

14.—THE FISHING GROUNDS OF BRISTOL BAY, ALASKA: A PRELIMINARY
REPORT UPON THE INVESTIGATIONS OF THE U. S. FISH
COMMISSION STEAMER ALBATROSS DURING
THE SUMMER OF 1890.

BY LIEUT. COMMANDER Z. L. TANNER, U. S. NAVY.

[Accompanied by three charts, forming Plates CVIII-CX.]

INTRODUCTION.

Bering Sea was designated as the working ground for the steamer *Albatross* during the summer of 1890, the object of the cruise being to develop its offshore fishing grounds. The exploration of the cod banks of Bristol Bay occupied most of the time, and this report is chiefly limited to a discussion of that region. We also made a partial reconnoissance of the coast lines as an indispensable preliminary to the fishery investigations. In prosecuting the work the region was thoroughly sounded, the currents, wind, and weather observed, and other information obtained of such direct value to the fisherman and mariner that it was deemed advisable to present the principal results in advance of the regular report. All the bearings given are magnetic, and the depths are expressed in fathoms. Longitudes depend upon Dall's astronomical station, Iliuliuk Harbor (point opposite the wharf), being in longitude $166^{\circ} 31' 44.2''$ W.

Bristol Bay may be said to include all that part of Bering Sea lying east of a line drawn from the Northwest Cape of Unimak Island to the Kuskokwim River. The Island of Unimak and the Alaska Peninsula bound it on the south and east, and separate it from the Pacific Ocean. The Naknek River is at the head of deep-water navigation, while the bay itself terminates in the Kvichak River, a few miles to the northward. The region about the Nushagak River, Kulukak Bay, and the Kuskokwim forms its northwest boundary.

The shore lines are usually low, and without distinctive features, but high mountain ranges and volcanic cones extend along the central parts of Unimak and the Alaska Peninsula. These rugged snow-covered mountains and lofty peaks would serve as unmistakable landmarks were they not obscured by the almost constant fogs which prevail in that region during the summer months. In fact, they were so seldom visible during the season of 1890 that the officers of the *Albatross* made no pretense

of using them as landmarks. The shore line and objects near the sea level were often seen beneath the fog when the higher lands were obscured, and, therefore, most of the available landmarks were found on or near the beach.

THE COAST FROM UNIMAK PASS TO PORT MÖLLER.

The Northwest Cape of Unimak is low with detached rocks, around which strong tidal currents sweep. The land falls away to the eastward in a gentle curve, forming an open bay about 4 miles in depth between the cape and Cave Point, which lies NNE. $\frac{1}{2}$ E., 16 miles from the former. It is a vertical rocky cliff about 150 feet in height, and takes its name from a cave on its face, inhabited by sea birds which in summer time hover about it in thousands, making it conspicuous in clear weather by their numbers and in fogs by their constant cries.

The snow-clad peak of Programnoi Volcano, rising to an altitude of 5,523 feet above the sea, forms a striking background to the low monotonous coast.

Passing Cape Lapin, a low bluff point 8 miles from Cave Point, the coast falls away slightly for 6 miles, when it turns abruptly to the eastward for 5 miles, and then takes a northerly direction, forming Shaw Bay. This bay is open to the northward, but affords protection from all winds to the southward of east or west. The approaches are clear, and the water shoals gradually to 6 fathoms, black sand, about three-quarters of a mile from shore.

From Shaw Bay to Isanotski Strait the coast trends in a northeasterly direction, is very low, and has several rocky patches extending from half a mile to a mile from shore, making navigation unsafe inside the 12-fathom line. The volcano of Shishaldin rises 8,953 feet, about midway between the above points and 7 or 8 miles inland. Isanotski Strait is available only for vessels of the smallest class.

From the strait to Cape Glasenap, about 19 miles, the coast line retains the same general direction and is very low until reaching the latter point, which is oval in form, about 150 feet in height, and has been called Round Point.

Izenbek Bay covers a large area at high tide, but much of it becomes dry at low water. A small vessel may, however, find a secure harbor behind the cape. The channel follows close around the point, and has a depth of 10 to 12 feet on the bar.

