape San Juan and Palominos Island. Vessels of the deepest draft can find good anchorage here during ordinary weather. The general depths are 7 to 10 fathoms, except westward of the line of Mount Pirata and the summit of Cabeza de Perro, and southward of a 296° true (NW by W ½ W) line from the south end of Palominos Island to the broad, low hill (break in southern slope) ⅝ mile southward of Cape San Juan lighthouse, where there are numerous spots with 24 to 30 feet.

Playa de Fajardo, the village on the south side of the harbor, has a population of 1,007, and is a subport of entry. There are landings for small boats, and ordinarily little surf except with northeasterly or northerly winds. A road leads to Fajardo, a town of 6,571 population, 1½ miles inland. There is a highway to San Juan, and another southward and westward, near the coast, to Ponce. Automobile busses maintain a regular schedule to San Juan and there is railroad communication through Fajardo between Mameyes and Naguabo.

Prominent features.—The customhouse is a two-story-and-gable blue building, with red roof, and the largest in the playa, near its western end. There is a high, reddish bluff, with a scattered growth of scrub on its face, just westward of the playa.

A little over ¼ mile northwestward of Point Bateria there is a flat-topped house, back of which there is a division line or hedge of trees running up to the top of the hill. The line of these trees, 271° true (W ¼ N mag.), leads a little northward of the buoy on the south side of the passage southward of Laja Shoal, and is a useful guide in entering the harbor from eastward.

Iron stacks of a sugar central between Playa Fajardo and Fajardo show up prominently when south of the line Point Fajardo and Zancudo Cay.

Channels.—The principal entrance is from northward or northeastward, on either side of Laja Shoal. There is a channel into the harbor from southward, inside Ramos Cay and the reefs between it and Zancudo Cay, with a depth of about 17 feet, but it is rarely used except by small local craft.

Approaching from westward along the north coast of Porto Rico, steamers usually enter through San Juan Passage, but Cucaracha Passage is better for sailing vessels with the prevailing winds. From

eastward, the best passage is on either side of Blake Shoal and between Cordilleras Reefs and Palominos Island. These passages are good for vessels of any draft. From Port Mulas, the most direct route is northeastward of Outer Piraguas Rock, and thence between Little Palominos Island and Largo Shoals; this passage has spots with 27 feet of water. From southward, the passage around Cabeza de Perro and eastward of Ramos Cay has a depth of 28 feet.

A pilot can be obtained from Playa de Fajardo.

Anchorage.—The usual anchorage is about ¼ mile from the western side of the harbor, and from ⅜ to ⅝ mile northward of the playa, in 15 to 24 feet of water, according to draft. An anchorage, convenient to the playa, for vessels of 12 feet or less draft, is in the deeper channel southwestward of Obispo Cay. Vessels, seeking anchorage only, sometimes anchor ¼ to ⅜ mile from the shore northeastward of Point Bateria, in 4½ to 6 fathoms.

Directions.—Vessels entering from the northward after passing through San Juan Passage or Cucaracha Passage as directed on pages 44 or 70 should pass ⅜ to ½ mile eastward of Cape San Juan, and steer 187° true (S by W mag.). When the high reddish bluff westward of Playa de Fajardo bears 210° true (SW by S mag.) and is in line with a high grassy hill (small clump of trees on top, apparently highest hill in that direction), steer this course which should lead nearly ⅜ mile off Point Gorda and about 400 yards westward of Laja Shoal buoys. Anchorage may be had with the customhouse bearing 206° true (SSW ⅝ W mag.), distance ⅝ to ⅜ mile, according to draft. Vessels of 12 feet or less draft may proceed to an inner anchorage by bringing Point Fajardo in line with the prominent point of mangroves southward of it, bearing 184° true (S ¾ W mag.) and steering in on this range until 100 yards westward of the red and black can buoy. Then steer about 145° true (SSE ¾ E mag.) and anchor about 300 yards south-southeastward of the buoy, with the north end of Palominos Island open a little northward of Zancudo Cay, in 19 to 20 feet of water.

From Eastward.—Having come from the eastward to a position ½ to ¾ mile northward of the northwest point of Palominos Island, steer about 250° true (WSW ½ W mag.), heading for Point Bateria, and pass between the red nun buoy on the south end of Laja Shoal and the black can buoy 600 yards southward of it. Pass about ¼ mile northward of Obispo Cay, and anchor as directed in the preceding paragraph.

If coming from the southward of Palominos, pass southward of Little Palominos Island ½ mile distance, on a course 310° true (NW mag.) heading for a broad, low hill (break in its southern slope) on Cape San Juan midway between the lighthouse and the high hill southward of it, and when the southern high head of Palominos Island bears 91° true (E ½ S mag.), steer 271° true (W ½ N mag.), heading for the division line, or row of trees on the shore to the westward. Stand in on this line, going nothing to the southward of it, and pass northward of can buoy No. 1 and southward of Laja Shoal buoys. Pass about ¼ mile northward of Obispo Cay and anchor as directed in the preceding paragraph.

From Southward.—Eastward of Ramos Cay. Having come from the southward to a position 1 mile eastward of Ramos Cay, steer 340°

true (N by W ⅜ W mag.), heading for Cape San Juan lighthouse until the division line or row of trees mentioned in the preceding paragraph bears 271° true (W ½ N mag.) and the high head of Palominos Island bears 91° true (E ½ S mag.). Then stand in on this line, guided by the directions in the preceding paragraph.

Westward of Ramos Cay. This passage is seldom used by vessels. It has a depth of 17 feet, but is only 200 yards wide in its narrowest part. These directions, if closely followed, are good for vessels of 12 feet or less draft.

When up with Cabeza de Perro, pass ¼ mile northeastward of it. Then steer 322° true (NW by N mag.) for 4¼ miles, and pass ¼ mile westward of Ramos Cay. Continue the course until the eastern end of Point Fajardo (low and sandy; trees and houses show a little back from its end) is in line with the high bluff, Point Bateria, bearing 292° true (N by W ¾ W mag.). Then steer this course until the west side of Obispo Cay is in line with Cape San Juan lighthouse, bearing 1° true (N ⅜ E mag.). Then steer the latter course until the west end of Ramos Cay is in line with the summit of Cabeza de Perro, bearing 152° true (SSE ⅛ E mag.). Then steer 332° true (NNW ⅛ W mag.), keeping the range astern, which leads about 100 yards westward of the buoy westward of Obispo Cay. Anchorage can be made about 300 yards south-southeastward from the buoy.

Romos Cay, ⅞ mile eastward from Point Barrancas, is 400 yards in diameter and covered with palm trees except on its summit, which is a grassy knoll 35 feet high. A reef surrounds the cay to distances of 200 to 300 yards. A shoal, with depths of 23 feet and marked by a buoy, lies ½ mile east-southeastward from the cay.

A reef lies between Romos and Zancudo cays and from ½ to ⅜ mile from shore, and is ¾ mile long in a north and south direction. There is a passage into Fajardo Harbor from southward, passing westward of Ramos Cay and this reef, about 200 yards wide in its narrowest parts with a depth of 17 feet, which has been described in the sailing directions for Fajardo Harbor.

Point Barrancas, 1¼ miles southward of Point Fajardo, is a prominent, small, red bluff. The hills westward of the point are mostly grass covered and 430 to 460 feet high. A reef, bare at low water, extends ⅜ mile eastward from the point, and thence northward to Point Fajardo a shoal makes out 400 to 500 yards from shore.

Point Mata Redonda, just southward of Point Barrancas, is low. A brush-covered bluff lies ¼ to ½ mile southward of it; behind the bluff the land rises sharply to a hill 300 feet high and wooded on top. A reef, bare at low water, extends ¼ mile eastward from the point.

Majagua Bay, between Point Mata Redonda and Point Figuera, is shoal and open to the eastward. A narrow spit with a least depth of 23 feet, makes off about 1½ miles to the eastward from the center of the bay.

Points Figuera and **Figuerita,** 1⅜ and 1¾ miles southward of Point Mata Redonda, are low and wooded. A reef with little water over it extends ⅜ mile eastward of Point Figuerita; a shoal with 15 feet of water lies 1½ miles northeastward of Point Figuera, and another shoal with 21 feet and marked by a nun buoy, lies 2 miles eastward of the same point.

Port Medio Mundo, between Point Medio Mundo and Point Figuerita, is shoal, open northward and eastward, and affords no shelter for vessels. Ceiba is a small settlement 1 mile westward of the port.

Point Medio Mundo, 3/8 mile westward of Pineros Island, is a prominent hill, 130 feet high, with a bluff at the water and lowland behind it. A shoal with 12 feet at its end extends 1/2 mile northward from the point.

Medio Mundo Passage, between Pineros Island and the shore from Point Puerca to Point Medio Mundo, is foul, but there is a narrow, crooked channel with a depth of 15 feet, suitable only for small craft with local knowledge. Pinerita Islet is a grass-covered rock 1/4 mile southward of Pineros Island.

Pineros Island, about 1 mile northward of Point Puerca, is wooded and 1 1/8 miles long east and west. There is a wooded hill 230 feet high near its middle, with a regular slope to its eastern end. On the west and north sides of the island there are a number of hummocks, and its northeast point is a rocky bluff.

Cabeza de Perro is a prominent wooded island close eastward of Pineros Island. It is a little over 1/4 mile long northeast and southwest, highest (100 feet) in its southwest part, and there is a slight saddle near its middle. Its northeast end is a rocky bluff, with a large detached bare rock close-to.

Point Puerca is a prominent, bold, wooded head, with a high, rocky bluff at the water. It is about 3/4 mile long, with lowland behind it, and is formed by two hills, the eastern one 200 feet high and wooded, the western one lower and grass-covered.

Puerca Bay makes westward about 3/4 mile on the south side of Point Puerca, and is about 1/2 mile wide. It is foul and affords little or no shelter. Cabritas Islet, near the southwest point at the entrance, is rounded, rocky, and covered with brush. A shoal, with 12 feet at its end, extends 600 yards eastward from the islet. A shoal extends nearly 1/4 mile off the south side, and another, partly awash, extends nearly 3/8 mile from the head of the bay.

Cabra de Tierra is the southernmost point of a low neck, 1 mile long and covered with mangroves, which separates Ensenada Honda from Puerca Bay. The point is rocky, 35 feet high, has a few scrubby trees, and some palm trees a little northward of it.

Cabras Island, 600 yards eastward of Cabra de Tierra, is 3/8 mile long east and west, and wooded. It is highest (70 feet) toward its western end and low in the middle, and there is a rocky bluff at its eastern end. The passage westward of the island has a depth of 4 to 5 feet. A fixed white light is exhibited from a gray tower, situated near the eastern point of Cabras Island.

Ensenada Honda is a good harbor but little used. The entrance lies between Cabra de Tierra on the east and Point Cascajo on the west, a distance of 1 mile. It is about 1 mile in extent and is protected by reefs which contract the entrance to about 600 yards in width, with an entrance depth of 20 to 30 feet. The harbor is easy of access in the day time for steamers or sailing vessels; with the wind northward of east sailing vessels will have no difficulty in leaving the harbor. **Aguas Claras River** flows into the northern part of the bay.

Dangers.—A shoal with 17 feet at its end extends 1 mile southeastward from Point Cascajo. There is a dry reef about 250 yards from the point; the general depths on the shoal outside the reef are 12 to 16 feet. A detached shoal with 17 feet outside this shoal is marked by a can buoy. The line of the eastern ends of Cabras and Cabeza de Perro islands leads eastward of the shoal.

A shoal surrounds Cabra de Tierra to a distance of 350 yards, and extends the same distance off the western side of the point. A nun buoy marks the southern edge of the shoal. The bight, between Cabra de Tierra and the partly-cleared hill 7/8 mile northward of it, is shoal to a distance of 3/8 mile from its head; and shoals extend about 400 yards from the shore at and a little northward of the hill.

A shoal, with 10 to 12 feet of water on its outer part, extends 1/2 mile northeastward from Point Cascajo. There is a detached rock with 17 feet outside this shoal, and 5/8 mile west-northwestward from Cabra de Tierra. A can buoy marks its eastern edge.

The northwest part of the harbor is foul for a distance of 5/8 mile from shore, there being as little as 2 feet of water on numerous shoals.

Directions.—When off the entrance steer for Cabra de Tierra on a 333° true (NNW 1/8 W mag.) course until Point Puerca is in line with the east end of Cabras Island, then steer 313° true (NW 1/8 N mag.) so as to pass about 1/4 mile southwestward of Cabra de Tierra and avoiding the 17-foot spot on the western side of the channel marked by the can buoy.

Point Cascajo, the western point at the entrance to Ensenada Honda, is 70 feet high and cleared, but there is a fringe of trees at the water. There are rocky cliffs on the south side of the point, and a bare reef about 250 yards off its southeast side.

Point Algodones, 3 miles east-northeast from Point Lima, is high and partly wooded.

Algodones Cay, near the middle of the north side of Algodones Bay, is small and grass covered. Its southeast side is a rocky bluff, 40 feet high; its northwest end is low. There is a group of prominent hills northward of the cay, with low land east and west of them.

Algodones Bay is 2 1/2 miles wide between Point Lima and Point Algodones. It is of no importance, either commercially or as an anchorage, and should be avoided by vessels of any size. There are numerous shoals in the bay, with depths of 13 to 17 feet, which extend 2 miles off; the southernmost, with 15 feet, lies 2 miles east-southeastward from Point Lima, and shoals with 21 to 23 feet extend 1 1/2 miles farther southwestward.

Point Lima is projecting and prominent. It is a rounded, wooded hill, 262 feet high, with a low neck of land behind it. Lima Reef, 1/2 mile eastward from the point, is 300 yards in diameter, has little water over it, and the sea often breaks on it.

Port Naguabo is at the northern end of the open bay included between Santiago Cay and Point Lima. It is easily entered, and affords good anchorage for vessels of about 18 feet or less draft except with southeasterly or southerly winds. The depths in the bay range from 30 feet in the entrance to 18 feet about 3/8 mile off Playa de Naguabo.

A spot with 15 feet lies ¾ mile east-northeastward from the northeast end of Santiago Cay, and a shoal with a depth of 16½ feet lies from 1¼ to 1½ miles eastward, from the south end of the cay. The north side of the bay, from Point Lima to a little westward of Playa de Naguabo, is high, with a number of bluff, rocky points. The northwest side is low and covered with palm trees.

To enter Port Naguabo, steer for the summit of Point Lima on any bearing between 338° true (N by W ⅝ W mag.) and 22° true (NNE ¼ E mag.) until about 1 mile from it, and haul westward and follow the shore at a distance of ½ to 1 mile. When the deep valley making in from Playa de Naguabo bears 341° true (N by W ¼ W mag.), steer for it and anchor on this line according to draft, allowing about 6 feet under the bottom.

Playa de Naguabo is a small town on the north side of Port Naguabo, 1½ miles westward of Point Lima. The buildings of the town show up well to seaward. A road leads inland to **Naguabo**, a post village, 1½ miles northwestward, which has communication by telegraph, and is on the road between Humacao and Fajardo. It is also the terminus of the railroad from Mameyes through Fajardo.

Santiago Cay lies 2½ miles southwestward from Point Lima and ⅝ mile southeastward of Playa de Humacao. It is 600 yards long north and south, and about 100 feet high near its southern end. The north end of the cay is low, and is joined by a low neck to a rocky knob, over 60 feet high, eastward of it. There is deep water fairly close to the cay, but surrounding it at a distance of 1 mile are a number of spots with 16 to 18 feet. A shoal extends from the cay to Playa de Humacao; it has 10 feet of water over it near the playa, and very little near the cay.

Port Humacao, on the west side of Santiago Cay, is of some commercial importance, and affords a good anchorage for vessels of 16 feet or less draft except with southeasterly or southerly winds. The port is exposed southeastward and southward, and a heavy sea sometimes makes in with southeasterly winds. The deepest draft of the vessels calling at the port is about 18 feet. The anchorage for vessels of 16 feet or less draft is westward of Santiago Cay, between Evelyn Shoal and Playa de Humacao, in 18 to 22 feet of water.

Playa de Humacao is a post village on the beach northwestward of Santiago Cay, and is the subport of entry for Naguabo, Humacao, Yabucoa, and Vieques Island. The landing is on a flat sand beach, and the surf is usually light except with southeast winds. The water supply is from cisterns, and there is none for vessels. There are highways to Humacao and Naguabo.

Humacao is an inland town about 6 statute miles westward of the playa, and is the principal town in this part of Porto Rico. It has a population of 6,183. There is communication by telegraph and telephone to all parts of the island. The town is on the highway which connects the principal towns near the coast, and another highway leads inland to the road across the island between San Juan and Ponce.

Dangers.—Evelyn Shoal, with a depth of 16 feet, is small, and is marked by a can buoy on its western side, lying ⅜ mile westward from the southern point of Santiago Cay. **Parse Shoal**, with a depth

of 16 feet, lies 7/8 mile southward from Santiago Cay. It is marked off its western side by a nun buoy and its eastern side by a can buoy. A shoal, with 16½ feet of water, marked by a nun buoy off its western end, lies 1½ miles from the same cay. There are other shoals the positions of which can be best understood by reference to the chart.

A pilot for the port can be obtained from the playa.

DIRECTIONS.—Vessels entering Port Humacao steer for the west end of Santiago Cay on a 353° true (N ¼ W mag.) course until up to Parse Shoal east side buoy. Pass close eastward of the buoy and steer for the customhouse (large, yellow, flat-topped building) on a 337° true (N by W ¾ mag.) course, which will lead in depths of 21 feet, and pass 100 yards eastward of Evelyn Shoal buoy. Anchor with the northwest point of Santiago Cay just touching the southern end of Point Lima. Vessels if loading to more than 18 feet draft usually drop outside of Evelyn Shoal buoy and anchor with Cabras Island lighthouse showing a little outside of the southern part of Santiago Cay. Loaded vessels leaving Port Humacao should pass westward of Parse Shoal nun buoy, on account of the deeper water in this channel.

El Morrillo, 1¾ miles northward of Morro de Humacao, is a prominent, small hill, about 100 feet high, which rises abruptly from the water and the lowland around it.

Morro de Humacao, 3½ miles southwestward of Santiago Cay, is a prominent, bluff, rocky point, 100 feet high, with higher land a short distance westward. **Batata Cay**, grass-covered and about 40 feet high, lies 3/8 mile eastward of Morro de Humacao, with depths of 13 to 19 feet between. A bare ledge lies 300 yards eastward of the cay, and a reef, awash and steep-to, extends 350 yards southward from them.

Point Candelero, 1½ miles southward of Morro de Humacao, is low and covered with brush and a few palm trees. The point is surrounded by a sunken reef and breakers, from which a shoal, with 17 feet of water at its end, extends nearly 3/8 mile south-southeastward, and another, with 8 to 15 feet of water, extends 5/8 mile northeastward from the point.

Point Fraile, 5/8 mile northward of Point Icacos, has a prominent, high, bare islet close-to. A reef, partly bare, extends ¼ mile eastward from the point to two large bare rocks with a number of smaller ones close-to.

Point Icacos, 1 mile northward of Point Guayanes, has a high, grass-covered rock close-to, which shows detached from the point when seen from southward. From Point Fraile to Point Guayanes, a distant of 1½ miles, the coast is high and rocky.

Point Guayanes, the north point of Port Yabucoa, is 360 feet high, covered with a scrubby growth, and has rocky bluffs at the water's edge.

Port Yabucoa is an open bay, 2 miles wide, with numerous reefs, sunken and awash. It is not a desirable anchorage and of little commercial importance. The anchorage is inside the reefs at the northern end of the bay and is a little over ¼ mile in diameter, with depths of 23 to 25 feet. It is exposed to southeasterly winds and sea. The

entrance is close to Point Guayanes and is about 100 yards wide and 20 feet deep, but it is not recommended for a draft of over 15 feet.

Playa Guayanes, lying along the north shore of Port Yabucoa, is a small town of 1,438 inhabitants. The warehouse and houses show up well to seaward. There is no water for vessels and the river water is polluted. A road leads to **Yabucoa,** a town and post office in the valley 3½ miles westward. It has communication by telegraph, and is on the highway between Maunabo and Humacao.

Dangers.—The entrance reef is about 350 yards in diameter, and its northern point, with 9 feet, is marked by a can buoy, which lies nearly 150 yards southward of Point Guayanes; there is a small patch, nearly awash and on which the sea often breaks, 200 yards southward of the buoy. A detached shoal with a depth of 16 feet lies ½ mile south-southeastward of the buoy. Another detached shoal, with 15 feet, lies 300 yards east-southeastward from the entrance can buoy, and one with 16 feet, marked by a can buoy "ILS," lies about ¼ mile eastward from the entrance buoy. The southern extension of the reefs making off Point Guayanes is marked by a nun buoy in a depth of 30 feet. A 17-foot spot lies very close to the center of the anchorage inside.

Point Quebrada Honda, 1⅛ miles northward of Point Yeguas, is the south point of Port Yabucoa. At ⅜ mile westward of the point there is a prominent hill, 479 feet high, the surface of which is strewn with large white bowlders.

Point Yeguas lies 1⅛ miles southward from Point Quebrada Honda. It is low with a rocky bluff at the end, but rises gradually in a smooth, grassy ridge which joins the eastern end of Panduras Ridge.

Toro Point, 1½ miles westward of Point Yeguas, is a spur 500 feet high from Panduras Ridge, which is 1 mile northward of the point and has elevations of 1,400 feet.

Point Tuna is 70 to 100 feet high, with cliffs at the water, and is marked near its end by a lighthouse. From the point the land rises in a distance of ½ mile to a prominent hill, 400 feet high and with some trees near the summit, which lies about 1 mile from the mountains north of it.

Sargent Reef is about 1¾ miles long in a northeast and southwest direction, and at Point Tuna is from ⅜ to ½ mile from shore. A small patch, nearly ¾ mile eastward from the lighthouse, is awash, from which the reef gradually deepens to 15 feet near its eastern end 1¼ miles eastward from the lighthouse. The depths on the southwestern part of the reef range from 12 feet a little southwestward of the patch awash to 17 feet at its end lying ⅝ mile southwestward from the lighthouse. The reef is steep-to on its seaward side. The break on the reef does not show well except when there is considerable sea, and there are parts of it on which the sea rarely breaks. The western end of the reef is marked by a nun buoy. There is a channel, with a least width of ¼ mile, between the reef and Point Tuna, but it is not recommended for strangers.

From Sargeant Reef a ridge with 22 feet of water over it extends east-northeastward, passes ⅝ mile off Toro Point, and ends ½ mile southward of Point Yeguas. This ridge forms the southern edge of the bank of soundings and is close to the 100-fathom curve.

DIRECTIONS, NORTH AND EAST COAST OF PORTO RICO AND VIEQUES SOUND.

GENERAL REMARKS ON APPROACHING AND STANDING ALONG THE NORTH COAST OF PORTO RICO.

Approaching Porto Rico from northward, there are few natural landmarks that can be identified by a stranger. The lighthouses at Cape San Juan, San Juan Harbor, Arecibo, and Point Borinquen are unmistakable. The higher mountains of Porto Rico are nearer the southern side of the island, and while they will be seen in the daytime with clear weather, they can not be identified so as to be used as landmarks. Luquillo Mountains, in the northeast corner of the island, will sometimes be sighted at a distance, but they are often obscured by clouds and rain squalls.

San Juan Harbor, the usual point of destination, has a few distinctive marks which may be recognized at a distance. When within 15 miles or so of the island, if west of the longitude of San Juan, there will be sighted a continuous line of sharp conical hills, which occur in remarkable numbers west of San Juan and extend to Point Borinquen, but do not extend east of San Juan. On approaching San Juan, a prominent black water tank and radio towers will be made out when well offshore and when closer in the gray and yellow walls of Morro Castle. At night the lighthouse on Morro Castle and the electric lights of San Juan will be seen as much as 18 miles in clear weather. A stranger should not attempt to enter San Juan Harbor at night. Sailing directions for San Juan Harbor are given under that heading.

While the trade wind is blowing freshly from eastward, the current so far as known has a slight westerly set with it; an allowance of ¼ mile an hour is sometimes made for this current. (See also the remarks on currents on p. 29.)

San Juan Harbor is the only harbor on the north coast. Vessels sometimes stop at Arecibo for a few hours to discharge or load. Small local craft also touch at other points along the north coast, but no definite information can be given of these places.

Deep water extends close to the north coast of the island in places, the 100-fathom curve being sometimes less than 1 mile from the breakers, and the lead is of little use at night as a guide to indicate danger or distance from the shore. Safety will be insured in the daytime by giving the coast a berth of 3 miles; at night vessels should keep farther offshore.

From Point Borinquen to San Juan Harbor Entrance.—From a position 3½ miles northward of Point Borinquen lighthouse a 92° true (E ½ S mag.) course made good for 58 miles will lead to a position 4 miles northward of Port San Juan lighthouse on Morro Castle.

To Virgin Passage.—From a position 4 miles northward of Port San Juan lighthouse a 100° true (ESE ¾ E mag.) course made good for 50 miles will lead to a position 4 miles northward of Northeast Cay, Culebra Island, then steer 126° true (SE ½ E mag.) heading for Sail Rock, for 7 miles; when Culebrita Island lighthouse bears 265° true (W mag.) the course may be shaped as desired through the Virgin Island Passage.

To Vieques Sound, through San Juan Passage.—From a position 4 miles northward of Port San Juan lighthouse make good a 100° true (ESE ¾ E mag.) course for 19 miles to a position where Point Miquillo bears 169° true (S ⅝ E mag.), distant 4 miles. From this position make good a 116° true (SE by E ⅜ E mag.) course heading between the Las Cucaraches light and Cape San Juan lighthouse to a position abeam of the latter, distant ⅝ mile. Then steer 124° true (SE ⅝ E mag.) to pass 350 yards southward of the can buoy on Blake Shoal.

1. **Bound to Culebra or St. Thomas.**—From the position southward of Blake Shoal steer 109° true (ESE mag.) to 1 mile south of Point Soldado and ½ mile southward of Grampus Shoal south buoy ("Grampus Shoal"). Then a 75° true (E by N mag.) course made good for 16½ miles will lead nearly 1½ miles southward of Sail Rock and to a position about 1 mile southward of St. Thomas Harbor entrance.

2. **Bound around East Point, Vieques Island.**—From Blake Shoal continue the 124° true (SE ⅝ E mag.) course to a position 1¼ miles north-northeastward of East Point.

3. **Bound to Port Mulas.**—From the position southward of Blake Shoal can buoy steer 156° true (S by E ¾ E mag.) for 11 miles, to ⅜ mile eastward of Outer Peraguas Rock and 1 mile eastward of Caballo Blanco, whence anchorage may be selected according to draft. (See "Anchorages, Port Mulas," p. 54.)

To Vieques Sound through Vieques Passage.—Having arrived at a point ¼ mile northward of Arenas Bank gas buoy, steer 90° true (E ⅜ S mag.) for 5 miles, heading for Caballo Blanco, to a position 100 yards southward of the red buoy off the southern extension of shoals from South Chinchorro Shoal. Then proceed as directed in paragraphs below.

1. **Bound for Port Mulas.**—The directions following lead near or over a 27-foot spot lying 700 yards southwestward from Caballo Blanco.

Steer for Caballo Blanco on a 90° true (E ⅜ S mag.) course until ¾ mile from it, and Martineau Hill, Vieques Island, bears 176° true (S mag.); the eastern end of the break on Corona Reef will then bear about south-southwest. Then steer for Point Mulas lighthouse on a 118° true (SE by E ⅛ E mag.) course, and select anchorage according to draft. (See "Anchorages," Port Mulas, p. 54.)

2. **Bound to Virgin Passage, passing southward of Grampus Shoal.**—From a position 200 yards southward of the red buoy lying 2⅞ miles westward from Caballo Blanco, steer 69° true (ENE ½ E mag.) for 3 miles to a position 1 mile northward of Caballo Blanco. Then make good an 80° true (E ½ N mag.) course for 15 miles to a position ½ mile southward of Grampus Shoals south buoy (red, "Grampus Shoals"). From this position a 75° true (E by N mag.) course made good for 16½ miles will lead nearly 1½ miles southward of Sail Rock and to a position about 1 mile southward of St. Thomas Harbor entrance.

Or, in passing Grampus Shoals, keep on or southward of the line of Sail Rock and Signal Hill, St. Thomas, until Palada Cays open from Cape Passage, Culebrita Island, bearing 328° true (NNW ½ W mag.); Grampus Shoals will then be cleared, and a course can be shaped northward through Virgin Passage.

3. **Bound to Virgin Passage, passing between Grampus Shoals and Culebrita Reefs.**—This passage is about ¾ mile wide and buoyed, and may be used in the daytime with good weather; with a heavy sea it is better to take the safer passage southward of Grampus Shoals.

From a position 200 yards southward of the red buoy lying 2⅞ miles westward from Caballo Blanco, steer 69° true (ENE ½ E mag.), passing 1 mile northward of Caballo Blanco; this course made good for a little over 15 miles from the buoy should lead to a position 1¼ miles southeastward of Point Soldado.

Then bring Point Soldado in line with the peak of Southwest Cay, bearing 305° true (NW ½ W mag.), and Point Negra in line with the summit of the hill (100 feet) on the western end of Culebrita Island, bearing 31° true (NE ⅞ N mag.). From this position steer 74° true (E by N mag.), heading for Signal Hill, St. Thomas Island, and pass about midway between Grampus Shoals north buoy (black, No. 1) and Culebrita Reef buoy (red, No. 2). When Palada Cays are open from Cape Passage, bearing 327° true (NNW ⅝ W mag.), all dangers are passed and the course may be shaped as desired. Or, follow the preceding directions until Cape Passage is in line with Palada Cays, and then bring Point Soldado astern on an 86° true (E mag.) course; this course if made good will lead ⅜ mile northward of Sail Rock, and ½ mile southward of the islands westward of St. Thomas Harbor.

The *tidal currents* set diagonally across the channel between Grampus Shoals and Culebrita Reefs.

From Virgin Passage bound westward, to pass between Grampus Shoals and Culebrita Reefs.—The line of Palada Cays just open from Cape Passage, bearing 327° true (NNW ⅝ W mag.), leads eastward of Grampus Shoals. Steer for Point Soldado on a 268° true (W ¼ N mag.) course with Sail Rock astern. When Culberita Island lighthouse bears 335° true (NW by W ⅞ W mag.), steer 254° true (W by S mag.) and pass about midway between Grampus Shoals north buoy and Culebrita Reef buoy (red, No. 2). When the peak of Southwest Cay opens westward of Point Soldado, all dangers are passed.

4. **Bound to Barriles Passage.**—From a position 200 yards southward of the red buoy lying 2⅞ miles westward from Caballo Blanco, steer 90° true (E ⅜ S mag.) for Caballo Blanco until 2 miles from it and ¾ mile eastward of the red buoy, and then steer 31° true (NE ⅞ N mag.) with Mount Pirata astern. This course made good for 11½ miles will lead through Barriles Passage ½ mile westward of Cactus Cay. From this position a 20° true (NNE ⅛ E mag.) course for 2½ miles will lead ½ mile westward of The Washer.

EAST COAST OF PORTO RICO—FROM CAPE SAN JUAN TO POINT TUNA.

These directions are for daylight and clear weather, and if closely followed will lead in a least depth of 28 feet. This passage is used by steamers of as much as 21 to 22 feet draft in coasting around Porto Rico. A stranger should not attempt the passage at night.

To enter through San Juan Passage, give the north shore of Porto Rico a berth of 3 or 4 miles, and when Cape San Juan light-

house bears 118° true (SE by E ⅛ E mag.) distance 12 to 15 miles, steer 116° true (SE by E ⅜ E mag.) and pass ¼ to ½ mile northward of the cape, heading in midway between Las Cucaraches light and Cape San Juan lighthouse. Or to enter through Cucaraches Passage from a position 3 miles 30° true (NE by N mag.) from Cape San Juan lighthouse steer 199° true (SSW ⅛ W mag.) through the middle of the passage, slightly favoring the eastern side if any; this course should lead ⅜ mile eastward of Cape San Juan.

Pass ⅜ to ½ mile eastward of Cape San Juan and steer 170° true (S ½ E mag.), keeping Mount Pirata, Vieques Island, midway in the opening between Pineros and Cabeza de Perro islands, and Las Cucaraches light dead astern. When abreast of Zancudo Cay, keep a little to the westward of the range, until abeam of Point Fajardo, to avoid a shoal with 24 to 25 feet on it. With Point Fajardo abeam steer 159° true (S by E ½ E mag.) heading for Cabeza de Perro gas buoy (flashing white) with Cape San Juan lighthouse dead astern, to a position with Cabeza de Perro bearing 270° true (W ⅜ N mag.), distant ½ mile. Then steer 180° true (S ⅜ W mag.), with Palominos Island dead astern, for 1⅝ miles and Cabeza de Perro is on range with Cape San Juan Lighthouse. Then bring Cabeza de Perro gas buoy astern on a 224° true (SW ¼ W mag.) course. Continue on this course until ⅝ mile north-northwestward of Arenas Bank gas buoy (occulting white). Then make good a 226° true (SW ½ W mag.) for 16 miles to a position 2 miles southeastward of Point Yeguas. Then steer 240° true (SW by W ¾ W mag.) for about 3¾ miles to a position 2 miles south-southeastward of Point Tuna lighthouse.

SOUTH COAST OF PORTO RICO.

A detailed description of parts of the south coast and the harbors is given under separate headings.

The mountains on the south side of the island between Cape Rojo and Jobos Harbor are 7 to 10 miles inland, and then incline toward the coast where they terminate between Cape Mala Pascua and Point Yeguas. Between the foothills of the mountains and the coast, there is generally lowland of varying widths up to 3 or 4 miles, but this does not show well from seaward until close in and the coast has generally a bold appearance. The different mountain peaks can not be easily identified by strangers, and the mountains are often obscured by clouds and haze.

On approaching or standing along the coast, however, there are numerous points which can be recognized and used for cross bearings. The best are Cape Rojo and Mariquita Hill at the southwest end of the island; Point Brea and Guanica entrance and lighthouse (see view under Guanica Harbor); Toro Hill and Point Ventana (see view under Guayanilla Harbor); a cliff 3¼ miles eastward of Point Guayanilla; Cardona Island lighthouse, visible 6 or 7 miles; municipal pier at Ponce; Muertos Island and lighthouse, visible about 20 miles and the best mark on the south coast; Point Petrona, Barca Islands, the twin hills near Aguirre Central, Point Ola Grande, and Point Figuras, all prominent from eastward and westward, but not from southward; Aguirre Central (sugar mill) and high light-brick stack; Cape Mala Pascua and Point Yeguas (see

view under Port Maunabo); and Vieques Island, the prominent features on which are Mount Pirata and Mount Jalobre.

At night no difficulty should be experienced by vessels approaching or standing along the south coast of the island, as the lights are numerous and can be readily distinguished. From Ponce westward to Cape Rojo and from Arroyo eastward to Port Yabucoa, the 100-fathom curve extends close to the reefs and the coast in places, and the lead is of little use at night as a guide to indicate danger or distance from the shore. Safety will be insured in the daytime by giving the coast and Muertos and Berberia islands a berth of 3 miles.

From Point Tuna to Point Viento the coast has fringing reefs close-to, and landing is difficult and often dangerous. A ridge, with depths of 6¼ to 8½ fathoms, and deeper water inside, follows the coast at distances of 1 to 1¼ miles from Guayama Reef to Sargent Reef. This ridge forms the southern edge of the bank of soundings, and is close to the 100-fathom curve.

Point Tuna is 70 to 100 feet high, with cliffs at the water, and is marked near its end by a lighthouse (white tower on square, flat roof dwelling). The light is a group flashing white (two flashes every 120 seconds). From the point the land rises in a distance of ½ mile to a prominent hill, 400 feet high and with some trees near the summit, which lies about 1 mile from the mountains north of it.

Port Maunabo is a small cove on the west side of Point Tuna. Steamers occasionally stop here to discharge or load, but the port affords little shelter from the prevailing southeast wind and sea, and is a poor anchorage. The cove indents the coast about ¼ mile, and has a depth of 24 feet, hard bottom, at its entrance, decreasing to 12 feet at 200 yards or less from its north side. There is a warehouse, with chute for loading lighters, on the eastern side at the head of the cove. There is always some swell and surf, but landing can generally be made on the sand beach southeastward of the warehouse.

Maunabo is a post village in the valley about 1 mile inland from the cove, and has communication by telegraph. There is a sugar mill a little westward of the village. There is a highway along the coast westward, and another to Yabucoa over the mountains northeastward.

Sailing Directions.—*From eastward.*—Pass 1 mile or more southward of Point Tuna lighthouse on a 268° true (W ¼ N mag.) course and when it bears about north-northeast, steer 291° true (NW by W ¾ W mag.). When the high hill ½ mile northward of the lighthouse is in line with the second peak from the eastward of Panduras Ridge (see view) stand in on this line, course 33° true (NE ¾ N mag.). On this course the warehouse at the head of the cove will be a little on the starboard bow. Anchor eastward of the range with the warehouse bearing between 21° true (NNE ¼ E mag.) and 32° true (NE ⅞ N mag.), in a depth 8 to 10 feet greater than the draft. Depths of 24 to 26 feet will be found between these bearings, and 400 to 500 yards from the northeast side of the cove, with Point Tuna lighthouse bearing between 77° true (E ¾ N mag.) and 82° true (E ⅜ N mag.).

From westward.—Pass 3 miles or more southward of Point Figuras lighthouse, and shape the course to pass about 1 mile southward of Cape Mala Pascua. When the high hill ½ mile northward of Point

Tuna lighthouse is in line with the second high peak from eastward of Panduras Ridge (see fig. 5) stand in on this line, course 33° true (NE ¾ N mag.). Anchor as directed in the preceding paragraph.

Maunabo River Valley is a low depression, which makes northwestward from Port Maunabo between the mountain ridge of Cape Mala Pascua and **Panduras Ridge**. The latter mountain range terminates at the coast, between Toro Point and Port Yabucoa.

Cape Mala Pascua, lying 3½ miles eastward of Point Viento, is the most prominent high headland on the south coast, and is formed by a mountain ridge which ends at the cape. From the water the cape rises with a steep slope to a peak 1,060 feet high, and peaks up to 1,610 feet high are found a little westward of it.

Point Viento, lying 3½ miles westward from Cape Mala Pascua, is low cane land, with a fringe of cocoanut trees and mangroves near the water. A reef extends ⅝ mile off the southwest side of the point; it is awash and nearly steep-to on its southern and western sides, and the sea always breaks on it.

A shoal, on which 21 feet was found, lies in the entrance nearly midway between the east end of Guayama Reef and the reef at Point Viento. It is marked by a nun buoy.

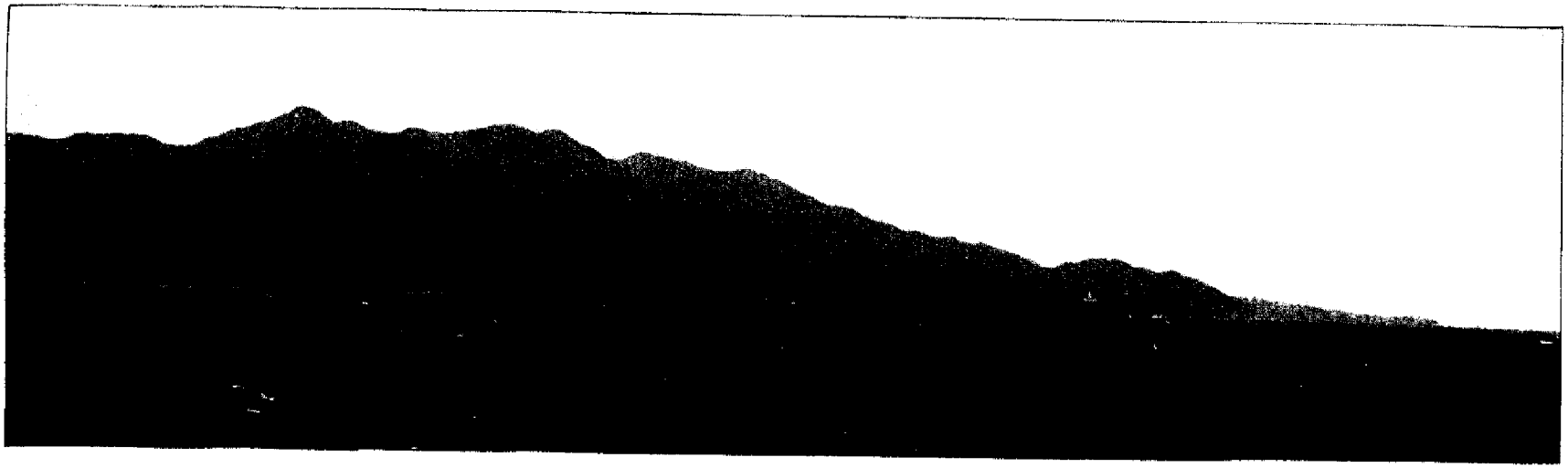
Point Guilarte is on the west side of Port Patillas nearly 1 mile northeastward of Point Figuras; Guilarte Shoal, consisting of lumps with 11 to 15 feet, extends ¾ mile east-southeastward from Point Guilarte. The southeast end of the shoal is marked by a red and black nun buoy surmounted by a ball.

