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COAST AND GEODETIC
SURVEY

ALASKA COAST PILOT

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DEPARTMENT OF COMMERCE AND LABOR

COAST AND GEODETIC SURVEY

O. H. TITTMANN, SUPERINTENDENT

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ALASKA COAST PILOT NOTES

FROM

YAKUTAT BAY TO COOK INLET
AND SHELIKOF STRAIT

SECOND EDITION

2nd ed not for sale



WASHINGTON

GOVERNMENT PRINTING OFFICE

1910

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DEPARTMENT OF COMMERCE AND LABOR,
COAST AND GEODETIC SURVEY,
WASHINGTON, D. C., *April 15, 1910.*

The information contained in this publication relates to the coast, bays, and harbors of Alaska from Yakutat Bay to Shelikof Strait and the head of Cook Inlet. It is based on the work of the Coast and Geodetic Survey, including the latest surveys and the results of special investigations and examinations by Mr. Herbert C. Graves, the compiler, under the direction of J. J. Gilbert, Assistant, Coast and Geodetic Survey, Inspector of Hydrography and Topography.

Great courtesy has been shown by local authorities and masters and pilots navigating these waters in furnishing information for use in this publication.

As absolute accuracy in a work of this class is scarcely possible, navigators will confer a favor by notifying the Superintendent of the Coast and Geodetic Survey of errors which they may discover, or of additional matter which they think should be inserted for the information of mariners.

O. H. TITTMANN,
Superintendent.

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.

Distances and velocities of currents are in *nautical miles*.

GENERAL REMARKS AND DIRECTIONS, YAKUTAT BAY TO COOK INLET.

From Cape St. Elias to the head of Cook Inlet and southward to Chiniak Bay, Cape Karluk, and Takli Island the principal points along the coast are determined by triangulation, and accurate courses and distances for coasting can be taken from chart 8502 (1910 edition). Some of the bays and arms are not surveyed, and their delineation on the chart is taken from the sketches of the early navigators adjusted to known points determined by later surveys.

Vessels approaching Prince William Sound from southeastward generally make Cape St. Elias and pass 1 mile or more southward of Southeast Rock. On page 8 bearings and distances are given from Southeast Rock to the principal coast points of Southeast Alaska. A current, constant so far as known, sets northwestward along the coast of Alaska as far as Cape St. Elias. This current is increased by southeast winds and decreased by northwest winds, but its estimated velocity under ordinary conditions is $\frac{3}{4}$ mile an hour. This should be kept in mind, especially when approaching Cape St. Elias from southeastward, as a vessel will generally overrun her log when bound westward.

Cape St. Elias to Cape Hinchinbrook.—From a position 2 miles southward of Southeast Rock a 295° true (**W** $\frac{1}{4}$ **S** mag.) course made good for 67 miles will lead to a position $1\frac{1}{2}$ miles southward of Cape Hinchinbrook.

An examination of the logs of several courses between Cape St. Elias and Cape Hinchinbrook indicates that the currents are influenced by the tides, being stronger with the larger tides, and that the current on the ebb has frequently, but not always, caused a southerly set, and the current on the flood a northerly set. On some occasions when the range of the tides was small no marked set of current was noted. Results seem to point to a stronger current toward Cape St. Elias than Cape Hinchinbrook. Surveying parties report a constant set southwestward along the coast of Hinchinbrook Island, and strong tidal currents were noticed across the reef at Cape St. Elias. At Middleton Island the tidal currents have a velocity of 2 to 3 miles, setting northward on the flood and southward on the ebb.

Prince William Sound.—Vessels from southeastward enter Prince William Sound through Hinchinbrook Entrance, and leave the sound through Latouche or Elrington Passage when bound southwestward. The principal ports of call are Cordova and Valdez. Sailing directions for Orca Bay to Cordova are given on page 17. Sailing directions for the sound from Hinchinbrook Entrance and Latouche Passage to Valdez are given on page 21. Sailing directions for Latouche and Elrington passages are given on page 30.

Latouche Passage to Resurrection Bay.—Having come from Latouche Passage by the channel east of Elrington Island, when $\frac{1}{2}$ mile past Danger Island steer 257° true (**SW** $\frac{1}{2}$ **W** mag.) for 9 miles, giving the shore of Elrington Island a berth of $\frac{3}{4}$ mile, to a position 3 miles 168° true (**SE** $\frac{1}{2}$ **S** mag.) from Cape Puget. Then steer 263° true (**SW** by **W** mag.) for 26 miles, passing 2 miles off the headland 6 miles southwestward of Cape Puget. The south end of Rugged Island should be ahead, and the course and distance made good should lead to a position 1 mile 173° true (**SE** by **S** mag.) from Barwell Island off Cape Resurrection. Then follow the directions for entering Resurrection Bay from eastward.

Latouche Passage to Seal Rocks.—Having come from Latouche Passage to a position 1 mile off the southeast side of Elrington Island, a 239° true (**SSW** $\frac{1}{8}$ **W** mag.) course made good for 52 miles will lead to a position 3 miles 151° true (**SE** by **E** mag.) from Seal Rocks.

Or, having come from Elrington Passage to a position 3 miles 168° true (**SE** $\frac{1}{2}$ **S** mag.) from Cape Puget, a 235° true (**SSW** $\frac{1}{2}$ **W** mag.) course made good for 43 miles will lead to a position 3 miles 151° true (**SE** by **E** mag.) from Seal Rocks.

There is little information about the currents between Cape Cleare and Seal Rocks. When out of the bight of the coast between these points a southwesterly set may be experienced. The principal flood and ebb current to and from Prince William Sound westward of Montague Island is through Montague Strait.

The passage between Seal Rocks and Chiswell Islands is nearly 3 miles wide and is frequently used by vessels between Resurrection Bay and the coast southwestward. In thick weather or at night, and also when vessels are standing along the coast and not entering Resurrection Bay, it is better to pass outside Seal Rocks.

Seal Rocks to East Chugach Island.—From a position 3 miles 151° true (*SE by E* mag.) from Seal Rocks, make good a 245° true (*SW $\frac{1}{2}$ S* mag.) course for 26 miles to a position $3\frac{1}{2}$ miles 155° true (*SE $\frac{1}{2}$ E* mag.) from the peak of the outer Pye Island; Pye Island Reef should then bear 296° true (*W* mag.) distant $2\frac{1}{2}$ miles. Or, vessels from Resurrection Bay going inside Seal Rocks, pass 1 to $1\frac{1}{2}$ miles northwestward of Seal Rocks and make good a 237° true (*SSW $\frac{3}{4}$ W* mag.) course for 26 miles to a position $3\frac{1}{2}$ miles 155° true (*SE $\frac{1}{2}$ E* mag.) from the peak of the outer Pye Island.

From a position $3\frac{1}{2}$ miles 155° true (*SE $\frac{1}{2}$ E* mag.) from the peak of the outer Pye Island, make good a 246° true (*SW $\frac{3}{8}$ S* mag.) course for $35\frac{1}{2}$ miles, passing 2 miles off Point Gore, $1\frac{3}{4}$ miles off the sunken rock nearly midway between Point Gore and East Chugach Island, and to a position with the southeast point of East Chugach Island bearing on the starboard beam, 336° true (*NW $\frac{3}{8}$ W* mag.) distant 3 miles.

Under ordinary conditions the current may be expected to set southwestward along the coast, but its rate is not known. It is reported that the flood current sets strongly southwestward toward Cook Inlet, while the ebb current is almost negligible. When crossing the entrances to the larger bays, the tidal current setting to or from them will be noticed.

In 1908 breakers in a heavy sea were reported about 9 miles 177° true (*SSE $\frac{1}{2}$ E* mag.) from the southeast point of East Chugach Island.

East Chugach Island to Seldovia.—From Pearl Island nearly to Seldovia the tidal currents have an estimated velocity of 3 to 5 miles in the track usually followed by vessels. No allowance for the current is made in the following courses and distances, and care will be required to make them good.

The following is the usual route followed by large vessels. The smaller vessels, especially with local knowledge, frequently go through the passage inside Pearl and Elizabeth islands. Directions for this passage are given on page 36.

From a position 3 miles 156° true (*SE $\frac{3}{8}$ E* mag.) from the southeast point of East Chugach Island, make good a 269° true (*SW by W $\frac{3}{4}$ W* mag.) course for 15 miles, passing 2 miles off the southeast bare rock near Pearl Island, the same distance southward of Dora Reef, and to a position with Cape Elizabeth bearing on the starboard beam; 0° true (*NNW $\frac{1}{4}$ W* mag.), distant $5\frac{1}{2}$ miles. Then make good a 339° true (*NW* mag.) course for $11\frac{1}{2}$ miles, passing 2 miles off Cape Elizabeth, and to a position $1\frac{1}{2}$ miles 249° true (*SW* mag.) from Point Adam.

From this position make good a 352° true (*NNW $\frac{7}{8}$ W* mag.) course for 6 miles, passing 1 mile westward of Magnet Rock, and to a position $1\frac{1}{2}$ miles 284° true (*W by S* mag.) from Flat Island. From this position the course is about 30° true (*N $\frac{1}{2}$ E* mag.), and the distance about 7 miles, to a position $1\frac{1}{2}$ miles off a prominent flat-topped point about 80 feet high. Then the course is about 68° true (*NE $\frac{1}{8}$ N* mag.) and the distance about $7\frac{1}{2}$ miles to a position 1 mile off the entrance of Seldovia Bay. Directions for entering the bay are given on page 40.

The **tidal currents** in the entrance of Cook Inlet have great velocity, especially among and around Chugach and Barren islands and off the north end of Shuyak Island. With the large tides, rips dangerous to small craft occur in the channels among the islands and in the wake of many projecting points. With an ebb current of the large tides and easterly winds, a very heavy sea and tide rips will be found in mid-channel on either side of Barren Islands.

Cook Inlet to Kodiak.—The usual route is through Marmot Strait. With heavy easterly weather vessels sometimes go down Shelikof Strait and pass eastward through Kuprenof Strait.

From a position $1\frac{1}{2}$ miles westward of Flat Island steer 186° true (*S by E $\frac{5}{8}$ E* mag.) for $24\frac{1}{2}$ miles to a mid-channel position between the northeast end of Ushagat Island and the southwest end of West Amatuli Island.

Then steer 170° true (*SE by S* mag.) for 36 miles to a position $1\frac{1}{4}$ miles off a point $1\frac{1}{2}$ miles southeastward of Tonki Cape. Then steer 180° true (*SSE $\frac{1}{8}$ E* mag.) for about $4\frac{1}{2}$ miles to a position about $1\frac{1}{4}$ miles off a prominent point on the western shore; the northern end of Marmot Island should then bear about 80° true (*NE by E* mag.).

Then steer 203° true (*S $\frac{1}{8}$ E* mag.) giving the western shore of Marmot Strait a berth of about 1 mile; the distance to Pillar Cape abeam is $8\frac{1}{2}$ miles. Continue the course across Marmot Bay, passing 3 miles eastward of Spruce Island and the same distance westward of

Williams Reef. The eastern end of Woody Island should be made ahead, and the course made good for $28\frac{1}{2}$ miles, or 20 miles from Pillar Cape abeam, will lead to a position $1\frac{3}{8}$ miles eastward of Hanin Rocks. Then enter St. Paul Harbor on one of the ranges for the northern entrance as directed on page 62.

For **tidal currents** in the entrance of Cook Inlet see the page preceding. In Marmot Strait the tidal currents have an estimated velocity of 1 to 3 miles, the flood current setting northward and the ebb southward.

COAST FROM YAKUTAT BAY TO CAPE ST. ELIAS.

From Point Manby to Cape Suckling the coast is clear as far as known. A reef extends $\frac{1}{2}$ or $\frac{3}{4}$ mile off Cape Yakataga. There is no sheltered boat landing between Yakutat and Controller Bay. There are numerous swift streams which generally enter the sea through sandy deltas, and none are navigable.

Point Manby is low and wooded for about 4 miles back to Malaspina Glacier.

Sitkagi Bluffs are about 4 miles long, and are formed by Malaspina Glacier, which at the bluffs comes down to high-water mark but does not discharge into the sea. From Sitkagi Bluffs the glacier recedes from the coast about 4 miles up the Yahtse and Yana rivers, and then comes to the coast again at Icy Cape.

Icy Cape, the first point of any prominence west of Point Manby, lies about 56 miles westward of Ocean Cape. It is the end of a branch of Malaspina Glacier, which discharges into the sea, but the ice does not drift far.

Mount St. Elias is 18,025 feet high, and at the top is a massive pyramid with a shoulder on each side as seen from southward.

From Icy Cape to Cape Suckling, a distance of about 70 miles, the coast is low and wooded and backed by ice fields and glaciers.

Cape Suckling is low and wooded. Lying 2 miles northwestward of the cape and 1 mile inland is the end of a prominent mountain ridge which extends about 8 miles in a northeasterly direction, with elevations of 1,500 to 2,500 feet.

Three bluffs about 100 feet high lie $1\frac{1}{2}$ to $2\frac{7}{8}$ miles westward of Cape Suckling. From the eastern bluff a sunken reef extends $\frac{5}{8}$ mile southwestward to three rocks, close together and bare at low water.

Southwest Breaker is on a rock bare at low water, and lies 2 miles 212° true (*S* $\frac{1}{4}$ *W* mag.) from the western bluff mentioned in the preceding paragraph, and $3\frac{3}{4}$ miles 260° true (*S* W $\frac{1}{2}$ *W* mag.) from Cape Suckling.

Okalee Spit, forming the south side of Controller Bay, is low, bare sand dunes, 7 miles long in an east and west (true) direction.

The entrance to Controller Bay between the north end of Kayak Island and Okalee Spit is of little use except for small craft or very small vessels that can cross the flats eastward of Wingham Island.

Two prominent rocks about 75 feet high lie outside the entrance, $1\frac{1}{2}$ miles northeastward of Lemesurier Point and $1\frac{1}{4}$ miles southward of Okalee Spit. They are connected by ledges bare at low water, which also extend about 300 yards eastward and westward from them. The group is prolonged by shoals, which shelve off to 18 feet in a distance of $\frac{7}{8}$ mile 299° true (*W* mag.) from the western rock and to 16 feet a little over $\frac{1}{2}$ mile 82° true (*NE* $\frac{3}{4}$ *E* mag.) from the eastern rock.

From the shoal surrounding the rocks a rocky bar with 17 to 19 feet over it extends $1\frac{1}{4}$ miles eastward on the range of the two rocks, and then with 19 to 21 feet over it curves northeastward and joins the shoal with 16 to 18 feet over it that extends about $1\frac{1}{4}$ miles from Okalee Spit. This bar is open to the sea from eastward and southward. The channel to this entrance of Controller Bay is over this bar with a least depth of 17 to 19 feet and then passes between Okalee Spit and the two rocks.

From **Lemesurier Point** (northeast end of Kayak Island) foul ground with 13 feet over its outer half extends nearly to the shoal surrounding the two high rocks. There is little depth near Lemesurier Point, and it shelves off to 10 feet in a distance of $\frac{1}{2}$ mile toward the two rocks.

From northward of the two high rocks the channel has depths of 5 to 7 fathoms until about 1 mile inside the north end of Kayak Island. It then leads between flats to Kayak Entrance

with a least width of $\frac{1}{4}$ mile and depth of 18 feet. The best depth that can be carried across the flats in Controller Bay eastward of Wingham Island is 6 feet at low water.

Kayak Island is $17\frac{1}{2}$ miles long, has peaks 1,200 to 1,400 feet high, and slopes gradually to its northern part, which is low and wooded. **Cape St. Elias**, the south end of Kayak Island, is an important and unmistakable landmark. It is a precipitous, sharp, rocky ridge, about 1 mile long and 1,665 feet high, with a low, wooded neck between it and the high parts of the island farther north. About $\frac{1}{4}$ mile off the cape is the remarkable **Pinnacle Rock**, 494 feet high.

Boats can generally land on the south side of Cape St. Elias just eastward of a small point which extends toward Pinnacle Rock. The better approach is from westward, keeping close to the island to clear a ledge which extends $\frac{1}{4}$ mile northwestward from Pinnacle Rock.

The eastern coast of Kayak Island is strewn with boulders and landing is impracticable. Rocky shoals with 11 feet over them lie $1\frac{3}{4}$ miles 172° true (*SE $\frac{3}{4}$ S mag.*) from Lemesurier Point. Lying $3\frac{1}{4}$ miles southward of the point and 1 mile offshore is a reef $\frac{1}{2}$ mile long. Its northern end is a rock 10 feet high, and its south end is bare at half tide. For a distance of 6 miles northward of Cape St. Elias boulders bare at low water and breakers extend $\frac{3}{4}$ mile off the eastern coast of the island.

Breakers extend 2 miles southeastward of Cape St. Elias to **Southeast Rock**, which is awash, the breakers extending $\frac{3}{4}$ mile southwestward of the line joining them. There is a depth of 20 fathoms about $\frac{3}{8}$ mile outside these breakers. A ridge with 10 to 15 fathoms over it extends $1\frac{1}{2}$ miles southwestward from Southeast Rock. The 50-fathom curve lies about 7 miles southwestward and westward of Southeast Rock, but is only $\frac{1}{2}$ mile southeastward of it. The tidal currents have considerable velocity across the reef.

Eastward of this reef another reef on which the sea breaks extends $1\frac{1}{2}$ miles from Kayak Island, the end of the reef lying about $1\frac{5}{8}$ miles northward from Southeast Rock.

The following are computed bearings and distances from Southeast Rock:

Entrance to Monti Bay, Yakutat, $94\frac{1}{2}^\circ$ true (*NE by E $\frac{3}{4}$ E mag.*), 145 miles.

Cape Spencer, 111° true (*E $\frac{3}{4}$ N mag.*), 263 miles.

Klokachef Point, Salisbury Sound, $117\frac{1}{2}^\circ$ true (*E $\frac{1}{8}$ N Northerly mag.*), 307 miles.

Cape Edgecumbe, 121° true (*E $\frac{1}{8}$ S mag.*), 321 miles.

Cape Ommaney, 124° true (*E $\frac{3}{8}$ S Southerly mag.*), 383 miles.

Summit of Forrester Island, 130° true (*E by S Easterly mag.*), 467 miles.

Cape Hinchinbrook, 295° true (*W $\frac{1}{4}$ S Southerly mag.*), 67 miles.

Sea Ranger Reef is two shoals lying off a point on the western coast of Kayak Island $3\frac{1}{4}$ miles northward of Cape St. Elias. The inner one lies $\frac{3}{4}$ to $1\frac{1}{4}$ miles from shore, has 11 feet over it, is $\frac{3}{4}$ mile long, and the sea often breaks on it. The outer shoal is small, lies $1\frac{1}{2}$ miles from shore, has a least depth of 24 feet, and there is seldom a break on it. Tide rips occur around it at times.

The **tidal currents** on the western side of Kayak Island set northward on the flood and southward on the ebb, with an estimated velocity at strength of $\frac{1}{2}$ to $\frac{3}{4}$ mile.

From the high bluff point on Kayak Island $3\frac{1}{2}$ miles south of Wingham Island a shoal with 13 feet near its end extends $\frac{3}{4}$ mile northward. Anchorage can be made in the bight northward of the point, $\frac{3}{4}$ to $1\frac{1}{2}$ miles from the point and $\frac{1}{2}$ to 1 mile from shore, in 4 to 5 fathoms, bottom soft in places, with shelter from easterly and southeasterly winds. Large deep-draft vessels should anchor farther out in not less than 10 fathoms, with the southeast end of Wingham Island bearing about 48° true (*N by E $\frac{3}{4}$ E mag.*).

CONTROLLER BAY

is formed by Okalee Spit and Kayak Island on the south and Wingham and Kanak islands on the west. For some distance back from the eastern shore the land is but slightly above high water, and is broken by many streams. Quicksand has been found in the channel at the mouth of Edwardes River. The bay is filled by flats between which are two principal channels, one from Kayak Entrance to the northern end of Kayak Island, and Okalee Channel.

Kayak Entrance, between Kayak and Wingham islands, is rocky and foul, there being numerous lumps with 12 to 13 feet over them. The channel with depths of 12 to 15 feet is $\frac{1}{2}$ mile wide between a sand spit, largely bare at low water, extending 1 mile off the southwest

side of the low wooded spit on the northwest side of Kayak Island, and a reef, partly bare at low water, extending 350 yards southeastward from the southeast end of Wingham Island. There is a channel with a depth of 15 feet and width of 150 yards in its narrowest part between lumps with 13 feet over them. The approach is lumpy, with numerous spots of 2 to 3 fathoms inside the 5-fathom curve. The latter is about on a line from the southwest point of Wingham Island to the high bluff point on Kayak Island $3\frac{1}{2}$ miles 201° true ($S\ \frac{3}{4}\ E$ mag.) from it. A reef, partly bare at low water, extends 600 yards southward from the southeast point of Wingham Island.

The following directions lead in the best water through Kayak Entrance, but in the absence of aids can not be depended on for a greater depth than 12 feet at low water, and the entrance should be used at high water only.

Steer for the end of the low wooded spit on the northwest side of Kayak Island on a 60° true ($NNE\ \frac{3}{4}\ E$ mag.) course until the southeast tangent of Wingham Island bears 6° true (NNW mag.). Then steer 18° true (N by W mag.) and give Wingham Island a berth of 350 yards.

Anchorage can be made about 250 yards northeastward of the point of Wingham Island just southeastward of Kayak, in 3 fathoms, or a short distance southeastward of this position, in depths up to 4 fathoms, bottom soft in places. Good anchorage may also be selected anywhere in the channel from the southeast end of Wingham Island to the northern end of Kayak Island, for which chart 8513 and the lead are the guides. There is some local chop with strong winds, but no outside swell enters the bay either through Kayak Entrance or around the northern end of Kayak Island.

Kayak, on the east side of Wingham Island $\frac{3}{8}$ mile from its southeast end, is abandoned.

Wingham Island is 4 miles long and wooded, and has three hills, the highest, near its northern end, having an elevation of 832 feet. The western shore of the island is precipitous.

With heavy easterly winds anchorage and shelter can be found in 16 to 18 fathoms $\frac{3}{8}$ to $\frac{1}{2}$ mile from the western side of Wingham Island, abreast its middle and lowest part.

Small vessels can anchor in the narrow channel close to the eastern side of Wingham Island. This channel is about 300 yards wide and extends nearly 2 miles southward from the northern end of the island, with depths of 7 to 12 fathoms for 1 mile and then shoals gradually southward. The flats on the eastern edge of the channel have depths of 7 to 11 feet and are generally steep-to. The mid-channel leads about 200 yards from the island. A depth of 6 feet at low water can be carried through close to the island to Kayak Entrance. The tidal currents have some velocity around the north end of Wingham Island. A shoal extends about 200 yards off the middle of the northern end of the island.

Okalee Channel, between the north end of Wingham Island and Kanak Island, is $\frac{5}{8}$ mile wide, with depths of 6 to 7 fathoms at the entrance, and these depths or more can be taken through the greater part of the channel. The channel is a secure harbor, but is little used in the absence of aids.

The shoal on the southeast side of the channel $1\frac{1}{2}$ miles northeastward from the northern end of Wingham Island is bare shortly after high water, and this shoal and the one on the opposite side of the channel are generally partly indicated by breakers, especially at low water. The shoal extending southward from Kanak Island is mostly well out at low water. Above these shoals the flats bordering Okalee Channel are partly bare at low water only, and there is nothing to indicate the channel when the flats are covered. On the edges of the channel the shoaling is abrupt except at the entrance and on the southeast side where it changes direction southeastward of Kanak Island.

Vessels sometimes anchor in Okalee Channel about 2 miles above the northern end of Wingham Island. This part of the channel is generally easy of access in clear weather. Above this point Okalee Channel should be navigated at low water only, in the absence of aids or local knowledge, and extra care is required to keep in the channel. Chart 8513 and the lead are the guides.

Kanak Island is $3\frac{1}{4}$ miles long, very low and flat, and wooded in the middle. An extensive shoal makes out southwestward from the island, about 3 miles from its southeast end and 2 miles from its northwest end. The southern edge of the shoal passes about 1 mile northwestward from the northern end of Wingham Island. When off the southwest side of

Kanak Island vessels should keep in over 5 fathoms (low water). The range of the north ends of Wingham and Kayak islands, bearing 119° true (*E mag.*), leads clear southward of the shoal.

The passage between Kanak Island and Strawberry Point is used only by boats and launches at high water.

Point Hey is a projecting and prominent high, narrow point on the northwest side of Controller Bay 1 mile northward of Kanak Island.

Weather.—During the summer the prevailing winds are easterly with rain, and this is the direction from which the heaviest weather comes. Westerly winds are infrequent during the summer, and generally light. Fog was rare and cleared off before noon.

Tides.—High and low water occur 27 minutes later than at Sitka, and the rise and fall of tides is the same.

The **tidal currents** set into Controller Bay through all the entrances on the flood and out on the ebb. In Kayak Entrance the ebb has greater velocity than the flood, and it is estimated that the greatest velocity at strength does not exceed 3 miles. Tide rips occur at times in the channel abreast the southern end of Wingham Island. The velocity of the current in the channel north of Kayak Island does not exceed 2 miles. In Okalee Channel the tidal currents have a velocity of 2 to 3 miles at strength, and small rips occur when the wind is against the current.

KATALLA BAY,

23 miles northward from Cape St. Elias, is included between Strawberry Point on the east and Martin Islands on the west, a distance of 5 miles, and indents the coast about 2 miles to the mouth of Katalla River. The bay is a roadstead anchorage sheltered from offshore winds, but exposed to winds from southeast, south, and southwest.

Strawberry Point is low and bare at the end and wooded toward the foot of the hill. There is a prominent hill on the point with a low break between it and the higher land northward. A shoal with little water over it, and on which the sea generally breaks at low water, extends nearly $1\frac{1}{2}$ miles southward from the point.

The northeastern shore of the bay from Strawberry Point to the mouth of the Katalla River is a steep sand beach. The northwestern shore from Katalla to Martin Islands is foul and should be given a berth of about $\frac{3}{4}$ mile.

Palm Point is $1\frac{1}{2}$ miles southwestward of Katalla. There are a number of buildings of a railroad camp just northward of the point. A bowlder reef, bare at low water, extends $\frac{3}{8}$ mile southward from it.

Martin Islands are two in number, about 60 feet high, have steep rocky sides, and lie $\frac{1}{2}$ to 1 mile from shore. The northern island is joined to the shore by a flat, bare at extreme low water. There is a wireless telegraph station on the northern island.

Katalla is a town and post-office on the northern side of the bay and on the western side of the mouth of Katalla River. There is a landing for the lighters, which are towed over the bar except at low water. The bar at the mouth of the river has a depth of about 3 feet at low water. With a smooth sea, lighters also land in the bight on the northeastern side of Palm Point. There is always some surf on the beach, and with southeasterly or southwesterly winds landing is impracticable. Goods are discharged by means of lighters. The necessary towing is done by large launches, of which there are a number.

The anchorage in the bay is from 1 to 2 miles southward of Katalla in 5 to $7\frac{1}{2}$ fathoms, with the eastern end of the town bearing between 17° true (*N by W mag.*) and 355° true (*NW by N mag.*). The bottom is hard sand but the holding ground is generally good. There are no dangers if the shore be given a berth of over $\frac{3}{4}$ mile, but the shoal extending $1\frac{1}{2}$ miles southward from Strawberry Point should be kept in mind.

Approaching from southeastward, vessels pass 1 mile or more southward of Southeast Rock and round Cape St. Elias at a distance of about $2\frac{1}{2}$ to 3 miles. From a position $2\frac{1}{2}$ miles 276° true (*WSW mag.*) from Pinnacle Rock a 12° true (*N by W $\frac{1}{2}$ W mag.*) course made good for about 23 miles will lead to the anchorage in Katalla Bay. Strangers entering Katalla Bay should do so in the daytime and with clear weather.

From Katalla bound westward, vessels can pass 1 to $1\frac{1}{2}$ miles southward of Martin Islands and make good a 273° true (*SW by W $\frac{3}{4}$ W mag.*) course for 61 miles to a position $1\frac{1}{2}$ to 2

miles southward of Cape Hinchinbrook. This course if made good should lead in a depth of over 15 fathoms $3\frac{1}{2}$ to 4 miles southward of the sand islets lying 9 to 19 miles westward of Martin Islands.

COPPER RIVER

breaks through the mountains between Miles and Childs glaciers, and above which are rapids. Below the rapids the river flows through flats about 5 miles wide in many changeable channels, varying in depth from 5 to 20 feet at high stages of the river, and not navigable. The current is swift and the effect of the tide on the current is only felt near the mouth.

The entire delta is low marshy flats except for sand dunes, 50 to 150 feet high, on the islands and banks of the main channel. From seaward the vicinity of Copper River shows as a vast, rugged mountain range, with numerous glaciers filling its gorges.

From Point Martin to the northeast end of Hinchinbrook Island the coast is fringed by sand islets from 5 to 30 feet high, lying 4 to 5 miles from shore. Shoals extend seaward from these islets, but they have not been developed. Danger will be avoided by giving the islets a berth of about 3 miles; the depth should not be shoaled to less than 10 fathoms (low water). The space between these sand islets and the flats is largely bare at low water, and is navigable only for small craft of 3 or 4 feet draft, in places at high water only.

Alaganik Slough, the westernmost branch of Copper River, is $\frac{1}{2}$ to 1 mile wide, with depths from 5 to 15 feet, depending on the stage of the tide and the river. The mean rise and fall of the tide at the mouth is about 10 feet and at Alaganik 2 to 3 feet, and the flood current is felt to the village.

Eyak River, 6 miles northeastward of Point Whithshed, is connected with Eyak Lake and has a swift current. At favorable stages of the tide it is navigable for small, light-draft craft to the lake.

MIDDLETON ISLAND

is between 7 and 8 miles long and has a greatest width of about 2 miles near its southern end. Its southeast end is in latitude $59^{\circ} 24' N.$, longitude $146^{\circ} 20' W.$ It is flat and about 120 feet high, with clay bluffs and occasional shingle or boulder beaches, and slopes gradually to its north end, which is a low spit. The island is moist, almost boggy, and numerous ponds are formed by rains. It is covered with grass, flowers, and berries; but there are no trees. It is frequented by wild fowl, and there is driftwood on the shores. There are large boulders on the beaches and reefs around the island.

Reefs and breakers extend possibly 2 miles eastward and 4 miles southward from the island and are reported to extend 2 or 3 miles off its north end. On the west side kelp extends $\frac{1}{2}$ to $1\frac{1}{2}$ miles from shore. The island is not surveyed and should be approached with caution.

The usual anchorage is about $1\frac{1}{2}$ miles off, about 320° true (*WNW* mag.) from, a shallow bight near the middle of the west side of the island, in 12 to 13 fathoms, gravelly bottom. This anchorage is outside the kelp, with the north end of the island bearing 52° true (*NNE* $\frac{1}{8}$ *E* mag.) and the extreme southwest end 206° true (*S* $\frac{1}{8}$ *E* mag.). The landing is bad except with a smooth sea.

The **tidal currents** have a velocity of 2 to 3 miles at the anchorage, setting northward on the flood and southward on the ebb.

Wessels Reef, awash at low water and 2 miles long northeast and southwest, lies in latitude $59^{\circ} 47' N.$, longitude $146^{\circ} 12' W.$, or about 16 miles 11° true (*N* by *W* $\frac{1}{2}$ *W* mag.) from the north end of Middleton Island. There is a depth of 20 fathoms close to the reef, and with a smooth sea no indication of it can be detected.

PRINCE WILLIAM SOUND.

Hinchinbrook Entrance, between Montague and Hinchinbrook islands, is used by vessels entering Prince William Sound from eastward and southeastward, while one of the entrances westward of Montague Island is used by vessels approaching from southwestward. Hinchinbrook Entrance is about 6 miles wide and clear, with the exception of Seal Rocks.

Currents.—The tidal currents have considerable velocity in the entrance, setting directly in or out of the sound. The ebb current running out against a large swell causes overfalls, especially in the deep water 2 or 3 miles eastward of Zaikof Point, which have been mistaken for

breakers. There are also tide rips on the broken ground around Cape Hinchinbrook. The flood entering westward of Montague Island sets northeastward past Montague Point and causes rips between it and Johnstone Point.

Outside the entrance along the southeast coast of Hinchinbrook Island the current sets southwestward almost constantly.

Seal Rocks lie off the entrance 6 to 7 miles 230° true (*SS W mag.*) from Cape Hinchinbrook and over 6 miles from Montague Island. They are two bare rocks 30 to 37 feet high, surrounded by low rocks. Sunken rocks extend 1 mile northeastward and a short distance southwestward of them.

Hinchinbrook Island is two mountain ridges with elevations up to 2,300 feet, and a low valley between them running through from the head of Port Etches. The tree line is about 1,000 feet above the sea, and the summits of the island are bare. There are a few rocky islets close to the southeast side of Cape Hinchinbrook, and sunken reefs on which the sea breaks in a moderate swell lie $\frac{3}{8}$ mile southeastward and southward from the cape. It should be given a berth of over $\frac{3}{4}$ mile.

A lighthouse is under construction on the southwest end of Cape Hinchinbrook, and a temporary white light is maintained until the completion of the lighthouse.

Northeastward of Cape Hinchinbrook the seaward face of Hinchinbrook Island is steep, with rocky bluffs at the water, for 12 miles to an open bight with a broad sand beach on the northwest side of Hook Point. From **Hook Point** to **Point Steele**, a distance of 2 miles, the coast is a bluff about 200 feet high with low, swampy land between it and the mountains which lie nearly 2 miles back. The coast is clear except from Hook Point to Point Steele, where reefs make out $\frac{3}{8}$ mile. A boat can land in good weather on the northwest side of Hook Point and $\frac{1}{2}$ mile northward of Point Steele. A depth of 2 $\frac{1}{2}$ fathoms was found 3 miles southeastward of **Point Bentinck**, the northeast end of Hinchinbrook Island, and breakers extend out nearly this distance in ordinary weather.

Montague Island is high and mountainous, and wooded to an elevation of about 1,000 feet. At its north end are three prominent points forming Zaikof and Rocky bays, and low depressions run through from the heads of the bays to the northwest side of the island. **Schooner Rock**, 61 feet high, lies nearly $\frac{1}{4}$ mile off Zaikof Point, the northeast end of Montague Island, and is a good mark.

For a distance of 20 miles southward of Zaikof Point the coast of Montague Island is unbroken and free from outlying dangers, excepting Seal Rocks. Thence southward the coast is more irregular and should be given a good berth in the absence of a complete survey. A vessel is reported to have struck a sunken rock lying about 9 miles northeastward of Cape Cleare and possibly as much as 2 miles offshore. The position is doubtful.

Wooded Islands lie 13 to 17 miles northeastward of Cape Cleare and extend off shore about 3 miles. The largest are five in number, 60 to 130 feet high, flat-topped, and wooded, with bluff sides. Rips or breakers are reported to extend 1 $\frac{1}{4}$ miles northeastward from the northernmost island.

Tides.—In Prince William Sound high and low water occur about 50 minutes earlier than at Kodiak, and the mean rise and fall of the tides is about 9 $\frac{1}{2}$ feet. To find the approximate height of the tide multiply the height of the corresponding tide at Kodiak by the ratio of ranges 1.37.

Glacial ice is rarely found in the open waters of Prince William Sound. Ice is discharged by Columbia Glacier, northward of Glacier Island, and generally drifts westward, but with westerly or northwesterly winds it drifts eastward and is occasionally found in the entrance of Port Valdez, westward of Bligh and Busby islands. There are numerous discharging glaciers in Port Wells, the northwest arm of the sound, but this is well out of the track of vessels. Ice is discharged by Chenega Glacier on the southwest side of the sound, and occasionally drifts eastward as far as Point Helen and the north entrance of Latouche Passage through the passage south of Chenega Island. During very cold weather ice sometimes forms in the arms of the sound which reach well into the mountains, and is at times sufficiently heavy to impede navigation for wooden vessels.

PORT ETCHES

is an inlet in the southwest end of Hinchinbrook Island, about 4 miles northwestward of Cape Hinchinbrook. The port is about 7 miles long in a 56° true (*NNE* $\frac{1}{2}$ *E* mag.) direction and about $1\frac{1}{4}$ miles wide. It is a secure anchorage, the best in Hinchinbrook Entrance, and is easy of access. The strongest gales are northeast and are not steady, but descend from the surrounding mountains in heavy williwaws of varied direction, and they sometimes blow hard in Port Etches when comparatively light winds prevail outside. Fresh water can conveniently be obtained from streams in Garden Cove and on the northwest side of Constantine Harbor.

The best anchorage for large vessels is in the middle abreast Garden Cove, 2 miles from the head of the port, in 12 to 15 fathoms, muddy bottom. A flat extends $1\frac{1}{2}$ miles from the head, but the lead is a good guide to avoid it. The swell is quite perceptible in heavy southerly weather.

Garden Cove (Mosquito Bight), on the southeast side, 2 to $2\frac{1}{2}$ miles from the head of the port, is the best anchorage for small vessels. Garden Island, wooded and having a break through it, lies in the middle of the entrance; the bight eastward of this island is shoal, and there is no safe passage northeastward of it. Point Horn, the southwest point of the cove, is the most prominent of the projecting points on the southeast shore of Port Etches. *To enter Garden Cove* pass 400 to 500 yards northward of this point and steer 93° true (*NE* by *E* $\frac{3}{4}$ *E* mag.). Anchor with Point Horn in line with the southernmost of the Porpoise Rocks, and about 250 yards southeastward of Garden Island, with the break through it open, in 4 to 5 fathoms, sticky bottom. No ocean swell reaches the anchorage, but as elsewhere in Port Etches the williwaws are bad in easterly gales, coming both from the head of the port and the head of the cove.

English Bay, on the southeast side at the entrance of the port, is a bight about $\frac{3}{8}$ mile wide. It may be used as a temporary anchorage by small vessels, but it is exposed to the ocean swell in heavy weather and open to northerly and westerly winds. Easterly gales blow in williwaws from all directions, but do not raise much sea if anchored well in the cove. The holding ground is good. When entering give the southwest point of the cove a berth of $\frac{1}{4}$ mile, and anchor in the middle just inside the entrance, in about 5 fathoms.

The two bights on the southeast shore of Port Etches, $1\frac{1}{4}$ and $3\frac{1}{2}$ miles northeastward of English Bay, are rocky and should be avoided.

Porpoise Rocks, on the northwest side at the entrance of Port Etches, are three principal rocks about 48 feet high, with numerous small rocks between and northeastward of them. The westernmost and largest is flat on top and grass-covered, and a rock covered at high water lies 200 yards westward from it. There is deep water close to the rocks, except on their northeast side, where there is foul ground extending to Point Barber at Nuchek, a distance of 1 mile, with no safe channel between. There is kelp around Porpoise Rocks and for a distance of $\frac{3}{8}$ mile southwestward of Point Barber.

In good weather steamers sometimes anchor off the shingle spit northwestward of Nuchek to land or receive passengers and freight. It is an uneasy anchorage on account of the swell. The best anchorage is abreast the spit midway between the village and the rocky, wooded knob on the middle of the spit, with the village bearing 95° true (*ENE* mag.), and the southeast one of the three largest Porpoise Rocks in line with the end of Hinchinbrook Island, bearing 191° true (*S* by *E* $\frac{1}{2}$ *E* mag.), in about 10 fathoms, sandy bottom.

Nuchek is an Indian village on the southeast end of the shingle spit at the southwest end of Constantine Harbor.

Constantine Harbor is the lagoon on the northwest side of Port Etches, its entrance lying 3 miles northeastward of Porpoise Rocks. It is suitable only for small vessels on account of the very narrow entrance channel, which is 50 to 100 yards wide with depths of 18 to 19 feet. The tidal currents have considerable velocity in the entrance. The best time to enter is at high water, preferably near slack water. The harbor is generally shallow, but has an area $\frac{1}{2}$ mile long and $\frac{3}{8}$ mile wide with depths of 3 to $4\frac{1}{4}$ fathoms, sticky bottom, but exposed to williwaws.

