1.—EXPLORATIONS OF THE FISHING GROUNDS OF ALASKA, WASHINGTON TERRITORY, AND OREGON, DURING 1888, BY THE U. S. FISH COMMISSION STEAMER ALBATROSS, LIEUT. COMDR. Z. L. TANNER, U. S. NAVY, COMMANDING.[1]

CONTENTS.

[1] This first report upon the explorations of the steamer *Albatross* along the western coast of North America contains the earliest positive information that has been obtained respecting most of the ocean fishing grounds of that important region. Its publication, it is hoped, will tend to stimulate the fishing interests in the North Pacific Ocean, and, at the same time, give substantial evidence as to the relative values of the different grounds that have been studied. Future investigations will be directed toward completing the detailed examination of the same region, and toward extending the researches farther north into Bering Sea, and farther south along the coasts of Oregon and California. The report has been compiled from the reports of Lieut. Commander Z. L. Tanner, commanding the steamer *Albatross*, and of Mr. Charles H. Townsend, naturalist, and Mr. A. B. Alexander, fishery expert of the same steamer, as explained on page 17. The introduction was written by Mr. Richard Rathbun.

MARSHALL MCDONALD, *Commissioner*.

ILLUSTRATIONS.

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A.—INTRODUCTION.

1. PREVIOUS KNOWLEDGE RESPECTING THE FISHING GROUNDS OF THE NORTH PACIFIC OCEAN.

Although it had been known for many years that the Pacific coasts of North America were abundantly provided with choice varieties of edible fishes, it was not until 1880 that even the economic species inhabiting that region were thoroughly studied and classified, and the Alaskan cod determined to be the same as the cod of the North Atlantic. The first cod brought to San Francisco from the North Pacific region were taken in 1863 off the island of Saghalien, in the Ochotsk Sea, by a vessel which discovered them by accident. Two years later seven vessels were engaged in this fishery, and in 1866 they began to fish in the neighborhood of the Shumagin Islands, on the Alaskan coast. The largest number of vessels that took part in this industry prior to 1880 was twenty-one, in 1870; while the largest catch was made in 1879 by thirteen vessels.

The absence of large and convenient markets has hindered the development of the ocean fisheries on the Pacific coast, notwithstanding that their practically unlimited resources have been widely known and frequently discussed. But with the completion of several railroads, affording the means of transporting fresh produce into the interior of the country, with the prospect of establishing a large and lucrative trade in salt cod and other species with the markets of South America and Asia, and, not least important, with the advent of New England fishermen, a renewed and stronger interest has sprung up in relation to these same fisheries, which seems destined to exert a marked influence upon the future welfare of the Pacific States and Territories.

Until the summer of 1888, however, no systematic investigations had been made to determine the extent and character of any of the fishing grounds located in the North Pacific Ocean. Prof. George Davidson, in the Alaska Coast Pilot for 1869, mentions several shallow off-shore soundings, indicating the existence of banks, on some of which he found cod to be abundant. In the report of the United States Department of Agriculture for 1870, Mr. William H. Dall has brought together all of the information that was obtainable at that time respecting the fishing grounds and food-fishes of Alaska. The same subject was further elaborated and brought down to 1880 by Dr. T. H. Bean, in two important papers which have been published by the U. S. Fish Commission.[1] The fishing grounds between the Straits of Fuca and Lower

[1] Tarleton H. Bean. The Fishery Resources and Fishing Grounds of Alaska. <The Fisheries and Fishery Industries of the United States, by George Brown Goode and a staff of associates. Section III, pp. 81–115. Washington, 1887.

The Cod Fishery of Alaska. <Idem. Section V, pp. 198–226. Washington, 1887.

California were also reported upon in 1880 by Dr. David S. Jordan, who was able to procure but few data concerning them, although many portions of this coast were otherwise well known.[1]

The following account of the Alaskan grounds is extracted from Mr. Dall's report:[2]

"The most fruitful of the Alaskan fishing grounds are considerably to the north of the limit of the migrations of the cod, and may be said to extend northwest from Yakutat or Bering Bay along the coast and the line of the Kadiak and Aleutian Archipelagoes. The cod banks are generally in the vicinity of land, yet off-shore banks have been and will continue to be discovered, though the fishermen endeavor to retain the secret of such discoveries. Such banks are usually to be looked for in the direction of the trend of the adjacent islands or in lines parallel to that trend. The soundings of Portlock, Vancouver, and the U. S. Coast Survey expedition prove the existence of a comparatively shoal bank extending along the southeastern coast of Afognak and Kadiak, with a deep pocket (no bottom at 90 fathoms), 25 miles east of St. Paul. The shoalest water found upon this bank by Mr. Davidson, of the U. S. Coast Survey, was 45 fathoms. It probably extends along the southeast shore of Kadiak. Belcher caught cod and halibut off Cape Greville, the eastern point of Kadiak. South by east 14 miles from the eastern end of the easternmost point of the Trinity Islands, Vancouver found bottom at 50 fathoms, and 15 miles south of Ukamok at 75 fathoms. Thirty-five miles east of the south end of the island of Niuniak, the most southern of the Shumagin Group, Mr. Davidson obtained bottom at 40 fathoms, and 9 miles southeast of the Sannakh Reef at 35 fathoms. Near this last-named locality Cook caught over one hundred halibut, ranging from 20 to 100 pounds each; he therefore called it Halibut Island. Mr. Davidson discovered a fine cod bank about 65 miles southeast (true) from the middle of Akutan Pass and 40 miles south-southeast from Unimak Pass. Here the water has a depth of 60 fathoms, with pebbly bottom. Many fine cod were caught, of which one was 36 inches long, 23 inches in girth, and weighed 27 pounds.

"Some of the vessels are said to commence fishing along the coast north of latitude 54° 40′ north, and to work northward along numerous banks which they have found. The fish are taken in from 15 to 40 fathoms, the very best fish in the deepest water. The banks along the Gulf of Alaska, around the Kadiak Group, and part of the Aleutian Chain have an area of not less than 45,000 square miles, with a depth of not over 50 fathoms. If the fishing depth extends to 100 fathoms there is little doubt that the cod-fishing area will reach 100,000 square miles. In addition to the fisheries of the Great Bank the cod are reported to run in great numbers in and around the entrance of Hamilton Bay, near the western part of Frederick Sound. Lisiansky caught them with hook and line in Sitka Sound, Portlock abundantly at Port Etches, and Belcher near Cape Chiniak."

After discussing the in-shore cod-fishing grounds along the Alaskan coast, Dr. Bean states that "extended areas of soundings on which cod assemble in great masses

[1] David S. Jordan. The Sea Fishing Grounds of the Pacific Coast of the United States from the Straits of Fuca to Lower California. <The Fisheries and Fishery Industries of the United States, etc. Section III, pp. 79, 80. Washington, 1887

[2] The Food Fishes of Alaska. <Report of the Commissioner of Agriculture for the year 1870, pp. 375–392.

are present in the Gulf of Alaska, but they have been but little investigated, and their limits and characteristics are imperfectly known." He then describes each of the off-shore fishing banks known to exist in this region at that time, giving in some detail the incidental and unconnected observations by which they were distinguished. From this account the following summary has been prepared:

Portlock Bank.—Known chiefly from a single series of soundings extending in a northeasterly direction from the eastern end of Kadiak Island, about 115 miles, with more numerous soundings near the land. A few widely separated soundings indicated the extension of the bank along the southeastern side of Kadiak Island, where Albatross Bank has recently been developed by the Fish Commission. The extent and outline of these banks were wholly unknown.

Shumagin Bank, formerly called Simeonoff or Seminoffsky Bank, was indicated by only two accurate soundings off shore. This bank had, however, been resorted to by fishing vessels from which further information of a general nature was obtained. Its length was estimated by different persons at from 10 to 40 miles.

Sannakh Bank was located by two positions.

Davidson Bank, south of Unimak Pass, was known solely from the observations of Prof. George Davidson, of the U. S. Coast Survey, who made a number of soundings upon it in depths of 50 to 60 fathoms, and established its character as a fishing bank by making several successful trials for cod.

Single soundings are recorded by Dr. Bean south of Unalashka Island, south of Umnak Island, and south of Amchitka Island; and he also describes many grounds near the shore, especially in the neighborhood of settlements. Most of the fishing has been done on these in-shore areas "at such distances as may be traversed by canoes and dories."

The following extract from Dr. Jordan's report states concisely the condition of the ocean fisheries between the Straits of Fuca and Lower California at the time of his investigations in 1880:

"Except the salmon fisheries of the Sacramento and the Columbia, and the ocean fisheries in the immediate neighborhood of San Francisco, the fisheries of the Pacific coast exist only as possibilities. For the most part only shore fishing on the smallest scale is done, and no attempt is made to discover off-shore banks, or to develop them when discovered. * * * Between the rocky headland of Point Reyes and the entrance to the Golden Gate is a long stretch of smooth sandy bottom at a considerable depth. The bottom here swarms with flounders, and a mode of fishing is pursued analogous to the trawl net of the Atlantic—the fishing of the paranzella. This mode of fishing is doubtless possible outside of the kelp at many places along the coast, but the markets elsewhere are too small to make it profitable, excepting on a few small reefs in the neighborhood of the Farallones where rock cod abound, and at the mouth of Monterey Bay; and beyond this stretch of deep water now fished by the paranzella, we can hardly say that any definite off-shore fishing grounds exist south of the Straits of Juan de Fuca. Off the mouth of the Straits of Fuca, about 8 miles northwest of Cape Flattery, there is an extensive halibut bank where the Indians take halibut in large numbers, and which may some time become of importance to the white people."

2. PLANS AND NARRATIVE OF THE CRUISE.

Plans.—The steamer *Albatross* was dispatched to the Pacific coast for the purpose of investigating the ocean fishing grounds adjacent to the territory of the United States, and with a view to furnishing accurate information respecting their positions, characteristics, and resources, to the American fishermen. Barring the fact that they are much less resorted to at present than are the corresponding grounds upon the Atlantic coast, there was greater need of subjecting them to a careful survey, as even their outlines and surface contours had never been determined, while the same features of the eastern grounds have been known to a large extent for many years. The steamer *Albatross* is especially adapted for the different branches of this class of work, having all the most approved appliances for sounding, dredging, and fishing, many of which have originated or been perfected in the service of the Fish Commission. She was commanded by Lieut. Commander Z. L. Tanner, U. S. Navy, who had been in charge of all of her operations on the Atlantic coast. Mr. Charles H. Townsend, who had had several years' experience in Alaska, acted as naturalist, while fishery matters were attended to by Mr. A. B. Alexander, formerly of the Gloucester (Mass.) fishing fleet.

Considering that the season was well advanced before it was possible to begin active work, it was decided to send the *Albatross* directly to Alaska, where good weather for her operations could not be expected to continue beyond the summer months, after which she would return to the coasts of Washington Territory, Oregon, and California. The region selected for exploration was to the south and southeast of the Aliaska Peninsula and the easternmost of the Aleutian Islands, comprising the entire width of the submerged continental plateau between the island of Unalashka and the longitude of Prince William's Sound, as the principal known fishing banks were contained in this area. Lines of soundings were to be run over as large a part of the region as possible, with the object of locating all of the elevations of the bottom which might properly be designated as banks. The latter, wherever discovered, were to be carefully sounded over in order to determine their extent, outline, and surface contour, and the character of the bottom. The richness of the bottom as dependent upon the abundance of animal life, indicating good feeding grounds, and the actual presence, abundance, and size of edible fishes, especially the cod, were to be ascertained by frequent dredgings and by the use of hand lines and trawl lines. Attention was also to be paid to the surface-schooling fishes, to the important question of the bait supply, to the history and present condition of existing fisheries, and to all other matters bearing upon these subjects.

When the weather became unfavorable for continuing the work in the Alaskan region, the steamer was to return south, and, after refitting at Seattle, begin upon the same basis the exploration of the coasts of Washington Territory and Oregon.

Narrative.—The steamer *Albatross* left San Francisco, Cal., for Alaska July 4, 1888, at 9.30 a. m. Thirty live lobsters, being part of a shipment sent to California from the New England coast in June, were taken on board and carried as far as Trinidad Head light-house, California, in about latitude 41° N., where they were planted in a favorble locality which had been recommended by Prof. George Davidson. Being detained by head winds on the way to the coaling station at Departure Bay, Vancouver Island,

it was considered prudent to make a short stop at Esquimalt, situated at the southeastern extremity of the same island, where a small supply of coal was obtained from Her Britannic Majesty's dock-yard. The coaling of the ship at Departure Bay was finished July 11, and she immediately proceeded northward by way of the inland passage between Vancouver Island and the mainland. An anchorage for the night was made in Tribune Bay. Seymour Narrows were passed the next morning just as the tide was beginning to ebb, which caused strong eddies and whirls, but the passage was made without difficulty. Stops were made the same day at Alert Bay and Fort Rupert for the purpose of obtaining a supply of clams to use as bait on the northern fishing grounds. A large number were secured at the latter place, where the steamer also anchored for the night.

Leaving Fort Rupert July 13, the steamer passed through Goleta Channel and thence into the open sea, where a course was laid in the direction of the Shumagin Islands. July 19 a line of deep-sea soundings was begun in a depth of 2,550 fathoms, latitude 52° 15′ N., longitude 156° 37′ W., and carried during that and two succeeding days, 390 miles N. 88° W. to off Unalashka Island. A line of soundings was run from the end of this series to the mouth of Kiliuluk Bay, Unalashka Island, and the investigation of the Alaskan fishing grounds was then begun. The details of this work are fully explained in a subsequent part of this report, and only the general progress of the steamer and the principal points of interest visited need be mentioned in this connection. The researches were carried northeastward from the vicinity of Unalashka to the reported position of Pamplona Rocks, the most time being spent in those regions where banks had been reported by the fishermen or where their existence had been conjectured upon other evidence.

Ten or eleven days were spent in the vicinity of Unalashka and Unimak Islands, including Davidson Bank. Soundings were carried through Unimak Pass and off the northern side of Akun and Akutan Islands to Iliuliuk Harbor, Unalashka, where a supply of coal was obtained and where opportunity was given to study the fisheries and the in-shore fishing grounds of the region. The reported positions of Lenard Rock and Anderson Rock south of the Sannakh Islands were examined July 30, and on the following day the steamer arrived at Humboldt Harbor, Popoff, one of the Shumagin Islands. At this place the services of Capt. Paul M. Pavloff, a well-known pilot of the coast, were secured. Subsequently, Eagle Harbor, Nagai Island, and Yukon Harbor, Big Koniushi Island, were visited. About six days were spent in the region between the Sannakh Islands and the Shumagins, and on Shumagin Bank, the exploration of which was completed August 6. From the Shumagin Islands soundings were carried to Mitrofania Island and Bay on the mainland, and thence to Lighthouse Rocks, Chirikoff Island, and the Trinity Islands, the *Albatross* arriving at Old Harbor, on the southern side of Kadiak Island, August 10. The development of Albatross Bank occupied five days, and on the 14th the harbor of St. Paul, at the eastern end of Kadiak Island, was reached. The steamer was detained here until the 20th in coaling and in studying the fisheries and shore fishing grounds, beginning the investigation of Portlock Bank August 21. On the afternoon of the 24th an anchorage was made off Middleton Island, which was visited the next day for the purpose of determining its precise position and the character of its surroundings. From this point the *Albatross* proceeded to one of the reported positions of Pamplona Rocks, in latitude 59° 03′ N., longitude 142° 40′ W., where a thorough search was made for these

supposed dangers to navigation, but no trace of them was found within 20 miles of this locality. Having finished this examination, a course was laid down the coast, sounding and dredging stations occasionally being made on the way until September 1, when the steamer entered Goleta Channel and proceeded through the inland passage to Departure Bay, making night anchorages in Alert Bay and Tribune Bay. After coaling at Departure Bay the voyage was continued to Seattle, Wash. Several casts of the beam trawl were made during the inland trip from Goleta Channel southward.