Amak Island is of volcanic origin, about $2\frac{1}{2}$ miles in length, $1\frac{1}{2}$ miles in width, and 1,682 feet in height. It lies 11 miles northwest from Cape Glasenap. The beaches are mostly of huge water-worn boulders, having vertical bluffs from 30 to 150 feet in height with moss-covered plateaus, which in summer time are covered with a rank growth of grass and wild flowers. The central peak is of dark brown rock, exceedingly rugged and precipitous, and entirely devoid of vegetation. The southeast point was found to be in latitude $55^{\circ} 25' 05.6''$ N. and longitude $163^{\circ} 07' 33.6''$ W. There is foul ground off the northwest extremity of the island, several rocks awash or under water, and Sea Lion Rock lying between 2 and 3 miles distant. The latter is several hundred yards in extent and about 150 feet high, its slopes being occupied by an extensive rookery of sea lions.

The Khudiakof Islands extend about 19 miles NNE. $\frac{1}{2}$ E., between Cape Glasenap and Moffett Point. They are but little above high water, and some of them are connected by narrow spits when the tide is out.

From Moffett Point the low coast trends north by east 15 miles to Gerstle Bay, then to the northward and eastward about 55 miles to Wolf Point, on the western side of the entrance to Port Möller.

The Khudubin Islands occupy the last 23 miles of this distance. They are very low, and it is difficult to distinguish them from the mainland, the only distinctive feature being a knob about 25 feet high on the east end of Kritskoi. The land between Herendeen Bay and Nelson Lagoon is very low.

PORT MÖLLER, HERENDEEN BAY, AND VICINITY.

Port Möller and Herendeen Bay had no commercial importance until the recent opening of a coal mine in the latter, which has drawn attention to this almost unknown region. The *Albatross* visited the mine twice during the season of 1890, and made a survey which was found to be sufficiently accurate for purposes of navigation. The chart should be used with caution, however, until it is ascertained whether the extensive banks guarding the entrance are permanent or shifting.

To enter Port Möller from the southward, pass Walrus Island in from 10 to 12 fathoms and bring Entrance Point to bear east-southeast. It will then be about 8 miles distant and have the appearance of being the southern extremity of a high and bold headland, the first that approaches the coast between that point and Cape Glase-nap. Stand in, keeping the point on the above bearing until within 2 or 3 miles, when it will show as a low spit backed by a cluster of hillocks, the high land before referred to being seen farther inland. Pass Entrance Point at a distance of 1 mile, steering about SSE. $\frac{1}{2}$ E., and stand for Harbor Point, passing it within a quarter of a mile, where anchorage may be found. The point is low.

A shoal makes off from Entrance Point about northwest by north, extending between 3 and 4 miles, and vessels making for the harbor from the northward are liable to run in behind it. Entrance Point should not be brought to bear to the southward of southeast after having approached within 4 miles of it.

To enter Herendeen Bay, bring Entrance Point to bear NE. $\frac{1}{2}$ E., 1 mile distant, and Point Divide SSW. $\frac{3}{4}$ W., $8\frac{3}{4}$ miles distant; then steer for the latter, keeping it on that bearing until within $2\frac{1}{2}$ miles, when the course may be changed to about SW. $\frac{3}{4}$ S., passing in mid-channel between Point Divide and Doe Point. The least water is 4 fathoms at the entrance to the channel.

Having cleared Hague Channel, bring Coal Bluff to bear SE. $\frac{1}{4}$ S., and stand for it until Point Divide bears S. by E. $\frac{1}{2}$ E., $1\frac{1}{2}$ miles distant and about 400 yards open of Doe Point; then SSE. $\frac{3}{4}$ E., until Eagle Rock is abeam, keeping the above points a little open to clear Half Tide Rock. Then steer S. by E. $\frac{1}{4}$ E. until Shingle Point is abeam, when a course may be laid for Mine Harbor, giving Bluff Point a berth of a quarter of a mile.

Mine Harbor is small but free from dangers, except Midway Reef, which shows at half tide. Anchor in from 12 to 15 fathoms, and if a vessel intends to remain any time it is advisable to moor.

It is high water in Mine Harbor, full and change, at 8 hours 0 minutes 0 seconds, rise 15 feet, and it occurs at Entrance Point about two hours earlier, with a rise of 10 to 12 feet.