Port Patillas, between Point Figuras and Point Viento, is an open bay 3½ miles wide. It is not a good anchorage and of no commercial importance, and vessels rarely have occasion to enter. Considerable sea generally makes into the bay, and there is little shelter except for small craft which can anchor in 7 to 8 feet of water close to Patillas Landing. Vessels can anchor with the red bluff westward of the landing bearing 21° true (NNE ¼ E mag.), distant ½ mile, and Point Viento bearing 100° true (ESE ¾ E mag.) in 24 feet of water. There is a lump with 10 feet over it 600 yards south-southwestward from the red bluff.

Patillas, with a population of 1,693, is a post village 1½ miles inland northward of the bay; it has communication by telegraph. **Patillas Landing** is a few houses on the northeast side of the bay. There are a prominent red warehouse, a small wharf, and a sugar mill with stack about ¾ mile northward from the landing, which can not be seen when bearing westward of about north.

Point Figuras is marked by a lighthouse (white octagonal tower and flat roof dwelling), which stands about 300 yards from its southern end. The light is fixed white. The point southward of the lighthouse has low brush and mangroves, but back of the lighthouse there are extensive groves of cocoanut trees which extend eastward and westward along shore. The point and lighthouse show well in approaching from eastward, but from southward and southwestward they blend with the shore and are made out with difficulty until close in.

Dangers.—Guayama Reef lies from 1 to 1½ miles off Point Figuras, and is nearly 3 miles long in an east-northeast and west-southwest direction. The line of Point Tuna light just open from Cape Mala



Port Maunabo. Pt. Tuna Lighthouse, NE. ¾ E., 2 miles, Toro Pt. Pt. Yeguas.

FIG. 5. PORT MAUNABO TO POINT YEGUAS.

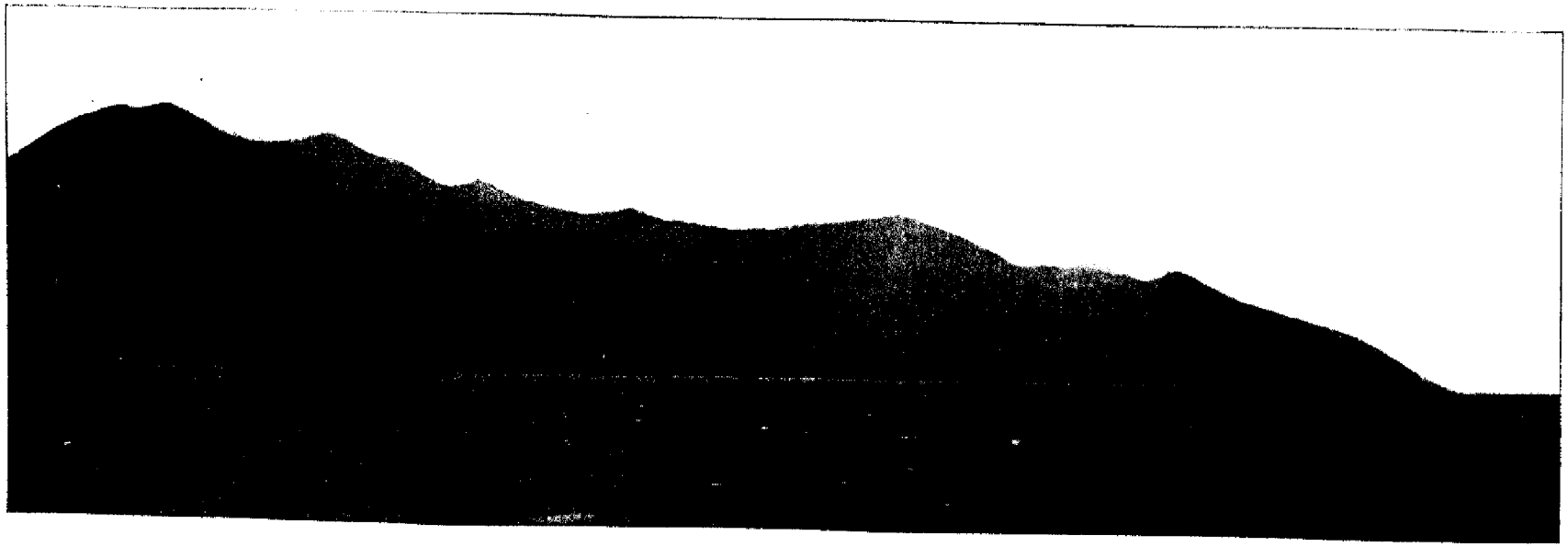
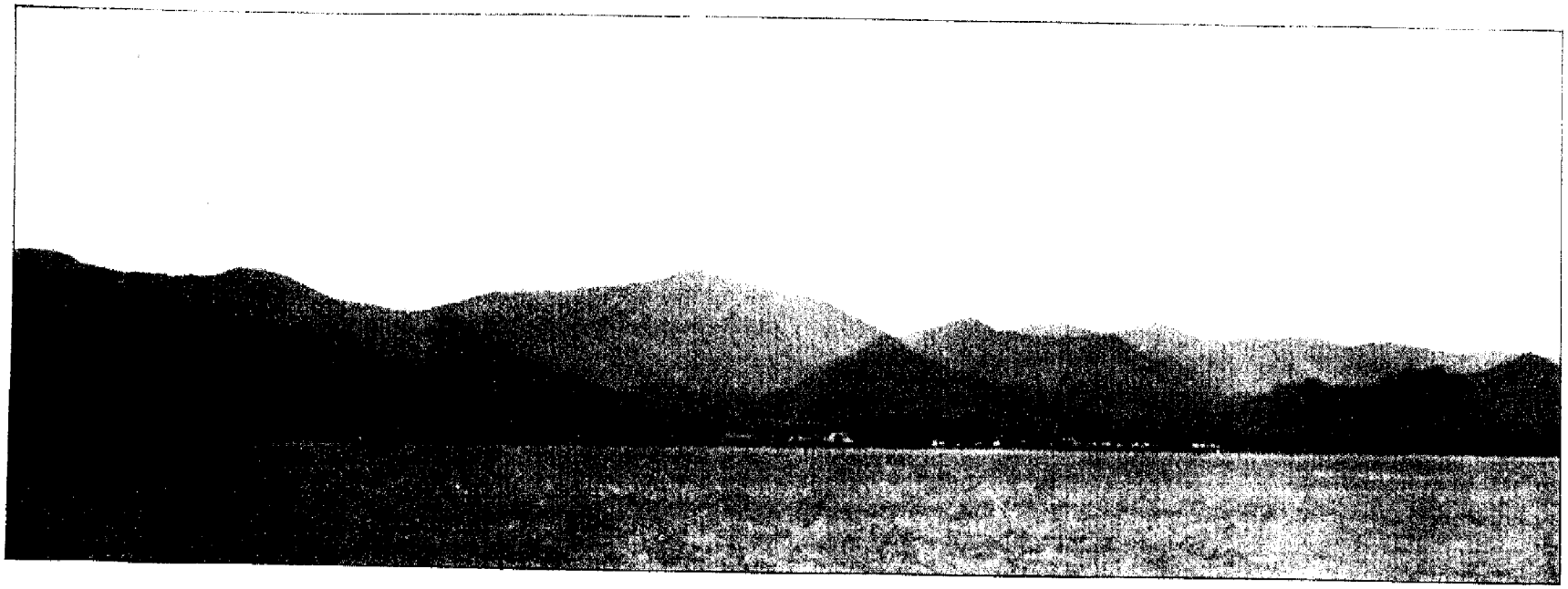


FIG. 6. CAPE MALA PASCUA, FROM WESTWARD. Cape Mala Pascua, ENE., 4 miles.

Serial No. 164.



Range Hill and Stacks, N. by E. ½ E.

FIG. 7.—ARROYO.

Pascua, passes close to the south edge of the reef. The 100 fathom curve is close to the south side of the reef, and it is dangerous to approach. Its eastern part is awash, and the sea always breaks on it; a shoal with depths of 25 to 28 feet extends ½ mile east from its eastern end, marked by a can buoy. The middle part of the reef has little water on it, and there are patches awash on which the sea always breaks. Its western part has lumps with 17 feet and deeper water between, the western end lying from 1½ to 2 miles south-southwestward from Point Figuras lighthouse. A black can buoy marking the northern extremity lies 187° true (S by W mag.) from the lighthouse.

PORT ARROYO.

This is an open bay on the south coast of Porto Rico, lying on the west side of Port Figuras and about 27 miles eastward of Muertos Island. It is the anchorage for Arroyo, the port of Guayama, and is of some commercial importance. The port is exposed to all southerly winds. The prevailing southeast sea is always felt in the anchorage, although its force is somewhat broken by the outlying reef southward and southeastward of Point Figuras. Under ordinary conditions, vessels can discharge and load from lighters at the anchorage. The deepest draft of the vessels trading at the port is about 20 feet.

From Point Figuras the shore of the bay has a general northwesterly direction for about 1½ miles, and then curves to a general westsouthwesterly direction for 5¼ miles to Point Ola Grande. The land bordering the bay is a low strip from 1½ to 2 miles wide, on which are a number of sugar mills, and is bounded on the north by the foothills of the mountains, which rise abruptly. From Arroyo to Point Ola Grande the shore is fringed with reefs and shoals to a distance of ¾ to 1 mile in places. Mareas Reef and two 3-fathom patches southeastward are marked by a bell buoy.

Arroyo is a village of 3,025 population on the shore about 1 mile westward of Point Figuras. It is the port for Guayama, with which it is connected by a good road, and is the site of the customhouse. All goods are discharged and loaded by means of lighters.

Guayama, 3½ miles northwestward of Arroyo and 2 miles inland, is the principal town in the southeastern part of Porto Rico. There are machine shops here, and small repairs to machinery can be made in case of necessity. It is on the highway which follows the coast from Ponce eastward, and there is another highway from Guayama inland to Cayey, where it connects with the highway across the island between Ponce and San Juan. The town has communication by telegraph and telephone and is the terminus of a railroad from Ponce.

The town of *Guayama* is high and can be seen for some distance offshore. The large church in the town has at its western end two square towers, and on its eastern end a cupola, and is prominent. A large warehouse, with loading chutes on the seaward side, is located 1 mile westward of the water front of Arroyo, adjacent to the beach.

A prominent grey brick chimney is near the beach south of Guayama.

Entrance range.—*Range Hill* is a distinct, isolated, sharp, conical hill, 3 miles northward from Point Figuras lighthouse. This hill in line with two iron stacks, close together, about 1 mile northward of Arroyo, leads in deep water from outside to the anchorage, course 14° true (N by E 5/8 E mag.) (see fig. 7). A tall red water tank shows up to the eastward of the range.

Channels.—The principal entrance to the bay is from southwestward, passing westward of Guayama Reef. A number of spots with 26 to 30 feet over them were found in this approach, and the bottom is irregular.

There is a passage from eastward between Point Figuras and Guayama Reef, which is used by the smaller vessels, but is not recommended for strangers. At its narrowest point southward of the lighthouse, the channel is a little over 3/8 mile wide. It is marked by buoys.

Pilot.—There is a pilot at Arroyo.

Anchorage.—Vessels loading or discharging anchor as close in as their draft will permit, taking care to keep about 6 feet under the bottom. Depths of 26 to 30 feet will be found on the line of the entrance range, about 1/4 mile southeastward of the black buoy.

Landing.—There is always a little surf on the beach, and some care should be used in selecting a landing place as there are rocks in places. The lighters land near the customhouse. A good place for boats to land, when there is not too much sea, is just eastward of the customhouse and inside a ledge awash which lies about 50 feet from shore.

DIRECTIONS, PORT ARROYO.—These directions are good for vessels of 20 feet or less draft to an anchorage off Arroyo.

Approaching from the eastward.—Passing 3 miles or more southward of Point Figuras lighthouse, steer 268° true (W 1/8 N mag.) until Range Hill bears 14° true (N by E 5/8 E mag.). Then steer for Range Hill on this bearing with the two black iron stacks in line and stand in to an anchorage. Anchor on the range about 400 yards east-southeastward from the black buoy, Point Figuras lighthouse bearing 74° true (ENE 7/8 E mag.) in 26 to 28 feet of water. At night, keep 3 or more miles southward of Point Figuras light and steer 268° true (W 1/8 N mag.) until it bears 32° true (NE 7/8 N mag.). Then steer 0° true (N 3/8 E mag.) until it bears 43° true (NE 1/8 E mag.), and then steer for it, using the lead. Anchor with the light on this bearing and Arroyo bearing about north, in 5 to 6 fathoms, and wait for daylight to go closer in; the light will then be distant 1 to 1½ miles. Safety will be insured by keeping in a depth of over 5 fathoms, with the light bearing northeastward.

From the westward.—Give the coast westward of Arroyo a berth of about 3 miles, and steer for Cape Mala Pascua, bearing northward of east-northeast until Range Hill bears 14° true (N by E 5/8 E mag.) Then steer for Range Hill on this bearing, and stand in on the entrance range to the anchorage as directed above. At night, keep Point Tuna light open from Cape Mala Pascua, and when Point Figuras light bears 43° true (NE 1/8 E mag.) steer for it, using the lead. Anchor with Point Figuras light on this bearing and Arroyo bearing about north, in 5 to 6 fathoms, and wait for daylight to go closer in. Safety will be insured by keeping in a depth of over 5 fathoms, with the lighthouse on the above bearing.

JOBOS HARBOR.

This harbor is on the south coast of Porto Rico, its entrance lying 14 miles eastward of Muertos Island lighthouse and the same distance westward of Point Figuras lighthouse. It is a good anchorage in a hurricane, and the large central (sugar mill) at Aguirre gives it some commercial importance. Steamers of about 20 feet or less draft, with care, can enter the harbor to an anchorage off Aguirre; a draft of 22½ feet has been taken out. Sailing vessels have some difficulty in entering, as the prevailing wind is ahead in standing up the harbor, and there is no room in the channel for beating.

The harbor is formed by Point Pozuelo and a chain of several groups of islands which lie from ½ to 1 mile from shore. The main entrance is between Morrillo Islet, and the eastern end of Ratones Islands, and is nearly ¾ mile wide. From its entrance the harbor bends sharply to about east-southeast for 2 miles, narrowing gradually in this distance to a width of about ½ mile between Puerca Island and the middle of Barca Islands. Beyond this point the harbor has an average width of about 1 mile, and extends northeastward and then northward for about 2 miles to Point Rodeo and Aguirre Central. Here the harbor again bends eastward, and extends about 2 miles to its head with an average width of about ¾ mile.

The shores and islands are low, but all are covered with a thick growth of brush and mangroves and show well. The north shore, from a point abreast of the entrance to Point Colchones, is formed by numerous islands, the southernmost called **Puerca Island**, among which sloughs make inland for short distances. There are two wooded hills near Aguirre, which are prominent and readily identified from eastward or westward but not from southward.

Caribes Islands, extending nearly 1 mile southwestward from Point Pozuelo, are numerous wooded islands separated by narrow strips of water. A reef awash extends along the southeast side of Caribes Islands, its western end lying 700 yards south-southwestward from the western end of the group.

Boca del Infierno is about 400 yards wide between the reef extending from Caribes Islands and that extending nearly ¼ mile eastward from Barca Islands. There is a depth of 11 feet on the bar across the entrance. It breaks with a heavy sea, and is used by small local craft only.

Barca Islands are the southern group of the chain on the south side of Jobos Harbor. They are 1⅝ miles long in a west-northwesterly direction, and are numerous, good sized, wooded islands, separated by narrow strips of water. A reef, awash and steep-to, extends along the southern side of the islands and ¼ mile eastward of them. The western end of Barca Islands is separated from Pajaros Island by a passage 300 yards wide with depths of 14 to 15 feet.

Pajaros Island is wooded, and 700 yards long in a northwesterly direction. A reef, awash and steep-to, fringe its southern side and extends 200 yards westward of it. The passage between the reef of Pajaros Island and that of Morrillo Islet is about 350 yards wide with depths of 17 to 33 feet.

Morrillo Islet, small and wooded, lies a little over ½ mile west-northwestward from the west end of Pajaros Island, and nearly ¾

mile east-southeastward from Jobos Harbor light. A reef awash surrounds the islet and extends 300 yards northeastward from it.

Ratones Islands lie about ⅜ mile southward of Point Arenas, and on the western side of the entrance to Jobos Harbor. The islands are two in number, about ¼ mile apart, and extend about 1 mile east and west. **Jobos Harbor light** (white skeleton tower, flashing white), on the eastern end of the eastern island, marks the west side of the main entrance to Jobos Harbor. There is a narrow channel, which may be used by vessels, northward of the islands, connecting Rincon Bay and Jobos Harbor.

Aguirre Central, a prominent large and high red building with high light-brick stack, is on the north side of the harbor northwestward of Point Rodeo. A road leads inland 1½ miles to the highway between Ponce and Guayama, and there is communication by telegraph and telephone. A railroad is operated eastward to Guayama and westward to Ponce. There are small piers at the central where lighters can land, and fresh water can be obtained at the pier in boats. In 1920 there was a gasoline boat that would assist vessels in the harbor when the conditions were favorable. Aguirre has a population of 5,807.

Jobos Landing is a small settlement on the north side at the eastern end of the harbor.

Channels.—There are channels between the groups of islands forming the harbor, which are sometimes used by small sailing craft with local knowledge in entering the harbor with the prevailing wind. They are described with the islands preceding.

The principal entrance is between Morrillo Islet and Ratones Islands, and has a clear width of about ½ mile. It is marked by Jobos Harbor light, which stands on the eastern end of Ratones Island. When inside the entrance the channel has a general 120° true (SE by E mag.) direction, and leads across a ridge, with depths of 23 to 29 feet, northward from Pajaros Island.

The channel at Point Colchones leading to the anchorage off Aguirre Central is close to the point and leads between a sand shoal on the southeast and a coral reef fringing the shore on the northwest. The channel is buoyed, and is about 100 yards wide in its narrowest part, with a depth of over 20 feet. The deepest draft taken through the channel is 22½ feet, but this requires local knowledge.

The channel northward of Ratones Islands may be used with care by vessels from Rincon Bay to enter Jobos Harbor or the reverse. It has a depth of about 30 feet, but is only a little over 100 yards wide in its narrowest part between the 24-foot curves.

Anchorages.—Vessels sometimes anchor just inside the entrance between Morrillo Islet and Jobos Harbor light to await daylight or when headed off by the wind from standing up the harbor.

There is good anchorage in the channel from abreast Pajaros Island to abreast the middle of Barca Islands, with depths of 28 to 36 feet in the middle.

The anchorage off Aguirre Central is about ¾ mile in diameter, and has depths of 19 to 20 feet on the east side, increasing to 23 to 26 feet on its west side. Mooring buoys are maintained off the central. A little swell makes in through Boca del Infierno with southerly winds.

The harbor east of Point Rodeo is landlocked, but rarely used. It has a depth of about 17 feet at its western end, decreasing to about 10 feet at Jobos Landing.

DIRECTIONS, JOBOS HARBOR.—The directions following are good for vessels of 20 feet or less draft to an anchorage in Jobos Harbor off Aguirre Central.

From eastward.—From a position 4 miles southward of Point Figuras lighthouse make good a 273° true (W ½ N mag.) course for 11 miles to a position 1 mile southward of Barca Islands. Then steer about 292° true (NW by W ¾ W mag.), and follow the islands at a distance of about 1 mile. When Jobos Harbor light bears 345° (N by W mag.) steer for it until it is about ½ mile distant, and then steer about 42° true (NE mag.) and pass midway between it and Morrillo Islet.

From westward.—Approaching from Muertos Island. From a position 3 miles southward of Muertos Island lighthouse make good a 72° true (ENE ¾ E mag.) course for about 14 miles to a position 1 mile southward of Jobos Harbor light. Pass about ⅜ mile southeastward of the light (midway between it and Morrillo Islet) on a 42° true (NE mag.) course.

Approaching from Jauca Islands.—From a position 1 mile southward of Jauca Islands steer 81° true (E ½ N mag.) for nearly 6 miles, giving Media Luna Reef a berth of ¾ mile, to a position 1 mile southward of Jobos Harbor light. Pass about ⅜ mile southeastward of the light (midway between it and Morrillo Islet) on a 42° true (NE mag.) course.

From entrance to anchorage off Aguirre Central.—Pass midway between Jobos Harbor light and Morrillo Islet on a course 42° true (NE mag.), and then haul eastward and pass about 100 yards northward of nun buoy No. 2. Then steer 117° true (SE by E ¼ E mag.) for nearly ⅝ mile to a position 300 yards northward of the northwest end of Pajaros Island. Then steer 105° true (ESE ⅜ E mag.) with Jobos Harbor light astern and Boca del Infierno ahead, until Point Colchones opens eastward of Puerco Island.

Then round the south point of Puerco Island and pass 200 to 250 yards southeastward of the island on a 48° true (NE ½ E mag.) course heading for Point Rodeo. When up with the fringing reefs at Point Colchones, haul northward to a 34° true (NE ⅝ N mag.) course, heading between it and the red buoys, and follow the edge of the reef at a distance of about 80 yards, giving the red buoy a berth of 125 yards. Pass about 40 or 50 yards eastward of the black can buoy, and continue the course for the prominent point on the north shore ½ mile eastward of the Central. Anchor with the Central bearing 0° true (N ¼ E mag.) and Point Rodeo bearing eastward of 109° true (ESE mag.)

From the anchorage off Aguirre to the anchorage off Jobos.—There is a depth of 17 feet about ½ mile eastward of Point Rodeo. Thence the water shoals gradually to 10 feet off Jobos Landing.

Round Point Rodeo at a distance of 200 yards, and follow the southern shore at that distance, passing in mid-channel southward of the shoal (with prominent bush) lying ⅜ mile ENE from Point Rodeo. When past this shoal bring it to bear 268° true (W ⅛ N mag.) astern, and steer 88° true (E ⅛ S mag.). Anchor according to draft.

From Rincon Bay, passing northward of Ratones Islands—Note.—This channel has a width at its narrow part of about 175 yards between the 18-foot curves, and 125 yards between the 24-foot curves, and is not marked. The slope is abrupt on both sides, especially on the south side of the channel, where the shoal generally shows by discolored water. The narrowest part of the channel is about 400 yards westward of the light. The following directions lead through the middle of the channel:

Pass about ½ mile northward of the western end of Ratones Islands, and bring the tangent to the north side of the eastern end of Ratones Islands (a little northward of the light) in line with the tangent to the south side of Pajaros Island. Stand in on this range, course 120° true (SE by E mag.) until Point Arenas bears N. Then steer 105° true (ESE ⅜ E mag.), and follow the north side of Ratones Islands at a distance between 175 and 200 yards. Continue the course and pass 100 yards northward of buoy No. 2, lying 600 yards northward of Morillo Islet. Then steer 117° true (SE by E ¼ E mag.), and follow a part of the direction given in section preceding, to Aguirre.

RINCON BAY.

This is the name applied to the large indentation on the south coast of Porto Rico, between Jauca Islands on the west and Ratones Islands on the east. It is about 5 miles wide east and west and 3 miles north and south. The bay is of no commercial importance, but there is a good anchorage on its eastern side during ordinary weather and it is easily entered in the daytime. The general depths in the bay are 8 fathoms, irregular bottom, at the southern end, decreasing to about 5 fathoms at 1 mile from the northern shore. The shores of the bay are mostly low and wooded and the foothills of the mountains lie some distance inland. Several small rivers empty into it.

Point Petrona, lying 5¾ miles westward from Point Arenas, is low and partly covered with brush or mangrove; it is prominent from eastward or westward, but not from southward. There are a number of prominent sugar mills with stacks northward of the point near Santa Isabel. Foul ground, with depths of 3 to 8 feet, extends southward of the point to Jauca Islands. There is a narrow crooked channel north of the islands, but it is not marked and should not be attempted without local knowledge.

Jauca Islands, lying 1¼ miles southward of Point Petrona and close together, are three in number, low, and covered with brush and mangrove. The islands are near the western end of a reef which extends about 1 mile northeastward, nearly to Caracoles Island. This reef is bare or awash at low water, nearly steep-to, and the sea always breaks on its southern side. The western end of the reef awash should be given a berth of 400 yards or more.

Caracoles Island, lying ¾ miles east-northeastward of Jauca Islands, is low and wooded, and about ¼ mile long east and west. A reef awash extends ¼ mile east from the island and there is a channel ¼ mile wide between this reef and Alfenique Reef. There are shoals between the island and the shore northward of it.

Alfenique Reef, awash and on which the sea breaks, lies ¾ mile eastward of Caracoles Island. It is ⅜ mile long in a northeasterly direc-

tion, apparently steep-to, and there is a clump of bushes on its southern end. There is a good passage 1½ miles wide east of this reef, between it and Media Luna Reef, which leads into the middle of the bay. The depths are 5 to 11 fathoms, irregular bottom, between the reefs. A spot with 4¼ fathoms lies ¾ mile northwestward from Media Luna Reef.

Media Luna Reef, partly bare and on which the sea breaks, lies 1 mile west-southwestward from the western end of Ratones Islands. It is about ⅜ mile long in a northeasterly direction and there is deep water fairly close-to. There is a deep channel into the bay between this reef and Ratones Islands, on either side of a shoal which has a least depth of 11 feet.

A shoal with 2 to 6 feet extends about 250 yards northward from the western Ratones Islands the 18-foot curve lying about 350 yards northward of the island. The western end of this shoal has 13 to 18 feet and lies nearly ¼ mile northward from the western end of the island.

The western side of Point Arenas should be given a berth of over 600 yards. The 24-foot curve lies about 600 yards southwestward of Mata Island and ⅝ mile off Salinas Landing.

The best anchorage in Rincon Bay is north of the western Ratones Islands, where the depths are 4¼ to 5½ fathoms, and affords good shelter during ordinary weather.

A good anchorage may also be had about ⅜ mile from the east side near the northern end of the bay, in 4 fathoms, sandy bottom. The northwest shore of the bay should be given a berth of over ¾ mile; the 18-foot curve is nearly ⅝ mile off Salinas Landing.

Salinas is a village about 2½ miles northward of Ratones Islands and 1 mile inland. It is on the highway and railroad which lead eastward from Ponce and has communication by telegraph. A road leads to the landing, which is a small settlement on the shore 1½ miles northward of Ratones Islands. Anchorage can be made from ⅝ to ¾ mile off the landing in 3 to 5 fathoms. A gray water tank is prominent.

Directions, Rincon Bay.—Bring the west end of Ratones Island to bear 10° true (N by E ¼ E mag.) distant nearly 1 mile, and Jobos Harbor Light, on the eastern end of Ratones Islands, to bear 55° true (NE by E ¼ E mag.). From this position steer 325° true (NNW ¾ W mag.) passing about ⅝ mile southwestward of Ratones Islands and about ⅜ mile northeastward of the bare part of Media Luna Reef. When the reef bears abaft the beam, haul northward and eastward and steer for Point Arenas on a course between 89° true (E ¼ S mag.) and 112° true (SE by E ¾ E mag.). Anchor with Point Arenas bearing about 94° true (E ¾ S mag.) and the west end of Ratones Islands bearing between 179° true (S ¼ W mag.) and 212° true (SW ¾ S mag.).

Coast from Jauca Islands to Ponce.—Point Petrona and Jauca Islands are described on page 80. A shoal in the form of a ridge lies from 1¼ to 3¼ miles southwestward from Point Petrona. The depths on it are 15 to 22 feet on its northeast half and 24 to 30 feet on its southwest half. The least depth found is 15 feet near its northeast end, 1⅛ miles west-northwestward from the northwest end of Jauca Islands. The channel northeast of it is nearly ¾ mile wide with a

depth of 21 feet or more. A nun buoy is located off the southern edge of the 15-foot spot.

From Jauca Islands to Ponce, a distance of 14½ miles, the coast is a low plain backed by higher land several miles inland. There are a number of small settlements with sugar mills, the largest of which is Santa Isabel. There is a good highway and a railroad connecting the various towns along this part of the coast. There is also communication by telegraph and telephone.

Santa Isabel is a post village about 2 miles northward of Point Petrona and 1 mile inland. It is on the highway which leads eastward from Ponce, and has communication by telegraph. There are a number of sugar mills in its vicinity. A road leads to the playa or landing, a small settlement on the beach 1½ miles northwestward of Point Petrona.

A pier for loading lighters is located on the shore about ⅞ mile southeastward from the mouth of the Descalabrado River. A road and sugar railway leads down from Santa Isabel mill to the landing. There is a warehouse and a number of small buildings.

From Santa Isabel to Frio Islands there are no marked features except the stacks of numerous sugar mills. Anchorage, with comparatively smooth water, may be made in 4 to 5 fathoms anywhere along this shore during ordinary weather, and there are no dangers for vessels of about 15 feet or less draft if the shore be given a berth of ½ mile. There are a number of outlying shoals; those with the least water are—

A spot with a depth of 18 feet lies 1½ miles from shore and 2¼ miles northwestward from the northern point of Berberia Island. It is marked by a can buoy. Spots with 20 feet of water lie ⅜ mile southeastward, and ¾ mile south-southwestward, from the 18-foot spot; the second 20-foot spot lies 2⅛ miles west-northwestward from the north point of Berberia Island.

A spot with 17 feet of water lies 1½ miles from the shore northeastward of it, and 1⅝ miles northward from the northern point of Berberia Island. It is marked by a nun buoy. A shoal with depths of 21 to 23 feet extends ½ mile eastward and 1⅛ miles southeastward from the 17-foot spot.

Frio Islands, two in number and covered with brush, lie 1¾ miles eastward of Point Cabullon and ⅝ mile from shore. The surrounding reef is ⅜ mile long east and west, and its southern edge is steep-to.

Point Cabullon, about 3 miles eastward of Cardona Island lighthouse, is the eastern point of Cabullon Bight. A reef with three islets extends ⅜ mile west-southwestward from the point. The reef is steep-to, and the sea breaks on the southern side.

Cabullon Bight, between Point Carenero and Point Cabullon, affords a comfortable anchorage with little swell during ordinary weather for vessels of about 17 feet or less draft. The anchorage is about ½ mile in extent with depths of 18 feet or more. Ahogado Rock, small and bare, lies in the middle of the entrance; a shoal with 15 to 22 feet of water extends nearly ¼ mile southeastward of it. A nun buoy lies off the southwestern side of a 3¼-fathom shoal near the southern approach.

To anchor in Cabullon Bight, enter between Ahogado Rock and the islets off Point Cabullon, favoring the eastern side, if any. Anchor

with Ahogado Rock in line with Cardona Island lighthouse, and Muertos Island lighthouse midway in the opening between the two outer islets off Point Cabullon, in about 27 feet, soft bottom. The shoaling is regular to the shore, and there is no danger in the anchorage.

Muertos Island lies 4½ miles off the middle of the south coast of Porto Rico. It is 1½ miles long in a northeasterly direction, and covered with tangled scrub. The summit of the island, near its middle, is 243 feet high, and is marked by a Muertos Island lighthouse (gray cylindrical tower on flat-roofed dwelling). The light is fixed white, with a white flash of 9 seconds duration every 180 seconds. The southwest end of the island is very low, except its extreme southwest point, which is a round steep hill 170 feet high. Landing can be made on the western side of the island near a boathouse during ordinary weather.

The Hammock is a flat-topped island ¼ mile long and 31 feet high, lying 200 yards from the southwest point of Muertos Island, with a reef between them. Its southern side should be given a berth of over ⅜ mile.

The water is shoal for some distance eastward of Muertos Island, the 5-fathom curve lying about 1½ miles from its northeast point, descreasing to about ½ mile off its southwest point. A bank, with 12 fathoms near its end, extends about 3 miles southwestward from The Hammock. The least depth found on it is 6¾ fathoms at a point 2¼ miles 212° true (SW ⅞ S mag.) from Muertos Island lighthouse.

Anchorage.—The western side of Muertos Island is free from danger, and affords anchorage during ordinary weather with less swell than in Ponce Harbor. The best anchorage is from ⅜ to ½ mile westward of the southern half of the island in 6 to 12 fathoms, according to swinging room required. The slope of the bottom is somewhat steep, and the anchorage should be approached with care.

Bar.—From Muertos Island a bar trends northeastward and curving gradually eastward joins the shoaler water making westward from Berberia Island. The bar has a general depth of about 15 feet on its crest. The sea rarely breaks on it, and it is dangerous to approach. Southeastward of the bar the water seems to deepen gradually, although the bottom is irregular; but on its western and northern sides the bar is steep-to.

Berberia Island lies 3½ miles east-northeastward from Muertos Island, and 2¼ miles from the shore northeastward. It is ⅝ mile long, and is low and covered with brush and mangroves. A shoal with 8 to 13 feet of water extends nearly ¾ mile westward of the island to the bar (described above) which extends to Muertos Island. The northern edge of the shoal, the northern limits of which is marked by a can buoy, is steep-to, and lies about ¼ mile northward of the island. A shoal with 4 fathoms or less extends 1⅝ miles southward from Berberia Island; spots with depths of 15 feet were found 1¼ miles south-southeastward from the island. There is a fringing reef on the eastern side of the island on which the sea breaks, and this side of the island should be given a berth of ⅜ mile or more.

The passage between Muertos and Berberia islands on the south and the coast has smooth water usually, and is generally used in the daytime by the smaller coasting vessels when bound eastward from Ponce or the reverse. There are a number of shoals with depths of 17 to 20 feet, and one with 15 feet, in the passage. Sailing directions through the passage from eastward for vessels of 17 feet or less draft are given on page 97. Strangers with a greater draft than 17 feet should pass outside of Muertos Island.

PONCE HARBOR

is on the south coast of Porto Rico, 32 miles eastward of Cape Rojo and 7 miles northwestward of Muertos Island. It is one of the three leading commercial ports of Porto Rico, and is frequented by both steamers and sailing vessels. The harbor affords shelter from the prevailing southeast trade winds, although there is always a swell in the anchorage; but it is exposed southward, and is dangerous during a hurricane. The nearest hurricane harbors are Guayanilla and Guanica westward, and Jobos eastward.

Ponce Harbor is the eastern part of an open bay, 3 miles wide between Point Carenero on the east and Point Cuchara on the west. Its southwestern side is formed by Cardona Island, with its surrounding reefs, and Cayito Reef. The harbor is nearly 1 mile long north and south, and averages about 5/8 mile wide, with depths of about 8 fathoms at the southern end, decreasing gradually toward the northern shore. On the eastern side are two bights, included between Gata Islets, Point Penoncillo, and Port Ponce. The shore and islands are low and covered with mangroves; the high land is 2 or 3 miles in the interior.

Port (Playa) Ponce, the town on the northeast side of the harbor, is the port of Ponce and the site of the customhouse. There are several small piers in front of the town to which lighters can go. The public landing is east of the customhouse. The municipal pier is located at Point Penoncillo and is the most conspicuous object on the water front.

Ponce is the second in commercial importance and population of the cities in Porto Rico. It lies about 2 miles inland from the Playa, with which it is connected by a highway and an electric railway. It has a system of waterworks and is lighted by electricity. The population in 1920 was 41,561.

Prominent features.—Muertos Island, 7 miles southeastward, and marked on its summit by a lighthouse, is the most prominent and unmistakable feature in the approach.

Cardona Island, small, low, and marked near its middle by a lighthouse (blue cylindrical tower on flat-roofed dwelling) is on the west side of the entrance and is the principal guide for entering. The light is fixed red.

Point Carenero, the eastern point at the entrance, is low and covered with mangroves. Gata Islets extend 1/4 mile westward from the point.

Point Penoncillo, the site of the municipal pier, is a small, low projection on the east side of the harbor, about 600 yards northward of Gata Islets.

Ponce Harbor range lights (occulting red) are in the northern part of the harbor, the front light in the water, and the rear light on the roof of the Capitania (port captain's office) just west of the customhouse. The range can not be seen in the daytime until in the harbor.

Channels.—The principal channel has a bearing of 355° true (N 1/8 W mag.) for Cardona Island lighthouse, with a width of nearly 1/2 mile, and leads between banks with depths of 3 1/2 to 7 fathoms at the edges, dropping off abruptly to great depths in the channel. The channel then leads eastward of the shoal surrounding Cardona Island, between it and Gata Islets, with a width of nearly 1/2 mile, and thence northward into the harbor.

There is a deep channel into the harbor from eastward between Tasmanian Shoal and Gata Islets, which is frequently used in the daytime by steamers of about 17 feet or less draft passing northward of Berberia Island. There are a number of detached shoals, with depths of 20 to 24 feet, in the approaches.

Coasting vessels of as much as 21 feet draft frequently enter over the southern part of the bank on the west side of the channel, shaping the course for Tasmanian Shoal bell buoy, and passing over 1/4 mile westward of it.

The channel between Cardona Island and Cayito Reef is 400 yards wide, and is used to some extent by vessels of about 12 feet or less draft with local knowledge.

Pilotage is compulsory for certain vessels. Pilots come out in small boats if not too rough, and meet vessels near Cardona Island. The rates of pilotage, and extracts from the rules and regulations relating to pilots and pilotage, are given in the Appendix.

Anchorage.—The usual anchorage is westward of the harbor range line, and from 3/8 to 5/8 mile off the playa, in 3 to 5 1/2 fathoms, according to draft. Large deep-draft vessels sometimes anchor farther southward in 6 to 7 fathoms.

Small vessels, with cargo to discharge or load and not going to the pier, generally anchor east of the range line and inside Point Penoncillo. Small craft and lighters are anchored near the shore from Point Penoncillo to the playa. There is always some swell at these anchorages, but it does not prevent vessels from discharging or loading by lighters.

Pier.—The municipal pier is located at Point Penoncillo. It is 427 feet long and 110 feet wide, and is almost entirely covered by a pier shed and with two towers and a mast and yard at the inner end. The shed is painted a light straw color and can be picked up at sea before either Cardona lighthouse or the city can be seen. Pipe lines for both fuel oil and water are on the dock and tracks extend the entire length of the pier on the western side. A road and electric railway connect the pier with the city. There is a depth of 25 feet at mean low water alongside the pier.

Quarantine.—National quarantine regulations are enforced. The quarantine officer is in the customhouse. Vessels subject to inspection are required to fly the letter "Q" of the International Code at the foremast head from the time of their entrance into the harbor until pratique is given by the quarantine officer.

Supplies.—Provisions, ice, lumber, and some ship chandler's stores can be obtained. Fuel oil and water may be obtained from pipe lines on the municipal pier.

Repairs.—There are machine shops, and small repairs to machinery can be made. The nearest dock for vessels is at St. Thomas.

Winds.—The prevailing winds are the easterly trades, which vary from northeast to southeast, the most common being about east-southeast; these are generally fresh during the day. At night, the trade wind generally dies down, and a light northerly breeze comes off the land. The heaviest gales are to be expected in the summer and fall; southerly gales do the most damage, and are dangerous.

Dangers.—Tasmanian Shoal is the northern and shoaler part of an extensive bank on the eastern side of the entrance to the harbor. It is about 1 mile long, and has a number of spots on which depths of 16 to 18 feet were found. A red bell buoy marks the western limit of the shoal water and is located 1 mile south-southeastward from Cardona Island lighthouse; vessels should pass 200 yards or more westward of the buoy. A detached rock, with 17 feet of water in a surrounding depth of 12 fathoms, lies northward of the shoal, and ⅞ mile east-southeastward from the lighthouse.

The bank on the western side off the entrance extends about 1½ miles southward of Cardona Island and Hojas Bank. In general, depths of 6 to 8 fathoms were found on it, but spots with 28 to 30 feet of water were found near its southern and eastern edges, which drop off abruptly to great depths. The northern and shoaler part of the bank extends ⅝ mile southward from Hojas Bank, with depths of 18 to 23 feet in spots. Depths of 25 and 26 feet were found ½ mile south-southwestward from the lighthouse. **Hojas Bank**, lying ¾ mile westward of the lighthouse, is about ¼ mile in diameter and awash at its shoalest point.

Cardona Island Shoal extends 600 yards east-southeastward from the island, with depths of 12 to 17 feet, and is marked at its eastern end by a can buoy. A reef, bare in places at low water, and on which the sea always breaks, extends 300 yards northeastward from the island, and depths of 11 to 13 feet are found for a distance of 200 yards farther in the same direction.

A reef, bare at low water and steep-to, extends about 300 yards westward and southwestward from Gata Islets, and is marked at its western edge by a nun buoy. The sea always breaks on the outer side of the reef.

Cayito Reef lies northwestward and northward of Cardona Island, and is ¾ mile long in a northeasterly direction. A small patch near its southwest end is awash. Eastward and northward of this spot the reef has depths of 6 to 11 feet, and is steep-to. Its northeastern point is marked by a can buoy, lying ¾ mile westward of Point Penoncillo, and the same distance from Cardona Island lighthouse. The channel between the reef and Cardona Islands is about 400 yards wide, and is used to some extent by vessels of about 12 feet or less draft with local knowledge.

A detached rock, with 11 feet over it and 30 feet close-to, lies ¼ mile from the north shore of the harbor and 1 mile westward of the port.

The 18-foot curve is about ⅜ mile from the shore at the port and the depths decrease regularly toward the beach.