On the northeast side of the entrance are three small, rocky, wooded islets with overhanging sides. Between them are three rocks bare at low water, and 60 yards 180° true (*SSE* $\frac{1}{2}$ *E*

mag.) from the western islet is a sunken rock, all marked by kelp at slack water. The channel is close to the islets, between them and a shoal with 9 to 10 feet over it extending 600 yards northeastward from Phipps Point.

The following directions lead in the best water into Constantine Harbor, but in the absence of aids a stranger can not depend on a greater depth than 12 feet at low water.

Follow the northwest shore of Port Etches at a distance of about $\frac{1}{2}$ mile, course about 45° true (**N by E $\frac{1}{2}$ E** mag.) until the three rocky islets are recognized. Then steer for the southeast islet open from the western end of the largest on a 5° true (**NNW** mag.) course until a small islet in Constantine Harbor is open from the south side of the entrance. Then steer 320° true (**WNW** mag.) and pass 100 yards southwestward of the western islet. Then follow the northwest shore at a distance of 125 yards and pass through the narrow entrance in mid-channel heading for Bear Cape on a 258° true (**SW $\frac{1}{2}$ W** mag.) course. Keep this course for $\frac{1}{2}$ to $\frac{3}{4}$ mile from the entrance and anchor about 200 yards from the southeast shore, which affords some protection in northeast gales from the strongest williwaws that come apparently from the head of Port Etches.

A temporary anchorage can be made about $\frac{1}{2}$ mile southeastward of the rocky islets in the entrance of Constantine Harbor, with the southeast Porpoise Rock open from the northwest shore of the port, bearing 242° true (**S W by S** mag.), in 10 to 12 fathoms, sticky bottom, but there is considerable swell in heavy weather.

Tides.—High and low water occur about 45 minutes before high and low water at Kodiak. The mean rise and fall of the tides is 9 feet. To find the height of the tide for any day at Port Etches multiply the height of the corresponding predicted tide at Kodiak by the ratio of ranges 1.29.

ZAIKOF BAY,

the easternmost of the two bays in the north end of Montague Island, is clear and affords anchorage, but is exposed to northeast winds. Anchorage can be selected with the aid of the chart along the southeast shore, from 2 miles inside Schooner Rock to the head, also on a bar with 10 to 15 fathoms which extends across the bay $2\frac{1}{2}$ miles from the head. A good berth is in 7 to 12 fathoms, depending on the swinging room required, in the cove on the southeast side $2\frac{1}{2}$ miles inside Schooner Rock, with Middle Point bearing 351° true (**NW $\frac{3}{4}$ N** mag.). This anchorage is exposed to winds from north to east, and a swell makes in during southeast gales. The only dangers are a short reef marked by kelp off the point westward, and two rocks, bare at half tide and marked by kelp, close to the shore eastward.

A small vessel can anchor in the cove on the southeast side $1\frac{5}{8}$ miles from the head with shelter from northeast winds. Anchor close to the southern side of the point, about 200 yards from the short spit making out from it, in 8 to 10 fathoms. There is no swell, but the williwaws blow with great force over the lower land inside the point. When the wind hauls southeastward or southward the williwaws come from all directions, and it is well to shift anchorage farther from the spit. There is a small shallow lagoon at the head of the cove, and the bank is steep-to.

ROCKY BAY

has deep water and is exposed to northerly and easterly winds. A small vessel can anchor in good weather about $\frac{5}{8}$ mile from the head and 400 yards from the northwest side in 8 to 10 fathoms. Small craft can anchor in the lagoon, on the southern side 1 mile from the head, where there is a small area with a depth of 10 feet. When entering the lagoon care should be taken to avoid a reef, partly bare at low water, extending westward and northwestward from the north point at its entrance.

Two ledges, bare at low water and marked by kelp, lie nearly $\frac{1}{2}$ mile off the southern side of Rocky Bay, $\frac{3}{8}$ to $\frac{3}{4}$ mile inside Middle Point. Kelp extends northeastward from them to a $3\frac{3}{4}$ -fathom patch lying $\frac{5}{8}$ mile 354° true (**NW by N** mag.) from Middle Point. Foul ground marked by kelp extends $\frac{1}{4}$ mile off Middle Point.

A reef, the higher part bare at half tide, extends nearly $\frac{3}{4}$ mile northeastward from Montague Point.

NORTHWEST SHORE OF HINCHINBROOK ISLAND.

Bear Cape is steep and high, and is the southwest end of the northwest mountain ridge of Hinchinbrook Island.

A small cove in Hinchinbrook Island, 3 miles northward of Bear Cape, has anchorage a little southward of the middle of the entrance in 8 to 10 fathoms, with shelter from easterly and southeasterly winds.

Temporary anchorage, with shelter from offshore winds, may be had southward of the sharp point, with two rocks about 30 feet high close-to, lying $\frac{3}{8}$ mile southward of Johnstone Point. The anchorage is about $\frac{1}{2}$ mile off the sand beach and southwestward of the sharp point, in about 10 fathoms, sandy bottom.

Johnstone Point, the northwest end of Hinchinbrook Island, is low and wooded, with a small bluff at the water.

Eastward of Johnstone Point the shore is low, and there are several lagoons largely bare at low water. Anchorage can be selected off the shore, westward of Middle Ground Shoal, in 12 to 20 fathoms, soft bottom, with shelter from southerly and easterly winds.

Middle Ground Shoal fills the opening between Hinchinbrook and Hawkins islands and extends into Orca Bay 3 miles. The general depths on the shoal are 2 to 6 feet, and it is a danger for vessels entering Orca Bay from southward.

Hawkins Island Cut-off, between Hinchinbrook and Hawkins islands, is navigable only for small craft with local knowledge. It is filled with shoals, and in its eastern end are extensive flats bare at low water and largely covered at high water. There are strong tidal currents in its narrower parts.

ORCA BAY

is an extensive arm on the eastern shore of Prince William Sound between Johnstone Point and Knowles Head, having a length of about 30 miles in an 85° true (*NE* by *E* mag.) direction. Its principal importance is derived from the railroad terminal of Cordova on Orca Inlet at its head. Its southern side is formed by Hinchinbrook and Hawkins islands and is clear with the exception of Middle Ground Shoal. Its north side is indented by large bays which are of no present commercial importance.

Knowles Head, the southwest end of the mountainous peninsula between Port Gravina and Port Fidalgo, is a steep massive headland, 1,502 feet high, with a prominent yellowish landslide down its southern face. There is a low depression between it and Porcupine Point, and others northeastward of it running through from Snug Corner Cove and the arms of Bowie Bay. There are numerous rocks close to shore, but there are no dangers if it be given a berth of $\frac{1}{2}$ mile.

Red Head, 4 miles 101° true (*ENE* $\frac{1}{2}$ *E* mag.) from Knowles Head, is a high hill with a long, low, wooded neck behind it.

Port Gravina has its entrance between Red Head and Gravina Point. It is not surveyed.

Gravina Point, 12 miles 107° true (*E* by *N* mag.) from Knowles Head, is low and wooded, and at its southern end is a bare spit with a large and a small clump of trees on it.

Gravina Island, low and wooded, lies $1\frac{1}{2}$ miles 315° true (*WNW* $\frac{1}{2}$ *W* mag.) from the point and $\frac{3}{8}$ mile from shore. Anchorage with shelter from northeast winds can be had about $\frac{1}{2}$ mile from shore between the island and Gravina Point, in about 10 fathoms.

Sheep Bay has its entrance between Gravina and Sheep points, and extends northward about 7 miles. Foul ground extends $\frac{1}{4}$ to $\frac{3}{8}$ mile from the eastern shore for a distance of 2 miles northward of Sheep Point. Indifferent anchorage in 18 to 20 fathoms can be selected in the middle about 3 miles above Sheep Point and $\frac{3}{8}$ mile below the point where the bay contracts. Small vessels can follow the deep channel among the islands in the upper part of the bay and select anchorage in 11 to 15 fathoms. The chart is the guide.

Sheep Point, $7\frac{1}{4}$ miles 93° true (*NE* by *E* $\frac{3}{4}$ *E* mag.) from Gravina Point, is moderately low and wooded at the end, with high land back of it. A wooded islet lies $\frac{1}{4}$ mile westward of the point, with bare rocks between.

Hanks Island, small and wooded, lies $\frac{3}{4}$ mile eastward of Sheep Point and $\frac{1}{2}$ mile from shore. **Gatherer Rock**, $\frac{5}{8}$ mile 124° true (*E* $\frac{1}{2}$ *S* mag.) from Hanks Island, is a pinnacle

with 13 feet over it and deep water close-to. A rock with 8 feet over it lies nearly $\frac{5}{8}$ mile 197° true (*S. by E mag.*) from Hanks Island.

Simpson Bay, northeastward of Sheep Point, is not surveyed.

Hawkins Island is about 20 miles long and mountainous, with elevations up to 2,025 feet. **Canoe Passage**, dividing the island about 8 miles from its south end, is navigable only for boats at high water. The northwest shore southwestward of Canoe Passage is low tundra meadows with patches of trees. Northeastward of Canoe Passage the high land is nearer the northwest shore of the island, there are bluffs in places, and it is more densely wooded.

With the aid of the chart anchorage can be selected in places along the northwest shore of Hawkins Island with shelter from easterly and southerly winds. The best anchorage is $\frac{1}{4}$ to $\frac{3}{8}$ mile off the spit at the south end of **Cedar Bay** in 9 to 12 fathoms, soft bottom. There is a round, wooded islet at the north end of this spit, and a larger wooded one $\frac{1}{2}$ mile northward. Small craft, entering at high water and passing northward of the rocks awash and sunken inside the entrance, can anchor in the north angle of the lagoon inside the spit, where there is a limited area with a depth of 7 feet.

Channel Islands are wooded and nearly 1 mile long, and lie on the northwest side of the bay 6 miles above Sheep Point. The channel at the islands is $\frac{1}{2}$ mile wide and is called **The Narrows**. A rock with 12 feet over it lies $\frac{3}{8}$ mile 219° true (*S by W mag.*) from the southwest end of Channel Islands. It is at the north end of a ridge about $\frac{3}{8}$ mile long in a 231° true (*SSW mag.*) direction, with depths of 13 to 14 fathoms, except near the rock.

ORCA INLET

extends in a southerly direction from the head of Orca Bay. From North Island to Spike Island the western side of the inlet is shoal, and southward of Spike Island the inlet is filled by flats. Northward of North Island it has depths of 25 to 30 fathoms, and a flat extends 1 mile from the head at its north end.

Salmo Point, the northern extremity of Hawkins Island, is just above Channel Islands. **Knot Point**, the northeast end of Hawkins Island, lies $1\frac{1}{2}$ miles 182° true (*SSE $\frac{3}{8}$ E mag.*) from Salmo Point with a bay $1\frac{1}{2}$ miles long and $\frac{1}{2}$ mile wide between. This bay has depths of 3 to 6 fathoms, but a shoal with 9 to 12 feet over it extends across its entrance; it may be used as an anchorage by small vessels that can cross the shoal.

Observation Island, $\frac{3}{4}$ mile long, high and wooded, lies $\frac{3}{8}$ mile northeastward of Knot Point. There is good anchorage 300 to 500 yards westward of Observation Island, in 8 to 10 fathoms. **North Island**, $\frac{3}{8}$ mile long, low and wooded, lies 1 mile northward of Salmo Point.

From Salmo Point there are three channels to Orca cannery and Cordova.

The deepest channel is north of North Island, and then follows the eastern shore with a least width of 350 yards and a least depth of about 5 fathoms. A rock bare at three-quarters ebb lies 650 yards 71° true (*NE $\frac{1}{4}$ N mag.*) from the north end of North Island. The shoal on the west side of the channel between North and Observation islands has depths of 10 to 18 feet, and with care can be avoided by the use of the lead. A buoy (nun, red, No. 2) is placed in a depth of 22 feet on the northeastern edge of the shoal on the western side of the channel, and lies $\frac{7}{8}$ mile eastward from the northern end of North Island.

The bight in the eastern shore eastward of North Island is filled by a flat, largely bare at low water and steep-to, which extends $\frac{1}{4}$ mile off the sawmill at the mouth of the stream in the bight. The bight extending $\frac{1}{2}$ mile northward from Cordova wharf is filled by a flat, and depths of 19 to 24 feet are found on and a little westward of the line from the wharf to the north point of the bight. With these exceptions the eastern shore is clear.

Orca Channel, between North and Observation islands, has a depth of about 18 feet and a width of about 300 yards between shoals with 10 to 12 feet over them. It is used by small vessels with local knowledge, but should be avoided by strangers. **South Rock**, bare at half tide, lies 250 yards northward from Observation Island. **North Rock**, covered only at high water, lies midway between Observation and North islands.

Odiak Channel passes westward of Observation Island, and across the shoal $1\frac{1}{4}$ miles southward of the island where the depth is 18 to 20 feet. The following directions lead through the channel in a least depth of 18 feet:

Round Salmo Point at a distance of about 400 yards, steer 185° true (**SSE** $\frac{1}{8}$ **E** mag.) and pass about 200 yards eastward of Knot Point. Then steer 164° true (**SE** mag.) with Knot Point astern and the south side of the point $\frac{1}{2}$ mile northward of Cordova wharf a little on the port bow. When about $\frac{1}{4}$ mile from the eastern shore, and the depth is 5 fathoms or more, steer about 211° true (**S** $\frac{1}{4}$ **W** mag.) for Spike Island.

Orca cannery is on the eastern shore southeastward from Observation Island. There is a depth of 25 feet at the end of the wharf, and water can be obtained through pipe and hose. There is good anchorage about $\frac{1}{4}$ mile from the eastern shore abreast or southward of the cannery, in 7 to 9 fathoms.

Cordova wharf is on the eastern shore $\frac{1}{2}$ mile northward of Spike Island and 2 miles southward of Orca. There is a depth of 30 feet alongside the wharf, but a depth of 26 feet is found for a distance of 150 yards westward from its northern end. There are hotels and stores at Cordova and cable communication with other points in Alaska and Seattle. There is good anchorage in the channel westward of the wharf and Spike Island, in 8 to 10 fathoms. The edge of the flat on the western side of the inlet lies $\frac{3}{8}$ mile westward of the wharf and $\frac{5}{8}$ mile southwestward of Spike Island. **Spike Island** is about 300 yards long, and wooded. The inlet eastward and southward of it is shoal.

The **tidal currents** in Orca Inlet set southward on the flood and northward on the ebb, slack water occurring about the time of low water and 50 minutes after high water at Kodiak. The ordinary velocity at strength of the flood current off the wharf at Orca is about $1\frac{1}{2}$ miles and off the wharf at Cordova 2 miles, but at the latter place the current may exceed 3 miles at times. Ordinarily the ebb current has less velocity than the flood.

SAILING DIRECTIONS, ORCA BAY.

From Hinchinbrook Entrance.—Round Cape Hinchinbrook at a distance of about $1\frac{1}{2}$ miles and steer 350° true (**NW** $\frac{5}{8}$ **N** mag.) so as to follow the western shore of Hinchinbrook Island at a distance of about 1 mile. When $3\frac{1}{2}$ miles above Bear Cape, steer 28° true (**N** mag.) for $7\frac{1}{2}$ miles to a position about 2 miles off Johnstone Point. Then steer 63° true (**NE** $\frac{1}{8}$ **N** mag.) for $8\frac{3}{4}$ miles, heading for the southeastern side of the high peninsula between Port Gravina and Sheep Bay until Red Head is abeam. Then steer 86° true (**NE** by **E** $\frac{1}{8}$ **E** mag.) for 13 miles, passing Gravina Point at a distance of $2\frac{1}{2}$ miles and Sheep Point $1\frac{5}{8}$ miles.

When $\frac{3}{8}$ to $\frac{1}{2}$ mile from the southeastern shore above Windy Bay, steer 79° true (**NE** $\frac{1}{2}$ **E** mag.) for $4\frac{1}{4}$ miles until the southwest end of Channel Island bears 17° true (**N** by **W** mag.) distant $\frac{5}{8}$ mile. Then steer 51° true (**NNE** mag.) for $1\frac{3}{4}$ miles and pass in mid-channel eastward of Channel Islands. When Salmo Point is abeam, steer 62° true (**NE** by **N** mag.) for $1\frac{3}{4}$ miles, passing in mid-channel northwestward of North Island. When the eastern sides of North and Observation islands are in line, steer 125° true (**E** $\frac{1}{2}$ **S** mag.) about 1 mile to a position $\frac{1}{4}$ mile northward of red nun buoy No. 2. Then steer 197° true (**S** by **E** mag.) for Orca cannery, pass 250 yards eastward of the buoy, follow the eastern shore at a distance of 600 to 700 yards until North Island is abaft the beam, and then pass the point on the eastern shore at a distance of 250 to 300 yards. Continue the course until the north end of Observation Island is abeam. Then steer 216° true (**S** $\frac{5}{8}$ **W** mag.) and pass the point on the eastern shore 1 mile southward of the cannery at a distance of 250 yards. Then steer 211° true (**S** $\frac{1}{4}$ **W** mag.) for Spike Island until about $\frac{1}{4}$ mile from the wharf at Cordova, and then haul in for the wharf.

From northwestward.—Pass about 1 mile southward of Knowles Head and steer 108° true (**E** by **N** mag.) for $12\frac{1}{2}$ miles to a position 1 mile southward of Gravina Point. Then steer 96° true (**ENE** mag.) for 9 miles, passing $1\frac{3}{8}$ miles southward of Sheep Point, to a position $\frac{3}{8}$ to $\frac{1}{2}$ mile from the southeastern shore above Windy Bay. Then follow the directions in the preceding paragraph.

Or, from a position 1 mile northward of Point Eleanor a 90° true (**NE** by **E** $\frac{1}{2}$ **E** mag.) course made good for $47\frac{1}{2}$ miles should lead $1\frac{3}{4}$ miles southward of Gravina Point, $1\frac{1}{2}$ miles southward of Sheep Point, and to a position $\frac{3}{8}$ to $\frac{1}{2}$ mile from the southeastern shore above Windy Bay. Then follow the directions in the second paragraph preceding.

From southwestward.—Directions from Latouche Passage to Seal Island are given on page 21. Pass about 1 mile southeastward of Seal Island and steer 70° true (**NE** $\frac{1}{4}$ **N** mag.)

for 28 miles, passing about 4 miles northward of Johnstone Point; the southeastern side of the high peninsula between Port Gravina and Sheep Bay should be made ahead. When Bligh Island is shut out by Knowles Head, bearing 328° true (*NW by W $\frac{3}{8}$ W mag.*), steer 86° true (*NE by E $\frac{1}{8}$ E mag.*) for $16\frac{1}{2}$ miles, passing Gravina Point at a distance of $2\frac{1}{2}$ miles and Sheep Point $1\frac{5}{8}$ miles. When $\frac{3}{8}$ to $\frac{1}{2}$ mile from the southeastern shore above Windy Bay, follow the directions in the second paragraph preceding.

PORT FIDALGO

has its entrance on the eastern shore of Prince William Sound between Goose and Bligh islands, where it is 5 miles wide, and extends northeastward 25 miles or more. Above Fish Bay it is not surveyed, and with the exception of the mines on Boulder and Landlocked bays is not of commercial importance at present.

Goose Island is $1\frac{1}{2}$ miles long, 320 feet high, and wooded, and has two prominent knolls. **Gull Island**, small and rocky, is midway between it and the shore. The passage between the islands should be avoided by strangers, and that between Gull Island and Porcupine Point is foul.

Porcupine Point is a round, wooded bluff, 894 feet high, with a low depression between it and Knowles Head. A rock, bare at low water and marked by kelp, lies 350 yards northward of the point.

Snug Corner Cove, on the northeast side of Porcupine Point, has good anchorage except from northwest winds, but the bottom is irregular and it should be avoided by large vessels. Foul ground extends $\frac{3}{8}$ mile from the northeast shore of the cove, and a rocky patch with $4\frac{1}{4}$ fathoms, possibly less, lies in the entrance $\frac{1}{2}$ mile off the northeast side of Porcupine Point. There is a low divide at the head of the cove and another across Porcupine Point.

To enter *Snug Corner Cove* avoid the rock off Porcupine Point and follow the southwest shore at a distance of about $\frac{1}{4}$ mile. Anchor about $\frac{1}{4}$ mile off the bight in the southwest shore, before reaching the narrowest part of the cove, in 10 to 11 fathoms, soft bottom. Small vessels can find better shelter from northerly winds in the basin at the head of the cove, in a depth of 5 fathoms. Favor the southwest shore slightly when entering and anchoring. The shores of the basin should be given a berth of over $\frac{1}{4}$ mile.

Bowie Bay, on the southeast shore of Port Fidalgo, 4 miles above Porcupine Point, is 1 mile wide at the entrance, and about 2 miles long to the head of either of its two arms. Low divides extend through to Orca Bay from the head of the arms. There is good anchorage in the bay at the entrance to either arm, and vessels of moderate size can anchor in the arms, depths moderate, and bottom generally sticky. A mid-channel course should be followed in the arms. At the head of the southeast arm is a basin trending southward where small vessels can anchor in 6 to 8 fathoms. The channel is between the west point and a reef bare at low water near the middle of the entrance.

On the southeast shore of Port Fidalgo $7\frac{3}{4}$ miles above Porcupine Point is a narrow inlet about 1 mile long. Small craft can find secure anchorage in the widest part near its head in 5 fathoms. To enter favor the eastern side to the narrows and then keep in mid-channel.

Fish Bay is on the northwest shore of Port Fidalgo 9 miles above Porcupine Point. It is an indifferent anchorage and should be avoided by large vessels. The williwaws are heavy with northeast winds, drawing through the bay from the high mountains above its head. A small, wooded island lies just inside the entrance $\frac{1}{4}$ mile from the west side. The channel is eastward of the island and is obstructed near the middle by a rock with $3\frac{1}{2}$ fathoms, possibly less. Rocks, bare at low water, lie 200 yards off the eastern point at the entrance. Anchorage can be had in the middle; $\frac{1}{4}$ to 1 mile above the island, in 8 to 13 fathoms, bottom soft in places. A flat extends $\frac{7}{8}$ mile from the head to the prominent point on the southeast side $1\frac{1}{4}$ miles above the island.

Landlocked Bay is on the northwest shore of Port Fidalgo east of Copper Mountain Point. It has a width of about 1 mile at the entrance, contracts to 400 yards at 2 miles from the entrance, and then widens again to $\frac{3}{8}$ mile. There is secure anchorage in the widest part above the narrows in 14 to 15 fathoms, sticky bottom.

The islands on the eastern side below the narrows have covering rocks near them. On the northwest side at the entrance of the narrows is a wharf, for vessels, and ore bunkers of the

Standard Copper Company. Near the middle of the narrows is a rock with 6 feet over it and marked by a buoy (nun, red and black horizontal stripes). The deepest water is northwest of the buoy, but the northwest shore abreast it should be given a berth of about 100 yards. There is a flat at the head of the bay with an islet at its lower edge.

To enter *Landlocked Bay* follow the western shore at a distance of about $\frac{1}{2}$ mile, course 11° true (N by W $\frac{1}{2}$ W mag.), pass in mid-channel westward of the islets below the narrows, and pass about 50 yards northwestward of the buoy in the narrows, above which the mid-channel is clear.

Copper Mountain Point is a wooded hill 912 feet high with a lower strip at its south end having considerable grassy areas. A shoal extends $\frac{1}{4}$ mile southward from the point.

Boulder Bay, on the northwest side of Port Fidalgo between Bligh Island and Copper Mountain Point, is about 4 miles long and 2 miles wide at the entrance. There are several dangers in the bay, the depths are very irregular and there is no desirable anchorage. On the east side at the head of the bay is a wharf, for vessels, of a copper mine.

A reef, bare at lowest tides, lies $\frac{5}{8}$ mile from the western shore of the bay; its eastern end, with 15 feet over it, lies $\frac{3}{4}$ mile from the western shore and $\frac{7}{8}$ mile 197° true (S by E mag.) from the southeast end of the islands at the entrance to *Tatitlek Narrows*.

A sunken rock, nearly awash at low water, lies about $\frac{3}{8}$ mile 267° true (SW by W $\frac{1}{4}$ W mag.) from a point on the eastern shore, and $1\frac{5}{8}$ miles 350° true (NW $\frac{5}{8}$ N mag.) from Copper Mountain Point. It is marked on its southwest side by a buoy (nun, red, No. 2).

A reef, partly bare at low water, lies 400 to 800 yards 163° true (SE mag.) from the small wooded island in the middle near the head of *Boulder Bay*.

To enter *Boulder Bay*, bring the houses on the east side at the head to show just open westward of the wooded island in the middle near the head, bearing 17° true (N by W mag.), and stand in on this line, passing about 200 yards westward of the red buoy. On approaching the island, edge a little westward and pass midway between it and the grassy, partly wooded islet near the western shore. Then steer for the wharf.

Bligh Island, on the eastern shore of Prince William Sound, is $4\frac{1}{2}$ miles long, 3 miles wide, and mountainous. The southwest end of the island is a steep wooded head 1,634 feet high with some yellow landslides near the water. On its northwest side are a number of islands with foul ground between.

Reef Island, off the west side of Bligh Island, is 1 mile long, level and wooded, and has a single knoll, 338 feet high, in the middle, which distinguishes it from Goose Island. A rock, bare at low water, lies $\frac{1}{4}$ mile 208° true (S mag.) from the southwest end of the island.

Bligh Island Reef is $\frac{3}{4}$ mile long in a 40° true (N by E mag.) direction, with depths from 7 to 28 feet. It is marked at its southern end by a buoy (can, red and black horizontal stripes) lying $1\frac{3}{8}$ miles 253° true (SW mag.) from the south end of Reef Island. The passage between the reef and Reef Island has deep water and is used at times by vessels rounding Bligh Island; the line of the west end of Busby Island and Rocky Point, bearing 23° true (N $\frac{1}{2}$ W mag.), leads through the middle of the channel.

Busby Island, off the northwest end of Bligh Island, is $1\frac{1}{4}$ miles long, 275 feet high, and partly wooded. Its western point is long, level, and wooded, and is surrounded by a reef to a distance of nearly $\frac{1}{4}$ mile.

TATITLEK NARROWS AND VIRGIN BAY.

Tatitlek Narrows separates Busby and Bligh islands from the main shore, and offers a more direct route for small craft between Port Valdez or Ellamar and points on Port Fidalgo. The channel has a depth of about 4 fathoms, but it is narrow with foul ground on both sides and should not be used by vessels in the absence of aids.

Tatitlek is a small Indian village on the northeast shore at the southeast end of the narrows.

Virgin Bay is a shallow bight $\frac{1}{2}$ to $\frac{3}{4}$ mile long on the northeast shore of *Tatitlek Narrows*. There is little water in the northern and southern ends of the bay, and on the north side in the entrance is a long reef bare at low water. The entrance is marked by two buoys. There is a depth of 10 to 12 feet in the approach to the wharf, which is on the northeast side and

has a depth of 12 feet at its end. Fresh water can be had at the wharf. Vessels going to the wharf wait until the tide is high enough to insure safety.

Ellamar, on the northeast side of Virgin Bay, is a post-office, store, hotel, and other buildings. Ore from the copper mine is shipped to Tacoma.

Anchorage can be had $\frac{1}{4}$ to $\frac{3}{8}$ mile from the northeast shore of Tatitlek Narrows, $\frac{3}{4}$ to 1 mile westward of the wharf at Ellamar, in 12 to 16 fathoms, sticky bottom. Two shoals lie in the narrows in the approach from northwestward to Virgin Bay—one with 15 feet over it $\frac{3}{8}$ mile 298° true (*W mag.*), and the other with about 17 feet over it about $\frac{3}{4}$ mile 287° true (*W by S mag.*), from the southeast point of Virgin Bay.

PORT VALDEZ,

the northern arm of Prince William Sound, extends about 13 miles in a 33° true (*N $\frac{1}{2}$ E mag.*) direction from Busby Island and Point Freemantle to the northern end of Valdez Narrows, and then turns to about 85° true (*NE by E mag.*) for 11 miles to the town of Valdez at its head. The water is very deep and there are no outlying dangers except Middle Rock. There are few anchorages on account of the great depths. Rocks bare at low water lie $\frac{1}{4}$ mile from shore and $2\frac{5}{8}$ miles northward of Point Freemantle, and with this exception the western shore is bold to Valdez Narrows.

Sawmill Cove, on the western shore 9 miles northward of Point Freemantle, is $\frac{3}{8}$ mile wide at the entrance and $1\frac{1}{2}$ miles long in a 349° true (*NW $\frac{1}{2}$ N mag.*) direction. Entering in mid-channel, there is a secure anchorage for vessels of any size in the expansion $\frac{1}{2}$ mile inside the entrance, in 9 fathoms, sticky bottom. The south and west ends of the basin forming the anchorage are shoal, and a flat fills the head of the bay down to the narrows at the north end of the basin.

Rocky Point, off the western end of the peninsula between Tatitlek Narrows and Galena Bay, is a chain of low, rocky islands, the outer and highest one about 30 feet high and having some scattered trees. The south point of Galena Bay is a wooded islet joined to the shore by a low spit. A rocky, grass-covered islet lies $\frac{1}{4}$ mile 45° true (*N by E $\frac{1}{2}$ E mag.*) from the south point at the entrance.

Galena Bay is about 5 miles long in a general easterly direction, with a width of $\frac{3}{4}$ to $1\frac{1}{4}$ miles, but narrowed at 3 miles from the entrance to $\frac{1}{4}$ mile. The depths are great throughout except for flats off the mouths of streams. There is an islet on the north side below the narrows, and a rock with 12 feet over it lies 300 yards 62° true (*NE by N mag.*) from the islet. The only anchorage is about $\frac{1}{4}$ mile southward of the islets on the north side at the head of the bay, in about 15 fathoms, bottom soft in places. A flat extends $\frac{5}{8}$ mile from the southeast end of the bay at its head.

A group of rocky, grass-covered islets extends $\frac{1}{2}$ mile off the north point at the entrance of Galena Bay. There is anchorage in the middle of the cove northeast of the islets, in 10 to 12 fathoms, sticky bottom.

Jack Bay, on the eastern shore southward of Valdez Narrows, is $5\frac{1}{2}$ miles long in an 118° true (*E mag.*) direction, with a width of $\frac{3}{4}$ mile at the entrance and $\frac{1}{4}$ to $\frac{3}{8}$ mile in the upper 3 miles. Anchorage can be had in mid-channel or closer to the southern shore, $1\frac{1}{2}$ miles inside the entrance, in 10 to 12 fathoms, bottom sticky in places; also in the entrance of the short arm, northeastward of the islands in the bay, in the same depths. The first cove on the south side is foul. Shoals make out about 400 yards from the southeast end of the second cove. A flat extends about $\frac{5}{8}$ mile from the head of the bay to an islet. A small vessel can anchor about 300 yards westward of the islet and the same distance from the south shore in about 15 fathoms.

Valdez Narrows is about 2 miles long and $\frac{3}{4}$ mile wide, with deep water and bold shores, especially the eastern one. A wooded islet lies 300 yards from the western shore at the north end of the narrows. **Middle Rock**, a pinnacle barely covered at extreme high tides, lies in the middle of the north end of the narrows 850 yards 85° true (*NE by E mag.*) from the islet and $\frac{1}{2}$ mile from the eastern shore.

The bay at the mouth of **Shoup Glacier** is closed by a sand spit nearly all dry at low water and over which the best depth is about 7 feet. This bay is often filled with floating ice, some of which escapes into the port when the wind and tide are favorable.

Swanport is a small anchorage under Jackson Point, the western end of the eastern one of the two islands on the south side of Port Valdez, $3\frac{3}{4}$ miles from Valdez. The bottom drops off abruptly, but vessels will have swinging room if anchored in 10 fathoms 350 yards 242° true (*SW* by *S* mag.) from Jackson Point and the same distance from the south shore. This is the best anchorage between Valdez Narrows and Valdez. The cove inside the island is nearly filled by a flat, and vessels have been beached on it.

Fort Liscum is an army post and wharf on the south shore 1 mile eastward of Jackson Point. Water can be had at the wharf.

Valdez is an important town at the head of Port Valdez. There are stores and hotels, and provisions and supplies of all kinds can be obtained. Most of the vessels trading to Prince William Sound call at Valdez, and there is communication by small local craft with other places on the sound. From Valdez a government trail and telegraph line lead into the interior of Alaska, and there is an overland mail service. There is cable communication with other points in Alaska and Seattle.

Three wharves extend out from the town to the edge of the flat. The middle one is the regular steamer wharf.

SAILING DIRECTIONS, PRINCE WILLIAM SOUND AND PORT VALDEZ.

From Hinchinbrook Entrance.—Round Cape Hinchinbrook at a distance of about $1\frac{1}{2}$ miles and steer 349° true (**NW** $\frac{1}{2}$ **N** mag.), keeping 1 mile off the southwest shore of Hinchinbrook Island. This course made good for 37 miles from Cape Hinchinbrook, or 30 miles from Bear Cape, should lead to a position 4 miles from Bligh Island with the highest peak at the southwest end of the island bearing 101° true (*ENE* $\frac{1}{2}$ *E* mag.), and Bligh Island Reef buoy should then be on the starboard beam distant 2 miles.

Then steer 31° true (**N** $\frac{1}{4}$ **E** mag.) for 17 miles, passing $1\frac{1}{2}$ miles westward of Busby Island, 1 mile westward of Rocky Point, and to a position $\frac{1}{4}$ mile off the eastern shore about halfway through Valdez Narrows. Then steer 48° true (**N** by **E** $\frac{3}{4}$ **E** mag.) for $1\frac{1}{2}$ miles, following the eastern shore of Valdez Narrows at a distance of $\frac{1}{4}$ mile or less to insure clearing Middle Rock. When Entrance Island (close to southeast shore) is abeam distant about $\frac{3}{8}$ mile, an 82° true (**NE** $\frac{3}{4}$ **E** mag.) course made good for 10 miles will lead to the wharves at Valdez.

From Latouche Passage.—From a position in the northern entrance of Latouche Passage about $\frac{3}{4}$ mile westward of Point Grace, steer 50° true (**NNE** mag.) for $5\frac{1}{4}$ miles to a position 1 mile eastward of Point Helen. Then steer 26° true (**N** $\frac{1}{8}$ **W** mag.) for 20 miles and pass 1 mile westward of Seal Island. When Seal Island bears 140° true (*ESE* mag.) distant a little over 1 mile, steer 50° true (**NNE** mag.) for $7\frac{1}{2}$ miles, passing $1\frac{1}{4}$ miles southeastward of Smith Island and to a position with the northeast point of the island bearing 275° true (*WSW* mag.) distant 2 miles. Then steer 25° true (**N** $\frac{1}{4}$ **W** mag.) for 20 miles to a position 4 miles from Bligh Island with the highest peak at the southwest end of the island bearing 101° true (*ENE* $\frac{1}{2}$ *E* mag.). Bligh Island Reef buoy should then bear about 79° true (*NE* $\frac{1}{2}$ *E* mag.), distant 2 miles. Then steer 31° true (**N** $\frac{1}{4}$ **E** mag.) and follow the directions in the preceding paragraph.

ISLANDS IN PRINCE WILLIAM SOUND.

Naked Islands are three principal islands, called Naked, Peak, and Storey, all wooded, 700 to 1,323 feet high, and 8 miles long north and south, with a greatest width of 6 miles. The principal points of the islands are correct in position, the bays and coves are sketched, and little sounding has been done near them. A small wooded island about 250 feet high lies $\frac{3}{4}$ mile off the south side of Naked Island, with deep water between.

The following anchorages at Naked Island were used by the Coast and Geodetic Survey Steamer *Patterson*: At the south end of the large bay on the north side of the island, in 18 fathoms; at the north end of the large bay on the south side of the island, and in the small cove on the east side just inside the entrance of this bay; on the southeast side of the southern bay on the west side of the island about $\frac{3}{4}$ mile inside the entrance.

Lone Island, $7\frac{1}{2}$ miles westward of Naked Island, is $2\frac{1}{2}$ miles long, comparatively level, and possibly 500 feet high.

Perry Island, $3\frac{1}{2}$ miles westward of Lone Island, is mountainous and has a high peak in the middle.

Smith Island, 6 miles southeastward of Naked Island, is 3 miles long, wooded, about 500 feet high, and lowest at its southwest end. At the northeast end of the island is a bare ledge with three large rocks, the outer one having an arch through it. **Little Smith Island**, bluff, wooded and about 350 feet high, lies $\frac{3}{8}$ mile off the southwest end of Smith Island. Temporary anchorage has been made off the middle of the southwest side of Little Smith Island, and off the middle of the southeast side of Smith Island. A bank with 11 to 12 fathoms over it extends 1 mile 70° true (*NE* $\frac{1}{4}$ *N* mag.) from the northeast end of Smith Island.

Seal Island lies 5 miles 174° true (*SE* by *S* mag.) from Little Smith Island and $5\frac{3}{4}$ miles off the eastern shore of Knight Island. It is about $\frac{3}{8}$ mile in diameter, wooded, about 350 feet high near the middle, and slopes to the water, giving it a rounded appearance. There are two bare, rocky islets close to its eastern end, and a small bare rock about 200 yards off its west end. Broken ground extends 1 mile between the bearings 16° true (*N* by *W* mag.) and 61° true (*NE* by *N* mag.) from Seal Island. The least depth is 2 fathoms on its northwest end, lying 1 mile 27° true (*N* mag.) from the west end of the island.

KNIGHT ISLAND AND ASSOCIATED ISLANDS.

Knight Island is 22 miles long and very rugged, the peaks having elevations up to 3,186 feet. It is wooded to an elevation of about 1,000 feet, and above this is grass covered. Three mountainous, sparsely wooded islands, called Disk, Ingot, and Eleanor, extend 6 miles northward from Knight Island to Point Eleanor, the north end of the group.

Eleanor Island is about 4 miles long, has elevations up to 834 feet and bluff, rugged shores. The bay on the northwest side of Eleanor Island is deep and clear. There is anchorage for small vessels in the south arm, about $\frac{3}{8}$ mile from the head, in about 20 fathoms.

Near the eastern point of Eleanor Island, 2 miles southeastward of Point Eleanor, there is a rocky islet with a few trees and foul ground inside of it. A bare rock lying $\frac{1}{4}$ mile southeastward of the islet should be given a berth of $\frac{1}{4}$ mile.

A group of prominent bare rocks, close together and about 12 feet high, lie over $\frac{1}{2}$ mile off the southeastern point of Eleanor Island and 3 miles southeastward of Point Eleanor. There is broken ground, with depths of 6 to 7 fathoms, between them and Eleanor Island. A bare rock about 5 feet high lies $\frac{1}{2}$ mile southward of the group of bare rocks; it should be given a berth of over $\frac{1}{4}$ mile when southeastward of it.

Upper Passage, separating Eleanor and Ingot islands, is generally deep and clear. An island, 1 mile long and its northern end joined at low water to Eleanor Island, lies in the passage. In the narrowest part of the passage between this island and Ingot Island, favor if anything the northeast side of the channel. A ledge with 5 fathoms over it lies in the middle of the southeastern entrance of Upper Passage 600 yards southeastward from the southern end of the island in the passage.

A prominent wooded island, 269 feet high and with deep water all around it, lies 600 yards southward from Eleanor Island and on the northern side at the southeastern entrance of Upper Passage. A larger and higher wooded island lies $\frac{5}{8}$ mile southward of the preceding island and $\frac{3}{8}$ mile eastward of Ingot Island; there is deep water all around it.

Ingot Island, lying between Upper and Lower passages, is 4 miles long, over 1 mile wide, and 1,114 feet high. A prominent wooded island 246 feet high lies $\frac{1}{4}$ mile off the northwest end of Ingot Island.

Disk Island, on the northeastern side of Lower Passage, is about 1 mile in diameter and 677 feet high. The narrow channel between it and Ingot Island is blocked by reefs. A bay with two narrow entrances makes into the southwest side of the island. The main entrance is 50 yards wide with a depth of 3 fathoms, and there is a depth of 13 fathoms in the bay.