Hague Channel is 1 mile in width at its northern entrance, and is contracted to

less than half a mile between Point Divide and Doe Point. The tidal streams are very strong, and near high water they sweep across the narrow channel and over the flats, making it impossible to steer a compass course. They are more regular near low tide, which is the best time to make the passage, as the channel is indicated by the flats showing above water on either hand.

Johnston Channel has from 7 to 15 fathoms of water, but is very narrow with steep sides. It is difficult to find but, once in, the navigation is comparatively simple, as the tides follow the general direction of deep water. The width of the northern entrance is a quarter of a mile, with little variation until near the south extremity, where it contracts to 250 yards. Having cleared the channel and entered the upper bay, there is ample room and depth of water in every direction, Crow Reef being the only outlying danger.

Anchorage may be found anywhere between Walrus Island and Entrance Point in case of fog, and a vessel may anchor in Hague Channel, but the tides are strong. There are fairly good anchorages under the north side of Point Divide and Doe Point where, near the bank, a vessel will be out of the strength of the current. The *Albatross* anchored in mid-channel a mile inside of the above points at the time of spring tides, and the flood came in with a bore between 2 and 3 feet in height, the patent log registering a 9-knot current for some time, with a swell which occasionally splashed into the scuppers. There is fair anchorage off the northern entrance to Johnston Channel, and an excellent one at its southern extremity, off Marble Point, or, in fact, almost anywhere in the upper bay. The last quarter of the flood tide is the best time to pass through this channel.

High land rises at the base of Harbor Point, and extends to the northward and eastward near the center of the peninsula. Point Divide is 50 feet in height, and mountain ranges rise a few miles back. The coal measures are found between Mine Harbor and the head of Port Möller. Doe Point is 40 feet in height, while the rest of Deer Island and the mainland south and west of it is generally lower. The southern shores of Herendeen Bay are mountainous with intervening valleys, the whole face of the country being covered with rank grass and wild flowers during the summer months; but there is no timber except occasional small poplars, alder bushes, and willows. Fresh winds with fog and mist blow across the low divides from the Pacific, obscuring the sun and greatly increasing the rainfall in Port Möller and vicinity.

The region is uninhabited, except by men employed at the coal mine, yet bears and reindeer were plentiful, and the waters teemed with salmon. There are no large fresh-water streams entering the bay, however, which probably accounts for the absence of Esquimaux.

The coal mine in Herendeen Bay lies $1\frac{1}{4}$ miles from the landing in Mine Harbor, the coal being transported to the water front by a steam motor over a light tramway.

The opening of this mine is an event of no little importance to vessels visiting Bering Sea, and, the *Albatross* having used between 200 and 300 tons of its first output, the following report of Passed Assistant Engineer C. R. Roelker, U. S. Navy, chief engineer of this vessel, on the results obtained by the consumption of 80 tons of this coal, will be read with more than usual interest:

The following statement regarding the coal received from the mine recently opened at Herendeen Bay is based on the results obtained with some 80 tons of this coal consumed while this vessel was engaged in her regular work at sea, under average conditions. The quantities of coal consumed and

of refuse matter were carefully measured, the behavior of the coal in the furnaces was closely observed, and the results obtained have been deduced from the entries in the steam log.

The average consumption of the coal was at the rate of 25 pounds per square foot of grate per hour. The boilers furnished the same amount of steam as when we have been using a fair quality of Wellington coal, but to obtain the result we had to burn from 20 to 25 per cent. more of the Herendeen Bay coal.

The coal ignites readily, and burns with considerable flame, forming a closely cohering coke which easily breaks up into small pieces; thus a considerable amount of small particles of coal is lost through the grates. There was a large proportion of fine stuff in the coal, which burned well, but contained an excessive quantity of refuse matter. The refuse amounted to 26 per cent. of the total weight of fuel consumed; it consists of ash and cinders, no glassy clinkers being formed. The smoke produced is lighter in color than that of Wellington coal, and less soot is formed.