Directions, Ponce Harbor.—Approaching from either direction bring Cardona Lighthouse to bear 355° true (N ⅛ W mag.) and steer for it until about 1 mile off and nearly ¼ mile westward of

Tasmanian Shoal bell buoy. Then steer 22° true (NNE ⅜ E mag.) heading for the municipal pier on Point Penoncillo and pass eastward of Cardona Island Shoal can buoy. When Cardona Island lighthouse bears about 280° true (WNW ¾ W mag.) steer 357° true (N mag.) into the harbor and select anchorage according to draft, off the range.

At night, or when the range can be seen.—Steer for Cardona Island lighthouse on a 355° true (N ⅛ W mag.) course until Ponce Harbor Range lights are sighted and then stand in on the range passing nearly ½ mile eastward of Cardona Island lighthouse. Select anchorage according to draft, westward of the range line.

If going to the municipal pier, vessels leave the range line when eastward of the nun buoy off Gata Islands reef. A shoal lies northwest of the inshore end of the pier, and vessels when docking on the west side are liable to be carried upon it by excessive headway, or blown down on it by the wind.

From Ponce to Point Guayanilla, a distance of about 7½ miles, there are a number of outlying low cays and reefs, inside of which there is a passage for launches and other small craft with local knowledge. There are narrow fringing reefs close to the shore in places and landing is difficult.

Point Cuchara, 2½ miles westward of Cardona Island lighthouse, is low for ½ mile back to the railroad, which skirts the foot of the higher land.

Ratones Islet, lying 1 mile south-southwestward from Point Cuchara, is low, covered with brush and mangroves, and is prominent. A bank extends 3 miles westward of the islet and about 2 miles offshore; the least depth found on it is 28 feet, and it is steep-to on its south and west sides. **Ratones Reef** extends 1 mile east-southeastward from Ratones Islet. It is bare at low water, and has a few scattered mangrove bushes, for a distance of ½ mile from the islet; and there is a depth of 17 feet on its eastern end, which lies 1¾ miles westsouthwestward from Cardona Island lighthouse.

Arenas Cay is small, and lies between Ratones Islet and Point Cuchara. There is a crooked channel with 10 to 15 feet of water between Arenas Cay and Ratones Islet and Reef, and another with 10 to 11 feet of water between Arenas Cay and Point Cuchara, but these channels are exposed to the prevailing southeast sea and are used by small local craft only.

Tallaboa Bay extends nearly 3 miles eastward of Point Guayanilla. It is formed on the south by Maria Langa and Caribe islands and the extensive reefs surrounding them, and there are several islands and shoals in the bay. It is of no commercial importance, and should be avoided by strangers. There is anchorage with good holding ground for small vessels behind some of the islands, with some shelter from the prevailing southeast wind and sea; but there are no aids, and only small local craft have occasion to enter the bay. Guayanilla and Ponce are better anchorages and easier of access.

There is a prominent cliff about 100 feet high on the shore 3¼ miles eastward of Point Guayanilla.

GUAYANILLA HARBOR.

This harbor is on the south coast of Porto Rico, 25 miles eastward of Cape Rojo, and 7½ miles westward of Ponce Harbor. It is the

largest and one of the best hurricane harbors in Porto Rico, and is available for vessels of any draft; otherwise it has little commercial importance. The harbor lies between Point Verraco on the west and Point Guayanilla on the east, and is protected at its entrance by extensive reefs which extend about 1 mile offshore. The entrance channel between these reefs is about 1½ miles long, nearly ⅜ mile wide, and has general depths of over 15 fathoms at its southern end, decreasing to 9 fathoms abreast Mata Islet.

Point Ventana lies 2¾ miles westward of the entrance. From Guanica a high, nearly level, brush-covered ridge follows the coast to the point where it ends in a high, prominent, rocky bluff. A low break separates the point from Toro Hill, ¼ mile northeastward.

Toro Hill has a bluff head, about 100 feet high, at its western end, and a gentle slope northeastward to the low part of Point Verraco. There is a bright yellow spot in the bluffs on its southeast side. This hill and Point Ventana generally show well (see fig. 8).

Point Verraco forms the west side of the entrance to Guayanilla Harbor, and is included between a shallow arm of the harbor and the sea. From a little northeast of Toro Hill it extends about northeastward for 1 mile, and is a nearly level ridge, about 80 feet high near its north end. There are numerous low bluffs on its southeast side. Reefs extend over 1 mile southeastward of the point.

Point Guayanilla is low and wooded, and forms the eastern side of the harbor. **Point Gotay** is the western end of Point Guayanilla. There are several low islands, covered with mangrove and brush, southward and eastward of Point Guayanilla, the southwestern one of which is **Maria Langa Island**. In approaching from southward and westward, these islands and the point are made out with difficulty until near them.

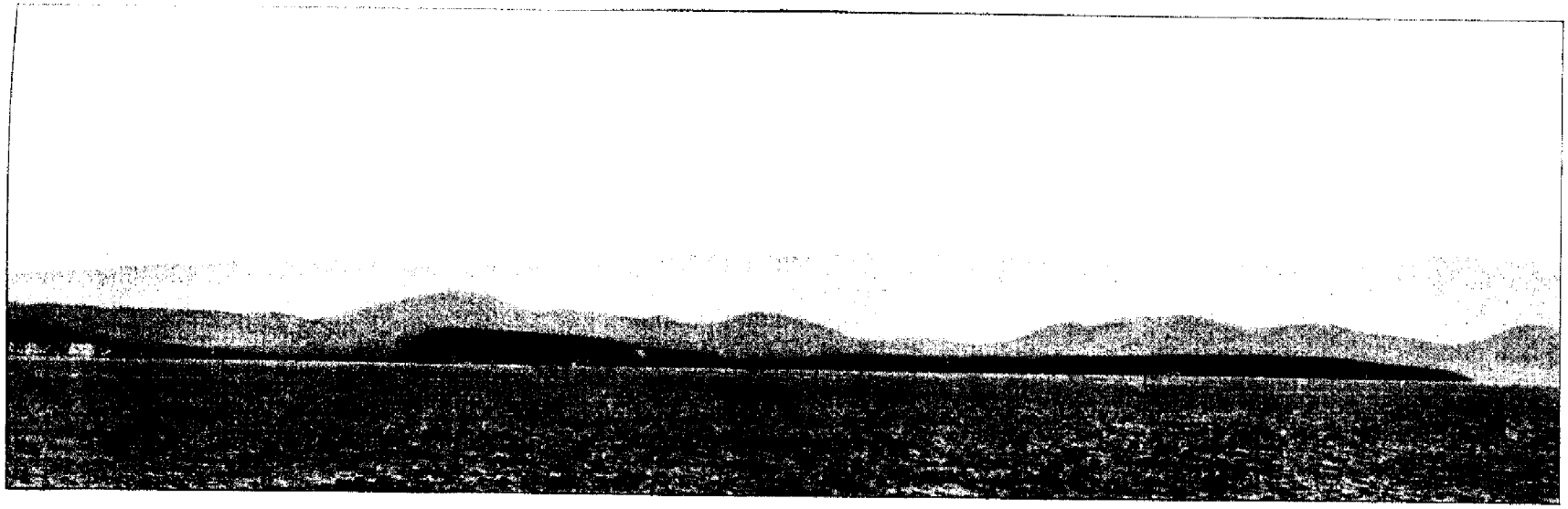
Point Pepillo, on the northeast side of the harbor, is the western end of a hill 130 feet high; there are higher hills close northward of it, and the railroad and highway run between. About ¼ mile north of Point Pepillo, the cuts for the railroad and highway show as a prominent rocky bluff on the east side at the head of the harbor. There is a black oil tank located on the hill eastward of Point Pepillo and is the most prominent object in that vicinity and a leading mark for the entrance to the harbor.

Calderon Mountain and **Calichosa Hill** are shown in the view of Guayanilla entrance, and are easily recognized. There are several brick stacks at the head of the harbor, which sometimes show well from outside.

The playa consists of a few houses on the north side of the harbor. There is always a little surf here, and the best landing for lighters is near the north end of the rocky bluff ⅝ mile eastward of the playa.

Guayanilla, a town of 1,434 population, is about 2 miles inland, on the railroad which runs from Ponce to Mayaguez, Aguadilla, and San Juan.

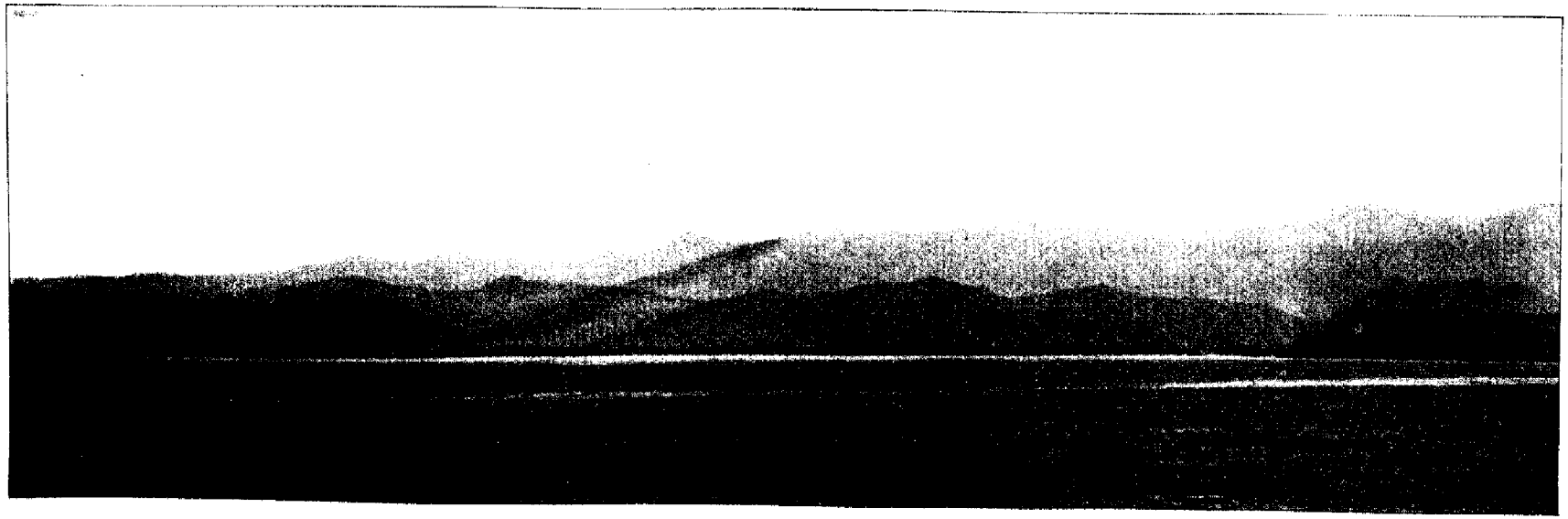
The anchorage is about 1 mile in extent with depths of 6 to 8 fathoms, soft bottom. A good berth, convenient to the shore, for vessels of moderate size is in the north end of the harbor between Point Pepillo and the playa, in 24 to 28 feet of water. There is no current in the harbor, and vessels swing to the wind. A mooring buoy in 10 feet of water is maintained by private parties.



Pt. Ventana, N. by W. ½ W., 2 miles. Toro Hill. Pt. Verraco.

FIG. 8. COAST WESTWARD OF GUAYANILLA HARBOR.

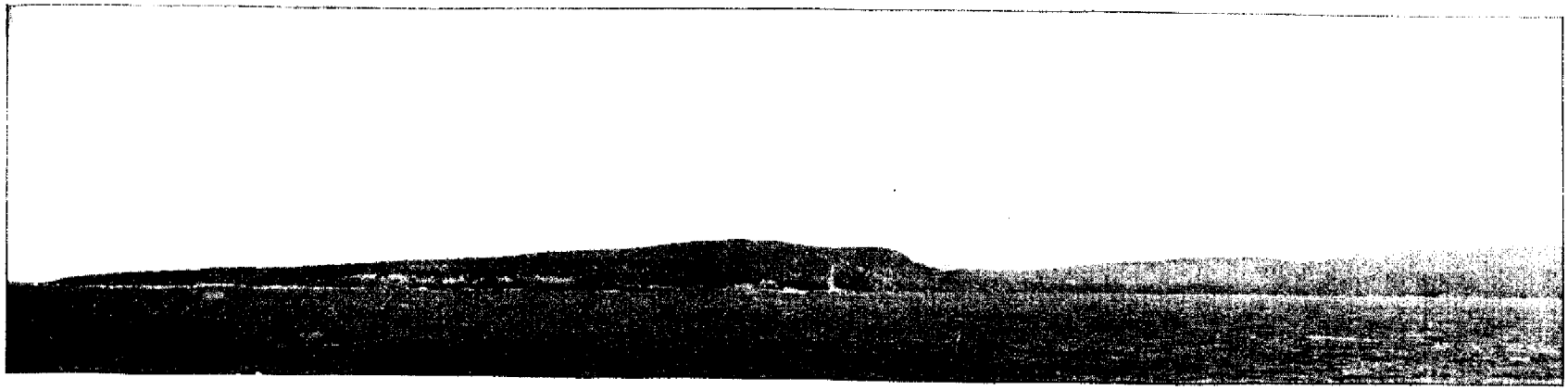
Calderon Mt., N. by W. ¾ W. Black oil tank.



Pt. Verraco. Calichosa Hill, N. by W. Entrance Buoy.

FIG. 9.—GUAYANILLA HARBOR, FROM OFF THE ENTRANCE.

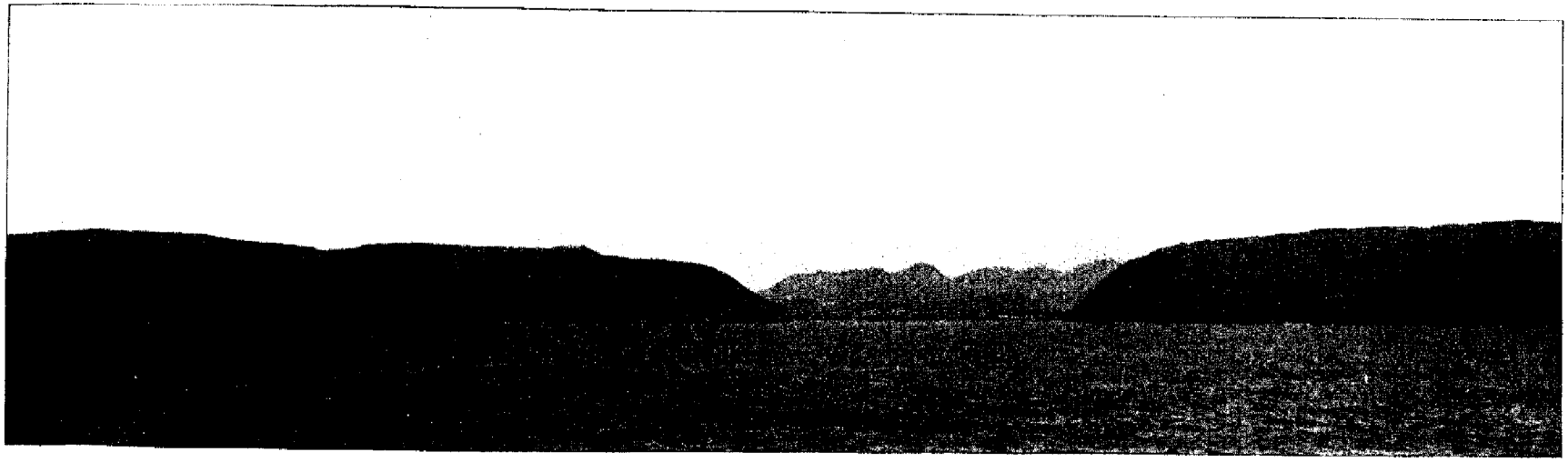
Serial No. 164.



W. ½ S.

FIG. 10.—POINT BREA, FROM EASTWARD.

Guanica Lighthouse, N. 1¾ miles.



Guanica Harbor entrance range.

FIG. 11.- ENTRANCE TO GUANICA HARBOR.

Water may be obtained from several small streams, but should not be used for drinking purposes without boiling.

Winds.—The prevailing winds are the southeasterly trades, which are generally fresh during the day. At night the trade wind usually dies down near the coast, and a light breeze comes off the land.

Dangers.—**Guayanilla Reef**, on the west side of the entrance, forms the south side of the reefs which extend 1⅛ miles southeastward from the shore between Toro Hill and Point Verraco. It is 1¼ miles long east and west, mostly bare at low water, and the sea always breaks on it. The 5-fathom curve is about ¼ mile from its south side, and the slope is abrupt to great depths.

Unitas Reef extends about 1 mile northeastward from the north side of Guayanilla Reef to the west side of the channel about ⅜ mile west-northwestward from buoy No. 2. It is mostly bare at low water, and the sea always breaks on it. Detached shoals with 10 to 18 feet of water extend over ½ mile southward from the eastern end of Unitas Reef; the channel with depths of over 30 feet is nearly ¼ mile wide between these shoals and buoy No. 2. Patches of 27 to 30 feet lie westward of the fairway.

The north end of the reefs on the west side of the channel is partly bare at low water, and there is generally a break on it. It lies a little over ½ mile westward of Point Gotay.

Maria Langa Island is surrounded by reefs on which the sea breaks. The 5-fathom curve is a little over ¼ mile southward, and nearly ⅝ mile east-southeastward from the island, and the slope is abrupt to great depths.

Fanduco Reef is the southwest end of the shoals which extend ⅝ mile southward of Point Guayanilla and ⅜ mile westward of Maria Langa Island. It is partly bare at low water, and the sea always breaks on it. The west side of the reef is marked by a nun buoy.

A shoal with a depth of 13 feet at its end extends ¼ mile south-southwestward from Point Gotay, and is marked on its west side by a nun buoy.

A shoal with little water on it extends from Point Gotay to **Mata Islet.** Its west side, nearly ¼ mile southwestward from the islet, is marked by a nun buoy. The bay eastward of a line from Mata Islet to Point Pepillo is shoal.

The bay is shoal westward of a line from Point Verraco to the playa, and shoals extend ½ mile eastward of the point.

Lumps with 12 to 14 feet of water extend ¼ mile westward from Point Pepillo, and there is one with 18 feet of water nearly ⅜ mile from the point on the same line.

The 18-foot curve is about 400 yards from the north shore between Point Pepillo and Guayanilla River.

Directions, Guayanilla Harbor.—Vessels approaching from either direction during the daytime can follow the coast at a distance of 2½ miles, when between Guanica and Ponce, until the entrance of Guayanilla Harbor is recognized. Bring the black oil tank on Point Pepillo to bear 3° true (N ½ E mag.) and steer for it, which will lead to a position a little westward of the entrance buoy. When up to the entrance buoy steer for Calichosa Hill (see view) on a 347° true (N ⅞ W mag.) course, and pass about 150 yards westward of buoys Nos. 2, 4, and 6, which mark the eastern side

of the channel. Select anchorage as desired when inside buoy No. 6, taking care to keep westward of a line joining Mata Islet and Point Pepillo, and to keep over ½ mile northeastward of Point Verraco, and give the north shore a berth of about ⅜ mile.

Vessels of about 18 feet or less draft can anchor between Point Pepillo and the playa.

A shoal with 11 feet of water near its end extends about ¼ mile southeastward from Point Brea.

The shore of **Pardas Bay** westward of Point Pescadores is fringed with reefs, mostly bare at low water, which make out to a greatest distance of ⅜ mile. Guanica lighthouse kept bearing northward of 38° true (NE ¼ N mag.) clears the reefs.

Inside the entrance the shores of the harbor shelve off about 100 yards to depths of 22 to 25 feet until up with buoy No. 4. This buoy lies 600 yards southwestward of Playa de Guanica, and marks the point of a shoal which makes off from the north shore 300 to 350 yards. Westward of buoy No. 4, the north shore shelves off about 200 yards, and the south shore from 100 to 150 yards, to the 18-foot curve. A can buoy lies 200 yards from the south shore at ½ mile westward of buoy No. 4, and a nun buoy marks the 18-foot curve on the north side in the entrance to Northwest Bay.

At night vessels should keep well offshore, as there is very deep water close to the reefs in places, and this is particularly the case off Guayanilla Harbor. The channel into the harbor is not lighted, and vessels can enter during daylight only.

Sailing vessels can enter the harbor at almost any time during the day, but in leaving it is advisable to get underway at daylight, and thus take advantage of the land breeze which generally blows until about 7 or 8 o'clock, after which there is a varying period of calm for an hour or so before the trade wind begins. It is well to stand as far offshore as possible with the land breeze, so as not to be set on the reefs by the southeasterly sea during the interval between the land breeze dying out and the trade wind setting in.

Cana Gordo Islands, lying 2 miles eastward of Guanica Harbor, extend ¾ mile southwestward from Crillo Point. They are low, covered with mangrove, and do not show well from seaward. Reefs partly bare at low water surround them to a distance of ¼ mile.

GUANICA HARBOR.

This harbor is on the south coast of Porto Rico, 17 miles eastward of Cape Rojo and 8 miles westward of Guayanilla Harbor. Though small, it is one of the best hurricane harbors in Porto Rico, and is available for vessels of about 20 feet or less draft; a somewhat greater draft has been taken inside the entrance. The entrance, between Point Meseta on the east and Point Pescadores on the west, lies 1¼ miles northeastward from Point Brea, and is about 400 yards wide (see view). From the entrance the harbor extends in a north-northwesterly direction, widening somewhat, for about ¾ mile, and then curves northwestward and westward for about 1 mile, with an average width of 700 yards. The shores of the harbor are steep, high, and wooded, except the north shore, which is low from the playa to Northwest Bay.

Point Meseta, on the east side of the entrance, is marked by Guanica lighthouse (white octagonal tower on flat-roofed dwelling). The light is fixed white. From the point the land rises northward to an elevation of 463 feet in a distance of ¾ mile.

Point Pescadores, on the west side at the entrance, has a bluff at the water. From the point the land rises northwestward to elevations of 330 to 360 feet in a distance of ¾ mile.

Northwest Bay makes northward from Guanica Harbor east of Point Pera. It is about ⅜ mile in extent, with 19 feet in the middle, and affords anchorage for vessels of about 15 feet or less draft. Loco River empties at the northern end of the bay through a mangrove swamp.

Playa de Guanica is on the north side at the eastern end of the harbor. Guanica, a town with a population of 1,900, and of some commercial importance, is ½ mile northward of the playa. A large water tank is located in the northwestern part of the town. It shows up well from the outside when southward of the entrance, and serves as the back range for Guanica Harbor Entrance Range.

Ensenada, a town built around the activities of a large sugar mill is located on the western shore of Northwest Bay.

Wharves.—Three piers are built on the south side of Point Pera. Vessels load to 20 feet alongside. A red light maintained by the sugar central is shown from the outer end of the eastern pier.

Repairs.—In case of necessity repairs to machinery of vessels will be made by the machine shops run in connection with the sugar mill.

Communications.—A railroad is maintained for freight between Ensenada and Santa Rita, a station on the main line of the American Railroad. Passengers and mails are carried by automobiles over good connecting highways. There is communication by telephone.

The customs and immigration services have representatives at Ensenada.

Anchorage may be had throughout the harbor, according to draft, the bottom being soft and good holding ground except in the entrance. The depths in the harbor decrease from about 27 feet at the entrance to 23 and 24 feet in the wider part southeastward of red buoy No. 4, and 19 and 20 feet toward its western end. There is no current in the harbor, and vessels swing to the wind.

Winds.—The prevailing winds are the southeasterly trades, which are generally fresh during the day and draw into the entrance. At night the trade wind usually dies down near the coast, and a light breeze comes off the land.

Dangers.—A series of ridges, with depths of 28 to 30 feet, begin ⅜ to ⅝ mile southward of Point Brea, and extend eastward to an extensive shoal on the eastern side of the approach. This shoal lies 1 to 2 miles from shore, and the depths on it range from 20 to 24 feet on its northern part to 28 and 30 feet on its southern part. The spots with less depths than 28 feet will be avoided by keeping Point Jorobado open from the south side of Point Brea, bearing 280° true (WNW ¾ W mag.), until Guanica lighthouse bears northward of 353° true (N ¼ W mag.).

An extensive reef lies eastward of the entrance, about 1 mile from shore, and ½ to 1 mile westward from Cana Gorda Islands. The reef is partly bare at low water, and its west end lies nearly 1 mile south-

eastward from Guanica lighthouse. There is foul ground between it and the north shore and Cana Gordo Islands.

La Laja Shoal lies 7/8 mile southward from Guanica lighthouse. It is about 400 yards in diameter, and has 8 to 17 feet of water over it and 9 to 11 fathoms close to its south side. The sea seldom breaks and there are usually no surface indications over it. From the shoal a ridge with depths of 22 to 24 feet extends 700 yards westward, its west end lying S. by W. from Guanica lighthouse. A deep channel, 200 yards wide, separates the western end of this ridge from a detached shoal to the westward, which lies 5/8 mile east-northeastward from Point Brea. It is 1/4 mile long in a northeasterly direction and has 20 to 26 feet over it, in surrounding depths of 8 to 9 fathoms.

DIRECTIONS, GUANICA HARBOR.

Sailing vessels can enter the harbor at almost any time during the day, as the trades draw in. The entrance is too narrow for a vessel to beat out, and sailing vessels can leave only during the early morning when there is usually a light land breeze. It is advisable to get under way at daylight, and get as far offshore as possible with the land breeze. If it falls calm after the land breeze dies out before obtaining an offing, it is better to anchor than drift, as the sea sets almost continuously on the reefs and rocks on the Point Brea side of the approach.

Vessels approaching from either direction should bring Guanica lighthouse to bear 0° true (N 1/4 E mag.) when about 2 1/2 miles off. Then steer 356° true (N mag.) on the Guanica Harbor Entrance range (red front light exhibited from a white skeleton tower with slatted daymark; red rear light on prominent water tank), until past the bell buoy. Then keep a little eastward of the range when entering the harbor between Meseta Point and Point Pescadores. When inside select anchorage southeastward or southward of the nun buoy southward of the playa, taking care not to anchor on the range line. Or, go to the wharves at Point Pera, being guided by the buoys.

Coast from Guanica Harbor to Cape Rojo.—Cape Rojo lies 16 miles westward from Guanica entrance, but the coast recedes 1 to 2 1/2 miles northward of the straight line joining them. This coast is separated from a valley, which extends from Boqueron Bay to Lake Guanica, by a range of high hills extending from Point Melones to Guanica Harbor and Point Brea, the highest and most prominent of which is Mariquita Hill (990 feet), the summit of which lies 6 miles northeastward from Cape Rojo. The country south of this range is covered with a dense growth of small trees, cactus, and brush, and there are mangrove swamps in many places along the shore. Some salt is produced by the evaporation of seawater in ponds in the vicinity of Cape Rojo, Montalva Bay, and Point Jorobado. The largest settlement is at Parguera which has no commercial importance.

The coast from a little eastward of Cape Rojo nearly to Point Jorobado is fringed with numerous reefs, mostly bare or awash at low water, which in some places lie as much as 2 miles offshore. The southernmost are Margarita, Media Luna, Corral, Terremoto, and Baul; but southward of them the bottom is irregular, and there are depths less than 5 fathoms on many spots. There are deep passages

among some of the reefs, and with local knowledge there is an inside smooth-water passage for launches and small craft from Sucia Bay nearly to Point Brea.

Pardas Bay, on the north side of Point Brea, is open to the prevailing southeast wind and sea. Reefs, partly bare at low water and on which the sea breaks, extend ¾ mile from the north side and the head of the bay.

Point Brea (see view) is the southeast end of the high peninsula included between Montalva Bay and Guanica Harbor. It is rocky at the water with low bluffs in places. From the point the land rises by a uniform slope to an elevation of 260 feet, then drops to a low break between Salinas Cove and Pardas Bay, and again rises by a uniform slope to higher land on the south and west sides of Guanica Harbor. A shoal with 11 feet near its end extends about ¼ mile southeastward from Point Brea.

Baul Reef lies 700 yards offshore for a distance of 1 mile eastward of Point Jorobado. It is partly bare at low water, and the sea always breaks on it.

Point Jorobado is the southwest end of the high peninsula included between Montalva Bay and Guanica Harbor. It is a small projection with a hummock 92 feet high, and there is deep water close to its west side.

Terremoto Cay, 1 mile westward of Point Jorobado, is a sandy islet with some grass and shows but little above water. It is surrounded by reefs to a distance of about 300 yards. The 10-fathom curve is about 1¾ miles southward of Terremoto Cay and Point Jorobado; there are spots with 4¾ to 5¼ fathoms inside the 10-fathom curve.

Salinas Cove, on the northwest side of Point Jorobado, is small but affords anchorage, with some shelter in ordinary weather. Vessels of 15 feet or less draft can anchor with Point Jorobado bearing southeast, distant 600 yards, and Terremoto Cay west-southwest, in a depth of 24 feet. Small vessels can anchor a little farther in, in as little as 17 feet, but the head and north side of the cove must be given a berth of 350 yards. Some salt is produced from ponds in the vicinity and shipped in small local craft. A road leads from Salinas Cove to Ensenada, Guanica.

Romero Reef is about 1½ miles long east and west. Its south side is bare at low water, and the sea always breaks on it; its eastern part is covered with scattered mangroves and a number of mangrove cays. A narrow shoal, projecting ¼ mile northward from the reef, has 1½ to 4 feet of water on its north point, which lies ½ mile southeastward of Point Penones; a spot with 13½ feet of water lies 250 yards west of the north point of this shoal. The eastern part of Romero Reef is separated from shore reefs and **Don Luis Cay** (low and covered with mangroves) by a narrow and crooked channel, with a depth of over 14 feet, which is suitable only for small craft.

Enmedio Reef is a little over 1 mile long in an easterly direction and ⅜ mile wide. Its west end lies 1⅜ miles southwestward from Point Penones, and nearly ¾ mile northward from Corral Cay. Its west, south, and east sides are bare at low water, and the sea always breaks on them. On its south side near its west end is a low cay with a mangrove bush on it, but it is not prominent. The north side of the reef has depths of 2 to 5 feet with 7 to 9 fathoms close-to.

Enmedio Reef is separated from Romero Reef by a passage with a least width of 250 yards and depths of 10 to 11 fathoms in the middle. A number of shoals with depths of 21 to 25 feet lie between Corral and Terremoto cays, southward of the passage between Romero and Enmedio Reefs.

Port Quijano is a name which has been applied to the sheltered anchorage between Point Penones and Enmedio and Romero reefs. It has a length of 1 mile, a clear width of about ⅝ mile, and depths of 8 to 10 fathoms. It is easy of access in the daytime, entering through Falucho Pass; but it is of no commercial importance and is not used.

Montalva Bay, lying east of Matei Island, is 1 mile wide and ¾ mile long. There are numerous cays of mangroves and some sunken rocks in the bay. Vessels of 12 feet or less draft can anchor near the middle of the bay, but care is required in entering. The channel is between the cays of mangroves in the middle of the entrance and Point Penones. Rocks with 1 to 3 feet of water extend 500 yards eastward from Point Penones, and a rock with 1 foot of water over it lies 300 yards 329° true (NNW ½ W mag.) from the southern mangrove cay in the entrance; these rocks generally show by discolored water. Some salt is produced from artificial ponds on the north side of the bay, and shipped in small local craft.

Matei Island, 1 mile west-northwest of Point Montalva, is joined to the land north of it by mangrove swamps, and forms the west side of Montalva Bay. The island is 1 mile long and 165 feet high. There are two hills on its northwest part, and its eastern half slopes to a small head at its southeast end called **Point Penones**. The narrow slue at the west end of the island has high land on both sides.

Mata Seca Cay (low and covered with mangroves) is close to a low point of mangroves on the southwest side of Matei Island. A reef with 4 to 6 feet of water near its end extends 600 yards southwestward from the cay.

Falucho Pass is the best entrance through the reefs, and lies 9 miles eastward of Cape Rojo and 6½ miles westward of Point Brea. It is 1 mile wide between Media Luna Reef on the west and Corral Cay and Enmedio Reef on the east. The depths in the pass are 6 to 11 fathoms, but there are shoals in its approach with 14 to 30 feet lying southwestward of Corral Cay.

Corral Cay, lying 1⅞ miles southwestward from Point Penones, is on the southwest side of a reef 300 by 600 yards in extent, on which the sea always breaks. The cay is small and sandy, and has a good-sized clump of mangroves. A shoal with depths of 16 to 21 feet extends ½ mile east-southeastward from the reef, and a detached shoal with 11 feet of water lies between this shoal and Enmedio Reef.

The bottom is very broken southward of Corral Cay.

A shoal, with 14 to 23 feet of water in surrounding depths of 6 to 8 fathoms, lies from ½ to 1 mile southwestward from Corral Cay.

Shoals, with depths of 28 and 30 feet, respectively, lie 1½ and 2 miles southwestward from Corral Cay.

A shoal, with 18 to 24 feet of water in surrounding depths of 11 to 13 fathoms, lies from 1 to 1¼ miles southeastward from Corral Cay.

Enrique Cay, ⅞ mile southward of Maguey Island, is a reef ¾ mile long in an easterly direction, ¼ mile wide, and its southern side is

bare at low water. There is a good-sized clump of mangroves on the middle of its south side, and a small clump at its northeast end. A detached reef, partly bare at low water, lies 200 yards off the west end of Enrique Cay. Enrique Cay is separated from Caracoles Cay by a pass with a least width of 100 yards and depths over 10 fathoms in the middle.

Caracoles Cay, 5/8 mile southeastward of Maguey Island, is a reef 3/4 mile long in a northeasterly direction and 1/4 mile wide. Its southeast side is a ridge bare at low water, on which are three good-sized clumps of mangroves about 350 yards apart. The passage north of the reef is suitable only for small craft. A rock with 8 feet of water lies 1/4 mile southeastward from the southern mangrove clump on Caracoles Cay.

Media Luna Reef, about 2 miles southward of Maguey Island, is 3/4 mile long in an east-northeasterly direction, and has a greatest width of 600 yards. Its south side and eastern end are bare at low water, and the sea always breaks on them. At its western end there is a clump of mangroves, which is a good mark. A detached shoal with 21 feet of water lies 650 yards southwestward of the mangrove clump. An extensive reef, mostly bare at low water, extends westward of Media Luna Reef to Margarita Pass.

Maguey Island is close to shore, 1/4 mile long, 130 feet high, and rounded in outline.

Parguera Cove lies west of Maguey Island, and inside the reefs which extend from it to Cueva Island. It affords good anchorage for small vessels, but strangers should not attempt to enter without a pilot. *Parguera* is a small settlement 1/4 mile westward of Maguey Island.

Cueva Island, 1 mile northeastward of Guayacan Island, is joined by swamps to the land. Its eastern end is a bare bluff 30 feet high. Reefs, partly bare at low water, extend from Cueva Island to Maguey Island, through which there are passages to Parguera Cove for small vessels with local knowledge. The best one has a width of 150 to 250 yards and depth over 18 feet, and lies 1/2 mile 237° true (SW by W 1/2 W mag.) from the summit of Maguey Island.

Guayacan Island is a continuation of the mangrove swamps northeastward from Point Tocon. Its northeast end is about 30 feet high. Reefs extend a little over 1 mile southeastward of the island to Margarita Pass.

Margarita Pass is a channel 3/8 mile wide through the reefs, and lies about 2 1/2 miles southwestward from Parguera. The sea always breaks on the reefs on each side, but the bottom is very broken in the pass and its approach; a number of spots with 23 to 28 feet and deep water close-to were found. There is a smooth anchorage in 7 to 12 fathoms inside the pass.

From Point Tocon the coast trends westward for 3 miles to Point Molino. This part of the coast consists generally of mangrove swamps with brush-covered higher land a short distance back. Beginning about 1 mile northward of Point Tocon, a range of hills extends north-northeastward, and then turning eastward follows the coast to Matei Island. These hills are round knobs from 150 to 500 feet high. Shoals and reefs extend southward of Point Tocon to Margarita Reef.

Margarita Reef lies about 1¾ miles southward of Point Tocon, and its western end 3⅝ miles east-southeastward from Cape Rojo lighthouse. The south side of the reef is mostly bare at low water, and the sea always breaks on it. This part of the reef is about 2 miles long in an easterly direction, and there is a prominent old boiler on it ¼ mile from its west end. Depths less than 23 feet are found in a distance of ½ mile west of the reef. A ridge with 24 to 28 feet of water over it extends 2 miles westward, and another with the same depths extends ½ mile eastward, from the reef.

Point Molino, nearly 2 miles northeastward from Cape Rojo, is the western point of a bluff nearly 1 mile long east and west, and 25 to 30 feet high. For a distance of 2½ miles southward of the point the depths are irregular, the bottom having ridges, with 3½ to 5 fathoms over them, and deeper water between.

Sucia Bay extends northward about 2 miles on the eastern side of Cape Rojo, and is nearly 1¾ miles wide between the cape and Point Molino. It is exposed to the prevailing southeast wind and sea. **Ola Rock**, partly bare, lies about ½ mile from the southwest side of the bay, and bears 7° true (N by E mag.) from the eastern side of Cape Rojo. The shore of the bay is low and rather swampy.

Cape Rojo, the southwest end of Porto Rico, is a low neck, 1¼ miles long, at the southern end of which are two hills with bluff faces. The eastern hill is 118 feet high. The western hill is 75 feet high, and is marked on its summit by **Cape Rojo lighthouse** (gray hexagonal tower on flat-roofed dwelling). The light is a fixed white with a white flash of 1.3 seconds duration every 10 seconds.

DIRECTIONS, SOUTH COAST OF PORTO RICO.

OFFSHORE.

Point Tuna to Muertos Island.—From a position south-southeastward of Point Tuna lighthouse make good a 246° true (WSW ⅛ W mag.) course for 9¼ miles to a position 4 miles south-southeastward from Point Figuras lighthouse. Then make good a 264° true (W ¼ S mag.) course for 28½ miles to a position 3 miles southward of Muertos Island lighthouse.

Muertos Island to Ponce.—From a position 3 miles southward of Muertos Island lighthouse make good a 302° true (NW ⅞ W mag.) course for 7½ miles to a position 2½ miles southward of Cardona Island lighthouse. Then follow the directions under the heading "Ponce Harbor," page 86.

Muertos Island to Guayanilla Harbor.—From a position 3 miles southward of Muertos Island lighthouse make good a 293° true (NW by W ⅝ mag.) course for 15 miles, to a position 1½ miles southward of the entrance to Guayanilla Harbor. Then follow the directions under the heading "Guayanilla Harbor," page 89.

Muertos Island to Guanica Harbor.—From a position 3 miles southward of Muertos Island lighthouse make good a 281° true (WNW ¾ W mag.) course for 22 miles, to a position 2 miles southward of Guanica Harbor entrance. Then follow the directions under the heading "Guanica Harbor," page 92.

Muertos Island to Cape Rojo.—From a position 3 miles southward of Muertos Island lighthouse a 272° true (W ½ N mag.) course made

good will lead to a position 4 miles southward of Cape Rojo lighthouse.

INSHORE.

Point Tuna to Jauca Islands.—From a position 2 miles southward of Point Tuna lighthouse make good a 251° true (WSW ⅝ W mag.) course for 10 miles to a position 3 miles southward of Point Figuras lighthouse. Then a 267° true (W mag.) course made good for 10½ miles will lead to a position 1 mile southward of the eastern end of Barca Islands, with the prominent smokestack of Aguirre Central bearing 358° true (N ¼ E mag.). If bound for Jobos Harbor follow the directions under the heading "Jobos Harbor," page 79; otherwise steer a 272° true (W ½ N mag.) course to a position 1 mile south-southwestward of Jauca Islands.

From Jauca Islands to Ponce.—When the two Jauca Islands close, haul northward to a 302° true (NW ¾ W mag.) course, heading for a prominent chimney east of Ponce. Continue this course for 4¼ miles to a position 300 yards northward of the can buoy marking the reefs off the northern end of Berberia Island. Then make good a 266° true (W mag.) course for 4¼ miles to a position 250 yards southward of Frio Island buoy. Then steer a 280° true (WNW ¾ mag.) course for 5¼ miles, heading for Cardona Island lighthouse, to a position ¼ mile eastward of Cardona Island Shoal buoy, passing 100 yards southward of Cabullon Point buoy. If bound for Ponce Harbor steer northward into the harbor. (See p. 86, "Ponce Harbor.")

From Ponce to Cape Rojo.—From a position ¼ mile eastward of Cardona Island Shoal buoy steer a 212° (SW ⅞ S mag.) course, with the west end of Gata Islets astern, to a position ½ mile westward of Tasmanian Shoal bell buoy. Then steer 263° true (W ¼ S mag.), with the bell buoy astern, for a distance of a little over 15 miles to a position 2½ miles southward of Guanica lighthouse. From this position a 268° true (W ¼ S mag.) course made good for 12 miles will lead to a position 2 miles southward of Cape Rojo lighthouse, clearing the old boiler marking Margarita Reef by 1 mile.

WEST COAST OF PORTO RICO.

Cape Rojo, the southwest end of Porto Rico, is a low neck 1¼ miles long, at the southern end of which are two hills with yellow bluff faces. The eastern hill is 118 feet high. The western hill is 75 feet high and is marked on its summit by Cape Rojo lighthouse. The coast from Cape Rojo to Point Melones is low.