It was September 6 when the *Albatross* arrived at Seattle, where she was detained until the 17th of the same month, undergoing a few necessary repairs. The examination of the coasts of Washington Territory and Oregon was then begun. During the progress of this work visits were paid to Port Townsend, Neeah Bay, Victoria, Barclay Sound, and Departure Bay, the last three places being on Vancouver Island. The first trip lasted until October 1, during which time the explorations were carried on along the outer coast from Barclay Sound, in the north, to off Shoalwater Bay, Washington Territory, in the south. Four days were spent at Seattle, after which the work was continued southward from Shoalwater Bay to Heceta Bank, Oregon, a visit also being paid to Astoria, at the mouth of the Columbia River. San Francisco was reached October 21.

3. SUMMARY OF RESULTS.

ALASKA.

As previously explained the steamer *Albatross* was sent to Alaska chiefly for the purpose of developing the off-shore fishing grounds occurring upon the submerged continental border south of the Aliaska Peninsula and the easternmost of the Aleutian Islands. Work was begun in the neighborhood of Unalashka Island and carried thence eastward to the reported position of Pamplona Rocks, in latitude 59° 03′ N., longitude 142° 40′ W. Although much foggy weather was encountered, making it difficult at times to locate the sounding stations with accuracy, the investigations were vigorously pushed and most successful results were accomplished. When detained in port for the purpose of coaling or to escape bad weather, attention was paid to the in-shore fishery resources and to the practical fisheries, respecting both of which subjects important information was obtained. In the report following this summary will be found a complete detailed account of all of these explorations, the brief outline of results here given having reference only to the off-shore grounds.

The five banks whose positions were indicated by older surveys, namely, Davidson, Sannakh, Shumagin, Albatross, and Portlock Banks, were more thoroughly examined than were the intervening areas, some of which, however, may, upon further examination, prove to contain fishing banks of equal value, and not inferior in size to at least the smaller of the banks mentioned. Good fishing was obtained at nearly all localities where trials were made with hand lines, whether upon defined banks or upon the more level grounds between them, and it is natural to infer that the entire submerged plateau from off Unalashka Island to Fairweather Ground is one immense fishing bank, limited upon the outer side only by the abrupt slope, which may be said to begin about the 100-fathom curve. Equally good fishing can not be expected to exist in all parts of this area, some places being more favorable for the feeding and spawning of

the cod and halibut than others, and as a rule the larger fish have to be sought for in the deeper waters. This important tract of fishing ground can best be compared with the succession of well-known banks which skirt the southern border of the British Provinces on the eastern coast of North America from the Gulf of Maine to beyond Newfoundland, but its total area is much less.

HYDROGRAPHY OF THE ALASKAN FISHING GROUNDS.

Vicinity of Unalashka.—One line of soundings was made in approaching Kiliuluk Bay from the south, and another from the same bay in a southeasterly direction to the 100-fathom curve, which was traced eastward to Davidson Bank. A third line was also carried along the inner edge of the plateau from the entrance to Akutan Pass to Davidson Bank. These soundings were not sufficient to demonstrate the existence of a defined bank in this region, but it was estimated that an area of about 2,000 square geographical miles to the westward of Davidson Bank was suitable for fishing. The width of the plateau at this place varies from 15 to 24 miles inside of the 100-fathom line. Beyond this line the bottom drops off very suddenly here as elsewhere along this part of the Alaskan coast, a depth of 1,961 fathoms having been found within 34 miles of Unalashka.

Davidson Bank.—This bank was discovered over twenty years ago by Prof. George Davidson, of the U. S. Coast Survey, who made a number of soundings upon it in depths of about 50 fathoms, and found cod abundant in some places. Its outline and surface contour were established by the *Albatross* with considerable accuracy. The bank lies south of Unimak Island, and extends westward from the neighborhood of the Sannakh Islands to about the longitude of the southern entrance to Unimak Pass (about longitude 164° 40′ W.). Its eastern end seems to be continuous with the shoal water surrounding the Sannakh Islands; its area was estimated at about 1,600 square miles. The greatest width of the submerged plateau off Unimak Island is 45 to 50 miles. Depths less than 50 fathoms were found over a large part of the bank, 41 fathoms being the shoalest water discovered. Between this shallow area and the islands to the north and northwest of it depths of 50 to 72 fathoms occur.

Sannakh Bank.—The shoal water at the eastern end of Davidson Bank was traced some distance eastward along the southern edge of the Sannakh Islands, and between those islands and the reported positions of Lenard and Anderson Rocks; but still farther eastward on the same line of soundings (longitude 162° 22′ W.) a depth of 60 fathoms was found. Sannakh Bank begins immediately to the northeastward of this position, and covers an estimated area of about 1,300 square miles. Its outline and surface contours were established by the *Albatross*. It lies to the east and southeast of the islands of the same name, is somewhat elongated in shape, and trends in a general way northeast and southwest. A small area having depths of 30 to 37 fathoms occurs near the center of the bank. A depth of 63 fathoms was found between it and the Sannakh Islands, and depths of 75 to 82 fathoms exist off the northern edge in the direction of the Sandman Reefs.

Between Sannakh Bank and the Shumagin Islands.—In this area about 1,800 square miles, more or less adapted to fishing, were partly surveyed, the depths ranging from 38 to 74 fathoms. This region is free from the hidden dangers which render Sannakh Bank unsafe to those who are not well acquainted with its surroundings.

Shumagin Bank.—This bank lies to the south and southeast of the Shumagin Islands, and its outer margin follows approximately the trend of the coast line formed by the adjacent islands. It has been traced westward to about longitude 159° 52′ W., but probably extends farther in that direction. East of the Shumagin Islands it reaches north to the latitude of Big Koniushi Island. Its width inside of the 100-fathom curve varies from 15 to 35 miles, while its area has been estimated at about 1,800 square miles. The depths over a large part of the bank are less than 50 fathoms, and the bank is not separated from the islands by deep water.

Shumagin Islands to Kadiak Island.—Only a single series of soundings was carried across this wide area to the eastward of Shumagin Bank, with a double line extending from the neighborhood of Light-house Rocks to Mitrofania Bay. These soundings were insufficient to demonstrate the full value of this region, but they indicated the existence of several fishing banks the outlines and characteristics of which must be left for future investigations. The extent of the area thus partly developed was estimated at about 4,400 square miles.

Albatross Bank.—This bank lies off the southeastern side of Kadiak Island and extends the entire length of that island and also in front of the Trinity Islands. At the eastern end it is practically continuous with Portlock Bank. Along some portions of the coast, as in the neighborhood of Sitkalidak Island, the bank is separated from the land by comparatively deep water, while in other places shoal water intervenes. The 100-fathom curve is distant 25 to 45 miles from the land, inside of which limit there is an estimated area of 3,700 square miles. The existence of this bank was predicted by Prof. George Davidson upon the evidence of a few isolated soundings, which were the only ones that had been made previous to the investigations of the steamer *Albatross*, from which it has derived its name.

Portlock Bank.—This is the largest single bank that has yet been discovered on the Alaskan coast, its area inside of the 100-fathom curve being about 6,800 square miles, or only 1,600 square miles less than that of George's Bank, the second largest of the great banks of the western Atlantic. It extends northeastward from Kadiak Island, in the direction of Middleton Island, a distance of about 120 miles, and is irregular in shape. Isolated soundings of 68 to 81 fathoms occur near Kadiak Island, at the western end of the bank, but there are no indications of a marked or extensive depression between the bank and the land.

From Portlock Bank the soundings were carried to Middleton Island, the position of which was ascertained by a careful series of observations on a clear day. The reported position of Pamplona Rocks, in latitude 59° 03′ N., longitude 142° 40′ W., was next visited, but only deep water was found within a radius of 20 miles of this locality. The *Albatross* then proceeded to Washington Territory.

Character of the bottom on the banks.—Sand was the predominant material composing the bottom on these several banks, a gray sand being the most common. This was combined in many places with pebbles, gravel, or broken shells, which were also recorded separately in some localities. Mud rarely occurred upon the banks or anywhere inside of the 100-fathom line. Rocks were not found upon Davidson Bank, but on Sannakh Bank they compose a large part of the bottom, even in the deeper soundings. Rocky patches are numerous on Shumagin and Albatross Banks, but were observed only at the extreme western end of Portlock Bank, near Kadiak Island. In

the region between Sannakh Bank and the Shumagin Islands the bottom consists of sand, mud, pebbles, gravel, and rocks, but the last-mentioned material occurs only in the neighborhood of the islands and of Sannakh Bank. In the corresponding area between the Shumagin Islands and Kadiak Island fine sand was most abundant in depths less than 100 fathoms, with the admixture in places of pebbles, gravel, and broken shells, and occasional patches of mud and coarse sand. Green and blue mud usually composed the bottom in depths over 100 fathoms, but sand and rocks were also recorded.

Off Unalashka sand was traced down to a depth of 228 fathoms, with mud at 261 fathoms. Black sand was found in 342 fathoms just off Davidson Bank, while mud occurred in 435 fathoms off Sannakh Bank, with rocky patches at depths of 265 and 464 fathoms. Sand and rocks composed the bottom off Shumagin Bank, in 105 to 119 fathoms. Off Albatross and Portlock Banks gray sand was discovered in 298 fathoms and black sand in 594 fathoms. Muddy bottom, however, occurs in places close to the 100 fathom line, but in the pocket which indents the southwestern end of the latter bank, with depths of 102 to 166 fathoms, the bottom consists entirely of sand. A rocky spot was found off Albatross Bank, in a depth of 485 fathoms.

RESULTS OF DREDGINGS AND FISHING TRIALS ON THE ALASKAN GROUNDS.

Dredging trials.—The beam trawl and the naturalists' dredge were frequently used upon the banks in order to determine the richness of the bottom as feeding grounds for fish. Nearly all the trials were very successful, resulting in the collection of a large amount of material bearing upon the natural history of this new and important region. The examination and identification of this material will, however, require considerable time, and until that has been done it will be impossible to report upon it fully, or, in fact, to state more than its general character and value. As was to be expected, the assemblage of forms strongly recalls the fauna of the great fishing banks of Eastern North America, and many of the species from these two northern regions will probably be found to be identical on both sides of the continent. The more conspicuous features of the hauls were the fishes, crustaceans, mollusks, and echinoderms. Edible fishes, crabs, and shrimps were frequently taken, the last-mentioned group often in great numbers. The dredging operations were entirely subordinated to those of sounding, as it was considered most important to first determine the outlines and contours of the banks, but the results were ample to prove the exceeding richness of the grounds with respect to the lower forms of animal life, upon which their value for fishing entirely depends. The details of the natural history work, so far as they can be given at this time, will be found in the main body of this report in connection with the discussion of each of the fishing banks.

Trials for fish.—The trials for fish on the Alaskan banks and other off-shore grounds were made entirely with hand lines. Cod and halibut were the principal species taken, and are the only ones to which we need refer in this connection. Six to nine lines were generally used at each trial, which occupied from fifteen minutes to something over an hour each, according to circumstances. Salt clams and salmon were chiefly employed as bait, and pollock, sculpins, and cod occasionally. The depth at which the fishing was done ranged from 27 to 84 fathoms, and every variety of bottom observed upon the banks was tried. A complete record of all the captures

made, showing the number of individuals of each sex taken, and their average weight and length, will be found at the end of this report.

The fishing trials made by the *Albatross*, as every bank fisherman will understand, do not furnish positive or conclusive results with respect to the average size of the fish inhabiting the banks. The large cod, as a rule, are the last to be attracted by the bait, being "tolled" around the ship by the activity of the smaller fish in finding a new source of food. As time was too valuable, in the case of the *Albatross*, to permit of long stops at any single position, the records concerning the size of fish taken are less gratifying than might have been. A length of 28 inches is taken as the standard size for off-shore fish on the Atlantic coast, and all under this size command a lower price in the markets. Out of twenty captures of cod recorded by the *Albatross*, the average size of the fish attained this standard in only six instances; it was rarely below 24 inches, and generally above 25 inches. The trials were usually made during the progress of or subsequent to a sounding or dredging haul, the steamer often drifting with the tide and changing the ground before the lines had touched bottom. By anchoring, and especially by remaining some time in each position, much better results would undoubtedly have been obtained.

Halibut were secured at nearly every trial; a record of their size and abundance will be found in the description of each fishing ground, and also in the tabular statement above referred to.

In four trials made off Unalashka Island, aggregating eighty-five minutes, twenty-two cod were taken, averaging for the several trials from 21 to 28¾ inches in length. In one instance, on Davidson Bank, twenty-five cod averaged 28 inches, and in another, twenty-one cod, 24½ inches. Eighteen cod captured on Sannakh Bank averaged 23½ to 25 inches in length. The cod taken off Unga, one of the Shumagin Islands, had an average length of 30 inches; on Shumagin Bank, of 26½ inches, and near the Chirikoff Island of 23⅘ inches. Several trials were made on Albatross Bank, two of which were unusually successful. One was off Tugidak, the westernmost of the Trinity Islands, in 37 fathoms, where forty-seven cod were captured in thirty-eight minutes, and the other off Dangerous Cape, Kadiak, in 39 fathoms, where the capture amounted to sixty-nine cod in fifty minutes. At the former locality the fish averaged 28½ inches in length, and at the latter 30¾ inches, in both instances being above the eastern standard. Pair after pair of cod were hauled up in quick succession at each of these localities, and they were seizing the bait as actively at the close of the trials as at the beginning. Only one large catch of cod was made on Portlock Bank, in a depth of 36 fathoms, where thirty individuals, averaging 27 inches in length, were taken in the course of eighteen minutes.

Bait.—The bait question is one that will occasion no concern at present. The fishermen generally have no trouble in securing, during the progress of their work, all the bait they need, and several species of bottom-fish, taken in connection with the cod, prove sufficiently attractive for the latter species. It is therefore customary, in fitting out, to provide only a sufficient quantity of salt herring or salt clams to make the first few baitings, relying thereafter upon the supply of halibut, sculpins, or pollock captured on their own hooks. The yellow-fish (*Pleurogrammus monopterygius*) is generally considered to form the best bait that can be secured in these waters; but this species was not encountered by the *Albatross*. Sculpins, however, are regarded with scarcely less favor by the local fishermen, and they are everywhere abundant.