Two small bare rocks, close together and nearly awash at high water, lie $\frac{1}{2}$ mile 115° true (*E* $\frac{1}{4}$ *N* mag.) from the southeast point of Ingot Island, with deep water between. The rocks should be given a berth of $\frac{1}{4}$ mile when northeastward of them. A rock, with 5 fathoms on it and which should be avoided, lies $\frac{1}{2}$ mile 109° true (*E* $\frac{3}{4}$ *N* mag.) from the bare rocks.

Lower Passage is a deep navigable channel at the northern end of Knight Island, between it and Disk and Ingot islands. A rock with 4 fathoms on it lies 200 yards northward from

the turning point on the south side of Lower Passage southeastward from Disk Island. Broken ground, on which the least depth obtained is $6\frac{1}{2}$ fathoms, extends into the passage 400 yards from the southwest shore just northwestward of the entrance of Louis Bay. A rock, bare at half tide, lies 350 yards from the western shore $\frac{3}{4}$ mile inside the northwest end of the passage. There is foul ground from this rock to the head of the cove $\frac{1}{2}$ mile southward.

A rock with $4\frac{1}{2}$ fathoms on it lies nearly $\frac{3}{8}$ mile northwestward from the northern end of Disk Island. Another rock with 5 fathoms over it lies nearly $\frac{1}{2}$ mile from Ingot Island and over $\frac{3}{4}$ mile 42° true (*N by E $\frac{1}{4}$ E mag.*) from the southern point at the northwestern entrance of Lower Passage. These rocks are well out of the usual track of vessels going through Lower Passage.

Entering Lower Passage from eastward, vessels may pass on either side of the two small outlying bare rocks (see the description preceding). Give the prominent turning point on the south side of the passage southeastward of Disk Island a berth of 300 yards, and follow the southern side of Disk Island at about that distance until up with its southwestern end. Then steer 349° true (*NW $\frac{1}{2}$ N mag.*) and pass about $\frac{1}{4}$ mile northeastward from the southern point at the northwestern end of the passage.

Louis Bay, at the southern end about halfway through Lower Passage, is $\frac{1}{2}$ mile wide at the entrance, and affords anchorage for small vessels 250 to 300 yards from the head of either of its two arms in about 15 fathoms. The western arm is clear. A rock with a reported depth of 4 feet lies 200 yards from the eastern shore and 450 yards northward from the entrance of the eastern arm. The eastern arm is $\frac{1}{8}$ to $\frac{1}{4}$ mile wide; a ledge makes out about 30 yards from the western point (a wooded islet) at the entrance. When inside the entrance of the eastern arm, favor the western side to avoid three rocks which are bare at lowest tides; one lies 100 yards off a point on the east side 300 yards northward of the houses at the head; the other two lie 225 yards northward of the same point and the same distance from the east side.

Bay of Isles is on the eastern side of Knight Island, 260° true (*SW $\frac{5}{8}$ W mag.*) from Seal Island. It has numerous islets and pinnacle rocks, sunken and awash, and is suitable only for small vessels, for which there is secure anchorage in the South and North arms, the latter being easier of access. The depths in the bay are great, and the deep water extends close to the rocks, which are not marked by kelp.

To enter Bay of Isles, steer 260° true (*SW $\frac{5}{8}$ W mag.*) with Seal Island astern, and pass in mid-channel northward of the islets lying in the middle of the bay. Continue the course $\frac{1}{2}$ mile past the islets, and then steer 221° true (*S by W $\frac{1}{4}$ W mag.*), and pass in mid-channel westward of the islands near the southern shore. Then steer about 269° true (*SW by W $\frac{1}{2}$ W mag.*), and keep the northern shore aboard distant about 150 yards in entering North Arm. Anchor in the middle of the broad part of the arm in 9 to 11 fathoms.

Foul ground extends $\frac{1}{2}$ mile southeastward from the northern point in the approach to Bay of Isles. At the end of the foul ground is a rock with 10 feet over it, lying $\frac{7}{8}$ mile 73° true (*NE mag.*) from an island near the northern shore. The tangent to the shore southward of Bay of Isles in line with the eastern shore of Knight Island southward of Snug Harbor, bearing 197° true (*S by E mag.*), leads eastward of the foul ground.

Manning Rocks lie about 2 miles off the entrance of Bay of Isles. They are three pinnacles, with depths of 5, 9, and 23 feet on the south, middle, and north one, respectively, the distance between the end ones being $\frac{7}{8}$ mile. They are surrounded by deep water, and are the worst danger on the east side of Knight Island. Between Manning Rocks and the foul ground in the entrance of Bay of Isles the bottom is very irregular, although the least depth found is $8\frac{1}{2}$ fathoms.

Marsha Bay, $4\frac{1}{2}$ miles southward of Bay of Isles, has a crooked narrow entrance, and is suitable only for small craft. The depths are great except at its north end, where anchorage can be selected in 15 fathoms or less. The entrance is between two sunken rocks, and the channel then leads southward of the islands which choke the mouth of the bay. Enter in mid-channel between the outer island and the south point of the bay on a 252° true (*SW mag.*) course, and then favor the south point of the islands when passing through the narrowest part of the channel.

Snug Harbor is on the east side of Knight Island 6 to 7 miles northward of Point Helen. Its western arm is $\frac{1}{4}$ mile wide and clear near mid-channel, and is a secure anchorage at its head in 12 to 17 fathoms. Anchorage, exposed to northerly and northeasterly winds, can be

had in the broad cove on the south side in the entrance of the harbor in 12 to 15 fathoms, rocky bottom.

Hogan Bay, on the east side of Knight Island $2\frac{1}{2}$ miles northward of Point Helen, has anchorage in the middle, with the north point at the entrance bearing 92° true (*NE by E* $\frac{3}{4}$ *E mag.*), and the north end of the spit on the southwest side at the entrance to an inner cove bearing 336° true (*NW* $\frac{1}{2}$ *W mag.*), in 16 fathoms. The bottom is rocky and uneven, and the anchorage is exposed eastward. Small craft can pass through the narrow channel at the head of the bay and find secure anchorage in the inner cove in 12 fathoms or less. The spit on the southwest side of the channel is bold, and should be favored when entering the inner cove.

KNIGHT ISLAND PASSAGE,

on the west and south sides of Knight Island, is used by vessels calling at Drier and other bays on the west side of Knight Island. With easterly winds it offers a smoother channel, for vessels bound to Valdez, from Latouche Passage to the northern end of the Naked Island group, than the generally used route eastward of Knight Island.

From its northern entrance between Herring Point and Crafton Island, where it is 5 miles wide, it extends 16 miles in a 196° true (*S by E mag.*) direction to Pleiades Islands, with a least width of 2 miles at the southeast end of Chenega Island. The channel leads eastward of the Pleiades, where it is $1\frac{1}{4}$ miles wide between them and Point of Rocks. From these islands the passage has a 135° true (*ESE* $\frac{1}{2}$ *E mag.*) direction for 10 miles, with widths of 3 to 4 miles, to Montague Strait between Point Helen and the north end of Latouche Island.

The depths in the passage range from 150 to 400 fathoms. The west side is generally bold, with the exception of the bight between Crafton Island and Point Nowell, which is foul. From Pleiades Islands to 5 miles southward of Herring Point the eastern shore is foul for $\frac{3}{4}$ mile off, many islands, rocks, and reefs being found in it.

Herring Bay, in the northwest end of Knight Island, has a 180° true (*SSE* $\frac{1}{2}$ *E mag.*) direction, and a length of 4 miles from Herring Point to the head of its southeast and south arms. It has a width of $1\frac{1}{4}$ miles at the entrance and 2 miles inside. Little sounding has been done in the bay, but vessels occasionally entered to the mining camp at the head of the southeast arm. There are numerous islands on the eastern and southern shores of the upper part of the bay and in the middle, $1\frac{1}{2}$ miles 152° true (*SE by E mag.*) from Herring Point, is a prominent bare rock about 6 feet high. The following is the usual track of vessels entering Herring Bay, and is clear so far as known:

From northward, round the north point at the entrance at a distance of $\frac{3}{4}$ mile and steer 185° true (*SSE mag.*) for the bare rock in the middle. When $\frac{3}{4}$ mile from the rock and a prominent point is on the port beam, steer 163° true (*SE mag.*) for 1 mile, passing $\frac{1}{4}$ mile northeastward of the rock and to a position with three wooded islets (northeast one the largest) $\frac{1}{4}$ mile on the port beam.

Then steer 107° true (*E by N mag.*) for $\frac{1}{2}$ mile until the narrow entrance to the southeast arm is open. Then steer 177° true (*SSE* $\frac{3}{4}$ *E mag.*) in mid-channel, heading for the houses at the head of the southeast arm. Exercise caution when $\frac{3}{8}$ mile inside the entrance, as a single cast of 7 fathoms was obtained there. Anchor $\frac{1}{2}$ mile below the houses in about 15 fathoms. Rocks extend about 50 yards off the west point at the entrance of the arm. A rock covered at high water lies about 150 yards off the point on the west side of the arm $\frac{3}{8}$ mile northwestward of the houses.

From southward, round Herring Point at a distance of $\frac{1}{2}$ to $\frac{3}{4}$ mile and steer about 163° true (*SE mag.*) for 2 miles, passing $\frac{1}{4}$ mile northeastward of the rock in the middle and to a position with three wooded islets $\frac{1}{4}$ mile on the port beam. Then proceed as directed in the preceding paragraph.

Herring Point, on the west side of Knight Island 8 miles southward of Point Eleanor, is the north end of a narrow ridge, 600 to 800 feet high, forming the west side of Herring Bay.

There is a prominent point on the west side of Knight Island, 3 miles southward from Herring Point, from which a reef bare at low water extends 200 yards.

Crafton Island, 5 miles 287° true (*W by S mag.*) from Herring Point and $\frac{1}{2}$ mile from the west shore, is 1 mile long, and wooded. At its north end are rocky bluffs about 100 feet high, while its southern part is lower and has sandy beaches in places. Two low islets with sandy

beaches lie off its south end. Foul ground extends $\frac{1}{2}$ mile eastward from Crafton Island, and there is foul ground between the island and Point Nowell.

Point Nowell, on the west side $4\frac{1}{2}$ miles 183° true (*SSE* $\frac{1}{4}$ *E* mag.) from Crafton Island, is a small wooded hook, about 50 feet high, back of which the land rises abruptly to about 2,000 feet. The cove on the south side of Point Nowell is about 300 yards in diameter and apparently clear, and affords anchorage for small craft in about 5 fathoms.

Dangerous Passage, on the west side of Chenega Island, has rocks bare at low water near mid-channel in its northern entrance, and appears foul.

Chenega Island, on the west side of Knight Island Passage, is 7 miles long and 1,800 to 2,000 feet high. Close to the north end of the island is a low, wooded island, with several islets on its northwest side. There is a prominent landslide at the south end of Chenega Island over the small Indian village of Chenega, and two low, wooded islets close to the shore off the village.

Lower Herring Bay, on the east side 7 miles southward of Herring Point, has an entrance $\frac{1}{2}$ mile wide with a small rocky island in it. The shores at the entrance are shelving, with outlying ledges. It is not used.

A prominent, bare, black rock, about 6 feet high, lies nearly 1 mile off the entrance of Lower Herring Bay, and there are rocks and foul ground inside it. A reef, barely covered at low water, lies 1 mile 25° true (*N* $\frac{1}{4}$ *W* mag.) from this rock and $\frac{7}{8}$ mile from the eastern shore.

There is a group of wooded islands near the eastern shore between Lower Herring and Johnson bays. They are surrounded by reefs.

Johnson Bay, $8\frac{1}{2}$ miles southward of Herring Point, is $\frac{1}{2}$ mile wide at the entrance and about $1\frac{1}{2}$ miles long. There is a good-sized wooded island in the entrance. Reefs bare at low water make well out from the island, and also short distances from both points at the entrance. Small craft have entered the bay northward of the island, favoring the north point at the entrance. It should be avoided by strangers in the absence of a survey.

Squirrel Island, $9\frac{1}{2}$ miles southward of Herring Point and $\frac{1}{2}$ mile from the eastern shore, is the northernmost of the islands extending $1\frac{1}{2}$ miles northward of the entrance to Drier Bay. It is $\frac{5}{8}$ mile long, 180 feet high, and wooded.

Drier Bay is described under a separate heading following.

Southward of Drier Bay there are two large islands on the east side of Knight Island Passage, separated from Knight Island by Long Channel. Mummy Island is described under Drier Bay. **Squire Island**, the southern one, is 3 miles long and about 1,000 feet high. A ledge, bare at low water, lies $\frac{1}{4}$ mile southward from the south end of Squire Island. Two islands lie $\frac{1}{4}$ mile off the west side of Squire Island, and from these islands a large reef extends $\frac{3}{8}$ mile westward to **Point of Rocks**, the latter awash at high water. There is a deep channel between Mummy and Squire islands leading into Long Channel.

Long Channel is a deep inside passage from Drier Bay to the southern end of Knight Island Passage. It is $4\frac{1}{2}$ miles long and the mid-channel is clear. The channel is generally $\frac{1}{4}$ to $\frac{3}{8}$ mile wide, but narrows to 175 yards abreast Mummy Island and to 250 yards $\frac{3}{4}$ mile from the north end of Squire Island. A rock, covered at high water, lies in the northern entrance $\frac{1}{4}$ mile 88° true (*NE* by *E* $\frac{3}{8}$ *E* mag.) from the north end of Mummy Island. The tidal currents have little velocity.

From southward, the mid-channel courses are 22° true (*N* $\frac{1}{2}$ *W* mag.) for 1 mile, then 358° true (*NNW* $\frac{5}{8}$ *W* mag.) for $\frac{3}{4}$ mile to the southern end of the narrowest part of the channel abreast Squire Island, then 10° true (*N* by *W* $\frac{5}{8}$ *W* mag.) for 2 miles to the northern end of the narrowest part of the channel abreast Mummy Island, and then 30° true (*N* $\frac{1}{4}$ *E* mag.) into Drier Bay.

There is a large bay on the east side of Long Channel abreast the north end of Squire Island. Its entrance is very narrow and foul, and suitable only for small craft with local knowledge. The tidal currents have considerable velocity in the entrance.

Pleiades Islands, in the middle of Knight Island Passage, are a group of 7 wooded islands 1 mile long. The southernmost and largest is about 80 feet high.

Mummy Bay, in the south end of Knight Island 4 miles westward of Point Helen, is about 1 mile wide and $3\frac{1}{2}$ miles long in a 38° true (*N* by *E* mag.) direction. It is deep and

clear, but rocks extend $\frac{1}{4}$ mile from the head. Small vessels can anchor $\frac{1}{2}$ mile from the head in 15 to 20 fathoms. The southern arm on the eastern side of the bay is clear and affords anchorage for small vessels in 12 to 15 fathoms. The northern arm on the eastern side is an anchorage for small craft.

Little Bay, on the south side of Knight Island $1\frac{3}{4}$ miles westward of Point Helen, is 1 mile long, $\frac{1}{2}$ mile wide, and clear. The depths are 13 to 18 fathoms, rocky bottom, and it is a fair anchorage except with southerly winds.

Ice.—Considerable glacial ice was seen in the passage south of Pleiades Islands. It comes from westward between Point Countess and Chenega Island, and drifts eastward as far as Latouche Passage with the ebb.

The **tidal currents** in Knight Island Passage have a velocity of 1 to 2 miles at the strength of the large tides.

SAILING DIRECTIONS, KNIGHT ISLAND PASSAGE.

Approaching from northward the Naked Island group can be passed on either hand. From a position $1\frac{1}{2}$ miles west of Storey Island make good a 211° true (**S** $\frac{1}{4}$ **W** mag.) course for 22 miles, passing $1\frac{1}{2}$ miles westward of Herring Point and to a position 1 to $1\frac{1}{4}$ miles eastward of Point Nowell.

Or, if approaching southward of Naked Island, pass 1 mile southward of the wooded island off the south side of Naked Island and steer 270° true (**SW** by **W** $\frac{1}{2}$ **W** mag.) for 5 miles, passing 1 mile northward of Point Eleanor. Continue this course 2 miles past Point Eleanor and then steer 223° true (**S** by **W** $\frac{3}{8}$ **W** mag.) for 8 miles, following the eastern shore at a distance of $1\frac{1}{2}$ miles. When Herring Point is $1\frac{1}{2}$ miles on the port beam, steer 211° true (**S** $\frac{1}{4}$ **W** mag.) for 5 miles to a position 1 to $1\frac{1}{4}$ miles eastward of Point Nowell.

From a position 1 to $1\frac{1}{4}$ miles eastward of Point Nowell, steer 196° true (**S** by **E** mag.) for Pleiades Islands with Lone Island astern; having stood 7 miles on this course, New Year Islands, on the north side at the entrance to Drier Bay, should bear about $1\frac{1}{2}$ miles on the port beam. Continue the 196° true (**S** by **E** mag.) course for $10\frac{1}{2}$ miles from Point Nowell until $1\frac{1}{4}$ miles from Pleiades Islands and the south tangent of Chenega Island is abeam.

Then steer 169° true (**SE** $\frac{1}{2}$ **S** mag.) for $2\frac{1}{2}$ miles, passing midway between Point of Rocks and the Pleiades. When the southeast end of Squire Island is 1 mile on the port beam, steer 146° true (**SE** by **E** $\frac{1}{2}$ **E** mag.) with the north end of Pleiades Islands astern. This course made good for 7 miles will lead $1\frac{1}{4}$ miles off the southern shore of the passage and to the north entrance to Latouche Passage, and the course made good for 10 miles will lead into Montague Strait.

DRIER BAY

has its main entrance between Mummy Island and New Year Islands on the west side of Knight Island $11\frac{1}{2}$ miles southward of Herring Point and $4\frac{1}{2}$ miles northward of Pleiades Islands. Considerable prospecting for copper has been done on the bay, and at the head is the wharf of the Hubbard-Elliott Mining Company. The bay is 5 miles long in a northeasterly direction and nearly 1 mile wide. It is generally clear with deep water, but there are several dangers as mentioned. The southeast shore of the bay is indented by a number of bays and coves and by Long Channel.

Mummy Island, on the south side at the entrance, is $1\frac{1}{2}$ miles long, 543 feet high, and wooded; there are patches of grass on the southern half of the island. Reefs extend $\frac{1}{4}$ mile southwestward from the northwest end of the island, and wooded islets with reefs around them extend $\frac{5}{8}$ mile westward from the southern half of the island. A rock covered at high water lies $\frac{1}{4}$ mile 88° true (**NE** by **E** $\frac{3}{8}$ **E** mag.) from the north end of the island, but is in the way only when using Long Channel. A rock with 4 fathoms over it lies $\frac{1}{4}$ mile 64° true (**NE** $\frac{3}{4}$ **N** mag.) from the north end of Mummy Island.

New Year Islands are the southernmost of the islands which extend $1\frac{5}{8}$ miles northward from the entrance to Drier Bay. They are about $\frac{3}{8}$ mile long, wooded, and the southern and largest one 200 feet high. Bare reefs extend 250 yards southward of the south island. A rock bare at low water lies $\frac{1}{4}$ mile 19° true (**N** $\frac{3}{4}$ **W** mag.) from the north island, and is a serious danger in the channel between New Year Islands and the islands northward.

Clam Islands, two in number, low and wooded, lie between New Year Islands and the north point of the bay. A rocky patch with $3\frac{3}{4}$ fathoms over it lies 600 yards 191° true (*S* by *E* $\frac{1}{2}$ *E* mag.) from Clam Islands, and nearly $\frac{3}{4}$ mile 102° true (*ENE* $\frac{5}{8}$ *E* mag.) from the south end of New Year Islands.

Range Isle, small and wooded, lies close to the north side of the bay and 2 miles inside New Year Islands. The line of Range Isle just clear of the north shore eastward of it, bearing 75° true (*NE* $\frac{1}{4}$ *E* mag.), leads about through the middle of the entrance between Mummy Island and New Year Islands, and is sometimes used as a range for entering the bay.

Cathead Bay, on the south side 2 miles from Mummy Island, is 1 mile long and $\frac{1}{4}$ to $\frac{3}{8}$ mile wide. There are two islands in the upper part of the bay. The soundings taken indicate deep water. In the entrance of the bay 200 yards from the west side is a rock with 4 feet over it. Also off the entrance, $\frac{1}{4}$ mile 50° true (*NNE* mag.) from Cat Head and $\frac{5}{8}$ mile 191° true (*S* by *E* $\frac{1}{2}$ *E* mag.) from Range Isle, is a rock with $3\frac{1}{2}$ fathoms over it. When entering favor the east side to avoid these rocks and then proceed with caution on either side of the islands to its head.

Mallard Bay, on the south side, $2\frac{1}{2}$ miles inside Mummy Island, is 1 mile long and $\frac{3}{8}$ to $\frac{1}{2}$ mile wide. The bay is foul for a distance of $\frac{1}{4}$ mile from its head. Approaching with care, anchorage can be made $\frac{3}{8}$ to $\frac{1}{2}$ mile from the head in 17 to 20 fathoms.

Barnes Cove, 4 miles inside Mummy Island and 135° true (*ESE* $\frac{1}{2}$ *E* mag.) from Chase Island, is obstructed by ledges at its entrance, and shoals make out from the shores of the cove. Small craft entering with care can find good anchorage in 8 fathoms. Vessels can anchor 300 to 500 yards off the entrance in 20 to 22 fathoms.

The point on the northeast side of Barnes Cove is prominent and high, with bare rocky sides. A reef extends 150 yards off the small point $\frac{3}{8}$ mile northeastward of this point.

Chase Island, small and wooded, lies 700 yards from the northwest side of the bay and $1\frac{3}{4}$ miles above Range Isle. A ledge bare at low water extends 300 yards 207° true (*S* mag.) from Chase Island.

A rock awash at half tide lies $\frac{3}{8}$ mile 61° true (*NE* by *N* mag.) from Chase Island. It is sometimes marked by a buoy. There is a rock bare at extreme low water between the half-tide rock and the northern shore.

Northeast Cove, on the southeast side at the head of the bay, is small and has shoals at its entrance and also inside for 200 yards from its head. Small craft entering with care can find good anchorage in 4 to 5 fathoms. Vessels can anchor 300 to 500 yards off the entrance in 17 to 20 fathoms.

The wharf and mining camp of the Hubbard-Elliott Mining Company is on the north side of the head of the bay $1\frac{1}{4}$ miles above Chase Island. It extends about 200 feet southeastward from the shore, its southeast end being less than 30 yards from the shore northeastward. Vessels over 200 feet long would find it difficult to use the wharf. It is usual to make the southeast corner and make fast port side to, heading southeastward. A patch of rocks extends 50 yards from shore 200 yards southeastward of the wharf. Vessels can anchor 200 to 500 yards southward of the wharf in about 15 fathoms, irregular bottom.

At 400 yards northwestward of the wharf is the narrow entrance to a lagoon, which affords good anchorage for small craft in 6 to 10 fathoms. There is 7 feet in the narrow entrance; a flat extends 250 yards from the head. A sunken rock lies in the approach 50 yards from the eastern shore and 100 yards southeastward from the narrow entrance. There is a sawmill on the west side at the head of the lagoon.

SAILING DIRECTIONS, DRIER BAY.

Strangers may have some difficulty in recognizing the entrance to Drier Bay, as there are several groups of islands on the east side of Knight Island Passage, both north and south of the entrance.

From northward, follow the directions for Knight Island Passage, and when 7 miles past Point Nowell the position should be midway between New Year Islands and the south end of a sand beach on Chenega Island. Then steer 129° true (*E* by *S* mag.) for the north end of Mummy Island and pass about $\frac{3}{8}$ mile southward of the bare rocks off the south end of New Year Islands.

When New Year Islands are a little abaft the beam, steer 84° true (**NE** by **E** mag.) and pass about $\frac{3}{8}$ mile northward of Mummy Island into the bay.

From southward, steer 16° true (**N** by **W** mag.) with Pleiades Islands astern until about 1 mile past the southeast point of Chenega Island. Then steer 64° true (**NE** $\frac{3}{4}$ **N** mag.) with the southeast point of Chenega Island astern, and pass about $\frac{3}{8}$ mile northward of Mummy Island.

Entering about midway between Mummy Island and the bare rocks southward of New Year Islands, steer 84° true (**NE** by **E** mag.) for $3\frac{1}{4}$ miles, passing $\frac{1}{4}$ mile southward of Range Isle. When 400 yards from the southeast shore above Mallard Bay, steer 50° true (**NNE** mag.), passing about 600 yards southeastward of Chase Island and about 400 yards off the southeast shore above the island. When $\frac{3}{4}$ mile above Chase Island and Mountain Point is on the port beam, steer 2° true (**NNW** $\frac{1}{4}$ **W** mag.) for the wharf.

MONTAGUE STRAIT,

between Montague and Latouche islands, is the broadest of the passages westward of Montague Island, and passing westward of Green Island offers a clear channel $4\frac{1}{2}$ miles wide from Prince William Sound to the sea. It is, however, rarely used, vessels generally passing through Latouche Passage. The passage between Green and Montague islands has considerable foul ground and should be avoided by strangers in the absence of a survey.

From a position 1 mile westward of Seal Island a 203° true (**S** $\frac{3}{8}$ **E** mag.) course made good for 42 miles will lead 1 mile off the eastern shore of Latouche Island, $1\frac{1}{2}$ miles off the western shore of Montague Island near its southern end, and to a position about $2\frac{3}{8}$ miles westward of Cape Cleare.

Or, having made good the 203° true (**S** $\frac{3}{8}$ **E** mag.) course for 30 miles to a position 1 mile off the eastern shore of Latouche Island $5\frac{1}{2}$ miles from Point Grace, steer 232° true (**SSW** $\frac{1}{4}$ **W** mag.) for 8 miles to a position $1\frac{3}{4}$ to 2 miles southeastward from Danger Island. From this position a course can be shaped as desired (see bearings and distances from Danger Island on page 29).

Green Island is wooded, about 6 miles long, possibly 500 feet high near its middle, and slopes gradually to its north and south ends. The vicinity of the island is very foul. Two wooded islets and numerous small ones lie close to the northwest side of the northeastern half of the island. Three rocks 10 to 15 feet high lie 1 to $1\frac{1}{4}$ miles off the northwest and west sides, the southwesternmost lying 1 mile 252° true (**SW** mag.) from the western end of the island.

An extensive reef, marked by kelp, extends 4 miles in a 353° true (**NW** by **N** mag.) direction from Green Island. It is apparently two ridges about 2 miles apart, each having a general 39° true (**N** by **E** mag.) direction. In both reefs are bare rocks which may be covered at extreme high tides, and numerous sunken rocks. The northern bare rock lies $3\frac{3}{4}$ miles 173° true (**SE** by **S** mag.) from Seal Island, with deep water between.

A low, wooded island $\frac{5}{8}$ mile long lies $1\frac{1}{8}$ miles 207° true (**S** mag.) from the south end of Green Island. A large reef, partly bare at low water, lies $\frac{3}{8}$ to $1\frac{1}{8}$ miles 230° true (**SSW** mag.) from the south end of the low, wooded island.

The Needle is a flat-topped, steep-sided rock, about 75 feet high, in the strait $3\frac{3}{4}$ miles from the nearest point of Montague Island and $5\frac{1}{2}$ miles 117° true (**E** mag.) from Point Helen.

Hanning Bay is on the east side of the strait, 13 miles northward of Cape Cleare and 151° true (**SE** by **E** mag.) from the north end of Latouche Island. It is a good anchorage with easterly winds, but is exposed from northwest, through west, to southwest. It is about 2 miles in diameter, with depths from 7 to 22 fathoms. Shoals extend nearly $\frac{3}{8}$ mile off from the streams at the northeast and southeast ends of the bay, and a reef extends nearly $\frac{1}{4}$ mile from the point on the eastern side. The best anchorage with southerly winds is about $\frac{3}{8}$ mile from the south side, with Danger Island open from the south point at the entrance bearing 258° true (**S** $W\frac{1}{2}$ **W** mag.), and the north point at the entrance bearing between 5° true (**NNW** mag.) and 348° true (**NW** $\frac{1}{2}$ **N** mag.), in 15 to 16 fathoms, sticky bottom. With northwest winds a better berth can be had $\frac{1}{4}$ to $\frac{3}{8}$ mile off the cove on the north side, $\frac{5}{8}$ mile inside the entrance, in 5 to 8 fathoms, hard bottom. When entering give the points at the entrance a berth of over $\frac{3}{8}$ mile.

Macleod Harbor, on the east side of the strait, $6\frac{1}{2}$ miles northward of Cape Cleare, is not surveyed. It is $1\frac{1}{2}$ miles wide at the entrance and possibly 2 miles long. The following information is from reports: Vessels can anchor in 13 to 14 fathoms about $\frac{1}{2}$ mile off the sand beach on the south side in the lower part of the bay, but it is more exposed to the ocean swell than Hanning Bay. The depths at the entrance are 7 to 8 fathoms, and in the bay 12 to 21 fathoms. There is a dangerous flat on the eastern and southeastern sides of the bay. There is good anchorage for small craft and possibly very small vessels in a cove on the north side toward the head. The cove is formed by a point which is bold and should be kept aboard. The anchorage is with the south point of the harbor shut in by this point, about 200 yards from the latter, in $4\frac{1}{2}$ fathoms.

Latouche Island is 10 miles long and has elevations up to 2,255 feet. It is wooded to an elevation of about 500 feet, and above this is covered with moss and bushes, except the highest peaks, which are bare rocks. The eastern shore is precipitous and the 100-fathom curve less than $\frac{1}{4}$ mile off in places.

Danger Island, $1\frac{3}{8}$ miles 207° true (*S mag.*) of Latouche Island, is $\frac{3}{8}$ mile in diameter, low and wooded. The island is surrounded by bare rocks and kelp to a distance of $\frac{5}{8}$ mile northward and southward of it and $\frac{1}{4}$ mile eastward and westward. Eastward of the island the foul ground is not developed. There is no safe passage between it and Latouche Island. A bar with depths of 6 to 11 fathoms extends 319° true (*WNW mag.*) from Danger Island to Elrington Island. A depth of $3\frac{1}{2}$ fathoms is found on it $\frac{3}{8}$ mile westward of Danger Island, and $3\frac{3}{4}$ fathoms 700 yards from Elrington Island and 308° true (*W by N mag.*) from Danger Island. The following are bearings and distances from Danger Island:

Barwell Island, off Cape Resurrection, 264° true (*SW by W $\frac{1}{8}$ W mag.*), $36\frac{1}{2}$ miles.

Lone Rock, south end of Chiswell Islands, 246° true (*SW $\frac{1}{2}$ S mag.*), 51 miles.

Seal Rocks, 242° true (*SW $\frac{1}{8}$ S mag.*), 53 miles.

LATOUCHE AND ELRINGTON PASSAGES,

between Latouche and Hoodoo islands, are generally used by vessels between Prince William Sound and the coast southwestward, passing on either side of Elrington Island. There is also considerable traffic to the wharves of the copper mines on the west side of Latouche Island.

From Point Grace to the north end of Elrington Island, a distance of 5 miles, Latouche Passage is about $1\frac{3}{4}$ miles wide, with deep water. There is a wooded islet, with a grass-covered rock close to its north end, near Hoodoo Island $\frac{3}{4}$ mile northwestward of the northern entrance.

Latouche Passage, east of Elrington Island, is 7 miles long and $\frac{3}{4}$ to 1 mile wide, with moderate depths, under 30 fathoms in most places. Anchorage can be selected nearly anywhere in this channel where the depth is suitable. At the south end the depths are 6 to 11 fathoms on the bar between Danger and Elrington islands.

Barrack's wharf, on the west side of Latouche Island, $1\frac{7}{8}$ miles southward of Point Grace, has a depth of about 24 feet at its end. The post-office of **Latouche** was located here in 1907. A little southward of the wharf a dangerous reef makes out over 100 yards from shore, and is sometimes marked by a buoy.

Beetson's wharf, on the west side of Latouche Island, $2\frac{1}{4}$ miles southward of Point Grace, has a depth of 13 feet at its end. Vessels generally go to the wharf port side to, heading southward, and to leave the wharf swing the bow in toward the shore and back into the passage. There is a tramroad to the mine about $\frac{1}{2}$ mile southeastward, and considerable copper ore has been shipped. The cove southward of the wharf is shoal, and a reef makes out about 100 yards from the point 400 yards southwestward of the wharf. Anchorage can be had 300 to 500 yards 320° true (*WNW mag.*) from the wharf in 10 to 15 fathoms.

Chicken Island, $3\frac{1}{2}$ miles southward from Point Grace, is the northern one of two small wooded islands, $2\frac{1}{2}$ miles apart, on the east side of Latouche Passage. It is separated from Latouche Island by a pass 350 yards wide with a depth of 4 feet. A rock with 15 feet over it lies 300 yards off the point on the eastern shore $\frac{5}{8}$ mile northward from Chicken Island.

Horseshoe Bay is on the west side of Latouche Island, $4\frac{1}{2}$ miles southward of Point Grace. Its southern half is shoal; small craft or a very small vessel, entering close to the north point of the bay, can anchor in its north end in 18 to 20 feet of water. There is a wharf on the south point of the bay, and fresh water can be had through pipe and hose. There is deep water along-

side, but in the entrance of the bay is a depth of 3 fathoms which is crossed by vessels going to the wharf. Just northward of the wharf is a rock, covered at high water, with clusters of piles on its western side which keep vessels clear of it when at the wharf. Vessels can anchor about $\frac{1}{4}$ mile off the wharf, in 16 to 18 fathoms.

From a little southward of Horseshoe Bay to the southern island in Latouche Passage the eastern side has broken ground and kelp in places, and should be given a berth of $\frac{3}{8}$ mile. The passage eastward of the southern island is $\frac{1}{4}$ mile wide, with much kelp, and should be avoided by vessels.

On the west side of Latouche Passage is a long bay separated from Elrington Passage by several high, wooded islands. The bay has deep water, but is not thoroughly developed. At the southwest end of the bay is a cascade, which shows from Latouche Passage.

Elrington Passage, on the west side of Elrington Island, is 8 miles long, $\frac{1}{2}$ to 1 mile wide, deep and clear. Anchorage is not easily found on account of the great depths.

A grass-covered rock, about 10 feet high and with some brush on its summit, lies close to the west side of Elrington Island 4 miles from its north end.

In the southeast angle of the passage $1\frac{3}{8}$ miles southward of this rock there is good anchorage in 5 to 20 fathoms, muddy bottom, depending on the swinging room required.

An island $\frac{5}{8}$ mile in diameter and 500 feet high lies in the bend at the south end of the passage close to Elrington Island, from which its southeast point is separated by a narrow passage at low water.

A pyramidal, pinnacle rock, about 8 feet high and with grass on top, lies about 250 yards off the north point at the southwest entrance of Elrington Passage.

Procession Rocks, near the south end of Flemming Island, $3\frac{1}{4}$ miles westward of the southwest entrance of Elrington Passage, are a good mark. They are a small cluster of rugged rocks, the three largest about 35 feet high.

Elrington Island, which divides Latouche Passage from Elrington Passage, is 10 miles long, about 1 mile wide, and has a greatest elevation of 1,967 feet. The general tree line is about 500 feet high, and the higher peaks are precipitous and bare. The southwest end of the island is $2\frac{1}{2}$ miles across in a northerly and southerly direction, and is formed by three high, prominent points with two long bays between. Both bays are clear and afford anchorage. The southern one has the best shelter, with depths from 17 to 20 fathoms, and is exposed to southwesterly and westerly winds only.

Point Elrington, the southwest end of Elrington Island, is a small hill, 515 feet high and wooded, with cliffs at the water, and is joined to the island by a sand and gravel neck just above high water. A hill, 1,050 feet high, lying $1\frac{3}{8}$ miles eastward of the point, has a low divide about 100 feet high at its east end.

The north point at the southwest end of Elrington Island is a hill 1,116 feet high and $1\frac{3}{8}$ miles long. At its southeast end it is connected with the island by a long, low, wooded neck.

SAILING DIRECTIONS, LATOUCHE AND ELRINGTON PASSAGES.

To go through Latouche Passage.—From a position $\frac{3}{4}$ to 1 mile eastward of Point Helen steer 230° true (SSW mag.) for 5 miles to a position with Point Grace on the port beam distant $\frac{3}{4}$ to 1 mile. Then steer 221° true (S by W $\frac{1}{4}$ W mag.) for 6 miles to a mid-channel position abreast the southern island in Latouche Passage. Then steer 207° true (S mag.) for 2 miles, following the western shore at a distance of about $\frac{3}{8}$ mile. Then bring the southern island in Latouche Passage open half its width westward of Chicken Island, and steer out of the passage on this line, course 220° true (S by W $\frac{1}{8}$ W mag.) for about $4\frac{1}{4}$ miles, which leads in the deepest water (about 11 fathoms) over the bar between Danger and Elrington islands. For courses and distances to Resurrection Bay and Seal Rocks see page 5.

To go through Elrington Passage.—From a position $\frac{3}{4}$ to 1 mile eastward of Point Helen steer 230° true (SSW mag.) for $9\frac{1}{4}$ miles, passing about $\frac{3}{4}$ mile off the western shore of Latouche Island. When the north end of Bettles Island (the northeast island northward of Elrington Island) is on the starboard beam, distant about $\frac{3}{8}$ mile, steer 263° true (SW by W mag.) for $1\frac{1}{8}$ miles, passing in mid-channel between Bettles Island and the north end of Elrington Island.

When $\frac{1}{4}$ mile westward of the north end of Elrington Island steer 219° true (S by W mag.) in mid-channel for $4\frac{3}{4}$ miles, with the eastern side of the island westward of Bettles Island

astern. When the south end of Hoodoo Island (forming the west side of the pass) is abeam, steer 286° true (**W** by **S** mag.) for $2\frac{3}{4}$ miles, about mid-channel northward of the large island in the pass, and then passing about $\frac{3}{8}$ mile off the south side at the entrance. Round the south point at the entrance at a distance of about $\frac{1}{2}$ mile and steer 227° true (**S** by **W** $\frac{3}{4}$ **W** mag.) about 8 miles to a position 3 miles 168° true (*SE* $\frac{1}{2}$ *S* mag.) from Cape Puget. From this position the courses and distances to Resurrection Bay and Seal Rocks are given on page 5.

COAST FROM CAPE PUGET TO CAPE RESURRECTION.

This coast is high and rugged, with numerous glaciers showing in the valleys. The prominent headlands are fairly well located, but the bays are sketched and no information about them is available. There are no outlying dangers along the coast so far as known.

Cape Puget is a high, sloping headland, and there are several bare rocks off it, the farthest about $\frac{3}{8}$ mile. Rocks about 30 feet high lie off its eastern side well northward of the cape. From alongshore eastward or westward the cape shows a wooded peak at the end, with a large conical rock in the water close to its foot.

The cape 6 miles 255° true (*SW* $\frac{1}{4}$ *W* mag.) from Cape Puget is high and has two steps near the water at its end as seen from alongshore.

At the head of the bay, 5 miles westward of the cape with steps, is a large, prominent glacier which comes down to high-water mark.

The cape on the west side of the bay is a high, sloping headland, with an immense pinnacle shaped like a shark's tooth at its foot. As seen from southwestward there are two smaller pinnacles on either side of it.

There is a large glacier at the head of the eastern arm of Day Harbor.

Cape Resurrection is a precipitous headland of solid rock, with little vegetation except some trees on the lower slopes. From eastward two dome-shaped peaks, with a slight notch between them, show at the end of the cape, with a somewhat lower ridge back of them, but rising to higher mountains farther north; the south dome is 1,035 feet high, the north one about 1,800 feet. **Barwell Island**, $\frac{3}{8}$ mile southeastward of Cape Resurrection, is small, bare, rounded, precipitous, and 472 feet high.

RESURRECTION BAY

is about 16 miles long from Cape Resurrection. The depths are great throughout, and there are no dangers in the usual track of vessels. A flat extends $\frac{1}{2}$ to $\frac{5}{8}$ mile from the entire northern shore at the head of the bay. The shores and islands are steep and high, with precipitous slopes in many places. The anchorages are few and indifferent on account of the great depths, and are subject to heavy williwaws.