Salinas Bay is on the west side of Cape Rojo, between it and Point Aguila. The sea from southeastward makes into the bay and it usually affords little shelter except for small craft. The salt works (yellow buildings with red roofs) on the north side ship some salt in boats and small lighters. There is a small boat landing at the southeast end of the bay. The 18-foot curve is fairly close to Cape Rojo, but lies ⅝ mile from the north side. The shoaling is fairly regular, though somewhat abrupt in places, toward the north shore; a rock with 4 feet of water over it lies 900 yards southeastward from Point Aguila.

Point Aguila, 1¾ miles northwestward of Cape Rojo, is two small bluff heads with lower land behind them. A shoal with depths of 12 to 16 feet extends 1 mile westward from the point. A windmill and some buildings of salt works are about ⅜ mile northward of the point, and there is a boat landing near them off which lighters and small craft anchor to load salt.

Casabe Shoal makes off from the shore 1 mile at Point Aguila, ⅜ mile at Point Moja Casabe, and ¼ mile at Point Melones. Off the last two points there are depths of 15 to 16 feet near the western edge of the shoal, and the 12-foot curve is about ⅜ mile from shore. There are depths of 4 to 7 fathoms near the western edge, which is fairly steep-to. A nun buoy lying 1¼ miles westward of Point Aguila marks the western limit of Casabe Shoal. A shoal with 3¾ to 4¼ fathoms extends westward from the southern part of Casabe Shoal, its western end lying about 2½ miles west-northwestward from Point Aguila.

Point Moja Casabe, 1¾ miles northward of Point Aguila, marks a small change in the direction of the coast. A reef, partly bare at low water, extends ¼ mile off the point.

Point Melones is the western end of a range of hills, 200 to 260 feet high, which extends eastward. There is a detached, partly cleared hill, 230 feet high, on the point. The coast from Point Melones to Cape Rojo is low.

Mariquita Hill, the highest at the southwest end of Porto Rico, is a prominent ridge nearly flat on top, and its summit is not well marked. The highest point, 990 feet, lies 6 miles northeastward from Cape Rojo.

Point Guaniquilla, the north point at the entrance to Boqueron Bay, is sharply projecting and prominent. It is a narrow grass-covered ridge over 35 feet high, with trees at the water, from which a higher wooded ridge extends northeastward. From southward the end of the point shows as a low brown bluff.

BOQUERON BAY.

This bay is on the west coast of Porto Rico about 12 miles southward of Mayaguez and 6 miles northward of Cape Rojo. It is a good harbor for vessels passing through the Guanajibo Channel and is easily entered, but it is rarely used except by small local craft. Owing to the protection afforded by the reefs at the entrance the bay may be a good anchorage in a hurricane, although there is no report of its use as such.

The bay is 2½ miles wide at its entrance between Point Guaniquilla and Point Melones, and extends eastward for 2 miles to its head, where it is 1 mile wide. Enmedio and Palo shoals extend across the entrance, through which two channels lead into the bay. For a distance of ⅝ mile inside Enmedio Shoal the depths range from 27 to 35 feet. A ridge, with depths of 19 to 23 feet, extends in a north and south direction near the middle of the bay between Roman and Ramito shoals. The depths east of the ridge decrease gradually from 26 feet to 12 feet, the latter depth being found about 200 yards from the head. The south shore of the bay is clear; the north shore is fringed with mangroves, which should be given a berth of 300 yards or more.

Boqueron is a small settlement with a store on the north side at the head of the bay.

North Channel leads into the bay between Point Guaniquilla and the north end of Enmedio Shoal. It has a least width of about 350 yards, with depths of 21 to 28 feet. The channel has an east-southeasterly direction, and its northern edge is about 125 yards south of the point. Owing to its nearness to the shore this channel is easily followed and is the better one for strangers.

South Channel leads into the bay between Enmedio and Palo shoals. It is 350 yards wide between the 30-foot curves, with depths of 36 to 40 feet in the middle. The shoals on the sides of the channel are fairly steep-to, there being 7 to 13 feet close to its north side and 12 to 13 feet near its south side. The middle of the channel is ¾ mile from the south side of the bay.

A **pilot** for the bay can be obtained at Boqueron.

Anchorage can be had with soft bottom anywhere in the bay, except on the shoals where the bottom is hard.

Dangers.—Enmedio Shoal extends across the mouth of the bay for a distance of 1 mile, and has a width of about 350 yards at its south end and 600 yards at its north end. Small patches near the middle of the shoal are nearly awash at low water, and there are numerous heads with 5 to 6 feet, except toward its north end, where the depths are 10 to 12 feet. The shoal is steep-to, especially its west side, and its full extent, as indicated by the color of the water, shows only under favorable conditions. Point Ostiones, open westward of Point Guaniquilla, bearing 10° true (N by E ⅛ E mag.), leads westward of the shoal; and the summit of the hill on Point Melones, bearing 189° true (S by W ⅛ W mag.), leads eastward of it. A nun buoy marks the northern end of the shoal and a can buoy the southern end.

Palo Shoal extends nearly ¾ mile northward from the south shore of the bay, between ⅜ and ¾ mile northeastward of Point Melones, and is separated from Enmedio Shoal by South Channel, 350 yards wide. A depth of 5 feet is found on Palo Shoal about 600 yards from shore, and north of this the water deepens gradually from 8 feet to 13 feet at its north end. The west side of the shoal is steep-to.

Roman Shoal is a small patch on which the least depth found is 18 feet, with a surrounding depth of 27 feet. It lies about ⅜ mile from the north shore and 1 mile from Point Guaniquilla.

Ramito Shoal is a small spot with a depth of 8 feet and 20 to 24 feet close-to. It lies about ½ mile from the south side of the bay, and 1¾ miles northeastward from Point Melones. It is marked by a nun buoy.

A ridge with depth of 19 to 23 feet extend ½ mile northward of Ramito Shoal. The least depth (19 feet) is found nearly in the middle of the bay, and there is a spot with 20 feet of water over it 400 yards eastward of the 19-foot spot.

Velasquez Rock, which should be avoided by all vessels, lies nearly ¼ mile westward from the village of Boqueron.

Direction, Boqueron Bay.—*To enter by the North Channel*—Steer to pass 250 yards southward of Point Guaniquilla and about 100 yards northward of the nun buoy marking the 21 foot spot off Enmedio Shoal on a 105° true (ESE ½ E mag.) course. When ⅝ mile inside the point, the hill on Point Melones bear-

ing 193° true (S by W ½ W mag.), haul southward and select anchorage as desired inside Enmedio Shoal in depths of 28 to 33 feet, sticky bottom. Or, to anchor off Boqueron, bring the houses of the town to bear 87° true (E mag.) and steer for them. This course will lead 250 yards southward of Roman Shoal. Anchor with Boqueron bearing east-northeastward and distant from ⅜ to ½ mile, in 17 to 19 feet sticky bottom. The lead is a good guide.

To enter by the South Channel.—Vessels coming up from southward steer for Point Guaniquilla bearing 20° true (NNE mag.) with Point Boca Prieta on line, until the hill on Point Melones bears 140° true (SE ¾ S mag.) Then steer 69° true (ENE ⅜ E mag.) heading for the houses of Boqueron and passing 150 yards southward of the can buoy marking the southern end of Enmedio Shoal. When the hill on Point Melones bears 193° true (S by W ½ W mag.) haul northward, and select anchorage as desired inside of Enmedio Shoal in 28 to 33 feet of water sticky bottom. If bound to an anchorage off Boqueron, follow the directions in the preceding paragraph.

Offshore shoals.—An extensive bank makes off from the west coast of Porto Rico, the 100-fathom curve lying nearly 15 miles westward of Point Guanajibo and about 8 miles westward of Cape Rojo. The principal dangers are described below. On the western edge of the bank there is a ridge with depths of 4¾ to 5½ fathoms which extends 7 miles north-northwestward from Gallardo Shoal gas buoy. This part of the bank will be avoided by keeping Desecheo Island bearing northward of 350° (N ⅝ W mag.) while Buenta Vista Hill bears between 91° true (E ⅜ S mag.) and 72° true (ENE ¾ E mag.). Depths of 4⅜ to 8 fathoms lie on the outer part of the bank ½ to 2½ miles southward of Gallardo Shoal gas buoy.

The 100-fathom curve is 3 miles southward of Cape Rojo. A rocky patch with a depth of 4½ fathoms lies near the south edge of the bank 4 miles west-southwestward from Cape Rojo. Other patches lie 2 miles off the cape in the same direction.

Gallardo Shoal has a least depth of 15 feet and lies 9⅛ miles west-northwestward from Cape Rojo. It is marked by a gas buoy, showing a flashing white light.

Resuello Shoals lies off the entrance to Boqueron Bay. They consist of three shoals separated by channels having depths of 4 to 6 fathoms; the southern extremity of the shoals is westward from Point Melones and is marked by a can buoy.

Corona Larga Shoal consists of two shoals, with 4½ to 9 fathoms of water between. The northwest shoal is 1½ miles long and lies 4½ miles westward from Point Guaniquilla and has a least depth of 12 feet at its north end. The southeast shoal is 1 mile long and has depths on the coral heads of 16 to 18 feet.

Las Coronas consists of a shoal of numerous heads with depths of 9 to 14 feet, the south end of which is 1½ miles northward of Corona Larga Shoals and 4 miles west-northwestward from Point Guaniquilla. The eastern end of the shoal is a narrow ridge with depths of 15 to 17 feet lying 1⅝ miles westward of Point Ostiones. A shoal with 12 to 15 feet of water lies between Las Coronas and Corona Larga Shoal. There are passages ⅜ to ½ mile wide north and south of it.

Media Luna Bank is a continuation southward of Negro Bank and the eastern part of Tourmaline Reef, and lies from 3½ to 5 miles westward of Point Ostiones. The western face is a reef ½ mile long north and south on which the sea always breaks. Three small reefs, which likewise break, lie from ½ to 1 mile east-northeastward from the preceding reef. The major portion of the shoal consists of numerous rocky heads with depths of 6 to 12 feet. A rocky patch with a least depth of 4½ fathoms lies 1 to 1¾ miles westward of Media Luna Bank.

Negro Bank is the northern shoal on the west side of Guanajibo Channel. It is about 2½ miles long in a northeasterly direction and about 1½ miles wide and the general depths on it are 7 to 12 feet. There is a small patch on the northern part which always breaks. Detached shoals with 14½ to 17 feet lie north of Negro Bank and from the northern end a narrow shoal extends northeastward nearly to Manchos Grandes. A can buoy marks an 18-foot passage across this ridge into Guanajibo Channel.

Tourmaline Reef extends 5 miles westward from Negro Bank, with a width of 2½ miles, its northwest end lying 9½ miles westward from Point Guanajibo. There are depths of 5 to 7 fathoms on the western and southern parts of the reef, decreasing to 3 and 4 fathoms on its northeast part. A head with 17 feet of water over it lies close to its north side, 2 miles from its west end. Several heads with depths of 18 feet lie 1¾ miles east-southeastward from the 17-foot spot, with a depth of 22 feet between. The northwestern extremity of the 24-foot curve is marked by a gas buoy (occulting white).

Guanajibo Channel is the name applied to the buoyed passage inside of the above-described reefs from Point Aguila to Mayaguez Bay. It has a least depth of 18 feet at its northern end on the ridge extending northeastward from Negro Bank. The least depth at the southern end of the channel is 23 to 24 feet on a bank making westward from Casabe Shoal. Elsewhere in the channel the water is deeper. It is generally quite smooth in the channel.

Sailing directions for Guanajibo Channel will be found on page 109.

Point Boca Prieta, ⅝ mile southward of Point Fuerta, is low but is covered with high cocoanut trees which give it the appearance of a bluff head as seen from southward.

Buena Vista Hill, 4 miles eastward of Port Real, is 817 feet high, and a prominent and useful landmark for many miles, especially from westward. From that direction it shows a knob at the summit, with a steep convex slope on its north side to lowland. A ridge about the same height extends eastward from the hill, and another ridge, decreasing in height, extends westward to the coast between Point Fuerte and Point Guaniquilla. The most prominent hill on this ridge westward of Buena Vista is 142 meters (466 feet) high.

Point Fuerte, the south point of Port Real, is low and covered with cocoanut trees which extend southward to Point Boca Prieta. There is a small patch of mangroves at the north end of Point Fuerte. There is a good anchorage in 6 fathoms of water ½ mile westward of Point Fuerte.

Point Carenero, the north point at the entrance to Port Real, is low with many cocoanut trees, and there is a fringe of mangroves at the water.

Port Real is a nearly circular basin about 5/8 mile in diameter. It is of no commercial importance, but affords a good harbor for vessels of about 8 feet or less draft, with local knowledge. The depths in the harbor are 10 to 15 feet, except toward its eastern end where the 8-foot curve is 1/4 mile from shore. A spot with 6 1/2 feet lies in the middle 775 yards northeastward from Point Fuerte. There is a village on the north side.

The entrance to Port Real is 3/8 mile wide, but is contracted by reefs, partly bare at low water, which extend 425 yards southward from Point Carenero, and 175 yards northward from Point Fuerte. The channel is 150 yards wide with depths of 8 to 15 feet. A rock with 6 feet of water over it lies 350 yards 332° true (NNW 1/4 W mag.) from Point Fuerte; the channel is south of the rock and has depths of 8 to 10 feet.

Fanduca Cay, 3/4 mile southwestward from Point Ostiones and a little over 1/2 mile from shore, is a few bare rocks which show but little above water. There is a narrow channel between it and the shore, with a depth of about 7 feet, but it should not be attempted by strangers.

Point Ostiones, 4 1/2 miles southward of Point Guanajibo and 1 1/4 miles northward of the entrance to Port Real, is low but covered with high cocoanut trees and a fringe of mangroves at the water. The point is projecting and prominent, especially as seen from southward.

A shoal with 5 to 11 feet of water makes off from the shore between Port Real and Point Ostiones, nearly 1/2 mile from the former and 7/8 mile from the latter. Lumps with depths of 13 to 17 feet extend westward of the northern end of the shoal to Las Coronas, with deep water between. A nun buoy lying 1 1/2 miles westward from Point Ostiones marks the eastern side of the best channel through these lumps.

Pinero Islet, 1 1/4 miles southward of Point Arenas and 1/4 mile from shore, has a clump of mangroves on it. The 4-fathom curve is about 300 yards westward of it. A shoal with a least depth of 10 feet lies 5/8 mile west-southwestward from Pinero Islet.

Point Arenas is the northwestern point of a low strip covered with cocoanut trees, included between Lake Joyuda and the sea. A reef partly awash extends 1/4 mile northwestward from the point.

Bramadero Bay indents the coast about 1/2 mile between Point Guanajibo and Point Arenas, a distance of 1 1/2 miles. The bay has general depths of 12 to 16 feet, somewhat irregular bottom, and is of no importance. The lead is a good guide for vessels of less than 12 feet draft.

A shoal, about 1/2 mile in diameter and with depths of 10 to 14 feet, lies 2 1/2 miles west-southwestward of Point Guanajibo. A nun buoy marks the northwestern extremity of this shoal and the eastern side of the channel between it and Negro Bank.

Point Guanajibo, 3 miles southwestward of Mayaguez, is a flat-topped hill or short ridge, 165 feet high. There is an umbrella-shaped tree at the break on the northwest end of the ridge, and a detached clump of trees on the point as seen from southward.

A shoal with 13 to 18 feet surrounds Point Guanajibo to a distance of 1 mile. Farther out there are numerous spots with depths of 15

to 18 feet. A nun buoy 1⅞ miles west-northwestward from Point Guanajibo marks the westernmost lump.

MAYAGUEZ BAY.

This bay is on the west coast of Porto Rico, about 10 miles southeastward of Point Jiguero and 17 miles northward of Cape Rojo. It is one of the three leading commercial places of Porto Rico, is easily entered either in the daytime or at night, and is a good harbor during any weather, except a hurricane. Steamers of most of the lines trading to Porto Rico and many sailing vessels call here. Vessels discharge and load by means of lighters.

Mayaguez Bay is included between Point Algarrobo on the north and Point Guanajibo on the south, a distance of 3¾ miles, and has a greatest length of about 2 miles inside the shoals which extend across the mouth of the bay. There are several channels through the shoals. The depths in the bay are 8 to 10 fathoms near the shoals, decreasing regularly shoreward, but its southern part is shoal. The shore of the bay is a sand beach, and at its southern part there are a number of lagoons and marshes. Mayaguez River empties a little north of the customhouse, and Guanajibo River on the north side of Point Guanajibo.

Little Algarrobo Point is a little over 1 mile southeastward of Point Algarrobo, and at the north end of Mayaguez. An iron wharf without flooring extends from the point, and there is a large yellow building on the point.

Point Algarrobo is low and projects but little. A range of wooded hills extends eastward from the point, attaining an elevation of 265 feet at ¾ mile from it.

Mayaguez extends about 2 miles inland from the eastern end of the bay, and is one of the three leading commercial cities of Porto Rico. It has a system of waterworks, is lighted by electric lights, and there is communication by electric street cars. The population in 1920 was 19,069. The town is on the main line of the American Railroad, with direct service to Ponce and San Juan. There is also communication by telegraph and telephone to all parts of the island.

Landings.—The customhouse landing, to which the lighters go, has depths of 3 to 4 feet at its end. There is a public landing for boats just south of it. There is always a little surf on the beach, but it does not interfere with boats and lighters at the landings. The Government iron wharf at Little Algarrobo Point is without flooring and not used.

Prominent objects.—During the earthquake of 1918 most of the prominent buildings along the water front were shaken down and are now replaced by temporary structures. The customhouse is now in ruins with the walls standing to a height of one story, and it is partially hidden by a large shed in front of it. The new cathedral is in the city about ¾ mile east-southeastward, but it does not show up prominently from the water front. The barracks is a large, flat-topped, white building ½ mile southeastward of the customhouse. The electric lights of the town show well at night from seaward.

Ranges.—Mayaguez Harbor range lights (occulting red) guide at night through the main channel to the anchorage, course 109° true (ESE mag.). The rear range stands just south of the shed in front

of the customhouse and about 100 feet back from the beach between the boat and customhouse landings. It is a white pyramidal, skeleton structure with a red diamond-shaped daymark. The front range is a pyramidal structure on piles, upper half white, lower half red, and 750 yards in front of the rear range.

Front Hill (highest point) in line with **Montuoso Peak** forms an excellent day range to lead from seaward through the main channel, course 103° true (ESE ½ E mag.). Front Hill, saddle shaped, is wooded and stands just east of Mayaguez. Montuoso Peak is cone-shaped and lies 7½ miles back from Front Hill.

Channels.—The principal channel leads between Inner Manchas and Manchas Grande shoals. It has a width of about ⅜ mile, with depth of 8 to 20 fathoms and is marked by buoys and Mayaguez Harbor range.

A channel leads into the bay from northward, east of Outer and Inner Manchas shoals. It has a least width of 1 mile between Algarrobo Reef and Inner Manchas, and depths of 18 feet or more. It is not buoyed and little used.

These channels into Mayaguez Bay are the only ones that should be used. Small vessels with local knowledge sometimes cross the reefs between Manchas Grandes and Rodriguez Bank and between the latter and the shore, but the probable depths on the coral heads may range from 2 to 6 feet less than charted.

Dangers.—**Outer Manchas** lies 2¼ miles west-northwestward from Point Algarrobo, and is a ridge ⅝ mile long in a north-northwesterly direction, and steep-to on its western side. The general depths on it are 16 to 17 feet, but a least depth of 12 feet is found near its southern end. The shoal is marked on its western side near the middle by a can buoy. Broken ground, with general depths less than 6 fathoms, extends southeastward from the shoal to within 1 mile of the shore, and then trends southward to Inner Manchas. There are numerous heads on this broken ground, some of which have depths of 12 to 21 feet.

Inner Manchas lies on the north side of the main entrance to Mayaguez Bay, and is marked at its southern end by a black bell buoy which lies 1⅜ miles westward from Point Algarrobo. A depth of 15 feet is found on the shoal for a distance of ⅜ mile, and heads with 18 feet on them occur as much as ⅝ mile, northward of the buoy. The

Manchas Grandes lies on the south side of the main entrance to Mayaguez Bay, and is marked on its northeast side by a gas buoy (occulting white) which lies a little over ½ mile south-southeastward from the black bell buoy on the north side of the channel. The shoal has a length of about 1½ miles in a southwesterly direction, and extends southward to Rodriguez Bank. The general least depths on the east, north, and west sides of the shoal are 13 to 15 feet, but there is a depth of 12 feet a little southward of the red buoy, and 11 feet about ½ mile southward of the buoy. The north end of the shoal with depths of 19 to 21 feet lies ⅜ mile southward of the black bell buoy and ¼ mile west-northwestward from the gas buoy.

Rodriguez Bank lies about 1½ miles northward from Point Guanajibo, and is about ½ mile in diameter. At its western end is a reef about 400 yards in diameter, which is awash and always breaks. The part of the bank east of the reef awash has depths of 6 to 9 feet, but

at its north end there is a small patch with 3 feet of water lying 600 yards northeastward from the north end of the reef awash. A shoal with 10 to 14 feet of water in places extends northward from Rodriguez Bank to Manchas Grandes.

White Rock is small, has a depth of 9 feet with 7 to 9 fathoms close-to, and lies about ¾ mile north-northeastward from the center of the reef awash on Rodriguez Bank.

Algarrobo Reef is small, has a few heads which show at low water, and lies nearly ⅜ mile southwestward from Point Algarrobo. The reef is marked by a can buoy moored close to its southwest side. The depths between the reef and the shore east of it are 5 to 11 feet.

Mondongo Shoal is small and partly awash at low water, and lies from 300 to 600 yards westward of Little Algarrobo Point and 600 yards northwestward from the end of the old wharf off the point.

The 18-foot curve trends southward for ½ mile from the old wharf on Little Algarrobo Point, and then turns southwestward to Rodriguez Bank.

Pilotage is compulsory for certain vessels. Pilots come out in small boats and meet vessels outside the entrance buoys. The rates of pilotage, and extracts from the rules and regulations relating to pilots and pilotage are given in the Appendix.

Anchorage can be made in the bay anywhere off the line of the range lights with the rear light or customhouse bearing between 122° true (SE ⅞ E mag.) and 64° true (ENE mag.), in a depth of over 20 feet; the lead is a good guide. The usual anchorage for commercial vessels is a little southward of the range line, and from ⅜ to ¾ mile from the landing, in 20 to 30 feet, according to draft.

Harbor regulations are given in the Appendix.

Quarantine.—National quarantine regulations are enforced.

Supplies.—Provisions, ice, lumber, and some ship chandler's stores can be obtained, and water from a pipe at the customhouse landing. Some small repairs to machinery can be made.

Currents.—The tidal currents set northward and southward across the entrance with an estimated velocity of about 1 mile at strength. These are not felt at the anchorage.

DIRECTIONS, MAYAGUEZ BAY.—*From northward.*—Approaching Mayaguez Bay, round Point Jiguero at a distance of 2 miles, and when the lighthouse bears east-northeastward make good a 152° true (SSE ¼ E mag.) course for 8½ miles. When Front Hill is in line with Montuoso Peak, bearing 103° true (ESE ½ E mag.), or at night when the Mayaguez Harbor range lights are in line, bearing 109° true (ESE mag.), stand in on either range, and enter the bay. Select anchorage according to draft, as recommended under heading "Anchorage," above.

From southward.—From a position ½ mile westward of Tourmaline Reef gas buoy steer 56° true (NE by E ¼ E mag.) for 7¼ miles. When Front Hill is in line with Montuoso Peak, bearing 103° true (ESE ½ E mag.), or at night when the Mayaguez Harbor range lights are in line, bearing 109° true (ESE mag.) stand in on either range and anchor as directed under heading "Anchorage," above.

Añasco Bay.—From Point Algarrobo the coast turns to a general north-northwesterly direction for 4 miles and then turns to a west-

northwesterly direction for 4 miles to Cadena Point, forming Añasco Bay.

Several rivers empty on the eastern side of the bay, the largest of which is Añasco River, and their entrances show as breaks in the cocoanut groves. The northern part of the bay is somewhat foul for a distance of about 1 mile from shore, there being a number of shoals with 16 to 17 feet over them inside the 10-fathom curve; the lead gives little or nor warning in approaching them. A shoal with 5 feet or less makes out nearly ⅜ mile from the mouth of Añasco River, and thence it shelves off to 15 feet at a distance of nearly ⅝ mile from shore. Outer and Inner Manchas shoals lie from 1¼ to 2¼ miles offshore at the southern end of the bay, and are marked by buoys; they are described under Mayaguez Bay.

San Francisco Hills are a series of dome-shaped hills which slope upward from Cadena Point to Atalaya Peak. They are mostly cultivated, and have but few trees. The most readily identified is a hill, 151 meters (495 feet) high, which stands above the general line of the others. It is saddle-shaped, with the highest point eastward, and is a useful landmark for many miles southward (see Fig. 4).

Atalaya Peak, 1,184 feet high, is the western small knob or peak of the highest part of a short ridge which has about the same height as the peak. From the peak there is a decided slope to the lower hills which extend to Cadena Point. It is a useful landmark for many miles southward and westward (see fig. 4).

From Cadena Point the coast extends 4¼ miles north-northwestward to Point Jiguero, and is a narrow strip of lowland fringed with cocoanut trees, and backed by rolling hills. At Corsica a valley makes inland, at the head of which is Atalaya Peak. The coast is fringed with rocks and coral reefs to a distance of about ⅜ mile, and Peregrina Reef lies ⅝ mile from the shore at Cadena Point. When approaching the coast the depths change suddenly from 100 fathoms and over to 5 fathoms and less within ½ mile. The water is clear, and shoal spots can generally be seen in the daytime by a change in the color of the water. There is always a surf on the beach; places for boat landings can be found in ordinary weather, but it is dangerous in rough weather.

Peregrina Reef, with least depths of 8 to 14 feet, makes out obliquely from the shore southward of Corsica to a greatest distance of ⅝ mile southwestward of Cadena Point. The reef is in the form of a ridge, and its edge is steep-to. The lead can not be depended on to keep clear of it.

Corsica is a railroad station, 3 miles southeastward of Point Jiguero lighthouse. A building, painted red, just back from the beach is prominent. Vessels call for sugar and it is delivered to them in lighters.

Rincon is a village and railroad station on a slight indentation 1¼ miles southeastward from Point Jiguero lighthouse. Reefs, with 5 to 12 feet of water over them and steep-to at their outer edges, make out nearly ⅜ mile from the shore.

Point Jiguero, the western end of Porto Rico, is projecting and prominent. The end of the point is low and partly wooded, but at a distance of 600 yards from it the land rises quickly to rolling hills, 135 to 270 feet high, which extend southeastward, rising gradually

Serial No. 164.

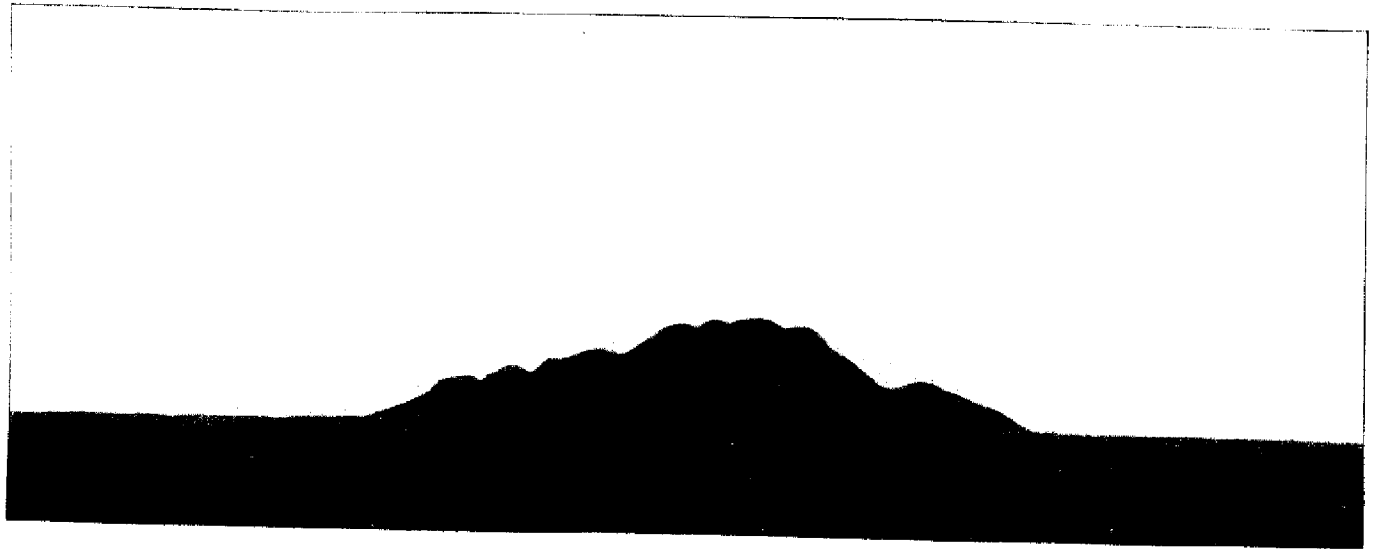


FIG. 12.—DESECHEO ISLAND, N. BY W., 3 MILES.

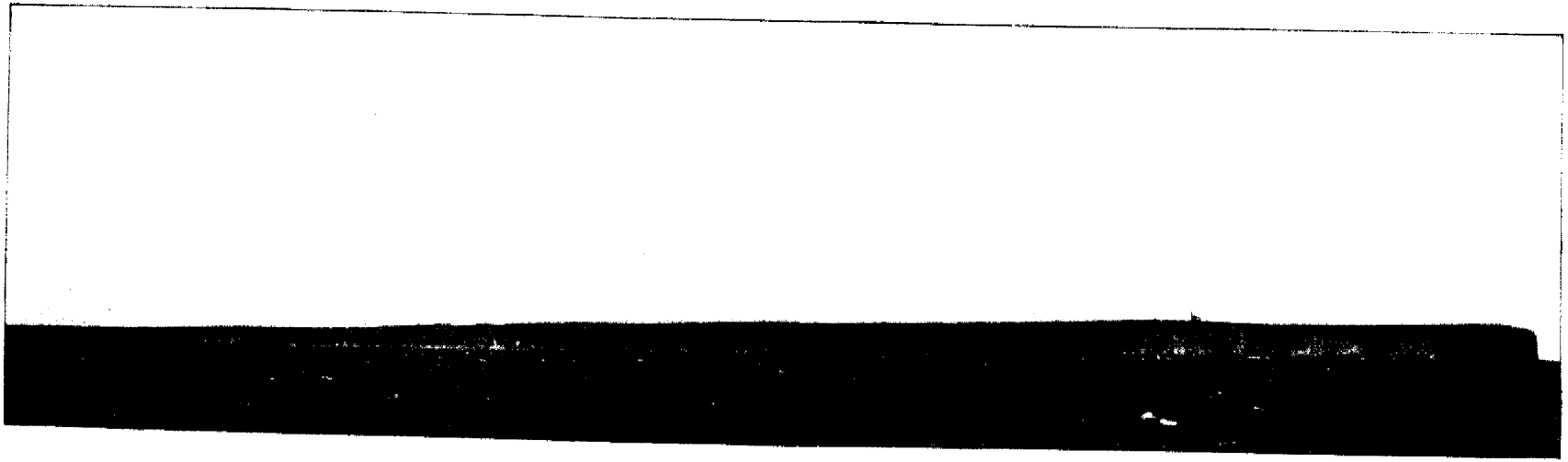


FIG. 13.—EAST CAPE, MONA ISLAND.

Lighthouse, NNW., 2 miles.

to Atalaya Peak, and are mostly cultivated to their summits. The lighthouse stands on the point about 60 yards from the water. It is a red octagonal tower on a stone colored flat-roofed dwelling, from which is exhibited a group flashing white light (three flashes every 15 seconds). A new lighthouse of concrete is under construction.

Desecheo Island lies in Mona Passage about 12 miles westward from Point Jiguero. It is 1 mile in diameter, 620 feet high, wooded, visible 30 miles or more in clear weather, and is one of the best landmarks for Mona Passage and the west coast of Porto Rico (see fig. 13). The island is not inhabited and there is no anchorage.

From Point Jiguero lighthouse the coast trends about east-northeastward for 7 miles to a little southward of the town of Aguadilla, and then trends about northward for 7½ miles to Point Borinquen. From 1 to 2 miles southward of Point Borinquen the coast is low, rocky bluffs, backed by sloping highland. Beginning 2 miles southward of the point the coast is conical, wooded hills, 500 to 800 feet high, with patches of white rock showing near their summits. These hills extend south of Aguadilla to a large valley formed by the Culebrina River, and then trend inland along the north side of this valley. The town of Aguadilla is on a narrow strip of lowland at the foot of the hills, and shows for some distance seaward.

The range of high hills on the peninsula, of which Point Jiguero is the western end, is prominent, but except the point there is no distinctive feature that can be identified from northward. These hills are highest near the south side of the peninsula for some distance eastward of Atalaya Peak. From Aguadilla to Point Jiguero, the coast is a sandy beach with cocoanut groves, and westward of Culebrina River is backed by low, wooded hills a short distance inland, and higher hills farther southward.

AGUADILLA BAY.

This bay is on the west coast of Porto Rico between Point Borinquen and Point Jiguero. It is exposed northward and westward, but with the ordinary easterly trade winds the anchorage off Aguadilla is smooth. A narrow bank of soundings, very steep-to, skirts the shore of the bay; the only dangers are said to be the sand bars, which extend about 400 yards off from the mouths of the streams on its south side.

Aguadilla is an important town on the east shore of the bay, 3½ miles southward of Point Borinquen lighthouse. In 1920 the population was 8,035. It is a port of call for the coasting steamers, and foreign vessels call occasionally. Vessels discharge and load by means of lighters. Water can be obtained in casks from a large spring in the town. The town is on the railroad which runs between San Juan, Mayaguez, and Ponce.

Prominent features.—There is a *cemetery* at the north end of the town. South of it is a *schoolhouse* (two-story, gable-roofed, gray building, with red roof), and the old *barracks* (group of red buildings). The *customhouse* is a one-story, gable-roofed, gray building on the beach about the middle of the water front. Just north of it is a boat landing, without flooring, and south of it is a large sewer outlet with retaining wall. A little farther southward and back from the beach, near the foot of the hills, are the *new church* (red

roof and belfry) and *old cathedral* (yellow, with clock tower and belfry).

A pilot may be obtained by making signal.

Anchorage.—The usual anchorage is with the customhouse bearing east distant about 400 to 800 yards, in 6 to 20 fathoms, according to size and swinging room required. If not sure of the customhouse, the yellow cathedral on an east-southeast bearing will lead to practically the same anchorage. At the anchorage the depths increase rapidly seaward, and the edge of the bank may drop off quickly to the 100-fathom curve, so that care is necessary in selecting an anchorage. A shoal makes off probably 200 yards or more from the point at the north end of the town between the schoolhouse and the cemetery. A shoal with 15 feet at its end extends 350 yards from the point ¼ mile southward of the customhouse.

The anchorage is smooth during the ordinary easterly trades, but from November to March there is sometimes a heavy northerly wind and sea which are dangerous to vessels at anchor. There is always some surf, but landing is generally not difficult, except with northerly winds, when it is impracticable. The beach is sandy.

Quarantine.—National quarantine regulations are enforced.

DIRECTIONS, AGUADILLA BAY. The bay is open and clear, and the anchorage is easy of access in the daytime for both steamers and sailing vessels. At night there is usually little wind in the bay, and the town is dark and overshadowed by the high hills behind it, so that the anchorage is not easily made.

From northward.—Round Point Borinquen at a distance of 1½ to 2 miles, and when the lighthouse bears 64° true (ENE mag.), distant 3 miles, steer 155° true (SSE mag.), giving the shore a berth of about 1 mile. When the yellow cathedral in the southern part of the town bears 110° true (ESE mag.), steer for it and proceed with care to the anchorage (see description preceding).

From southward.—Round Point Jiguero at a distance of 1½ to 2 miles, and when the lighthouse bears 155° true (SSE mag.), steer for the northern part of the town, course 65° true (ENE mag.) for the former, and 70° true (ENE ½ E mag.), for the latter distance off Point Jiguero. Either course made good for 6½ miles will lead to a position 1 mile off the town. Then steer for the customhouse on an 88° true (E ⅛ S mag.) course or for the yellow cathedral on a 110° true (ESE mag.) course, and proceed with care to an anchorage.

DIRECTIONS, WEST COAST OF PORTO RICO.

OFFSHORE.

Passing westward of all shoals.—For vessels of the deepest draft. From a position 4 miles southward of Cape Rojo make good a 272° true (W ½ N mag.) course for 7½ miles. Cape Rojo should then bear 64° true (ENE mag.), distant 8½ miles. From this point make good a 325° true (NNW ⅞ W mag.) course for 15½ miles. Desecheo Island should then bear 0° true (N ¼ E mag.) and Buena Vista Hill 91° true (E ⅜ S mag.). This position is just outside the range of visibility of the lights at Mona Island and Cape Rojo, but if well above the deck they may be seen on a clear night; the former should

bear 271° true (W ¼ N mag.) and the latter 118° true (SE by E ¼ E mag.).

Then make good a 30° true (NE by N mag.) course for 20½ miles to a position 2 miles 301° true (NW by W mag.) from Point Jiguero lighthouse. Then a 40° true (NE ⅛ N mag.) course made good for 14 miles will lead to a position 3½ miles northward of Point Borinquen lighthouse. For courses along the north coast of Porto Rico see page 69.

Passing westward of Gallardo Shoal.—For vessels of 21 feet or less draft. These directions lead close to a least depth of 4¾ fathoms.

From a position 2 miles southward of Cape Rojo lighthouse steer to make good a 304° true (NW ¾ W mag.) course for 10½ miles, to a position ¼ mile westward of Gallardo Shoal gas buoy. On this course with the sun shining the bottom will be seen in the vicinity of Cape Rojo and Gallardo Shoal.

Then steer a 0° true (N ¼ E mag.) course for 9¾ miles to a position ¾ mile westward of Tourmaline Reef gas buoy. If bound to Mayaguez Bay follow directions on page 105. If bound north, steer 10° true (N by E ⅛ E mag.) for 13¼ miles to a position 2 miles 301° true (NW by W mag.) from Point Jiguero lighthouse.

From the foregoing position a 40° true (NE ¼ E mag.) course will lead to a position 3½ miles northward of Point Borinquen lighthouse. For courses along the north coast of Porto Rico see page 69.

INSHORE.

Through Guanajibo Channel.—For vessels of 15 feet or less draft. From a position 2 miles southward of Cape Rojo lighthouse steer 308° true (NW ⅜ W mag.) for 4 miles, when Cape Rojo lighthouse should bear 98° (E by S mag.), distant 3 miles. Then steer 20° true (NNE mag.) with Point Guaniquilla and Point Boca Prieta in line ahead, leaving Casabe Shoal nun buoy ¼ mile to starboard and Resuello Shoal can buoy ⅜ mile to port, for 4¼ miles, when the hill on Point Melones will bear 140° true (SE ¾ S mag.), distant 1 mile. If bound into Boqueron Bay follow the directions given on page 100.

If bound northward make good a 355° true (N ¼ W mag.) course for 4⅝ miles to a position 100 yards westward of Point Ostiones nun buoy. Then steer a 0° true (N ¼ E mag.) course for 4 miles to a position 150 yards westward of Point Arenas nun buoy. Then steer 357° true (N mag.) for 1⅞ miles to a position 100 yards eastward of Negro Bank can buoy, which marks the northern end of Guanajibo Channel. If bound to Mayaguez Bay continue this course for ½ mile beyond the buoy and then steer 17° true (N by E ¾ E mag.) for 2 miles, heading for Atalya Peak. When Front Hill is in line with Montuoso Peak bearing 103° true (ESE ½ E mag.), or at night when the Mayaguez Harbor range lights are in line stand in on either range and be guided by the directions on page 105.

If bound northward steer at 342° true (N by W ⅜ W mag.) course for 12½ miles to a position 2 miles 301° true (NW by W mag.) from Point Jiguero lighthouse. Then a 40° true (NE ¼ E mag.) course will lead to a position 3½ miles northward of Point Borinquen lighthouse. For courses along the north coast of Porto Rico see page 69.

MONA PASSAGE.

Mona Passage, between Point Jiguero, of Porto Rico, and Cape Engaño, of the island of Haiti, is 61 miles wide and receives its name from Mona Island, which, with Monito Island, lies nearly midway at the south entrance, between Cape Rojo and Saona Island. Desecheo Island, a prominent landmark for the passage, lies 12 miles westward of Point Jiguero. (See page 107.)

The 100-fathom curve is about 15 miles westward of the western part of Porto Rico, on the southeastern side of Mona Passage. This bank is described on page 100 under heading "Offshore Shoals." When navigating this portion of the passage safety will be assured by keeping Desecheo Island bearing eastward of 0° true (N ¼ E mag.).

A bank extends from Cape Engaño, the eastern extremity of the island of Haiti, and the western side of Mona Passage, for a distance of 23 miles, with a least depth of 27 fathoms. Strong tide rips and heavy swell, caused by the meeting of contrary currents, and visible for many miles, mark the position of this bank.