Salt salmon was also found to be very efficacious by the *Albatross*. There are times, however, when the cod prefer other kinds of bait than can be taken by means of the hook, such as squid, lant, or capelin, but all of these species are abundant in their season, in close proximity to the fishing grounds, and can readily be secured in nets.

WASHINGTON TERRITORY AND OREGON.

Halibut banks off Cape Flattery.—No hydrographic work was done north of Cape Flattery, as the contour of the bottom in that region had previously been determined with sufficient accuracy for the purposes of this preliminary survey. The dredging and fishing appliances were used, however, in several localities.

A well-known halibut bank, resorted to by the Indians, begins close to the shore in the vicinity of Cape Flattery, and extends thence northwestward some 15 miles with depths of 35 to 75 fathoms. Halibut are abundant here from early in the spring until the middle of June, when the bank becomes infested with dogfish and sharks. It was in this locality that the Gloucester schooner *Mollie Adams* obtained its fares of fresh halibut which were shipped to eastern markets during 1888. The bottom was found by the *Albatross* to be exceedingly variable, consisting of rocks, sand, mud, and shells, and the dredging appliances suffered severely, but all of the hauls were successful, demonstrating that the bottom is exceedingly rich in the lower forms of animal life. Two trials for fish with trawl lines were made on this bank, one in 40, the other in 59 fathoms. In the former four halibut, averaging 47¾ pounds in weight, and in the latter two halibut, averaging 55 pounds in weight, were captured. Several sharks and dogfish were also secured. It was considered that a vessel properly equipped might pick up a good fare of halibut at this season, in a comparatively short time, but the fish were very much less abundant than they are reported to be in the spring. It has been shown, however, by the experience of the *Mollie Adams* that successful summer trips for halibut may be made to more northern localities. This schooner left Seattle July 24, on a fletched halibut cruise, and, after trying in several places, found the fish abundant off the southern extremity of Queen Charlotte Islands, in depths of 30 to 45 fathoms. The vessel continued on these grounds until September 8, fishing during nineteen days, and securing a fare of 150,000 pounds. About half of the halibut taken were large enough for fletching, the remainder being used as bait or thrown away. The crew received $175 each as their share of the proceeds, or at the rate of about $9 for each fishing day. Two such trips could probably be made in the course of a season, while the fletched trips to Greenland or Iceland from New England ports consume an entire season. One of the chief obstacles to the financial success of the fresh halibut fishery on the Pacific coast is the high price which the fishermen have to pay for ice, but it is expected that better arrangements will be possible in the future.

The work of the *Albatross* was extended from the bank off Cape Flattery to the neighborhood of Barclay Sound, Vancouver Island, where the bottom was found to be less rich than farther south. The trawl lines were set in four separate localities, with depths of 24 to 66 fathoms. The total catch amounted to five halibut, one black cod, one cultus cod, thirty-nine dogfish, and seven sharks, but the indications were that good halibut fishing might be found in this region in the spring.

Another halibut bank known to the Indians occurs off Flattery Rocks and between those rocks and Cape Flattery. Only one halibut, weighing 140 pounds, was taken on

the trawl lines, the catch consisting here, as elsewhere, mainly of sharks and dogfish. The bottom in all places where it was examined was composed of sand. While the Indians visit this bank in the spring it is not known whether the halibut are sufficiently abundant to encourage vessel fishing.

After the numerous fishing trials made by the *Albatross* on this part of the coast, both with trawl lines and hand lines, it became evident that sharks and dogfish had taken possession of the grounds to the almost entire exclusion of edible fishes. In the spring these pests are rarely seen, but it is not known at what time in the fall or winter they disappear, as there has been no fishing done during those seasons, and no investigations had been made prior to the visit of the *Albatross*.

The outer coast of Washington Territory.—Hydrographic soundings were carried on systematically along the entire outer coast of Washington Territory and as far south as Tillamook Rock, Oregon. The locality of certain fishing banks reported to exist some 60 to 75 miles southwest of Cape Flattery was visited, but no traces of the banks were found. Down to Gray's Harbor the soundings inside of the 100-fathom line indicate a nearly uniform bottom of gray sand. A bank reported by the Indians was, however, discovered and developed by the *Albatross* off Gray's Harbor. The bank begins about 15 miles southwest (magnetic) from Point Chehalis and extends thence about 20 miles in a southwesterly direction. It has an extreme width of about 12 miles, and the bottom consists of sand, rocks, and mud. The dredging trials showed a rich bottom, and by means of the trawl and hand lines thirteen red rockfish, two black cod, and several sharks were captured.

Coast of Oregon.—The trawl lines were set on the fishing grounds about Tillamook Rock, a short distance south of the mouth of the Columbia River, taking only seven dogfish, but the dredges brought up evidences of a rich bottom, indicating that good fishing might be obtained there at some seasons.

Heceta Bank, which had been partly surveyed before, was further developed by the *Albatross* and found to have a length of about 20 miles and a width of about 10 miles. The bottom is rocky, alternating with patches of clay and pebbles, and supports a richer fauna than was discovered anywhere else to the south of Cape Flattery. One halibut, weighing 10½ pounds, one black cod, one dogfish, and one shark were the only fish taken on the trawl lines. The finding of halibut at this locality gives promise that the bank may prove of some value during the early part of the year. It is not resorted to at present, and the fishermen are unacquainted with its resources.

RICHARD RATHBUN.

B.—REPORT OF THE EXPLORATIONS IN ALASKA.[1]

4. DEEP-SEA SOUNDINGS SOUTH OF THE ALEUTIAN ISLANDS.

Approaching the Aleutian Islands, sounding was begun July 19 in latitude 52° 15′ N., longitude 156° 37′ W., 2,550 fathoms, the bottom consisting of brown ooze. This was the first of a series of ten soundings, extending N. 88° W. 390 miles, and made to further develop a remarkable submarine depression discovered by the U. S. S. *Tuscarora* in 1874 to the southward of the Aliaska Peninsula and the easternmost of the Aleutian Islands. The soundings of the *Tuscarora* revealed a depression simply, but geologists have predicted the existence of a submarine trough, running parallel to the islands and extending probably their entire length, to the sounding of 4,037 fathoms made by the *Tuscarora* off Attu Island. The *Albatross* soundings, supplementing those of Captain Belknap, developed this predicted trough to the extent of 400 miles. Its direction, where determined, is S. 65° W. and N. 65° E., nearly parallel with the trend of the islands, the center being 60 miles from the Shumagins and 100 miles from the southwestern extremity of Unalashka. It is about 30 miles in width between the 3,000-fathom lines, with a maximum depth of 3,820 fathoms in latitude 52° 20′ N., longitude 165° W.

Having crossed the trough and reached the normal depth west of it, the *Albatross* ran a line to the island of Unalashka, in the vicinity of Kiliuluk Bay, developing the contour of the slope and locating its position with reference to the land, on the afternoon of July 21. At 5.30 p. m. that day a sounding was made in 28 fathoms off Kiliuluk Bay.

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[1] These reports have been compiled from the three separate reports of Lieut. Commander Z. L. Tanner, U. S. Navy, Mr. Charles H. Townsend, and Mr. A. B. Alexander, covering the different branches of the work prosecuted during the cruise, all of which were, however, carried on under the direction of Lieutenant-Commander Tanner. No material from other sources has been added. The original reports were in narrative form. They have been combined, rearranged, and in large part rewritten, in order to present the results of the explorations in more convenient form for reference. The account of the natural history work was furnished by Mr. Townsend; that relating to the fishing trials and the fisheries by Mr. Alexander, while Lieutenant-Commander Tanner is responsible for the hydrographic results, including the charts of the fishing grounds, the narrative of the cruise, sailing directions, and most other matters not specified above. The detailed report of the latter will be published in the annual report of the U. S. Commissioner of Fish and Fisheries for 1888.

All bearings mentioned in this report are "true" unless otherwise stated.

5. UNALASHKA ISLAND TO UNIMAK ISLAND.

HYDROGRAPHIC WORK, DREDGINGS AND TRIALS FOR FISH.

Hydrographic work.—The general contour of the slope approaching Unalashka Island from the south was developed in the manner described above. Leaving Kiliuluk Bay on the afternoon of July 21, the *Albatross* ran a line of soundings in a southeasterly direction, a distance of about 20 miles to the 100-fathom curve, which was traced approximately 95 miles northeasterly to latitude 53° 42′ N., longitude 163° 57′ W., depth 95 fathoms, on the southern edge of Davidson Bank. Subsequently four lines of soundings were made inside of the 100-fathom curve between the Aleutian Islands lying to the eastward of Unalashka and the region of the Sannakh Islands, in part crossing Davidson Bank. A line was also run through Unimak Pass, off the southwestern end of Unimak Island, and thence from off the northwest cape of the latter island in a southwesterly direction to the north head of Akutan Island. After coaling at Iliuliuk, soundings were begun July 28 at the southern entrance to Unalga Pass, and carried thence in the direction of Davidson Bank.

Depths of 30 to 72 fathoms were found in Unimak Pass, 71 fathoms at the southern entrance, and 80 to 85 fathoms at the northern entrance.

Dredgings.—Four dredgings with the beam trawl were made in this region in close proximity to the land. Two hauls were made off the north head of Akutan Island at distances of 2 and 6 miles from land, in depths of 56 and 72 fathoms, the bottom consisting of black sand. One was off the southern entrance to Akutan Pass, in 45 fathoms, broken shells and pebbles, and the fourth was 10 miles farther to the eastward, off Rootok Island, in 54 fathoms, sand, broken shells, and pebbles. The fishes taken to the northward of Akutan Island were, "cusk," stellate flounders, sea ravens, sculpins, and several small specimens of the family *Agonidæ*.

At the two stations to the southward of Akutan Island there were secured several species of flounders, a kind of lump-fish, a scaled sculpin, several species of *Agonidæ*, one ray, and other small forms. Of invertebrates, crustaceans (especially crabs and shrimps), mollusks, and echinoderms were exceedingly abundant in most of the hauls, and other groups were largely represented.

Trials for fish.—The first trial for fish was made as the steamer approached Unalashka, about 15 miles south of the entrance to Kiliuluk Bay in 84 fathoms; bottom, black sand and pebbles. One line, baited with salt clams, was put over at this station, and the bait was seized almost as soon as the lead touched bottom, an 11-pound cod being secured. At three subsequent hydrographic stations during the day, on the slope between Unalashka and the 100-fathom line, the bottom consisting of sand, further trials were made, using from two to eight lines at a time. These trials were all successful, and at one station a chicken halibut weighing 15½ pounds was captured. The total catch for the day was twenty-two cod, one halibut, two flounders, and two sculpins. The average weight of the cod ranged from 8 to 11¾ pounds; the average length, from 21 to 28¾ inches. Shrimps and small fish-bones were found in the stomachs of the cod, and a partly digested fish in that of the halibut.

Directly off the southern entrance to Akutan Pass, in a depth of 45 fathoms, the bottom consisting of pebbles and broken shells, no success was had, but only one line,

baited with salt clams, was used for twenty minutes. Ten miles to the eastward of this point, in 54 fathoms, sandy bottom, six lines, baited with clams and salmon, caught two cod, three halibut, and one flounder.

Off-shore fishing grounds.—The area lying between the longitude of Ugomok Island, at the southern entrance to Unimak Pass, and that of Kiliuluk Bay (longitude 164° 55′ to 167° W.), and between the coast line and the inner edge of the steep submarine slope, gives promise of affording important cod and halibut fisheries, but its characteristics are as yet very imperfectly known. Its extent, inside of the 100-fathom line, is estimated to be about 2,000 square geographical miles.

South of Unalashka the 100-fathom line is distant 15 to 24 miles from the coast, approaching nearest to Cape Prominence, near the center of the island, and receding from the land toward the eastward. Off Tigaldi Island it is distant about 25 miles from land. Beyond the 100-fathom curve the depths increase rapidly, 1,961 fathoms having been found about 34 miles off the nearest point of Unalashka Island.

The only soundings made on this area are two lines between Kiliuluk Bay and the 100-fathom line, which is developed to the eastward as far as Davidson Bank, and one line along shore from Akutan Pass to off Ugomok Island. The bottom consists chiefly of sand, varying in color from gray to black, and with broken shells, pebbles, and gravel in places. Sand was traced on the edge of the slope to a depth of 228 fathoms, but in 261 fathoms green mud was discovered. These few soundings do not indicate the existence of a defined bank in this area, separated from the coast by deeper water, but such an elevation may occur in its unexplored portion.

Two dredgings only were made in this region, and they were both close inshore, as follows: off Akutan Pass, in 45 fathoms, and off Rootok Island, in 54 fathoms. They indicate an exceedingly rich bottom, as previously explained. All of the trials for fish described above were also made on different parts of this ground.

UNALASHKA HARBOR.

Approaching Unalashka Harbor from the northeast.—"The volcano of Akutan, 3,332 feet in height, became prominent as we approached the island of that name (on the northern side), although the summit was enveloped in fog. The whole visible portion of the island was covered with a luxuriant growth of grass which could be seen surrounding great patches of snow still remaining in the gorges at an elevation of 1,000 feet or more; but there was not a tree of any kind to be seen.

"Two hauls of the beam trawl were made off the northern extremity of Akutan. We then laid a course for Cape Cheerful, about S. 55° W., 24 miles distant. It was not visible until we were nearly up with Kalekhta Point, when it came out of the fog with such remarkable distinctness that it appeared close at hand in comparison with Kalekhta, not one-third the distance from us, but just visible through the mist. Appearances were so deceptive that it was only after cross-bearings had been taken that we could convince ourselves that we were not several miles out of position.

"Priest Rock, near Kalekhta Point, is nearly as high as the point itself, is very conspicuous and an unmistakable landmark when open of the point, but in approaching from the northward it does not begin to open until it bears about S. 67° E. Needle Rock, lying off the northwest extremity of Amaknak Island, near Ulakhta Head, is a small pinnacle which has been mistaken for Priest Rock when the latter has been ob-

scured by fog or mist, and has led vessels to the westward of the island into Captain's Bay, instead of Iliuliuk, the port to which they were bound. It may be said that cross bearings would make such a mistake impossible, but it too often happens in this region that anchorage must be made on a momentary view of one point only. Priest Rock once recognized, there should be little difficulty in reaching Unalashka, as a direct course leads to the outer harbor.

"We anchored in the inner harbor of Iliuliuk at 3.15 p. m., July 23, entering without the least difficulty, the channel having been buoyed by the Alaska Commercial Company. The steamer *St. Paul*, belonging to the company, was at the wharf, preparing for a trip to the Seal Islands; and at the mooring buoy was the schooner *Angel Dolly*, with a cargo of walrus hides which she had taken in Moller Bay."

Unalashka Harbor to the Pacific Ocean, through Unalga Pass.—"Fog and rain prevailed, with intervals of partially clear, pleasant weather, during our stay in port. We left Iliuliuk at 9 a. m., July 28, after several hours' detention by a dense fog, which, however, had begun to lift at intervals, enabling us to see land at a distance of half a mile. Rounding Kalekhta Point, we stood for the southwest extremity of Unalga Island and through the pass of that name, which is to be preferred to all others for a steamer bound to or from Unalashka, particularly in thick weather.