Seal Rocks, the southernmost point in the approach to the bay, are a group of four small, rocky islets. The northernmost and largest is about 240 feet high and has an arch through the middle. The following are bearings and distances from Seal Rocks:

Cape Resurrection, 26° true (*N* mag.), 23 miles.

Cape Puget, 55° true (*NNE* $\frac{1}{2}$ *E* mag.), 44 miles.

Point Elrington, 59° true (*NNE* $\frac{7}{8}$ *E* mag.), 49 miles.

Danger Island, 62° true (*NE* $\frac{7}{8}$ *N* mag.), 53 miles.

Cape Cleare, $74\frac{1}{2}^{\circ}$ true (*NE* $\frac{1}{4}$ *E* mag.), 55 miles.

Marmot Island (southeast point), 220° true (*S* by *W* $\frac{1}{4}$ *W* mag.), 105 miles.

Pye Island Reef, 243° true (*S* *W* $\frac{5}{8}$ *S* mag.), 27 miles.

Lone Rock, $3\frac{3}{8}$ miles 4° true (*NN* *W* mag.) from Seal Rocks, stands well southwestward of Chiswell Islands and is a good mark. It is a high, round rock, and there is a rock showing but little above high water about $\frac{1}{4}$ mile northward of it. The passage between Seal Rocks and Lone Rock is clear so far as known, and is frequently used by vessels between Resurrection Bay and the coast southwestward.

Chiswell Islands are a group of numerous, high, precipitous, rocky islands. The northeasternmost and largest lies 5 miles 21° true (*N* $\frac{1}{2}$ *W* mag.) from Seal Rocks. North of Chiswell Islands is the entrance of Aialik Bay, which is not surveyed.

Pilot Rock, lying $1\frac{1}{4}$ miles from the nearest point on the western shore and 9 miles 18° true ($N\ \frac{3}{4}\ W$ mag.) from the northeast end of Chiswell Islands, is a bare, rounded, rocky islet about 100 feet high.

There is a large and prominent glacier on the western shore 297° true (W mag.) from Cape Resurrection.

Toward the eastern shore in the entrance of Resurrection Bay are three large, high, rugged islands, named in order from southward **Rugged**, **Hive**, and **Renard**. The passages through the islands are deep. Their shores are generally bold, but two rocks bare at low water lie 200 yards southward from the southeast end of Renard Island.

Sunny Cove, the southern bight on the west side of Renard Island, is the best anchorage in Resurrection Bay. No ocean swell makes into the cove, and it is sheltered from all but westerly winds. The williwaws are bad with easterly winds. The cove is $\frac{3}{8}$ to $\frac{1}{2}$ mile wide and clear. The anchorage is in the middle, 300 to 800 yards from its head, in 15 to 25 fathoms, muddy bottom.

Small craft can anchor in the southeast arm of the bight on the eastern shore $1\frac{1}{2}$ miles northward of Renard Island.

Caines Head is the projecting and prominent, precipitous, high headland on the western shore $2\frac{3}{4}$ miles above Renard Island.

Thumb Cove, on the eastern shore 60° true (NE by N mag.) from Caines Head, is $\frac{3}{4}$ mile wide and $1\frac{1}{2}$ miles long. Anchorage can be selected $\frac{3}{8}$ to $\frac{1}{2}$ mile from the head, in 25 to 30 fathoms, soft bottom. A flat makes out 200 to 300 yards from the northern shore for a distance of $\frac{3}{8}$ mile from the head.

Seward is an important town on the western side at the head of Resurrection Bay. There are stores and hotels, and provisions and supplies of most kinds can be obtained. There is cable communication with other points in Alaska and Seattle. From Seward a railroad has been constructed across Kenai Peninsula to the head of Turnagain Arm. The wharf is off the southern front of the town, and has a depth of 30 feet or more along its southern face. Fresh water can be had at the wharf through pipe and hose. With strong southeast winds vessels can not lie at the wharf.

The only anchorage near the town is 300 to 400 yards off the railroad water tanks, about $\frac{1}{2}$ mile northward of the wharf, in 20 fathoms, soft bottom, with scant swinging room. This anchorage is exposed to southeast winds, and with offshore winds vessels are liable to drag off into deep water on account of the steep pitch of the bottom.

Tides.—At Seward high and low water occur about 46 minutes earlier than at Kodiak, and the mean rise and fall of the tides is 8.4 feet. To find the height of the tide multiply the height of the corresponding tide at Kodiak by the ratio of ranges, 1.21.

SAILING DIRECTIONS, RESURRECTION BAY.

From eastward.—From a position 1 mile 173° true (SE by S mag.) from Barwell Island steer 319° true (WNW mag.) for 5 miles, passing $\frac{1}{2}$ mile southwestward of Barwell Island and midway between Hive and Renard islands. When $\frac{1}{2}$ mile off the southwest end of Renard Island steer 4° true (NNW mag.) for $5\frac{1}{2}$ miles to a position $\frac{1}{2}$ mile off the northeast side of Caines Head. From this position a 342° true (NW mag.) course for $6\frac{3}{4}$ miles will lead to Seward.

From southward.—Pass about 2 miles eastward of Seal Rocks and steer 15° true (N by W mag.) for $14\frac{1}{2}$ miles, passing about $1\frac{1}{2}$ miles eastward of Chiswell Islands and to a position 1 mile eastward of Pilot Rock. Then steer 2° true ($NNW\ \frac{1}{4}\ W$ mag.) for $6\frac{3}{4}$ miles to a position $\frac{1}{2}$ mile off the southwest point of Rugged Island. Then steer 13° true (N by $W\ \frac{1}{4}\ W$ mag.) for $8\frac{1}{2}$ miles to a position $\frac{1}{2}$ mile off the northeast side of Caines Head. From this position a 342° true (NW mag.) course for $6\frac{3}{4}$ miles will lead to Seward.

Or, for vessels going inside of Seal Rocks, pass 1 to $1\frac{1}{2}$ miles northwestward of Seal Rocks and steer 57° true ($NNE\ \frac{3}{4}\ E$ mag.) for $4\frac{1}{2}$ miles until the easternmost of the Chiswell Islands bears on the port beam distant $1\frac{1}{2}$ to 2 miles. Then steer 15° true (N by W mag.) for 10 miles to a position 1 mile eastward of Pilot Rock, as in the preceding paragraph.

NUKA BAY

has its entrance on the southwest side of Pye Islands, where it is about 6 miles wide, and extends about 10 miles in a 352° true (*NW* by *N* mag.) direction. At this point it narrows to about 1 mile and turns 318° true (*WNW* mag.) for 4 miles to its northwest end. There are several bays and coves affording anchorage and two large arms on the northeast side.

The bay is not surveyed, but the shores were sketched and adjusted by the triangulation which extends to the head. Soundings through the middle of the bay indicate very deep water, as shown on the chart.

Pye Islands, on the east side at the entrance of Nuka Bay, are three rugged, mountainous islands about $7\frac{1}{2}$ miles long in a general 20° true (*N* $\frac{1}{2}$ *W* mag.) direction. The highest peak of the outer island is near its eastern end, and is a good mark. Approaching from northeastward the break between the outer and second islands shows well. From southwestward the separate islands do not show, but at the eastern end is seen the highest peak, from which there is a slope to a high shelf at the water. There are breakers in places along the eastern side of the islands the southernmost lying $\frac{3}{8}$ or $\frac{1}{2}$ mile eastward from the eastern end of the outer island.

Pye Island Reef, awash or barely covered at high water, lies $2\frac{3}{8}$ miles 206° true (*S* mag.) from the peak of the outer Pye Island. There is always a break on the reef, but at high water with an exceptionally smooth sea there may be some interval between them. Depths of 18 to 60 fathoms were found about midway between it and the island. The line of the western ends of the outer and second islands leads a little westward of the reef, and the line of the eastern ends of the outer and third islands leads well eastward of it.

The channel between the second and third Pye Islands has a kelp patch in its western entrance a little southward of mid-channel, and the eastern entrance is obstructed by breakers.

McArthur Pass, between the third Pye Island and the mainland, is about 100 yards wide in its narrowest part for a distance of about 200 yards. A least depth of 7 fathoms was found in mid-channel, and the tidal current had a velocity of 4 to 5 miles southwestward through the pass near the time of low water. It is not recommended except for small vessels at slack water.

Nuka Island, on the western side of Nuka Bay, is mountainous and about 8 miles long. At its southern end are two points; the southern one has the appearance of a large, high island, its outline being an arc of a circle, and is distinctive; the northwestern one is a high peak with a fairly regular slope to the water. Bare rocks show in the bight between these points and off the entrance. No information is available for the passage westward of the island, and the eastern shore of the island should be given a good berth.

At the western entrance of McArthur Pass there is a large arm of Nuka Bay, over 2 miles wide at the entrance, and 5 miles long in a 20° true (*N* $\frac{1}{2}$ *W* mag.) direction from the western point at the entrance to the large glacier which comes down to high-water mark at its head. No bottom at 20 fathoms was found through the middle of the bay, and no bottom at 35 fathoms was found about 100 yards or less from the bare spit at the foot of the glacier. No sounding was done in the two large coves on the east side of the arm. Passing about 1 mile westward of the second Pye Island, a 20° true (*N* $\frac{1}{2}$ *W* mag.) course for about 5 miles will lead to the entrance, and this course continued will lead to the head of the arm.

Palisade Bay, on the east side of Nuka Bay, $9\frac{1}{2}$ miles above outer Pye Island, will be known by a high, wooded island on the south side in its entrance. Anchorage can be had on the northeast side of the island, about on a line from its north end to the point on the main shore, in 14 to 20 fathoms. The cove on the southwest side of the island is foul.

Palisade Bay is about 3 miles long. Anchorage can be had about $\frac{1}{3}$ mile from the narrow part at its head, in 17 fathoms, with ample swinging room. From the top of an adjacent mountain a sunken rock was seen between this anchorage and the northeast shore, but a search for it in a boat did not find it.

Cabin Bay, on the west side, opposite Palisade Bay, is about $2\frac{1}{2}$ miles long. No bottom at 20 fathoms was found through the middle of the bay. The *McArthur* anchored at its head in 13 fathoms. From the prominent point on the west shore southward of Cabin Bay a reef makes out about $\frac{1}{4}$ mile.

Rock Bay, on the east side, $11\frac{1}{2}$ miles above outer Pye Island, will be known by a cluster of wooded islets and bare rocks on the south side at its entrance. From the islets to the north

point at the entrance is a bank, on which there is kelp for about 150 yards from the islets, and a reef extending one-third the distance across from the point. Entering in mid-channel or slightly favoring the islets, a depth of 9 fathoms will be found over the bank. Anchorage can be had toward the eastern shore in 14 fathoms. The course in is about 121° true (**E** $\frac{1}{2}$ **S** mag.).

Shelter Cove, on the west side, $13\frac{1}{2}$ miles above outer Pye Island, lies 236° true (**SSW** $\frac{3}{4}$ **W** mag.) from the point dividing the northeast and northwest arms at the head of the bay. The cove is small, but affords anchorage in the middle of its entrance, in 13 fathoms, with ample swinging room. At the head of the cove is a grassy flat, in front of which is a good sized mud flat that covers.

The point dividing the northeast and northwest arms at the head of the bay has a small cluster of grass-covered rocks and wooded islets close-to.

The northwest arm is $1\frac{1}{2}$ miles long, with deep water to the large mud flat at its head.

The northeast arm is 5 miles long in a 31° true (**N** $\frac{1}{2}$ **E** mag.) direction and nearly 2 miles wide at the entrance, and has a depth of about 77 fathoms through the middle until abreast Pilot Harbor. There is a depth of 18 fathoms less than 50 yards from the low-water edge of the flat at its head. **Pilot Harbor**, on the eastern side of the arm 1 mile from its head, is a short bay having a 93° true (**ENE** mag.) direction. There is a large bare rock, about 3 feet high, off each point at the entrance. Entering in mid-channel, a secure anchorage will be found in the middle, or slightly favoring the south side, in 13 to 15 fathoms. There is a flat at the head, on the low-water edge of which is a wooded islet, lying about $\frac{1}{4}$ mile above the bare rock off the north point at the entrance.

POINT GORE

is a prominent headland lying 18 miles 247° true (**SW** $\frac{1}{4}$ **S** mag.) from Pye Island Reef and 16 miles 70° true (**NE** mag.) from the southeast end of East Chugach Island. From eastward and westward it shows as an island with a high peak near the middle and a broad, high shoulder at the ends, and separated from the high land northward by a narrow gap. There is an arch in the rocks at the eastern end of Point Gore, which shows over a small arc from southward, and a folding in the strata in the face of the cliff on the south side of the point.

The neck joining Point Gore to the mainland is low and wooded. Anchorage with shelter from southwest winds is reported toward the northwest shore off the east side of this neck in about 17 fathoms, but no description or definite information as to its exact location is available. It is wide open to all easterly winds, and vessels must be prepared to leave immediately when the swell begins to make around the point to the anchorage.

On the west side of the neck back of Point Gore is a cove affording indifferent anchorage with easterly winds. The south point of the cove is the northwest end of Point Gore, and is a shelving ridge of bare rock, from the end of which rocks, bare at low water, and kelp extend about 200 yards northwestward. A rock covered at high water lies about 100 yards from the cliff at the southeast end of the cove, and a large kelp field extends about 200 yards northwestward from the rock. The anchorage is in 18 to 25 fathoms, soft bottom, 250 to 300 yards from the beach of the low neck and from the edge of the kelp off the rock, and about $\frac{1}{4}$ mile from the cliff on the southern side. The water deepens rapidly northwestward, the swinging room is scant, and the anchorage is uneasy.

To enter, round the south point of the cove at a distance of $\frac{1}{2}$ mile and steer 115° true (**E** mag.) for the gap in the trees, or lowest part of the neck.

PORT DICK,

on the west side of Point Gore, is about $2\frac{1}{2}$ miles wide at the entrance, and has a 357° true (**NNW** $\frac{1}{2}$ **W** mag.) direction to the glacier at its head. From the western side an arm extends westward about $6\frac{1}{2}$ miles. The port is not surveyed, and its delineation on the chart is taken from the sketches of the early navigators. The depths in the middle are over 100 fathoms until well toward the head of the western arm.

Sunday Harbor, on the east side, opposite the entrance of the western arm, is a small, double-headed bay, with anchorage for vessels of any size in its southeastern cove. The southern point at the entrance has a few rocks close-to, and a reef marked by kelp extends westward

from it. The western end of the reef is a very dangerous sunken rock, barely covered at low water, lying about $\frac{3}{8}$ mile 295° true (*W* mag.) from the point.

To enter *Sunday Harbor*, stand up the middle of the port on a 357° true (**NNW $\frac{1}{2}$ W** mag.) course, heading for the glacier at the head until off the entrance of the harbor. Enter the harbor on a 90° true (**NE by E $\frac{3}{4}$ E** mag.) course, with the head of the harbor ahead and a high wooded islet on the southern side of the western arm astern. Anchor with the southwest point at the entrance to Port Dick open from the southeast point of the harbor, in 12 to 15 fathoms. There are a number of high-water islets at the head of the harbor.

The arm of *Sunday Harbor* northwest of the anchorage has a large grass-covered rock in its entrance.

The west arm of Port Dick is about 1 mile wide at the entrance, and extends 295° true (*W* mag.) for $2\frac{1}{2}$ miles to the narrowest part of the arm, and then 291° true (*W $\frac{3}{8}$ S* mag.) about $3\frac{3}{4}$ miles, where there is anchorage in 13 to 15 fathoms below the rocky islet, with a few trees on top, which lies near the southern shore. The flat at the head extends below the houses on the north side, and vessels can not go above the islet. There is a cascade inside the islet.

There is a bare reef close to the south point at the entrance to the west arm, and a high wooded islet lies on the south side, about $\frac{3}{4}$ mile inside the entrance of the arm.

On the north side of the west arm is a bay with an island in it. Anchorage is reported in the bay eastward of the island.

The north arm of Port Dick is reported to be foul.

In the southwest approach to Port Dick there is a dangerous sunken rock, marked by a breaker at low water with a moderate sea, lying $7\frac{1}{2}$ miles 244° true (*SW $\frac{1}{2}$ S* mag.) from Point Gore and $8\frac{1}{2}$ miles 74° true (*NE $\frac{3}{8}$ E* mag.) from the southeast point of East Chugach Island. It lies about $\frac{3}{4}$ mile outside the line between these points and approximately $3\frac{1}{2}$ miles from shore. There is foul ground inside the rock and vessels should pass southward of it

CHUGACH ISLANDS

are three large, mountainous islands, named in order from eastward—East Chugach, Pearl, and Elizabeth islands, near the coast of Kenai Peninsula at the entrance of Cook Inlet.

East Chugach Island is about $3\frac{3}{4}$ miles long and mountainous, and has a low valley through the middle in a northeasterly and southwesterly direction. The south peak has an elevation of 1,450 feet, and the peak near the west end is higher. The southeast point of the island is a cliff with a peak at its crest and slightly lower land back of it before rising to the mountains. The northwest point of the island is a low wooded point or spit. There is considerable foul ground between the island and the coast, and this passage should be avoided by strangers in the absence of a survey. The passage between East Chugach and Pearl islands is clear so far as known, and is used by vessels passing inside of Pearl and Elizabeth islands.

Pearl Island is about $2\frac{1}{2}$ miles long and $1\frac{3}{4}$ miles wide. It is mountainous, with elevations up to 1,742 feet, but its northwest part is much lower. Its northwest point is a sand spit. High bare rocks extend $\frac{1}{2}$ to $\frac{3}{4}$ mile off the middle of the south side of the island.

Nagahut Rocks are three large, prominent, bare rocks, close together and connected at low water, lying $1\frac{1}{2}$ miles 247° true (*SW $\frac{1}{4}$ S* mag.) from the southwest end of Pearl Island, with foul ground and no safe passage between.

Dora Reef is a small patch of sunken rocks, on which the sea breaks at low water with a moderate sea, lying $1\frac{1}{4}$ miles 238° true (*SW by S* mag.) from Nagahut Rocks. It is steep-to.

There is deep water in the passage between Nagahut Rocks and Dora Reef on the southeast and Elizabeth Island on the northwest, but a depth of 6 fathoms was found $\frac{3}{8}$ mile eastward from the rock or islet close to the southeast end of Elizabeth Island, and no sounding was done closer to the island.

A reef, bare at low water, makes out about $\frac{5}{8}$ mile from the eastern side of the prominent point on the north shore between Pearl and Elizabeth islands. On the northeast part of the reef, about one-third the distance from the shore to its end, is a bare ledge that always shows above water. The outer rock that shows at low water lies about $\frac{7}{8}$ mile 130° true (*ESE $\frac{5}{8}$ E* mag.) from the point, and about $1\frac{1}{8}$ miles 333° true (*NW $\frac{5}{8}$ W* mag.) from the northwest end of Pearl Island. This is the worst danger in the passage inside of Pearl and Elizabeth islands.

Elizabeth Island is about 3 miles in diameter and is two mountain masses, with elevations up to 1,652 feet, and a low valley between them extending through in a northwesterly direction. The northeast point of the island is a sand spit awash at high water. There is a prominent, large, bare rock close to the north shore of Elizabeth Island about $\frac{3}{8}$ mile westward of the sand spit. Southward of the rock, kelp makes out about 350 yards from Elizabeth Island. **Cape Elizabeth** is the southwest end of the island.

The passage inside Pearl and Elizabeth islands is frequently used by the smaller vessels entering Cook Inlet from eastward. It is about 1 mile wide, and depths of 9 to 10 fathoms were found in the shoalest part of the channel between the southeast end of Elizabeth Island and the dangerous reef extending from the north shore.

There are strong **tidal currents** in the passage on either side of Elizabeth Island, and heavy tide rips occur from the northwest end of Pearl Island to the western end of the passage. The heaviest rips are in the vicinity of Pearl Island with an ebb current and easterly wind. Heavy rips also occur off the southeast point of East Chugach Island. The turn of the current occurs later, possibly as much as one hour, in the passage than in the main entrance south of Elizabeth Island.

SAILING DIRECTIONS FOR THE PASSAGE INSIDE PEARL AND ELIZABETH ISLANDS.

Pass $\frac{3}{4}$ to 1 mile off the southeast point of East Chugach Island, and steer 288° true (**W** $\frac{5}{8}$ **S** mag.) for $8\frac{1}{2}$ miles to a position 300 to not over 500 yards northward of the high north point of Pearl Island. Then steer the same course for 2 miles farther, heading for the first high peak on the south side of the large valley in Elizabeth Island.

When about $\frac{5}{8}$ mile from Elizabeth Island, and the southeast point of the island bears 213° true (**S** $\frac{3}{4}$ **W** mag.), steer 356° true (**NNW** $\frac{1}{2}$ **W** mag.) for 2 miles, with Nagahut Rocks astern and Chatham Island a little on the starboard bow, and follow the shore of Elizabeth Island at a distance of $\frac{3}{8}$ mile.

When the large bare rock close to the north shore of Elizabeth Island is abeam, and is closed with the north shore of Elizabeth Island westward of it, steer 284° true (**W** by **S** mag.) for $4\frac{1}{2}$ miles, with the middle one of the three highest peaks on the eastern shore astern, and pass $\frac{3}{8}$ mile northward of the rock and over 1 mile southward of the yellow bluff on the east side at the entrance to Koyuktolik Bay.

Then steer 307° true (**WNW** $\frac{7}{8}$ **W** mag.) for $3\frac{1}{2}$ miles, with the sharp southwest peak of Pearl Island showing over the middle of the low valley in Elizabeth Island astern, to a position $1\frac{1}{2}$ miles 249° true (**SW** mag.) of Point Adam.

PORT CHATHAM

lies northward of Elizabeth Island, and has a 25° true (**N** mag.) direction for 2 miles, narrowing from about 2 miles to $\frac{1}{2}$ mile. It then turns to about 115° true (**E** mag.) for $1\frac{1}{2}$ miles with a width of $\frac{3}{8}$ to $\frac{1}{2}$ mile. It is a secure harbor for vessels of any size and easily entered in the daytime with clear weather. During heavy gales some williwaws are felt at the anchorage, but they are not dangerous. Southward of Chatham Island the shores are foul, but northward of it the main part of the harbor is clear. The dangers are marked by kelp with the water below half tide. The mountains on either side of the harbor and approach rise abruptly from the water and are wooded about halfway to the summits.

Claim Point, on the west side at the entrance, is a wooded hill 220 feet high, with a low wooded neck back of it. Bare rocks and kelp extend about 400 yards off the southeast side of the point. The bay between Claim Point and Kelp Point has considerable foul ground, and has not been sounded.

Kelp Point is on the west side $\frac{1}{2}$ mile northeastward from Claim Point. A bare rock lies 250 yards southeastward from Kelp Point, and kelp extends $\frac{1}{4}$ mile eastward from the rock toward Chatham Island. Care should be taken to avoid it at high water when the kelp does not show.

Chatham Island, small, low, rocky, and partly wooded, lies in the middle of the port about $1\frac{1}{4}$ miles inside the entrance. The channel is west of the island, and the only danger is a rock with 7 feet over it and marked by kelp, except near high water, nearly in the middle

354° true (*NNW* $\frac{3}{4}$ *W* mag.) from the island. There is deep water on either side of the rock. A depth of 5 fathoms, with a possibility of less, was found 250 yards 230° true (*SSW* $\frac{1}{4}$ *W* mag.) from the western end of Chatham Island.

The passage east of Chatham Island is foul and should not be attempted by strangers. A rock, with 13 feet over it and marked by kelp, lies $\frac{3}{8}$ mile from the eastern shore and over $\frac{5}{8}$ mile 165° true (*SE* $\frac{1}{2}$ *S* mag.) from the western end of Chatham Island.

On the east side, $\frac{5}{8}$ mile 53° true (*NNE* $\frac{1}{2}$ *E* mag.) from Chatham Island, is a projecting, rocky, wooded point where the port changes direction. The opposite side, northeastward from this point, is a low, grassy spit, wooded near its eastern end. The best anchorage is in the broad part of the harbor $\frac{1}{4}$ to $\frac{1}{2}$ mile eastward of this spit, in 10 to 13 fathoms, soft bottom. At the eastern end of the harbor are some rocks showing but little above high water. On the south shore, 188° true (*S* by *E* $\frac{1}{2}$ *E* mag.) from these rocks, fresh water can be conveniently obtained by boats, which can be placed under a waterfall at the higher stages of the tide.

Tides.—High and low water occur about the same time as at Kodiak, and the mean rise and fall of the tides is 12.1 feet. To find the height of the tide at Port Chatham, multiply the height of the corresponding tide at Kodiak by the ratio of ranges, 1.75. The tidal currents have little velocity in the entrance and harbor, but in the approach on either side of Elizabeth Island there are strong tidal currents, and at times heavy tide rips.

SAILING DIRECTIONS, PORT CHATHAM.

From eastward.—Follow the directions for passing inside Pearl and Elizabeth islands preceding, until up with Elizabeth Island, and then steer 356° true (*NNW* $\frac{1}{2}$ *W* mag.) with Nagahut Rocks astern and Chatham Island a little on the starboard bow. Pass 400 to 500 yards southward of Chatham Island and steer 47° true (*NNE* mag.), passing 150 to 200 yards westward of the island. When inside the prominent point $\frac{5}{8}$ mile above it, steer about 109° true (*E* $\frac{1}{2}$ *N* mag.) in mid-channel for $\frac{3}{4}$ mile to the anchorage.

From westward.—Reverse the directions for passing inside Pearl and Elizabeth islands, page 36, until approaching Elizabeth Island, or enter about midway between Elizabeth Island and the shore northwestward. Then steer about 47° true (*NNE* mag.) with the hummock at the southwest end of Elizabeth Island astern and Chatham Island a very little on the starboard bow. Pass 150 to 200 yards westward of Chatham Island and steer 47° true (*NNE* mag.). When inside the prominent point $\frac{5}{8}$ mile above the island, steer about 109° true (*E* $\frac{1}{2}$ *N* mag.) in mid-channel for $\frac{3}{4}$ mile to the anchorage.

COAST FROM PORT CHATHAM TO SELDOVIA.

Koyuktolik Bay, about 3 miles westward of Port Chatham, is not surveyed. Its southeast point is a bare cliff to the summit of a high hill, and just southward of it is a low, yellow bluff. A reef makes off possibly $\frac{3}{8}$ mile from the yellow bluff, and it should be given a good berth.

Point Adam, 6 $\frac{1}{2}$ miles 336° true (*NW* $\frac{3}{8}$ *W* mag.) from Cape Elizabeth, is low at the end, and rises in a steep grassy slope to mountains.

Magnet Rock lies 4 $\frac{1}{4}$ miles 345° true (*NW* $\frac{3}{8}$ *N* mag.) from Point Adam and about $\frac{3}{8}$ mile from the coast in the vicinity of Point Bede. It is small, black, and prominent.

Flat Islet, 1 $\frac{1}{8}$ miles 13° true (*N* by *W* mag.) from Magnet Rock, is small, flat, grass-covered, and about 50 feet high, and is two closely connected islands joined by bare reefs.

Port Graham is described below.

There is a prominent, flat-topped, grassy point, with rocky sides and about 80 feet high, 6 $\frac{1}{4}$ miles northward of Flat Islet and 1 $\frac{1}{2}$ miles northward of Dangerous Cape. Its end is detached. At this point the coast changes direction northeastward for about 7 miles to Seldovia Bay.

PORT GRAHAM,

on the east side of Cook Inlet, 4 miles northward of Flat Island, is a secure harbor inside Passage Island, and with care is easily entered in the daytime. It is a port of call for some steamers, and passengers and cargo for Cook Inlet are here transferred to small steamers running up the inlet. Its entrance, between Russian Point and Dangerous Cape, is about 2 miles wide, and has

extensive outlying reefs, covered at various stages of the tide. The dangers are generally steep-to and are marked by kelp in summer and fall.

Russian Point, on the south side of the entrance, lies about $2\frac{3}{4}$ miles northeastward of Flat Island. **Alexandrovsk**, a small Indian village with a Greek church, is on the northeast side of English Bay, 300 to 400 yards southeastward of the point.

English Bay, the open bight south of Russian Point, is not surveyed and should be avoided by strangers. A reef, bare at low water, lies about $\frac{3}{4}$ mile off the bay and 1 mile 266° true (*SW by W $\frac{1}{2}$ W mag.*) from Russian Point. Foul ground also extends nearly $\frac{1}{2}$ mile westward of Russian Point.

A reef bare at low water extends 600 yards northward from Russian Point. Between this reef and that extending $\frac{7}{8}$ mile southwestward from Passage Island is a channel 250 yards wide, with depths of 6 to 8 fathoms, leading into Port Graham southward of Passage Island. A small reef, with 7 feet over it, lies $\frac{5}{8}$ mile inside Russian Point and 400 yards from the southern shore; the channel is northward of it.

Dangerous Cape, on the north side at the entrance, lies 5 miles northward of Flat Island. A reef, not fully developed, extends about $\frac{3}{4}$ mile westward from the western side of the cape; there are two rocks bare at low water, and a rock with 7 feet over it lies nearly $\frac{1}{2}$ mile from shore.

A reef, with bare rocks and some that cover, extends 650 yards southward from Dangerous Cape.

Bird Reef, 250 yards long, lies $\frac{1}{2}$ to $\frac{5}{8}$ mile southward from Dangerous Cape. The highest rock at the north end of the reef is covered at extreme high tide.

Midway between this reef and Passage Island and $\frac{1}{2}$ mile from the north shore is a small shoal with $2\frac{1}{2}$ fathoms and kelp. Vessels should pass southward of it, as another shoal with kelp makes out 650 yards from the shore inside it.

Passage Island, 1 mile inside the entrance, is 140 feet high and wooded. It is generally fringed with reefs to a distance of 150 yards, and a shelving spit, covered at high water, extends 350 yards eastward from its eastern end. A reef, with numerous rocks, bare and covered at various stages of the tide, extends $\frac{7}{8}$ mile 255° true (*S W $\frac{1}{2}$ W mag.*) from the western end of the island. The northern end of the island is marked by a fixed white light.

A rock, bare at low water, lies 250 yards 274° true (*WS W $\frac{1}{4}$ W mag.*) from the point on the north shore northeastward of Passage Island. This is the worst danger in the entrance north of the island. The channel has a width of 300 yards between the rock and the reef fringing Passage Island.

Above Passage Island the port is $4\frac{1}{2}$ miles long and $\frac{1}{2}$ to $\frac{3}{4}$ mile wide, with depths of 10 to 17 fathoms. The shores are generally fringed with kelp to a distance of 200 yards. The only serious danger is a narrow, sunken reef with kelp which extends halfway across the port from the northern shore $\frac{5}{8}$ mile above Passage Island, and is marked at its southern end by a buoy (can, black, No. 1). There are small streams on the shores of the port and a large stream and valley at its head.

The **wharf** is on the south side $1\frac{7}{8}$ miles above Passage Island. There is a depth of 18 feet at its end. Water can be obtained through pipe and hose, and small quantities of coal are generally kept on hand. There is a small store.

Anchorage.—Temporary anchorage for a small vessel can be selected in the middle of Coal Cove, inside Dangerous Cape, in 5 to 10 fathoms, rocky bottom; the shore of the cove is fringed with kelp to a distance of 350 yards. A better anchorage with more room will be found in the bight on the north shore northward of Passage Island in 7 to 10 fathoms; a shoal extends 400 yards from the northeast end of the bight, and kelp extends 250 yards from its north shore. These anchorages are exposed to a heavy swell in southerly or westerly weather.

When inside Passage Island anchorage can be had in any part of the port, the depths being 17 to 10 fathoms. One of the best is northward or northeastward of the wharf, in 10 to 13 fathoms, sticky bottom. The cove southeastward of the wharf is shoal. An equally good anchorage is in the middle 1 mile above the wharf, in 9 to 10 fathoms; above this anchorage the port narrows to $\frac{3}{8}$ mile, and is then shoal to the head, a distance of $1\frac{1}{4}$ miles.

Tides.—High and low water occur about 18 minutes later than at Kodiak, and the mean rise and fall of the tides is 14.4 feet. To find the height of the tide, multiply the height of the corresponding tide at Kodiak by the ratio of ranges, 2.1.

Strong tidal currents, both ebb and flood, set across the mouth of the harbor, but there is little current at or inside of Passage Island. With opposing wind and current heavy tide rips occur off and well northward and southward of the entrance to Port Graham.

SAILING DIRECTIONS, PORT GRAHAM.

The safest time to enter the port is at low water, and the better entrance is north of Passage Island. The channel south of Passage Island should not be used by strangers.

From southward, pass 1 to $1\frac{1}{2}$ miles westward of Flat Island and steer for the prominent coast point northward of Port Graham, course about 41° true (**N** by **E** $\frac{1}{2}$ **E** mag.). When the village of Alexandrovsk is abeam, head in with Passage Island a little on the starboard bow, course about 92° true (**ENE** mag.), and pass about 300 yards northwestward of the light on the north end of the island.

Pass 200 to not over 300 yards northeastward of the light on the north end of Passage Island and steer 129° true (**ESE** $\frac{3}{4}$ **E** mag.), passing midway between the east end of the island and the point on the north shore. Continue the course 300 yards past the island, and then steer 157° true (**SE** $\frac{1}{4}$ **E** mag.), with the point on the north shore astern, and pass westward and southward of black can buoy No. 1. Then keep in mid-channel. A flat extends $1\frac{1}{4}$ miles from the head of the port, and the cove in the south shore southeastward of the wharf is shoal.

From northward.—Follow the shore northward of the port on a 210° true (**S** $\frac{1}{2}$ **W** mag.) course, and pass ove. 1 mile westward of Dangerous Cape. Then steer for the village of Alexandrovsk, course about 168° true (**SE** $\frac{3}{4}$ **S** mag.), and when Bird Reef is about $\frac{1}{2}$ mile on the port beam steer for the summit of Passage Island, course about 120° true (**E** $\frac{1}{2}$ **S** mag.). When the point on the north shore northeastward of Passage Island bears 103° true (**E** by **N** mag.) steer for it and pass about 300 yards northwestward of the light on the north end of Passage Island. Then follow the directions in the preceding paragraph.

SELDOVIA BAY,

on the southeast side of Kachemak Bay, eastern shore of Cook Inlet, is a secure harbor in any weather. It extends 2 miles in a 176° true (**SSE** $\frac{1}{2}$ **E** mag.) direction to Powder Island, with a width of $\frac{1}{2}$ to $\frac{3}{4}$ mile, and then turns to 147° true (**SE** by **E** mag.) for 2 miles. The head of the bay is shoal down to $\frac{1}{2}$ mile southeastward of Powder Island.

From the entrance until nearly up with the wharf, shoals with 10 to 12 feet in places on their eastern part extend halfway across the harbor from the western shore. The channel is between the shoal and several rocks and kelp patches near the eastern shore, and varies in width from 150 to 400 yards. The channel has a depth of 18 feet or more at low water, with a rise and fall of tides of 16 to 24 feet. The principal danger in the entrance is sometimes marked by a black spar buoy, and if this buoy is in place vessels will have no difficulty in entering in the daytime. If the buoy be missing, strangers should either mark the rock or wait for low water, when it shows above water. The shoals and rocks are marked by kelp at slack water in summer and fall, but it is run under during the strength of the tidal currents.

Point Naskowhak, the western point at the entrance, is the northwest one of two small, high, rocky, wooded knobs which stand on a low, grassy spit surrounding a lagoon. A reef extends nearly $\frac{1}{4}$ mile northward from the point, and broken ground, marked by kelp, with 26 feet at its end, extends nearly $\frac{1}{2}$ mile 41° true (**N** by **E** $\frac{1}{2}$ **E** mag.) from it. Two kelp patches, in which the least depth found is 18 feet, lie 600 to 700 yards northeastward from the point.

Gray Cliff, the eastern point at the entrance, is a bare rock cliff 60 to 70 feet high. **Seldovia Point**, lying 1 mile northward of Gray Cliff, is a cliff 200 feet high, wooded on top.

On the eastern side of the harbor, nearly $\frac{1}{4}$ mile southward of Gray Cliff, is a prominent high, reddish bluff, which is a good mark.

A rock, bare 4 feet at low water, lies 300 yards southwestward from the red bluff, with foul ground between. This rock is steep-to on its western side, and is the principal danger in the harbor. It is generally marked close to its western side by a black spar buoy.

A high, pointed rock with some dead brush on top lies near the eastern shore about midway between the rock and Watch Point.

Watch Point, on the eastern shore, $\frac{3}{8}$ mile southward of the red bluff, is a small, grassy head, about 30 feet high, with a few trees, and a short, low, grassy neck behind it.

A rock, with 15 feet over it and marked by kelp, lies 150 yards 210° true (*S* $\frac{1}{2}$ *W* mag.) from Watch Point. The channel is westward of the rock.

Seldovia is a village and post-office, with several stores, small hotels, and a Greek church, on the eastern side of the harbor, $\frac{1}{4}$ mile southeastward of Watch Point. The village has a few white men and about 100 Indians. A shoal, partly bare at low water, extends 200 yards southwestward from the point at the village, and the cove southeastward of it is nearly dry at a good low water. The southwest side of the cove is formed by a grassy head with a few trees about 75 feet high, which at its southeast end, at the inner end of the wharf, is joined to the shore by a low, narrow spit.

The wharf is on the eastern side of the harbor, $\frac{5}{8}$ mile southward of Watch Point. It has a depth of about 11 feet at its end. Water can be obtained through pipe and hose. There is a red warehouse on the wharf, which shows, when approaching the harbor from southwestward, over the low spit westward of the entrance. When in the harbor the wharf is hidden until nearly up with it by the grassy head northwestward.

The best anchorage in the harbor is in the middle, about $\frac{3}{8}$ mile 238° true (*S* *W* by *S* mag.) from the wharf, in 9 to 10 fathoms, sticky bottom. A small vessel can anchor in the channel off the village, with the high, red bluff open westward from Watch Point, and the Greek church bearing 86° true (*NE* by *E* $\frac{1}{2}$ *E* mag.), in 5 fathoms.

Tides.—High and low water occur 27 minutes later than at Kodiak. To find the height of the tide, multiply the height of the corresponding tide at Kodiak by the ratio of ranges, 2.23. The tidal currents have an estimated velocity of 1 to 2 miles at strength.

SAILING DIRECTIONS, SELDOVIA BAY.

Steer for the north end of Gray Cliff on a 137° true (**ESE** mag.) course until Point Nasko-whak is abeam. Then steer for Watch Point on a 170° true (**SE** by **S** mag.) course, and pass about 300 yards westward of Gray Cliff and about 50 yards westward of the rock bare at low water (and black spar buoy). When about 350 yards from Watch Point, and the high, pointed rock near the eastern shore is forward of the beam, steer 193° true (**S** by **E** mag.) and pass 125 to 150 yards westward of Watch Point. When about 200 yards past the point and the graveyard on the eastern shore is abaft the beam, steer 176° true (**SSE** $\frac{1}{2}$ **E** mag.) and pass 200 yards off the point northwestward of the wharf. In going to the wharf, give the shore northwestward of it a berth of 100 yards.

BARREN ISLANDS

are six, mountainous, grass-covered islands nearly in the middle of the entrance to Cook Inlet between Chugach Islands and Shuyak Island, and are about 13 miles long and 5 miles wide. The best anchorages are Amatuli Cove and the northern bight in the western end of Ushagat Island. Some sounding has been done, and the dangers so far as known are mentioned.

The **tidal currents** have great velocity among and outside the islands, the flood current setting northwestward and being apparently stronger than the ebb. Heavy tide rips occur with strong winds in the vicinity of the islands, and during spring tides are frequently dangerous for small vessels.

East Amatuli Island, at the eastern end of the group, is about 2 miles long and has a high peak at either end joined by a sharp ridge, which at the head of Amatuli Cove is about 300 feet high. A rocky islet about 100 feet high lies 250 yards off its eastern end.