To form a correct estimate of the value of this coal for steaming purposes from the foregoing statement, the following facts should be taken into consideration, viz: The coal received by us was the first lot taken from this newly opened mine. It came from one of the smaller veins, through which a tunnel had been driven then a distance of about 200 feet, in order to get access to the main veins. No proper facilities for screening the coal existed, and in order to supply the quantity required by us a large amount of fine coal containing much dirt was delivered. It may be reasonably expected that, as the mine becomes further developed and proper screening facilities are provided, the amount of refuse matter in the coal will be greatly diminished and its steam-generating power correspondingly increased. It will be absolutely necessary, however, to store this coal under shelter, as it appears to absorb moisture readily, and the constant rains which have prevailed in this region during the present season would soon saturate it to such an extent as to greatly diminish its value as fuel.

THE COAST FROM PORT MÖLLER TO THE KUSKOKWIM RIVER.

The coast is low for 19 miles between Entrance Point and Cape Kutuzof, which rises in a rounded bluff to an elevation of 150 feet.

Cape Seniavin, 11 miles to the northward and eastward, is a rocky point 75 feet high. Passing it, the low monotonous beach continues to the Seal Islands; a cluster of small hillocks near the beach, 12 miles from Cape Seniavin, being the only exception.

The Seal Islands are composed of several small islets but little above high water, strung along near the coast for about 10 miles. Thence to Strogonof Point the land continues very low.

Port Haiden is said to be a good harbor, but we did not examine it. Should a survey show it to be safe and easy of approach, it will prove a great convenience to vessels employed on the northern part of Baird Bank. The approach to Port Haiden will be recognized by high bold headlands, which rise from its northern shore.

Chestakof Island, low and crescent-shaped, forms the seaward side of the harbor, the channel lying between its northern extremity and a reef which makes out from the land. The same low coast extends to Cape Menchikof in nearly a direct line, the high land of Port Haiden gradually receding from the coast.

The Ugashik, or Sulima River, lies to the northward of Cape Menchikof, and has been reported navigable for several miles by vessels of 14-foot draft. The schooner *Pearl* enters the river, but her captain reports a wide bar having intricate channels, strong currents, and usually a heavy swell. Ten feet is about all that can be carried in with safety. Once inside, it is reported to be a good harbor, but it can hardly be considered available for the ordinary purposes of fishing vessels.

Cape Grey, a bluff 243 feet in height, and a peculiar notched mountain some distance inland, are good landmarks for the river. The low coast continues from the cape

to the Ugaguk River, and thence to the Naknek River, with hardly a distinguishing feature, except Johnston's Hill, a solitary elevation 5 miles from the beach and about 9 miles S. $\frac{1}{2}$ E. from the mouth of the Naknek. The coast sweeps in a graceful curve to the northward between Cape Grey and the Ugaguk, and thence to the eastward to the Naknek River. A gravel bank lines the coast in several places, behind which a narrow strip of water is seen, particularly at or near high tide.

The Naknek River may be considered as the head of deep-water navigation in Bristol Bay. The *Albatross* found anchorage in 6 fathoms about 6 miles southwest from Cape Suworof, the water shoaling rapidly to 3 fathoms toward the head of the bay. Vessels of moderate draft can pass the bar at high water, but there is hardly depth enough to float a ship's boat when the tide is out. It is deeper inside, however, and a small vessel may find anchorage with swinging room. There is a fishing station on the river which is visited periodically by a small steam tender. The South Head is in latitude $58^{\circ} 42' 04.3''$ N., and longitude $157^{\circ} 02' 45.4''$ W. High water, full and change, 1 hour 5 minutes; rise, 23 feet. Shoal ground makes off from the west shore, confining the channel in one place to about 3 miles in width. It may possibly be a middle ground with a channel on either side, but the conditions off Etolin Point seem to disprove this.

The Nushagak River is assuming considerable importance as the location of a trading station and of several large and well-equipped salmon-canning establishments. Protection Point, the entrance to the river, is 50 miles SW. by W. from the Naknek River, and, owing to swift currents and extensive shoals, it may be classed among the most intricate pieces of navigation in Bristol Bay. A 6-knot current is frequently encountered, hence the shifting of banks and shoals must be expected, and the necessity for the constant use of the hand lead becomes too obvious to require remark; indeed, the warning from a lead on each side will leave but a small margin of safety at times. The land on both sides of the entrance is very low, and it is difficult to recognize Etolin Point even under favorable conditions. A vessel from the westward would make the Walrus Group and follow the coast to Cape Constantine, and, having cleared the outlying shoals, stand in for Protection Point, which is difficult of recognition from a distance.