In the middle of Mona Passage there are tidal currents, which during the calm weather of light trades set each way about 6 hours. In general, however, there is a southwesterly set, due to the prevailing trades. Observations made on the northwest edge of the bank about 13 miles westward of Point Guanajibo gave a velocity of about 1 mile at strength for both flood and ebb.

The passage presents no difficulties, excepting that great caution must be used in the vicinity of Saona Island, which is low and foul, and it should be given a berth of at least 6 miles. Heavy squalls, resembling tornadoes and generally giving sufficient warning of their approach, may be expected in the passage, particularly in the summer.

MONA ISLAND.

This island is in the middle of the south entrance to Mona Passage, East Cape of the island lying 38½ miles west-northwesward from Cape Rojo. Temporary anchorage and landing can be made in places on the south and west side of the island during good weather, but there are many days when anchorage and landing are impracticable. There are 35 inhabitants, consisting of a few fishermen, near West Point, and the light keepers on East Cape. On the island are numbers of wild cattle, goats, hogs, sea birds, and tortoises.

Mona Island is about 6 miles long east and west, and 4½ miles wide. From seaward the island appears perfectly flat on top, breaking off abruptly at the water in a vertical whitish cliff about 175 feet high (see view). On the southern side, from southwestward of East Cape to West Point, the cliffs are lower, permitting a view of the interior of the island, which is covered with scrub and cactus. On this side, too, there is a narrow strip of lowland between the foot of the cliffs and the water.

East, North, and **Northwest capes** are vertical cliffs about 175 feet high. East Cape is surmounted by Mona Island lighthouse (black hexagonal pyramidal tower and white dwelling). The light is fixed white with a white flash of 4.2 seconds duration every 120 seconds.

Cape Barrionuevo, the northwest end of the island, is a vertical cliff, from the foot of which projects a mass of rock shaped like two saw

teeth on top, the inner and higher one nearly half as high as the cape. This feature shows from northward and southward.

West Point is a low, narrow ridge, covered with brush, which projects nearly 1 mile westward of the cliffs. A reef extends about ¼ mile westward from the point, and there is not more than 5 fathoms ½ mile off; it should be given a good berth.

Caigo o no Caigo Point, about 3½ miles southeastward from West Point, is surmounted by a large balanced rock.

Dangers.—On the north and east sides of the island the water is apparently deep, and it offers no shelter from the prevailing wind. The west, south, and southeast sides are fronted by a bank of sand and coral, affording anchorage in places to a distance of about 1 mile offshore. The shore is fringed with detached coral reefs with boat passages through them leading to the beach. A good berth should be given West Point in rounding it (see the description preceding).

Anchorages.—With a strong wind from any direction, the sea draws around the island and generally into all the anchorages. Sardinero Anchorage is the best one during southeast winds and Isabella Anchorage during northeast winds; Ubera and Pajaro anchorages can be used only during fine weather and a smooth sea.

Sardinero Anchorage, the best one at the island during southeast winds, is exposed to northeast winds. It is on the west side between West Point and Cape Barrionuevo. The anchorage is in 8 or 9 fathoms, sand, about ½ mile from shore. The bank is steep outside these depths, and toward Cape Barrionuevo the water is deeper and bottom rocky. There are boat passages through the reefs to the shore at the southeast end of the bay, the best one having a depth of 4 or 5 feet. The beach is foul and the landing somewhat difficult. About midway between West Point and Cape Barrionuevo a prominent wooden chute has been constructed from the top of the cliff to the beach for shipping phosphate rock.

Isabella Anchorage, on the south side about ¾ mile eastward of West Point, is the best one during northeast winds, but is exposed southeastward. The white sandy beach is free from rocks in places, and a good position is in 7 fathoms, sand, about 600 yards from shore.

Ubera Anchorage, on the south side nearly 1 mile westward of Caigo o no Caigo Point, is in 6 to 9 fathoms nearly ½ mile from shore. It is exposed eastward and southeastward. There are boat passages through the reefs to the shore.

Playa Pajaro is nearly 1 mile southward of East Cape, and is the old buildings formerly used by a guano company. There is a boat harbor inside the reefs with 3 to 8 feet of water, to which there are three entrances. The southern and main entrance has depths of 7 to 20 feet, and is marked by a range (front, white post; rear, black post) on shore maintained by the light keepers as a guide for the tender's boat. Anchorage can be made about 800 yards off the reefs in 9 fathoms, but there are many rocks, and a sandy spot should be chosen for dropping the anchor, the bottom being visible. The slope is steep beyond a depth of 11 fathoms. The tender anchors on the range in as little as 7 fathoms, and aims to arrive at daylight before the trade wind is fresh. This anchorage is exposed to all easterly winds, and there are many days when anchorage and landing are impracticable.

Water.—Fresh water can be obtained under the cliffs on the southern side of the island, but none for vessels.

Tides.—In Sardinero Anchorage the flood sets northward and the ebb southward with a velocity of about ½ mile an hour. It is high water, full and change, at the island at 6h. 15m., and the rise is not more than 2 feet. A northerly current with a velocity of ½ mile has been experienced off Playa Pajaro.

Monito Islet lies about 3½ miles north-northwestward of Cape Barrionuevo, with a clear channel between. It is a bare rock about 400 yards in diameter, and its sides are cliffs lower than those of Mona. From some directions it has the appearance of a shoemaker's last. There is a narrow bank of sand and rock on the west side of Monito, on which a depth of 25 fathoms is found about 100 yards off. Vessels have anchored for guano on this side in 30 to 36 fathoms. The only place where landing can be effected, but with much risk to the boat even with a smooth sea, is at a rock on the west side of the islet.

THE VIRGIN ISLANDS.

The Virgin group of about 100 small islands and cays was discovered by Columbus on his second voyage in 1494. For some time they were chiefly in the hands of the buccaneers, but in 1666, Tortola, Virgin Gorda, and Anegada islands came into the possession of the British; and in 1672 the Danes colonized St. Thomas and St. John, which they sold to the United States in 1917. The first settlers at St. Croix were the Dutch in 1643; but it afterwards passed successively into the hands of the British, Spaniards, and French; and in 1733 it was sold by the latter to the Danes, who, in 1917, sold it to the United States.

The American islands lie westward of the line of demarcation, which runs from the north between Little Hans Lollik and Little Tobago; thence through the Narrows between St. John Island and Great Thatch Island; thence around the eastern end of St. John Island through Flanagan Passage between Flanagan Island and Pelican Island. They include the islands of St. Thomas, St. John, and St. Croix, together with the adjacent islands and rocks.

The British islands, which are attached administratively to the Leeward islands, are about 32 in number, and include Virgin Gorda, Anegada, Jost van Dyke, Tortola, and Peter islands.

Population.—According to the census of 1917 the population of the American group was 26,051. A census in 1911 gave the population of The British Virgin Islands as 5,562.

Trade.—The principal imports from the United States to the American islands are cereals, bituminous coal, iron and steel products, boots and shoes, meat and dairy products, oils, lumber, and refined sugar. The principal exports to the United States are sugar and bay rum, hides and skins, and cabinet woods. In 1919 the total imports amounted to $4,196,037 and the total exports $1,919,525.

In the fiscal year 1918–19 the aggregate tonnage of vessels entering and clearing the British group was 11,248 tons; the imports were valued at approximately $83,400, and the exports $44,000.

Aspect.—On making the Virgin Islands from the northward, Virgin Gorda will be seen on the extreme left, rising in a clear, well-defined peak 1,370 feet high. Anegada being only 30 feet above the sea, will not be seen more than about 7 or 8 miles at an elevation of 15 feet. Next to Virgin Gorda, Tortola will appear the most conspicuous; Sage Mountain, the highest in the island, does not rise into a peak from this direction, but appears flattened and elongated; its height is 1,780 feet. Immediately to the westward of it will be seen the rugged pointed peaks of Jost Van Dyke, 1,070 feet high, and behind them the irregular small peaks rising from the table-land of St. John, and varying in elevation from 800 to 1,225 feet.

From about 20 miles to the northward of the islands, on or near the meridian of 64° 50′ W., a separation will be observed between St. John and St. Thomas, as the small cays which lie off and between them will not be seen; but the other islands, viz., Virgin Gorda,

Tortola, Jost Van Dyke, and St. John, will appear as one large island, the prominent peaks on each being alone distinguishable.

The island of St. Thomas may be recognized by having a large saddle on its center, formed by Signal Hill and West Mountain, the former 1,500, the latter 1,550 feet high; and the island is less rugged in outline than the others. This saddle is equally conspicuous from the southward. Culebra from the above position will be only just in sight. Its hills are more rounded than the others and much less elevated, being not more than 650 feet high.

Virgin Bank.—It will be seen by the chart that the extensive group of the Virgin Islands lies on the southern edge of a bank of soundings, stretching from Porto Rico to the eastern end of Anegada, and on the meridian of 64° 40′ W. as far to the northward as latitude 18° 51′ N., about 15 miles west-northwest of the western end of Anegada, whence the edge gradually approaches to within 1½ miles of the north side of that island. From the above position it trends to the southwestward about 17 miles, when it assumes a more westerly direction, and runs nearly in a straight line for the northeastern point of Porto Rico. It will therefore be seen that the bank extends about 14 miles to the northward of St. Thomas, increasing to 23 miles on the same side of Tortola.

On the southern side of the group the edge of the bank lies only 1¼ miles from Norman Island; thence it takes a southwestern direction to the meridian of the western end of St. John, when it trends to the westward, passing about 7 miles from the southern sides of St. John and St. Thomas and 2 miles from Vieques Island.

The soundings on the southern side of the islands differ in a remarkable manner from those on the north. Here the edge of the bank, bold and wall-sided, lies at the distance of only from 1 to 7 miles from the cays, and close within it is a narrow ledge of coral, about 200 yards wide, with a depth of from 15 to 19 fathoms, which continues almost unbroken from the Horseshoe Reef at Anegada nearly to Vieques Island, having immediately within it from 25 to 30 fathoms of water.

The general depth on the northern side of the islands is from 28 to 30 fathoms, coral sand, with rocky patches from ½ mile to 4 miles in extent, on which the soundings vary from 6 to 15 and 20 fathoms. These patches lie from 2 to 7 miles from the edge of the bank. Eastward of 64° 40′ W the depth is from 15 to 22 fathoms, shoaling to 7 fathoms on nearing the western end of Anegada.

Whale Banks are the most northern of the patches on Virgin Bank; the southern bank, having a least depth of 10 fathoms, is in the shape of an oval, about 2 miles long by 1½ broad within the 20-fathom curve. The northern bank is about 3 miles long and from 1½ to 2 miles wide, with depths of from 12 to 20 fathoms.

Turtle Head is a small coral patch, lying southwestward of Whale Banks, with as little as 6 fathoms water on it. At ¼ mile northward there is a depth of 25 fathoms, while to the southward uneven ground extends nearly 1½ miles, with soundings of from 11 to 18 fathoms. When on the head, the westernmost hill on St. John will be seen over the western portion of Jost Van Dyke, bearing 180° true (S ¼ W mag.), and Virgin Gorda Peak 111° true (SE by E ¾ E mag.).

Barracouta Banks are several patches with from 11 to 20 fathoms water on them, and lie from 2 to 4 miles from the northern edge of the bank, the shoalest parts being at their northeastern and northwestern ends.

Kingfish Banks are two coral patches, each about a mile long and ½ mile wide, with 8 fathoms of water on them; they are 1 mile apart, with a depth of 23 fathoms between. When on the northern bank the highest peak of Jost Van Dyke bears 213° true (SW ⅝ S mag.), and Guano Island Peak 119° true (SE by E mag.).

With the exception of some rocky patches, having from 14 to 18 fathoms of water on them, the above are the only off-lying shoals on the northern side of the group.

The Virgin Passage.—This passage is 8 miles wide between Savana Island and Culebrita. The depths vary from 13 to 17 fathoms in the southern to 17 to 27 fathoms in the northern portion. It is quite clear, with the exception of the Grampus Shoals on the southwestern side and Sail Rock on the southeastern side.

Tidal currents.—In the middle of the passage the currents run with a velocity of about ½ knot an hour, the flood to the southward and the ebb to the northward. On the eastern side of the passage near Savana Island the velocity increases to about 2 knots an hour.

Sail Rock, so called from its resemblance to a vessel under sail, rises precipitously from the sea to the height of 125 feet. It is about 100 yards in diameter, quite barren, with a light grayish appearance, from its being frequented by birds at certain seasons. About 200 yards to the west-southwestward of it there is a small rock nearly awash, the only danger near it; on all other sides it is bold and steep-to. Sail Rock lies 3¼ miles south-southwestward from Savana Island, and is a remarkable object from any direction.

ST. THOMAS ISLAND.

St. Thomas is commercially the most important island of the Virgin Islands of the United States. It is 12 miles long, from east to west, and ranges from 1 to 3 miles in width. A lofty ridge extends its whole length; Signal Hill, nearly in the center of the island, is 1,504 feet high, and West Mountain, 2 miles to the westward, is 1,550 feet high, whence large spurs branch off to the north and the south terminating abruptly on the shore.

The western half of St. Thomas presents the appearance of a steep ridge sloping precipitously to the north and the south. Numerous dry ravines, which become the beds of small torrents during heavy rains, intersect these slopes, the ravines widening at their lower ends into small tracts of level land on the seacoast. Between these level tracts the coast is usually bold with rocky promontories of considerable height, the hills and ridges back of them being more rounded and of a softer outline. The principal hills, **Crown, Hawk,** and **Fortuna,** are flat topped and plateaulike, while the minor hills are for the most part dome-shaped. The country is almost entirely wooded, the region west of Perseverance Bay presenting a forestlike appearance, being covered with a thick growth of trees, shrubs, and vines. Only here and there patches of grass and cultivated land are seen, the most extensive being the large flat back of Mosquito Bay and the slopes eastward of Hawk Hill.

The eastern end of St. Thomas has the appearance of two main ridges separated by a large basin which slope to the northward and southward with numerous smaller ridges and spurs making off from them. These two ridges join westward of the Tutu Estate to form the one main ridge that runs through the center of the island and terminates at its eastern end. The highest elevation, 870 feet, on this end of the island is the Nulliberg.

St. Thomas is almost surrounded by small islands and cays, in general bold and steep-to, with but very few hidden dangers to guard against.

Population.—In 1917 the population of St. Thomas was 10,191.

Cockroach Island, 3 miles north-northwestward from the west end of St. Thomas Island, and **Cricket Rock,** ½ mile east-northeastward from Cockroach Island, are the northernmost features lying to the northwest of St. Thomas. **Cricket Rock** is 46 feet high, bold and steep-to with sharp pinnacle rocks on top. Cockroach Island, 151 feet high, is of irregular shape. The south shore is bold and precipitous, with white rocky cliffs rising vertically and abruptly from the water's edge to a height of 100 to 120 feet. The north shore is rocky with cliffs back from the shore rising to a height of 70 to 80 feet and is indented by numerous small bights and crevices. **Sula Cay,** close southeastward of Cockroach Island and separated from it by a very narrow channel is 57 feet high. There is a clear channel between Cockroach Island and Cricket Rock. The channel between Cockroach and Dutchmans Cap to the southward is free of dangers.

Dutchmans Cap, 275 feet high, 1½ miles southward of Cockroach Island, rises abruptly from the sea, with cliffs 100 feet high on the north shore and of lesser height on the south shore. There are scattered trees and bushes growing on top of the island which at a distance appears dome shaped. About 100 yards off its southwest face there is a small rock 2 feet high with a rock awash near it.

Salt Cay Passage is 1 mile wide, with depths of 13 to 19 fathoms in the channel and is free of dangers excepting a sunken rock charted 325 yards southwestward from Dutchmans Cap.

Salt and **West Cays** are two islets ⅞ mile and ⅜ mile, respectively, northwestward from the western end of St. Thomas. **Salt Cay** is generally rocky and rugged, particularly on the north coast where the cliffs rise precipitously to 100 and 150 feet high. The eastern shore is coral rock and gravel. There are many rocks awash close to the shore on the southwest, west, and east sides of the cay. The channel between Salt Cay and West Cay is shallow and breakers extend across it.

West Cay consists of two hills, 121 and 114 feet high, connected by a neck of low land. All the shore of West Cay except the two bights on the north and south shores and a small bight on the eastern end, is rocky with cliffs ranging from 20 to 100 feet high. The bight on the north side has a sandy beach and the one on the south side, sand and gravel. The small stretch on the eastern side of the cay is gravel. Landing may be made in the bight on the southern side.

Big Current Hole is a boat passage separating West Cay from Little St. Thomas. A number of rocks awash extending easterly from West Cay, the outer one bare 2 feet, contract the channel, and strong

currents and heavy tide rips render the passage difficult. Small boats using this passage, when passing through from southward head for the 2-foot rock and leave it close to on the port hand. **Little St. Thomas** is a low grass-covered peninsula and connected with the island of St. Thomas by a sand pit. There is a hill 50 feet high near the northeast point and a bluff 21 feet high at the southern end. An islet, 42 feet high, lies 100 yards northward and is separated from Little St. Thomas by **Little Current Hole**, a boat passage.

Turkey or Kalkun Cay, in the middle of Savana Passage, is a narrow islet, 275 yards long, from 20 to 30 yards wide, and 73 feet high. It is covered with grass and small underbrush. A bank with 5 to 10 fathoms of water extends northwestward and southeastward from the cay. About ½ mile southeastward of the cay is **Saltwater Money Rock**, 8 feet high, steep-to, with a clear channel between.

Savana Island lies 2 miles west-southwestward from the western end of St. Thomas. It is nearly a mile in length, ½ mile in width, and the highest part, 269 feet, is near the southwestern end. The island is covered with a dense growth of vines, small trees, and underbrush. The entire northwest shore is bold and precipitous with rock cliffs rising abruptly from the waters edge and in some places reaching a height of 120 feet. Just south of the north point on the western side of the island the shore is formed by massive boulders that have probably been torn away from the cliffs by volcanic action. Water plays in between these boulders and sometimes in heavy weather the noise of the seas washing in between the crevices is terrific and deafening. The southeastern shore of the island is generally rocky with short stretches of gravel beach in the bights. Just north of Virgin Point the cliffs are of a crushed rock and sandstone formation and from offshore appear as red cliffs. Detached rocks extend 200 yards southward of Virgin Point; there are also some rocks 8 to 10 feet high, and steep-to, on a sunken ledge which extends about 700 yards off the northeastern point, and there is a sunken rock close to the north point. The currents in the vicinity of the northeastern point are very strong and small boats should give the reef a wide berth.

Boat landings may be made only in smooth weather.

In navigating the passages between the above described islands the only caution necessary is to guard against the tidal currents, which in Savana Passage run with a velocity of 3 knots and in the others about 1 knot. Sailing vessels beating up against the ebb current had better stand well to the southward of Savana Island, so as to avoid the strength of the inshore tide.

NORTH COAST OF ST. THOMAS.

From Little St. Thomas, the western end of St. Thomas, the coast trends northeastward for ⅜ mile to Botany Point, then east-northeasterly for 1½ miles to Stumpy Point. The shore line of **Little St. Thomas** is generally low, with gravel and broken coral rocks in the bights and rock and sandstone bluffs at the points. From Little St. Thomas to Sand Bay the shore is rocky and precipitous with deep gashes in the cliffs. **Sand Bay** and **Botany Bay** are shallow bights separated by a rocky point. There is a large banana plantation at the head of Botany Bay. Sand Bay has a fine sand beach while Botany Bay has a fringing coral reef, bare at low water. When too rough

to effect a landing either in Sand Bay or Botany Bay small boats use the small gravel bay on the south side of Little St. Thomas.

From Botany Point to Bordeaux Point the shore line is irregular with rocky cliffs, 20 to 30 feet in height. **Bordeaux Bay**, eastward of Bordeaux Point, is a small bay of no commercial importance. The shore line is low and of coarse gravel. There are several rocks awash extending northwestward from the northeast point.

From Bordeaux Bay to Stumpy Point the shore line is rocky at the points with sandy beaches in the bights. **Stumpy Bay,** just westward of Stumpy Point, has a fringing coral reef, bare at low water, and a detached islet 40 feet high.

Santa Maria Bay, nearly a mile wide between Vluck Point and Stumpy Point, 2 miles eastward of the western end of St. Thomas, has depths of 4 to 7 fathoms; it affords fair shelter, but is seldom visited, being exposed to the rollers. There is a small wharf near the head of the bay that can accommodate launches.

From Vluck Point to Dorothea Point, a distance of 1¾ miles, the coast trends eastward, with no prominent points or bays, the points for the most part being rocky and rounding, while the bays are shallow. Almost the entire length of beach is fringed with a coral reef, which in most places is bare at low water. Landings through breaks in the reef may be made directly on the beach in Caret Bay and in Neltjeberg Bay. **Dorothea Bay** has no fringing reef but is shoal.

Brass Islands consists of two islands lying off the northern side of St. Thomas and about 4 miles from its western extremity. They are each about ¾ mile long in a northwesterly direction and 700 yards broad; the Inner Brass is 256 feet and the Outer Brass 412 feet high. Between the Inner Brass and St. Thomas there is a 5-fathom channel, 400 yards wide, and between the two islands the channel is 7 fathoms deep and 600 yards wide, but they are only used by the coasters.

Inner Brass Island.—From Fish Point eastward the shore is rocky with cliffs 40 to 50 feet high. A detached rock, 29 feet high, lies close to shore off the northern point. The northeastern and eastern sides of the island are low and generally rocky, excepting for two bights which have sand and gravel shores. Shoal water extends eastward about 300 yards, with bare reefs off the northeast point. **Boulder Point,** the southern extremity, is low with a rounded hill, 125 feet high, northward. Northwestward of this point is a fine sand beach, with a fringing coral reef. There are several breaks through the reef where small-boat landing may be made. The island is uninhabited. Fishing is good off the northwest point.

There is a secure and well-sheltered anchorage for local boats in 6 to 7 fathoms of water, about ½ mile from shore, with Fish Point bearing about 8° true (N by E mag.). A 5-fathom spot is near this position.

The eastern shore of **Outer Brass** is bold and precipitous with rocky cliffs rising vertically from the water's edge. From Gras Point, the southeastern extremity, westward and northwestward the shore is rocky and slopes up uniformly from the shore to the top of a hill northward. The western shore line is rocky and irregular, with numerous small bights and points. The island is covered with teyer palm and brush.

Lizard Rocks are a group of rocks about 1,500 yards off the north shore of St. Thomas and 1 mile westward of Inner Brass Island. There are 6 rocks bare at high water, the largest being 14 feet high. About 50 yards westward of this group there are 3 rocks awash.

Ornen Rock, with 9 feet of water on it, lies 1 mile eastward of Inner Brass Island and ½ mile from Picara Point. Dutchmans Cap, kept open between the two Brass Islands, leads to the northward of it.

Hull Bay, between Dorothea Point and Tropaco Point, is shoal and of no commercial importance. It is used to some extent by the fishermen.

Magens Bay is the only bight on the north shore of St. Thomas that is of any importance. It is 1½ miles in length and ½ mile wide, and its eastern side is formed by a long, narrow tongue of land, which terminates to the northwestward at Picara Point, nearly midway between Hans Lollik and the Brass Islands. Being, however, open to the northwestward, and consequently exposed to the rollers, it is only safe for small vessels, and they will find good anchorage anywhere under the weather shore. In entering care must be taken to avoid Ornen Rock.

The depth in the bay varies from 6 to 12 fathoms, but in the southern portion there is a bank of 1½ fathoms, extending ¼ mile from the shore, surrounded by depths of 2 to 3 fathoms. There is a fine sand beach at the head of Magens Bay. **Reseau Bay** and **Lerken Bay**, small bights on the west shore of Magens Bay, are used by fishermen to beach their boats. The beaches are protected from the swell by fringing coral reefs with breaks in them which afford access to the shore.

Hans Lollik is a small island 713 feet high, 1¼ miles long north and south, nearly ¾ mile broad, and lies 1½ miles northeastward of Picara Point. It consists of a single ridge, covered with a growth of teyer palms, shrubs, and undergrowth. The western side of the island is precipitous and rocky, except in a bay on the west, where there is a gravel beach. Fishing is carried on off the rocks along the shore. **Camp Bay**, on the southeast face, is protected by outlying reefs, through which there is a passage for small boats to the beach. **Hans Lollik Rock**, awash and on which the sea always breaks, is 700 yards east-southeastward of the southern point of Hans Lollik.

Little Hans Lollik is 400 yards northward of Hans Lollik and connected with it by a coral ledge over which the sea breaks. The northern half of the island is low and covered with grass while the southern part rises to a height of 217 feet and is covered with trees and brush. The shore line consists mostly of rocky cliffs from 20 to 60 feet high.

Pelican Cay, a grassy islet 20 feet high, lies 200 yards northward of Little Hans Lollik. There are several rocks awash between the two, and a reef over which the sea breaks is close northeastward of Little Hans Lollik.

With the exceptions of the dangers above mentioned, the channels on either side of the Hans Lollik group are clear. To avoid Hans Lollik Rock keep Shark Island, 32 feet high, near the shore at the east end of St. Thomas, open of the west end of Thatch Cay. Sailing vessels beating to the windward should do so on the flood.

From Picara Point the shore trends east-southeastward for 7 miles to Cabrita Point, the eastern point of St. Thomas. There are several

unimportant small bays along this coast all open to the prevailing easterly winds.

Mandal Bay, 3 miles eastward of Picara Point, is shoal, with a sandy beach at its head. In the interior there is a large salt pond, separated from the beach by mangroves. The shore line between Picara Point and Mandal Bay is precipitous with vertical cliffs, in some places 200 feet high. **Mandal Point**, just eastward of Mandal Bay, is 270 feet high, with cliffs at the water's edge 100 to 120 feet high. A reef, which generally breaks, is close northeastward.

Tutu Bay, **Sunsi Bay**, and **Spring Bay** are small bights between Mandal and Coki Points. **Coki Point**, 47 feet high, is a small peninsula extending east and west, which forms the northern shore of Water Bay. A conspicuous cone-shaped hill, 205 feet high, is just south of Water Bay. There is a mooring buoy near the head of the bay.

Turtleback Rock, 12 feet high, lies off the entrance to Water Bay, 590 yards east-southeastward of Coki Point. Shark Islet, 32 feet high, is 1 mile east-southeastward of Cabes Point. Northeastward of it are several rocks, the highest being 11 feet. Foul ground encircles the islet.

Cabrita Point, the eastern end of St. Thomas, rises to a height of 210 feet about ⅕ mile inland. A low narrow neck of land separates this hill from the remainder of St. Thomas.

Thatch Cay, ½ mile northward of Coki Point, is 1½ miles long, east and west, with an average width of ¼ mile. The island is in the form of a ridge, 482 feet high near the eastern end, with lesser heights westward. **Bull Point** and **Mother East Point** are prominent projecting points near the eastern and western points of the island, respectively.

Grass Cay, ½ mile eastward of and separated from Thatch Cay by Middle Passage, is ¾ mile long east and west, with an average width of only 200 yards. The north shore consists of rocky cliffs in places 150 feet in height. A narrow rocky ledge, 12 feet high at its eastern end is close to shore near the west end of the cay, and a rock awash at low tide, is 150 yards westward of the same point.

Mingo Cay, 165 feet high, lies directly east of Grass Cay. It is smaller than either Grass or Thatch Cays, but has the same general shape with a precipitous north shore. Between Mingo and Grass Cays there is a narrow shoal passage, with a bare rock 15 feet high, close to the middle.

Lovango Cay, eastward of Mingo Cay, and separated from it by a shoal passage, 300 yards wide, is ⅞ mile long in an easterly direction, with an average width of 300 yards. It has two summits, of almost equal heights, the eastern hill being 247 feet and the western one 255 feet. There are several houses in a bight along the south shore between Murder Rock and the southwestern point. **Blunder Rock**, 250 yards eastward of Lovango Cay, is a group of rocks, the highest of which is 5 feet above low water.

Congo Cay, a narrow pointed cay, lies northward of Lovango Cay, and is separated from it by a channel with depths of 2½ fathoms. It is 170 feet high, with a precipitous shore line and is covered with shrubs and bushes.

Carval Rock, 67 feet high, lies ¼ mile eastward of Congo Cay. There are several smaller rocks between it and the cay.

Pillsbury Sound is the body of water between St. Thomas, St. John, and the chain of small islands previously described, which bound the sound on the northern side, forming an excellent roadstead, about 2 miles in extent east and west and 1½ miles north and south, quite secure against rollers and all winds except from the southward, which only blow in the hurricane months. The current in it, however, attains a velocity of 2 knots, so that if intending to remain any time it will be better to moor to avoid a foul anchor.

Depths.—The depths in the sound are somewhat irregular, varying from 8 to 16 fathoms. All the main passages leading to it are deeper than the mean depth of the sound itself; that from the southward carrying from 13 to 18 fathoms, the Windward Passage 12 to 16, the Middle Passage 13 to 15, and the Leeward Passage 11 to 14 fathoms.

The **Two Brothers** are two small barren rocks, 20 feet high, lying in the middle of the sound. A ledge extends off their northeastern side, deepening to 5 fathoms at the distance of 250 yards. A depth of 4 fathoms has been reported ¾ mile south-southeastward from West Brother.

Anchorages.—About ¾ mile westward of Little Cruz Bay there is anchorage in the southern part of the sound in 11 fathoms of water, over sand and mud, with the center of the Two Brothers in range with the western point of Grass Cay, and Dog Rock open westward of Steven Cay; also in 9 to 10 fathoms ½ mile northeastward of the Two Brothers, and elsewhere if desirable.

Directions—Southern Passage.—A vessel may approach the anchorages in Pillsbury Sound by the southern passage between Steven Cay and St. John Island, but it can not be recommended to sailing vessels on account of the baffling winds under the high land. The passage westward of the cay is a mile or more in width, with not less than 14 fathoms of water, and Dog Rock, astern, bearing 177° true (S mag.), leads in the fairway; when Steven Cay bears 87° true (E mag.) steer northeastward for the anchorage.

The best mark to run through eastward of Steven Cay is Carval Rock, off the eastern end of Congo Cay, and the western hummock on Jost Van Dyke in line, bearing 12° true (N by E ⅜ E mag.). The reef off Turner Bay and the dry rocks off Steven Cay are bold and steep-to, but care must be taken to guard against being set out of the course by the tidal current that runs with a velocity of 2 knots through the channel, the flood to the southward, the ebb to the northward.

Northern channel.—*Windward Passage* lies between the Lovango and Durloe Cays, 600 yards wide. The Durloe Cays, within the entrance, can not be mistaken (described on page 131). On the western side of the channel are **Carval Rock**—400 yards off the eastern end of Congo Cay, which lies close to the northward of Lovango Cay—and **Blunder Rock**, awash, 400 yards from the eastern end of Lovango Cay.

Vessels of deep draft may take the passage between Lovango and Durloe Cays. The pilotage is simple, the eye being a sufficient guide, for every danger can be seen.

Sailing vessels, should the wind fall light, may anchor at a moment's warning; in less than 10 fathoms the bottom is rocky.

In this channel with the ebb running against the wind there is a race, which appears like broken water. Through Durloe Cays and between them and Hognest Point there are deep and clear passages, but these are not recommended.

Between Lovango and Mingo Cays there is a 3-fathom boat channel; it is narrow and the tidal current in it is strong.

Middle Passage, between Grass and Thatch Cays, is about 600 yards wide, and presents no difficulties to steamers, the only danger being a small rock awash, lying nearly 200 yards westward from the west end of Grass Cay, and is easily seen.

Sailing vessels generally use this passage in leaving the sound; it may be entered from the northward even on the ebb, provided the trades have not too much of a southerly slant.

Currents.—In Middle Passage the flood current sets to the southward with a velocity of about 2 knots at springs, and takes a southeastward direction inside; the ebb sets in the opposite direction, with the same velocity.

Leeward Passage, between Thatch Cays and the northern side of St. Thomas, is 800 yards wide, with depth of not less than 12 fathoms, and has no danger in it whatever. The flood sets through eastward with a velocity of about 2 knots, and the ebb with the same velocity in the opposite direction.

SOUTH COAST OF ST. THOMAS ISLAND.

Water Point is the end of a moderately high peninsula separating Great Bay from Cowpet Bay, the two bays which indent the coast between Cabrita Point and Deck Point. **Great Bay** has depths of 7 to 10 fathoms and at the head is a fine sand beach. Cowpet Bay is shoal, but well protected and is an arm of St. James Bay. **Deck Point** terminates in rocky cliffs, 40 to 60 feet high, north of which is a hill 142 feet in height.

Off Water Point lie the three islands of **Great St. James, Little St. James**, and **Dog Islands**, the latter having **Dog Rock**, 9 feet high, close off its eastern extremity; these form the western side of the entrance to Pillsbury Sound, previously described.

Current Hole and **Passage** is between Water Point, St. Thomas Island and Great St. James Island, nearly 400 yards distant. The passage is divided nearly in the center by Current Rock, 13 feet high, and between it and Water Point the depth is only 9 feet; but on the Great St. James side a draft of 23 feet can be carried through a channel not quite 100 yards wide and 200 yards long.

St. James Bay is formed between the eastern end of St. Thomas and Great St. James Island, and contains excellent and secure anchorage, except in the hurricane season, being sheltered from all points but the southwest. The **Cow**, 10 feet high is the western rock of a group of rocks in the southern approach to the bay. Close eastward and on the same reef is the **Calf**, 3 feet high.

Currents.—The flood sets through Current Passage to the southward with a velocity of at least 3 knots, and the ebb with equal velocity to the northward.

DIRECTIONS.—*Vessels entering St. James Bay from the southward* should give the Stragglers a berth of 100 yards and anchor where convenient. If necessary sailing vessels may run out between the Cow and Calf and Deck Point, in which channel there are irregular depths of 4½ to 9 fathoms. *From northward, through Current Hole and Passage.* Passing ⅜ mile southeastward of Cabrita Point steer 222° true (SW ⅛ W mag.) until up to Current Rock. Leave the rock to the westward and enter St. James Bay. Select anchorage as convenient. Sailing vessels when using the pass must do so with an ebb tide and there must be a steady, commanding breeze to stem the current.

Dog Island Cut, between Dog Island and Little St. James, has from 2 to 3 fathoms of water and with a charted depth of 1½ fathoms over a rock in the northern approach, is dangerous excepting for small boats or launches.

St. James Cut.—A depth of 20 feet may be carried through this cut between Great and Little St. James, passing on either side of Welk Rock, a group of rocks 10 feet high, which lies in the northern approach. The channel favors the Great St. James side, but is crooked and by no means safe. In case of necessity small sailing vessels can make the pass from the eastward with the wind well aft and against the current.

Jersey Bay, 1 mile westward of Deck Point, indents the coast between Compass Point and Patrick Point. **Rotto Cay**, 200 yards southward of Compass Point is 33 feet high and is covered with a scrubby growth. Coculus Rocks, a group of bare rocks, lie 350 yards eastward of Rotto Cay, and a small detached mangrove swamp lies the same distance northwestward. **Cas Island**, in the southern approach, lies ¼ mile northeastward of Patrick Point. It is ⅜ mile long, narrow, and 99 feet high at its eastern end. **Mangrove Lagoon** is a shoal lagoon at the head of Jersey Bay and is separated from the latter by mangrove swamps, through which lead two boat channels. The lagoon is used only by small local boats.

Long Point, the terminus of a high prominent ridge westward of Jersey Bay, consists of rocky cliffs 40 to 50 feet high. Bolongo Bay, 1¼ miles west-northwestward of Long Point and close to Coculus Point, is a small shoal bay at the head of which is a coconut grove and a valley reaching inland. The main road in this section leads through this valley to St. Thomas.

A **rock** with a depth of 9 feet of water over it lies ¼ mile offshore and about ¼ mile west-southwestward of Coculus Point.

Packet Rock is a coral shoal about 100 yards in extent, with a depth of about 5 feet, lying 1,600 yards 256° true (W ⅞ S mag.) from Long Point and 2,520 yards 2° true (N ½ E mag.) from Buck Island Lighthouse. The sea only breaks over the rock during heavy weather and it can not be seen until close-to. To the south and west it is steep-to; on the eastern side the depth gradually increases to 7 fathoms 150 yards from the rock. Contant Mill, well open southward of Muhlenfels Point, leads southwestward of Packet Rock.

Buck Island lies 2 miles southward of Coculus Point and is a prominent landfall for making St. Thomas Harbor. It consists of two small islands of irregular outline which are partially covered with a scrubby growth and separated by a narrow channel almost closed

by numerous uncovering rocks. **Buck Island light**, a group flashing white light, three flashes every 20 seconds, is exhibited at a height of 125 feet from a white square tower on the highest point of the western island. Off the western end a shallow ledge extends to a distance of 100 yards and off the northern side the depth is 5 fathoms at the same distance. The south side is steep-to. There is a small wharf and boat landing at the head of the southwest bight on the western island.

Frenchmans Cap lies 3½ miles southeastward of Buck Island, and like Buck Island is a useful landfall for making St. Thomas Harbor. It is 350 yards long, 200 yards wide, and 183 feet high, covered with grass and steep-to. The shore line for the most part consists of high rocky cliffs. Off the northern side of the islands are depths of 6 to 8 fathoms 400 yards from the island and off the southern side 24 fathoms at 200 yards.

ST. THOMAS HARBOR.

This is the most important harbor of the Virgin Islands and one of the best harbors of the Windward Islands. It is situated on the south coast of St. Thomas Island, is 10 miles eastward of Sail Rock, Virgin Passage, and 7 miles northwestward of Frenchmans Cap. The northern and eastern sides are formed by St. Thomas Island and the western side by Hassel Island.

The entrance between Rupert Rock Beacon and Frederik Point is 500 yards wide, from whence it spreads out on either side into a basin, about ¾ mile in diameter, and being open to the southward it is at all times convenient to enter or leave with the prevailing trade winds. Although of small extent, the harbor is well protected and perfectly safe except during a hurricane.

Muhlenfels Point is the eastern entrance point of the harbor. The quarantine station, a group of brown buildings with red roofs, and **Muhlenfels Point lighthouse** (white cylindrical tower, from which is shown a flashing white light every 15 seconds) are located on this point; a somewhat similar group of buildings on a ridge back of French Bay are sometimes mistaken for the quarantine station and Muhlenfels Point.

The West Indian Company's dock is located along a section of reclaimed water front northeastward from Havensight Point. Off the face of the dock is a channel dredged to 30 feet deep and 125 yards wide.

St. Thomas, formerly called Charlotte Amalia or Amalienborg, with a population of 7,747, is the principal town of the Virgin Islands and is located along the north shore of St. Thomas Harbor. As seen from off the entrance of the harbor the town is built around three spurs which branch off to the southward from the main mountain ridge. **French Hill**, the western spur, is 165 feet high. The center one, **Judge Bergs**, is 295 feet high, and there is a prominent square white building near the top. On the eastern spur, **Government Hill**, 205 feet high, is Blackbeards Castle (Kiaer Tower), a remarkable stone tower, 47 feet high. To the eastward of the town another hill, **Bluebeard** (Frederiksberg), rises abruptly from the shore, to a height of 224 feet, surmounted by a stone tower 34 feet high.

Chacha Village, a fishing settlement, lies along the shore of Mud Hole, the bay at the northwest corner of the harbor. **Ballast Island** is small, low, and covered with trees and undergrowth.

The Sticks or **Haulover** is a narrow channel separating St. Thomas from Hassel Island. At the present time the available depth through this passage into East Gregerie Channel is about 3 feet.

Hassel Island, 7/8 mile long, north and south, with an average width of 1/4 mile, is high and prominent, and forms the westerly side of the harbor. Along its northeast side are old docks, partly in ruins. **Careening Cove** indents the eastern shore and is the site of the U. S. Navy dock. Two large prominent oil tanks are on the hill southward of the dock. A conspicuous wreck lies on the shore just south of the southern entrance point to Careening Cove. Located on **Frederik Point,** the easterly point of the island, is an old fort. Cowell Point is the southern end of a ridge sloping up to the highest point on the island, known as Cowell Battery.

Channels.—The channel into St. Thomas Harbor is marked by **Judge Bergs range lights** (white structures on Judge Bergs Hill, front light fixed red, rear light fixed red), buoys, and a beacon on Rupert Rock, and has a least depth of 31 feet. A dredged channel leads alongside of the West India Company's dock at Havensight Point.

Pilotage is compulsory, and vessels approaching the harbor are met outside by the pilot. If compelled to wait for a pilot, vessels should keep the entrance range open somewhat to the westward. The rates of pilotage, and extracts from the rules and regulations relating to pilots and pilotage, are given in the Appendix.

Reporting station.—There is a signal station on Cowell Battery, Hassel Island, and all approaching vessels are reported to the Harbormaster.

Towboats.—No towboats can be obtained outside but there are small gasoline boats that do light towing in the harbor.

Anchorages.—The best anchorage in the harbor for deep-draft vessels is with the highest part of Rupert Rock in line with Muhlenfels Point lighthouse, and the easterly oil tank south of Careening Cove bearing 240° true (SW by W 3/4 W mag.) in 5 fathoms of water.

Vessels of lesser draft may anchor nearer the town or in Long Bay. Fishing vessels and small local craft usually select anchorage in Mud Hole.

Harbor regulations are given in the Appendix.