Amatuli Cove, on the northwest side of East Amatuli Island, is about $\frac{1}{2}$ mile in diameter and a good anchorage for vessels of moderate size. With heavy northeast winds, considerable sea makes in to the anchorage unless well in the bight, but the wind is little felt. The anchorage is in the middle, abreast or inside the north point of the cove, in 6 to 11 fathoms, mud and rock bottom. Scattered kelp grows in places in the cove, and along the shores there is thick kelp, which makes out farthest on the southeast side. There are no known dangers outside the thick kelp. There is a stream at the head of the cove.

Approaching from southward pass about $\frac{1}{2}$ mile westward of Sugarloaf Island and in mid-channel between East and West Amatuli islands, course about 38° true (**N** by **E** $\frac{1}{4}$ **E** mag.). The least depth found was 7 fathoms when the southwest peak of East Amatuli bore about 103° true (*E* by *N* mag.).

Approaching Amatuli Cove from northward pass in mid-channel between East Amatuli Island and the bare rocks (about 20 feet high) lying $\frac{5}{8}$ mile eastward from the northeast end of West Amatuli Island. The least depth found in this entrance was about 12 fathoms.

West Amatuli Island, about $\frac{3}{4}$ mile westward of East Amatuli and $2\frac{1}{2}$ miles eastward of Ushagat, is about 3 miles long 35° true (*N* by *E* mag.) and mountainous. A cluster of rocks about 20 feet high lies about $\frac{5}{8}$ mile eastward from the northeast end of the island, with a reef between. A bare rock lies close to the northwest point of West Amatuli, and a dangerous rock, awash at low water and on which the sea generally breaks, lies about $1\frac{1}{4}$ miles 348° true (*NW* $\frac{3}{4}$ *N* mag.) from the same point and $3\frac{1}{4}$ miles 88° true (*NE* by *E* $\frac{5}{8}$ *E* mag.) from the summit of Nord Island.

Sugarloaf Island, $1\frac{1}{8}$ miles southward of East Amatuli Island, is about $\frac{3}{4}$ mile in diameter and 1,000 feet high. A large bare rock lies $\frac{3}{8}$ mile southeastward of it, with foul ground and breakers between. There is also a rocky islet close to its eastern end, and breakers extend nearly $\frac{1}{4}$ mile off its western end.

Nord Island, $1\frac{1}{4}$ miles northward from the eastern end of Ushagat, with deep water between, is about $\frac{1}{2}$ mile in diameter. Its southern half is a dome 570 feet high, while its northern half is lower and irregular.

Sud Island, $1\frac{1}{8}$ miles off the southeast end of Ushagat, is $1\frac{1}{8}$ miles long and about 1,200 feet high near its southwestern end. Near its northeastern end is a knob over 300 feet high.

A small rocky island over 200 feet high lies $1\frac{1}{2}$ miles southeastward from the south end of Ushagat. A low rock and breakers lie 600 yards, and two large bare rocks lie $\frac{3}{4}$ mile southward from it.

Ushagat Island, the westernmost and largest of the Barren Islands, is $6\frac{3}{4}$ miles long 73° true (*NE* $\frac{3}{8}$ *E* mag.) and $3\frac{1}{2}$ miles wide near its western end. It is practically inaccessible except at the low neck near the northeast end and at several beaches fronting the valley in its northwest part. The southern part of the island is high, rocky peaks, with elevations up to 1,935 feet. Table Mountain, at the northeast end, is 1,350 feet high, and is separated from the other high land of the island by a low, narrow neck. There are several fresh-water lakes.

Two rocks, nearly awash at high water, lie $\frac{3}{8}$ mile northward from the northwest end of Ushagat.

A bare rock about 5 feet high lies $\frac{7}{8}$ mile 250° true (*SW* $\frac{1}{8}$ *W* mag.) from the northwest end of Ushagat. A reef awash at half tide lies 250 yards northwestward from the bare rock. A bare reef, nearly awash at high water, lies $\frac{1}{2}$ mile 110° true (*E* $\frac{3}{8}$ *N* mag.) from the bare rock and $\frac{3}{8}$ mile 260° true (*SW* by *W* mag.) from the high bare rocks close to a point of Ushagat $\frac{3}{8}$ mile southeastward of its northwest end.

The west side of Ushagat Island is indented about 1 mile by an open bay, about $2\frac{1}{2}$ miles long, and having two bights. A good anchorage for all easterly winds may be had in the bight at the north end of the bay. *To enter from westward*, give the northwest end of the island a berth of 1 mile and pass about $\frac{1}{2}$ mile westward and southward of the bare rock lying $\frac{7}{8}$ mile 250° true (*SW* $\frac{1}{8}$ *W* mag.) from the northwest end. Then steer 92° true (**ENE** mag.) for Table Mountain and anchor about $\frac{3}{8}$ mile from shore in 6 to 8 fathoms, hard bottom. Kelp extends some distance off the point dividing the bights on the east side of the bay.

Bare rocks extend $\frac{3}{8}$ mile southwestward from the southwest end of Ushagat Island.

COOK INLET.

The triangulation has been extended up the inlet, and the greater part of both shores are surveyed from East and West Forelands northward to Point Possession and the lower part of Knik Arm. Port Graham and Seldovia and Iliamna bays are surveyed, and otherwise no hydrography has been done except on a few reconnaissance lines. The following information is derived principally from reports and surveys by parties on the Coast and Geodetic Survey steamer *McArthur* to 1909.

Prominent features.—The shore on both sides of the inlet can be seen in clear weather, but it is sometimes difficult to locate the position on account of the lack of marked features on the eastern shore and the currents are so strong that logged distances are deceptive. Mount Augustine and Iliamna and Redoubt volcanoes are conspicuous and useful marks in the lower inlet, and Susitna Mountain in the upper inlet. The high land southward of Kachemak Bay and northward from Kamishak Bay, Anchor Point, Chisik Island, Kalgin Island, East, West, and North Forelands, Point Possession, and Fire Island are prominent in their respective localities.

Channels.—The better and more direct channel, eastward of Kalgin Island, is practically the only one used, and on mid-channel courses so far as known a depth of at least 10 fathoms may be carried nearly to East Foreland.

The channel westward of Kalgin Island is divided by the shoal lying about 2½ miles off the western side of the island. Vessels can pass on either side of the shoal, but the channel westward of it is wider and easier to follow.

From East and West Forelands to North Foreland there are two channels, separated by a long shoal near the middle of the inlet. Either channel may be used, but the eastern one is more direct. From North Foreland to the entrances of Turnagain and Knik arms the channel is practically in the middle of the inlet. A depth of 6 fathoms or more can be carried to Fire Island.

Pilots.—There are no regular pilots, but some one familiar with the usual courses followed to the head of the inlet by vessels of moderate draft can generally be secured for such service at Port Graham or Seldovia. The Indians on the inlet do not act as pilots.

Dangers.—The shores of Cook Inlet northward from Kachemak and Iliamna bays are fringed almost continuously with bowlder reefs, shoals, or mud banks. The farthest outlying dangers are Augustine Rocks, the bank off the western shore between Chinitna Bay and Tuxedni Harbor, the shoals around Kalgin Island, the banks off Ninilchik, Kasilof, and Kenai, the middle ground above East and West Forelands, and the banks fringing the shores in the upper inlet. These dangers, so far as known, are described with the shores of the inlet.

With an average tidal current there are swirls throughout the inlet, but they do not necessarily indicate dangers as they show in depths of 15 fathoms if the bottom is uneven. Heavy swirls with slight overfalls should be avoided, and any disturbance which has a recognized wake in the water should be considered as indicating a dangerous rock or shoal.

The waters of the inlet are much discolored by glacial silt. At low water the discoloration may extend to the mouth of the inlet, and at high tide the water may be comparatively clear to East and West Forelands or even above. Frequently with either a flood or ebb current the water above the Forelands appears as a liquid mud.

Harbors and anchorages.—Port Graham, Seldovia Bay, Kachemak Bay inside Homer Spit, Iniskin Bay, Tuxedni Harbor, and Knik Arm are the secure harbors in the inlet, and the anchorage at East Foreland (Nikishka) is sheltered from all but northwesterly winds. Anchorage with good weather or offshore winds can be had at other places, some of which are mentioned in the detailed description of the shores of the inlet. On account of the great range of the tides, the stage of the tide must always be kept in mind when anchoring to insure a depth sufficient to lie afloat and have swinging room at low water.

Settlements and supplies.—Port Graham is the transfer point for practically all passengers and cargo going up Cook Inlet. There are stores or trading stations at Seldovia, Beluga, Susitna, Knik, Hope, and Sunrise.

Water is piped to the wharf at Port Graham and Seldovia, but up the inlet is difficult to obtain and is accessible only at high water. The streams at East Foreland (Nikishka), the north side of Point Possession, and in Knik Arm are the only ones known where a vessel can approach the shore closely enough to permit boating water in any quantity.

Weather.—The prevailing winds during the summer are easterly with rain, the gales during that time being from the same direction. In the late summer and early fall, fresh southwesterly winds with clear but hazy weather are of frequent occurrence in the lower inlet, but they seldom blow with much force above the Forelands. Fresh northwesterly winds are apt to occur at any time during the early summer; they are generally accompanied by rain and

last from one to two days. At such times navigation in the inlet, except southward with an ebb tide, is uncomfortable and even dangerous for small vessels.

Easterly gales become more frequent in the fall, and southeast gales may also be expected in and following September. Snowstorms may be expected from the first of October to the last of April.

Fog may be expected occasionally during the summer. Its duration without partially clearing is generally short, although spells of generally foggy weather may last several days.

Ice.—The upper part of the inlet is generally closed to navigation by ice from November to the latter part of April. Ice does not generally interfere with navigation southward of Anchor Point, except on the western side of the inlet where large fields of it are sometimes carried by wind and tide as far as Augustine Island, closing Iliamna Bay for brief periods.

Tides.—The time of high and low water later than the time of the corresponding tide at Kodiak, the mean range of the tides, and the ratio of ranges to the range at Kodiak for places in Cook Inlet is given in the following table. To find the height of the tide, multiply the height of the corresponding predicted tide for that day at Kodiak by the ratio of ranges for the other place.

	Tide later than at Kodiak.		Mean range.	Ratio of ranges to range at Kodiak.
	High water.	Low water.		
	<i>h. m.</i>	<i>h. m.</i>	<i>feet.</i>	
Port Graham.....	0 19	0 17	14.4	2.09
Seldovia.....	0 27	0 27	15.4	2.23
Iliamna Bay.....	0 39	0 41	12.3	1.78
Kalgin Island.....	2 20	2 21	16.2	2.35
East Foreland.....	3 18	3 32	18.0	2.61
Fire Island.....	4 54	5 18	22.9	3.32
Knik Harbor.....	5 23	5 42	32.0	4.64

Tidal currents.—At the entrance of Cook Inlet the tidal currents have an estimated average velocity of 2 to 3 miles at strength, and in general the velocities increase up the inlet, with maximum velocities in the vicinity of Harriet Point, East and West Forelands, and the entrances to Knik and Turnagain arms. The maximum current velocity measured by the *McArthur* was 5 miles at anchorages near East and West Forelands, Tyonek and Point Mackenzie. These anchorages were out of the full strength of the current, and there is little doubt that the maximum velocity of the current at the strength of a large tide is as much as 8 miles between East and West Forelands, and probably more between Harriet Point and the south end of Kalgin Island.

From Anchor Point to East and West Forelands the flood current runs after the time of high water by the shore, the period of such overrun increasing toward the Forelands, where it amounts to as much as 2 hours at times. North of the Forelands observations show that the currents inshore change at about the time of high and low waters by the shore, but the currents in mid-stream overrun both high and low waters.

Off Kasilof the flood and ebb currents have an estimated average velocity of 3 miles at strength and $3\frac{1}{2}$ miles with the large tides. With the large tides the flood current runs $1\frac{1}{2}$ hours after high water by the shore, and with the small tides 2 hours.

At Nikishka anchorage, just inside East Foreland, the current inshore generally begins to run ebb while the current is still running flood in mid-stream, the difference of time being 1 to $1\frac{1}{2}$ hours.

At Knik Harbor, in Knik Arm, the tidal currents change practically at the time of high and low waters by the shore.

SAILING DIRECTIONS, COOK INLET.

The tidal currents have great velocity in Cook Inlet and must be considered at all times. The small local steam vessels plan their trips so as to have a favorable current, and prefer to anchor rather than steam against a current of a large tide.

A vessel with a speed of 8 miles picking up a flood current of a large tide a little northward of Anchor Point can carry it to Fire Island.

Flat Island to East Foreland.—From a position 2 miles westward of Flat Island make good an 8° true (N by W $\frac{1}{2}$ W mag.) course for $45\frac{1}{2}$ miles to a position $6\frac{1}{2}$ miles from the eastern shore with Ninilchik church or village bearing 115° true (E mag.). Then make good a 17° true (N $\frac{3}{4}$ W mag.) course for 40 miles to a position $1\frac{1}{2}$ miles westward of East Foreland.

The first course should lead 2 miles westward of Anchor Point when 27 miles from Flat Island. The flood current will generally set fair with the course except near Anchor Point, where a slight westerly set is sometimes felt. The wooded hill on the south end of Kalgin Island can be seen about 23 miles, and will be raised a little before Ninilchik village bears abeam.

On the 17° true (N $\frac{3}{4}$ W mag.) course, the northeast end of Kalgin Island will be passed at a distance of $6\frac{1}{4}$ miles. Abreast and northward of Kalgin Island, a slight easterly set will be experienced with a flood current; but on approaching East Foreland, a westerly set prevails and it is quite strong at times when abreast the point.

East Foreland to Knik Arm.—These directions lead in a depth of over 6 fathoms to Fire Island.

From a position $1\frac{1}{2}$ miles westward of East Foreland make good a 28° true (N $\frac{1}{8}$ E mag.) course for 25 miles and pass $1\frac{1}{2}$ miles off the western shore above North Foreland until abreast the village of Ladd. On this course with a flood current it will be necessary to allow from $\frac{1}{4}$ to $\frac{3}{4}$ of a point for easterly set, and possibly more after passing the shoal in the middle of the inlet until up with North Foreland; considerably less allowance will be required for the westerly set of the ebb current.

From a position 2 miles off the village of Ladd, make good an 80° true (NE $\frac{3}{4}$ E mag.) course with the old warehouse at Ladd astern; with a flood current steer 86° true (NE by E $\frac{1}{4}$ E mag.) to make the course good. The northern end of Fire Island should be made ahead, bearing 80° true (NE $\frac{3}{4}$ E mag.). When from 3 to 7 miles westward from Fire Island, the course should lead $1\frac{1}{2}$ miles southward of the low-water edge of the flat making off between Susitna and Little Susitna rivers. Having made good the course for about 20 miles, Fire Island should be about 3 miles distant, and its southwest end should bear 139° true (ESE mag.).

Then steer 67° true (NE $\frac{1}{2}$ N mag.) for Point Mackenzie and pass 1 to $1\frac{1}{2}$ miles off the northwest side of Fire Island. Make good this course for about 9 miles until Point Woronzof bears a little forward of the beam, and then proceed in mid-channel up Knik Arm. When about 2 miles northward of Fire Island, the course leads over a bar or shoal on the crest of which depths of 16 and 21 feet were obtained, and until the hydrography is completed vessels of a greater draft than 15 feet should wait for half flood before crossing.

Chisik Island to West Foreland.—The following courses, passing westward of Kalgin Island, were run several times by the *McArthur* carrying a marine sentry kite at various depths. It is believed that there is nowhere on the courses a less depth than 10 fathoms, except on the course passing southeastward of West Foreland, where depths of 7 or 8 fathoms may be found.

From a position 1 mile eastward from the southeast end of Chisik Island steer 31° true (N $\frac{1}{2}$ E mag.), heading a little westward of the middle of the passage between the southern end of Kalgin Island and Harriet Point. When 3 miles from the point haul eastward a little and pass about midway between Harriet Point and Kalgin Island.

When Harriet Point bears 284° true (W by S mag.) distant about $2\frac{1}{4}$ miles, steer 351° true (NW by N mag.) for about 4 miles until Harriet Point is in range with the high shore southward of Tuxedni Harbor. Then steer 37° true (N by E mag.) for 8 miles, with the summit at the northwest end of Chisik Island astern and showing over the land about $\frac{5}{8}$ mile inside of Harriet Point, and pass midway between the northern end of Kalgin Island and the low point on the western shore opposite.

When the northern side of Kalgin Island is open, and its northeast point bears 127° true (E by S mag.), steer 31° true (N $\frac{1}{2}$ E mag.) for $6\frac{1}{4}$ miles until a conspicuous dark wooded hill about 4 miles inland bears 284° true (W by S mag.). Then steer 70° true (NE mag.), heading $1\frac{1}{2}$ miles outside of West Foreland and with Redoubt Volcano astern. Hold this course about 9 miles until well clear of West Foreland. Care should be taken not to approach the shore closer than 3 miles when off the middle of the bight westward of West Foreland.

The flood current sets fair with all the courses except abreast the upper end of Chisik Island, where there is some westerly set, and on the 351° true (NW by N mag.) course passing Harriet Point, where it sets more northward.

West Foreland to North Foreland.—Round West Foreland giving it a berth of $1\frac{1}{2}$ miles, and steer 26° true (N mag.) with the high-water mark of West Foreland astern and heading just westward of the western end of a gray bluff on the shore ahead. Keep on this line until the shore ahead is 3 or 4 miles distant, and then haul eastward gradually and pass about 2 miles off the gray bluff. Then steer 58° true (NNE $\frac{3}{4}$ E mag.), which will lead 1 mile southeastward of North Foreland.

EASTERN SHORE OF COOK INLET.

The eastern shore at the entrance of Cook Inlet is mountainous, with steep slopes from the water to elevations of 2,000 to 3,000 feet in the vicinity of Cape Elizabeth. The mountains trend northeastward between Kachemak Bay and the sea, and then extend across to the head of Turnagain Arm. The greatest elevations occur about halfway up Kenai Peninsula, where many of the peaks are covered with perpetual snow.

From Kachemak Bay to Turnagain Arm the eastern side of the inlet is comparatively low, the country for some miles back being a rolling timbered plateau. The shore is a line of bluffs, with general elevations from 50 to 200 feet, in which there are occasional breaks where rivers enter the inlet.

Kachemak Bay is not surveyed. There is deep water near Homer Spit and on the southeastern side of the bay, while flats make out from its entire northern shore, possibly as much as 2 miles in places, and fully 3 miles from its head. **Homer Spit**, a low spit of sand and gravel, extends 4 miles from the northern shore. **Homer** is a practically deserted village on the end of the spit. There is good anchorage in Kachemak Bay inside of and near Homer Spit, but it is not safe to anchor in a less depth than 8 fathoms.

Bluff Point is a bluff about 800 feet high. Between Bluff and Anchor points foul ground and kelp are reported to extend well offshore in places. A rock, bare at lowest tides, is reported to lie about $2\frac{1}{2}$ miles from shore westward of Bluff Point. A similar rock is reported to lie over 1 mile from shore southeastward of **Anchor Point**, about on the extension of the shore northward of the point.

From northward of Anchor Point to southward of Ninilchik, temporary anchorage can be selected practically anywhere at distances of $\frac{3}{8}$ to $\frac{1}{2}$ mile from shore, in depths of 4 to 6 fathoms. A shoal, partly bare at low water, extends about $\frac{3}{4}$ mile off the mouth of the river which empties 3 miles northward from Anchor Point.

At **Cape Starichkof**, about 7 miles northward from Anchor Point, there is at the foot of the bluff a high sand spit, which at its northern end curves rather sharply inshore. In the cove on the north side of the spit there is anchorage for small craft with some shelter in southerly weather. Anchor about 250 yards from shore abreast a fisherman's house, in $3\frac{1}{2}$ fathoms, with Anchor Point showing just inside the end of the spit.

An area of broken water, lying $1\frac{1}{2}$ miles from shore and $2\frac{1}{2}$ miles northward of Cape Starichkof, indicates a probable shoal.

Anchorage can be had in a depth of 4 fathoms $\frac{3}{8}$ mile from shore abreast or a little southward of Ninilchik fish house (about 2 miles southward of Ninilchik). Do not anchor northward of the fish house, as a rock bare at low water lies 1 mile from shore a little northward of the fish house, and the shore is generally foul.

Ninilchik village is at the mouth of a river $17\frac{1}{2}$ miles northward of Anchor Point. A shoal, on the south end of which is a rock bare at lowest tides, lies about 2 miles 295° true (W. mag.) from the village. A shoal with about 5 fathoms over it lies about 5 miles from the village on the same bearing.

The Sisters are three prominent rocks, close together and the largest about 20 feet high, lying about 8 miles southward of Kasilof and 1 mile or more from the eastern shore. A rock is reported to lie about 1 mile outside and a little northward from The Sisters, and it is recommended to give them a berth of 2 miles.

Cape Kasilof lies 21 miles northward from Ninilchik. There is a break in the bluffs on the eastern shore from the vicinity of Cape Kasilof to Kenai.

Temporary anchorage can be had in 4 fathoms about $\frac{5}{8}$ mile from shore a little southward of Cape Kasilof. This anchorage is exposed except in northeasterly weather.

Kasilof is a cannery on the northern bank at the mouth of Kasilof River. An extensive flat fills the bight between Cape Kasilof and the mouth of the river, and extends offshore about 4 miles. A narrow winding channel, dry in places at low water, leads through the inner shoals to the mouth of the river. This channel is marked for the cannery steamers and launches during the season.

To anchor off the cannery, stand for it on a 105° true (**E** by **N** mag.) course. Keep the lead going and anchor 3 to 4 miles from the cannery, in a depth suitable at low water for the draft of the vessel.

Karluk Reef, partly bare at low water, is reported to be about 1 mile long, its southern end lying 6 miles 305° true (**W.** $\frac{3}{4}$ **N.** mag.) from Kasilof cannery. There are shoals between it and the shore.

Kenai is a cannery on the northern bank at the mouth of Kenai River, about 11 miles northward of Cape Kasilof. Extensive flats make off about 3 miles from the mouth of the river. **Salmo Rock**, which shows well at low water, is at the northern end of a sunken reef about 1 mile long, which lies about 4 miles southwestward from the cannery. It is generally marked by a buoy, maintained by the cannery vessels.

To anchor off Kenai, bring the cannery fish house on the north bank of the river to bear 83° true (**NE** by **E** mag.) distant about $3\frac{1}{2}$ miles, and anchor in a depth of about 7 fathoms (low water) well clear of the buoy marking Salmo Rock. The end of the fish house was formerly whitewashed.

Salamato is an old village about 5 miles northward of Kenai and 6 miles southeastward of East Foreland. Temporary anchorage can be had about $\frac{3}{8}$ mile off the village in 5 fathoms sandy bottom. It is exposed to southerly and westerly winds, and a heavy sea makes in with northwesterly winds.

East Foreland is a prominent, nearly level, wooded headland, with a bluff at the water about 200 feet high.

Nikishka is a fish trap and house $2\frac{1}{2}$ miles northeastward of East Foreland. There is good anchorage, sheltered from all but northwesterly winds, $\frac{3}{8}$ to $\frac{1}{2}$ mile from shore abreast or a little below the fish house, bearing 151° true (**SE** by **E** mag.), in about 6 fathoms, good holding ground. An anchorage farther southwestward is not desirable, as the holding ground is not as good and the ebb current increases greatly in velocity on approaching East Foreland. Fresh water in small quantities may be had by boats at high water from a seepage just north of the fish house. Water in larger quantities may be had from a stream $\frac{3}{4}$ mile northeastward of the fish house, but the flow does not usually last through the summer.

From the fish house northward nearly to Boulder Point, a distance of $2\frac{1}{2}$ miles, shoals, bare in two places at low water, extend $\frac{3}{4}$ mile from shore.

A shoal in the form of a long ridge of hard sand lies in the middle of the inlet 10 miles northward of East Foreland. It shows at low water for a distance of $3\frac{1}{2}$ miles in a northeasterly and southwesterly (magnetic) direction, and its greatest height above low water is estimated between 2 and 5 feet.

Beginning at **Boulder Point**, a prominent boulder reef with but few breaks in it extends along shore to Moose Point, a distance of 20 miles. For the greater part of this distance the bowlders, some very large, show at low water to a distance of 2 miles from shore, and there are occasional ones which show above high water. A rock awash at low water lies $3\frac{1}{2}$ miles from shore and nearly 4 miles 346° true (**NW** $\frac{3}{8}$ **N** mag.) from the grayish bluff mentioned in the next paragraph. Owing to the size of the bowlders along this shore, it is not safe to skirt it in a less depth than 7 fathoms.

There is a prominent yellowish bluff 4 miles northeastward of Boulder Point. A grayish bluff 150 feet high lies 10 miles northeastward of Boulder Point, and is a good mark from the inlet. There is a break in the boulder reef off the grayish bluff, and vessels may here approach the shore as close as $\frac{3}{4}$ mile, and find good anchorage in 4 fathoms, mud bottom, sheltered from easterly and southeasterly weather. The following directions will lead to the anchorage:

About $\frac{1}{4}$ mile southwestward of the highest part of the grayish bluff there is a conspicuous boulder (whitewashed in 1909) just outside of high-water mark, and about $\frac{3}{8}$ mile southwestward of the boulder there is a low rocky point and prominent boulder. Steer for this low rocky point on a 128° true (E by S mag.) course and anchor $\frac{3}{4}$ mile from shore. At this anchorage a rock about 10 feet high (lies $\frac{7}{8}$ mile from shore and $2\frac{3}{4}$ miles northeastward from Boulder Point) is just open from Boulder Point, and the boulder $\frac{1}{4}$ mile southwestward of the grayish bluff is in line with a prominent V-shaped notch in the top of the bluff.

Moose Point is low and wooded, with a grassy flat at its end, and not prominent. Between it and Point Possession, a distance of 10 miles, there are no boulders. A shoal, $3\frac{1}{4}$ miles long and bare at low water, begins just above Moose Point, and lies from $1\frac{3}{4}$ to $2\frac{1}{4}$ miles from shore. From its upper end a shoal which does not uncover extends into the shore well southward of Point Possession.

About 6 miles northeastward of Moose Point there is a prominent reddish bluff, on the north side of which is a small stream in a deep canyon, the latter showing from southwestward.

A shoal several miles long is reported to lie on the southeast side of the middle of the inlet between North Foreland and Point Possession, its southern edge about 274° true (WSW mag.) from Point Possession. The only evidence of the shoal found by the *McArthur* is a depth of $5\frac{3}{4}$ fathoms 9 miles 291° true (W $\frac{1}{2}$ S mag.) from Point Possession, and it can be stated that the shoal does not extend farther north than this position.

Point Possession is a low, rounding, heavily wooded headland, with a bluff at the water. There is a small native village on the western side of the point, where the bluff is low and a valley leads inland. The bluff is 140 feet high $\frac{7}{8}$ mile southward of the village, and from the village the bluff increases in height northeastward around into Turnagain Arm to a greatest elevation of 277 feet in a distance of $2\frac{1}{4}$ miles.

An extensive reef extends about $1\frac{1}{8}$ miles off the western side of Point Possession for a distance of about $\frac{3}{4}$ mile northward and southward of the village. There are depths of 3 fathoms on its western edge, which drops off abruptly to depths of 10 and 12 fathoms. The range of the eastern side of Fire Island and Point Woronzof leads close to the western edge of the reef, and care should be taken when rounding the point at low water not to open this range until well clear of the reef. A current line generally indicates the edge of the reef when the tidal current is strong in either direction.

Temporary anchorage may be had $\frac{3}{4}$ mile from shore and 2 miles southward of the village in 4 fathoms, sandy bottom. It is sheltered from easterly and southeasterly winds, but considerable sea makes around Point Possession at times from the violent northeasterly winds that blow at intervals out of Turnagain Arm.

On the north side of Point Possession, anchorage can be had in 4 fathoms, hard bottom, $\frac{1}{4}$ mile off a conspicuous gulch at the western end of a high bluff $1\frac{1}{4}$ miles northeastward of the village. The anchorage is inside of the strong tidal currents that set in and out of Turnagain Arm. Water can be secured by boats at high water from the gulch, but in the late summer the flow is small and the water discolored by flowing over the clay bluff.

Turnagain Arm is not surveyed and is dangerous for strangers. The flood tide comes in as a bore at times. **Hope** and **Sunrise** are trading stations on the south side of the arm, to which small craft can go at high water.

Turnagain Arm is noted for the violent winds which blow out of it whenever the wind is easterly, and is locally referred to as the "Cannon," which expresses the opinion held of it. With light to moderate easterly winds in other parts of the inlet, a moderate gale will frequently blow out of the arm, and a heavy sea and tide rips will be raised from its mouth across to Ladd on the western shore.

Fire Island is wooded and has a greatest elevation of 350 feet near its middle. Its southern part is broken, there being some high sand hills with bare summits, between which is a lake. The shore is high bluffs, except the northern and southern ends of the island which are low. There are no streams on the island, and after the snow is melted the island is dry except for the lake. Except in late summer some fresh water may be had at a depth of a few feet at the foot of the low bluff on the shore northwestward of the lake.

Fire Island is joined to Point Campbell by a flat, bare at low water, which extends southward of the island. Its southern and western edges are not developed, but a depth of $4\frac{1}{2}$

fathoms was found $2\frac{3}{4}$ miles 242° true (*S W by S mag.*) from the southwest end of Fire Island. A shoal extends about 1 mile from the bottom of the bight on the western side near the southern end of Fire Island. A depth of 4 feet was found $\frac{1}{2}$ mile northwestward from the southwest end of the island.

There is good anchorage in the northern part of the bight on the western side of Fire Island, in 4 fathoms, hard bottom. It is about $\frac{3}{8}$ mile from shore, on line between the northwestern and southwestern ends of the island, and about 1 mile from the former, with the highest hill near the middle of the island bearing about 128° true (*E by S mag.*). The current is strong here throughout the flood, but the ebb current has little velocity and after the first 2 hours of ebb is nearly slack. Occasionally some swell is felt from southwestward, but it does not affect the anchorage seriously. With fresh northwesterly or northerly winds the anchorage is untenable, as a rough sea and tide rips prevail, especially with a flood current. This anchorage is generally used by small craft bound up Turnagain Arm, either when wind bound or waiting for a favorable tide.

There is a shoal or bar about 2 miles northward of Fire Island, on the crest of which depths of 16 and 21 feet were obtained. It is probable that the best depth is close to the edge of the flat on the northwest side of the channel. In the absence of a complete survey, vessels of a greater draft than 15 feet bound into Knik Arm should wait for half-flood tide before crossing.

Point Woronzof is a rounding, wooded headland 155 feet high, with a bluff at the water. Lying from 1 to $2\frac{1}{4}$ miles southward from the point and $\frac{3}{4}$ to 1 mile from the eastern shore there is a shoal bare at low water.

Point Mackenzie is a bluff about 60 feet high, heavily wooded on top. For a distance of $1\frac{1}{2}$ miles westward of the point the bluff is at the water, and it then trends inshore and is fronted by a marsh. The Susitna mud flat begins about 1 mile westward of the point, and trends rapidly offshore westward. Just inside of Point Mackenzie there is a shoal which is bare at low water $\frac{3}{4}$ mile from shore.

Anchorage can be had $\frac{1}{2}$ mile southwestward from Point Mackenzie and $\frac{3}{8}$ mile from shore, in 4 fathoms, good holding ground. The flood current here has a velocity of 5 miles at times, but the ebb current is much weaker.

Knik Arm has a width of 2 miles between Point Woronzof on the south and Point Mackenzie on the north. At 3 miles inside of Point Mackenzie the arm narrows to $1\frac{3}{8}$ miles, and thence it widens northward. The upper part of the arm is filled by flats. The surveying vessel anchored in 5 fathoms, hard bottom, a little westward of mid-channel, at a point about $6\frac{1}{2}$ miles above Point Mackenzie, but the shoaling indicated the end of the channel in the arm that is navigable at low water. A current velocity of 4.2 miles was logged at the anchorage. **Knik** is a trading station on the western side of the arm, to which small craft can go at high water.

The small bight in the eastern shore 3 miles 78° true (*NE $\frac{1}{2}$ E mag.*) from Point Mackenzie is known locally as **Knik Harbor**, and affords good shelter from all but northerly winds. It is stated that severe northerly winds do not occur during the season of navigation. Anchor about 600 yards from shore, with the two houses on the beach bearing 95° true (*ENE mag.*), bottom hard mud and good holding ground. The depths increase rapidly offshore to 12 or 15 fathoms, and in order to have swinging room do not anchor where there will be less than 6 or 7 fathoms at low water. The tidal currents have little velocity at the anchorage, but are strong in mid-channel. A vessel swings around considerable at times, due to eddies, and is liable to foul her anchor.

Fresh water may be had at high water from two small streams northward of the houses, but the flow is small and the water discolored. About 200 yards southward of the houses a stream discharges from a grassy flat, and at high water a boat can be taken close to a 2-foot fall.

WESTERN SHORE OF COOK INLET.

On the western side of Cook Inlet, from Cape Douglas to above Chisik Island, the mountains generally rise abruptly from the water, and Iliamna and Redoubt volcanoes tower well above the surrounding peaks, affording excellent marks from all parts of the lower inlet. Northward from Redoubt Volcano the higher snow-clad peaks trend away from the inlet, passing through the lofty Mount Spurr.

Kamishak Bay is not surveyed. Its southern and western sides are said to be occupied by a flat, as shown on the chart. The shore is mountainous, and there is no timber except at the northern end of the bay. From Bruin Bay there is a trail about 15 statute miles long through a low pass to Iliamna Lake. From Iniskin Bay to Chinitna Bay the lower lands are about half wooded.

Augustine Island, about 7 miles in diameter, is a conical peak about 3,800 feet high, from the crater of which steam is discharged much of the time. The shore is low, with bluffs in places. Reefs, partly bare at low water, extend about $1\frac{1}{4}$ miles off the northeast and south-east sides of the island. The western end is detached from the main island by a lagoon, the entrances to which are partly blocked with large bowlders. A reef, partly showing above water, extends about $1\frac{1}{4}$ miles off the western end of the island.

There is a good anchorage sheltered from northeasterly winds near the southwest end of Augustine Island, in a depth of 4 fathoms. On the west side of the island just north of the center "rib" there is good anchorage in a depth of 4 fathoms, sheltered from easterly and southerly winds; but there are some dangerous rocks in the vicinity and the anchorage should be approached near low water if practicable.

Augustine Rocks (formerly Sea Otter) lie $7\frac{1}{2}$ miles 168° true ($SE \frac{3}{4} S$ mag.) from the peak of Augustine Island, and approximately $5\frac{1}{2}$ miles from the shore of the island. They are two flat rocks, with a smaller one between them, all covered at high water. Their position is said to be generally indicated by kelp or breakers.

Iliamna Bay is in the northwest corner of Kamishak Bay, about 15 miles 347° true ($NW \frac{3}{4} N$ mag.) from the peak of Augustine Island. It is 1 mile wide at the entrance and wider inside, and has a length of about 5 miles to its northern end, and to the head of its western arm called **Cottonwood Bay**. The greater part of the bay is filled by a flat, but there is good anchorage just inside the entrance. The shores are mountainous and there are no trees except the cottonwoods on the flats at the heads of the bay.

Dutton was in 1907 a store at the head of Cottonwood Bay. From the small native village in the cove 1 mile from the head of Iliamna Bay, a trail about 11 statute miles long leads to **Iliamna**, a village on a river of the same name 4 miles from Iliamna Lake. The summit of the pass is about 3 miles from the bay and has an elevation of about 900 feet. From Iliamna village boats up to about 3 feet draft can be taken through Iliamna Lake and Kvichak River to Bristol Bay.

White Gull Island, grass-covered and about 70 feet high, is conspicuous near the middle of Iliamna Bay just inside the entrance. There is a depth of 7 fathoms in the entrance north of White Gull Island, and the deepest water extends diagonally across to the entrance of Cottonwood Bay where the depth is 12 feet. Anchorage in $4\frac{1}{2}$ to 5 fathoms, soft bottom, may be had $\frac{3}{4}$ mile inside the entrance, with the northern side of White Gull Island in range with the south point at the entrance, and the north point at the entrance bearing 106° true ($E \frac{3}{4} N$ mag.). The anchorage is exposed to southeast winds only, and is regarded as secure during the summer.

In the approach to Iliamna Bay the depths are 6 to 8 fathoms several miles from shore, and these depths extend close to Turtle and Black reefs so that the lead will not serve as a guide to clear them. Enter the bay on a 305° true (**W** by **N** mag.) course, passing between the north point at the entrance and White Gull Island, favoring the point slightly, and anchor $\frac{3}{4}$ mile inside the entrance. When in the bay the lead is a good guide, but care must be taken to avoid a reef, partly bare at low water and with $2\frac{1}{2}$ to 3 fathoms close-to, which extends $\frac{3}{8}$ mile eastward (true) from the south point at the entrance to Cottonwood Bay.

Turtle Reef extends over $\frac{3}{8}$ mile eastward (true) from the south point at the entrance of Iliamna Bay. The reef is largely bare at low water, and is about 15 feet high at its highest point.

Black Reef lies over $\frac{1}{2}$ mile from shore and $1\frac{1}{8}$ miles 93° true ($ENE \frac{1}{8} E$ mag.) from the northern point at the entrance of Iliamna Bay. The highest part of the reef is two rocks 5 to 10 feet high. Lying $\frac{1}{2}$ mile northeastward of Black Reef is another reef which extends $\frac{1}{2}$ mile from shore.

It is reported that Iliamna Bay does not freeze, but that drift ice in large quantities sets in at times from the upper inlet. Fresh water may be obtained from streams on the northeast side about 1 mile inside the entrance. Northerly gales prevail in winter, and heavy williwaws are reported to come from the mountains on the northeast shore. The prevailing summer winds are down the bay, and are frequently fresh especially on bright days.

For tides in Iliamna Bay see page 43. The tidal currents at the anchorage have an estimated velocity of 1 to 2 miles.

Iniskin Bay is not surveyed but is a secure harbor in any weather. Its entrance is about 3 miles northeastward of Iliamna Bay, and the bay is about 10 miles long in a northerly direction. The eastern part and upper half of the bay are filled by flats bare at low water. The eastern point at the entrance is two small islands, 50 to 100 feet high, the inner one partly wooded, from which a partly bare reef extends about $\frac{3}{4}$ mile in a southwesterly direction. The following courses were used by the surveying vessel, and carried depths of 9 to 14 fathoms in the entrance:

From a position 1 mile eastward of Black Reef steer 27° true (**N** $\frac{1}{4}$ **E** mag.) and pass about $\frac{1}{4}$ mile off the western point at the entrance of Iniskin Bay. Continue the course about 2 miles beyond the most prominent point on the western shore and anchor in 4 or 5 fathoms, sticky bottom, with the eastern point at the entrance (an island) bearing 165° true (**SE** $\frac{1}{2}$ **S** mag.), the western point 221° true (**S** by **W** $\frac{1}{2}$ **W** mag.), and a house on the eastern shore 91° true (**ENE** mag.). This anchorage is well over in the western side of the bay, and from it the depths shoal gradually northward and eastward.

The entering course passes about $1\frac{1}{2}$ miles westward from the eastern point at the entrance. It is probable that a course nearer mid-channel could be used, but the depths there are not known.

Chinitna Bay is shoal and the lower part is exposed to all easterly winds, from which there is no shelter except possibly for small craft near the head of the bay. The surveying vessel anchored about $\frac{3}{4}$ mile above the island in its entrance, in about 20 feet, sticky bottom. The depths shoaled gradually from the entrance.

For about 10 miles northward from Chinitna Bay the shore is low and wooded, with lagoons and marshes in places, and is backed by Iliamna Volcano. The shore is fronted by a flat, the extent of which is not known.

The 5-fathom bank shown on the chart about 6 miles off shore between Chinitna Bay and Tuxedni Harbor does not exist as a continuous bank, but there are shoals at least 6 miles off shore and the locality should be approached with care in the absence of a survey. The surveying vessel got casts of 6 fathoms, deepening quickly to 12 fathoms, about 6 miles from shore, with a conspicuous wooded canyon, leading up to Iliamna Volcano and lying 6 or 7 miles northward of Chinitna Bay, bearing 295° true (**W** mag.).