Nichol's Hills, 280 feet in height, are a cluster of rounded elevations 5 miles northwest of the above point, and are the first natural objects distinguishable on the peninsula. Bring them to bear west-northwest and stand in, keeping them on that bearing until Protection Point bears about south, and anchor, making due allowance for falling tide.

There is a pilot station on the Point, with a small flagstaff, on which a flag will be hoisted if the pilot is at home. He is an Esquimaux, and speaks very little English, but he knows the channel. If he is not at the Point when the vessel arrives, he will probably be at Ekuk, and may be expected on board within a few hours if the weather is not too rough for his kayak. A stranger should not attempt to enter without a pilot, unless from necessity.

Clark's Point is 18 miles north by west from Protection Point, the usual anchorage being from half a mile to a mile above it.

Ekuk, an Esquimaux village, is on the bluff nearly 3 miles below Clark's Point.

Clark's Point is a bluff 200 feet in height, beginning below Ekuk and extending 2 or 3 miles up the river, and thence to Nushagak. It varies from 100 to 150 feet in

height. The west side is generally lower, but from Coffee Point to the northward the bluffs rise from 50 to 200 feet.

The reconnoissance of the Lower Nushagak was made during the few days we were detained in the river. The principal points are located by triangulation, Clark's Point by astronomical observations, and the reduction of soundings to low water depends upon the tides during our stay. It is to be regretted that we were unable to extend the soundings to the west shore.

The Nushagak Packing Company have a cannery at Clark's Point, and there are three others, besides a trading station, in the river, the latter at Nushagak, formerly called Fort Alexander. Vessels of moderate draft can reach the canneries, and, with a little care, find anchorage with sufficient water even during the lowest tides. The timber line is well defined about 3 miles below the mouth of Wood River, and extends to the westward as far as the eye can reach. The weather was pleasant during our stay, and, from all reports, they have less fog in the Nushagak than in any other part of Bering Sea.

Clark's Point (foot of bluff) is in latitude $58^{\circ} 49' 14''$ N. and longitude $158^{\circ} 31' 43.9''$ W. High water, full and change, 0 hours 53 minutes, approximate; rise, 24 feet. Variation, $23^{\circ} 40'$ east.

Cape Constantine, the southeast extremity of land at the entrance to the Nushagak, is very low, and shoals extend 10 or 12 miles to the southward and eastward, making its approach in thick weather very dangerous. There is said to be a channel between the cape and the first shoal, but the report requires verification. The coast line increases in height to the westward of the cape, the headlands in Kulukak and Togiak Bays reaching an altitude of 500 feet or more.

The Walrus Group is composed of three islands and three rocks, all above water, extending 16 miles east and west, and about 6 miles north and south.

Round Island, the easternmost of the group, lies W. $\frac{1}{2}$ S., 36 miles from Cape Constantine. It is nearly 2 miles in length, three-quarters of a mile wide, and about 800 feet high, its west end being in latitude $58^{\circ} 36' 09''$ N. and in longitude $159^{\circ} 57' 51.7''$ W.

Crooked Island is between 4 and 5 miles in length and 2 miles in greatest width. The eastern part is rather low, but toward the western extremity the elevation is nearly equal to that of Round Island. There is quite a large bay on the northeast side, but we did not examine it.

High Island, the westernmost of the group, is 4 miles in length, about a mile in width, and 900 feet or more in height.

The Twins are two isolated rocks 4 miles to the southward of Crooked Island, the larger 300 and the smaller 100 feet in height.

Black Rock, about 150 feet high, lies 1 mile to the northward of the south end of Crooked Island.

No other outlying dangers were seen in passing between the islands and the mainland. From 6 to 10 fathoms were found abreast of the group, the depth gradually decreasing to 3 fathoms off the north end of Hagemeister Island. We were near the shore, however, and would doubtless have found more water in mid-channel.