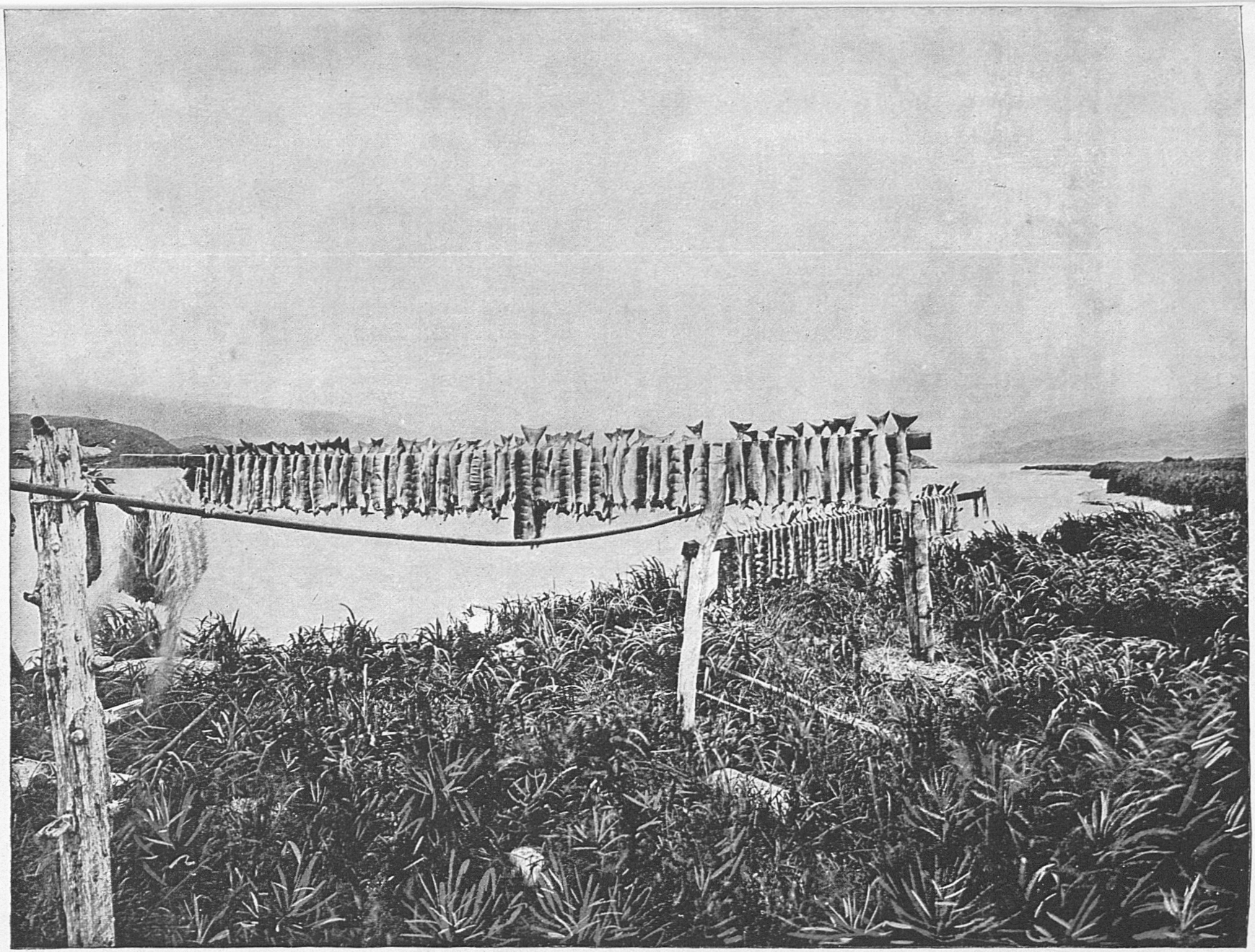
"The distance through is short, and there are no hidden dangers, the rocks bordering the shores on either side being close to the land and above water. The tide rushes through the narrows with great force, causing heavy rips, and at times overfalls, but it was quite smooth when we passed out near high water. A vessel bound in would make the Signals, Egg Island, and the Old Man, lying off Cape Burka, all of which can be approached with comparative safety, the distance from the last-mentioned to the southeast extremity of Unalga Island not exceeding 4 miles. Once in the pass, a vessel has only to keep Unalga Island in sight until passing its southwest end, when it is about 2 miles to Erskine Point and about 3½ miles to Kalekhta Point.

"There is a rock off Erskine Point which in thick weather might be mistaken for Priest Rock, but it may be recognized by another one between it and the point, having a flat top and showing smallest at the base. In approaching Kalekhta Point, Priest Rock will begin to open out at WSW. ¼ W. (magnetic).

"A full-powered steamer may use this pass at any stage of the tide, if time is an object; but under ordinary circumstances it would be advisable to enter it near slack water. We found 30 fathoms at the southern entrance to the pass in mid-channel, and 36 fathoms 2 miles north of Old Man Island.

"It is not intended to include sailing directions for the Aleutian Islands in this report, and my only excuse for describing this pass so much in detail is that there is no published information concerning it, as far as I know, and it would naturally be avoided by a stranger unless he had some such information as I have given."

Collecting in the harbor and vicinity.—Shortly after the *Albatross* came to anchor in Iliuliuk Harbor, several flounders and a specimen of the Alaskan pollock (*Pollachius chalcogrammus*) were caught on hand lines baited with salt clams. The three following days were spent in seining about the harbor, and nearly every suitable spot for that purpose was visited. On two occasions about half a boat load of salmon were taken in the seine in a little cove on the northern side of the harbor, near where the ship was anchored. Two species were included in the catch, the humpback salmon (*Oncorhynchus gorbuscha*), and the dog salmon (*O. keta*).



NATIVE METHOD OF DRYING SALMON (UKALI) AT UNALASHKA, ALASKA. (See page 22.)

The seining within the harbor was everywhere successful, but the few hauls made at or near its mouth were unproductive, due probably to the fact that in these places the water deepens rapidly from the shore, and the sea becomes rough whenever the wind blows up the harbor. The natives take cod in these exposed situations, but no trials for bottom-fish were made by the *Albatross* outside of the harbor. A diligent search was made for clams, but only about half a bucketful was obtained. These were placed in a tub and covered with mud, in which they lived for nearly three weeks. Squid are said to be abundant at times in different parts of the harbor, lying concealed beneath the sea-weed, but, although constantly searched for, only a single individual was observed during the stay in port. Failing to obtain a sufficient quantity of clams for use as bait, about two-thirds of a barrel of salmon slivers were salted for that purpose, and subsequently they proved to answer effectively in fishing for cod. Considering the present abundance of salmon in this region, their use as bait is not now regarded as an extravagance. Several hauls of the seine were made at the head of Captain's Harbor, where salmon were found to be as abundant as in Iliuliuk Harbor.

Oncorhynchus gorbuscha was the principal species of salmon taken by the *Albatross* party, a few specimens only of *O. nerka* being secured. The red spotted trout (*Salvelinus malma*) was seined both in the bay and in the fresh-water lake, and was everywhere abundant. Other common species were the *Pleuronectes stellatus* (starry flounder), *Lepidopsetta bilineata*, *Hemilepidotus jordani*, and *Clupea mirabilis* (herring). Among the smaller fishes were several specimens of *Murœnoides ornatus*, varying in color from light yellow to dark red. Sticklebacks (*Gasterosteus*) abounded in the fresh-water lake.

Large collections of marine invertebrates were obtained from the shores in this region.

Fishing Notes: Fishing gear.—The wooden halibut-hooks described by Petroff, Turner, and others are still used by the natives of Unalashka. The regular cod-hook is, however, employed in the cod fishery. The fishing lines are of various sizes, and are made of any suitable material which comes to hand—cod-line, sail-twine, and even pieces of old string tied together. Pieces of lead, old spikes, bolts, and stones serve as sinkers. Drag seines are used for capturing salmon. They are from 20 to 50 feet long, and about 5 feet deep, with the mesh ranging in size from 6 to 9 inches. These seines are rudely constructed, having inflated bladders or blocks of wood as floats, and pieces of lead or stones as sinkers. They are generally handled by the boys and superannuated men of the village, who do not accompany the seal hunters on their summer voyages.

Cod bait.—Sculpins, flounders, salmon, and clams are used for cod bait, whichever of these species is most easily obtained at the time being employed. It is also stated that smoked bacon is sometimes put to the same use and serves equally as well.

Boats.—Dories are mostly used about the harbor for ordinary fishing purposes, but when long distances are to be traversed the favorite bidarka is generally employed. In connection with the bidarka the double paddle is invariably used on fishing trips; but it is stated that in sea-otter hunting the single paddle is preferred by the skillful hunters.

Use of cod and halibut by the natives.—Cod and halibut are not sought for by the Indians and creoles of Iliuliuk for commercial purposes, and they are only taken to supply home wants. Large quantities are never kept on hand, but a short fishing trip

to Captain's Harbor, or some other favorite ground, generally satisfies the immediate demands.

Preparation of ukali.—On the beach, at the head of Captain's Harbor, the preparation of ukali was observed. When the seine is hauled the salmon are at once killed by breaking the backbone just back of the head, to prevent their thrashing around and becoming injured or covered with dirt. The Indians then proceed to split them, holding the fish by the gills in the left hand. A long sharp knife is inserted just below the nape-bone, and drawn thence close along by the backbone to within about 2 inches of the tail. Reversing the fish, the same cut is made on the other side, and a final stroke of the knife severs the backbone close to the tail, thereby detaching the edible portions from the head, bones, and viscera. The two slivers being connected at the tail may then be thrown over a line or frame to dry. In dry weather the slivers are cut apart and the curing is done upon flakes similar to those used for cod.

At the time of the *Albatross's* visit the Aleuts were engaged in catching and drying the salmon in this manner in considerable numbers. The drying frames were usually protected by a grass-thatched roof. When not so protected it is the custom to bunch the fish together upon the poles at night and cover them with canvas, or take them indoors.

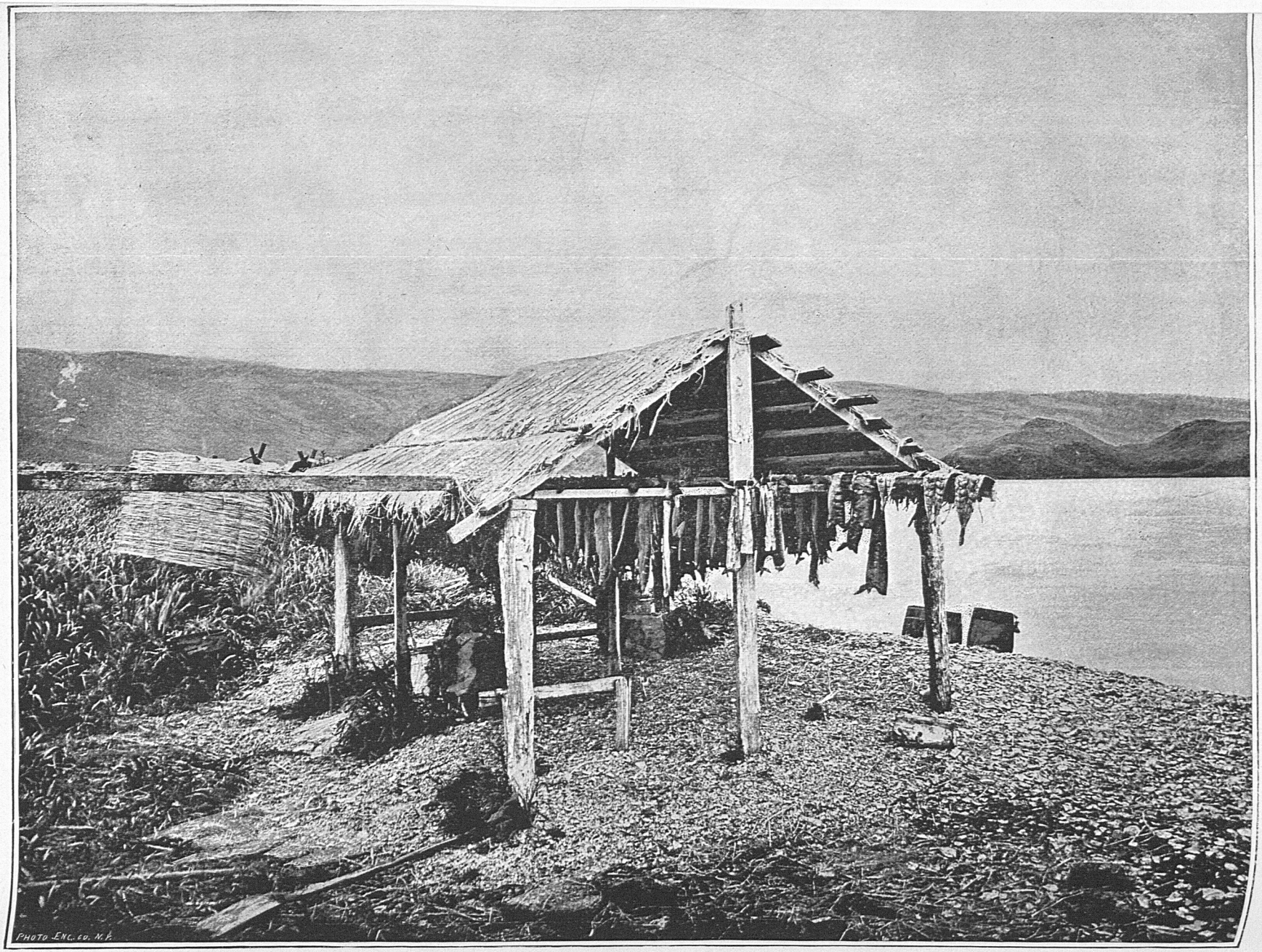
Advantages of Unalashka for the establishment of fishing stations.—Many places in the neighborhood of Unalashka are well suited to the construction of buildings, wharves, marine railways, weirs, and other structures necessary to the formation of a fishing station. The numerous bays and other indentations of the coast, as well as the narrow passage-ways between the islands, afford convenient shelter to vessels during stormy weather, and the nearness of the island to the fishing grounds, both north and south of the Aleutian Chain, specially adapts it as a fishing center. Should the climate prove too damp for the thorough drying of the fish, they could be landed here from the fishing vessels, and after being partly cured could be carried to Puget Sound or San Francisco for final treatment.

Favorable grounds for planting lobsters.—The sea-bottom in this region appears to be exceedingly well suited to the habits of the Atlantic coast lobster, and it is probable that they would live and multiply if a colony were once established here. They would find ample protection and an abundance of food in the many coves and among the rocks and islands with which the region abounds.