Iliamna Volcano, 10,017 feet high, is an important mark, lying 13 miles from the western shore of the inlet between Chinitna Bay and Tuxedni Harbor. Steam generally issues from fissures just below the summit and from one of the lower peaks on its southeast slope.

Tuxedni Harbor, on the southwest side of Chisik Island, is a large and secure anchorage. The anchorage is about $\frac{3}{8}$ mile from Chisik Island, abreast or a little below the house near its northwest end, in 18 to 19 fathoms, sticky bottom. The shoaling is abrupt to the flat which fills the bay at the head of the harbor and closes the passage around the northwest end of Chisik Island. On the island side the shore is bold, but a shoal makes out some distance from the main shore abreast the anchorage. No sea makes into the harbor, but heavy williwaws come from the high land of Chisik Island. The mid-channel through the harbor is clear and deep.

Chisik Island is a narrow ridge, about 5 miles long and comparatively smooth on top, that slopes gradually upward from the southeast end of the island to its northwest end where it terminates in a cliff, possibly 2,000 feet high, which is a conspicuous mark. A reef extends about $\frac{1}{4}$ mile southeastward from the southeast end of the island.

The shore must be given a good berth between Chisik Island and Harriet Point. At a point 8 miles southward of Harriet Point the 6-fathom curve is about $1\frac{3}{8}$ miles from shore, and inside this depth the water shoals rapidly, the beach drying at low water $\frac{3}{8}$ mile from shore.

Redoubt Volcano, 10,198 feet high, is an important mark, lying 12 miles from the shore northward of Harriet Point. There is a notch on its southeast slope just below the summit.

Harriet Point is a prominently projecting point on the western shore abreast the southern end of Kalgin Island. A reef bare at low water extends $\frac{3}{4}$ mile eastward from Harriet Point, and the point should not be approached closer than $1\frac{1}{2}$ miles on the line of the reef.

There is a good anchorage in moderate weather on the north side of Harriet Point, which so far as known is safe during the summer except for southerly, southeasterly, and northeasterly gales. Anchor in $4\frac{1}{2}$ or 5 fathoms, about $\frac{1}{2}$ mile from shore, with the point bearing 177° true (*SSE* $\frac{1}{2}$ *E* mag.). At the anchorage the ebb current has a velocity of 2 to 3 miles, while the flood current is weak and of short duration.

Kalgin Island is about 11 miles long, about 250 feet high at its northern and southern ends, where it is highest, and wooded.

Anchorage can be had in the bight on the western side of the northern end of Kalgin Island. Steer for the middle of the bight on a 116° true (*E* mag.) course, and anchor in 4 fathoms, hard bottom, about on the line of the two points of the bight, and just before the range of the south point of the bight and the southwest end of Kalgin Island is closed.

Shoals bare at low water lie northward and southward of Kalgin Island, in line with the general trend of the island. It is probable that there are channels between the shoals and the island. No rocks can be seen at low water over a large area between the ends of the island and the shoals, which insures a depth of at least 4 fathoms at high water. Rocks show for perhaps 1 mile off the northeast end of Kalgin Island, and there are dangerous bowlders lying in depths of 4 to 5 fathoms farther out in the same direction and eastward of the same point.

The southern end of the shoal that shows at low water lies about 7 miles southward from Kalgin Island, and a depth of 5 fathoms was found 11 miles 185° true (*S* by *E* $\frac{7}{8}$ *E* mag.) from the southwest end of the island.

A sand shoal or ridge about 6 miles long lies about $2\frac{1}{2}$ miles off the western side of Kalgin Island. The part near its middle that shows at low water is about 2 miles long. Its eastern and western sides appear to be fairly bold.

The shoal between Kalgin Island and West Foreland shows at low water as a curved ridge about 3 miles long in a northeasterly direction, its ends lying 4 miles 188° true (*S* by *E* $\frac{5}{8}$ *E* mag.) and $6\frac{3}{8}$ miles 209° true (*S* $\frac{1}{4}$ *W* mag.) from West Foreland.

From Harriet Point to West Foreland the coast is generally low and subject to overflow at extreme high tides, and is fronted by a flat which extends well out in places, especially at the mouths of streams. In the bight at the northern end of **Redoubt Bay** the flat extends 2 to 3 miles from shore.

West Foreland is a flat, wooded headland about 175 feet high, with a bluff at the water. **Kustatan** is a small native village on the top of the bluff 1 mile westward of West Foreland. The shore at West Foreland is fringed with bowlders, which extend below low water, and there are rocks awash farther out. Soundings for 1 mile or more southward of it indicate that bowlders extend that far. About 1 mile westward of West Foreland the mud flat begins and extends about 3 miles off the low shore westward.

Anchorage in 4 to 5 fathoms, rocky bottom, can be had about $1\frac{1}{2}$ miles 240° true (*S* *W* by *S* mag.) from the point of West Foreland, with shelter from northwesterly winds. The bottom is very uneven, and in the absence of a survey the anchorage is not recommended except in case of necessity. The flood current has a velocity of 5 miles and the ebb somewhat less.

Kustatan River has its entrance $3\frac{1}{2}$ miles westward of West Foreland. It connects inland with the river which enters the inlet 12 miles northward of West Foreland, and this route is used by the natives in bidarkas when going to Tyonek.

For a distance of 8 miles northward from West Foreland the bluff is at the water and there are numerous bowlders on the beach. The bluff then trends inland to a conspicuous wooded ridge, 5 miles long and 300 feet high, which is $2\frac{1}{2}$ miles inland at its northern end.

For a distance of 15 miles northward from the end of the bluff the shore of **Trading Bay** is flat, grass covered, and subject to overflow, and there are several slues. This part of the bay is fronted by a flat which extends off a greatest distance of $2\frac{1}{8}$ miles at the mouth of the river 12 miles northward of West Foreland. This river is about 1 mile wide at its entrance at high water, but it is uncertain what depth, if any, can be carried in at low water.

Nikolai River is a narrow slue 19 miles northward of West Foreland. There is a depth of 1 to 2 feet at low water in the channel across the flat which extends upward of 2 miles from shore. A depth of about 15 feet can be taken into the river at high water. The water in the river is fresh nearly to its mouth except for a short time at high water.

Beginning at a prominent gulch $2\frac{3}{4}$ miles northeastward of Nikolai River the bluff comes to the shore and so continues around North Foreland. There is a small stream in the gulch. Anchorage can be had about $\frac{3}{4}$ mile off the gulch, in 4 to 5 fathoms, hard bottom, with the village of Tyonek open about 100 yards from the grayish bluff point eastward of the anchorage. Rocks awash at low water extend $\frac{3}{4}$ mile from shore 1 mile eastward of the gulch.

Old Tyonek is a small native village $6\frac{1}{2}$ miles northeastward of Nikolai River. For a distance of 1 mile westward of Old Tyonek there are several large bowlders $\frac{3}{4}$ mile from shore. Thence eastward the shore is clearer.

Tyonek is a village of natives and a few whites, on a grassy spit on the southeast side of North Foreland 3 miles eastward of Old Tyonek. Anchorage can be had about 300 yards off the eastern end of Tyonek, with the Greek church bearing about 4° true (*NNW* mag.), in 4 to 5 fathoms, mud and gravel. The flood current has a velocity of 4 to 5 miles, and ebb 2 to 3 miles. Care should be taken to avoid a shoal bare at low water which lies about 250 yards westward of the anchorage and extends 100 yards from shore. The anchorage is good during moderate weather or with offshore winds.

North Foreland is a bluff about 150 feet high at the end of a hilly, wooded ridge. Thence northward the bluff is lower.

Chuit River, about 3 miles northward of North Foreland, is marked by a low break in the bluff. A depth of about 8 feet can be taken into the mouth of the river at high water, and the tides are felt about 1 mile up the river. **Ladd** is a small native village and a large warehouse on the north side at the mouth of the river.

There is a prominent bluff 150 feet high on the south side of a creek 3 miles northward of Chuit River. The bluff continues northward for $2\frac{1}{2}$ miles from this creek, and then the tree line is from 2 to 3 miles inland from ordinary high-water mark, the strip between being subject to overflow at extreme high tides. This feature continues to within 2 miles of Point Mackenzie.

Beginning at the creek mentioned in the preceding paragraph, the shore is fronted by a mud flat which extends off an increasing distance from the shore northward. Its low-water edge is about 2 miles off the mouth of Beluga River, 4 to 5 miles off the mouth of Susitna River, 4 miles off the shore eastward nearly to Little Susitna River, and extends to the shore about 1 mile westward of Point Mackenzie.

Beluga River is $11\frac{1}{2}$ miles northward of North Foreland. The channel through the flats at the mouth of the river has a depth of about 2 feet at low water, and is said to shift in the winter and spring from the action of ice. A depth of as much as 18 feet at high water can be carried to **Beluga**, about 2 miles above its entrance, where the depth is not over 8 feet at low water. At Beluga transfer is made from small steamers of 10 feet or less draft, running up the inlet from Port Graham, to light-draft, stern-wheel steamers which go up the Susitna River. The effect of the tide is felt in the Beluga River 6 or 8 miles from its mouth, and it is said that boats can ascend to Beluga Lake, about 20 miles inland. There is a fixed white light on the northern bank at the mouth of the river.

Theodore River, $3\frac{1}{2}$ miles northward of Beluga River, is similar to Nikolai River. About 3 or 4 miles up Theodore River it reaches to within $\frac{3}{4}$ mile from Beluga River, and there is an easy portage between.

Lewis River, 3 miles northward of Theodore River, is said to be a slue draining the marshes.

Susitna River is navigable for stern-wheel steamers of 2 or 3 feet draft to the Talkeetna River, a distance of about 60 miles, and under favorable conditions of high water a steamer has been taken to Indian Creek, about 100 miles from the mouth. A steamer is reported to have been about 20 miles up the Yentna from its junction with the Susitna. The tides are not felt more than 7 miles up the river, and above this the current is swift.

The channels across the flat at the mouth of the river have a depth of about 2 feet at low water. They change during the winter and spring, due to the action of ice and freshets, and

the channels in and above the entrance are said to change frequently in the spring and early summer.

At the mouth of the river there are two channels which unite about 15 miles above. There is a fixed white light on an island on the western side at the entrance to the eastern channel.

Little Susitna River, about 9 miles westward of Point Mackenzie, is reported to be navigable for launches at high water for a distance of 8 miles.

Susitna Mountain, the prominent mark in the upper inlet, is 4,401 feet high and lies on the west side of Susitna River, 13 miles above the head of Cook Inlet. A high ridge extends off from it in a westerly direction.

EASTERN COAST OF SHUYAK AND AFOGNAK ISLANDS.

Shuyak Island is generally wooded and hilly, with elevations probably above 1,000 feet. Some of the hills on the island, and the outlying islands and rocks on its northern and western sides, are located. The island is deeply indented by inlets, but no information is available respecting them.

Point Banks is an island about $\frac{3}{4}$ mile long close to the northeast end of Shuyak Island. A rock about 20 feet high lies $\frac{1}{2}$ mile northwestward of Point Banks; no breaker was seen outside of the rock at low water with a moderate swell.

Perevalnie Island is close to the northern shore of Shuyak, its western end lying $1\frac{7}{8}$ miles southwestward of the rock northwestward of Point Banks. Temporary anchorage for a small vessel, sheltered from southeasterly winds, can be had in the western entrance of the narrow passage between Perevalnie and Shuyak islands, in 10 fathoms, muddy bottom. There is no shelter in northeasterly weather, and it is a bad place to leave on account of the heavy sea and tide rips.

The northern side of Shuyak Island westward of Perevalnie Island is apparently foul, rocks awash and sunken extending well off in places. The western coast of Shuyak Island is described on page 67.

Sea Otter Island, lying $7\frac{1}{2}$ miles 155° true (*SE* $\frac{3}{8}$ *E* mag.) from Point Banks, is grass covered, $\frac{3}{8}$ mile long, and about 100 feet high. It is surrounded by bare rocks and breakers to a distance of $1\frac{1}{2}$ to 2 miles.

Afognak Island is in its eastern part a series of mountain ridges with low depressions between them running through the island from north to south. From a distance Marmot Island shows as the easternmost of these ridges. The lower parts of Afognak Island are wooded, except its eastern coast, and its southwestern end southward of Paramanof Bay. The northern part of the island between Black Cape and Tonki Cape is not surveyed.

Tonki Cape, lying 20 miles 148° true (*SE* by *E* mag.) from Point Banks, is the northern end of the high ridge separating Tonki Bay from Marmot Strait. It is about 100 feet high and grass covered, and rises gradually southward to high land. A short reef with some large bare rocks on it extends northward from the cape, terminating in a rock, bare at low water, $\frac{1}{4}$ mile from shore.

Tonki Bay, on the west side of Tonki Cape, has two main arms. The eastern one has a 199° true (*S* $\frac{1}{2}$ *E* mag.) direction, and is about 5 miles long from Tonki Cape. The arm is $1\frac{3}{4}$ miles wide abreast the headland separating the arms, which is $2\frac{1}{2}$ miles inside Tonki Cape, and has a high rocky islet about $\frac{3}{8}$ mile northward from it. Three rocks, covered at high water, lie about $\frac{3}{8}$ mile from the eastern shore and $1\frac{3}{4}$ miles southward of Tonki Cape. The west side of the arm is steep and apparently bold; the east side is lower and more broken. There is anchorage about $\frac{1}{4}$ mile from the head of the arm in 10 fathoms, soft bottom, but it is not secure with northerly winds.

The western arm of Tonki Bay extends southward to within about 2 miles of Izhut Bay, with low land between. There is no bottom at 20 fathoms in mid-channel until $\frac{1}{4}$ mile from the beach in the bight on the eastern side $\frac{3}{4}$ mile from the head, where there is secure anchorage in about 12 fathoms, hard bottom.

The coast for 5 miles southward of Tonki Cape is a low bluff, with a marsh $\frac{1}{4}$ to $\frac{1}{2}$ mile wide between it and the foot of the ridge which rises abruptly. Numerous islets and rocks fringe the coast, extending off $\frac{1}{4}$ mile in places. Thence southward the bluffs increase in height

toward King Cove. Southward of King Cove the coast is bluffs over 500 feet high, which extend around Pillar Cape.

King Cove, lying 288° true ($W \frac{1}{2} S$ mag.) from the south end of Marmot Island, is an open bight $1\frac{1}{2}$ miles long and indents the coast $\frac{1}{2}$ mile. It may be used as a temporary anchorage with offshore winds, and otherwise affords no shelter. There are numerous kelp patches in the cove near the shore.

Marmot Strait, between Afognak and Marmot islands, is $2\frac{1}{2}$ to 3 miles wide, and is frequently used by vessels. While no sounding has been done, it is apparently deep and clear in the middle. The shores are more or less foul and should be given a berth of over $\frac{3}{4}$ mile. The tidal currents have an estimated velocity of 1 to 3 miles, the flood current setting northward. Sailing directions through the strait are given on page 6.

Sealion Rocks lie $5\frac{1}{4}$ miles 96° true ($ENE \frac{3}{8} E$ mag.) from Tonki Cape and 4 miles northward from Marmot Island. They are two bare rocks, close together, and the larger one about 40 feet high, and a reef, bare at low water, lying $\frac{5}{8}$ mile northeastward from the bare rocks.

Marmot Island is about $6\frac{1}{2}$ miles long, with elevations up to about 1,300 feet, and wooded to a height of about 500 feet. The north end is low and rises gradually to the high land. The eastern side and southern end of the island are bluffs over 500 feet high in places. The western shore is also steep but lower. There are three high rocks close to **Marmot Cape**, the south end of the island, and two close to its southeast side.

A rock about 6 feet high lies 600 yards from the northwest side of Marmot Island, about $1\frac{1}{2}$ miles from its northern end. An extensive kelp field makes out from the island to a distance of about $\frac{1}{2}$ mile northward from the rock, and extends around to the north end of the island.

Two sunken rocks, on which the sea generally breaks at low water, lie about 1 mile apart and $2\frac{1}{2}$ miles eastward of **Cape St. Hermogenes**, the eastern end of Marmot Island. The northern rock lies 108° true ($E \frac{1}{2} N$ mag.) from the north end of the island and 38° true (N by $E \frac{1}{4} E$ mag.) from its southeast end. The southern rock lies 120° true ($E \frac{1}{2} S$ mag.) from the north end of the island and 45° true (N by $E \frac{1}{8} E$ mag.) from its southeast end. The range of the two pinnacle rocks close to the southeast side of Marmot Island, bearing 232° true ($SS W \frac{1}{2} W$ mag.), passes southeastward of both breakers.

Pillar Cape is a bluff over 500 feet high, similar to the southeast side of Marmot Island, and there is a high pinnacle rock at the foot of the bluff $\frac{1}{2}$ mile eastward of the south end of the cape. On the southwest side of Pillar Cape are three high bluff points with small coves between. About $1\frac{1}{2}$ miles westward of the cape is an open bight from which a low divide extends through to the western arm of Tonki Bay.

MARMOT BAY

extends westward between Afognak and Kodiak islands to Whale Island: The route along the south side of the bay through Narrow Strait and Whale Passage is generally used by vessels from Kodiak bound to Shelikof Strait. These passages are described on pages 63-64.

The northern part of Marmot Bay is clear except its western end between Kostromitinof Cape and Hog Island. Pillar Cape may be rounded at a distance of 1 mile in depths of over 20 fathoms. Deep water extends as close as $\frac{1}{4}$ mile to Izhut Cape. In the western end of the bay danger will be avoided by keeping eastward of a line from the eastern end of Kostromitinof Cape to Stripe Rock, and eastward of this range extended southward, until Hog Island is open from the northwestern side of Whale Island. The courses along the northern shore are:

From a position 1 mile southeastward of Pillar Cape steer 251° true ($SW \frac{1}{8} W$ mag.) for $8\frac{1}{2}$ miles to a position $\frac{3}{4}$ mile southeastward of Izhut Cape. Then steer 262° true (SW by $W \frac{1}{8} W$ mag.) for $6\frac{1}{2}$ miles to a position $\frac{1}{2}$ mile southeastward from Kostromitinof Cape. Then enter Danger Bay as directed under that heading from eastward.

Or, from a position 1 mile southeastward of Pillar Cape steer 246° true ($SW \frac{1}{4} S$ mag.), passing $1\frac{1}{2}$ miles southeastward of Izhut Cape and Stripe Rock. This course made good for $20\frac{1}{2}$ miles will lead to a position $\frac{1}{2}$ mile southeastward of Hog Island. To enter Afognak Bay or Strait see the directions under those headings from eastward.

Izhut Bay has its entrance between Pillar Cape and Peril Cape, and extends into Afognak Island about 7 miles in a northwesterly direction with a width of 3 miles in its lower part. No dangers were seen in the bay, but it has not been sounded and kelp extends a short distance off all the points. The shores are wooded and water may be obtained from numerous streams.

The southern arm on the western side of Izhut Bay has its entrance 3 miles inside Peril Cape, and is about 3 miles long in a 316° true (WNW mag.) direction with a width of about $\frac{3}{4}$ mile. Lying $1\frac{1}{2}$ miles inside the entrance of the arm there is an islet with a rock, bare at low water, 50 yards off its southern side. The surveying vessel used the channel southward of the island. Just above the island the arm contracts to $\frac{1}{4}$ mile and then expands into a basin about $\frac{3}{4}$ mile in diameter. There is a rock, bare at low water, close to the north point at the entrance of the basin. Secure anchorage can be selected in the basin. A stream enters on its southern side.

At the northern end of Izhut Bay is the entrance to two small arms, about $\frac{1}{4}$ mile off the western point of which is a prominent, steep, rocky islet about 60 feet high. The eastern arm has an islet in it, the channel being eastward of it; there is secure anchorage for a small vessel above the islet in 7 to 9 fathoms. The western arm is straight and clear, and has secure anchorage about $\frac{1}{2}$ mile from the head in 9 fathoms. A mid-channel course should be followed in the arms.

Peril Cape is a prominent, precipitous headland about 600 feet high, and there is a high pinnacle rock close to its southern side.

Izhut Cape, lying $2\frac{1}{2}$ miles southwestward of Peril Cape, is a projecting, long, wooded, hilly point from 250 to 500 feet high. There is deep water around the cape as close as $\frac{1}{4}$ mile.

Duck Bay is about 6 miles long from Izhut Cape to Kostromitinof Cape. At the eastern end of the bay temporary anchorage may be had in the middle of the cove $1\frac{1}{2}$ miles northward of Izhut Cape, in 6 to 7 fathoms. The anchorage is eastward of an islet, about 30 feet high, which lies $\frac{1}{4}$ mile from the northern shore and should not be approached closely.

A round, rocky island, about 150 feet high and grass covered on top, lies $2\frac{1}{2}$ miles westward from Izhut Cape and $\frac{3}{4}$ mile from shore. Kelp extends nearly $\frac{1}{4}$ mile westward and northward of the island, and numerous bare rocks extend $\frac{1}{2}$ mile eastward of the island and to the shore northeastward of it. In the cove northward of the island is a small native settlement. Temporary anchorage may be had in the middle of the cove, in 10 to 12 fathoms. Enter the cove westward of the island, between it and a large rock, awash at high water, lying $\frac{1}{4}$ mile southward from the western point of the cove.

The next cove westward, having its entrance 1 mile northwestward of the island, is 1 mile long and $\frac{3}{4}$ mile wide. The bottom is rocky and kelp extends some distance from shore in places. Small craft, entering with care, can anchor in 5 to 8 feet of water at the head.

Kostromitinof Cape is a projecting, long, level, wooded point, about 200 feet high, with bluffs in places at the water. Northward from the cape the land rises gradually in a distance of $5\frac{1}{2}$ miles to a prominent peak 2,080 feet high.

Spruce Island, on the south side of Marmot Bay, has generally a low, wooded strip all around it, but the middle of the island is a grassy ridge 1,580 feet high with but few trees. **South Point** of the island is marked by a high, black, rocky islet, with a lower one close to its south side, lying 600 yards southward from the point. **East Cape** has some large bare rocks close to, and broken ground, with 8 fathoms on it and a possibility of less, extends $1\frac{1}{2}$ miles northward from it. **North Cape** is a wooded knob 550 feet high. There is a high, wooded island close to the western end of Spruce Island.

The Triplets, lying $1\frac{1}{2}$ miles westward of North Cape of Spruce Island, are three grass-covered islands, the highest 190 feet. The group forms a chain 1 mile long, and there are bare rocks between them.

Whale Island, at the western end of Marmot Bay, is about 4 miles in diameter. Its southern half is a grass-covered mountain 1,980 feet high, with a narrow, light streak or landslide down its eastern slope. The northern side of the island is low, and the lower parts of the island are generally wooded. **Treeless Islet**, rocky and grass covered, lies $\frac{3}{8}$ mile off the eastern side of the northern end of the island. Whale Passage is southward of the island and Afognak Strait northward.

DANGER BAY,

on the north side near the western end of Marmot Bay, has its entrance between Kostromitinof and Kazakof capes, where it is $2\frac{1}{4}$ miles wide, and extends 6 miles 4° true (*N* by *W* $\frac{3}{4}$ *W* mag.) to its head where it is 1 mile wide. From the head of the bay two narrow arms extend northward, the western one 1 mile long and the eastern one 2 miles.

Parrot Islet, round, rocky, and about 60 feet high, is in the entrance of the bay and $\frac{3}{4}$ mile westward of Kostromitinof Cape. Broken ground, on which are several rocky islets and rocks awash, extends southward from the islet to two rocks bare at low water lying $\frac{1}{2}$ mile 171° true (*SE* by *S* mag.) from it.

A sunken ledge, with 22 feet over it and some kelp, lies $\frac{3}{4}$ to 1 mile 143° true (*SE* by *E* $\frac{1}{2}$ *E* mag.) from Parrot Islet, and its northern end lies $\frac{1}{2}$ mile southwestward from Kostromitinof Cape.

Stripe Rock, lying off the entrance of the bay $2\frac{7}{8}$ miles 190° true (*S* by *E* $\frac{1}{4}$ *E* mag.) from Parrot Islet, are two pinnacles, close together and about 35 feet high, the higher one having a prominent white streak for its entire height. There are some smaller rocks near them, and two rocks, covered at high water, lie $\frac{3}{8}$ mile 342° true (*NW* $\frac{1}{4}$ *N* mag.) from the pinnacles.

A large bare ledge about 30 feet high lies 1 mile 4° true (*N* by *W* $\frac{3}{4}$ *W* mag.) from Stripe Rock. From this ledge and Stripe Rock to the islands and Skipwith Reefs off the eastern entrance to Afognak Bay, the area is foul, having numerous reefs and kelp patches, and should be avoided by vessels.

On the eastern side of Danger Bay, $3\frac{1}{4}$ miles northward of Parrot Islet, there is a cove which affords anchorage for a small vessel, in 12 to 14 fathoms, and small craft can anchor in its southeastern end in about 5 fathoms. A reef extends about 100 yards off the south side just inside the entrance of the cove, and the small bight in its eastern side is shoal.

A bare rock, a few feet high, lies $\frac{3}{8}$ mile from the eastern shore and $\frac{5}{8}$ mile from the head of the bay. Vessels of any size can anchor about midway between this rock and the point separating the two arms at the head, in 14 to 15 fathoms, muddy bottom. Small vessels can anchor, in 8 to 10 fathoms, either in the broadest part of the western arm $\frac{1}{4}$ mile from its head, or in the entrance of the eastern arm.

SAILING DIRECTIONS, DANGER BAY.

From eastward, shape the course for a position about $\frac{1}{2}$ mile southeastward of Kostromitinof Cape. Then steer for Parrot Islet on a 305° true (*W* by *N* mag.) course until the southwestern end of the cape is a little forward of the beam. Then steer 333° true (*NW* $\frac{1}{2}$ *W* mag.) and pass $\frac{1}{4}$ mile off the southwestern end of the cape and the same distance northeastward of Parrot Islet.

Then steer 359° true (*NNW* $\frac{1}{4}$ *W* mag.) with Parrot Islet astern, which will lead to the head of the bay. Above Parrot Islet there are no dangers if the shores be given a berth of $\frac{1}{4}$ mile, except the bare rock lying $\frac{3}{8}$ mile from the eastern shore and $\frac{5}{8}$ mile from the head of the bay.

From southwestward, keep Hog Island open from the northwestern side of Whale Island until Stripe Rock is in range with the eastern side of Kostromitinof Cape. Then steer 41° true (*N* by *E* $\frac{1}{2}$ *E* mag.) for $2\frac{1}{4}$ miles to a position $\frac{1}{4}$ mile eastward of Stripe Rock. Then steer 6° true (*N* by *W* $\frac{5}{8}$ *W* mag.) for $1\frac{1}{8}$ miles to a position $\frac{1}{4}$ mile eastward of a bare ledge about 30 feet high. Then steer 333° true (*NW* $\frac{1}{2}$ *W* mag.) about 1 mile. Then steer 358° true (*NNW* $\frac{1}{4}$ *W* mag.) for $\frac{3}{4}$ mile, keeping Stripe Rock open westward of the bare ledge (about 30 feet high) astern until Parrot Islet is $\frac{1}{2}$ mile on the starboard beam. From this position a 5° true (*N* by *W* $\frac{5}{8}$ *W* mag.) course will lead to the head of the bay.

AFOGNAK BAY,

making into Afognak Island from the western end of Marmot Bay, is a secure anchorage and easily entered in the daytime. It is 5 miles long from Hog Island, the entrance is nearly 3 miles wide between Big Rock and Afognak village, and above Dot Island the bay is $\frac{1}{2}$ mile wide. On the western shore $1\frac{1}{8}$ miles above Dot Island is a disused cannery, and at the head of the bay is a government fish hatchery. The best anchorage is off the cannery in 8 to 10 fathoms.

The eastern side of the entrance is formed by a chain of islands and bare rocks. **Lamb Island**, nearest to the shore, is $\frac{1}{2}$ mile long and wooded. **Alexander Island**, $\frac{3}{4}$ mile eastward of Lamb Island, is grass covered, and has a knob about 80 feet high at its north end. **Skipwith Reefs**, a chain of bare rocks, extend $1\frac{1}{2}$ miles southeastward from Lamb Island to Big Rock. The southern side of the rocks should be given a berth of over $\frac{3}{8}$ mile. The principal danger in the approach is a rock, awash at low water and steep-to, lying $\frac{5}{8}$ mile 118° true (*E $\frac{3}{8}$ S mag.*) from **Big Rock**; Hog Island open from the northwestern side of Whale Island leads $\frac{1}{4}$ mile southward of the rock awash, and Stripe Rock in range with the eastern end of Kostromitinof Cape leads $\frac{1}{2}$ mile eastward of it. The better entrance to the bay is between Big Rock and Hog Island, and has a clear width of over $\frac{1}{2}$ mile.

Hog Island, the prominent mark in the entrance of the bay, is $\frac{3}{8}$ mile long, and has two wooded knolls with a saddle between. Foul ground marked by kelp extends about 350 yards northeastward from its eastern end and 650 yards westward from its western end.

Afognak is a village with post-office which extends along the western shore of the bay for a distance of nearly 2 miles northward of Head Point. The church (white with green roof) is the best mark in the village, and lies $\frac{1}{4}$ mile southward of Graveyard Point.

Village Reefs are partly bare at low water and covered with kelp, and extend over 1 mile eastward from Afognak toward Hog Island. The point of the reefs is midway between Graveyard Point and Hog Island. Southeastward from the point of the reefs is a detached shoal with depths of $3\frac{1}{2}$ to 4 fathoms. Between this shoal and the reef extending westward from Hog Island is a channel $\frac{1}{2}$ mile wide.

Danger Reef lies $1\frac{1}{8}$ miles 57° true (*NE by N mag.*) from Graveyard Point and $1\frac{1}{2}$ miles 317° true (*WNW mag.*) from the west end of Hog Island. It is small, bare at half tide, marked by some kelp, and is a serious danger when covered.

A rock, with 14 feet over it and marked by kelp, lies $\frac{5}{8}$ mile 322° true (*NW by W $\frac{1}{2}$ W mag.*) from Danger Reef and the same distance 52° true (*NNE $\frac{1}{2}$ E mag.*) from Lipsett Point on the western shore.

Dot Island, small and wooded, is the western one of three small islands close to the eastern shore where the bay narrows to $\frac{1}{2}$ mile. On the western shore opposite Dot Island is a cascade where fresh water can be obtained by boat.

For tides, see Afognak Strait.

SAILING DIRECTIONS, AFOGNAK BAY.

From eastward, keep Hog Island open from the northwestern side of Whale Island, bearing anything westward of 250° true (*SW $\frac{1}{8}$ W mag.*) until about $\frac{3}{4}$ mile from Hog Island, to clear the dangers on the northern side of the approach. Then pass midway between Hog Island and Big Rock.

From Narrow Strait, follow the directions on page 66 until westward of Three Brothers. Then steer 328° true (*NW by W mag.*) for 6 miles with Low Island astern to a position $\frac{1}{2}$ mile northeastward of Hog Island.

Pass midway between Hog Island and Big Rock and steer 315° true (*WNW $\frac{1}{8}$ W mag.*) for the old cannery building showing midway between Dot Island and the eastern shore. Keep this range for about 2 miles until the western end of Lamb Island is abeam. Then steer 308° true (*WNW $\frac{3}{4}$ W mag.*) for $1\frac{3}{4}$ miles and pass 400 to 500 yards southward of Dot Island.

Keep this course for about $\frac{1}{4}$ mile past Dot Island until $\frac{1}{4}$ mile off the cascade on the western shore. Then steer 353° true (*NNW $\frac{3}{4}$ W mag.*), favoring slightly the western shore, for $\frac{3}{4}$ mile. Anchor near mid-channel off the old cannery in 8 to 10 fathoms. The anchorage is clear if Winter Island be given a berth of 300 yards and Last Point (on the north shore) 400 yards.

From Afognak Strait, steer for the south end of Hog Island with Deranof Rock astern, course 73° true (*NE $\frac{3}{8}$ E mag.*) until $\frac{3}{8}$ mile past Dolphin point (northeast end of Whale Island). Then steer for the western end of Lamb Island with the eastern end of Whale Island astern, course 8° true (*N by W $\frac{3}{8}$ W mag.*) and pass $\frac{5}{8}$ mile westward of Hog Island. When $\frac{1}{2}$ mile past Hog Island and Big Rock is a little forward of the beam, steer 325° true (*NW by W $\frac{1}{4}$ W mag.*) heading for Dot Island with the western end of Hog Island astern, which leads nearly $\frac{1}{4}$

mile northeastward of Danger Reef. Keep this course for 2 miles until about $\frac{3}{4}$ mile from Dot Island, and then steer 308° true (**WNW $\frac{3}{4}$ W mag.**) and pass 400 to 500 yards southward of it. Then follow the direction in the preceding paragraph.

AFOGNAK STRAIT,

between Whale and Afognak islands, is not generally used, but is convenient when bound to or from Afognak Bay and the currents are only half as strong as in Whale Passage. With care the navigation is not difficult on a clear day when the marks for the strait can be seen. It has a least width of $\frac{5}{8}$ mile, but large areas, especially on the north side, are foul and there are many dangers. The channel at Chiachi Point, where it is narrowest and shoalest, has a width of $\frac{1}{4}$ mile and a depth of 24 feet, but there is a rock with 16 feet over it in mid-channel. The dangers are marked by kelp, which grows in depths up to about 6 fathoms and shows at slack water.

Dolphin Point is the northeast end of Whale Island. A reef partly bare at low water extends 600 yards from Whale Island at a point $\frac{1}{4}$ mile westward of Dolphin Point.

Fox Bay, the bight in Whale Island 1 mile westward of Dolphin Point, has a reef in its entrance which shows well at low water. A small vessel can anchor in the bay inside the reef in 4 to 5 fathoms, but the south shore must be given a berth of 300 yards. Thence westward the shore of Whale Island is clear to Chiachi Point, the northwest end of the island, from which a shelving reef makes out about 350 yards in a northwest direction.

In the narrowest part of Afognak Strait, for a distance of $\frac{3}{4}$ mile westward of Afognak village, foul ground extends $\frac{1}{4}$ mile from the north shore. Thence westward the northern half of the strait is foul. The principal danger is a reef awash at low water lying a little over $\frac{3}{8}$ mile northwestward of Chiachi Point and $1\frac{1}{4}$ miles 69° true (**NE mag.**) from the south end of Deranof Island.

A rock with 16 feet over it lies $\frac{1}{4}$ mile eastward of the preceding reef, $\frac{3}{8}$ mile 24° true (**N mag.**) from Chiachi Point, and on or a very little northward of the range of Deranof Rock and Kupreanof Mountain. The channel is southward of the rock and is about 300 yards wide.

Deranof Island, $\frac{1}{2}$ mile long, low and wooded, is the southernmost and largest of the islands at the western end of Afognak Strait.

Deranof Rock, about 8 feet high, lies nearly 200 yards southward of the island. Broken ground with a least depth of 16 feet lies $\frac{3}{8}$ mile eastward of the island and 74° true (**NE $\frac{1}{2}$ E mag.**) from Deranof Rock.

Temporary **anchorage** may be had in the channel of Afognak Strait between Fox Bay and Afognak village, in 7 to 8 fathoms, but exposed to the full strength of the currents and to easterly and northeasterly winds. A small vessel can anchor in Fox Bay.

Small vessels can anchor near the kelp on Village Reefs, with the church (white with green roof) in Afognak bearing 344° true (**NW $\frac{1}{2}$ N mag.**), and Head Point (south of the village) in line with Deranof Rock, in 5 fathoms. Little current will be felt here, but it is exposed to easterly winds.

With easterly winds small vessels can anchor about $\frac{1}{4}$ mile westward of the point on the north side of Afognak Strait $\frac{3}{4}$ mile westward of Head Point, in about 4 fathoms, but care is required. When rounding into the anchorage, pass northeastward of a reef, bare at low water, lying $\frac{3}{8}$ mile southwestward of the point, and give the point a berth of over 300 yards.

Tides.—High and low water occur about 10 minutes later than at Kodiak, and the mean rise and fall of the tides is 8.1 feet. To find the approximate height of the tide, multiply the height of the corresponding tide at Kodiak by the ratio of ranges 1.17.

The **tidal currents** in Afognak Strait set westward on the flood and eastward on the ebb. The estimated velocity is 2 to 5 miles at strength, depending on the range of the tide. Slack water occurs about 1 hour before high and low waters at Kodiak. During the flood there is a strong set into Raspberry Strait, which should be kept in mind when in the western end of Afognak Strait.

SAILING DIRECTIONS, AFOGNAK STRAIT.

From *Narrow Strait* follow the directions on page 66 to a position $\frac{1}{4}$ mile northward of Shakmanof Point. Then steer 313° true (WNW $\frac{1}{4}$ W mag.) for $5\frac{1}{2}$ miles and pass $\frac{1}{2}$ mile northeastward of Dolphin Point.

From eastward in Marmot Bay, keep Hog Island open from the northwestern side of Whale Island, bearing anything westward of 250° true (SW $\frac{1}{8}$ W mag.), and pass $\frac{1}{4}$ mile or more southward of Hog Island and $\frac{1}{2}$ mile northward of Dolphin Point.

From *Afognak Bay*, steer 145° true (SE by E $\frac{1}{4}$ E mag.) for the western end of Hog Island with Dot Island astern, which leads nearly $\frac{1}{4}$ mile northeastward of Danger Reef. When Alexander Island is abeam, steer 188° true (S by E $\frac{3}{8}$ E mag.) for the eastern end of Whale Island with the western end of Lamb Island astern, and pass $\frac{5}{8}$ mile westward of Hog Island.

Passing $\frac{1}{2}$ mile northward of Dolphin Point, steer for Deranof Rock in range with the summit of Kupreanof Mountain, or, if the mountain is hid, steer for Deranof Rock with the southern end of Hog Island astern, course 253° true (SW $\frac{3}{8}$ W mag.). In the narrowest part of the strait for $\frac{3}{4}$ mile westward of Afognak village, go nothing northward of the range. When approaching the western end of the strait, keep a little southward of the range to avoid the rock with 16 feet over it, but give the shore of Whale Island a berth of over 300 yards; on the flood guard against a northerly set toward Raspberry Strait.

When the eastern one of the two highest peaks on the southern side of Whale Passage opens westward of Whale Island, bearing 184° true (S by E $\frac{3}{4}$ E mag.), steer 238° true (SW by S mag.) and pass $\frac{1}{4}$ mile southeastward of Deranof Rock. Continue the course $\frac{3}{4}$ mile past the rock, and then steer 287° true (W $\frac{5}{8}$ S mag.) with the summit of Whale Island astern. This course made good will lead through Kupreanof Strait, passing $\frac{3}{8}$ to $\frac{1}{2}$ mile southward of Gori Point, $\frac{7}{8}$ mile northward of Outlet Cape, and $\frac{1}{2}$ mile southward of Malina Point.

CHINIAK BAY AND ST. PAUL HARBOR.

Chiniak Bay is the indentation in the northeast end of Kodiak Island between Cape Chiniak and Spruce Cape, and St. Paul Harbor is inside the islands on its northwestern side. The harbor is not difficult of access in the daytime and clear weather, but the entire bay and its approaches are dangerous at other times, and the narrow channel leading to the wharf at Kodiak requires careful piloting. Kodiak Island is mountainous, while the shores and islands of the bay are comparatively low. The prominent features in the bay and approaches are:

Cape Chiniak, the southeast point of the bay, is low and wooded for $\frac{3}{4}$ mile back and then rises gradually to high land. A flat islet and numerous high, bare rocks extend $1\frac{1}{8}$ miles northeastward from the cape.