Hagemeister Island lies 9 miles west of High Island, and is 14 miles in length and 8 in width. It is mountainous except for about 5 miles at the north end. Shoal ground surrounds the island and extends from 20 to 25 miles to the eastward, including the area between Hagemeister and the Walrus Group.

Hagemeister Channel is about 16 miles in length and lies between the island of that name and the mainland. It is from 3 to 4 miles in width, but shingle spits contract it in two places to less than 2 miles. The least water was $4\frac{1}{2}$ fathoms. Good anchorage was found under Tongue Point, the shingle spit making out from the mainland about midway of the channel. From the above anchorage the *Albatross* stood directly to sea, passing within a mile of the southwestern extremity of Hagemeister Island; thence S. $\frac{1}{2}$ W., shoaling the water to 3 fathoms 7 miles from the island. Greater depths might possibly be found by taking a more westerly course. The tides are very strong through the channel. We were visited by a number of Esquimaux while at anchor under Tongue Point.

Cape Peirce is of moderate height and symmetrical form, while Cape Newenham is high, with sharp peaks and rugged lines. The *Albatross* found anchorage under the latter cape near Seal Rock during a southerly gale, and laid it out very comfortably, notwithstanding swift currents and heavy tide rips.

The Kuskokwim River is much dreaded by navigators on account of its extensive shoals, strong currents, etc. The *Albatross* ascended it between 35 and 40 miles without difficulty or delay, but encountered extensive shoals on her return. Thick weather and the lack of time prevented an extended examination. They commenced about 9 miles west-southwest from Good News Bay and extended in a westerly direction for 10 miles or more. There is a channel between the shoal and the land about 4 miles wide, having a depth of 5 fathoms. From a point 5 miles west-southwest from the west head of Good News Bay we stood direct for Cape Newenham, the least depth being 4 fathoms. Great quantities of fresh water are borne down the Kuskokwim by the rapid currents, and, while there have been no surveys by which changes can be noted, there seems no reasonable doubt that great alterations have taken place since Cook ascended the river in the last century.

METEOROLOGICAL CONDITIONS OF BRISTOL BAY.

The winds and weather in Bristol Bay and the other parts of Bering Sea visited by the *Albatross* from the last of May to the 1st of September, 1890, may be summarized in a few words.

Southwest winds prevailed, but we had them frequently from southeast to northwest. It was boisterous weather nearly half the time, but seldom rough enough to interfere with our work. We had several summer gales of moderate force, but no severe storms. Fog and mist prevailed, and a clear day was the rare exception. The tidal currents were strongest in the vicinity of Unimak Pass and at the head of the bay; they were greatly affected, however, by the winds. The flood stream set to the northward and slightly inshore along the coasts of Unimak and the peninsula, the ebb to the southward and offshore. The former was invariably the stronger, and probably found an outlet by sweeping past Cape Constantine in the direction of Cape Newenham. There has been no systematic study of the currents of Bering Sea, and the almost constant fogs prevent the navigator from adding much to our meager knowledge concerning them.

THE CODFISHING BANKS OF BRISTOL BAY.

The codfish banks of Bristol Bay extend from Unimak Pass, along the Bering Sea shores of the island of that name and the Alaska Peninsula, to Cape Chichagof, and thence to the Kulukak Ground and the vicinity of Cape Newenham.

Slime Bank extends from Northwest Cape of Unimak to the vicinity of Amak Island, embracing depths from 20 to 50 fathoms. It is about 85 miles in length, 17 in average width, and covers an area of 1,445 square miles. The character of the bottom is generally black sand and gravel, pebbles being frequently added, with rocks near shore and mud in the greater depths.

The bank received its name from the fishermen on account of the number of medusæ or jelly fishes found on it. The species was unknown to our naturalists, but it may be described as brownish or rusty in color, from 6 to 18 inches in diameter, and with long slender tentacles well covered with stinging cells. These jelly fishes seem to inhabit an intermediate space near the bottom, very few being seen on the surface. Their numbers increase during the season until they become a great nuisance to the fishermen. Codfish of fair size and good quality were very plentiful over the whole bank, and scattering specimens of small halibut were taken.