Quarantine.—National quarantine regulations are enforced. The quarantine station is at Muhlenfels Point. Vessels with contagious diseases on board should anchor outside of Scorpion Rocks. Vessels subject to inspection are required to fly the letter "Q" of the International Code at the masthead from the time of their approach to the harbor until practique is given by the quarantine officer.

Communication.—St. Thomas has communication by cable with all parts of the world. The Navy Department maintains a radio station, the towers of which are located on Kings Wharf, St. Thomas.

St. Thomas is a port of call for steamship lines from United States and Europe.

Communication between St. Thomas, San Juan, and Christiansted is maintained by sailing vessels, on a regular weekly schedule.

Wharves.—There is a depth of 30 feet alongside the West India Company's dock at Havensight Point. The public boat landing is at Kings Wharf. Westward of this location there are several private landings for small boats. The Navy wharf is accessible for all but the largest ships.

Supplies.—Coal, water, and fuel oil may be obtained. Ship chandlery and other supplies may be purchased in limited quantities.

Repairs.—All ordinary repairs to vessels may be made. On Hassel Island, in the western part of the harbor, under the ruins of Shipley Battery, there is a marine railway capable of taking out vessels of 95 feet length, but owing to the filling of the entrance with mud the available draft is not over 9 feet.

The floating dock, which is situated in the western part of the harbor, has a length of 250 feet accommodating a length of keel of 300 feet, inside breadth 72 feet, greatest draft 21 feet, capacity 3,000 tons.

Hurricane warnings are displayed from a staff on Fort Christian, and at the signal station, Cowell Battery.

The **customhouse** is north of Kings Wharf, facing the public park.

Dangers.—Green Cay, a small islet south of French Bay, is 24 feet high and covered with a low underbrush. A reef partly awash extends to the nearest point on St. Thomas, and partially shelters French Bay. There are several bare rocks and rocks awash lying 100 yards southward of the cay.

Triangle Rocks lie nearly midway between Green Cay and Muhlenfels Point. They consist of three groups of rocks in the shape of a triangle; the eastern group, known as Barrel of Beef, is 2 feet high, the northern one is partially awash and seldom breaks, and the southwestern and outer rock is 1 foot high.

A detached coral rock about 35 yards in diameter lies with the two western rocks of the Triangle in line bearing north, distant 300 yards from the outer. It has 2¾ fathoms water on it, and 7 fathoms close-to, with patches of 5½ fathoms at short distances to south and east.

The southern limit of these dangers is marked by a red nun buoy.

Banana Point (the northern end of Water Island) just open of Cowell Point (the southwestern point of the entrance to the harbor), bearing 305° true (NW ½ W. mag.), leads northward of the 2¾-fathom rock, but rather close to the southwest of the Triangle, and it is advisable to pass southward and westward of the buoy marking the dangers.

Scorpion Rock lies in the fairway of the entrance to the harbor, between Muhlenfels and Cowell Points. It is a small coral rock, with two or three heads higher than the rest, on which there is a depth of 18 feet at mean low water. At about 30 yards on either side of the rock are depths of from 4 to 4½ fathoms. A red and black nun buoy surmounted by a perch and ball marks this danger. **Kiaer Tower** (Blackbeard Castle), in line with Frederik Point, bearing 2° true (N ½ E mag.), leads 250 yards to the westward, and the tower on Bluebeard Hill in line with the highest part of Rupert Rock bearing 9° true (N by E ⅛ E mag.), leads about 125 yards eastward of the Rock. The entrance range clears the rock about the same distance eastward.

Point Knoll is a coral head over which there is a depth of 16 feet, lying 238° true (SW by W ½ W mag.) from Muhlenfels Point lighthouse and about 175 yards from the nearest part of the point.

Rohde Bank lies 500 yards north-northwestward from Muhlenfels Point lighthouse and consists of three small coral heads lying close to each other with a least known depth of 12 feet. Kiaer Tower, open westward of Rupert Rock Beacon, bearing 350° true (N ½ W mag.), leads over the western part of the Bank in 23 feet of water. This range also clears Point Knoll. The western side of Rohde Bank is marked by a red nun buoy.

Rupert Rock, 12 feet high, white on top, lies about ½ mile northward of Muhlenfels Point lighthouse, at the narrowest part of the channel into the harbor. At its base are some large boulders which extend out to a distance of 100 yards and toward the west become just covered at high water. A beacon, white spindle with target, marks this danger. Between the Rock and Havensight Point there are only 12 to 15 feet of water.

Between Frederik Point and Careening Cove the 18-foot curve is 100 to 150 yards off shore.

Directions, St. Thomas Harbor.

From westward.—From a position 4 miles eastward of Culebrita lighthouse make good a 103° true (ESE ½ E mag.) for 9 miles to a position 1¼ miles south-southwestward of the prominent red cliffs of Saba Island, with Muhlenfels Point lighthouse just open southward of Flamingo Point, Water Island. This course will lead 1¼ miles to the northward of Sail Rock. Then steer to make good a 75° true (E by N mag.) course for 3¼ miles, to a position ½ mile south-southeastward of Flamingo Point. Then steer 53° true (NE by E ⅛ E mag.) heading for Muhlenfels Point lighthouse. When Rupert Rock is on range with the tower on Bluebeard Hill, or Judge Bergs Hill is open out of Frederik Point, haul slowly to the northward to meet the Judge Bergs entrance range (small white structures, with red vertical stripe) on Judge Bergs Hill, course 344° true (N by W mag.). Continue on this range until past Rupert Rock beacon, when anchorage may be selected to the eastward of the range. This range is not very sensitive off the entrance and care should be taken to keep on it.

From eastward.—To pass between Buck Island and Packet Rock. Bring the southern extremity of Dog Island in line with Ram Head, St. John Island, bearing 88° true (E ⅛ S mag.), and steer 268° true (W ⅛ N mag.). This range will lead over ½ mile southward of Packet Rock and ¾ mile northward of Buck Island lighthouse. When Contant Mill (stone structure on hill 377 feet high north of Gregerie Channel) is open of Cowell Point, bearing 319° true (NW ⅝ N mag.) it may be steered for, passing 400 yards southwestward of the nun buoy off the Triangle. When Judge Bergs entrance range is on steer for it, course 344° (N by W mag.) until past Rupert Rock beacon, when anchorage may be selected to the eastward of the range.

At night vessels should pass between Frenchman Cap and Buck Island.

From southward.—Vessels approaching from southward will sight Frenchman Cap and Buck Island as landfalls for the harbor. Steer

to give Buck Island lighthouse a berth of about 1 mile and head in for the harbor on a 344° true (N by W mag.) course and pick up the entrance range. Then follow the preceding directions.

Gregerie Channel, immediately westward of St. Thomas Harbor, is formed by Water Island to the south and St. Thomas on the north, making a complete elbow.

Water Island, 1½ miles long, 294 feet high, is of irregular outline, indented by several small bays and covered by small trees and dense underbrush. Flamingo Point, the southern point of the island, consists of brown rocky cliffs, 100 feet high, upon which the sea continually breaks. **Flamingo Bay** and **Drift Bay**, separated by Drift Point, are two small bights on the west side of Water Island.

Banana Point, the northern end of the island, is a low rocky point. Between it and Drift Point to the southward the sandy bays and beaches are used by the fishermen for seining. **Banana Bay** and **Sand Bay** are two shallow bights on the east side of the island. **Sprat Point**, terminating in high rugged cliffs, separates East Gregerie Channel from **Sprat Bay**, a small bight with a fine sand beach at its head. **Limestone Rock**, 4 feet high, lies on an extensive coral reef, 175 yards southward of **Carol Point**, the point which forms the eastern shore of Limestone Bay. Sprat Bay and Limestone Bay being open to the prevailing swell are rough and of no commercial importance.

East Gregerie Channel, between Hassel and Water Islands, is free from danger. At its entrance, between Cowell and Sprat Points, it is ½ mile wide, and at the elbow, or northwestern end, between Careen Hill and Banana Point, ¼ mile. **West Gregerie Channel**, the southwestern arm, is about the same length and over ¼ mile wide. At the head or elbow it opens into a well-sheltered basin ½ mile in diameter.

Depths.—East Gregerie Channel carries from 6 to 8 fathoms, and West Gregerie Channel from 6 to 9 fathoms. At the junction of the two, northward of Water Island, there is a bar with from 4½ to 5½ fathoms.

Dangers.—**Gregerie Bank** is in midchannel, 475 yards northwestward of Sandy Point. It consists of a coral sand shoal about 80 yards long and 40 yards wide, with a least depth of 13 feet. Cowell Point, open off Banana Point, bearing 125° true (SE ½ E mag.) leads northward of it. Sandy Point Rock is an elongated shoal with a depth of 1 foot at its northeastern end and 3 feet at its southwestern end, lying near the end of a sandy shoal making 250 yards off from Sandy Point. The distance between it and Gregerie Bank is 250 yards. Between Sandy Point Rock and Sandy Point there is a rocky shoal with a least depth of 1 foot.

Telegraph cables.—Three telegraph cables are laid through West Gregerie Channel, the landing place being on a small point in Crown Bay, westward of Careen Hill.

Anchorage.—Anchorage can be found anywhere in Gregerie Channel, clear of the shoals. To avoid fouling the cables in West Gregerie Channel anchorage should be selected off the entrance to Little Krum Bay. A good berth can also be found north of Banana Point.

Tides.—The flood in Gregerie Channel sets through to the eastward with a velocity of about ½ knot at springs; the ebb with the same velocity in the opposite direction.

DIRECTIONS.—To enter by East Gregerie Channel, when off the entrance steer a 332° true (NNW ⅛ W mag.) course keeping in mid-channel. When Regis Point opens northward of Banana Point, steer 295° true (NW by W ⅜ W mag.) heading for the Nisky Moravian Mission buildings, with Cowell Battery nearly astern. When Kiaer Tower (Blackbeard Castle) begins to open northward of Careen Hill steer 239° true (SW by W ⅝ W mag.), heading for the eastern summit of Haypiece Hill, to an anchorage off Little Krum Bay.

To enter by the West Channel when off the entrance steer a 47° true (NE ½ E mag.) course until the southern tangent of Regis Point is on range with the highest part of Grambokola Hill and Providence Point is on range with the northern part of Drift Point. Bring the latter range astern on a 26° true (NNE ⅝ E mag.) course and continue it until Little Krum Bay opens out. Then head west-northwestward and select anchorage off the mouth of the bay.

Krum Bay is an inlet lying between two high peninsulas at the western side of West Gregerie Channel. It is about 800 yards in length and 150 yards wide at its narrowest part, with a deep channel favoring the western side. This channel has an entrance depth of 7 fathoms, shoaling to 3 fathoms near the head of the bay. The entrance points are rocky, but the shore line at the northern part of the bay is a narrow strip of mangrove.

On the west shore, 300 yards from the head of the bay, is a cable station and wharf. On the shore opposite is an old wrecking station, and there are scattered along the shore the remains of old masts, rigging, etc.

Mosquito Bay, close westward of Krum Bay, is about ½ mile wide, between Mosquito Point and Red Point, ½ mile in length, and open to the southward. **Mosquito Point** is the southern end of the peninsula separating Krum Bay from Mosquito Bay. **Grambokola Hill**, 275 feet high, thickly wooded, and prominent, is the highest point on this peninsula. Off Red Point, the western entrance point, a rocky ledge extends 600 yards southward, ending in **Red Point Shoal**, which has a least depth of 4 feet and is steep-to. A detached rock, 25 feet high, lies close to the western shore, 400 yards north-northeastward from Red Point.

At the head of Mosquito Bay there is a fine sand beach and the interior to the northward is under cultivation. A small boat pier is in the northwest corner of the bay, and the U. S. Marine Barracks buildings are just back of it.

At the entrance to the bay the depths are 5 fathoms, gradually decreasing toward the head of the bay. The bay is used only by small local boats.

Water Island Anchorage is an excellent anchorage westward of Water Island, for deep-draft vessels. To make this anchorage vessels can pass on either side of Porpoise Rocks and come to in 9 to 10 fathoms of water, with the southern extremity of Water Island bearing 140° true (SE ¾ S mag.) and Careen Hill bearing 50° true (NE ¾ E mag.).

Westward of Water Island there is a group of islands and shoals forming the southern side of Southwest Road.

Porpoise Rocks lie 1 mile westward of Flamingo Point and 1½ miles southward of Red Point. They consist of two reefs connected by a shallow ledge, there being two distant breaks. The eastern reef is the larger and is about 200 yards wide. The highest rock of this reef bares 3 feet, with smaller rocks that bare or are awash. The smaller reef is about 30 yards in extent, with a rock which bares 2 feet. There is 6 to 10 fathoms of water in the channel between Porpoise Rocks and Water Island.

Flat Cays lie ⅞ mile northeastward from Saba Island and 1¼ miles south-southwestward from Red Point. They consist of two small islets, 32 feet and 11 feet high, respectively. The larger one is partly covered with underbrush, while the other is bare. About 300 yards eastward of Big Flat Cay is a rock awash, surrounded by a breaking reef.

Saba Island, 202 feet high and triangular in shape, lies 1 mile southwestward of Big Flat Cay. The northern part of the island is low. The southern part is high, with precipitous red cliffs 150 feet high along the south shore. The highest part of the island is near the western end, where it rises to almost a point. There are two small lagoons surrounded by mangroves near the north end. A landing can be made on the sand beach along the northwest shore. About 150 yards east of the island is a reef consisting of a bare rock 5 feet high, with numerous rocks awash over which the sea always breaks. Another reef awash lies 100 yards southward of the western end of the island.

Turtledove Cay, 50 feet high, 100 yards northward of Saba Island, is small, covered with tall grass, and connected with the latter by a reef bare at extreme low water. About 200 yards westward of the cay there is a cluster of rocks awash. There is a boat channel between these rocks and the cay.

Dry Rock, lying about ½ mile southwestward of Saba Island, is a group of bare rocks and rocks awash, with the highest rock baring 2 feet.

Southwest Road, between Flat Cays and Perseverance Bay, affords an excellent anchorage with the wind as far southward as east-southeast. A four-fathom spot lies 1,000 yards southwestward of Red Point.

Directions.—Steamers may anchor as convenient after entering through any of the channels between the islands and shoals southward. Sailing vessels should enter from the eastward between Water Island and Porpoise Rocks, favoring Water Island, and pass between Flat Cays and Red Point Shoal; to avoid the latter keep Flag Hill (hill 980 feet high, east of St. Thomas Harbor) open southward of Mosquito Point until the southeastern points of Big Flat Cay and Turtledove Cay are in line. Then haul to the northward and anchor as convenient.

From Red Point the coast trends northwestward for 1 mile to Black Point. **Range Cay**, an islet 21 feet high, lies close to the shore ½ mile from Red Point. **Brewers Bay** is a slight indentation between Range Cay and Black Point. The shore line in the bay is a fine sand beach. **Black Point**, 70 feet high, is a projecting point terminating in rocky cliffs 40 to 50 feet high.

Perseverance Bay, between Black Point and Lucas Point to the westward, has depths of 13 fathoms 800 yards from the shore. At the head of the bay, back of the sand beach, is a salt marsh. Coral reefs, bare at low water, fringe the beach. From the sand beach facing the marsh to Lucas Point the shore is generally rocky with cliffs 60 to 70 feet high.

Fortuna Bay, between Lucas Point and David Point, consists of two small bays separated from each other by a broad point. This point is high and faced by precipitous cliffs 200 feet high.

Between David Point and the western end of St. Thomas the shore line is bold, with rocky cliffs 50 to 200 feet high. A rock, 5 feet high, lies close to the shore midway between David Point and Little St. Thomas.

ST. JOHN ISLAND.

St. John Island is 8 miles long, east and west, but of varying width. Its eastern end, for the distance of 3 miles, is formed by a narrow neck of land from 1 mile to less than ½ mile across; and from its inner end the coast turns sharply to the southward, forming a deep bight, which terminates at Ram Head, forming the southern point of the island; thence across to Mary Point, on the northern side, the island is 5 miles wide. The central and western portions are composed of irregular hills, the highest of which, Bordeaux Mountain, reaches the height of 1,277 feet. For the most part the hills and mountains are covered with trees and brush, with some patches of grass, which are used for cattle grazing.

The principal and practically only industry is the growing of the bay leaves and the distillation of the bay oil from which bay rum is obtained. There is some little cultivation of lime trees, and sugar cane is grown at Reef Bay. The island is best adapted to cattle raising.

Interior communication is difficult, as only "horse trails" connect the different parts of the island. Communication between St. John and St. Thomas is by small sailing vessels.

The population of St. John is 959.

NORTH COAST OF ST. JOHN.

Durloe Cays are three islets westward of Hognest Point, the northwest point of St. John. **Henley Cay**, the largest, is 70 feet high, 300 yards east and west, of regular outline and covered with grass. **Ramgoat Cay**, 310 yards northeast of Henley, is 30 feet high, while **Rata Cay**, the smallest, and lying 400 yards west-northwestward of Henley Cay, is 15 feet high.

Hognest Point, a projecting point which forms the western shore of Hognest Bay, is wooded, and in the northern part there is a circular hill 130 feet high, with a low divide just southward. Off the extreme point is a bare rock 25 feet high. **Hognest Bay**, eastward of the point, is a small bay of no commercial importance. Off the southern shore of the bay are numerous rocks.

Perkins Cay is an islet close to the eastern point of Hognest Bay. Just eastward of this cay is **Denis Bay**, a small bight, almost filled by coral reefs, through which a boat channel makes into the beach. There are some houses at the head of the bay. **Trunk Cay**, a grass-

covered islet, 48 feet high, lies in Trunk Bay, the small bight eastward of Denis and Jumbie bays.

Johnson Reef, of coral formation, ½ mile northward of Trunk Bay, is ¼ mile in length, 200 yards wide, and always breaks. A sunken ledge connects this reef with the mainland to the southeast. There are depths of 3½ fathoms 200 yards northward of it, 3 fathoms about the same distance east and west and deeper water beyond.

Francis Bay, southward of Mary Point, is somewhat protected to the northward by Whistling Cay, and affords good anchorage in 9 fathoms, sandy bottom. Between Whistling Cay and the shore southwestward is a bank 800 yards in length and 250 yards in width, fronting the bay, with 3½ to 4 fathoms of water on it.

Cinnamon Cay, 32 feet high and covered with tall grass and cactus, lies near the middle of Cinnamon Bay, a shoal bight south of Francis Bay., **America Point**, back of which rises America Hill, a prominent elevation 526 feet high, separates Cinnamon Bay from Maho Bay, the head of which is shoal and has a fine sand beach.

Whistling Cay, 202 feet high, and separated from Mary Point by Fungi Passage, is covered with trees. Its north shore is precipitous, with cliffs 130 feet high. There is a gravel beach along the southeast side. Gravel beds are worked by natives who come from St. Thomas in sailboats. Some goats are raised on the cay.

Fungi Passage has a charted depth of 2¼ fathoms, but on account of the baffling winds from the adjacent high land, it is not easily navigated by sailing vessels.

Mary Point is a remarkable headland shaped in the form of a ridge, 1 mile east and west and 578 feet high. This ridge is connected with St. John by a low divide, separating Francis Bay from Smith Bay. The north shore of Mary Point from Fungi Passage eastward to Firewood Beach consists of high weather-beaten cliffs, with large boulders along the water line. **Firewood Beach** is of gravel and sand fringed by coral reefs.

Eastward of Mary Point peninsula there is an indentation about ¾ mile in length and ¼ mile in depth. **Smith Bay**, the western part of this bight, makes well in behind the high land northward. It is shoal and the shore is fringed with mangrove swamps. **Leinster Bay**, the eastern part, is partially protected by **Watermelon Cay**, 30 feet high, lying 250 yards westward of Leinster Point. The cay is bold and is separated from St. John by a channel, 200 yards wide, carrying 2 fathoms of water. Vessels may anchor under the cay about 200 yards from the shore. A reform school for boys is located near the head of Leinster Bay. **Annaberg Point**, 96 feet high, eastward of Leinster Bay, is faced by a conspicuous landslide.

Threadneedle Point, ½ mile eastward of Leinster Point, is precipitous, with cliffs up to 70 feet high. From Threadneedle Point the coast trends in a general east-southeasterly direction for 3½ miles to Eastend, the eastern point of St. John. **Brown Bay**, **Mennebeck Bay**, **Haulover Bay**, and **Newfound Bay** are small bights along this coast, which can be used for anchorage only when the wind is right. Haulover Bay probably makes the best anchorage.

The **Narrows** and waters separating St. John from the British Virgin Islands are described on page 145.

SOUTH COAST OF ST. JOHN ISLAND.

Privateer Point, a projecting point 164 feet high, separates Eastend Bay from Privateer Bay, two small bights open to the southeastward and forming the southeastern extremity of St. John. **Red Point**, a remarkable headland westward of Privateer Bay, is the southern end of a high ridge, and is the eastern entrance point to Coral Bay.

Flanagan Island, 127 feet high, lies ¾ mile southeast of Privateer Point, and may be passed on either side.

Coral Bay is the large bay extending northward into St. John between Red Point and Ram Head. The eastern side is formed by a lofty promontory, which terminates at Red Point. The bay is open to the southeastward, the narrowest part of the entrance, between Moor Point and Lagoon Point, being 1¼ miles wide. Inside the bay the shore is indented by three smaller bays, Round Bay, Hurricane Hole, and Coral Harbor. **Buck Island**, 85 feet high, nearly 600 yards long and 100 yards wide, lies in the entrance to Coral Bay, midway between Red Point and Ram Head.

Channels.—The entrance to Coral Bay, between Buck Island and Sabbat Point, is 700 yards wide and about 10 fathoms deep. The wider channel, between Buck Island and Moor Point, is 11 to 14 fathoms deep, with two coral patches with depths of 6 and 8 fathoms, respectively.

There are no towns in Coral Bay. The population of about 482 live in rural communities scattered in various localities around the bay. **Eastend** is a small settlement on Hanson Bay; the chief occupation of the people is the building of small boats and sloops. At **Emmaus**, on Coral Harbor, there is a Moravian Mission and school, and there is a group of prominent buildings north of Long Point in Hurricane Hole.

Round Bay, the northeastern of the three arms of Coral Bay, is ⅞ mile wide at the entrance, between Moor Point and Turner Point. There are several shoal patches of 3½ fathoms or more which should be avoided in entering.

Pelican Rock, 7 feet high, lies 100 yards off the southern entrance point of Hanson Bay. The **Blinders**, a group of rocks awash at low tide, project 220 yards southward from the western point of the Haulover.

The best anchorage in Round Bay is 600 yards from Moor Point with the point bearing 115° true (SE by E ⅜ E mag.), in 13 fathoms. Should the wind come to the southward of east, a vessel anchored here should be ready to move.

Hurricane Hole, the northern arm of Coral Bay, is ⅝ mile wide at the entrance westward of Turner Point. The shore line is indented by several small bays that afford protection from almost any direction for small vessels. Nathaniel Bay is the first bight northward of Turner Point. **Water Creek**, northward of Nathaniel Bay, affords good protection for small vessels. The creek was used by the Danes as an anchorage for some of their smaller cruisers, the vessels being moored to guns planted on the shore.

Otter Creek, **Princess Bay**, and **Borck Creek** are small bights in Hurricane Hole, any of which may be used as an anchorage.

The **School of Fish** is a shoal, awash at low water, which makes off 100 yards from shore southeastward from **Fortberg Hill**, western side of Hurricane Hole.

Anchorages.—Besides the anchorages in the small bays mentioned above, there is an excellent anchorage in 11 fathoms, with Turner Point bearing 126° true (SE ⅜ E mag.) and Harbor Point 256° true (W by S mag.).

Coral Harbor, the northwestern arm of Coral Bay, is narrow and the deep part of the bay is restricted to a width of 100 yards or less by encroaching shoals from the sides and head of the harbor. The anchorage ground, although smooth with ordinary winds, is narrow, and being on a lee shore it is available only for small, handy vessels.

Fresh water may be obtained from a well at the head of Coral Bay, near a small boat wharf, at which there is a depth of 3 feet.

Fortberg Hill, north of Harbor Point, is very nearly circular in shape, 425 feet high, covered with trees, and very prominent. Lagoon Point, the southern entrance point of Coral Harbor, is fringed by a coral reef 200 yards wide and bare at low water.

Freeze Bay and **Johns Folly Bay** are northward and southward, respectively, of Sabbat Point. The latter is almost filled with coral reefs, with a narrow boat channel to the beach. **Drunk Bay**, southward of Nanny Point, the southern point of Johns Folly Bay, is open to the eastward and the heavy swell makes landing along the beach difficult.

Ram Head, the southern point of St. John, is a remarkable bold headland, on which are two hills, the northern and highest being 288 feet. The eastern side of the point consists of rocky cliffs 100 to 150 feet in height. There is generally a heavy sea running off the point.

Dangers.—The only danger in the approach to Coral Bay for vessels of less than 18 feet draft is **Eagle Shoal**, which lies ⅝ mile southward of Buck Island. The shoal consists of two round patches of coral; the easternmost is 40 yards in diameter with a depth of 3 feet of water on it; the westernmost, with 12 feet of water, lies about 100 yards from it, and is a little larger. Close to and around them the soundings are 6 to 7 fathoms, and a little over 100 yards to the southward 13 fathoms.

Currents.—The flood and ebb currents set across the entrance to Coral Bay, the flood to the southwestward, the ebb to the northeastward; both with a velocity of ¾ knot. In the bay there is no current, and the range of tide is about 1 foot.

Directions.—*Approaching from westward.*—From a position ½ mile southward of Ram Head, steer a 70° true (ENE ½ E mag.) course until Turner Point opens eastward of the eastern end of Buck Island. Then make good a 4° true (N ⅝ E mag.) course, heading for Moor Point, to a position ⅜ mile eastward of Buck Island, from which point a course may be shaped for the anchorages in Round Bay or Hurricane Hole avoiding the 3½ and 4 fathom spots southward of Turner Point.

Leaving the bay, a sailing vessel may pass between Sabbat Point and Buck Island and to the leeward of Eagle Shoal, if advisable. In doing so, however, do not bring Sage Mountain on Tortola open eastward of the western hummock on Buck Island till southward of Eagle Shoal.

Between Ram Head and Cabrita Point, 1¼ miles west-northwestward, the shore is indented by several small bays. **Booby Rock,** 35 feet high, lies off the larger Saltpond Bay and ⅜ mile south-southeastward of Kiddle Point. This bight is shoal, with a coral ledge 3 feet above high water and another one awash. At the head of the bay is a salt pond. **Cabrita Point** is a well-defined projecting point, faced by high cliffs, back of which the land rises to a height of 280 feet.

Lameshur Bay, between Cabrita and White Points, is divided into three smaller bays by projecting points. In the eastern bay there is good shelter for small vessels in about 6 fathoms of water under the lee of Cabrita Point and about 400 yards offshore. Westward of White Point for ⅝ mile the shore consists of cliffs 150 feet high which on account of a white volcanic ash in them are quite conspicuous.

Reef Bay, westward of the "white cliffs," is a large open bight the shores of which are fringed by coral reefs, through which a passage leads to a small boat harbor protected by the outlying reefs.

Fish Bay, westward of Reef Bay, is only 200 yards wide between the reefs at the entrance, but nearly 800 yards in length. Within the bay the soundings gradually decrease from 4 fathoms to the shore. The head of Fish Bay is sandy, with sea grass bottom. The northeastern shore line is mangrove. **Cocoloba Cay,** 36 feet high, lies off the eastern point of the bay, but is connected to the shore by a submerged reef. **Ditless Point** is a bold promontory between Fish Bay and Rendezvous Bay. It terminates in rocky cliffs up to 100 feet in height.

Rendezvous Bay, ½ mile in extent, has depths of 5 to 6 fathoms and is open to the southward. **Chocolate Hole,** westward of Buhvun Point, is a small, shallow bight. **Maria Bluff** is the end of a projecting high point between Chocolate Hole and Great Cruz Bay, and forms the southwestern point of St. John. The cliffs are 100 feet high along the southern face of the bluff.

Great Cruz Bay, north of Maria Bluff, affords good shelter for small vessels; it is 300 yards wide at the entrance and 800 yards in length. There is 4 fathoms in the entrance, decreasing to less than 2 fathoms in the middle of the bay. One-half mile northward of Great Cruz Bay, is a projecting point which forms the north side of Turner Bay, a small shoal bight. Shoal water extends for a distance of 350 yards southwestward from the point. A patch awash at low water lies 200 yards from the point, and near the end of the shoal there is a depth of 6 feet.

Little Cruz Bay, a cove between Gallows Bay Point and Lind Point, is small and used only by local coasters. **Durloe** or **Little Cinnamon Bay,** ¾ mile northeastward of Lind Point and ⅝ mile southward of Hognest Point is small and open to the westward.

ST. CROIX ISLAND.

St. Croix Island, the largest island of the American Virgin Islands, is 19 miles long, in an east and west direction, and has an area of 84 square miles. The southern side is nearly straight and generally low, particularly toward the western end. Westward of Salt River Point the island has an almost uniform width of 5 miles and becomes more

elevated on the northern side. **Mount Eagle**, the highest point on the island, 3½ miles eastward of Ham Bluff, is 1,165 feet high. Southward from the mountain, St. Croix is composed of broad, fertile, undulating valleys. Modern farming methods are practiced, and some of the sugar estates employ machinery to advantage in the cultivation of sugar cane.

Sugar cane and cotton are the crops of most importance. The value reported for all crops at the census of 1917 was almost half a million dollars. Cattle raising is an important industry.

St. Croix is traversed by a network of roads, most of which are kept in very good condition, and the automobile is used extensively for interior communication.

The **population** of the island was 14,901 by the census of 1917.

Winds.—There is no regular land breeze at St. Croix, but when the trade wind is light during the day it generally falls calm in the night. From June to September, when the trade wind is generally light, occasionally strong winds from the southwestward blow across the island, with much rain. Northers, with the accompanying heavy ground swell, do not appear to reach this island.

Tides and Currents.—No perceptible tidal current has been observed at St. Croix. Between this island and St. Thomas there is usually a slight westerly current. The spring range of tide is about 1 foot, which may be increased by strong winds.

Communication.—St. Croix has communication by sailing vessels with St. Thomas. Steamships to and from the United States and Canada call regularly at Frederiksted. There is telegraphic communication by cable with Ponce, Porto Rico, and with St. Thomas; also with St. Lucia, thence to Granada and Trinidad. There is a telephone system connecting all points on the island.

NORTH COAST OF ST. CROIX ISLAND.

Ham Bluff, the northwestern extremity of the island, is a conspicuous cliff 100 feet high, back of which the land rises to elevations of 600 to 900 feet. **Ham Bluff Light**, 394 feet high, a group flashing white light (two flashes every 20 seconds), is exhibited from a white cylindrical tower, and is partly obscured from 53° to 62°. From Ham Bluff the coast trends in a general easterly direction for 5 miles to Baron Bluff, and consists of slightly jutting rocky points with sandy beaches between. The 100-fathom curve is not more than ½ mile from this part of the coast.

Baron Bluff eastward to Salt River the shore consists of low rocky cliffs. Westward of Salt River Point is a narrow passage, with a depth of about 10 feet, leading through the reef to an inlet into which Salt River discharges. The shores of the inlet are for the most part mangrove swamps through which there are several openings to higher ground which are used as boat landings. **Salt River Point** is situated 1¾ miles eastward of Baron Bluff, and from it the coast turns abruptly to the southeast for 3 miles to Christiansted. In this vicinity the hills near the coast are covered with grass and low bushes. Salt River Point is prominently marked by a hill 121 feet high. **White Horse**, 400 yards northward of Salt River Point, is a rock over which the sea always breaks. There is a boat channel with a depth of about 12 feet between the rock and the point.

An isolated hill, 200 feet high, is close to the shore south-southeastward of Salt River Point, and ¼ mile northward of this hill is a projecting point 100 feet high. A sugar-factory chimney is midway between the 200-foot hill and Salt River Point. The shore line to Christiansted is low and grassy, with a narrow sand beach. The hills are back ½ mile from the shore, with the area between in grass fields or planted in sugar cane.

CHRISTIANSTED HARBOR.

This harbor is on the north coast of St. Croix, 10 miles east of Ham Bluff and 7¾ miles west of East Point. The anchorage is in a basin protected from the sea by Long Reef and Scotch Bank. A tortuous channel leads in behind the reef to the anchorage. The greater portion of the harbor is shoal. The available anchorage space for vessels of about 17-feet draft is small, and the channels are so intricate that local information is needed to use them. A stranger should take a pilot.

Christiansted, with a population of 4,574, is the largest town on St. Croix, but it is not as commercially important as Frederiksted. It is picturesquely situated within an amphitheater of high hills. It is well laid out, with broad, clean streets, lined in places by fine buildings.

Prominent features.—The high hills in back of the town show up prominently from sea. Central Sugar Factory chimney, ¾ mile northwestward of the town, is a large stack and very prominent. Mount Welcome, 125 feet high, heavily wooded on its sides, has a stone tower and the ruins of a sugar mill at the top. **Protestant Cay,** 38 feet high, is an islet in the harbor, 150 yards north of the town. The pilot station is on this islet. **Fort Louise Augusta Light,** fixed red, is exhibited from a white house with red roof on the point, but it is not prominent by day.

Wharves.—Along the face of the town, south of Protestant Cay, there is a stone quay with 12 feet of water alongside, which is used as a loading pier for small vessels. There is a small wharf at the Central Sugar Factory for unloading coal barges.

Channels.—The principal entrance to the harbor is by the channel between Long Reef and Scotch Bank. It is marked by two day ranges and buoys, and has a least charted depth of 21 feet. There is a passage with a depth of 13 feet of water over the southern portion of Scotch Bank, which is used by small vessels coming from the eastward, but it is not recommended for strangers. **Schooner Channel,** between Round Reef and Fort Louise Augusta, has 14 feet of water in it and is sometimes used by small vessels instead of going to the westward of Round Reef. It is marked by buoys.

Pilots.—There is a pilot station on Protestant Cay, and pilots will come to vessels upon signal.

The Lagoon with an entrance depth of only 2 feet is a shallow arm of the harbor, making into the island eastward of the town.

Dangers.—**Long Reef** is a very narrow strip of reef about 2 miles long east and west, and nearly awash in places. It forms the north side of the harbor. Its eastern end (Great Middle Ground) is marked by buoys, where it encroaches upon the entrance channel. **Scotch Bank,** which makes northeastward from Fort Louise Au-

gusta, is a sand shoal 1¾ miles in length, with as little as 4 feet of water in places. It forms the eastern side of the harbor and approaches. **Round Reef,** 300 feet across and almost circular in shape, lies 370 yards eastward of Fort Louise Augusta. Near the center there is a spot bare at low water, and there are several soundings of 1 foot on the reef. The northeastern edge is marked by a red and black nun buoy, the southeastern edge by a red nun buoy, and the northwestern edge by a can buoy. The first two buoys also define the western side of Schooner Channel. **Lagoon Bank** is an extensive shoal making offshore northeastward of Gallows Bay and off the entrance to the Lagoon. A can buoy marks the northwestern extension of the 12-foot curve and another can buoy the southwestern extension. **Little Middle Ground,** a small spot with soundings of 8 to 11 feet, lies 480 yards north-northeastward of Protestant Cay. It restricts the deep anchorage area in this part of the harbor. Hans Sorensens Ground, with a depth of 5 to 8 feet, is the southeasterly extension of Long Reef. Shoal water makes northward from Protestant Cay.

Supplies.—Provisions, ice, ship chandler's stores in small quantities, and some lumber may be obtained at Christiansted. There is no coal in large quantities available. Water may be obtained.

Anchorage.—Vessels of over 15 feet draft usually anchor about 250 yards northeastward of Protestant Cay in 4 fathoms. Small vessels anchor 200 yards eastward of the southern end of the cay on line with King Street, Christiansted, in 15 to 22 feet of water. Local sailing boats generally go to the stone wall in front of the town.

DIRECTIONS.—The channel into the harbor is so intricate that strangers are advised to take a pilot, and it should not be attempted at night without one. The turns are sharp and a vessel may have to drop anchor to assist in making them. Mooring buoys are planted at the turns to assist vessels, but these are frequently pulled out of position and are often found in the fairway.

Approaching the harbor from the northeastward vessels should keep Ham Bluffs open well northward of Baron Bluff, bearing less than 261° true (W ½ S mag.), in passing Buck Island, to avoid Buck Island Bar. When the western point of Buck Island bears 156° true (S by E ¾ E mag.) distant 1¼ miles, make good a 241° true (SW by W ¾ W mag.) course for 4 miles, when the entrance range beacons will be on. Bring them ahead on a 164° true (S by E mag.) course heading down the channel between the buoys to the first turn 320 yards northward of the front range beacon on Fort Lousia Augusta and westward of nun buoy No. 4. Haul sharply to the westward and steer 270° true (W ⅜ N mag.) with Great Middle Ground Range beacons on astern. When approaching nun buoy No. 6 haul southward, passing between it and the can buoy northwestward of Round Reef. Pass about 50 yards westward of the can buoy and head for the fort in Christiansted. Anchor as directed in the paragraph "Anchorage," preceding.

Approaching from the westward, give the north coast of St. Croix a berth of 1 mile or more. From 1 mile northward of Salt River Point make good a 117° true (SE by E ¼ E mag.) course for 3 miles, when the entrance range beacons will be on; then follow the directions preceding. As Scotch Bank is ahead on this course care must be taken not to overrun this distance.

Vessels approaching from offshore should bring the Entrance Range beacons on before Baron Bluff is shut out by Salt River Point, to avoid running down on Scotch Bank.

From Fort Louise Augusta the coast trends easterly for 7¼ miles to East Point, the easterly end of the island. The coast is fringed by coral reefs, behind which small vessels may find protection from the sea in several localities. **Pull Point,** 2¼ miles east-northeastward of Fort Louise Augusta, is a small projecting point, terminating in cliffs 35 feet high. Back of the bight westward of the point is Southgate Pond, a salt pond, 1 to 2 feet deep, with an outlet near its eastern end. Westward of Pull Point at a distance of 1,100 yards is **Green Cay,** an islet 35 feet high. Between the cay and Pull Point and southward to the beach the area has depths of only 1 to 3 fathoms, with numerous coral heads.

Buck Island, 340 feet high, lies 4½ miles east-northeastward of Fort Louise Augusta and about 1½ miles off the coast of St. Croix. It is 1 mile long, east and west, 700 yards wide, and is situated on the southern edge of a coral bank, which extends westward of the island about ¾ mile, then sweeps around 1 mile north of the island, forming Buck Island Bar 1½ miles in length, east and west. Shoal soundings extend about 1¾ miles eastward of Buck Island. The island lies in the route from the eastward to Christiansted Harbor. Ham Bluff, the northwestern extremity of St. Croix, kept well open of Baron Bluff bearing less than 261° true (W ½ S mag.), leads northward of the bar.

Buck Island Channel lies between Buck Island and the adjacent reefs and St. Croix. Moderate draft vessels may approach it either from the northward or eastward.

To enter Buck Island Channel from the northward, bring the ruins on a knoll, 122 feet high, northwestward of Green Cay Estate on range with Sight Mill, bearing 196° true (S by W ¾ mag.). The mill stands on the center ridge of hills, which is here lower than elsewhere, and has neither head nor vanes. Steer in on this course until the south side of Buck Island opens well from St. Croix. Then haul gradually eastward and anchor under Buck Island as convenient. This range leads over 27 to 28 feet of water.

To enter from the eastward, bring the north point of Green Cay in line with Mount Eagle, bearing 267° true (W ⅛ N mag.), when northward and eastward of East Point. The back object from this direction will show as the left of two hills, apparently nearly of the same height, the northern one is a peak of the Salt River Hills rising near the shore 2 miles eastward. The least water will be 6 fathoms, with general depths of 10 fathoms. **Channel Rock,** awash, lies 800 yards southward of this range line and 1¾ miles west-northwestward of East Point.

The coast of St. Croix from Pull Point to East Point is fringed by a coral reef. Behind this reef there are several anchorages for small boats, but local knowledge is necessary to use them. Entrance is made eastward of Coakley Bay, a bight ¾ mile eastward of Pull Point.

Lang Bank is an extensive bank of soundings, from 3 to 5 miles broad, inside the 100 fathom curve, and stretches 9 miles northeastward from the east end of St. Croix Island. Along its edge there is

one of those remarkable wall-sided narrow coral ledges, which, commencing about 3 miles eastward of Buck Island, sweeps around in a convex form for about 14 miles, terminating 2 miles southward from East Point. Its northern part is from half a mile to 1 mile broad, and has a depth of 6 to 10 fathoms, and is known as Lang Bank; the southern portion is from a little more than 100 yards to 600 yards broad and has from 8 to 10 fathoms on it.

The shoalest part of Lang Bank breaks in heavy weather, and should be given a wide berth.

SOUTH COAST OF ST. CROIX.

From East Point the coast trends westward for 20 miles to Southwest Point. This coast is bordered by a dangerous broken coral reef, which extends from East Point to nearly abreast of Long Point, 3½ miles eastward of Southwest Point. Behind this reef there are several anchorages suitable for small local boats.