Long Island, the easternmost island in the northern end of the bay, is $3\frac{1}{2}$ miles long, about 250 feet high, hilly with cliffs at the water, and wooded except toward its northern end. The northeast end is two grassy knolls joined by spits, and a high, steep, rocky islet lies 250 yards eastward of it. Extensive, kelp-marked reefs, with some high, bare heads, extend from $\frac{5}{8}$ to $\frac{7}{8}$ mile 46° true (NNE mag.) from the northern side of the island, and broken ground with a possibility of danger extends in the same direction beyond the reefs to a distance of about 2 miles from the island. The southeastern side of Long Island is fringed with rocks and kelp to a distance of $\frac{1}{4}$ to $\frac{1}{2}$ mile from shore. There is a high pinnacle close to its south end, and a high grass-covered rock lies $\frac{3}{8}$ mile eastward of the pinnacle and 300 yards from shore.

Woody Island, westward of Long Island, is $2\frac{1}{2}$ miles long, nearly 200 feet high and heavily wooded. There is a native village, church, and boat landing on its western end.

Westward of Woody Island is a group of islands, of which **Holiday Island**, the northernmost, is 165 feet high and wooded. **Bird Islet**, close eastward of Holiday Island, is about 30 feet high and there is a bare rock close to its southern end. **Near Island**, the largest of the group, is 198 feet high and grass-covered.

Spruce Cape, the northwest point of the bay, is a low bluff, grass-covered on top and backed by woods. Bare rocks and foul ground extend $\frac{5}{8}$ mile northward from the cape to **Hanin Rocks**, which are two masses about 30 feet high with an extensive surrounding ledge.

A rock bare at low water lies 250 yards northward of Hanin Rocks, and Hutchinson Reef lies $\frac{1}{2}$ mile eastward from them.

Miller Point, 1 mile westward of Spruce Cape, is partly wooded and terminates in a rocky bluff. High, bare rocks extend 300 yards off the cape, and three rocks covered at high water lie $\frac{3}{8}$ to $\frac{1}{2}$ mile northward of it.

Devils Prongs are three prominent peaks southwestward of Sycamore Bay. Approaching from southeastward they appear of nearly equal height, the middle one flat on top. The northern prong is 2,075 feet high.

Pillar Mountain, a short ridge 1,206 feet high, rises steeply from the western shore about 1 mile southwestward of Kodiak.

Barometer Mountain is a peak 2,475 feet high lying 2 miles from the western shore of Chiniak Bay and 5 miles southwestward from Kodiak. It is a useful guide in clear weather for the northern approach, from which direction a notch shows on the western side of its summit.

Kodiak is a village and post-office on the western shore of the bay inside Near Island. There is a good general store, fresh water is piped to the wharf, and coal in limited quantities can be obtained. There is communication by the mail steamers with Seward, Valdez, and points southwestward to Unalaska.

SOUTHERN ENTRANCE.

The entrance to the bay and harbor from southeastward is southward of Long and Woody islands, and between the latter and Holiday Island. The principal dangers near the sailing line are:

Humpback Rock, lying 3 miles 143° true (*SE* by *E* $\frac{3}{8}$ *E* mag.) from the south end of Long Island, is a pinnacle with two bare rocks about 5 feet high. There are numerous reefs between Humpback Rock and the southern shore.

Woody Island.—Foul ground extends $\frac{1}{2}$ mile southward from Woody Island to Inner Humpback Rock, which is a pinnacle about 10 feet high. There is a kelp patch about 300 yards southwestward of the rock. A rocky patch with 6 fathoms over it lies $\frac{1}{2}$ mile westward (true) from the southern end of Woody Island.

A sunken rock marked by kelp lies $\frac{1}{4}$ mile eastward (true) from the southern end of **Holiday Island** and $\frac{3}{8}$ mile southward (true) of **Bird Islet**. A rock, bare at low water and marked by kelp, lies 200 yards from Bird Islet in the direction of the northern end of Woody Island. Foul ground and kelp extend 600 yards northeastward from the northern end of Holiday Island.

NORTHERN ENTRANCE.

The northern entrance to the harbor is not difficult in clear weather, but is dangerous at night or in thick weather. The soundings are irregular in the approach, and the lead can not be depended on as a guide to the entrance or to avoid danger. The principal dangers in the northern approach and entrance are:

Williams Reef is two rocks, 100 yards apart and bare at lowest tides, with deep water close-to. There are generally breaks on them, except near high water with a smooth sea. The reef lies $3\frac{1}{4}$ miles 26° true (*N* $\frac{1}{8}$ *E* mag.) from the northeast end of Long Island, and 126° true (*E* by *S* mag.) from the summit of Spruce Island. The range of the cliffs at the southwest end of Long Island open from the high, grassy head at its northern end, bearing 221° true (*S* by *W* $\frac{1}{2}$ *W* mag.), leads about $\frac{3}{8}$ mile westward of the reef. Barometer Mountain in range with Kodiak village or the northwest side of Near Island, bearing 247° true (*S* *W* $\frac{1}{4}$ *S* mag.), also leads about $\frac{3}{8}$ mile northwestward of it.

A small patch with 5 fathoms over it lies $1\frac{3}{4}$ miles 288° true (*W* $\frac{1}{2}$ *S* mag.) from Williams Reef. The ranges given in the sailing directions for the northern entrance clear this patch.

Hutchinson Reef, partly bare at low water, is $\frac{1}{4}$ mile long, and its northern end lies $\frac{1}{2}$ mile 122° true (*E* $\frac{3}{4}$ *S* mag.) from Hanin Rocks. There is a large kelp patch between the reef and rocks.

On the western side of the channel, $\frac{3}{8}$ and $\frac{3}{4}$ mile southward of Spruce Cape, are two bare reefs which extend 600 yards from shore. **Channel Rock**, the southern one, is a

black rock about 10 feet high with extensive surrounding ledges. Kelp surrounds the reefs and extends $\frac{1}{4}$ mile southward of Channel Rock, and there is deep water close to the kelp.

A rock with 2 fathoms over it lies near the middle of the northern entrance, $\frac{7}{8}$ mile 148° true (*SE* by *E* mag.) from Spruce Cape. The ranges given in the sailing directions for the northern entrance clear the rock.

Rocks, bare at low water, and kelp extend $1\frac{1}{4}$ miles northward from the eastern end of **Woody Island**, also nearly $\frac{3}{8}$ mile northward and 300 yards westward from the northern end of the island.

CHANNEL WESTWARD OF NEAR ISLAND.

The channel on the northwest side of Near Island has a depth of about 26 feet, and a width of only 50 to 60 yards in places. The dangers are marked by kelp, but it also sometimes grows in the channel. The entrance is between Cyane Rock and foul ground which extends nearly 200 yards from the bight in the western shore. **Cyane Rock** is 300 yards northward of Near Island and is bare at lowest tides. The northern side of Near Island is foul, but its northwest side bordering the channel is bold. The western side of the passage is foul nearly to mid-channel until through the narrowest part. The passage is then clear to the wharf if the shores be given a berth of 50 yards.

The **wharf** is 150 feet long on its face and has 17 to 27 feet alongside. Vessels generally go to the end of the wharf port side to, heading northward, and it is preferable to approach it near high water slack. About 100 feet southward of the wharf is a shoal, on which is a rock crib and post that should be given a berth of 50 yards.

From the point southwestward of the wharf an extensive shoal extends $\frac{1}{4}$ mile southwestward. It is bare at low water 300 yards from shore, and there is 18 feet near its southern end abreast the narrow opening between Near Island and the first islet southward. The range of the outer rock crib southward of the wharf and the western shore of the narrows $\frac{1}{4}$ mile 56° true (*NNE* $\frac{7}{8}$ *E* mag.) from the crib leads close eastward of the southern half of the shoal.

A shoal extends 200 yards westward from the small islet on the eastern side 600 yards southward from the preceding shoal.

Anchorage.—The outer anchorage or roadstead is off **Shahafka Cove**, $\frac{7}{8}$ mile northward of Near Island, in 13 to 14 fathoms, soft bottom. A good berth is with the high bluff south point of the cove bearing 294° true (*W* mag.), distant 300 to 500 yards, and Barometer Mountain in range between Near Island and the water front of Kodiak. This is a good anchorage, but not convenient, owing to its distance from the landing, and it is exposed to considerable sea and swell in heavy northeasterly weather. A rocky patch with 5 fathoms over it lying $\frac{3}{8}$ mile 107° true (*E* $\frac{5}{8}$ *N* mag.) from the south point of the cove should be avoided when anchoring. The cove is shoal, and there are some shacks on it.

The inner anchorage is about $\frac{1}{2}$ mile southwestward of the wharf and 250 to 300 yards from the western shore under Pillar Mountain, in 7 to 8 fathoms. This is a secure anchorage for well-found vessels, though there are heavy williwaws with northwest winds.

For **tides** see the Pacific coast tide tables, in which the tides are predicted for every day of the current year.

Currents.—In Chiniac Bay, including the passage westward of Near Island, the flood current sets northward and the ebb southward, with considerable velocity in places among the islands. In the northern entrance the tidal currents have an estimated velocity of 2 to 3 miles at the strength of the large tides. They turn sharply around Spruce Cape across the reefs northward of it, and must be kept in mind.

SAILING DIRECTIONS, ST. PAUL HARBOR.

Southern entrance.—Approaching from southward or eastward, **Ugak Island** will be made unless the weather is thick. This island can hardly be mistaken, as it is well detached from the land and possibly 1,200 feet high.

Cape Chiniac will be recognized by the islets and rocks extending northeastward from it, and may be rounded at a distance of 2 miles. Passing 2 miles or more off Cape Chiniac, steer for the south end of Long Island. The range of the south end of Long Island and the north peak of the Devils Prongs, bearing 313° true (*WNW* $\frac{1}{4}$ *W* mag.), leads $1\frac{1}{4}$ miles outside the

rocks off Cape Chiniak and $\frac{5}{8}$ mile northward of Humpback Rock, and the distance from the cape to the rock is $5\frac{1}{2}$ miles.

Pass $\frac{5}{8}$ mile northward of Humpback Rock, steer 294° true (**W** mag.), and pass 1 mile southward of Long Island and $\frac{1}{2}$ to $\frac{3}{4}$ mile southward of Inner Humpback Rock. On this course guard against the flood current which sets strongly northward at times. Continue the course for 5 miles until 1 mile past Inner Humpback and the passage between Long and Woody Islands is closed.

Then steer 18° true (**N** $\frac{1}{2}$ **W** mag.) for 2 miles and pass the western end of Woody Island at a distance of 200 to 250 yards. When Near Island opens northward of Holiday Island, steer 345° true (**NW** $\frac{1}{2}$ **N** mag.) for the anchorage off Shahafka Cove.

To go to the wharf at Kodiak, round the northern end of Holiday Island, giving it a berth of over $\frac{3}{8}$ mile, and enter as directed in a following paragraph.

Northern entrance.—*From seaward*, keep the summit of Spruce Island bearing anything southward of 294° true (**W** mag.) until the cliffs at the southwest end of Long Island are open westward of the high, grassy head at its northern end. Then steer for Barometer Mountain, course about 243° true (**SW** $\frac{1}{2}$ **S** mag.), until on one of the ranges for the entrance.

From northward.—Directions from Marmot Strait to the entrance are given on page 6.

Or, for vessels approaching eastward of Marmot Island, from a position 3 miles off the southeast point of the island steer 221° true (**S** by **W** $\frac{1}{2}$ **W** mag.) for 26 miles, which should lead $2\frac{1}{4}$ miles westward of Williams Reef. Woody Island should be made ahead, its western end a little on the starboard bow, and the course and distance made good should lead to a position $1\frac{3}{8}$ miles eastward of Hanin Rocks. Then enter on one of the ranges for the entrance.

Or, passing $1\frac{1}{2}$ to 2 miles eastward of East Cape of Spruce Island, steer for the middle of Long Island, course about 180° true (**SSE** $\frac{1}{8}$ **E** mag.), passing about $1\frac{1}{2}$ miles eastward of Hanin Rocks, until on one of the ranges for the entrance.

From Narrow Strait.—Pass $\frac{3}{4}$ mile northward of Hanin Rocks and steer 144° true (**SE** by **E** $\frac{3}{8}$ **E** mag.) for $1\frac{1}{4}$ miles, heading for the northeastern end of Long Island, until the northwestern side of Near Island opens from the shore northeastward, and then enter on this range.

Entering on the ranges.—Either of the following ranges may be used:

Bring the water front of Kodiak just open from the western shore, bearing 243° true (**SW** $\frac{1}{2}$ **S** mag.), and stand in on this range until the northern end of Woody Island is abeam. Then steer 229° true (**SSW** $\frac{1}{4}$ **W** mag.) for $\frac{1}{2}$ mile, following the western shore at a distance of $\frac{1}{4}$ mile.

Or, bring the northwestern side of Near Island barely open from the shore northeastward, bearing 239° true (**SW** $\frac{7}{8}$ **S** mag.), and stand in on this range until Spruce Cape is abeam. Then steer 229° true (**SSW** $\frac{1}{4}$ **W** mag.), pass 400 yards eastward of Channel Rock, and then follow the western shore at a distance of $\frac{1}{4}$ mile until $\frac{1}{2}$ mile past the northern end of Woody Island.

Having followed the directions in either of the two paragraphs preceding, when Barometer Mountain is in line with the passage between Near Island and the water front of Kodiak, steer this range, course 247° true (**SW** $\frac{1}{4}$ **S** mag.), and anchor off Shahafka Cove (see "Anchorages" preceding).

To go to the wharf.—Steer the range of the preceding paragraph until up with the end of the small bluff $\frac{1}{4}$ mile northward of Near Island. Then bring the southernmost building (extreme left-hand one) near the wharf at Kodiak open 100 feet from Near Island (nearer that side than the western shore), and keep this range which leads in mid-channel westward of Cyane Rock where the channel is 75 yards wide. Keep the northwestern side of Near Island aboard distant about 100 feet until through the narrowest part of the channel, and then steer for the wharf.

To go to the inner anchorage, when through the narrowest part of the channel steer 238° true (**SW** by **S** mag.), heading a little westward of the islands southward, until abreast the first narrow opening between Near Island and the next islet (Uski) southward. Then haul westward to the anchorage under Pillar Mountain (see "Anchorages" preceding).

NARROW STRAIT AND SOUTH SIDE OF MARMOT BAY.

Narrow Strait, between Spruce and Kodiak islands, is used by vessels from Kodiak bound to Shelikof Strait. It has a clear width of 1 mile at its eastern end, while at its western end the channel is 150 to 300 yards wide with a least depth of about 7 fathoms. With easterly gales a heavy swell sets into the strait, but this generally loses much of its force toward the western end.

There are two islands on the north side of the strait. The eastern one is very uneven and grassy on top; foul ground extends 300 yards southward from it. **Nelson Island**, the western one, is higher and wooded. A rock, bare at low water, lies 350 yards southward of Nelson Island, and three similar rocks lie $\frac{1}{4}$ to $\frac{1}{2}$ mile westward of the island and about $\frac{3}{8}$ mile from the northern shore.

Course Point, on the southern shore $1\frac{1}{2}$ miles westward of Nelson Island, is prominent and is marked by a small, rocky, grass-covered islet 150 yards from shore.

Prokoda Island, in the middle near the western end of the strait, is 114 feet high and partly wooded. An islet lies 100 yards off its northeast end, and kelp extends 100 yards off the islet and the southeastern side of the island.

A rock, showing about 6 feet at low water, lies 250 yards southwestward from the western end of Prokoda Island. It is 40 yards southward of a line from the southern end of Prokoda Island to Uzinki Point. The channel southward of the rock has a depth of 7 fathoms and is 125 yards wide between it and a shelving spit with kelp which extends 125 yards from **Otmeloi Point**, on the southern shore.

The channel northward and westward of Prokoda Island is 300 yards wide and clear, but the turns are sharp and are sometimes difficult to make when the current is running.

Uzinki is a small native village at the head of the cove in Spruce Island northward of Prokoda Island.

The best anchorage in Narrow Strait is in the middle of the cove between Prokoda Island and Uzinki village, in 18 to 20 fathoms, somewhat exposed to an easterly swell. A small vessel and small craft can anchor at the head of the cove near Uzinki, slightly favoring the western side, in 5 to 10 fathoms.

Uzinki Point, the southwest end of Spruce Island, is wooded, and has several knolls about 100 feet high. There is kelp close to the point, and it should be given a berth of about 100 yards.

Entrance Point, on the south side at the western entrance of Narrow Strait, is grassy with some scattered trees, and a rock 10 feet high lies 100 yards off its eastern side. A kelp-marked shoal with 7 to 12 feet over it extends 250 yards northward from the point.

A good anchorage for a small vessel, exposed to northwest winds only, may be had in the cove between Otmeloi and Entrance points in about 13 fathoms. The shore of the cove must be given a berth of over 100 yards, and a flat extends 300 yards from its head.

Low Island lies in the light on the southern shore $\frac{3}{4}$ mile westward of Entrance Point. It is grass covered and about 40 feet high at its southern end. Near its northern end is a clump of trees. A shoal, with 20 feet at its end and some kelp, extends 350 yards northward of the island, and a bank with 7 to 8 fathoms extends northward to a spot with 21 feet over it lying 900 yards from the island.

Three Brothers is a kelp-marked reef 400 yards long and steep-to except on its eastern side. At its southwestern end are two rocks bare at half tide, and at its northeastern end is a rock covered at one-third flood. The southwestern end of the reef lies $\frac{1}{2}$ mile 356° true (*NNW* $\frac{1}{2}$ *W* mag.) from the northern end of Low Island, and is on the range of Uzinki Point and the tangent to the southern shore of Narrow Strait, bearing 120° true (*E* $\frac{1}{2}$ *S* mag.). By keeping the strait well open vessels will pass clear southward of the reef.

Shakmanof Point is the prominent, heavily wooded point $1\frac{1}{4}$ miles westward of Low Island. Some rocks show at low water close to the point, and it should be given a berth of over 250 yards.

Kizhuayak Point, $\frac{3}{4}$ mile southwestward of Shakmanof Point, is higher than the latter, partly wooded, and terminates in white cliffs in places. A rock bare at half tide lies 400 yards northward from the point.

Between Kizhuayak Point and Kekur Point, a distance of 6 miles, there are two bays which have not been sounded.

Kizhuyak Bay is the head of Marmot Bay southward of Whale Island. Kekur and Peregrebni points, lying $3\frac{1}{2}$ miles southward of Whale Island, are at the entrance to the upper part of the bay, which trends 221° true (*S* by *W* $\frac{1}{2}$ *W* mag.) for $2\frac{1}{2}$ miles and then 181° true (*SSE* mag.) for 6 miles, with an average width of $1\frac{1}{2}$ miles. In this part of the bay the depths are irregular, but the mid-channel is clear. The western shore from $1\frac{1}{4}$ to $4\frac{1}{2}$ miles southward of Peregrebni Point is foul; a rock bare at low water lies $2\frac{1}{4}$ miles southward of the point and $\frac{3}{8}$ mile from the western shore. Anchorage sheltered from northeasterly winds can be selected about 300 yards from the eastern shore and $3\frac{1}{2}$ to $4\frac{1}{2}$ miles southward from Kekur Point in 16 to 18 fathoms. A flat extends nearly $\frac{1}{4}$ mile from the mouth of the stream on the eastern shore $5\frac{1}{4}$ miles southward of Kekur Point and 1 mile northward from an islet. This islet lies $\frac{3}{8}$ mile from the eastern shore and $2\frac{1}{2}$ miles from the head of the bay; rocks bare at low water lie 300 yards westward of the islet. A flat extends $\frac{3}{8}$ to $\frac{1}{2}$ mile from the head of the bay where there is a large valley.

The **tidal currents** are weak except in the western entrance of Narrow Strait, where the estimated greatest velocity is about 2 miles.

For sailing directions see page 66.

WHALE PASSAGE,

between Whale and Kodiak islands, is a part of the route used by vessels from Kodiak bound to Shelikof Strait. It is $\frac{1}{2}$ to $\frac{3}{4}$ mile wide and generally clear, and the navigation is not difficult in the daytime when the current is not too strong. The depths are 9 to 30 fathoms, and the bottom is very uneven, especially in the eastern entrance.

Ilkognak Rock, awash at high water, lies in the middle of the eastern entrance. A sunken reef extends 250 yards southwestward, and a ledge with 6 to 12 fathoms over it extends $\frac{3}{8}$ mile eastward from the rock. A detached rock with 4 fathoms over it lies 500 yards 44° true (*N* by *E* $\frac{3}{4}$ *E* mag.) from Ilkognak Rock, and 550 yards 151° true (*SE* $\frac{3}{4}$ *E* mag.) from a rock awash at high water near Whale Island. With a strong ebb current, heavy swirls and overfalls occur in the wake of this broken ground, and dangerous tide rips prevail at such times with northeasterly gales.

A rock bare at half tide lies a little over $\frac{3}{8}$ mile southward of Ilkognak Rock.

Koniuji Islet, grass covered and about 40 feet high, lies $\frac{1}{4}$ mile from the south side of Whale Passage and 2 miles westward of Ilkognak Rock. Kelp extends $\frac{1}{4}$ mile and broken ground $\frac{3}{4}$ mile westward from the islet. The channel is northward of Koniuji Islet, and it should be given a good berth as the current sets toward it at times.

Temporary **anchorage** can be had in the bight on the north side of Whale Passage if stopped by too strong a flood current in the passage eastward. There is an eddy current in the bight, and care should be taken to get in far enough to ride to the eddy alone. A good berth is in about 8 fathoms, 300 yards from Whale Island, with Koniuji Islet bearing about 238° true (*SW* by *S* mag.)

A better anchorage can be had $\frac{1}{4}$ to $\frac{3}{8}$ mile off the western side of Whale Island, in 8 to 10 fathoms. This is convenient to either Whale Passage or Afognak Strait and is well out of the current, but it is exposed to westerly winds.

The **tidal currents** in Whale Passage set westward on the flood and eastward on the ebb. The estimated velocity is 4 to 10 miles at strength, depending on the range of the tide. Slack water occurs about $1\frac{1}{4}$ hours before high and low waters at Kodiak. With a strong current swirls occur in the passage in the wake of all broken ground, and rips occur at the entrances when the current sets out against a strong wind. The worst place is at the eastern entrance, where these conditions are dangerous at times.

For sailing directions see page 66.

KUPREANOF STRAIT

extends from Whale Island to Shelikof Strait, between Raspberry and Kodiak islands. Its width is $1\frac{3}{4}$ to 3 miles and the strait is generally clear, but there are shoals to be avoided off the southeast end of Raspberry Island, on the south side from Islet Point to the western end of Dry Spruce Island and $4\frac{1}{4}$ miles westward of Dry Spruce Island and $1\frac{3}{8}$ miles from the south shore.

The islands on both sides are grass covered and mountainous, the north shore especially rising abruptly. The timber extends westward along the shores to Last Timber Point and Dry Spruce Island, where it terminates except for scattered clumps. Anchorage may be had in places near the shore, but the only secure harbor is Dry Spruce Bay.

Between Deranof Island and the southeast end of Raspberry Island there are two wooded islands, the south end of the western one being Nachalni Point. **Thomas Rock**, awash at low water, lies $\frac{3}{8}$ mile 226° true (*SSW* mag.) from Nachalni Point, and a patch with 6 fathoms over it lies $\frac{5}{8}$ mile in the same direction from the point.

Chernof Point is a prominent, low, wooded point on the south shore, $2\frac{1}{2}$ miles westward of Whale Island.

Islet Point, 2 miles westward of Chernof Point, is low and wooded, and has a high, grassy islet close-to. Broken ground with a depth of $4\frac{1}{2}$ fathoms lies $\frac{5}{8}$ mile 47° true (*NNE* mag.) from the islet.

Dry Spruce Island lies $\frac{3}{4}$ mile westward of Islet Point, with a wooded island between, the two islands and the shore eastward being joined by shoals dry at low water. It is $1\frac{3}{8}$ miles long, 225 feet high and wooded. Foul ground extends $\frac{3}{8}$ mile northeastward from its eastern point, and broken ground with a depth of 5 fathoms lies over $\frac{3}{8}$ mile northward from the same point. Two grassy islets and a pinnacle rock lie off the north side of the western point of Dry Spruce Island, and a ledge bare at half tide lies 650 yards 334° true (*NW* $\frac{1}{2}$ *W* mag.) from the same point. Broken ground with a depth of 5 fathoms lies $\frac{5}{8}$ mile northward from the western end of the island.

Bare Island, southward of the western end of Dry Spruce Island, is $\frac{7}{8}$ mile long and partly wooded on its eastern half. There is a fox ranch on its northeastern side. A small grassy island lies $\frac{3}{8}$ mile westward of Bare Island.

Dry Spruce Bay, the only secure harbor in Kupreanof Strait, is on the south side inside Bare and Dry Spruce islands, and extends 2 miles eastward from the latter. The entrance between Dry Spruce and Bare islands is over $\frac{1}{4}$ mile wide, and is clear with the exception of a rock bare at low water lying nearly 200 yards from the south side of Dry Spruce Island just inside its western end; a shoal extends 150 yards off the northern side of the eastern end of Bare Island. The entrance south of Bare Island and the small island westward of it is over $\frac{1}{2}$ mile wide and clear. The bay is clear with the exception of a rock, bare at low water, in the middle, $\frac{3}{4}$ mile from its eastern end.

The best anchorage for large vessels is about $\frac{1}{2}$ mile eastward of Bare Island and $\frac{3}{8}$ mile off the cove in Dry Spruce Island, in 16 to 19 fathoms. A small vessel can anchor in the middle of the entrance to this cove in about 6 fathoms, taking care to keep clear of the flat, which extends 250 yards from its northeast side. With strong southwesterly winds some williwaws are felt from Kupreanof Mountain. Water may be obtained from a stream in a cove on the south side of the bay south (true) from the eastern end of Bare Island.

Approaching Dry Spruce Bay from eastward, give Dry Spruce Island a berth of $\frac{3}{4}$ mile, and steer for the western end of Bare Island on any bearing southward of 226° true (*SSW* mag.) until past the reef northwestward of the western end of Dry Spruce Island. Then haul eastward and pass midway between Dry Spruce and Bare Islands, course about 139° true (*SE* by *E* $\frac{3}{4}$ *E* mag.).

Approaching Dry Spruce Bay from westward, vessels may enter either between Bare and Dry Spruce islands, or south of Bare Island and the small island westward of it.

A rock with 16 feet over it lies in Kupreanof Strait $4\frac{1}{4}$ miles westward of Dry Spruce Island, $1\frac{3}{8}$ miles from the south shore, and $2\frac{1}{4}$ miles 97° true (*ENE* $\frac{1}{2}$ *E* mag.) from the northern extremity of Outlet Cape. It is at the northern end of a bank about $\frac{1}{4}$ mile in diameter with depths of 7 to 20 fathoms. The range of Chernof Point and the southern side of Whale Island leads 200 yards northward of the rock.

Onion Bay makes into Raspberry Island about 2 miles, and from its head a low divide extends through to Shelikof Strait. The entrance is narrow, and just inside it the bay is blocked by shoals partly bare at low water, between which are narrow channels suitable only for small craft. Above these shoals the bay has depths of 15 to $21\frac{1}{2}$ fathoms. The tidal currents have

an estimated velocity of 3 to 5 miles in the entrance. Temporary anchorage can be had $\frac{3}{8}$ to $\frac{1}{2}$ mile off the entrance, in 10 to 15 fathoms.

Outlet Cape is the western end of the peninsula included between Kupreanof Strait and Viokoda Bay. The cape has a steep slope to a peak 1,600 feet high, eastward of which is a low divide extending through. A cluster of bare rocks lies 350 yards off the northwest end of the cape. **Kupreanof Mountain**, $7\frac{1}{4}$ miles eastward of Outlet Cape, has a surface of broken, gray rock; it is 2,400 feet high.

Malina Point, 2 miles eastward of Raspberry Cape, is projecting and prominent. It has a grass covered knoll at its end, with a low neck behind it, and then a steep slope to 1,500 feet.

Raspberry Cape, the southwestern end of Raspberry Island, is steep and high, and has areas of bare rock for one-third its height. There are some bare rocks in the water close to its foot.

Tides.—At Onion Bay high and low water occur about 26 minutes later than at Kodiak, and the mean rise and fall of the tides is 11.8 feet. To find the approximate height of the tide multiply the height of the corresponding tide at Kodiak by the ratio of ranges, 1.71. The tides meet in the strait a little westward of Dry Spruce Island. The tidal currents have an estimated velocity of 2 to 3 miles at the strength of the large tides.

SAILING DIRECTIONS, KODIAK TO SHELIKOF STRAIT.

Narrow Strait.—Coming from Kodiak, pass 400 yards eastward of Channel Rock and steer 49° true (**NNE $\frac{1}{4}$ E mag.**) for 2 miles, passing $\frac{7}{8}$ mile eastward of Hanin Rocks. When Miller Point opens northward of Hanin Rocks, bearing 280° true (**WSW $\frac{3}{4}$ W mag.**), change course to 300° true (**W $\frac{1}{2}$ N mag.**), with Uzinki Point just open from the southern shore of Narrow Strait ahead, and pass $\frac{3}{4}$ mile northward of Hanin Rocks. Steer this range for $4\frac{1}{2}$ miles past Hanin Rocks until Nelson Island is $\frac{1}{2}$ mile on the starboard beam. Then steer 304° true (**W $\frac{7}{8}$ N mag.**), pass about $\frac{1}{4}$ mile northward of Course Point, and continue the course about $\frac{3}{4}$ mile past the point.

When Shakmanof Point shows in the middle of the passage southward of Prokoda Island, bearing 290° true (**W $\frac{3}{8}$ S mag.**), steer this course, pass 75 to 100 yards southward of the rock westward of the island, and give Otmeloi Point on the south shore abreast the rock a berth of 150 yards. Continue the course until Uzinki Point is 125 to not over 150 yards on the starboard beam.

Then steer 297° true (**W $\frac{1}{4}$ N mag.**) for $2\frac{1}{4}$ miles with the tangent to the southern shore of Narrow Strait astern, and pass 650 yards northward of Low Island, 300 yards southward of Three Brothers, and $\frac{1}{4}$ mile northward of Shakmanof Point.

Whale Passage.—From a position $\frac{1}{4}$ mile northward of Shakmanof Point steer 263° true (**SW by W $\frac{1}{4}$ W mag.**) for $6\frac{1}{4}$ miles, passing over $\frac{3}{8}$ mile northwestward of Kizhuyak Point. The southern end of Whale Island will show as a small wooded head, and there is a rock awash at high water close-to. Keep the southern end of the island aboard distant about 350 yards in entering Whale Passage, and pass about 300 yards southward of the rock awash at high water and $\frac{1}{4}$ mile northward of Ilkognak Rock. Strict attention to the steering is important on account of heavy swirls.

Then steer 294° true (**W mag.**) for Koniuji Islet, following the northern shore at a distance of about 400 yards, and when about $\frac{3}{4}$ mile from the islet steer 316° true (**WNW mag.**) for the end of Whale Island to a position $\frac{1}{4}$ mile northward of Koniuji Islet.

Kupreanof Strait.—From a position $\frac{1}{4}$ mile northward of Koniuji Islet steer 292° true (**W $\frac{1}{8}$ S mag.**) for $7\frac{3}{4}$ miles, passing $\frac{3}{8}$ mile northward of Chernof Point, to a position $\frac{3}{8}$ to $\frac{1}{2}$ mile southward of Gori Point. Then steer 287° true (**W $\frac{5}{8}$ S mag.**) with the summit of Whale Island astern, passing $\frac{7}{8}$ mile northward of Outlet Cape and $\frac{1}{2}$ mile southward of Malina Point, the distance from Gori Point to Malina Point being $10\frac{1}{4}$ miles. Then,

If bound down Shelikof Strait, from a position $\frac{1}{2}$ mile southward of Malina Point make good a 245° true (**SW $\frac{3}{8}$ S mag.**) course for 18 miles, which leads $1\frac{1}{2}$ miles westward of Cape Uganik and to a position 2 miles westward of Cape Ugat. Then a 230° true (**SSW $\frac{3}{8}$ W mag.**) course made good for 28 miles will lead nearly $2\frac{1}{2}$ miles westward of Cape Uyak and to a position 2 miles westward of Cape Karluk.

SHELIKOF STRAIT.

The triangulation has been extended southward through the strait to Cape Karluk and Cape Kubugakli. Only the outlying islands and rocks are located from the northwest end of Shuyak Island to Black Cape, but from the latter point to Cape Karluk most of the points are determined by triangulation. From Shaw Island to Takli Island most of the principal points and outlying rocks are located.

The hydrography of the main part of the strait has been done from Barren Islands southward to Raspberry Island. In this part of the strait great depth is not generally found near the land, and depths suitable for temporary anchorage will be found near the shore in most places. In thick weather or when uncertain of the position the depth should not be shoaled to less than 50 fathoms.

Currents.—Current observations were made for short periods at the anchorages used by the surveying vessel near the shore. The currents are principally tidal, but the relation of the current to the rise and fall of the tide is not in all cases clear. On the western side of the strait a current of $\frac{1}{2}$ and $\frac{3}{4}$ mile is recorded, setting along shore in either direction. It is believed that along the western shore the southerly current predominates.

Between Cape Douglas and Shaw Island the current is stronger, a 2-mile current being recorded, setting along shore to and from Kamishak Bay. The current seems to decrease in velocity with increase of distance from shore. Apparently there is less current along the west coast of Afognak Island than on the opposite side of the strait.

Strong tidal currents are encountered off the northwest side of Shuyak Island, and heavy tide rips variable in position are frequently seen along the western side of Dark Island and Latax Rocks. The flood sets into Shelikof Strait and the ebb the opposite way. The direction of the set is dependent upon the adjacent land, and a knowledge of its configuration will enable one to estimate closely the direction of the set. The greatest velocity recorded on the southwest side of Dark Island is 1.3 miles on the flood, but this probably is not the maximum velocity. On the day of the observations slack water occurred near the time of low water at Kodiak.

Weather.—During the summer of 1908 gales and rainy conditions were frequent. June was the best month and July perhaps the worst. Northeast winds invariably bring rain and thick weather, and it is from this direction that most of the heavy weather comes. During the greater part of the season the wind when strong from this quarter rarely varied much in direction while its strength lasted and it never backed. In the latter part of the season a northeast gale almost invariably backed through northwest to west or southwest, blowing with great force.

Southeast winds generally bring clouds, but may be accompanied by either rain or fair weather.

Southwest and west winds are invariably accompanied by fine clear weather, but they often blow with great force. The southwest gale is perhaps the most to be dreaded in Shelikof Strait, as it raises a short, heavy sea that is trying to a small vessel.

Southerly winds generally bring haze, which is sometimes so thick as to resemble fog.

Northwest winds bring fair weather and a clear atmosphere.

Gales in this region last without intermission anywhere from a day to two or three days.

Northeast winds are generally accompanied by a low barometer and southwest winds by a high barometer, but the rule is not invariable. The barometer is of little or no value in foretelling the weather, as it accompanies rather than precedes corresponding conditions. The slope of the barometric curve is apt to change suddenly, the weather changing with equal suddenness. A sure sign of rainy weather and wind from northeast is the gathering of clouds on the northeast side of the mountains.

Little fog was encountered during the season, but blinding snowstorms were frequent early in spring.

WESTERN COAST OF SHUYAK AND AFOGNAK ISLANDS.

The general trend of the western coast of Shuyak and Afognak islands is 218° true (*S* by $W \frac{1}{4} W$ mag.), and the distance from the northernmost of the Latax Rocks to Raspberry Cape is 48 miles. From Raspberry Cape the eastern coast of Shelikof Strait trends 230° true (*SS* $W \frac{3}{8} W$ mag.) for $45\frac{1}{2}$ miles to Cape Karluk.

Party Cape is the northwest end of Shuyak Island. A reef bare at low water lies about midway between the cape and **Dark Island**. The latter lies $1\frac{1}{4}$ miles northward from the

cape, and is about $\frac{3}{4}$ mile in diameter, about 200 feet high, and grass covered. There are several large black rocks off the southwest end of Dark Island.

Latax Rocks are a chain of three rocky islets, about 60, 50, and 30 feet high, respectively, lying $1\frac{1}{4}$ to 3 miles northward of Dark Island. Between the two outer ones is a reef bare at low water, and a rock bare at low water lies about $\frac{3}{8}$ mile northward of the outer rock. Vessels should not attempt to pass between Party Cape and the outer rock, $5\frac{1}{4}$ miles northward, in the absence of a survey.

A depth of 7 fathoms, with a probability of less, was found $1\frac{1}{2}$ miles westward of the southernmost Latax Rock.

The western side of Shuyak Island is irregular and fringed by a chain of islets and rocks 1 to 2 miles from shore. Between them and the island there are many rocks and kelp patches. Some of the outer ones are located, and these only are mentioned. They lie nearly on a line from the rocks westward of Party Cape to Black Cape, bearing 214° true ($S \frac{7}{8} W$ mag.).

A rock a few feet high lies $\frac{7}{8}$ mile westward of Party Cape. **Shag Islet**, rocky and about 50 feet high, lies 1 mile southward of the preceding rock and about $\frac{5}{8}$ mile from a point on Shuyak.

Gull Island, the highest and most prominent of the offlying islets, is about 150 feet high, and has a rounded, grass-covered summit. It lies $2\frac{3}{4}$ miles southwestward from Party Cape. Some rocks, covered or awash at high water, lie off the south side of Gull Island, and kelp shows between it and Shuyak.

Rocks show at low water some distance off the southwest point of Shuyak Island.

Shuyak Strait was not examined. It is reported to have strong tidal currents.

From Shuyak Strait to Black Cape, the coast of **Afognak Island** is irregular, rocky, and wooded. Many islets lie offshore, especially near Black Cape. Three prominent islets lie nearly on line from the cape to the islets off the western side of Shuyak. The northern one, lying 6 miles from Black Cape, is a large black rock. The second one is about 40 feet high and lies $1\frac{1}{4}$ miles southward of the preceding rock. The third, lying $2\frac{1}{2}$ miles from Black Cape, is about 40 feet high and broken into several parts, and there are many rocks and islets between it and the shore.

Black Cape is low and grassy at the end, and rises gradually in a narrow heavily wooded ridge to a prominent bald knob 1,155 feet high. Bare and sunken rocks extend a short distance off the cape, and a reef, mostly showing above water, lies on its south side.

The bay between Black Cape and Ban Island has reefs, which do not extend westward of the island.

Ban Island is mountainous, its highest peak being found near its south shore. There is kelp close to its west end.

Paramanof Bay, between Ban Island and Cape Paramanof, is not surveyed. It is recommended to favor Ban Island when entering. The *Explorer* anchored on the south side, 3 miles eastward of Cape Paramanof and about $\frac{1}{2}$ mile off a rocky shore, in 22 fathoms, soft bottom. There is a short sand beach just eastward of the anchorage, and a rocky islet close to shore a short distance westward. The anchorage is exposed to westerly and northerly winds. There is said to be good anchorage farther in, but no definite information is available.

Cape Paramanof is the northwest end of the peninsula included between Paramanof and Alimvoak bays. It is a low tongue of land projecting $\frac{1}{2}$ mile northward from the mountains. A reef lies on the north side of the cape inside Paramanof Bay, and a part of it about $\frac{1}{2}$ mile from shore is bare at low water.

The peninsula between Paramanof and Alimvoak bays is marked by two mountain ridges trending eastward, with a small stream in the valley between them. The land is grass covered, with bare rocks in places, and there is no timber. The northern ridge rises in steep grassy slopes to an elevation of 1,842 feet, with a saddle behind it, and then extends eastward with about the same height. **Tanaak Cape** is the northern point at the entrance of Alimvoak Bay.

Alimvoak Bay is described below.

Steep Cape is a cliff 1,600 feet high, with a deep break (saddle) behind it, and then a gradual rise to higher land. From offshore the top of the cliff shows irregular, but from northward or southward the summit is sharp. Lying 1 mile northward of Steep Cape is another cliff 1,060 feet high, which is on the south side at the entrance to Alimvoak Bay.

Raspberry Strait, between Afognak and Raspberry islands, is not surveyed. Its southeast end is bare at low water.

Raspberry Island is mountainous and grass covered on its western side, the principal points being three high cliffs, between which are two deep valleys trending eastward. The southern valley, about the middle of the island, is especially low, and extends through to Onion Bay.