A well-found fishing schooner could anchor anywhere on this ground between May and September with an even chance of being able to lay out any gale she would encounter. Shaw Bay affords excellent protection against winds from southeast to southwest.

Baird Bank has been named by the writer in honor of the late Prof. Spencer F. Baird, the first U. S. Commissioner of Fish and Fisheries, through whose untiring efforts the great scheme of deep-sea fishery investigation was inaugurated. This bank is the largest and most valuable of the fishing grounds yet discovered in Bering Sea. Commencing in the vicinity of Amak Island, it stretches along the coast of the peninsula to Cape Chichagof, 230 miles, with an average width of 40 miles, and thus covers an area of 9,200 square miles. The depths range from 15 to 50 fathoms, with a bottom of fine gray sand, occasional spots of black sand, black sand and gravel, and a few rocky patches near the shore.

Well-equipped fishing vessels can anchor anywhere on Baird Bank and lay out such winds as she would be likely to encounter during the summer months. The peninsula will afford a weather shore for southeast winds, and Amak Island offers fairly good protection on its southeast and southwest sides. Port Möller and Herendeen Bay will be ports of call for fishermen when they become better known. Port Haiden also may become available after it has been surveyed.

We found codfish in great abundance and of good quality over the whole bank, but the best fishing ground is without doubt in depths between 25 and 40 fathoms, and the Port Möller region is the most prolific. Fish taken near shore were smaller and apparently not in as good condition. Codfish are found on the Kulukak Ground and in the region of Cape Newenham, but they are smaller and inferior in quality to those on the shores of Unimak and the peninsula.

Codfish have their enemies in Bering Sea as well as in other parts of the world. Many wounded fish are seen, particularly in spring and fall, after the passage of the seals into and out of the sea. This phenomenon is observed more noticeably near the passes between the Aleutian Islands. Bering Sea also suffers, in common with other

prolific grounds that are not much fished upon, in that numbers of fish are left to die of old age or other natural causes. At a certain age the fish become weak and more liable to be infested with parasites, all of which is soon apparent from the general condition of the victims. This is a trouble which decreases, however, as a bank becomes more generally fished.

Scattering specimens of small halibut of fine quality were found on Baird Bank. Flounders of several species, some of them excellent fish, were also taken in the beam trawl wherever it was lowered in Bering Sea.

U.S. Commission of Fish and Fisheries.
Marshall McDonald, Commissioner.

CHART OF BRISTOL BAY AND ALASKA PENINSULA ALASKA

1890

NOTE
Compiled from all accessible data and showing results
of recent investigations made by the Officers of the U.S.
Fish Commission Steamer "ALBATROSS" Lieut. Commander
Z.L. Tanner, U.S.N. Commanding.

TIDES

H.W.F. & C.	Approximate.	Rise of tide
Nushagak River, Clarks Pt.	0 ^h 53 ^m	25 ft.
Kahoon River	1 ^h 05 ^m	23 "
Harenden Bay, Mine Harbor	8 ^h 0 ^m	15 "
Kuskokwim Bay	6 ^h 15 ^m	13 1/2 "





U.S. Commission of Fish and Fisheries.
Marshall McDonald, Commissioner.

CHART OF LOWER NUSHAGAK RIVER

— ALASKA —
(BRISTOL BAY DISTRICT)

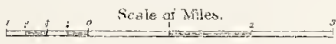
1890.