6. NOTES ON THE COD FISHERY OF BERING SEA.

While at Humboldt Harbor, Shumagin Islands, the schooner *Arago*, owned by Lynde & Hough, of San Francisco, arrived in port from a cod-fishing trip in Bering Sea with a fare of 103,000 cod. She had been absent from San Francisco since April 12, began fishing May 18, and left the grounds July 12. The *Arago* is of 176 tons burden and carries twenty-one men and twelve dories. She is greatly inferior in type to the poorer class of off-shore fishing vessels on the eastern coast, and would not command a crew from Gloucester or Portland. She is thirty years old and was built at Goose Bay, Cal. The floor timbers used in her construction were taken from an English bark which was wrecked at that place.

No trawling is done in Bering Sea, "dory fishing" being the only method followed. During the season of 1887 the schooner *Constitution* tried trawl fishing, but soon aban-



METHOD OF PROTECTING SALMON FROM THE RAIN, WHILE DRYING, BY MEANS OF A GRASS-THATCHED ROOF, UNALASHKA, ALASKA. (See page 22.)

doned it on account of the sea fleas (Amphipod crustaceans), which were very abundant on the bottom, and devoured or injured the fish before the lines could be hauled. Trawl lines were again tried this season by the *Arago*, but with no better success, and they were obliged to return to hand-line fishing.

Mr. Edwin Torbin, first mate of the *Arago*, states that they found the best fishing in latitude 56° 40′ N., 10 to 15 miles off shore, in depths of 19 to 24 fathoms, sandy bottom. A few herring were taken along for the first baiting of the lines to secure halibut, after which the latter species was exclusively used as bait. Mr. Torbin has engaged in fishing on the banks both to the south and north of the Aliaska Peninsula, and considers Bering Sea cod superior to the others. Fogs and rains are also much less prevalent during the fishing season in Bering Sea than to the south of the peninsula.

A bank lying about 20 miles to the northward of Unimak Pass has yielded some of the largest cod taken in Alaska, and is occasionally resorted to by the fishing vessels. It is called "Slime Bank" by the fishermen, who report that it is covered at a fathom or two above the bottom with a dense layer of slimy *Medusæ*, which generally prevents the hooks reaching bottom in a clean condition. The nature of this peculiar phenomenon is unexplained, but it may be due to a dense growth of large algæ. Cod are said to respond quickly to the bait when it is not covered with slime.

Only two vessels were fishing in Bering Sea during 1888, and it is customary to make only a single trip to that region during a season. This year the *Dashing Wave*, of San Francisco, contemplated starting upon a second trip, but the attempt was finally abandoned. The gear employed by these fishermen is similar to that used by the hand-line dory fishermen on the Western Bank, but it is not so neatly rigged. The fishing leads are made by the crews of the vessels, and therefore do not compare in finish with those of New England. The lines are not tarred, and soon show signs of wear. Patent swivels are apparently unknown; none of the crew of the *Arago* had ever seen or used them; but after the method of working them, and their advantages, had been explained the fishermen expressed their intention of giving them a trial next year. The dories correspond in shape and size with those used upon the eastern coast, the only perceptible difference noticed being that the stem, timbers, and planking are a trifle heavier. They are manufactured in San Francisco by Lynde & Hough. Galvanized-iron rowlocks are used instead of thole-pins.

7. DAVIDSON BANK.

Hydrography.—Davidson Bank, so named in honor of Prof. George Davidson, of the U. S. Coast and Geodetic Survey, who first reported it, lies south of Unimak Island, and extends westward from the vicinity of the Sannakh Islands to about the longitude of the southern entrance to Unimak Pass (longitude about 163° 18′ to about 164° 40′ W.). Its area inside of the 100-fathom curve is estimated to be about 1,600 square miles.

The 100-fathom line was located approximately by the steamer *Albatross*. It makes a rather strong outward bend in about longitude 164° W., where it is distant 45 to 50 miles from the nearest point of Unimak Island.

Five lines of soundings were run across this region inside of the 100-fathom line. The shoalest water discovered was 41 fathoms, in latitude 54° 06′ N., longitude 164° 17′ W.; but depths less than 50 fathoms were found over a considerable area, the

center of which is about latitude 54° N., longitude 164° W. A depth of 43 fathoms was sounded on the southeastern part of the bank, within about 8 miles of a depth of 342 fathoms. Between the shoaler area of the bank and the adjacent land to the north and west the following depths occur: Toward Unimak Island, 51 to 72 fathoms; toward Ugomok Island, 52 fathoms; toward Tigalda Island, 50 to 61 fathoms. The sounding of 41 fathoms above mentioned is the nearest to land of any less than 50 fathoms made upon the bank, excepting in the direction of the Sannakh Islands. It is about 20 miles from Seal Cape, Unimak Island, and about 22 miles from Ugomok Island. A depth of 63 fathoms was found directly off Promontory Cape, Unimak.

Toward the eastward the shoal area of the bank extends close to the Sannakh Islands, if it is not continuous with them, depths of 25 to 44 fathoms being found near together over a small area, just to the southwest of the islands. This shallow water (43 to 44 fathoms) also continues part way along the south side of the Sannakh Islands, midway between them and the reported positions of Lenard and Anderson Rocks.

A line of soundings extending S. 15° E., from off the northeastern end of Ugomok Island toward Davidson Bank, shows less depths than occur elsewhere between the shoaler part of the bank and the shore, which seems to indicate a deposit along this line from the swift currents of Unimak Pass.

The bottom upon the bank consists, in different places, of fine to coarse sand, pebbles, and gravel. Green mud was found at a depth of 95 fathoms, near the outer edge of the bank, and black sand in 342 fathoms just off the bank.

Dredgings.—The beam trawl was used once on Davidson's Bank, at Station No. 2845, latitude 54° 05′ N., longitude 164° 09′ W.; depth, 42 fathoms; bottom, coarse black sand. Among fishes, twelve specimens of *Hemilepidotus jordani*, and twenty or more specimens of *Lepidopsetta bilineata*, together with two or three small unidentified species, were taken. Shrimps and crabs were common, mollusks in small numbers, sea urchins and brittle stars very abundant.

Trials for fish.—Two trials for fish were made on Davidson Bank—one at dredging station No. 2845, the other at hydrographic station No. 1166. The former was in latitude 54° 05′ N., longitude 164° 09′ W.; 42 fathoms; coarse black sand; clams and salmon being used as bait. The weather was foggy, southerly and easterly winds prevailing. Twenty-five cod were caught here in a period of twenty minutes, the bottom being fairly alive with them and the bait seized as rapidly as it touched bottom. The average weight of the fish was 11¾ pounds, the average length 28 inches. The other trial was made on the eastern end of the bank, in latitude 54° N., longitude 163° 45′ W.; 45 fathoms; fine sand; salt clams being used as bait. While the fish seemed to be plentiful they did not bite as well as usual, a fresh breeze causing the ship to drift rapidly to leeward. Eight lines were in use for about an hour, taking twenty-one cod and one halibut during the drift. The halibut weighed 6½ pounds; the cod averaged 11¾ pounds in weight and 24½ inches in length.

Davidson Bank is said to be annually visited by large schools of herring, squid, and other pelagic species, moving from deep water toward the coast, and fishing vessels furnished with suitable gear might obtain large quantities of surface bait with little trouble.

DRYING SALMON AT ILIULIUK, UNALASHKA, ALASKA. (See page 22.)

8. SANNAKH ISLANDS TO THE SHUMAGIN ISLANDS, INCLUDING SANNAKH BANK.

REPORTED DANGERS SOUTH OF THE SANNAKH ISLANDS.

Lenard Rock and Anderson Rock.—"We were under low speed during the night and early morning of July 31, awaiting daylight, to approach reported dangers—the first, Lenard Rock, in latitude 54° N., longitude 163° 12′ W., and the second, Anderson Rock, in latitude 54° N., longitude 162° 47′ W., the latter showing above water. We intended passing over the positions given, and supposed we had done so until some hours later, when we found that we were about 12 miles N. 57° E. out of our reckoning. The low speed at which we ran all night and the prevalence of a moderate southerly breeze probably account for the unusual effect of current upon our positions. At 7.45 a. m. we left the above station, and stood S. 7° E., 10 miles, finding bottom at 51 and 464 fathoms, the latter S. 52° E., 3 miles from the reported position of Anderson Rock. We saw no indications of shoal water, but that proved nothing, as we were enveloped in so dense a fog that we were unable to see more than a quarter of a mile, most of the time, and probably not to exceed one-half mile at any time while we were in the vicinity.

"The rock may be in or near the position assigned it, but, considering the influence of the current on our course from Promontory Cape and the absence of any indication of shoal water in our last two soundings, it seems possible that the rock seen by Captain Anderson might have been one of the outer rocks on the Sannakh Reefs."

SANNAKH BANK.

Hydrography.—The shoal-water area of Davidson Bank (43 to 44 fathoms) was traced eastward between the Sannakh Islands and the reported positions of Lenard Rock and Anderson Rock, in a single line of soundings, extending about half the length of the former group. In about the same latitude as this line of soundings, but farther to the eastward (latitude 54° 08′ N., longitude 162° 22′ W.), a depth of 60 fathoms was found. Immediately to the northeastward of this position is an extensive shoal area, called Sannakh Bank. It lies to the east and southeast of the Sannakh Islands, is somewhat elongate in shape, and trends in a general way northeast and southwest. Four lines of soundings, approximately parallel with this trend, were run through the region containing this bank. A small area with soundings of 30 to 37 fathoms is about central in latitude 54° 20′ N., longitude 161° 53′ west.

Directly north of this shallow water, in the direction of the Sandman Reefs, depths of 63 to 82 fathoms were found; but it is bordered on the southeast, south, and southwest by a considerable area having depths of 40 to 60 fathoms. The connection between the bank and the islands of the same name was not determined, nor was the 100-fathom curve on the southern side developed, but near the southwestern end a depth of 435 fathoms was found close by 67 fathoms.

The estimated area of the bank was 1,300 square miles. Much of the bottom was found to be rocky. Sand, pebbles, gravel, etc., also occur.

Dredging.—No dredging was done on the main part of Sannakh Bank, but the beam trawl was used at Station No. 2846, about 15 miles south of Sannakh Island (latitude 54° 08′ N., longitude 162° 44′ W.), 44 fathoms, gravel bottom. The net came

up with many specimens of the red rockfish, *Sebastichthys*, and of *Lepidopsetta bilineata*. One skate was also taken. Several species of shrimps were very abundant, and hermit crabs, pectens, other mollusks, ascidians, and echinoderms were common.

Trials for fish.—Three trials for fish with hand lines were made on or near Sannakh Bank. The first was at dredging station No. 2346, about 15 miles south of Sannakh Island, 44 fathoms, gravel bottom, seven lines in use for fifteen minutes taking ten cod and two halibut, with clams and salmon for bait. The halibut averaged 14½ pounds in weight, the cod 11 pounds in weight and 23½ inches in length.

The second trial was made at hydrographic station No. 1213, about 12 miles south of Caton Island, latitude 54° 12′ N., longitude 162° 17′ W., 47 fathoms, the bottom consisting of sand and fine gravel. Nine lines were kept over about half an hour, being baited as in the previous trial, with the addition of sculpin on one of the hooks, and six cod and one halibut were taken. The average weight of the cod was 8½ pounds, their average length 25 inches. The halibut weighed 30 pounds, and was "white." This was the largest specimen that had been taken up to this time; but large halibut, it is said, are seldom caught on these in-shore banks.

The third trial was at hydrographic station No. 1239, about 12 miles a little south of east of Caton Island (latitude 54° 23′ N., longitude 161° 56′ W.), depth 34 fathoms, the bottom consisting of pebbles. Nine lines, baited with salt clams and salmon, were kept down for fifteen minutes, securing two cod and five halibut, the former averaging 8½ pounds in weight and 23¾ inches in length, the latter 9¾ pounds in weight. The largest halibut weighed 22 pounds. The stomachs of these fish contained fragments of squid and a few small partly digested fish.

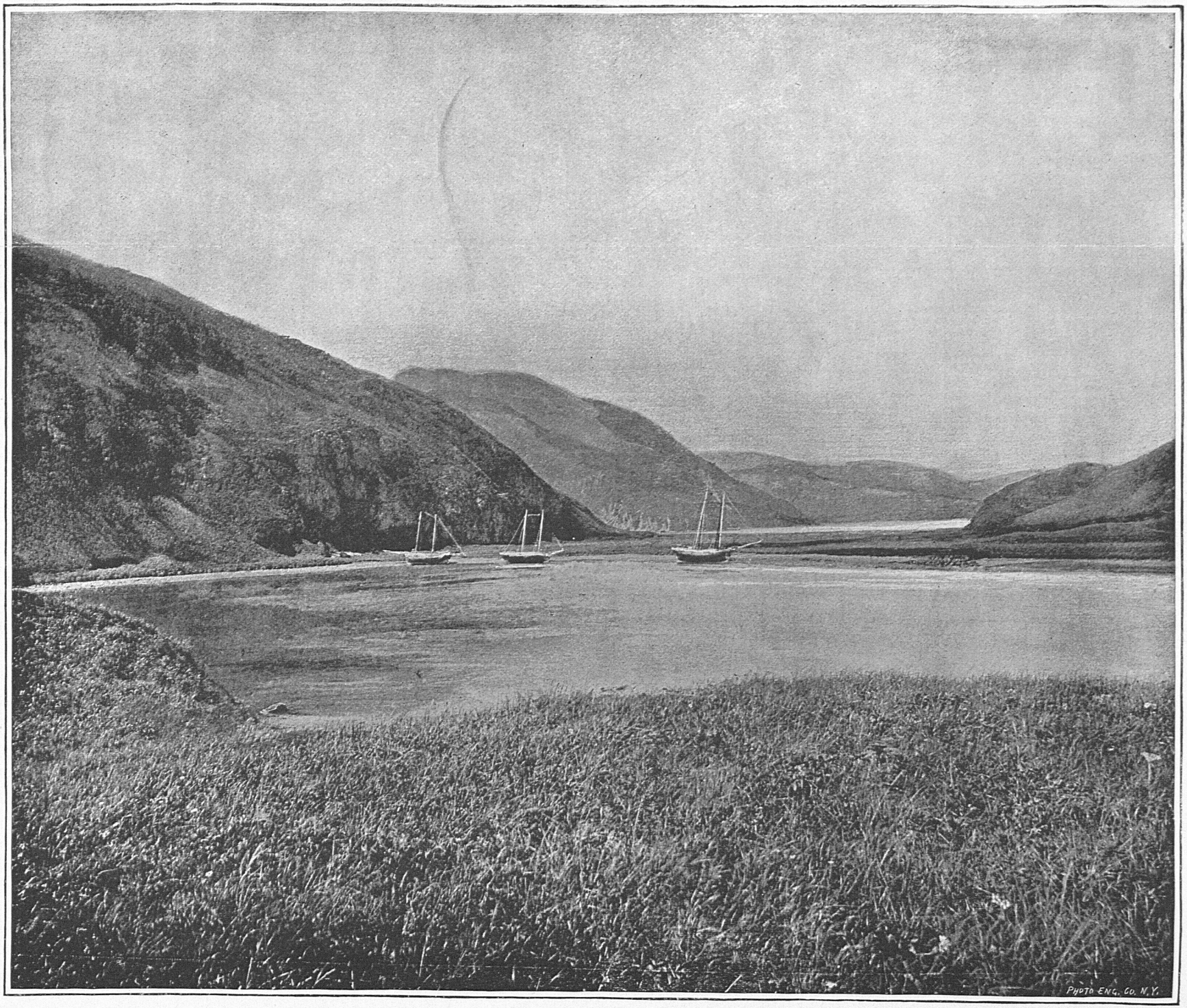
Remarks.—Some of the best fishing grounds in this region will probably be found about Sannakh Bank. The Sannakh Islands are, however, a dangerous group, with few safe harbors or anchorages, and the proximity of the bank to this inhospitable region will detract somewhat from its value, at least until the class of fishing vessels visiting it are prepared to lie out occasional gales without seeking a harbor.