ALIMVOAK BAY

lies between the mountainous peninsulas terminating westward in Tanaak and Steep capes. It is about 10 miles long and is a secure harbor. Water can be obtained from numerous small streams. There is some timber near the head of the bay and in some of the valleys. Steep Cape and the high cliff at the south point at the entrance, and the rounded grass-covered mountains on the northern side of the bay, mark the entrance.

The bay is $2\frac{1}{2}$ to 3 miles wide for nearly 4 miles, and then contracts rapidly to a neck about $1\frac{1}{2}$ miles long with a least width of $\frac{3}{8}$ mile. From the south side of the neck an arm extends $1\frac{1}{2}$ miles southeastward. Above the neck is a basin 2 miles long with a greatest width of $1\frac{1}{4}$ miles. From the eastern end of the basin an arm extends 2 miles eastward, with a width of about $\frac{1}{4}$ mile; it is filled by a flat nearly to its mouth.

The outer part of the bay is clear, with the exception of a rock bare at low water lying $\frac{1}{4}$ mile from shore in the bight on the south side nearly 4 miles inside the entrance. Rocks awash at high water extend 300 yards off the south side at the entrance to the neck, and lie $\frac{1}{2}$ mile westward of the island in the entrance of the southeast arm. The depths are suitable or anchorage $\frac{1}{4}$ to $\frac{3}{8}$ mile from shore nearly anywhere in the outer bay. An anchorage, exposed only to westerly winds, can be had on the north side of its eastern end, about $\frac{1}{4}$ mile westward of an islet, and the same distance from the shore northwestward, in 15 fathoms, sticky bottom.

In the **neck** off the entrance of the southeast arm is an island, $\frac{3}{8}$ mile long and 115 feet high, with a clump of trees near its middle. There is no safe passage between it and the shore southeastward. An islet 30 feet high lies on the south side of the neck $\frac{3}{8}$ mile eastward of the island, and foul ground extends 225 yards from the south shore just eastward of the islet. A rock 15 feet high, with a small one close westward, lies 400 yards northeastward of the islet, the best channel being between them. A rock bare at low water lies 400 yards eastward of the rock 15 feet high, and over 300 yards from the northern shore.

To go through the neck, pass 200 yards northward of the island, steer 121° true (**E** $\frac{5}{8}$ **S** mag.), and pass 100 yards southward of the rock 15 feet high lying in the middle of the neck.

The **basin** has depths of 30 to 47 fathoms in its western half and shoals gradually eastward, affording secure anchorage. A rock covered at high water lies 400 yards westward from the north point at the entrance to the narrow arm extending eastward, and a shoal extends 600 yards southwestward from a point on the north shore $\frac{3}{8}$ mile northward of the rock. The best anchorage is about $\frac{3}{8}$ mile off the bight at the northern end of the basin, with the entrance (neck) just closed, in 15 to 18 fathoms, sticky bottom.

The **southeast arm** is a secure anchorage with a clear width of nearly $\frac{1}{4}$ mile. The northwest point of the island in the entrance should be given a berth of over 100 yards, and a rock bare at low water lies 100 yards from the shore southwestward of the same point.

To enter the southeast arm, steer 163° true (**SE** $\frac{3}{8}$ **S** mag.), pass 150 yards southwestward of the northwest point of the island, and follow the southwest shore of the arm at a distance of about 250 yards. Anchor in the broad part about $\frac{5}{8}$ mile from the head, in about 10 fathoms, sticky bottom. A flat extends nearly $\frac{3}{8}$ mile from the head.

Tides.—High and low water occur about 20 minutes later than at Kodiak, and the mean rise and fall of the tides is 12 feet. To find the height of the tide multiply the height of the corresponding tide at Kodiak by the ratio of ranges, 1.74.

VIEKODA BAY

is on the eastern side of Shelikof Strait between Outlet Cape and Uganik Island. It extends into Kodiak Island in a 131° true (*ESE* $\frac{1}{2}$ *E* mag.) direction, and has a length of $13\frac{1}{2}$ miles from Outlet Cape and 17 miles from Cape Uganik. The lower part of the bay is 3 miles wide. From its southern side, 8 miles below the head, Uganik Passage extends southeastward. Above Uganik Passage the bay is 2 miles wide and narrows to $\frac{1}{2}$ mile at its head.

Foul ground exists near the shore in places, but except where mentioned below danger will be avoided by giving the shore a berth of $\frac{1}{2}$ mile.

The head of the bay is shoal for 1 mile to two islets. About $\frac{1}{2}$ mile below the islets there are two islands near the southern shore. Good anchorage may be had $\frac{1}{2}$ to 1 mile below the islands and about 2 miles from the head of the bay, in 12 to 17 fathoms.

Off the entrance, $2\frac{3}{4}$ to $3\frac{1}{4}$ miles from Outlet Cape, is a bank on which the least depth found is $6\frac{3}{4}$ fathoms at its northeast end, lying 267° true (*SW by W $\frac{1}{2}$ W mag.*) from the north end of Outlet Cape and 166° true (*SE $\frac{5}{8}$ S mag.*) from Raspberry Cape.

A narrow point, its end detached, extends $\frac{3}{8}$ mile from Uganik Island 1 mile eastward from its northern end. Broken ground, with depths of 4 and 5 fathoms, extends $\frac{5}{8}$ mile 10° true (*N by W $\frac{1}{4}$ W mag.*) from the point. There is a fair anchorage in southerly weather in the bight on the east side of the point, $\frac{1}{4}$ to $\frac{3}{8}$ mile from shore, in 10 to 15 fathoms.

A rock, with $4\frac{1}{2}$ fathoms on it and which should be avoided, lies $\frac{5}{8}$ mile from Uganik Island and $2\frac{1}{2}$ miles westward of the point dividing Viekoda Bay and Uganik Passage.

The latter point has an islet near it, and a rock bare at low water lies $\frac{3}{4}$ mile above the islet and $\frac{3}{8}$ mile from the south shore of Viekoda Bay. Depths of 3 to 5 fathoms extend $\frac{1}{4}$ mile northward of the rock.

UGANIK PASSAGE

borders the northeast and south sides of Uganik Island and connects Viekoda and Uganik bays. The depths in the passage are too great for anchorage except in Terror Bay.

The part of Uganik Passage on the northeast side of Uganik Island is clear in mid-channel except 5 miles from Viekoda Bay and 1 mile from the southeastern end of Uganik Island. At this point a flat makes two-thirds the distance across the passage from the mouth of a stream in a large valley on the northeastern shore, and leaves a clear channel 350 yards wide close to a point of Uganik Island. There is an islet close to Uganik Island in the bight southeastward of this point.

Terror Bay extends 4 miles 190° true (*S by E $\frac{1}{4}$ E mag.*) from the southeast end of Uganik Passage, with a width of $\frac{5}{8}$ to $\frac{3}{4}$ mile. It then narrows to $\frac{3}{8}$ mile, trends 154° true (*SE $\frac{1}{2}$ E mag.*) for nearly 2 miles, and is filled by a flat. The main bay is clear with the exception of three rocks which lie 300 yards from the western shore; the first two, lying $\frac{3}{4}$ and $1\frac{1}{4}$ miles inside the entrance, have 3 feet over them; the upper one, lying $1\frac{3}{4}$ miles inside the entrance, is bare at low water. There is secure anchorage for vessels of any size 3 to 4 miles above the entrance and about $2\frac{1}{2}$ miles from the head of the bay, in 7 to 15 fathoms.

The part of Uganik Passage south of Uganik Island is 9 miles long from the southeastern end of Uganik Island to East Point, where it joins Uganik Bay.

A rock bare at low water lies $\frac{1}{4}$ mile from the south side of Uganik Island $\frac{5}{8}$ mile from its southeastern end.

A high **peninsula** extends southeastward from Uganik Island 2 miles from its southeastern end and narrows the passage to $\frac{1}{4}$ mile. From the point on the south shore southeastward of the peninsula a ledge bare at low water makes nearly halfway across the passage where narrowest, and the southeast end of the peninsula must be kept aboard distant 100 to 150 yards until past the narrowest place.

Westward of the peninsula is an island in the middle of the passage, in the vicinity and westward of which are several rocks, sunken and bare at various stages of the tide. Vessels from eastward may pass northward of the foul ground by following the southwest shore of the peninsula at a distance of about 200 yards until the island is abaft the port beam, and then steer 300° true (*W $\frac{1}{2}$ N mag.*) for the southernmost point which shows ahead of Uganik Island, with the summit of the peninsula a little on the port quarter. When the bare rock $\frac{3}{8}$ mile westward of the island is abaft the port beam the dangers will be passed. These are:

A rock bare at low water lies 300 yards northeastward of the island.

A rock bare at low water lies 250 yards northward of the bare rock $\frac{3}{8}$ mile westward of the island.

Foul ground and rocks bare at low water extend $\frac{1}{4}$ mile from Uganik Island $\frac{3}{8}$ to $\frac{7}{8}$ mile westward of the peninsula.

The channel southward of the island is narrower than that northward. To go through this channel from eastward, bring the south end of the peninsula barely open from the point eastward astern, and steer for the prominent point on the south shore $\frac{3}{4}$ mile westward of the island, course 281° true (**WSW $\frac{7}{8}$ W** mag.). Keep close on this line, passing midway between the island and an islet near the south shore $\frac{1}{4}$ mile westward of the island. When the islet is passed, haul northward and give the point a berth of over 200 yards. The principal dangers are:

A rock bare at low water lies 200 yards southwestward of the island.

A rock with 8 feet over it lies $\frac{3}{8}$ mile westward of the island and $\frac{1}{4}$ mile northwestward of the islet.

The islet should be given a berth of over 100 yards, and the south shore for $\frac{3}{4}$ mile eastward of the islet should be given a berth of 250 yards.

Westward of these dangers Uganik Passage is broad and free from outlying dangers. In the large bight of Uganik Island 5 miles eastward of East Point, shoals extend $\frac{1}{2}$ mile from its northwest shore for a distance of 1 mile from its head. From this bight a broad, low divide extends across the island.

Rocks bare at low water extend $\frac{1}{2}$ mile from the south shore of the passage $1\frac{3}{4}$ miles eastward of East Point, and $\frac{1}{2}$ mile farther eastward rocks make out 600 yards on the northwest side of a point on the south shore.

UGANIK BAY

is on the eastern side of Shelikof Strait, between Uganik Island and the mountainous peninsula terminating westward in Cape Ugat. Only the entrance from Noisy Islands to East Point is sounded. Anchorage with shelter from southerly and westerly winds can be had in the bight 2 miles southeastward of Broken Point, and there is secure anchorage in East Arm. Heavy williwaws occur during southwest gales, which are worst toward the head of the bay where the mountains are highest. The shores rise abruptly with cliffs in places, and are generally covered with grass and bushes.

Cape Uganik, the northwest end of Uganik Island, is low for about $\frac{1}{4}$ mile back, and then rises quickly to elevations of 1,200 to 1,400 feet. A valley extends across the island about $1\frac{1}{2}$ miles eastward of the cape, and the gap can be seen from southward. For a distance of $1\frac{1}{2}$ miles southward from the cape shoals extend about $\frac{1}{4}$ mile from shore in places.

Noisy Islands lie $\frac{1}{2}$ to $\frac{5}{8}$ mile from Uganik Island and $2\frac{1}{2}$ miles southward of Cape Uganik. The group is 1 mile long and is two principal islands—the northwest one 192 feet high, the southeast one low and flat. Reefs extend about $\frac{1}{4}$ mile northward and northwestward from the northwest island, and possibly as much southeastward from the southeast island. The passage between them and Uganik Island has a depth of about 8 fathoms.

Cape Ugat is on the eastern shore of Shelikof Strait 12 miles 243° true (**SW $\frac{1}{2}$ S** mag.) from Cape Uganik. It is a high ridge sloping to a low rocky shelf at the point of the cape. A short distance off the cape is a rocky, grass-covered islet, which can be seen about 15 miles on a clear day and is a good mark. **Little River** is on the south side of Cape Ugat.

Miners Point, $4\frac{1}{4}$ miles 72° true (**NE $\frac{3}{8}$ E** mag.) from Cape Ugat, terminates in two island-like knobs, the inner one 430 feet high and conical, the outer one lower and flatter.

Broken Point, $3\frac{1}{4}$ miles 105° true (**E $\frac{3}{4}$ N** mag.) from Miners Point, is low and flat for $\frac{3}{8}$ mile back, its end being detached, and then rises to high land. A depth of $3\frac{1}{2}$ fathoms, with deep water close-to, was found 400 yards northward of the point. The entrance of Uganik Bay is 3 miles wide between this point and Noisy Islands, and inside the point the bay widens to about 5 miles until up with East Point.

A stream empties in the bight $1\frac{3}{4}$ miles southward of Broken Point. There is good anchorage sheltered from southerly and westerly winds about $\frac{3}{4}$ mile southeastward of the mouth of the stream and $\frac{3}{8}$ to $\frac{1}{2}$ mile from shore, in 8 to 15 fathoms.

East Point, 5 miles eastward of Broken Point, is the northwestern extremity of the high peninsula separating Uganik Bay and Passage. There is a flat rock with bluff sides close to the point, and from the latter there is a long, gentle slope to high land.

At East Point Uganik Bay is $2\frac{1}{2}$ miles wide, from which it extends $12\frac{1}{2}$ miles 180° true (**SSE** mag.), narrowing gradually, to the head of South Arm. Little sounding has been done, but the bay is clear so far as known.

Northeast Arm, not surveyed, extends eastward from Uganik Bay $2\frac{1}{2}$ to 4 miles southward of East Point. **Rock Point**, the south point at the entrance, is marked by several bare rocks which extend off 250 yards.

Village Islands are numerous islands and rocks extending $\frac{1}{4}$ to $\frac{1}{2}$ mile from the western shore 2 to 4 miles southward of East Point. In the cove between the south end of the islands and Village Peninsula anchorage is reported for small vessels. There is a native village at the head of the cove.

East Arm extends eastward from Uganik Bay 7 miles southward from East Point. It is 1 mile wide at the entrance and over 3 miles long, but a flat extends $1\frac{1}{2}$ miles from its head or $\frac{1}{2}$ mile below the island in the bight on the south side of the arm. The depths range from 15 fathoms at the entrance to 6 fathoms near the edge of the flat. The arm is clear so far as known and is a secure anchorage for vessels of any size. It is subject to heavy williwaws during southwest gales, but these are not dangerous to well-found vessels. The north point at the entrance is a low spit on which is a disused cannery.

South Arm extends $5\frac{1}{2}$ miles southward from the south point of East Arm. No sounding has been done.

SAILING DIRECTIONS, UGANIK BAY.

From northward, round Cape Uganik at a distance of 1 mile and steer 222° true (S by W $\frac{5}{8}$ W mag.) for $3\frac{1}{4}$ miles to a position 1 mile westward of Noisy Islands. Then steer 164° true (SE $\frac{1}{2}$ S mag.), passing about $\frac{7}{8}$ mile off the western shore from West Point to Village Islands, and $\frac{1}{2}$ mile eastward of the islands. This course made good for 10 miles should lead to a mid-channel position between the southernmost of the Village Islands and Rock Point. Then steer 192° true (S by E mag.) for $2\frac{1}{2}$ miles, following the eastern shore at a distance of about $\frac{1}{2}$ mile, to the entrance of East Arm.

From southward, give Cape Ugat and Miners Point a berth of about $1\frac{1}{2}$ miles, and Broken Point a berth of about $\frac{3}{4}$ mile. Then steer 154° true (SE $\frac{3}{8}$ E mag.) for $3\frac{1}{2}$ miles to a position about $\frac{7}{8}$ mile off West Point. Then steer 164° true (SE $\frac{1}{2}$ S mag.) for 4 miles to a mid-channel position between the southernmost of the Village Islands and Rock Point as in the preceding paragraph.

UYAK BAY.

is on the eastern side of Shelikof Strait southward of the mountainous peninsula terminating westward in Cape Ugat. Uyak Anchorage, a secure harbor convenient to Shelikof Strait, is on the southern side of the bay, 16 miles southward of Cape Ugat and 18 miles northward of Cape Karluk. Some of the points in the approach to the bay are determined by triangulation, and Uyak Anchorage and Uyak Bay above Harvester Island are surveyed. The principal dangers in the surveyed areas are mentioned in the description following.

The approach between Cape Kuliuk and Rocky Point is about 11 miles wide, eastward of which the bay converges rapidly to Harvester Island. It extends 25 miles in a southeasterly direction above Harvester Island, and is 3 to 4 miles wide from the latter to Amook Island. The shores of the bay rise in steep slopes to elevations of 2,000 to over 4,000 feet, and there are numerous mountain streams.

Cape Kuliuk, about 5 miles 211° true (S $\frac{3}{4}$ W mag.) from Cape Ugat, is a cliff at the end of a ridge about 2,000 feet high.

From Cape Uyak high cliffs extend about 5 miles northeastward to **Rocky Point**. Between Rocky Point and Bear Island the coast is low bluffs, and a wide valley extends back several miles.

Bear Island, about $5\frac{1}{2}$ miles 89° true (NE by E $\frac{7}{8}$ E mag.) from Rocky Point, is nearly $\frac{3}{8}$ mile in diameter, 220 feet high and grass-covered. It lies $\frac{1}{4}$ mile from shore, with which it is connected by a boulder spit bare at half tide.

Harvester Island, $\frac{3}{4}$ mile eastward of Bear Island, is over 1 mile long, 863 feet high, steep-sided and grass-covered. The 20-fathom curve is about $\frac{1}{4}$ mile off the northern and eastern sides of the island.

Uyak Anchorage is the best harbor on the eastern side of Shelikof Strait southward of Uganik Bay, and is easily entered. It lies between Harvester Island and the shore, the passage having a width of $\frac{1}{4}$ to $\frac{3}{8}$ mile. The depths range from about 7 fathoms between Harvester

and Bear islands to 20 fathoms $\frac{1}{4}$ mile northwestward of the cannery. The best anchorage is about $\frac{1}{2}$ mile northwest of the cannery, in 12 to 14 fathoms. There is also good anchorage, except with heavy northeasterly or easterly winds, in the bight $\frac{1}{4}$ to $\frac{3}{8}$ mile southeastward of the cannery and $\frac{1}{4}$ mile from shore, in 12 to 14 fathoms.

The better and safer entrance is around the south end of Harvester Island. **Cormorant Rock**, bare at half tide, lies over $\frac{5}{8}$ mile southeastward of Harvester Island and 300 yards from shore. A spit, bare at low water and steep-to, extends 400 yards 215° true (*S* by *W* mag.) from the south end of Harvester Island.

The northwest entrance is $\frac{3}{8}$ mile wide between two reefs, partly bare at half tide and marked by kelp, one extending 400 yards westward from the northwest end of Harvester Island, and the other lying 250 to 550 yards eastward from Bear Island. With care this entrance is not difficult in the daytime, especially at low water when the principal dangers show above water.

Uyak is a post-office and cannery on the southwest side of Uyak Anchorage 253° true (*SW* $\frac{1}{2}$ *W* mag.) from the south end of Harvester Island. There is a depth of 20 feet at the end of the north wharf and 9 feet at the south wharf. Water can be obtained through pipe and hose. There are some buildings and the remains of a wharf in the bight $\frac{3}{8}$ mile southward of the cannery.

The large arm on the eastern side of Uyak Bay opposite Harvester Island is not surveyed.

Zachar Bay is on the eastern side, 6 miles 124° true (*E* by *S* mag.) from Harvester Island and $2\frac{1}{2}$ miles northward from Amook Island. It is 6 miles long 124° true (*E* by *S* mag.), and $\frac{3}{4}$ to 1 mile wide. No sounding has been done, but the north side is apparently clear. The south point at the entrance is surrounded by sunken reefs, and a reef bare at half tide lies $\frac{3}{8}$ miles northward from the point. A flat extends nearly 2 miles from the head of the bay.

Larsen Bay is on the western side, 6 miles southward of Harvester Island and 262° true (*S* *W* by *W* $\frac{1}{4}$ *W* mag.) from the north end of Amook Island. It is 4 miles long 259° true (*S* *W* by *W* mag.), about $\frac{1}{2}$ mile wide, and has depths of 30 to 40 fathoms on its northwest side and less on the opposite side. From its head low land extends to Karluk River, a distance of about 2 miles.

The entrance to Larsen Bay is through a crooked channel $\frac{1}{2}$ mile long and 200 yards wide, between flats partly bare at low water, one extending 300 yards southward from the north point at the entrance, and the other filling the bight on the south side opposite. A rock bare at low water lies in the entrance of the channel 200 yards northwestward from a black rock about 20 feet high, which lies 100 yards off a point on the south shore. The better channel is between the black rock and the rock awash, and has a depth of about 27 feet. The tidal currents in the entrance have an estimated velocity of 2 to 4 miles at strength.

Strangers should enter Larsen Bay at low water, or buoy the rock at the entrance and the flat on the north side. With care small vessels can enter by the following directions: Pass 75 to not over 100 yards northward of the black rock near the south shore, and steer 260° true (*SW* by *W* mag.) for the mound on the southern side until the north point at the entrance is abeam and the disused cannery is open about one-half point westward of it. Then haul northward and pass about 200 yards northward of the mound.

Anchorage can be had in mid-channel southward of the disused cannery on the north side just inside the entrance, in 5 to 8 fathoms. Near the south shore of Larsen Bay 1 mile southward of the disused cannery is a small island. There is good anchorage 300 to 400 yards northward or northwestward of the island, in 6 to 10 fathoms, but care must be taken to avoid the flat which makes out $\frac{1}{4}$ mile in the bight northeastward of the island. A flat extends about $\frac{1}{4}$ mile from the head of the bay; anchorage can be had below the flat in 10 to 12 fathoms.

Amook Island, $7\frac{1}{2}$ miles long and 1,686 feet high, divides Uyak Bay into two passages, the north end of the island lying $6\frac{1}{2}$ miles southeastward of Harvester Island. Reefs extend $\frac{1}{4}$ mile northward from the north end of Amook Island.

The passage west of Amook Island is the principal one. It is 1 to $1\frac{3}{4}$ miles wide and generally clear. In the bight of Amook Island $2\frac{1}{2}$ miles from its north end there is anchorage for a small vessel, in about 10 fathoms, with shelter from easterly and southerly winds. The bottom is uneven and there is a possibility of dangers. The entrance is between the south point of the bight and a bare rock lying $\frac{5}{8}$ mile northward from the point and $\frac{1}{2}$ mile from

Amook Island. Between this rock and the island is a reef, partly bare at low water, which extends $\frac{1}{2}$ mile southeastward from an islet.

A rock, bare at low water and which may be passed on either side, lies $\frac{1}{4}$ mile from Amook Island and $\frac{3}{8}$ mile 253° true (*S W $\frac{1}{2}$ W mag.*) from its south end.

The passage east of Amook Island is obstructed at points $2\frac{1}{2}$ miles from the north end of the island and $3\frac{1}{4}$ miles from the south end, and should be used only by small vessels with local knowledge. For a distance of $2\frac{1}{2}$ miles the north end of the passage is clear, with depths of 14 to 20 fathoms, and anchorage can be had here. At the southeast end of this anchorage is a shallow lagoon at the mouth of a deep valley. Small vessels can anchor 300 yards off the mouth of the lagoon in 5 to 6 fathoms.

At $\frac{1}{4}$ mile westward of the lagoon the passage narrows to 300 yards, and from the east point of the narrows a kelp-marked reef extends westward and northwestward over halfway across, leaving a narrow channel between it and the west shore. Near the northwest end of the reef is a bare rock. There is a good anchorage around the point on the west side at the south end of the narrows, in 5 to 8 fathoms.

Thence for a distance of 2 miles the passage is clear to the second narrows. At this point a spit partly bare at low water extends halfway across from a low grassy point on the west side, and leaves a channel 125 yards wide between the southeast end of the spit and an island. The channel is westward of this island and the next one $\frac{3}{8}$ mile southward, and the western shore should be favored until over $\frac{1}{4}$ mile southward of the southern island. Southward of this point the passage is clear. Some prospecting has been done on the east side of the passage 2 miles from its south end.

Lying $\frac{3}{4}$ to $2\frac{1}{2}$ miles southward of Amook Island is a chain of islands with foul ground between them and about 300 yards off the northwest end of the northern one called **Alf Island**. There is deep water between the islands and the foul ground abreast them making out from the western shore, but the safer channel is eastward of the islands and is clear. Lying $1\frac{1}{2}$ miles southeastward of Amook Island is a bare rock at the end of a reef extending 200 yards from the eastern shore.

At the south end of these islands there is an inlet in the west shore about $\frac{3}{4}$ mile long and 300 yards wide, affording anchorage in about 12 fathoms.

Southward of the islands Uyak Bay is $1\frac{1}{2}$ miles to 1 mile wide, and trends 158° true (*SE mag.*) for 7 miles from the south end of Amook Island. In the last 3 miles of this distance the depths shoal gradually from 20 to 7 fathoms, and anchorage can be selected in any depth desired. The bay then turns to 119° true (*E $\frac{1}{2}$ S mag.*) for 5 miles, with a width of $\frac{1}{4}$ to $\frac{3}{4}$ mile, and is filled by a flat.

Tides.—At Uyak Anchorage high and low water occur about 18 minutes later than at Kodiak, and the mean rise and fall of the tides is 11.5 feet. To find the height of the tide multiply the height of the corresponding tide at Kodiak by the ratio of ranges, 1.67.

SAILING DIRECTIONS, UYAK BAY.

From northward, round Cape Ugat at a distance of about $1\frac{1}{2}$ miles and steer 220° true (**S** by **W $\frac{1}{2}$ W mag.**) for 6 miles to a position $2\frac{1}{2}$ miles off Cape Kuliuk, bearing 102° true (*E by N mag.*). Then steer 172° true (**SSE $\frac{3}{4}$ E mag.**) for 10 miles, giving the eastern shore a berth of about 2 miles, to a position $\frac{1}{2}$ mile eastward of Harvester Island.

Then steer 237° true (**SW by S mag.**), passing about $\frac{1}{4}$ mile southeastward of Harvester Island and heading for an old wharf. Anchor 300 to 500 yards northeastward or northward of the old wharf, in 10 to 14 fathoms.

To go to the inner harbor, follow the preceding directions, and then hauling northwestward keep the western shore aboard distant 250 to 350 yards to avoid the spit extending from the south end of Harvester Island. Then steer 341° true (**NW $\frac{1}{4}$ N mag.**) for the northwest end of Harvester Island, pass 150 to 200 yards off the cannery wharf, and continue the course to mid-channel.

From southward, it is said in going from Karluk to Uyak Anchorage that there are no dangers 1 mile offshore. The following are the approximate courses and distances: From a position 1 mile northwestward of Cape Uyak 68° true (**NE mag.**) for $4\frac{1}{2}$ miles, and then 93° true (**ENE $\frac{1}{4}$ E mag.**) for $6\frac{1}{2}$ miles passing 1 mile off Rocky Point and Bear Island. When Bear Island

bears 180° true (*SSE* mag.) steer about 124° true (**E** by **S** mag.) for 2 miles to a position $\frac{1}{2}$ mile northeastward of Harvester Island. Follow the eastern shore of Harvester Island at a distance of about $\frac{1}{2}$ mile, and proceed as directed in the two paragraphs preceding.

COAST FROM CAPE UYAK TO CAPE KARLUK.

Cape Uyak is a precipitous, high headland at the end of a ridge. From the water the slope is rapid to an elevation of 647 feet. There is then a slight fall to a deep notch in the narrow neck back of the cape, from which there is a rise in steep, grassy slopes to higher land.

Northeast Harbor is a bight about 1 mile long, with a beach of sand and shingle, on the south side of Cape Uyak. It affords anchorage for small vessels in depths of 9 to 15 fathoms, bottom sand and good holding ground, with fair shelter in northeasterly weather.

Between Cape Uyak and Karluk there are two long cliffs about 1,300 feet high, the southern one having a marked slide extending from its highest point almost to the water. In the valley between the cliffs are two waterfalls. There is a house on the bluff near the south fall, and a fishermen's camp on the beach near the north one.

Karluk, $5\frac{1}{2}$ miles southward of Cape Uyak and $1\frac{1}{2}$ miles eastward of Cape Karluk, is important on account of the extensive salmon fishing during the summer. There are several canneries on the spit, about $\frac{3}{4}$ mile long, which separates Karluk Lagoon from the roadstead. The entrance to the lagoon is through a narrow channel at the south end of the spit, and is only passable for boats with the water above half tide.

The anchorage off Karluk is an open roadstead, sheltered from easterly winds but exposed to winds from southwest through west to northeast. It should not be used by vessels without power to get away in case of its coming on to blow. There are several mooring buoys $\frac{3}{8}$ to $\frac{5}{8}$ mile off the canneries in depths of over 10 fathoms. Anchorage may be had westward of the buoys in depths of 12 to 14 fathoms. The 3-fathom curve lies about 300 yards off the spit, and there are no dangers so far as known in the approach. Uyak Anchorage is the nearest harbor for vessels compelled to leave Karluk from stress of weather.

There is a cliff 820 feet high just south of Karluk, and between this cliff and Cape Karluk is a small bight called **Tanglefoot Bay**. There is a cannery on the bay, and lowland extends through back of Cape Karluk to the beach south of the cape.

Cape Karluk is a prominent, projecting head, 1,440 feet high, with bare rock cliffs on its seaward face and grassy slopes on its eastern side to lowland. It is readily identified by its cone-shaped appearance, a notch in the summit, and the lowland behind it.

WESTERN SHORE OF SHELIKOF STRAIT FROM SHAW ISLAND TO TAKLI ISLAND.

Shaw Island lies 10 miles northwestward from Cape Douglas and $1\frac{3}{4}$ miles from shore. It is $\frac{5}{8}$ mile long, about 50 feet high, flat and grass covered. A depth of 12 fathoms was found midway between it and the shore. Ledges extend northwestward from the island to a greatest distance of $\frac{3}{4}$ mile from its northern end.

The two bluff points $1\frac{3}{4}$ miles southward and 5 miles southeastward of Shaw Island are the ends of two sharp, rocky ridges extending from the high land of Mount Douglas. Anchorage can be had in the bight between the points in 13 to 15 fathoms, sandy bottom, with shelter from southerly and westerly winds, but the williwaws are bad during westerly gales. At the head of the bight is a short valley with a glacier. Just clear of the bluff point at the southeast end of the bight is a pinnacle rock about as high as the bluff. The bight southeastward of this last point appears shoal.

Sukoi Bay, on the north side of Cape Douglas, is shoal and can be used only by small craft with local knowledge. There are rocks bare at low water in the middle of the entrance, and a ledge bare at low water between the rocks and the south shore.

Cape Douglas is a grassy peninsula about 3 miles long and 189 feet high. At its western end it breaks off in a bluff to a low, narrow neck which connects it to the mainland. Rocks bare at low water extend about $\frac{1}{2}$ mile eastward from the cape.

The bight south of the neck back of Cape Douglas is an anchorage sheltered from northerly and westerly winds. There is some shelter from northeasterly winds, but if heavy, some swell rolls around the point. A stream enters the northeast end of the bight at the foot of the bluff,

and this part of the bight is dry at low water nearly out to the southwest end of Cape Douglas. The anchorage is in the middle of the bight, with the two points on the south side of Cape Douglas in range, bearing 114° true (*E mag.*), in 6 fathoms, sandy bottom.

Douglas Reef, lying $5\frac{1}{2}$ miles 187° true (*S by E $\frac{1}{2}$ E mag.*) from Cape Douglas, is about 2 miles long north and south. The reef is partly bare at low water, and near its middle is a rock about 10 feet high. A sounding of $6\frac{3}{4}$ fathoms with 40 to 60 fathoms close-to was found 1 mile 81° true (*NE by E mag.*) from the rock, and vessels should not approach it closer.

Two rocks, close together and awash at high water, lie $2\frac{3}{4}$ miles southwestward of Douglas Reef and $1\frac{1}{2}$ miles from shore. A reef bare at low water extends about $\frac{3}{4}$ mile southeastward from them.

About 10 miles southward of Cape Douglas is a point marked by a hill 673 feet high. There is a small glacier in the valley south of the point. Lying $1\frac{1}{4}$ miles from the point and 168° true (*SE $\frac{3}{4}$ S mag.*) from the hill there is a rock awash at about half tide. There is no kelp on the rock, and the sea seldom breaks on it when it is covered.

Two kelp patches lie about $1\frac{1}{2}$ miles southward of the preceding rock and the same distance from shore. The kelp shows well at low water only, and the sea seldom breaks on the rocks. The eastern patch lies 193° true (*S by E mag.*) from the hill mentioned in the preceding paragraph.

Kiukpalik Island lies $17\frac{1}{2}$ miles southward of Cape Douglas and 2 miles from shore. It is $1\frac{1}{4}$ miles long, 155 feet high, nearly level and grass covered. A shoal scantily marked by kelp lies about $\frac{1}{2}$ mile 339° true (*NW mag.*) from the north end of the island, and there is no safe channel between them. A temporary anchorage with shelter from easterly winds may be had in the bight on the west side near the south end of the island, in 8 or 9 fathoms, muddy bottom. The shore of the mainland inside the island should be avoided, as there is a possibility of shoals on that side.

Shakun Rock, a prominent, dark pinnacle about 75 feet high, lies 5 miles 232° true (*SSW $\frac{1}{2}$ W mag.*) from Kiukpalik Island. From the rock a semicircular reef, partly bare at low water, extends southward and westward to the south end of a chain of grass-covered islets. There is foul ground between Shakun Rock and the islets, and the latter are apparently connected with the shore northwestward by a reef.

Swikshak Bay has not been examined and is reported to be shoal.

Cape Chiniak, the north point of Hallo Bay, lies $7\frac{1}{2}$ miles northward of Cape Nukshak. There is a high hill near its end.

Hallo Bay has not been examined except near Cape Nukshak. **Ninagiak Island**, in Hallo Bay, has a knob with an estimated height of 200 feet. A rock bare at low water lies approximately $\frac{3}{4}$ mile eastward of the island.

A reef, about $1\frac{1}{4}$ miles long east and west, lies in Hallo Bay approximately $1\frac{1}{2}$ miles southeastward of Ninagiak Island and $1\frac{3}{4}$ miles northward of Cape Nukshak. The reef is bare in places at low water, is covered at high water, and has no kelp.

Cape Nukshak terminates in an island $\frac{1}{2}$ mile long and 134 feet high, with two knolls. The cape is flat and grass covered to the foot of a sharp, prominent peak, but there is a break through the flat part of the cape forming a second island at high water.

Anchorage, sheltered from southerly and westerly winds, may be had about 400 yards off the north side of Cape Nukshak, with the foot of the eastern slope of the peak on the cape bearing 203° true (*S mag.*), in 22 fathoms, muddy bottom.

From Cape Nukshak to the entrance of Kukak Bay the coast is irregular cliffs, with detached rocks showing some distance off. A reef, partly bare at low water and marked by kelp, extends nearly 1 mile from shore $1\frac{1}{2}$ miles southward of Cape Nukshak.

Kukak Bay is not surveyed, but a fair general idea of it is shown on chart 8851 taken from Russian charts. It is clear in mid-channel and easily entered. There is a stream in the valley on the west side about halfway up the bay, and a flat makes out possibly 300 yards from its mouth. From the valley at the southwest end of the head of the bay a flat makes out to an estimated distance of $\frac{1}{2}$ mile, with deep water close to. The bay has great depth, there are numerous pinnacle rocks near the steep shores, and the anchorage area is limited.

On the east side of the bay are two islands, Aguligik in its northern part and Aguchik in its southern part. The best anchorage in the bay is apparently in the bight south of Aguchik

Island, where the depth is 30 fathoms in the middle, shoaling gradually northeastward toward its head. No dangers were noted in the bight, but it was observed at high water only.

Cape Ugyak lies $7\frac{3}{4}$ miles southward of Cape Nukshak and 4 miles northward of Cape Gull. It is the east end of the mountainous peninsula south and east of Kukak Bay. There are some bare rocks close to the cape, and a breaker was seen at low water about in the position of the sunken rock on the chart, $1\frac{3}{4}$ miles northwestward of the cape.

Kafia Bay, between capes Ugyak and Gull, has a narrow entrance, reported to be bare at low water. In the narrow entrance is an islet. The channel is south of the islet, apparently on either side of a rock bare at low water. The bay is two small basins, with 20 to 35 fathoms in the middle of each, joined by a very narrow channel. It is not an anchorage, except possibly for small craft.

Cape Gull is a bold headland, terminating in a cliff 500 feet high. Temporary anchorage can be had in the middle of the entrance to the cove on the south side of the cape, in 9 fathoms, sandy bottom. The south point of the cove is marked by a rocky islet about 15 feet high.

Cape Kuliak rises gradually from a crumbling bluff at the end to high mountains inland. The following are bearings and distances from Cape Kuliak:

Cape Gull, 24° true (*N mag.*), $5\frac{1}{2}$ miles.

Cape Nukshak, 28° true (*N $\frac{3}{8}$ E mag.*), $17\frac{1}{2}$ miles.

Shakun Rock, 33° true (*N $\frac{7}{8}$ E mag.*), 30 miles.

Kiukpalik Island, 37° true (*N by E $\frac{1}{8}$ E mag.*), 35 miles.

Douglas Reef, 38° true (*N by E $\frac{1}{4}$ E mag.*), 48 miles.

Between capes Kuliak and Atushagvik is an open bay nearly 4 miles long, which has not been sounded. A bare rock lies 300 yards off a prominent point on the north shore. A rock bare at low water lies 600 yards southeastward from the point, and another lies $\frac{1}{2}$ mile westward from the point, and $\frac{1}{4}$ mile from the northern shore.

Cape Atushagvik lies $4\frac{1}{4}$ miles 225° true (*SSW mag.*) from Cape Kuliak. It has a low bluff at the water, and rises in a gentle slope to a prominent knoll, 900 feet high, with a decided saddle between it and the higher land farther back. There is a kelp patch nearly $\frac{3}{8}$ mile southeastward from the southern end of the cape.

Between capes Atushagvik and Ilktugitak there are two bays, the southwestern one of which is Amalik Bay. The northeastern bay is 8 miles or more long, 344° true (*NW $\frac{1}{2}$ N mag.*), and nearly 3 miles wide at the entrance. It is clear of islands, except those off Amalik Bay on the southwest side of the entrance. On the northeast side of the bay, $1\frac{1}{2}$ miles inside Cape Atushagvik, is a low peninsula $\frac{5}{8}$ mile long, with a bluff 150 feet high near its end. **Russian Harbor**, the cove on the northwest side of the peninsula, is a good anchorage, 300 to 500 yards from shore, in 10 to 18 fathoms, muddy bottom. Fresh water may be obtained by boat. The entrance of the bay to the anchorage has been sounded, and the only directions necessary are to give Cape Atushagvik and the islands on the southwest side of the entrance a berth of about 1 mile.

Amalik Bay lies on the north side of Cape Ilktugitak, and is separated from the bay northeastward by a high peninsula. No sounding has been done, but there is secure anchorage at its head. Takli Island lies in its mouth. About $\frac{5}{8}$ mile northwestward of Takli Island there is an inner chain of islands which extends $1\frac{1}{2}$ miles southwestward from the high peninsula. On the north and west sides of this chain of islands is a basin $\frac{3}{8}$ to $\frac{1}{2}$ mile wide. The anchorage is at the north end of the basin. An inlet not surveyed makes inland from the western side of the basin.

The entrance to Amalik Bay on the southwest side of Takli Island is $\frac{5}{8}$ mile wide and apparently clear. Thence the channel follows the western shore, and then northward through the basin along the western side of the inner chain of islands.

From the bay northeastward there is a channel along the shore of the high peninsula, passing northward of all the outlying islands, and then between Takli Island and the inner chain of islands.

Takli Island is nearly 2 miles long, its eastern part being low, broken, and rocky. At its extreme western end is a hill 455 feet high, from which there is a sheer cliff to the water. A chain of rocky islands extends $1\frac{1}{2}$ miles eastward from Takli Island. Reefs extend about $\frac{1}{2}$ mile eastward and southward from these islands, and the passage between them and the group of islands 1 mile northward has dangers and should be avoided.

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