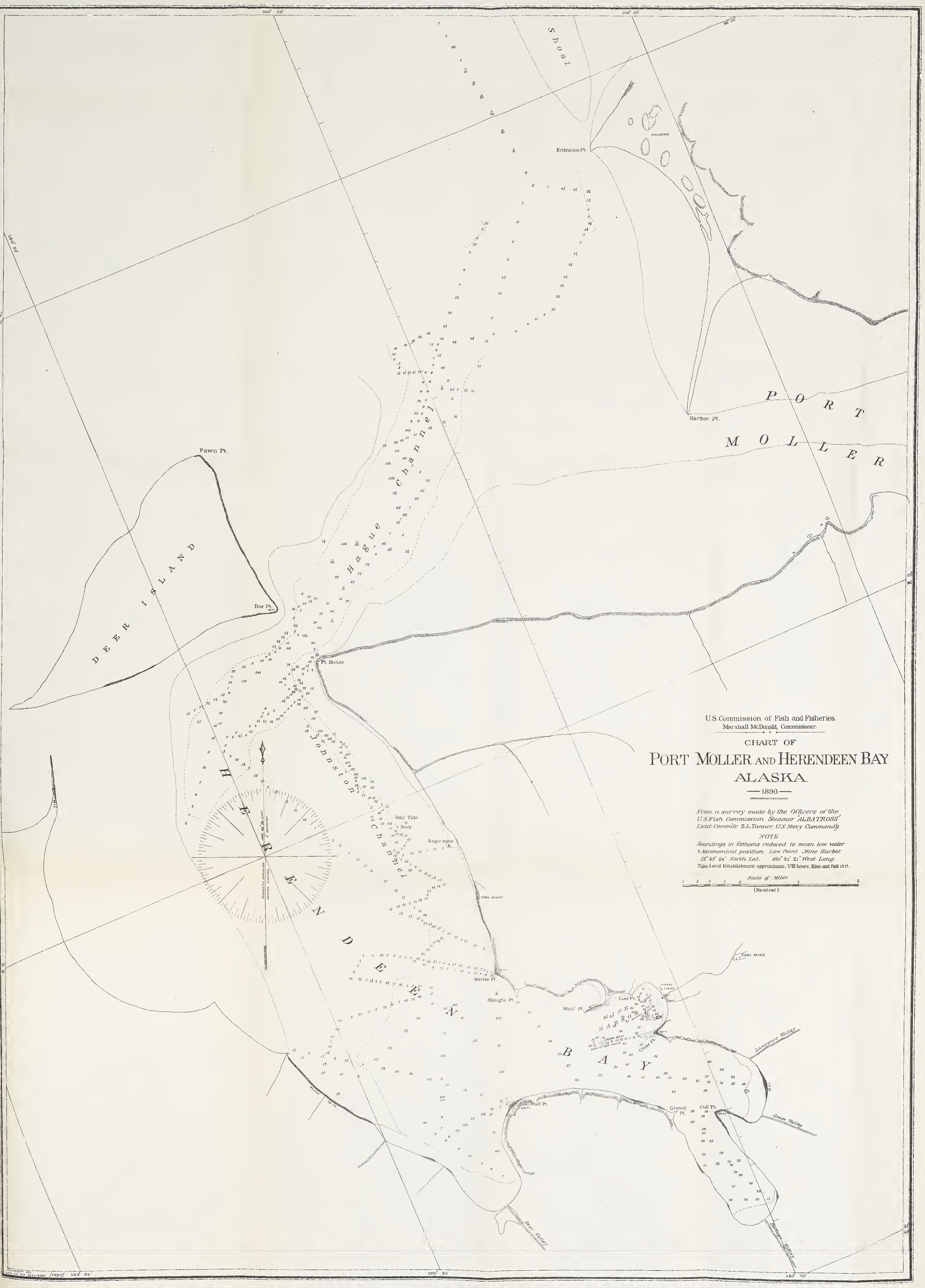
NOTE

From a reconnaissance made in June 1890 by
the Officers of the U.S. Fish Commission Steamer
"Albatross" Lieut. Comdr. Z. J. Tanner U.S.N. Comdg.

Astronomical Station Clark's Point
Lat. $58^{\circ} 49' 14''$ North. Long. $158^{\circ} 31' 43.9''$ West.
Tides, Local Establishment.
53 minutes approximate rise and fall 2 1/4 ft.

Scale of Miles.





U.S. Commission of Fish and Fisheries,
Marshall McDonald, Commissioner.

CHART OF
PORT MOLLER AND HERENDEN BAY
ALASKA
— 1890 —

From a survey made by the Officers of the
U.S. Fish Commission Steamer ALBATROSS,
Lieut. Commdr. T. L. Tanner, U.S. Navy Command.

NOTE
Soundings in fathoms reduced to mean low water
Astronomical position, Low Point, Mine Harbor:
55° 45' 24" North Lat. 160° 41' 21" West Long.
Tides Local Establishment approximate, VIII hours. Rise and Fall 15 ft.