But little attention is now paid to the bank. Mr. Collam, of Popoff Island, one of the Shumagin Group, is said to be the only person who engages in fishing there at the present time. He built a small fishing station on Sannakh Island in 1886, and has a small schooner of about 20 tons burden, which fishes in the neighborhood of that island, and carries the catch to Pirate Cove, Popoff Island. Several trips are made each season.

The cod caught in the vicinity of the Sannakhs are considered by many fishermen to be superior in quality to those found about the Shumagins, being pronounced by them less watery. The Sannakh cod are said to be plump and very firm meated, and do not shrink so much in curing. Very few of these fish, however, find their way to market.

FISHING GROUNDS BETWEEN SANNAKH BANK AND THE SHUMAGIN ISLANDS.

The region between Sannakh Bank and the Sandman Reefs on the west, and the Shumagin Islands on the east, was partly explored and shown to be suitable for fishing, but its precise value in that respect can only be determined after a more thorough examination has been made. The area of this ground is roughly estimated at 1,800 square miles.



THREE SEALERS FROM BRITISH COLUMBIA, CAPTURED IN BERING SEA DURING 1888, AND BEACHED AT ILIULIUK, UNALASHKA.

Three lines of soundings were continued across the region in a northeasterly direction from the vicinity of Sannakh Bank to the Shumagin Islands. The northernmost line extended from near Pinnacle Rock, off the Sandman Reefs, to the southern end of Unga Island, and showed depths of 38 to 74 fathoms; the second line extended from the northern end of Sannakh Bank to near Falmouth Harbor, Nagai Island, with depths of 45 to 64 fathoms; and the third line from the southern end of the same bank to Bird Island, in the southern part of the Shumagin Group, with depths of 40 to 72 fathoms. The 100-fathom curve was developed at only one point, just off the southernmost line of soundings. The bottom was found to be exceedingly variable, consisting in different places of sand, mud, pebbles, gravel, and rocks, the latter occurring only near Sannakh Bank on the one side, and near the Shumagin Islands on the other.

Dredgings and trials for fish were made only in the neighborhood of the Shumagin Islands, and will be described in connection with that group. Such trials as were made, however, on the edges of the ground showed a rich bottom.

This region possesses many advantages over Sannakh Bank from the absence of hidden dangers and its proximity to safe harbors.

Fishing vessels have not been in the habit of resorting to it, however, for the reason that an abundance of cod has always been found nearer the Shumagin Islands and upon Shumagin Bank. More thorough investigations will probably indicate the existence of defined banks or areas of rich feeding bottoms for cod and halibut.

SANDMAN REEFS.

Corrected positions for some of the rocks and islands.—A sounding of 74 fathoms was made at hydrographic station No. 1233 (latitude 54° 52′ N., longitude 161° 17′ W.), August 3, at 10.18 a. m., the position being located by cross-bearings of the large and more important islands to the northward and westward. "The weather was clear at the time and we could see land at a great distance, particularly to the northward and westward, where the snow-capped peak of Pavloff's volcano was distinctly visible. Deer Island and most of the smaller islets and rocks of the Chernaboura Group were in sight, and directly ahead of us was a small pinnacle-shaped island, not more than 10 miles distant, far from its position on the chart. Changing the course a little to bring it on the starboard bow, we steamed ahead a few miles, when breakers, and a moment later rocks, were reported on the port bow, still more out of position than the island. Subsequently Hay Island was located by cross-bearings and found to be several miles out of place on the published charts.

"The following are the positions we assigned to the rocks and islands mentioned above, based on cross-bearings and the noon position of the ship, when the latitude was determined by meridian altitude of the sun, and the longitude by chronometer:

"Low Rocks, latitude 54° 45′ N., longitude 161° 28′ W.

"Pinnacle Island, latitude 54° 45′ N., longitude 161° 35′ W.

"Hay Island, latitude 54° 39′ N., longitude 161° 53′ 30″ W."

BELKOVSKY BAY AND VICINITY.

Abundance of cod.—Mr. Pavloff, who acted as pilot for the steamer *Albatross*, states that the cod have been increasing in abundance during the past four years in the vicinity of Belkovsky, on the mainland, opposite the Sandman Reefs. Formerly

cod were not caught in that region during the winter months, but now they are abundant at that season. This increase Mr. Pavloff attributes to the present abundance of sculpins, which first made their appearance in the fall and winter from six to eight years ago. Sculpins of various species occur at other seasons, but they now arrive on the in-shore grounds in large numbers in the early fall and remain until late in the spring, being especially plentiful during the winter. Only enough cod are taken at Belkovsky for local consumption, there being no regular fishery in that region at present.

Cod banks in the vicinity.—To the north of the Sannakh Islands and west of the Sandman Reefs is a large unexplored area on which cod and halibut are reported to be abundant by the natives.

Method of hunting sea otters at Belkovsky.—In this locality the people depend chiefly upon the hunting of sea otters for a living. These animals are taken by means of bows and arrows, rifles, and gill nets. Gill nets are only employed in the winter, and are not used by the Indians, who find them too expensive. These nets are from 14 to 20 fathoms long, and 12 feet deep, with a 10-inch mesh. Some are made of single and others of double twine, the latter being most durable. The former cost from $10 to $15 each, the latter about $5 extra. They are knit by the Indian women. When gill nets were first introduced into this region by the Americans, the Indians manifested no surprise, saying that they had been employed many years before all along the Aleutian Islands, but that their use had been prohibited by the Russians a long time ago. Subsequent inquiry at Kadiak threw no light on this subject. If gill nets were formerly used by the Indians and Russians in pursuit of the sea otter they no doubt learned how destructive these appliances were, and took the necessary precautions to prevent the extinction of this important fur-bearing animal.

The Indians only hunt for sea otter in calm weather, as they can not capture them when the sea is rough. Several weeks may pass without a favorable opportunity, but a constant watch over the favorite hunting grounds is kept up from the hills and prominent places in the vicinity. At the first indications of fair weather word is passed around and the bidarkas are quickly manned and silently leave the shore in the direction of their prey. Gill nets can be hauled and set in weather which would not be regarded as suitable for hunting with the bow and rifle, and in consequence of the adoption of this method of capture, in recent years, it is claimed that the sea otter is fast becoming exterminated, and unless some restrictive measures are adopted, will soon be a thing of the past.

9. SHUMAGIN ISLANDS.

HYDROGRAPHIC WORK, DREDGINGS, TRIALS FOR FISH, ETC.

Hydrographic work, etc.—But little hydrographic work was done to the north and west of Nagai Island; sounding and dredging stations were made in mid-channel of Popoff Strait, 69 fathoms, mud and rocks; off the southern entrance to the same strait, 110 fathoms, mud; and south of the entrance to Falmouth Harbor, Nagai Island, 48 fathoms, fine gray sand. The lead was also cast in 18 fathoms at the mouth of Eagle Harbor, and in 34 fathoms close by Sea Lion Rocks. These rocks are about 100 feet high, and can be safely approached to within one-half mile. They are the resort of sea lions and birds.

NEARER VIEW OF ONE OF THE CAPTURED SEALERS FROM BRITISH COLUMBIA SHOWN ON PLATE IV.

August 4 a sounding was made 2 miles N. 34° W. from the center of Bird Island, in the southern part of the group, depth 21 fathoms, the bottom consisting chiefly of broken shells. The beam trawl and trial lines were put over at the same place. A successful haul was made with the former, but for the first time since the arrival of the *Albatross* in this region no fish were taken on the hand lines. Another rich cast with the beam trawl was made 4 miles N. 48° W. from the last station, 35 fathoms, gray sand; but the trial lines used in a depth of 25 fathoms, gray sand, midway between the Twins and Near Island, captured only two sculpins. A depth of 27 fathoms was found 3 miles N. 22° E. from the last station, 26 fathoms 5 miles S. 78° E., 37 fathoms 4 miles N. 40° E., or at the southern entrance to the strait between Spectacle and Big Koniushi Islands. The trial lines took one halibut in the last position. The experience above described demonstrated the absence of cod in August in a region where they are found in great numbers at other seasons of the year. During the winter this region is a favorite fishing ground.

A sounding of 57 fathoms was made in mid-channel, abreast of the north end of Spectacle Island, and another of 39 fathoms off the north end of Peninsula Island. The beam trawl was cast with good results in 58 fathoms, Cape Thompson bearing S. 76° E., distant 5 miles, and a sounding was subsequently made in 23 fathoms about mid-channel of the passage between the cape and Castle Rock.

Dredgings.—The beam trawl was used in six different places among the Shumagin Islands, disclosing an exceedingly rich bottom fauna. The results of this work have been grouped under two series of three stations each. The first three stations were as follows: No. 2847, about 2 miles south of the entrance to Falmouth Harbor, Nagai Island, 48 fathoms, fine gray sand; No. 2848, midway between Unga and Nagai Islands, 110 fathoms, green mud; No. 2849, between Unga and Popoff Islands, 69 fathoms, green mud. At these stations the following genera of fishes were represented by several specimens each, viz: *Hippoglossoides*, *Pleuronectes*, *Lepidopsetta*, *Atherestes*, *Sebastichthys*, *Lycodes*, *Hemilepidotus*, *Raia*, *Cyclopterus*, besides which there were a number of unidentified forms. The different groups of marine invertebrates made each a large showing, shrimps, crabs, amphipods, worms, gastropod mollusks, scallops, mussels, brachiopods, ascidians, and echinoderms being specially abundant.

The three other stations were in the southeastern part of the group, as follows: No. 2850, north of Bird Island, 21 fathoms, broken shells; No. 2851, midway between Bird Island and Nagai Island, 35 fathoms, gray sand, broken shells; No. 2852, at the north end of the passage-way between Nagai and Big Koniushi Islands, 58 fathoms, black sand. Flounders, sculpins, eelpouts, and species of *Agonidæ* were very abundant. Shrimps, crabs, and the lower crustacea were taken in large numbers. Scallops, mussels, and gastropods, among the mollusks, and sea urchins, star fishes, and sea cucumbers, among the echinoderms, were very numerous.

Trials for fish off the shore.—At hydrographic station No. 1227, about 13 miles south of Unga Island, latitude 54° 56′ N., longitude 160° 33′ W., depth 52 fathoms, nine hand lines were kept over twenty-five minutes, securing nine cod, averaging 11 pounds in weight and 30 inches long, and three flounders (*Atherestes*). These were the largest cod yet taken, being on an average 2 inches longer than the standard eastern size. Just north of Bird Island, in a depth of 21 fathoms, broken shells, nine lines were used for twelve minutes without success. One halibut weighing 4 pounds was the only result of a brief trial made in 37 fathoms, just west of the southern end

of Big Koniushi Island, the character of the bottom at this spot not being indicative of a rich fauna.

General character of the islands.—The general aspect of the Shumagins is mountainous, with numerous streams rushing down the mountain sides, often forming cascades of great beauty. Copious rains and a humid atmosphere favor the rank growth of grass, ferns, and flowers, which cover the islands during the summer months and give the impression of great fertility when viewed from a distance. There is no timber on the islands larger than alder bushes, but the beaches are lined with drift wood in sufficient quantities to supply the probable demand for many years.

Few dangers about the islands.—There are but few outlying dangers about these islands, and as a rule the shores can be approached within half a mile or less with safety. There are many secure harbors in the group, and vessels can find anchorage almost anywhere near the land in 10 to 20 fathoms. The region about Simeonoff is an exception, however, and should be navigated with great caution as there is foul ground surrounding the island.

Islands and Bays in Nagai Strait; corrections.—Several inaccuracies were observed in U. S. Coast and Geodetic Survey Chart No. 806. Among the most important may by mentioned the following:

(1) Spectacle Island is about 3 miles long, high and rounded at both ends, and connected by a narrow strip of low land near the center. A deep bight on the eastern side, and a prominent point projecting to the westward, give it the general form of a pair of spectacles, from which it derives its name.

(2) Peninsula Island is placed on the chart N. 35° E., about 2½ miles from its correct position. It lies directly mid-channel of the strait, and is, in fact, the projection shown on the west side of Big Koniushi Island. A low spit makes off from the east side of the former, but there is a passage between the two islands.

(3) The bays on Big Koniushi Island, north and south of Peninsula Island, are much deeper than shown on the chart.

HUMBOLDT HARBOR, POPOFF ISLAND.

Approaching Humboldt Harbor.—"Entering Popoff Strait we saw nothing until up with Barloff Bay, when the high and bold headlands forming its southern shore emerged from the fog not more than 400 yards distant. Thence to Egg Islands the course was clear, and after making them the fog partially lifted ahead, Sand Point and Arch Rock being visible. When up with Sand Point the station of Lynde & Hough was seen, and at 12.34 p. m., July 31, we anchored off the wharf in 12 fathoms. Humboldt Harbor has been surveyed by the U. S. Coast and Geodetic Survey (Chart No. 814). The holding-ground is good, and it affords excellent protection from all winds. There is a wharf at which ships' boats can land at all times of the tide."

Collecting in the harbor.—Beaches suitable for seining are less numerous here than in Iliuliuk Harbor, Unalashka, but two seines were kept in almost constant operation during the stay in port, securing an abundance of fishes, although not a great variety of species. *Salvelinus malma* was seined in great numbers in the harbor, and was also taken with hook and line in the fresh-water creek. Many young codfish were secured at each haul of the seines, but flounders, mostly *Lepidopsetta bilineata*, exceeded all other fishes in abundance, both adult and young specimens being taken. The

pollock (*Pollachius chalcogrammus*), a large sculpin (*Hemilepidotus jordani*), and the young of a species of *Hexagrammus* were common, and also many small species which have not yet been identified. A single *Limanda aspera* was taken with a hand line from the ship's side. A conspicuous feature of the seining at this locality was the abundance of large medusæ, sea urchins, and star fishes that dragged ashore. Cod-fishing with hand lines from the ship was always successful. The hooks at this anchorage frequently became entangled with sea-pens (*Pennatula*), of which more than a dozen fine specimens were secured. Clams are said to be plentiful, but none were obtained, the tides not serving right. The tides at this place are greatly influenced by the direction and force of the winds, which sometimes retain the water at high or low tide level for a considerable period.