Along the coast there are a number of small bights and indentations, but all are shallow and do not afford anchorage except for small craft. From East Point westward the principal ones are **Isaac Bay, Grapetree Bay, Turner Hole, Robin Bay, Great Pond Bay, Spring Bay, Halfpenny Bay, Manchineel Bay, Canegarden Bay, Limetree Bay, King Bay, Negro Bay, Breid Bay** and **Long Point Bay. Great Pond Bay,** 6 miles westward of East Point, affords a safe anchorage for vessels of 10 feet draft. Access is had through a narrow cut in the reef at the western end of the bay. One of the best small craft anchorages is found south of Krause Point, 12 miles westward of East Point. **Long Reef,** lying to the southward, affords protection from the sea at this anchorage. Krause Lagoon to the northward of the point is an extensive mangrove swamp with areas of shoal open water.

Long Point, 3½ miles eastward of Southwest Point, is a low projecting point covered with grass. Westward of the point is **Long Point Bay,** into which several small rivers discharge. The bay is shoal. **Southwest Shoal,** 1¼ miles southeastward of Long Point, has only one fathom of water over it, and from it eastward to Krause Point the outlying reefs are the most dangerous along the south coast. They generally break, but as several shoal spots exist southward the locality should be approached with caution.

Southwest Anchorage, between Long Point and Southwest Point affords temporary anchorage in 7 fathoms of water, and for smaller vessels farther in, about 1 mile from the beach in 4 fathoms.

Southwest Point, the southwestern extremity of the island, is a low point projecting 1½ miles in a southwesterly direction. A shallow salt pond without opening through the beach is on the point, the rest of the point being covered by low bushes, trees, and coconut trees. A coral reef extends southward, with only 3 fathoms of water over it at a distance of ¾ mile from the shore. The shoal water continues from its southeast side along the coast eastward to and beyond Long Point. The 5 fathom curve is 1¾ miles southward of Long Point and nearly a mile south of Southwest Point, but to the westward of the point it is only 200 yards off. The 100 fathom curve lies nearly 3 miles southwest of Southwest Point.

Caution is necessary in approaching Southwest Point. The point fringed by shoals is low and is backed by high land some 3 or 4

miles distant, conditions which may cause the mariner to overestimate his distance from the coast, especially at night. Several wrecks have occurred in this vicinity presumably from this cause.

WEST COAST OF ST. CROIX.

The west coast of St. Croix Island forms an open bay about 4 miles in extent. From Southwest Point the coast trends north-northeastward for 2¼ miles to Frederiksted. It is mostly a sand beach back of which the land slopes gently upward and is covered by grass and bushes. The beach is steep to, the 5 fathom curve lying 200 yards off Southwest Point and about the same distance along the coast to a little southward of Frederiksted, where it trends slightly off shore.

Frederiksted, 2¼ miles northward of Southwest Point and 3½ miles southward of Ham Bluff, is on an open roadstead, a port of call, and is the chief commercial town of the island.

Population.—By the census of 1917 the population was 3,144.

Supplies.—Some ship chandlers' supplies and provisions may be obtained, but there is no coal.

Wharves.—There is a stone pier and a wooden wharf for small boats and loading lighters. On the northern wharf there is a loading crane.

Range.—Frederiksted Harbor Range Lights, front light fixed red, exhibited from a white lamp post on wharf, and rear light fixed red, on porch of customhouse, lead to an anchorage and the customhouse wharf.

Anchorage.—The best anchorage off the town is with the fort (northern part of town) bearing 99° true (ESE ¾ E mag.) and Southwest Point 200° true (SSW ⅛ W mag.) in 6 to 7 fathoms.

Customhouse.—The customhouse is on the water front, back of the northern wharf.

No directions are necessary for making an anchorage off the town, excepting that when rounding Southwest Point care must be taken not to shoal the water to less than 15 fathoms. In front of the town the 10 fathom curve is less than ½ mile off shore.

From Frederiksted, the coast trends northward for 2½ miles and curves eastward for 1 mile to Ham Bluff. The hills gradually work westward meeting the shore near Butler Bay. Ham Bay is a small bight ½ mile westward of Ham Bluff. It is open to the northwest and shoal.

Jost Van Dyke lies nearly 3 miles northward of the western end of Tortola. It is 3⅓ miles long, east and west, 1¼ miles broad, lofty and rugged, bold and steep-to, and toward its northwestern point it rises to the height of 1,070 feet. On the southern side are Great and Little Harbors, the former about ½ mile deep, with from 2 to 7 fathoms water in it, the latter, more snug, has 8 fathoms within the entrance, but they are only fit anchorages for small vessels.

Little Jost Van Dyke is a mile in length, ½ mile in breadth, 370 feet high, and is connected with the eastern end of the greater island by a shallow ledge 200 yards wide. Close to its eastern end is Green Cay, 110 feet high and 300 yards long; south of the cay there is a small dry rock and shallow water for nearly ¼ mile.

Sandy Cay lies south nearly a mile from Green Cay and ¾ mile from the eastern end of Jost Van Dyke. Its eastern end is 66 feet high, but to the westward it terminates in a low sand spit, and both ends are foul to the distance of 200 yards.

The channel between it and Jost Van Dyke is ½ mile wide, but the Jost Van Dyke shore, which is steep-to, must be kept aboard. Sandy Cay is about 2½ miles westward of Cane Garden Bay in Tortola and, with Green Cay, bounds the western side of the channel between.

Tobago lies 2 miles westward of Jost Van Dyke, and is ¾ mile long, north and south, ½ mile broad, and 540 feet high. A small rock, awash and steep-to, lies about 100 yards from the northern point. The southern side of the island is fringed with coral to a short distance, but elsewhere the shore is steep-to close to the cliff. At ¼ mile from the southwestern side is Watson Rock, perpendicular, steep-to, and 90 feet high.

Mercurias Rock is the only danger in the channel between Jost Van Dyke and Tobago; it is small, bold, and steep-to, and has a depth of 7 feet. From the rock the northern point of Tobago Island bears 289° true (WNW mag.), distant ¾ mile. Between the rock and the island the depth is from 7 to 9 fathoms, and the same depth will be found for 1,300 yards southeastward of it. In running through this channel the Jost Van Dyke shore must be kept aboard.

Little Tobago lies about 1 mile southwestward from Tobago; it is nearly ½ mile in length, ¼ mile in breadth, and 280 feet high.

There is a deep channel between these islands, but, if used, care must be taken to avoid King Rock, which is awash, and may be seen ½ mile off under favorable circumstances. It is bold, steep-to, and is situated within the 10-fathom curve which extends ¾ mile southward from Tobago.

TORTOLA.

Tortola Island is the largest of the British Virgin Group, being 10 miles in length in an east and west direction, and its greatest breadth about 3½ miles, with a very irregular outline. Like Virgin Gorda, it is mountainous, Mount Sage rising near the western end to the

height of 1,780 feet, and its rugged hills rise on all sides somewhat abruptly from the shore.

Road Harbor, in latitude 18° 25′ N., longitude 64° 36′ W., is on the southeastern side of Tortola, and the only port of entry in the British portion of the Virgin Islands. Being completely exposed to the southeastward, it may be more properly described as a bay, about 1¼ miles deep, ¾ mile wide, and surrounded by an amphitheater of lofty hills, the spurs of which reach the edge of the shore, Mount Sage and Todman Peak overlooking it on the west and Bellevue on the east, the latter 1,270 feet in height.

Aspect.—The town stands on the southwestern shore of the bay and immediately above it a spur of the main ridge reaches 940 feet high, where Fort Charlotte formerly stood, but no part of the fort is now seen. On the eastern side, immediately opposite, and scattered along the shore, is the village of Kingston. Conspicuous objects seen on entering the harbor are the flagstaff of the commissioner's house, the wind pump erected on the northwestern shore, and the customhouse, a red-roofed building resembling a church.

Wickham and **Little Wickham Cays** at the northwestern corner of the bay are low, covered with mangrove bushes, and show well against the cultivated ground behind them.

Other marks useful for navigation are: A white hut used as an isolation hospital, on Burt Point, at the western side of the entrance; and a clump of coconut trees to the northward of the town behind Wickham Cay.

Road Harbor Range lights guide vessels into Road Harbor: The rear light, visible 3 miles, and elevated 41 feet above high water, is exhibited from the customhouse flagstaff. A front light, visible 3 miles to seaward, and elevated 15 feet above high water, is shown from a white staff at the outer end of the customhouse pier. These lights in line, bearing 290° true (NW by W ¾ W mag.), lead into the inner harbor.

Depths.—Although a depth of not less than 8 fathoms can be carried right up to the anchorage for a distance of 1½ miles from the entrance irregular soundings are met with and coral patches with from 4 to 5 fathoms on them, with deep water between. In the anchorage itself the bottom is very uneven, the depths varying from 6 to 12 fathoms. The northern part of the bay shoals rapidly from 5 to 2 fathoms, and coral reefs extend from 400 to 800 yards off the shore in the northwestern portion.

Dangers—Denmark Banks, the eastern extremity of which lies nearly midway between Hog and Slaney Points, have from 2 to 4½ fathoms on them. The Bluff, southern extremity of Beef Island, open southward of the outer rock off Nora Hazel Point, 73° true (ENE ⅞ E mag.), leads southward.

Lark Bank, which lies 400 yards eastward of the dry reef off Fort Burt Point, has 2½ fathoms least water on it. Todman Peak, in line with the coconut trees, seen over Wickham Cay, bearing 308° true (NW ⅛ W mag.), leads eastward of it. The above shoals lie southward of the fairway.

Scotch Bank, on the northern side of the fairway, lies between 400 and 700 yards from the eastern shore at Kingston and has 2 fathoms over it. The 940-foot hill (site of Fort Charlotte) and the hospital

on Burt Point in line, 278° true (WNW 7/8 W mag.), leads southward, and the coconut trees over Wickham Cay in line with Todman Peak, 308° true (NW 1/8 W mag.), leads westward of it.

Harbor Rock, with 3 fathoms of water 700 yards northeastward of Burt Point, is separated from Harbor Spit on the western side of the anchorage by a narrow gut carrying 5½ fathoms.

There are patches of 4¼ to 5 fathoms in the eastern part of the anchorage, as charted. The head of the harbor is shallow to 800 yards offshore.

Anchorages.—The anchorage for deep draft vessels is surrounded by the shoals above described, especially on the western side northward of Burt Point, where Harbor Spit and rock extend ½ mile southeastward from Wickham Cay. Northward of Harbor Rock there is a space 600 yards in length and breadth, with not less than 5 to 7 fathoms.

There is a berth for a small vessel in 9 fathoms southward of Harbor Spit, between it and the reef off Burt Point, at about 500 yards north-northeastward of the point.

Careening Cove is small and well sheltered with a depth of about 10 feet, under the lee of the dry reef off Burt Point.

Pilots.—Large vessels are recommended to take a pilot.

Town.—The town contains a population of about 400, is dilapidated, most of the houses being in ruins.

Supplies.—The harbor abounds with excellent fish, which may be taken by the seine inside of Wickham Cay. There is a spring of good water at the cottage near Wickham Cay, but it does not yield abundantly, and the water has to be paid for.

DIRECTIONS—**Steamers.**—Having entered Sir Francis Drake Channel, by one or other of the recommended passages from southward or northward, from abreast the Bluff, the southern extremity of Beef Island, distant about ½ mile, steer to the westward, passing about ½ mile off Nora Hazel Point, until 940-foot hill (site of Fort Charlotte) comes in line with the hospital on Burt Point, bearing 278° true (WNW 7/8 W mag.); this mark will lead along the shore in from 13 to 15 fathoms, passing Hog Point at 300 yards. When the coconut trees over Wickham Cay are in line with Todman Peak, 308° true (NW ¼ W mag.), steer for them, which will lead between Lark and Scotch Banks to the anchorage for deep-draft vessels between Shirley and Burt Points. When the hospital on Burt Point bears 257° true (W ¾ S mag.), the vessel will be within the shoals and can pick up an anchorage as convenient in from 8 to 12 fathoms, with the hospital between that bearing and 235° true (SW by W ¼ W mag.), at about 200 yards northward of the range line.

Vessels of moderate draft can run straight into the harbor on the leading mark, coconut trees in line with Todman Peak, which leads over an outer coral patch with 4¼ fathoms of water on it.

To proceed to the inner anchorage, in 5 to 7 fathoms, from a position in which Burt Point hospital bears 257° true (W ¾ S. mag.), steer 333° true (NNW mag.), passing northeastward of Harbor Rock, and anchoring when Todman Peak bears 302° true (NW ¾ W mag.).

If bound to the anchorage south of Harbor Spit; when on the range coconut trees on Wickham Cay on line with Todman Peak with the hospital on Burt Point bearing 256° true (W ¾ S. mag.), steer for the Customhouse or Road Harbor Range lights in line, bearing 290° true (NW by W ⅜ W mag.), anchoring between Burt Point and Harbor Spit, in 9 fathoms.

Sailing vessels from the northward had better keep to the westward of Anegada, passing through the Scrub or Dog Island channels; from the eastward they may pass either to the northward of Virgin Gorda or through Round Rock Passage; and from the southward through any of the openings to the eastward of Peter Island.

In leaving the harbor, if bound to the northward, sailing vessels will find little difficulty in beating up Sir Francis Drake Channel and so pass out through Scrub Passage, especially if they take the right time of inshore tide; or they may run to leeward through the channel northward of St. John Island. If proceeding to the southward they had better take the Flanagan Passage.

Sopers Hole.—From Road Harbor the south coast of Tortola Island trends westward nearly 6 miles to Sopers Hole, a snug, deep little basin, a mile in length, east and west, and about ¼ mile in breadth, between Frenchman Cay (400 feet high) and Little Thatch Island on the south, and the west end of Tortola on the north side. Between Frenchman Cay and Tortola the bottom is muddy and is the best holding ground.

Depths.—In the center of the Sopers Hole there is a depth of 13 fathoms, which gradually decreases to 6 fathoms at 100 yards from the shore, over sandy bottom. In the passage between Little Thatch Island and Frenchman Cay there is from 6 to 7 fathoms, and in the approach from the westward from 9 to 16 fathoms.

Thatch Island Cut is the passage, ¼ mile wide, between Great Thatch Island and Tortola, and must not be attempted by a sailing vessel from the northward except with a flood tide, as the eddies and currents are very strong.

Great Thatch Island is 1¾ miles long, east and west, and rises to a peak 680 feet high. Its eastern point, forming the western side of Thatch Island Cut, is bold and steep-to.

DIRECTIONS—**Steamers.**—There are two passages by which Sopers Hole may be entered from the southward; one between the western end of Tortola and Little Thatch Island and the other between the latter island and Frenchman Cay.

For steamers there are no difficulties in either of the passages, but the western ends of both Tortola and Little Thatch Island must be given a berth of over 200 yards.

Sailing vessels taking Thatch Island Cut should approach it on the flood, which will shoot a vessel into it.

If coming from the eastward the passage eastward of Little Thatch Island will be the best, as a vessel will have a leading wind and can luff up closer under the western end of Frenchman Cay, which is steep-to, and shoot into the Hole with either the flood or ebb.

Leaving the Hole, pass out to the northward through Thatch Island Cut, or, if bound into Sir Francis Drake Channel, round the western end of Little Thatch at a distance of somewhat over 200 yards and

haul to the wind, when, with the flood current on the lee beam, she will be set through between St. John and Tortola with a velocity of 3 or 4 knots. There is no danger on either shore.

A vessel must be prepared to meet the gusts and baffling winds which rush through the valleys of Tortola.

Tides.—In the channel between St. John and Tortola the flood runs to the eastward and the ebb to the westward, with a velocity of from 3 to 4 knots.

Cane Garden Bay, 3½ miles northeastward of Thatch Island Cut, is the only place on the north side of Tortola Island that affords anchorage even for small vessels. Across the entrance is a bar with 12 feet of water, inside of which there are depths of 3 and 4 fathoms.

Off the eastern end of Tortola Island there are a number of islands and rocks, which are separated from each other by intricate channels from 200 to 600 yards wide.

Guano Island, about 1½ miles in extent and 810 feet in height, lies about 600 yards from the northeastern extremity of Tortola, with shallow water between.

There is anchorage on the western side of this island, but it should by no means be taken up during the period of rollers, for on such occasions the sea will break here in 8 or 9 fathoms.

Great Camanoe Island, 1 mile eastward of Guano Island, is 2½ miles in length north and south, with an average breadth of ½ mile, and is nearly divided in two between Lee and Cam Bays. It is 570 feet in height and is separated from Scrub Island by a narrow channel, with about 3 fathoms of water. **Marina Cay** lies southeastward and **Little Camanoe** southwestward of the southern end of Great Camanoe, and the whole are connected by a shallow ridge with the northern extremity of Beef Island at the eastern end of Tortola.

Beef Island, about 2 miles in length and crescent shaped, is 660 feet in height in its eastern part; its southern extremity is the Bluff, a landmark for Road Harbor from the eastward.

Scrub Island, the easternmost of the group of islands off Tortola, is 450 feet high. It is separated from Great Camanoe Island by a narrow passage.

Southern Channels.—Between the southern end of Virgin Gorda and the eastern end of St. John, about 14 miles apart, is a range of rugged and most irregularly shaped islets and rocks. Between most of them are deep and navigable passages leading into Sir Francis Drake Channel, simple and easy of access in the daytime. In the smaller ones, however, a little precaution is necessary in a sailing vessel to guard against the eddy currents and flaws of wind when coming under the lee of the larger islands.

Round Rock Passage is the eastern channel, and by far the best for vessels coming from that direction, as it is easily recognized by the remarkable cay of Fallen Jerusalem, a mile to the northward of it. It also offers advantages to sailing vessels, on account of the small islands which form the weather side not obstructing the regular breeze.

The passage lies between **Round Rock,** 220 feet high, and Ginger Island and is about ½ mile wide, without any danger in it, and both points are bold and steep-to. The tidal current sets through generally with a velocity of 1 knot; the flood southeast, the ebb northwest.

Ginger Island is 500 feet high, and the channel between it and Cooper Island to the westward is ¾ mile wide. At the southern entrance lies the **Carvel**, a small rock 110 feet high, bold and steep-to. It may be passed close on either side. Ginger Island, however, is so lofty that a vessel is likely to be becalmed under it, and if the tidal current is strong against her she will probably have some difficulty in getting through. In other respects the passage to the westward is as good as Round Rock Passage.

Cooper Island is 1¾ miles long in a north and south direction, and at its south end 530 feet high. The passage between it and a small rock awash off the northeastern point of Salt Island is not ¼ mile wide and should never be attempted by a sailing vessel.

Salt Island Passage.—Salt Island forms the eastern side of the passage of that name, and at its northern part is 380 feet high. The channel between it and **Dead Chest**, a small islet 200 feet high to the westward, is 1½ miles wide. **Blonde Rock**, a small head with 2 fathoms of water, lies 1,200 yards eastward of Dead Chest, near the fairway; by keeping Salt Island aboard, within about ½ mile, there is nothing to fear. The sea is generally smooth until well outside, and in light winds the anchor may be dropped, if necessary, between the island and the rock.

The passage between Dead Chest Islet and Peter Island is only about ¼ mile wide, but with a good commanding breeze it may be freely taken from the southward.

Peter Island—Passage.—Peter Island, on the western side of Salt Island Passage, forms an elbow; the eastern part, 540 feet high, trends north and south for 1½ miles; the northern, 440 feet high, east and west 2½ miles, which makes the passage between it and Norman Island southwestward of it, although a mile wide, somewhat crooked, so that it is seldom taken by sailing craft. Besides it is obstructed at the southern entrance by **Carrot Shoal**, a patch with 1¾ fathoms of water, lying nearly ½ mile 256° true (W ⅞ S mag.) from Carrot Rock, 84 feet high, off the southern end of Peter Island. These islands are inhabited by fishermen. The channel westward of the patch is ¾ mile wide, with a least depth of 12 fathoms, and easily navigated by a steamer by keeping Norman Island aboard.

Flanagan Pass is the westernmost of the southern channels, and in the narrowest part, between Indian Rocks and Flanagan Island, it is 1 mile wide.

Santa Monica Rock lies in the fairway of the approach; it is small, with 1¾ fathoms water on it and 17 fathoms close-to, lying ¾ mile 205° true (SSW ⅝ W mag.) from the western end of Norman Island.

Clearing marks.—940 feet Hill (site of Fort Charlotte) on Tortola, in line with the highest of the Indian rocks 3° true (N ⅝ E mag.) leads close eastward of it, and Mount Bellevue, the highest hill on the east end of Tortola, in line with Indian Rocks 16° true (N by E ¾ E mag.), leads to the westward.

The Indians are four remarkable small pinnacle rocks, 50 feet high, close together, about 200 yards westward of **Pelican Island**, which lies ½ mile from the northwestern point of Norman Island, and is 180 feet high.

Directions.—Approaching Flanagan Passage from the eastward haul close round the western side of Norman Island, inside the Santa Monica Rock, which may be done without fear at the distance of

about 300 yards. The southern peak of Cooper Island, just open of Peter Island, leads ½ mile to the southward of Santa Monica Rock.

Approaching from the westward, observe the clearing-mark westward of Santa Monica Rock.

The Bight is a small inlet on the northwestern side of Norman Island, about ¾ mile deep, east and west, and about ¼ mile broad in the narrowest part, affording excellent anchorage. There is no water on Norman Island, and firewood is scarce.

The shores on either side of the bight are steep-to, and when beating in the only danger to be avoided is **Ringdove Rock**, with 2 fathoms water on it, which lies about 300 yards from the northwestern point of Norman Island. The mark to pass westward of it is **Treasure Point**, the southern point of the entrance to the Bight, in line with the summit of the western hill. The wind, however, under the lee of the island is so baffling that sailing vessels may have to anchor at the entrance and warp in. Although open to the westward, the island of St. John prevents any sea from setting in, and the holding ground is good.

The above leading mark also leads westward of the Indians, and having passed them a vessel may proceed to the westward, or into Sir Francis Drake Channel. There are 6¾ fathoms of water on the bank, lying ¾ mile northwestward from Pelican Island.

Sir Francis Drake Channel.—This passage is bounded on the south by the islands between Virgin Gorda and St. John just described, and on the north by Tortola and the small islets to the eastward of it. The narrowest part is about 2¼ miles wide, between the south end of Beef Island, and the northern point of Cooper Island.

Depths.—It is available for most vessels by the several passages described in the preceding pages; Salt Island passage is the best. Eastward of a line drawn from the eastern end of Tortola to Salt Island, the soundings in the channel are regular, from 13 to 14 fathoms. Westward of this line are numerous coral banks, some of those off Road Harbor, which extend fully one-third across the channel, having as little as 4 fathoms over them; the remainder from 5 to 9 fathoms with deep water between, the latter being the least depth in the fairways.

Anchorages.—There is anchorage anywhere in this channel to the eastward of a line drawn between Buck Island, lying off the southeastern end of Tortola, and Dead Chest southward of it. The bottom is hard, being a thin bed of sand over coral, and therefore requires a good scope of cable. To the westward of this line there are many rocky knolls.

With strong northeasterly winds an excellent anchorage will be found on the southwestern side of Beef Island, under the lee of The Bluff.

Great Harbor is a snug little bight, on the north side of Peter Island, about ½ mile long and the same wide, and may be entered without the slightest difficulty at any time; the water is deep close up to the shore, and it has excellent holding ground. The harbor is open to the northwest, but Tortola Island protects it in that direction and makes it quite smooth. **Little Harbor**, a short distance to the westward of Great Harbor, is of much the same character, but smaller and more exposed. There is no water on Peter Island.

Tidal stream.—In Sir Francis Drake Channel there is scarcely any stream, except close inshore where small vessels may gain some advantage from it on the ebb stream when beating to windward.

VIRGIN GORDA.

General remarks.—Virgin Gorda is easily distinguished on making the land, by its rising gradually to a distinct summit in Virgin Peak, 1,370 feet high; the coastline of the island is extremely irregular, affording good anchorages. Its scattered inhabitants are employed in the raising of stock and vegetables, and burning charcoal, for the market of St. Thomas.

From Pajaros Point in latitude 18° 31′ N., longitude 64° 18′ W., on the east, to Mountain Point on the west, the north side of the island is 5½ miles long, and from the latter point to the southern point of the western shore is 5 miles. The center portion is about 2 miles square, and occupied by Virgin Peak above mentioned. Thence the eastern end of the island is a narrow strip of land composed of irregular rugged hills, terminating at Pajaros Point in a remarkable pinnacle rock, 120 feet in height. The southern portion is about a mile in breadth, more regular in outline, from 250 to 450 feet high, and nearly separated from the center by an isthmus about 200 yards across.

The most remarkable feature of Virgin Gorda is on its western side, between Colison Point and the southern end of the island. The eastern side of this peninsula has been broken up by some violent action of nature into immense granite blocks, which lie scattered about on the shore. The cays and islets to the southward as far as Round Rock, 2 miles distant, are also composed of the same kind of stone; and the largest, which lies nearly ½ mile from the southern end of the island, from its having the appearance of a town in ruins, is named Fallen Jerusalem.

Many of these blocks are 60 and 70 feet square; some are merely confined in their places by the weight of others leaning on them; and many with deep rents and fissures in their sides appear ready to fall by the slightest shock. In one or two places the sea finds its way through the crevices, and forms beautiful natural baths. It is also a curious circumstance that similar granite blocks are found scattered about on Beef Island, the opposite side of Sir Francis Drake Channel, and nowhere else.

Water.—The island of Virgin Gorda is badly watered; there are two small wells at the southern end of the beach in St. Thomas Bay, but the yield is little and indifferent. The supply in Gorda Sound is equally deficient.

Necker Island.—On the northern side of Virgin Gorda there are several small slightly wooded cays and islets, the outer or northernmost of which is Necker Island, lying northwestward, about 2½ miles from Pajaros Point. It is nearly ½ mile long north and south, and about ¼ mile wide, and toward its northern end it is 110 feet high; its southeastern side is low and sandy. The northern side is fairly bold and steep-to, there being from 6 to 10 fathoms water within 300 yards; but on the eastern and western sides it is foul and dangerous to the distance of nearly ½ mile.

Virgin Sound.—From the southern side of Necker Island a detached reef extends off nearly ¼ mile, leaving a clear channel named Virgin Sound, with 9 fathoms water in it, and ¼ mile wide between the island reefs and those extending northward of Eustatia Islet. It affords good temporary anchorage in 7 or 8 fathoms of water, but care must be taken to avoid the foul ground to the northwestward of the latter island. There is a tidal current of ½ knot shown on the chart, the flood to the eastward and ebb to the westward.

The Invisibles are two small rocky heads with only 3 feet water on them, and do not always break. They lie about ¾ mile eastward from Necker Island; between them and the reef on the eastern side of Necker Island the depths are from 5 to 6 fathoms, but on their north and east sides there are depths of 10 fathoms at a short distance.

Eustatia Islet, 650 yards long northeast and southwest, and 170 feet high, lies ¾ mile to the southward of Necker Island, and nearly ½ mile from the nearest part of Virgin Gorda. Its northern side is foul to the distance of 200 yards, and thence a barrier reef extends on almost a straight line along the shore to Pajaros Point, under the lee of which, in Eustatia Sound, there is a safe anchorage for small vessels.

The entrance is through a small cut in the reef, about ½ mile eastward of the islet; but this part of Virgin Gorda should be avoided by strangers, as the ground is foul for some distance outside the cut.

Prickly Pear, the largest of the islets off the northern side of Virgin Gorda, is 1 mile in length northwest and southeast, about ¼ mile in breadth, and 230 feet high. Its eastern end is not quite ¼ mile from the nearest part of a small peninsula of Virgin Gorda, and in the space between is the **Saba Rock,** 25 feet high.

From the western end of the island, the Cactus, a dry reef, extends 300 yards in that direction. The northern side is bold.

Mosquito Island, the highest of the islets off the northern shore of Virgin Gorda, lies nearly a mile westward of Prickly Pear, and is 1,300 yards in length northeast and southwest, about ¼ mile in breadth, and 250 feet high. From its northern end small detached rugged rocks extend off 300 yards, the outer end, Mosquito Rock, being 24 feet high. From it **Colquhoun Reef,** dry in most places, extends to the southeastward about ½ mile, and is bold and steep-to outside. This reef, with Mosquito Island, forms the northwestern side, and Prickly Pear Island and Cactus Reef the northern side of Gorda Sound.

Gorda Sound is an excellent and capacious harbor, 1¾ miles long, east and west, and ¾ mile broad, with an average depth of 11 fathoms over sand and mud; sheltered from all winds, and protected from the rollers.

As there is no health officer or other representative of the Government here, vessels before visiting it should obtain pratique at the port of entry, Road Harbor, Tortola.

Depth.—Approaching Gorda Sound there is a uniform depth of from 9 to 12 fathoms. From either side of the entrance (which lies between the ends of Cactus and Colquhoun reefs, ¼ mile apart) the depth gradually increases to 6 fathoms, in a very narrow channel, in

a north-northwesterly and south-southeasterly direction. Between the 5-fathom curves the channel is only 60 yards wide.

Beacons.—No natural marks can be given for the channel, but there are two pole beacons, each surmounted by a triangle, painted white. The front beacon, 18 feet in height, is situated on Gnat Point. The rear beacon, with triangle inverted, is about 100 yards from high-water mark, about 300 yards southeastward of the eastern point of Gun Creek. These beacons in line, bearing 178° true (S ¼ W mag.), lead in not less than 5 fathoms between Cactus and Colquhoun reefs, but very close to 3½ fathoms. The beacons are not easily seen when the sun is behind them.

Directions.—**Steamers** coming from the eastward approach Virgin Gorda Sound by Necker Island Passage, which lies between Virgin Gorda and Herman reefs. The approach is dangerous at night, so that vessels should time their arrival to daylight.

Bring Virgin Gorda Peak to bear 261° true (W ⅜ S mag.) and steer for it on that bearing. When within 7 or 8 miles of Pajaros Point, Necker Island will come in sight, and may be steered for, when bearing between 273° true (W ⅝ N mag.) and 290° true (NW by W ¾ W mag.), when a vessel will be in the fairway. When Pajaros Point bears 222° true (SW ⅛ W mag.), distant about 1½ miles, steer to pass northeastward of the Invisibles off the eastern end of Necker, which are not seen until close upon them. Give Necker Island a berth of ½ mile or more, and when the peak of Virgin Gorda bears 210° true (SW ⅞ S mag.) steer for it until the leading beacons for the sound are in line, bearing 178° true (S ¼ W mag.), which will lead into the sound in not less than 5 fathoms, but only about 50 yards eastward of the extremity of Colquhoun Reef; the marks might be opened a little eastward when approaching this spit.

Coming from the northward it is better to pass to the westward of Anegada. Virgin Gorda Peak, bearing between 155° true (S by E ¾ E mag.) and 133° true (SE ¼ S mag.), is the best line of approach.

Sailing vessels can follow the directions for steamers given above, but from the northward, if passing eastward of Anegada, they should on no account attempt to pass close to windward of Horseshoe Reef, which has been the cause of many disasters.

It should be borne in mind that Horseshoe Reef may be distinctly seen, as it breaks in the finest weather; but Herman Reefs only break with a swell or strong breeze, and the White Horse, the dry sand bore to the northward of them, being only 3 feet out of water, is scarcely visible at any distance.

Pajaros Point may, if necessary, be rounded at the distance of 400 yards.

Tides.—It is high water, full and change, in Gorda Sound at 8h. 30m., and the rise is about 1½ feet. The tidal currents at the entrance of the sound, between the reefs, seldom run more than ½ knot, and the flood sets toward Prickly Pear Island. Between Mosquito Island and Anguilla Point, south of it, the flood sets to the eastward with a velocity of 1 and 1½ knots. Between Pajaros Point and Horseshoe Reef it seldom runs more than 1 knot, but its duration varies.

Western Roads.—There are two excellent anchorages for vessels of any draft under the western side of Virgin Gorda. The first is situated in the bay between Mountain Point, the northwestern end of the island, and Colison Point, 3 miles southwestward of it, and is partially protected to the northwestward by the Dog Islands. It seldom, however, blows hard to the westward of north, and the only thing to be prepared for is the ground swell in the winter months. At this season it will be better to anchor in about 13 fathoms water, midway between Great Dog and Virgin Gorda, a mile from either, where with good ground tackle and a long scope of cable there will be nothing to fear, as the rollers are seldom accompanied by much wind.

The southern anchorage, in the same depth, 13 fathoms, between Colison Point and Fallen Jerusalem, 2½ miles to the southward of it, is the best for sailing vessels, as, if necessary, they can weigh and run out to the westward with more ease than in the former. The holding ground is good at both places, and, except occasionally, the water is always smooth. There is a small patch of 4¼ fathoms lying 800 yards westward from Colison Point.

Directions.—To gain the Western Roads either the northern or southern channels may be taken. The passage between the islets are all bold and free of danger, with the exception of that between Scrub and the Dog Islands, in which lies Tow Rock with 2½ fathoms of water on it, and as it is only 20 yards in extent, it must be carefully avoided. It lies a little more than 1 mile west-northwestward from the West Dog. The eastern extremity of Scrub Island bearing 180° true (S ½ W mag.) or 210° true (SW ⅞ S mag.) leads well clear on either side of it. When West Dog bears 90° true (E ½ S mag.) the vessel will be well within it, but the best direction to give is to keep either Dog or Scrub Island close aboard, as they are bold and steep-to.

The Great, George, and West Dogs can not be mistaken, being three small islets, and the nearest to Virgin Gorda; the two eastern are 250 and 270 feet high, and the western 150 feet. About 400 yards westward of the George or Northern Dog is Cockroach Rock.

Seal Dogs are a cluster of three much smaller islets, lying close together, about 1½ miles northeastward of George Dog, with clear channels on both sides. The northernmost islet is only 6 feet high, the others 100 and 74 feet.

ANEGADA ISLAND.

General remarks—**Aspect.**—Anegada, the most northern and eastern of the Virgin Group, is included in the British portion and has a population of 450, whose chief employment is fishing and wrecking; the principal settlement is on the south side, 6 miles from the west end. The island being low, the strength and irregularity of the tides and currents in its immediate neighborhood makes it dangerous to approach at night, unless very certain of the position.

In the daytime, however, with clear weather, the risk is not so great, as Virgin Gorda Peak, 1,370 feet high, serves as a landmark to guide mariners clear of all its dangers. Anegada lies within 1½ miles of the edge of the Virgin Bank, but the soundings are so deep

up to it that the lead is scarcely of any use. It is 9 miles in length east and west and from 1 to 2 miles in breadth, almost uniformly about 30 feet high, and covered with brushwood excepting in a few spots which are cleared for the cultivation of corn and vegetables. A large portion of the interior is cut up by extensive salt-water lagoons.

Fresh water may be obtained by digging wells in the sand, particularly near the beach at the western end of the island, but the inhabitants prefer drinking the rain water caught in the natural cisterns formed in the rock.

Horseshoe Reef.—The island of Anegada is skirted on its outer or northern side by a narrow barrier reef to the distance of from 200 yards at its extreme north point to 1½ miles at its eastern end; thence a most dangerous reef extends 140° true (SE ⅞ S mag.) for 7 miles, upon which many vessels have been lost. This portion is called Horseshoe Reef, and from its southern end detached coral heads and shallow ledges extend 4½ miles southwestward, where they terminate in Herman Reefs, on which the sea generally breaks.

Two miles west-southwestward from the elbow or easternmost point of Horseshoe Reef is a heap of dead white coral, 3 feet out of water, known as the White Horse; 2½ miles to the eastward of the elbow there are depths of 34 fathoms close within the 100-fathom curve, and within a mile of it there are 10 fathoms. Abreast Herman Reefs the edge of soundings is a little more than a mile distant, which makes them still more dangerous. The southern end of this reef bears 62° true (ENE mag.) 5½ miles from Pajaros Point, the eastern end of Virgin Gorda.

There is a detached 5-fathom spot about 1½ miles southward from the summit of Herman Reefs.

Robert Reef is a small rocky patch with 4½ fathoms of water on it, lying 3½ miles within or to the westward of Herman Reefs; from it Pajaros Point bears 196° true (S by W ⅞ W mag.), distant 4¼ miles.

At 1¼ miles to the north-northeastward of this reef there is also a small rocky head with 4 fathoms water on it.

Hawks Bill Bank is a small rocky ledge, with depths of from 3 to 5 fathoms, lying about 2 miles north-northwestward of Robert Reef. From the 3-fathom head Pajaros Point bears 186° true (S by W mag.) 5¾ miles. These patches should be avoided when anchoring under the lee of Horseshoe Reef. The water is, however, so clear that the bottom may be seen distinctly in 8 or 9 fathoms.

Anchorages.—The reef fringing the northern side of Anegada terminates at the western end of the island at about 300 yards from the shore, but the southern side of the island is foul, with detached coral patches extending for more than 2 miles off.

There is good temporary anchorage off the western end, in from 5 to 6 fathoms of water, at about a mile distant. It will not be prudent, however, to remain here during the period of the rollers, which frequently occur from October to May; it will be better at that season to anchor well under the southern side of the island.

The best anchorage will be found in 6 fathoms, with the western end bearing 338° true (N by W ½ W mag.) distant 5½ miles, and East Point 71° true (ENE ¾ E mag.). Care, however, must be

taken after rounding the western end; attention should be paid to the lead, and do not come within the depth of 5 fathoms.

There is a 2½-fathom head about 1 mile eastward of this anchorage, 5 miles 251° true (WSW ¾ W mag.) from East Point, so in anchoring the western end of the island should not bear less than 330° true (NNW ¼ W mag.).

The bank westward of Anegada is chiefly fine sand, and in light weather vessels may anchor on it in safety, taking care to avoid the rocky banks already described.

The rollers, or ground swell, frequently occur from October to May, and continue sometimes three or four days. In general they set in after a prevalence of light east or southeast winds. Between Tortola and Guano Island they have been seen to top and break in 9 fathoms, and on the southwestern side of Anegada, in 4½ fathoms, anchors are sometimes lifted; it is consequently dangerous for sailing vessels to come too near any part of the northern shores of the Virgin Islands, for the rollers get up suddenly and during their continuance the wind is too light to keep a vessel under command. They appear to have great influence on the bottom in loosening the sand, thus discoloring the water for some miles to the northward of the islands as far as the edge of the bank. In some places near the western end of Anegada, where the bottom is composed of very fine sand, the formation of the banks is frequently changed.

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	.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 (this volume)	.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., room 1806, customhouse.
New York, N. Y., room 503, customhouse.
New Orleans, La., room 314, customhouse.
San Francisco, Calif., room 508, 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, Buoy Lists, and Notices to Mariners are kept for sale or for free distribution to mariners.

The field stations are also sales agencies for the Coast and Geodetic Survey publications.

A chart catalogue, giving lists of charts, coast pilots, tide tables, and agencies of the Coast and Geodetic Survey, can be obtained from any of the field stations, or will be sent, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C. Frequent changes occur in the agencies, and the list of agencies is published in the first notice each month of the Notices to Mariners.

AN ACT FOR THE REGULATION AND GOVERNMENT OF THE DOCKS AND HARBORS OF PORTO RICO.

All masters of vessels not engaged in the coastwise trade are forbidden to allow their vessels to be boarded by anyone except the pilot prior to the visit of the health officer; the full amount of the penalty for violating this section

shall be paid alike and separately by the master of the vessel and the person boarding said vessel. The penalty for violating this rule shall be a fine of not more than two hundred and fifty ($250) dollars, or imprisonment in jail for not more than one year, or both, in the discretion of the court.

Every vessel not engaged in the coastwise trade entering the harbor of any port in Porto Rico shall proceed to the quarantine ground designated by law. Any violation of this section shall be punished by a fine not exceeding one hundred dollars, or by imprisonment in jail not exceeding ninety days, or by both such fine and imprisonment, in the discretion of the court.

Every master of a vessel on arriving in port shall proceed to the office of the captain of the port and make a report of his vessel and cargo, and before leaving the port must report clearance. Any master failing to comply with the provisions of this section shall be fined in a sum not exceeding one hundred dollars.

All boats moving about any harbor between the hours of sunset and sunrise shall display either a white light or the regular running lights required by international law. Every master or person in charge of a vessel who fails to comply with this section shall be subject to a fine not exceeding one hundred dollars.

The harbor of San Juan shall be held to include all waters of the bay of San Juan, including Catano and Pueblo Viejo bays. The limits of the other harbors shall be those designated by capes or other natural limits or works constructed for maritime demarcation.

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 one such light in the forward part of the vessel at a height of not less than twenty feet and not exceeding forty feet above the hull, and another at or near the stern of the vessel, and at a height of not less than fifteen feet lower than the forward light. The length of a vessel shall be deemed to be the length appearing in her certificate of registry. Every master or person in charge of a vessel who violates any of the provisions of this section shall be subject to a fine not exceeding one hundred dollars.

No person or persons shall deposit in any harbor stones, gravel, ballast, cinders, ashes, dirt, mud, or any other substance, under penalty of a fine not exceeding five hundred dollars, or imprisonment in jail not exceeding six months.

Vessels wishing to unload or load ballast will be assigned anchorage by the captain of the port, and must have a proper chute so arranged as to prevent ballast from falling overboard. The master or person in charge of any vessel who shall unload or load ballast without complying with the provisions of this section shall be subject to a fine not to exceed five hundred dollars, or to imprisonment in jail not exceeding six months.