Fishery Notes; Salmon fishing.—Humboldt Harbor would furnish shelter to a large fleet of vessels. A fishing station established in 1887 by Lynde & Hough, of San Francisco, offers the only inducement at present for people to settle here, and there are now but few inhabitants. Six fishermen are employed at the station, and up to date they had caught and prepared for shipment 300 barrels of salt salmon. The fish are taken in drag seines and gill nets. The seines measure from 20 to 125 fathoms long and 2½ to 3 fathoms deep, and have a mesh of about 2½ inches. The floats are made of wood, the sinkers of pieces of lead hammered into the required shape by the fishermen, and then bent around the foot-line. The salmon did not "strike" at Humboldt Harbor and the adjacent bays this year until the middle of June; they usually appear early in May. They continued to be unusually abundant until the latter part of July, but suddenly disappeared when the rainy season began, about a week before the arrival of the *Albatross*. A second school, which is expected to arrive about August 20, generally remains until the last of September.

Dories are used by the Indians for general fishing, but bidarkas are employed here as at Unalashka for long cruises in search of seals and sea otters. In hunting these mammals the single paddle is preferred, as it enables the Indians to approach nearer their game without disturbing them, otherwise the double paddle is used. Kiaks are not employed about the Shumagins.

PIRATE COVE, POPOFF ISLAND.

Fishery notes.—Cod fishing is now carried on in the vicinity of this harbor almost exclusively by means of dories, only one vessel having been engaged here in actual fishing during the present season. Most of the schooners had been sold, and those retained are used for freighting. The grounds resorted to are all within a short distance of the harbor, where dories are more convenient than larger craft. Trawls are chiefly employed, and during good weather they are hauled two and three times a day, but the fish are not dressed until the last haul for the day has been made. Cod fishing continues throughout the year. In summer, when the salmon are running, cod are not abundant, but they reappear in incredible numbers as soon as the salmon leave. During the winter strong southeasterly gales may prevent the hauling of the trawls for a number of days at a time, but there is no period of the year when they can not be used at least several times a week. This is in marked contrast with the climate of the Grand and Western Banks, off the Atlantic coast, some ten degrees farther south, where the fishing vessels are often compelled to lie to for a week, and sometimes for a fortnight, with their dories lashed upon the deck.

Vessels of suitable type and construction might engage in fishing in the Shumagin region during the entire year. They would not be compelled to ride out heavy gales on the banks, as do the fishing vessels of the Atlantic coast, endangering lives and property. The numerous bays, harbors, and small islands in close proximity to most of the fishing grounds afford convenient shelter. If winter fishing is ever carried on to a great extent on the Pacific coast by vessels sent out from San Francisco, however, a very different class of vessels from that now in use will have to be constructed in order to weather the severe gales encountered on the passage up and down the coast.

EAGLE HARBOR, NAGAI ISLAND.

The harbor.—The *Albatross* reached Eagle Harbor, on the west side of Nagai Island, August 2. This harbor offers good shelter to fishing vessels, and is in close proximity to many small fishing spots. It has no inhabitants, the high lands which descend on all sides close to the water's edge leaving no level ground upon which to plant a settlement. There is, however, a small beach or spit extending off from the southern side of the entrance to the harbor which is suited to the dressing of fish, the mending of nets, etc.

A vessel may anchor anywhere in the harbor in from 15 to 20 fathoms, and in the cove on the northern side she would find perfect protection from the sea, where she could haul out for repairs, fill her water casks, or gather drift wood on the beaches. The south cove has a narrow, tortuous entrance, too shoal for anything larger than a ship's boat at low water, but a vessel drawing 6 or 8 feet could be warped or towed in at high tide, and once inside would be as secure as in a dock.

Trials for fish.—A cod trawl containing four hundred hooks was baited and set in 16½ fathoms of water across the mouth of the harbor, where it was allowed to remain four hours. The inner end of the trawl lay on rocky ground, but on hauling it up it was found that it soon ran off into muddy bottom. The catch consisted of six cod averaging 8½ pounds each, three halibut averaging 5 pounds each, and a large number of flounders and sculpins. The last-named species had no doubt prevented a larger catch of cod and halibut, by taking the bait as soon as the hooks reached bottom.

Young cod attracted by the electric light.—During the evening the electric light was used at the surface with surprising success, attracting thousands of young cod, measuring about 3 inches long, which swarmed about it. With a single haul of the dip-net a hundred specimens were landed on deck. Some of these were placed in one of the aquaria, but they lived only a few days, being devoured by the larger fish confined with them.

YUKON HARBOR, BIG KONIUSHI ISLAND.

On August 8, a night anchorage was made at Yukon Harbor, but no shore investigations were attempted. A trial for cod was made with hand lines, but only one specimen was taken; flounders (*Lepidopsetta bilineata*) were so abundant that they seemed to drive all other species away. Hundreds of flocks of auks were flying about the harbor, and a boat being lowered several specimens were shot.

ALASKAN METHODS OF CURING COD COMPARED WITH THOSE OF NEW ENGLAND.

Mr. Ivan Petroff, in his "Report on the Population, Industries, and Resources of Alaska," page 69, states that "a peculiarity of the Alaska codfish industry is that the fish is not cured in the vicinity of the banks. The cod is only cleaned and pickled on board of the carrying craft, taken down to San Francisco and there pickled anew, being finally taken out and dried in quantities to suit the market. Expert fishermen located on the Shumagin Islands and at Kadiak claim that the fish could be cured on the spot as well as it is done at Cape Ann and other Atlantic cod-fishing stations. It is difficult to understand the reason for the process adopted by these San Francisco firms. The repeated pickling certainly does not serve to enhance the quality of the Shumagin codfish, and it is probably owing to this fact that the eastern codfish commands a higher price in the markets of the Pacific coast."

Mr. Petroff's statements are somewhat misleading, as the New England fishing vessels which visit the East coast fishing banks on "salt trips" bring back their catch in precisely the same condition as do the vessels sent out from San Francisco to the fishing grounds of Alaska and the Ochotsk Sea. The eastern cod are much larger in size than the average fish which have hitherto been obtained in the North Pacific, and the greater care exercised in curing them may account for their more inviting appearance. To these qualities possessed by the Atlantic cod, combined with the universal prejudice in favor of supplies coming from old and well-known sources, is due the higher price which these fish command in the markets of the Pacific coast.

THE LAY OF THE ALASKAN FISHERMEN.

The lay of the Alaskan fishermen differs considerably from that of the New England fishermen. The captain is paid a stated sum per month and has no share in the cargo. The mate receives a monthly salary, and also a certain sum for every thousand fish caught. Each of the crew receives $25 per thousand fish; splitters, $50 per month; salters, $40 per month; cooks, $60 per month. On the return from a trip the crew has nothing more to do with the vessel, taking no part in the discharging of the cargo, which is done entirely at the expense of the owners. The cod livers are never saved, and a profitable portion of the fish is thereby thrown away.

THE YELLOW-FISH.

Mr. Pavloff states that the yellow-fish (*Pleurogrammus monopterygius*) varies in size in different places. Those taken at Unalashka are much smaller than those found at Atka Island and on the fishing grounds south of the Aleutian Chain. They are not abundant about Belkovsky. None were secured by the *Albatross* during its cruise. This species is regarded by those who have eaten it as superior to any other on the coast of Alaska as an article of food.

The yellow-fish usually approach the Shumagin Islands about the latter part of August, and remain in that region in immense schools until the beginning of cold weather, when they retire to the deep water south of Shumagin Bank. They can probably be caught by the same methods employed in the mackerel fishery on the Atlantic coast. They are distributed along the coast for many hundred miles, and

occur in incredible numbers. Some years they appear earlier than others. Vessels fitted with boats and purse seines, after the fashion of the eastern mackerelmen, could readily obtain large fares. The few shipments sent to market have brought good prices, some lots having sold for as high as $28 per barrel. A lucrative business could probably be started with the San Francisco markets.

10. SHUMAGIN BANK.

Hydrography.—This bank lies south and southeast of the Shumagin Islands, and its outer margin follows approximately the trend of the coast line formed by the adjacent islands. It has been traced westward to about longitude 159° 52′ W., but probably extends farther in that direction. Its width within the 100-fathom curve, to the south of the group, is from 15 to 22 miles to the nearest outlying islands. Southeast of Simeonoff Island the width increases to between 30 and 35 miles. East of the Shumagins the bank extends north to about the latitude of Big Koniushi Island. Its area inside of the 100-fathom line is estimated at about 1,800 square miles. The bank is not separated from the Shumagins by deep water. Depths of 35 to 38 fathoms were found directly off Simeonoff Island, and from these positions the water deepens more or less regularly in a southeasterly direction towards the edge of the bank, with deeper spots sometimes intervening.

The western extension of the bank was not so thoroughly surveyed as the eastern portion. About midway between the islands and the 100-fathom line depths of 35 to 49 fathoms occur. A sounding of 115 fathoms was made 7 miles beyond a depth of 43 fathoms, indicating a very steep slope on this part of the bank. The northern boundary of the eastern portion of the bank was not fully determined. A line of soundings extending 38 miles southeast from Cape Thompson, at the northern end of Big Koniushi Island, showed depths of 47 to 114 fathoms, the former depth being found at only one place. A short distance farther north 97 to 103 fathoms were found within 30 miles of the shore, along a line of soundings running east, a little north from Cape Thompson. The character of the bottom on the bank varies greatly, sand, pebbles, gravel, broken shells, mud, and rocks being found in different places. Rocky patches were of frequent occurrence, even in comparatively deep water.

The work in this region was done in pleasant weather, when some portions of the adjacent islands were in sight most of the time, permitting of the positions being verified by cross-bearings from the land.

Trials for fish.—The beam trawl was not used on Shumagin Bank, but two trials were made for fish with hand lines. One was at hydrographic station No. 1286, on the western part of the bank, about 5 or 6 miles southeast of Chernaboura Island (latitude 54° 42′ N., longitude 159° 24′ W.), 35 fathoms, rocky bottom; the other at hydrographic station No. 1266, on the eastern part of the bank, about 15 miles east of Simeonoff Island, 46 fathoms, gray sand and broken shells. At the former station nine lines were employed for thirty-five minutes, taking eight cod, three halibut, and three sculpins. Salmon and pollock were used as bait. The cod averaged 8 pounds in weight and 26½ inches in length, the halibut 18⅔ pounds in weight. At the latter station one halibut, weighing 5 pounds, and three sculpins were taken.

Remarks.—This is one of the most important fishing banks in Alaska as it is also one of the best known. Its value is greatly increased from its proximity to the Shu-

magin Islands, where numerous safe and convenient harbors are available in case of storms. With the exception of Simeonoff Island and the reefs in its neighborhood, there are very few hidden dangers. The bottom is rich and fish are known to be abundant.

II. SHUMAGIN ISLANDS TO KADIAK ISLAND.

HYDROGRAPHY AND TRIALS FOR FISH.

Hydrography.—Only a few lines of soundings were made across this wide region, which, while they indicated the existence of several apparently rich banks, were insufficient to determine their extent and character. Beginning at a point 5 miles from Castle Rock, off the northern extremity of Big Koniushi Island, Shumagin Group, one line was carried 65 miles N. 84° E. to latitude 55° 25′ N., longitude 157° 28′ W., about 19 miles south of Light-house Rocks. Soundings were made at intervals of 10 miles, except at the end of the line, where the distance between the last two soundings was 5 miles. The water gradually shoaled from a depth of 103 fathoms near the Shumagins to 46 and 47 fathoms south of Light-house Rocks. From this point the line was continued to Mitrofania Bay, with depths of 53, 73, 73, 64, and 68 fathoms, the last being between Mitrofania Island and the bay of the same name; thence a line was run to Light-house Rocks with depths of 67, 44, 57, and 67 fathoms, 49 to 67 fathoms being found in the neighborhood of these rocks.

From Light-house Rocks the sounding was continued as follows: 33 miles S. 79° E., in 49, 48, 49, 50, 55, and 135 fathoms; 24 miles N. 31° E., in 137 and 119 fathoms, the last position being midway between the Semidi and Chirikoff Islands; 29 miles S. 36° E., in 89, 60, and 96 fathoms; 20 miles N. 23° E., in 57, 26, and 27 fathoms, terminating 6 miles S. 22° E. from the north end of Chirikoff Island, where a successful trial was made for cod. From this point a line was run 12 miles S. 34° E., sounding in 76 and 287 fathoms; 32 miles N. 28° E., in 89, 81, 76, 60, and 37 fathoms, the last position being 17 miles south from the south end of Tugidak Island, where cod were again found in abundance.

The soundings indicate a bank of considerable size in the region surrounding Light-house Rocks, but mainly to the south of these rocks, and extending to the eastward of latitude 157° W., and to the westward of latitude 158° W. It is probable, however, that good fishing will be found over a large part of the area included between the Shumagins and Kadiak. The extent of the area partly developed by the soundings is estimated at about 4,400 square miles.

Trials for fish.—On the morning of August 7 a trial for fish was made at hydrographic station No. 1317, latitude 55° 26′ N., longitude 157° 28′ W., about 19 miles south of Light-house Rocks, in 47 fathoms, green mud. The ship was hove to and allowed to drift for forty minutes, but no species of economic value were obtained. Salt salmon and pollock were used as bait. The bottom did not appear to be rich in food. The grounds in the immediate vicinity of Light-house Rocks can not be regarded as of any value to the fishermen while the large sea-lion rookery continues to exist there, as these animals feed chiefly upon fish, and keep the stock greatly reduced.

In the extreme eastern part of the area lying between the Shumagin Islands and Kadiak two trials for fish with hand lines proved unusually successful, and

demonstrated that the bottom in this region is exceedingly rich. The first trial was at hydrographic station No. 1343, in the vicinity of Chirikoff Island, latitude 55° 49′ N., longitude 155° 20′ W., depth 27 fathoms, sandy bottom. The second trial was at hydrographic station No. 1350, about 16 miles south of Tugidak Island, one of the Trinity Islands, in latitude 56° 07′ N., longitude 154° 38′ W., 37 fathoms, sandy bottom. This last position is actually on the western end of Albatross Bank. At the former station with seven hand lines used for twenty-five minutes, fifteen cod were taken, averaging 9¼ pounds in weight, and 23⅝ inches in length; at the latter 47 cod were secured with nine hand lines in a little over half an hour, the average weight of these being 10 pounds, the average length 28½ inches. In the former instance pollock and cod were used as bait, in the latter walrus flesh and cod.

MITROFANIA BAY.

Approaches; character.—"The mainland was sighted soon after daylight, August 7, and Mitrofania Island at 8 a. m.; but we failed to recognize the latter for several hours, owing to fog-banks which hung over the land. We were up with the island at 1.30 p. m., and, leaving it on the port hand, steamed into the bay of the same name, anchoring off Long Beach at 2.48 p. m. in 15 fathoms, latitude 55° 58′ N., longitude 158° 47′ W. (approximately).