No warp or line shall be passed across any channel or dock so as to obstruct the passage of vessels or cause any interference with the discharging of cargoes; and no vessel shall anchor within one hundred and fifty yards of the shore without the consent of the captain of the port, or in such position as to impede the movements of a ferry or to prevent ready access to or from a pier. Any person violating any of the provisions of this section shall be subject to a fine not to exceed one hundred dollars or imprisonment not to exceed ninety days.

If any damage shall be caused by vessels or their mooring cables to the works of any harbor, the parties responsible shall pay the cost of the necessary repairs, and the same may be recovered in any court of competent jurisdiction.

Steamers on entering or leaving a port shall proceed at a speed not exceeding six knots per hour. The master or person in charge of any steamer violating the provisions of this section shall be subject to a fine not exceeding one hundred dollars.

If a vessel occupying a berth at a wharf or pier, with or without the consent of the captain of the port, fails to vacate such berth when ordered by the captain of the port, or, when not loading or unloading, fails to make way for another vessel that wishes to load or unload, the captain of the port shall then cause such vessel to be moved to some other berth, or to be anchored in the stream, and the expense of such removal shall be paid by the master, agents, or owners of such vessel; and in case of their neglect or refusal to pay such

expense upon demand, it may be recovered in an action before a competent court. And in addition thereto the master or person in charge of such vessel shall be subject to a fine not exceeding one thousand dollars, or to imprisonment in jail not exceeding one year, or both such fine and imprisonment, in the discretion of the court.

No vessel will be entitled to a berth until application has been made by the master, owner, or consignee of the vessel to the captain of the port, and such application must state the length, draft, and kind of cargo. No one but the captain of the port or the Commissioner of the Interior has authority to assign berths to vessels. No vessel, whether at anchor or lying at wharf, shall shift her berth without permission from the captain of the port or the Commissioner of the Interior. Any violations of the provisions of this section shall be punished by a fine not exceeding one hundred ($100) dollars, or by imprisonment in jail not exceeding two months, or by both such fine and imprisonment.

All goods, merchandise, and material of every kind, landed or placed on any pier, bulkhead, or other wharf property, or upon reclaimed land, must be removed therefrom within thirty-six hours, provided that the Commissioner of the Interior for good cause may extend the time. All goods, merchandise, and materials of every kind encumbering any pier, bulkhead, or other wharf structure, or reclaimed land, after the time designated for the removal thereof shall have expired, will be liable to be removed by the Commissioner of the Interior to any warehouse or yard, at the sole risk and expense of the owner of any such goods, merchandise, or materials, and all expense incurred for such removal and storage, or otherwise, shall be and become a lien thereon; and such goods, merchandise, and materials will not be delivered to the owner until the expense of such removal and storage has been paid.

It shall not be lawful for the owners, lessees, or occupants of any pier, wharf, or bulkhead, which has been covered with a shed, to use such shedded pier, wharf, or bulkhead for the permanent storage of goods, merchandise, cargo, or material of any kind which may be discharged or placed thereon. Piers, wharves, and bulkheads thus shedded are designated for the protection of merchandise and cargo in transit, and such merchandise and cargo must be removed therefrom within thirty-six hours, provided that the Commissioner of the Interior for good cause may extend the time. If the person in charge of a pier, wharf, or bulkhead fails or refuses to remove the cargo or merchandise therefrom within the period provided for by this section, he shall be punished by a fine not to exceed one hundred ($100) dollars or by imprisonment in jail not to exceed ninety days, and each day's delay in removing such cargo or merchandise shall constitute a separate offense.

The captain of the port shall prevent any accumulation of material upon all piers, wharves, bulkheads, and reclaimed land; and whenever any pier, wharf, bulkhead, or reclaimed land shall be encumbered or obstructed in its free use by any vessel, merchandise, or material, or by any structure, encumbrance, or obstruction not authorized or permitted by the Commissioner of the Interior, the captain of the port is authorized to require the owner, agent, consignee, or person occupying or in charge of such merchandise or obstruction to remove the same without delay. Upon receiving said order, the owner, agent, consignee, or person in charge of the vessel, merchandise, material, structure, encumbrance, or obstruction, as the case may be, in reference to which said order or direction was given, shall comply with the same without delay, and upon his refusal or failure to do so he shall be punished by a fine not to exceed one hundred ($100) dollars, or by imprisonment in jail not to exceed ninety days, and each day's delay in complying with said order shall constitute a separate offense.

No nets will be permitted in any of the passages, entrances to ports, or in the harbors, or in any other place in which, in the opinion of the captain of the port, such nets interfere with navigation, and it shall be the duty of the owner thereof upon notification of the captain of the port to remove them immediately. Nor will the installation of any palisade or permanent framework be permitted on the shore of any of the harbors without a permit from the executive council. Each violation of any provision of this section will subject the offender to a fine of not more than two hundred dollars, or to imprisonment in jail not to exceed two months.

Every owner or agent of a vessel engaged solely in carrying cargo between ports in the island of Porto Rico, Vieques, and Culebra shall, on or before the 1st day of May of each and every year, file in the office of the captain of the port a sworn statement showing the registry of his vessel and such other facts thereunto relating as may be required. The change of name, loss, sale, or

transfer of any vessel, lighter, or boat must be immediately reported in writing to the captain of the port. Any owner or agent guilty of violating any of the provisions of this section shall be subject to a fine not exceeding one hundred dollars.

The master of any vessel having gunpowder or other explosives on board shall declare the fact to the captain of the port upon arrival, in order that it may be taken in charge, or that the vessel may be assigned to a special anchorage; and permission must be obtained from the captain of the port before loading or unloading explosives. Any violation of this section shall subject the master of the vessel to a fine of not less than two hundred dollars nor more than one thusand dollars, or to imprisonment in jail for a term not less than two months nor more than one year, or to both such fine and imprisonment.

All vessels laden with explosives shall display at the foremast head at all times while in harbor, between the hours of sunrise and sunset, a red flag at least thirty-six square feet; and between the hours of sunset and sunrise a red light shown at the foremast head. Any violation of this section shall subject the master of the vessel to a fine not to exceed one hundred dollars, or to imprisonment in jail not to exceed two months.

DAMAGES AND GENERAL PENALTIES.

The captain of the port may in all cases, when called upon, survey hatches and examine all damaged goods on board a vessel in their original place of storage, to ascertain, if possible, whether such damage was or was not caused by improper storage; and he may, when called upon, proceed to any warehouse or wharf within his jurisdiction, with one expert selected by the consignee of the goods and one by the ship's agents or master, to hold a survey and ascertain and award damages, if any, on said goods, and they shall make and sign a report on same to be filed in the office of the captain of the port; the expenses and fees for such survey shall be paid by the parties calling for such survey; he shall also have cognizance of all surveys of vessels or cargoes damaged, and on payment of the regular fee shall give certificates of such survey. A fee of five ($5) dollars shall be charged for each survey.

RULES REGULATING PILOTS.

The pilot service at each port of the island shall be under the supervision and direction of the captain of the port.

Pilot boats shall be painted black with a large white letter "P" on either bow, and display a square blue flag with a white letter "P."

The number of pilots allowed to each port shall be at the discretion of the Commissioner of the Interior.

Only licensed pilots are authorized to pilot vessels on entering and leaving port or in shifting berth. A master or captain who does not engage a pilot will nevertheless pay full pilotage; besides he will be held responsible for all damages caused by the absence of a pilot.

Each pilot shall have on his person, and display if called for, a pilot's certificate signed by the captain of the port and countersigned by the Commissioner of the Interior.

Any person who pilots or attempts or offers to pilot a vessel on entering or leaving a port of the island of Porto Rico without the license required by existing laws and regulations shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine not exceeding three hundred ($300) dollars, or by imprisonment in jail not exceeding three months, or by both, in the discretion of the court.

Any pilot who refuses to take his turn at piloting, without just cause when in the judgment of the captain of the port the weather does not prevent his doing so, shall pay a fine of not more than fifty ($50) dollars, and shall be responsible for any damage that his refusal may have caused and his license may be revoked.

Pilots are forbidden to take from any vessel any persons or effects.

Pilots of outgoing vessels shall remain on board until after the vessel has cleared buoy No. 1.

The captain of the port, in his discretion, may suspend from duty any pilot whose efficiency may be in doubt.

A pilot while on his business as a pilot found guilty of using abusive or insulting language, or threatening conduct, shall be suspended or have his license revoked by the captain of the port.

Any pilot violating any of the provisions of this law or of the regulations established under authority hereof shall be liable to suspension from duty in the discretion of the captain of the port. Any suspended pilot who takes charge of a vessel during the period of his suspension shall be liable to a fine of not more than fifty dollars for each offense.

The pilots shall report to the captain of the port the name and draught of every vessel piloted by them, where boarded, and what extra services, if any, were rendered; also all vessels spoken by them and which have refused to accept the services of a pilot; and such report shall be made within twenty-four hours after services have been performed, or such refusal has occurred. Any pilot failing to comply with the provisions of this section shall be fined ten ($10) dollars.

Should a vessel take the ground or meet with an accident while in charge of a pilot, the pilot shall report the same to the captain of the port at his office immediately. Any pilot failing to comply with the provisions of this section shall be fined ten ($10) dollars.

Every master or captain of a vessel shall give an account to the pilot when boarding of the draught of his vessel, and in case he shall misrepresent said draught and give it as less than the actual draught he shall be fined in the sum of twenty-five ($25) dollars. The pilot of every vessel entering port must inform the master or captain of his having to report to the office of the captain of the port. The pilot of every vessel anchoring in quarantine must remain by his vessel until cleared by the health officer. Every pilot detained by the master, captain, owner, or consignee is entitled to three ($3) dollars per day and found. Any pilot not landed, but taken to sea, is entitled to three ($3) dollars per day and found during absence, and must be given first-class accommodation on vessel and the same, or its equivalent in money, to return to his home port. A pilot in charge of an inbound vessel is required to remain on board until notified by the master that his services are no longer required. All vessels sailing under an enrollment and licensed and engaged in the coasting trade between the ports of the island of Porto Rico, Vieques, Culebra, or of the United States, shall be exempt from all pilotage, unless a pilot is actually employed. But said vessels must take a pilot if they leave the island bound for a foreign port. And if no pilot is taken, full pilotage will be charged the same as if a pilot has been employed. Vessels owned or controlled by the United States or by foreign Governments and all pleasure yachts shall be exempt from pilotage, except where a pilot is actually employed. Whenever the services of a pilot are required to take a vessel to sea application must first be made by the master, owner, or consignee to the captain of the port. Any pilot suspended by the captain of the port may appeal to the Commissioner of the Interior, who may affirm, revoke, or modify such suspension. The action of the Commissioner of the Interior shall be final.

PILOT FEES.

The fees for pilotage are hereby established as follows: For every vessel inward or outward bound, and not exempted from pilotage and drawing less than fifteen (15) feet of water, one dollar per foot. For every vessel drawing more than fifteen feet of water, one dollar and twenty-five cents per foot. For fractions of feet, six inches or less, are not counted; above six inches, is considered an additional foot. Half pilotage shall be charged for shifting berth from one anchorage to the wharf, or vice versa. For shifting berth from one anchorage to another, for each change there shall be charged and paid two dollars and fifty cents. For shifting from one berth at wharf to another at wharf, there shall be charged and paid for each change the sum of two dollars and fifty cents. Night pilotage shall be double the day pilotage; the night counts from one hour after sunset until one hour before sunrise. Vessels not exceeding one hundred gross tons shall pay one-half of the above rate.

FEES TO BE COLLECTED ALONGSIDE OF WHARF.

Every vessel coming from ports outside of the island of Porto Rico that enters, uses, or makes fast to any pier, wharf, or bulkhead in any harbor of Porto Rico, or makes fast to any vessel lying at such pier, wharf, or bulkhead, or to any other vessel lying outside of such vessel shall pay for the use of such pier, wharf, or bulkhead for every calendar day or part thereof as follows: Every vessel of two hundred (200) tons or under, two cents per ton; and for

every vessel of over two hundred (200) tons, two cents per ton for the first two hundred tons, and three-quarters of one cent per ton for every additional ton. Only fifty per cent of the above shall be collected on vessels having less than fifty (50) gross tons. These charges will be based on the vessel's gross tonnage, to be ascertained from the vessel's register, license, or other official documents, and in the absence of such documents upon the estimate of the captain of the port.

Every vessel coming from ports outside of the island of Porto Rico entering and using a harbor and which does not use or make fast to any pier, wharf, or bulkhead, or does not make fast to any vessel lying at a pier, wharf, or bulkhead, or to any other vessel lying outside of such vessel, but uses the public wharf or bulkhead or shore for the purpose of loading or unloading merchandise or ballast by means of lighters shall pay for a calendar day, or part thereof, while so engaged in loading or unloading by means of lighters the following: Every vessel of two hundred (200) tons or under, one-half of one cent per ton; for every vessel of over two hundred (200) tons, one-half of one cent per ton for the first two hundred (200) tons, and one-fourth of one cent per ton for every additional ton. Only fifty per cent of the above shall be collected on vessels having less than fifty gross tons. These charges will be based on the vessel's gross tonnage, to be ascertained from the vessel's register, license, or other official documents, and in the absence of such documents, upon the estimate of captain of the port. The charges provided for in this section shall not apply to vessels calling for coal, water, or provisions necessary for a continuance of their voyage.

SMALL BOATS AND HARBOR CRAFT.

All rowboats, small sailing vessels, or other craft engaged in local passenger or other traffic shall be duly registered in the office of the captain of the port, and shall pay an annual license fee of one dollar and fifty cents, payable semiannually in advance.

A certificate duly numbered and showing the date of such registration shall be given to the owner of each such boat, vessel, or craft; and it shall be unlawful for such boat, vessel, or craft to carry passengers or freight until it has been so registered, or after the registration thereof has been annulled as herein provided. Any owner, master, or person in charge who shall use any such boat, vessel, or craft for hire before it has been registered or after the registration has been annulled shall be punished by a fine not exceeding twenty-five dollars for each offense.

The captain of the port shall estimate the number of passengers and the amount of freight that may safely be carried by such boat, vessel, or craft, and shall give to the owner or master thereof a certificate of such capacity, which certificate shall at all times be kept on board of such boat, vessel, or craft to be exhibited on request. The Commissioner of the Interior, with the approval of the executive council, shall also establish a tariff of charges to be made by such boats, vessels, or crafts for the transportation of passengers and freight; and a printed schedule of such tariff shall be supplied to the owners and masters, which schedule shall at all times be kept on board to be exhibited on demand. The owner, master, or person in charge of such boat, vessel, or craft who shall demand more than the schedule rate for the use of such boat, vessel, or craft, or who shall refuse, when requested, to give a passenger a written receipt for the amount paid to him, shall be subject for each offense to a fine not exceeding the sum of twenty-five ($25) dollars. It shall be the duty of the captain of the port from time to time to inspect such boats, vessels, or crafts in order to ascertain their condition of cleanliness and seaworthiness, and in case of defects of either kind he may, in his discretion, annul the registration of any such boat, vessel, or craft until such defect has been remedied to his satisfaction.

In case of extortion or attempted extortion by the owner, master, or person in charge of such boat, vessel, or craft, the registration of such boat, vessel, or craft may be annulled by the captain of the port for such time as in his discretion may seem proper.

The owner or master of every lighter, scow, barge, or similar vessel employed for the transportation of cargoes, merchandise, bricks, lumber, or other materials from point to point in the harbor, or to and between the shore and vessels in the harbor, shall pay for each fiscal year an annual license fee, payable semiannually in advance on every such vessel, as follows: Not ex-

ceeding five tons, two dollars and fifty cents; exceeding five tons and not exceeding fifteen tons, six dollars; not exceeding twenty-five tons, ten dollars; exceeding twenty-five tons and less than fifty tons, fifteen dollars; exceeding fifty tons, thirty dollars. The captain of the port shall determine the tonnage of each such vessel, and the name and number of each such vessel shall be conspicuously painted in large white letters on each side of the bow. The above rates shall apply to all tugs engaged in general towing.

Vessels engaged solely in carrying cargo or passengers between ports in the Island of Porto Rico, Vieques, and Culebra, and steam ferryboats plying in harbors, that enter, use, or make fast to any pier, wharf, or bulkhead in any harbor of Porto Rico, or entering and using a harbor and not using or making fast to any pier, wharf, or bulkhead, but use the public wharf or bulkhead or shore for the purpose of loading or unloading merchandise by means of lighters, shall pay for each fiscal year for the use of such public property an annual wharfage fee as follows: Not exceeding fifteen tons, ten dollars; exceeding fifteen tons and not exceeding twenty-five tons, fifteen dollars; exceeding twenty-five tons and not exceeding fifty tons, twenty-five dollars; exceeding fifty tons and not exceeding seventy-five tons, fifty dollars; exceeding seventy-five tons and not exceeding one hundred tons, seventy-five dollars; for each additional ton over one hundred tons, twenty-five cents. These charges will be based on the vessel's gross tonnage, to be ascertained from the vessel's register, license, or other official documents, and in the absence of such documents upon the estimate of the captain of the port, and will be payable semi-annually in advance.

FINAL PROVISIONS.

The harbor laws, and the rules and regulations established thereunder, shall be enforced by a captain of the port for each harbor, who shall be appointed by the Commissioner of the Interior and shall receive such salary as may be fixed by law. The captains of the respective ports shall be under the direction and supervision of the Commissioner of the Interior.

This law shall not be construed to limit the authority now exercised by the Commissioner of the Interior to establish, with the approval of the executive council, rules and regulations for the government of the docks and harbors of Porto Rico, provided such rules and regulations are not in conflict with this law: And provided further, That the executive council may alter or amend such rules and regulations.

Any person violating any of the rules and regulations established by the Commissioner of the Interior shall be punished by a fine not exceeding one hundred dollars.

The fines, penalties, forfeitures, and dues recovered or received by virtue of this act shall be covered into the insular treasury.

RULES AND REGULATIONS FOR THE DOCKS AND HARBORS OF PORTO RICO.

No vessel shall leave the quarantine ground until the requirements of the statutes in regard to examination by the marine hospital officer have been complied with.

Pleasure yachts may anchor in any location which will not interfere with the navigation of the harbors. Vessels must not anchor on the range line of any range lights.

No vessel shall lie in such manner as to obstruct or prevent the free passage of other vessels.

Vessels must be anchored in the harbor before berth can be assigned to them at a bulkhead, pier, or wharf.

In case any damage is done to a wharf, shed, or other structure on the water front by a vessel or individual, the captain of the port shall report such damage and the name of the individual or vessel causing it to the Commissioner of the Interior, and the expense of the repairs of said damage shall be charged against such vessel or individual. Skids must be constructed in such a way that they do not damage the pavement. The end on the bulkhead shall rest on two wheels.

Every vessel lying in a harbor shall, when directed by the captain of the port, cockbill the lower yards, brace the topsail yards fore and aft, and rig in the jib boom.

All vessels are forbidden to moor to any beacon, buoy, or other harbor mark, or to make use of the same for warping.

Pilots, upon finding any buoys out of position or any lights not working properly, shall immediately report same to the captain of the port.

Steamers while within a harbor must take all precautions to avoid the issue of sparks; vessels will be liable for all damages resulting from neglect of this rule.

No pitch, tar, turpentine, or other combustible shall be boiled on any wharf or on board any vessel without permission of the captain of the port.

In case of fire on board a vessel, all masters of other vessels shall render such assistance as may be in their power.

A vessel anchored or moored in the harbor or lying at dock must at all times, night or day, have on board a sufficient number of men to take care of such vessel.

No vessel shall unload lumber in the waters of a harbor without permission from the captain of the port, who shall designate where such lumber shall be rafted so as to avoid obstructing or hindering the movements of other vessels.

Lighters, scows, dredges, small craft of any and all description shall be anchored in such places as the captain of the port may direct, and shall at all times be under his general supervision and direction.

A vessel shall be deemed to have entered the harbor of San Juan after it has cleared buoy No. 3, and the moment of leaving is when it leaves its anchorage in the harbor.

All vessels in the service of the captain of the port, except guard boats, shall carry a distinctive flag at the bow; said flag shall be a blue field with crossed anchors of white in the center.

The captain of the port shall keep in his office records of all his proceedings, with statements of the results of all examinations and inquiries made by him, which records may be inspected by interested parties; he shall keep a record of all certificates granted by him and grant duplicates of the same upon payment of regular fee.

All notifications and requests to the captain of the port shall be made at his office in writing and shall be duly entered and filed by him.

Violations of the regulations shall be communicated to the captain of the port, and when they require immediate action he is authorized to call upon any boat in the harbor available to perform the service required in the absence of the boats in his regular service.

No vessel shall leave the harbor until the payment of all charges and fines imposed hereunder has been made, and the captain of the port shall have power to detain any such vessel until such payment.

It shall be the duty of the captain of the port to enforce and superintend the execution of all rules and regulations of the port for preventing nuisances at the wharves, or otherwise howsoever; for regulating and stationing all ships or vessels in the harbor; for removing from time to time ships and vessels in order to accommodate and make room for others; and for compelling the masters and captains of ships and vessels to accommodate each other, so that ships and vessels arriving from sea shall, for a reasonable time, be entitled to berths next to the wharf until they have landed their cargoes.

Any master or captain or person in charge of a vessel lying alongside a public bulkhead or wharf shall, at all times, have said vessel in readiness to leave said bulkhead or wharf upon being instructed to do so by the captain of the port or the Commissioner of the Interior.

The landing place in front of the customhouse in San Juan is reserved for the use of the small landing boats belonging to the Army and Navy, customhouse authorities, or to ships in the harbor; small vessels, boats, and harbor craft plying for hire are forbidden to use such landing place, except when actually disembarking passengers and baggage. The captain of the port will designate a resting place for such boats, vessels, and crafts.

TARIFF OF CHARGES FOR SMALL BOATS AND HARBOR CRAFT.

PORT OF SAN JUAN.

Charges to or from vessels anchored outside of the line, Miraflores Arsenal:

Each passenger	$0.50
Each large trunk or box	.50
Each small parcel, hand bag, etc.	.10

Charges to or from vessels anchored inside the line, Miraflores Arsenal:

Each passenger	$0.25
Each large trunk or box	.25
Each small parcel, hand bag, etc.	.10

Charges to or from Catano:

Ferriage for each person not to exceed	$0.05
Each large trunk or box	.10
Each small parcel, hand bag, etc.	.03

Between 8 p. m. and 5 a. m. the above tariff shall be doubled.

The above tariff shall be placed in a conspicuous place on the boat.

For each half hour or part thereof of delay at the side of a vessel or at a landing place, an additional charge of $0.50 may be made, the tariff by the hour controlled by agreement between the boatman and the passenger.

Any person demanding the exclusive use of a boat when other passengers are available shall pay for the use of such boat the same sum that would be paid between the same points by the number of passengers allowed to be carried by said boat, unless a lower amount is previously agreed upon.

Tariff of charges for small boats and harbor craft:

PORT OF PONCE.

Each passenger	$0.50
Each large trunk or box	.50
Each small parcel, hand bag, etc	.10

PORT OF MAYAGUEZ.

Each passenger	$0.50
Each large trunk or box	.50
Each small parcel, hand bag, etc	.10

HARBOR REGULATIONS OF ST. THOMAS.

Vessels of and above 100 tons gross register must engage a Government pilot in order to enter, leave, or shift berth to the harbor: *Provided*, That public vessels duly commissioned by the United States or foreign governments shall not be subject to the foregoing requirement. Vessels not required to engage a Government pilot shall report their arrival and intended departure to the harbor master as soon as practicable. Should a vessel lying outside the harbor send a boat ashore this must be promptly reported to the harbor master.

Vessels shall not anchor off the island of St. Thomas outside the limits of the harbor and the roadstead except in case of necessity. Where a vessel shall have so anchored the vessel's anchorage shall be shifted to the harbor as soon as circumstances shall permit this to be done.

Between sunrise and sunset every vessel, on entering or leaving the harbor, or when underway therein, shall fly its appropriate national flag. Every vessel which shall have entered the harbor after sunset shall fly such flag for at least one hour after sunrise the succeeding morning.

A vessel anchoring in the harbor shall be anchored in that part thereof delineated by a straight line between the two points of the entrance to the harbor and by straight lines from each of these two points to Kristiansfort, unless, in the opinion of the harbor master, such vessel can be conveniently anchored elsewhere in the harbor.

Except as otherwise provided in these regulations, no boat or other vessel shall be permitted to go alongside any vessel entering the harbor or passing St. Thomas, nor shall any person other than a harbor, customs, quarantine, or police official be permitted to go aboard any such vessel before the vessel is anchored or before the harbor master has granted permission for the same.

It shall be unlawful for any person on board any vessel to sell or give away any intoxicating drink or drug o er than malt liquors.

It shall be unlawful for any person to sell or give away to persons on board vessels in the harbor any intoxicating drink or drug other than malt liquors.

The United States quarantine laws and regulations are in force and effect at this port; any violation thereof will be punished as therein provided.

Vessels subject to quarantine inspection are:

(a) All vessels from foreign ports, except the British Virgin Islands.

(b) All vessels from domestic ports against which quarantine restrictions have been declared.

(c) All vessels having sickness on board.

Vessels subject to quarantine inspection shall be considered in quarantine, and on entering the port shall fly the yellow flag until released by the quarantine officer. Vessels held in quarantine shall fly the yellow flag from sunrise to sunset. At night a red light shall be shown at the foremast head. No persons except the quarantine officer, his employees, customs officers and pilots, and public officials specially authorized so to do by the governor shall be permitted to board vessels subject to quarantine inspection.

No direct communication shall be allowed between any vessel in quarantine and any person or place outside, and no communication whatever between quarantine or any vessel in quarantine and any person or place outside except under the supervision of the quarantine officer.

The occurrence of any sickness on board a vessel in the harbor shall be reported to the quarantine officer.

The presence of ammunition, gunpowder, or other explosives on board any boat or vessels entering the harbor shall be promptly reported to the harbor master. None of such explosives shall be placed on board any boat or vessel in the harbor without prior permission of the harbor master.

Such explosives as many be on board such boats and vessels shall, in the discretion of the harbor master, and upon his order, be transferred to such place as the harbor master may direct.

It is unlawful for any person to create, foment, or attempt to create or foment, any disturbance on board any vessel in the harbor, or to influence, or attempt to influence, any member of the personnel of any such vessel to abandon his duty on board any such vessel; or to prevent, or attempt to prevent, in any manner whatever, the employment of any person on board any vessel. It is also unlawful for any person on the docks, public wharves, or on board any vessel in the harbor to engage in the spreading of any propaganda intended to, or likely to, weaken the discipline of members of a crew of any vessel or of laborers engaged in work for such a vessel.

A "disturbance" shall embrace any act interfering with, or likely to interfere with, work of any character, in the vicinity of, or in connection with, any vessel in the harbor, and shall include the spreading of propaganda inducing, or likely to induce, such interference.

No one on board shall leave any vessel in the harbor before permission is given by the customs officials and immigration officers, and by the quarantine officer in cases where the vessel is subject to quarantine inspection; and if a person should be forbidden to go ashore the master of the vessel is responsible for the person not leaving the vessel until proper authority has been obtained.

Within two hours after the vessel has anchored the master shall cause to be delivered to the customhouse a correct statement signed by himself of the passengers and other persons arrived in the vessel whose names are not found entered on the muster roll. If the vessel arrives after sunset such statement must be so delivered before 8 o'clock on the following morning.

Immediately on arrival of a vessel the master shall deliver to the customhouse direct a manifest and the bills of lading of the cargo destined for St. Thomas, and as soon as possible thereafter, but within 24 hours (holidays excepted) a proper report shall be made to the customhouse by the master or consignee of the vessel, of all cargo landed for St. Thomas direct as well as for reexportation and transit. Extension of the time limit mentioned above may be granted to vessels belonging to lines calling regularly at St. Thomas.

Any discharging of cargo for which the above-mentioned documents have not been delivered to the customhouse within the above stipulated time will be punished with forfeiture of the goods so discharged, or by payment of their value, in addition to the other penalties provided for violation of these regulations.

Everything that can obstruct the traffic in the harbor must be hauled in, and boats, rafts or spars must not lie moored astern a vessel.

No vessel may change anchorage in the harbor without previous permission of the harbor master.

It is prohibited to throw anything overboard from any boat or vessel, or to pump overboard therefrom any fuel oil within the harbor limits. Ballast, ashes, and refuse shall be conveyed to such place as the harbor master may designate for dumping.

It is prohibited to boil or warm pitch, tar, or turpentine on board any vessel in the harbor, and no such vessel shall be heaved down to be cleaned or calked without prior permission from the harbormaster.

Firearms shall not be fired on or from any vessel in the harbor except when it is necessary to fire the same as signals of distress.

The blowing of steam whistles and sirens in the harbor is prohibited except when the same may be necessary, as for maneuvering purposes or in order to call the quarantine officer, pilot, etc.

None of the officers or crew of any vessel shall be discharged or left behind in St. Thomas without permission from the collector of customs, and should any person desert from any vessel in the harbor the master or consignee shall promptly report the desertion and all the facts in the case as known to such master or consignee to the collector of customs.

It is prohibited for steam launches, boats, and other small craft to remain at the landing at King's Wharf for a longer time than is necessary for landing and embarking passengers and luggage.

Sailing boats and other small craft shall within the limits of the harbor give way for larger vessels; the latter shall, however, take all necessary precautions and only use reduced speed in the harbor.

From sunset to sunrise lighters, water barges, rowboats, and similar craft must carry, when plying in the harbor, a bright, white light in the bow at a height of at least 3 feet above the gunwale, said light to be arranged and placed in such a manner as to throw an unbroken light over a range of 20 points, from right ahead to 2 points abaft the beam on either side, and also of such nature as to be visible at a distance of at least one nautical mile.

Steamboat and other craft propelled by machinery must carry in addition to the white light mentioned in paragraph 19:

On the starboard side a green light arranged and placed so as to throw an unbroken light over a range of 10 points from right ahead to 2 points abaft the starboard beam.

On the port side a red light arranged and placed so as to throw an unbroken light over a range of 10 points from right ahead to 2 points abaft the port beam.

The aforementioned side lights must be screened in such manner that the green light can not be seen from port nor the red light from starboard.

The side lights must furthermore be placed lower than the white light mentioned in the fifth paragraph above, and must be of such a nature as to be visible for at least half a nautical mile.

Sailing boats must carry permanently above the gunwale the white light mentioned in the sixth paragraph above, provided they do not carry side lights as mentioned above.

Small craft which do not regularly ply in the harbor may in the discretion of the harbormaster be exempted from the requirements of regulations in the fifth, sixth, and seventh paragraphs above, providing they comply with the International regulations concerning the rules of the road.

The harbormaster's orders concerning order in the harbor shall be promptly and explicitly obeyed. Any damage resulting from failure to obey promptly such orders or any damage resulting from any violation of these regulations shall be assessed against and collected from the party or parties at fault.

Violation of any of the provisions, requirements, or prohibitions of these regulations shall, in addition to any other penalties specifically imposed by these regulations, be punished by a fine of not less than $5 or more than $200, or by imprisonment for a period not exceeding one hundred and eighty days, or both such fine and imprisonment in the discretion of the court, the local courts of St. Thomas and St. John being hereby granted jurisdiction to adjudge the fines and penalties herein provided.

Masters of vessels will receive on arrival at St. Thomas a copy of these regulations gratis.

TARIFF OF CHARGES FOR PILOTING, WARPING, AND MOORING OF VESSELS IN THE PORT OF ST. THOMAS.

In accordance with the authority vested in me by the provisions of the law, No. 113 of April 6, 1906, concerning the administration of St. Thomas Harbor, and the act of Congress approved March 3, 1917, to provide a temporary government for the West Indian Islands acquired by the United States from Denmark, the following charges for services furnished by the harbor department, and the

following regulations for St. Thomas Harbor are hereby promulgated, to take effect from and after April 1, 1918:

For piloting steamers to or from the Harbor.

Draft.	From sunrise to sunset.	From sunset to sunrise.
	Franc.	*Franc.*
Under 12 feet	30	50
12 feet to 13 feet, both inclusive	35	55
14 feet to 15 feet, both inclusive	40	60
16 feet to 17 feet, both inclusive	50	70
18 feet to 19 feet, both inclusive	55	75
20 feet to 21 feet, both inclusive	60	80
22 feet to 23 feet, both inclusive	65	85
24 feet to 25 feet, both inclusive	70	90
26 feet to 27 feet, both inclusive	75	95
28 feet or over	80	100

NOTE.—Fractional parts of foot less than 6 inches will not be counted. Fractional parts of a foot 6 inches or more will be considered an additional foot.

For pilotage to or from Gregorie Channel add 25 francs to harbor pilotage.

For pilotage around the Islands of St. Thomas and St. John, special agreement will be made between master or agent of vessel and harbormaster.

For dry docking or moving in the harbor, half of pilotage to or from the harbor.

FOR PILOTING SAILING VESSELS TO OR FROM THE HARBOR.

For piloting sailing vessels up to and including 100 tons gross register, 10 francs. For every additional 100 tons or fraction thereof, 5 francs.

For moving, dry docking, or mooring sailing vessels in the harbor the fee will be the same as pilotage to or from the harbor.

For piloting of sailing vessels from sunset to sunrise add 50 per cent.

REGULATIONS GOVERNING BOATS FOR HIRE IN THE HARBOR OF ST. THOMAS, EFFECTIVE ON AND AFTER JULY, 1920.

Boats, other than those licensed, can not be hired to carry passengers or luggage to and from vessels or to and from places in the harbor of St. Thomas within a straight line from Muhlenfeldts Point to Cowells Point, except when a licensed boat is not obtainable.

The harbormaster is authorized to issue licenses for boats for hire subject to the approval of the chairman of the harbor board. Applications for licenses should be directed to the harbormaster, who will satisfy himself as to the personal qualifications of the applicants. Licenses will be given for a term of one year, subject to revocation, at any time, for noncompliance with these regulations.

License will be granted only to the owner, who will be required to show that he is capable of handling the boat himself or that he is placing the boat in the charge of a man capable of handling it.

For each pulling boat for hire a fee of 2.50 francs per month will be collected; for each power boat for hire a fee of 10 francs per month will be collected.

A license will not be granted to any person officially employed in the harbor or police departments.

Each boat is to have its proper number clearly marked outside each side of stem and stern. They are to be kept always in good order, and a general inspection of all licensed boats will be held by the harbormaster once each month.

The license as well as a printed copy of the regulations and the legal fares are always to be in the boat when at work. Each boatman is bound to have a plate of tin or copper on his hat, showing the number of the boat he works.

All licensed boats are to be kept ready for use on working days from 7 o'clock a. m. till 8 o'clock p. m., during which time no boat must be hauled on shore or left by the boatmen without special permission of the harbormaster. Two boats will by turns be specially appointed by the harbormaster to take station

at the Kings Wharf during the whole night for service if required. On Sundays and holidays and in all cases of emergency the harbormaster can make special provisions for securing a sufficient number of boats as occasion may require.

The rate of fares is fixed according to the distances, as follows:

	D. W. I. Cy.
(*a*) Between the town and customary anchorage of the St. Croix packets and similar short distances	$0.05
(*b*) Between Kings Wharf and either end of the town, as well as to vessels lying halfway between town and the R. M. Co.'s coal wharf	.10
(*c*) Between the town and all places of the harbor within Prince Ruperts and similar long distances	.30
(*d*) Between the town and all places beyond Prince Ruperts until a straight line from Muhlenfeldts Point to Cowells Point	.50
For each additional person in the case mentioned under Nos. (*c*) and (*d*)	.10
(*e*) Between the town and the steam packets when anchored in the stream	.15
For each additional person	.10
For each person's luggage (1 trunk and 4 smaller packages)	.20
For each additional trunk or package	.05

Half fare is charged for the return except in the cases mentioned under Nos. (*a*) and (*b*), which are full fare each way. For the time the boat is kept waiting after landing passengers longer than 15 minutes the hour fare is charged.

(*f*) The rates for a pulling boat for other than the short trips listed under (*a*) to (*e*) are as follows:

The first hour, one person	.40
Each additional person	.20
Each additional hour, half fare.	
The day from 7 a. m. to 5 p. m., one person	2.00
Each additional person	.50

The rates for a motor boat for other than the short trips listed under (*a*) to (*e*) are as follows:

The first hour, one person	$2.00
Each additional person	.50
Each additional hour, half fare.	

Special arrangements may be made to hire by the day.

Between 8 p. m. and 6 a. m. all fares are double.

In case of dispute the harbormaster may decide which rate is applicable.

The harbormaster has the control over licensed boats and their crews. If dispute arises between the boatmen and those that hire the boat the harbormaster must endeavor to have the matter settled amicably; if he does not succeed in this the case is to be referred to the police court.

Trespasses on the privilege of the owners of the boats for hire are to be punished with fines of from 10 to 200 francs. The fare paid for the use of an unlicensed boat will in all such cases be forfeited for the benefit of the police fund.

In case of fire breaking out in the town or in the harbor all licensed boats are to assemble at Kings Wharf and await the harbormaster's orders.

The owner or operator of a boat who asks or accepts fares beyond the legal rate will for the first offense pay a fine of from 5 to 100 francs, and of from 25 to 200 francs for the second offense; in case of a third offense the license may be revoked.

Whoever without permission hauls his boat ashore, quits the boat in which he is employed, refuses without sufficient excuse to work when demanded, or otherwise acts contrary to his duties, is liable to the penalties prescribed in the above paragraph, and if by gross misconduct he has caused any injury to persons or property he will be responsible according to common law.

Breaches of the present regulations are to be treated as public police cases.

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 than two points abaft the beam on their respective sides. To make the use of these portable lights more certain and easy the lanterns containing them shall each be painted outside with the color of the light they respectively contain, and shall be provided with proper screens.

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, respectively, and rowing boats, when under way, shall not be required to carry the lights mentioned in article two (a), (b), and (c), but if they do not carry them they shall be provided with the following lights:

First. Steam vessels of less than forty tons shall carry—

(a) In the fore part of the vessel, or on or in front of the funnel, where it can best be seen, and at a height above the gunwale of not less than nine feet,

a bright white light constructed and fixed as prescribed in article two (a), and of such a character as to be visible at a distance of at least two miles.

(b) Green and red side lights constructed and fixed as prescribed in article two (b) and (c), and of such a character as to be visible at a distance of at least one mile, or a combined lantern showing a green light and a red light from right ahead to two points abaft the beam on their respective sides. Such lanterns shall be carried not less than three feet below the white light.

Second. Small steamboats, such as are carried by seagoing vessels, may carry the white light at a less height than nine feet above the gunwale, but it shall be carried above the combined lantern mentioned in subdivision one (b).

Third. Vessels under oars or sails of less than twenty tons shall have ready at hand a lantern with a green glass on one side and a red glass on the other, which, on the approach of or to other vessels, shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side.

Fourth. Rowing boats, whether under oars or sail, shall have ready at hand a lantern showing a white light which shall be temporarily exhibited in sufficient time to prevent collision.

The vessels referred to in this article shall not be obliged to carry the lights prescribed by article four (a) and article eleven, last paragraph.

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 anchor, 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 eleven.

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 different sides, the vessel which has the wind on the port side shall keep out of the way of the other.

(d) When both are running free, with the wind on the same side, the vessel which is to the windward shall keep out of the way of the vessel which is to the leeward.

(e) A vessel which has the wind aft shall keep out of the way of the other vessel.

STEAM VESSELS.

Art. 18. When two steam vessels are meeting end on, or nearly end on, so as to involve risk of collision, each shall alter her course to starboard, so that each may pass on the port side of the other.

This article also applies to cases where vessels are meeting end on, or nearly end on, in such a manner as to involve risk of collision, and does not apply to two vessels which must, if both keep on their respective courses, pass clear of each other.

The only cases to which it does apply are when each of the two vessels is end on, or nearly end on to the other; in other words, to cases in which, by day, each vessel sees the masts of the other in a line, or nearly in a line, with her own; and by night, to cases in which each vessel is in such a position as to see both the side lights of the other.

It does not apply by day to cases in which a vessel sees another ahead crossing her own course; or by night, to cases where the red light of one vessel is opposed to the red light of the other, or where the green light of one vessel is opposed to the green light of the other, or where a red light without a green light, or a green light without a red light, is seen ahead, or where both green and red lights are seen anywhere but ahead.

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 of two vessels is to keep out of the way, the other shall keep her course and speed.

Note—When, in consequence of thick weather or other causes, such vessel finds herself so close that collision can not be avoided by the action of the giving-way vessel alone, she also shall take such action as will best aid to avert collision. [See articles twenty-seven and twenty-nine.]

CROSSING AHEAD.

ART. 22. Every vessel which is directed by these rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.

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 signals to be used or displayed by her, either together or separately, namely:

In the daytime—

First. A gun or other explosive signal fired at intervals of about a minute.

Second. The international code signal of distress indicated by N C.

Third. The distance signal, consisting of a square flag, having either above or below it a ball or anything resembling a ball.

Fourth. A continuous sounding with any fog-signal apparatus.

At night—

First. A gun or other explosive signal fired at intervals of about a minute.

Second. Flames on the vessel (as from a burning tar barrel, oil barrel, and so forth).

Third. Rockets or shells throwing stars of any color or description, fired one at a time, at short intervals.

Fourth. A continuous sounding with any fog-signal apparatus.

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