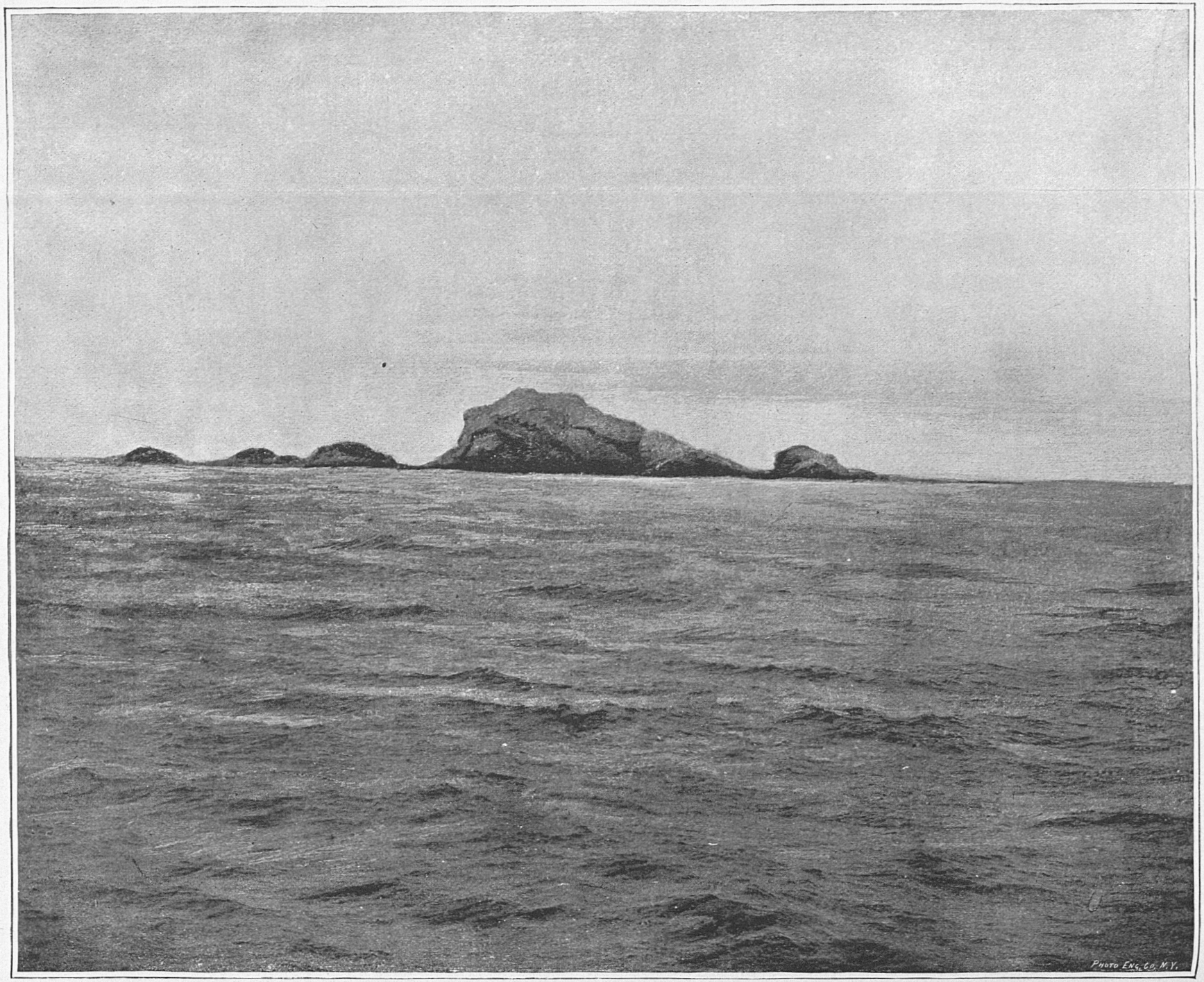
"Our anchorage was near the southwest extremity of a steep black-sand beach which lies back of the bay and extends in crescent form about 3 miles northeast and southwest. This beach is flanked on the eastern end by a nearly vertical cliff, 600 or 800 feet in height, made conspicuous by many strata of different-colored rocks, and on its western extremity by a precipitous mountain covered with a dense growth of alder bushes. An isolated rock lies near the base of the mountain, about 300 yards back of the beach, nearly rectangular in form, the sides being vertical, about 100 feet broad by 60 feet in height, and the top slightly rounded and covered with grass, ferns, and small bushes. Seen from a distance it had the appearance of a huge native sod house (barabara), with the roof overgrown with grass. An extensive valley lay back of the beach, in which were several ponds of fresh or brackish water, their shores being surrounded by a fringe of alder bushes. The land was covered by a rank growth of grass and wild flowers.

"Long Beach is a good anchorage except with winds from south to southeast, when a heavy swell rolls in. Better harbors are found on the east side of the bay.

"To make this anchorage leave Mitrofania and the small islands on the port hand, passing midway between them and the mainland, until well up with the sand beach. Then stand to the westward and anchor off the rock above mentioned, giving due attention to the lead, as the bank is steep."

Fishing; occupation of the natives.—Lines were baited and put over at the anchorage in Mitrofania Bay, in 27 fathoms, and in the course of a few minutes ten halibut were landed upon deck. The largest of these weighed 40 pounds, the smallest 4 pounds, the average weight being about 30 pounds. They were all "white;" the stomachs of some were empty, the others containing only a few crabs.

A settlement of creoles was established eight years ago on the northern side of the bay. These people were brought over from Kadiak Island by Mr. Pavloff, the pilot of the *Albatross*. Sea-otter hunting is their chief occupation, but cod, halibut, and salmon



LIGHT-HOUSE ROCKS, NEAR THE SEMIDI ISLANDS. ALASKA. (See page 37.)

are also taken for home consumption. The numerous small streams and lakes of the vicinity abound in trout and other kinds of fresh-water fishes. Bears and deer roam among the hills and through the valleys. They are hunted by the Indians in winter to supply additional food and clothing.

LIGHT-HOUSE ROCKS.

Position and character.—"August 8, at 12.30 p. m., we anchored in 49 fathoms, 890 yards N. 28° E. from the largest of the Light-house Rocks. The group consists of several detached rocks, ranging from 90 feet in height and 500 feet in length to 10 feet in height, with two or three nearly awash, over which the sea was breaking. They are about 500 yards in extent, and can be approached within half a mile with safety. No two charts agree as to their location, giving it from latitude 55° 44′ to 55° 45′ N., longitude 157° 25′ to 157° 30′ W. It was our intention to verify their position, but a dense fog, which settled down soon after we left the mainland, prevented.

"Our run placed them in latitude 55° 43′ N., and longitude 157° 20′ W., but it was not sufficiently reliable to justify us in changing their position on the chart. Latitude 55° 44′ N., and longitude 157° 25′ W. is about the mean and not far from correct."

Sea-lion rookery.—A landing was made by the naturalists in order to examine the large rookery of Steller's sea lion (*Eumetopias stelleri*) which exists there. The weather was very thick at the time, a dense fog hanging low over the water, but the sea being smooth a landing was easily effected. Much care had to be exercised in moving over the slippery rocks, smeared with the oil derived from the carcasses of numerous large sea lions which had evidently met their death in combat with their own species. Several hundred of these animals were crowded together upon a very limited area. Thousands of murres were breeding wherever they could find ledges and crevices inaccessible to the seals, and there were also a few kittiwake gulls and fulmars in sight. As the party was landing the sea lions came tumbling down over the rocks in their eagerness to reach the sea. A few, whose retreat was intercepted, were seen to jump from their high positions directly into the water, apparently sustaining no injury from the plunge, although the distance was considerable, especially for such large animals. There were probably as many pups as adults in the herd, and occasionally a small body of these would detach themselves from the rest and swim some distance off shore. A couple of killer whales (*Orca*), attracted doubtless by the disturbance at the rookery and the large number of seals in the water, came up quite close to the rocks, causing the seals to gather nearer shore and cast evident glances of alarm toward the killers, whose dorsal fins showed not less than 4 feet above the surface. The *Orcas* moved actively about, but it was not positively seen that any of the seals were seized by them. On several occasions, however, when pressed too hard on the water side, the seals ventured to crawl out upon the rocks, only to plunge back into the sea at the least movement on the part of the *Albatross* party. A rifle ball was finally planted in the back of one of the *Orcas*, causing the precipitate departure of both of them. A fine bull sea lion, measuring over 13 feet long, was shot by Mr. Townsend, and its skin removed and preserved after some two hours' hard labor. As soon as the naturalists left the island the sea lions returned to their rookery. These rocks are entirely barren of vegetation.

12. KADIAK ISLAND.

THE TRINITY ISLANDS.

Character and surroundings.—"The fog lifted as we approached the land, giving us a very good view of the Trinity Islands. Tugidak and the western portion of Sithinak Island are low and apparently marshy, while the eastern part of the latter island is higher. They are surrounded by foul ground, and, in the absence of proper surveys, should be approached with caution."

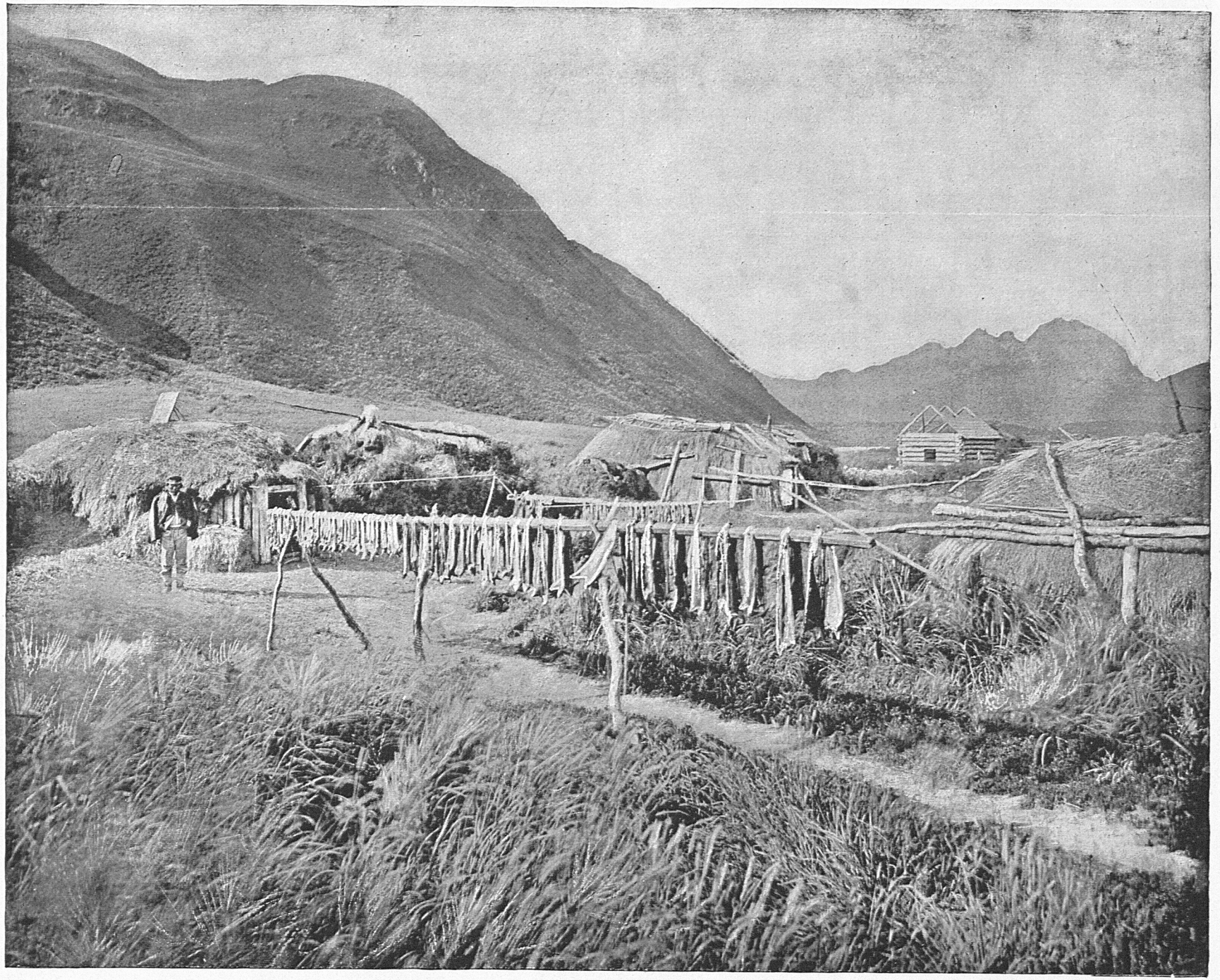
OLD HARBOR, KADIAK.

The harbor and its surroundings.—The *Albatross* arrived at Old Harbor (latitude 57° 11′ N., longitude 153° 13′ W.), in the channel separating Sitkalidak from Kadiak Island, on the afternoon of August 10, and anchored in 7 fathoms, off an Indian village called by the natives Three Saints. It lies about 4 miles to the northward of the Bay of Three Saints, the beautiful harbor of Lisiansky Bay intervening. The country surrounding Old Harbor is mountainous, with a narrow belt of comparatively level land, on which the village stands, near the water. It is covered with a luxuriant growth of grass and flowers during summer. Alder bushes grow to greater size than on the islands farther to the westward, and, in the sheltered valleys, the poplar is found of sufficient size to make it valuable to the natives in building their houses, and for other purposes. The rugged mountain range, sometimes called the backbone of Kadiak, was in sight, and the great gorges, still filled with snow and ice, lent an arctic hue to the otherwise summer aspect.

The village of Three Saints.—The village is scattered along the shingle beach, and consists of about thirty sod houses, or barabara, thatched with dried grass, and a few log buildings. The houses have the usual accompaniment of fish racks on which salmon were hung to dry. There are about two hundred and fifty Indians at this place, but most of the young men were absent at the time of the *Albatross's* visit, on hunting and fishing trips. The people in the village were engaged in drying salmon for their winter food supply, and a few were also in the employ of the salmon fishery near by.

Trials for fish.—The waters of the vicinity are everywhere filled with salmon, which seem to congregate in greatest abundance close to the sand bars and small rocky capes which project into the harbor. A short distance from the mouth of the harbor, in the vicinity of Two Headed Island, cod are also plentiful. Seining was carried on in the harbor, but not many species of fish were obtained there. The light seines also suffered severely from the presence of so many large salmon, which it was difficult to avoid taking in them. In addition to the salmon some of the same shore fishes taken at Unalashka were secured.

Directions for entering Old Harbor.—"To enter Old Harbor, make Two Headed Island (miscalled Two Headed Cape on Coast Survey Chart No. 702), which has two irregularly rounded peaks, and is easily recognized. Leave it on the port hand, and if the weather is clear Black Point will be seen, showing darker than its surroundings. There is a small islet about 200 yards in prolongation of this point, and one-fourth of a mile further on is a rock just above water, which marks the outer end of a ledge extending from the point. Having passed this rock, a mid-channel course around the



SOD-HOUSES (BARABARA) OF THE INDIAN VILLAGE OF THREE SAINTS, OLD HARBOR, KADIAK; ALSO SHOWING METHOD OF DRYING SALMON. (See page 38.)

second prominent point on the starboard hand leads to the strait where Old Harbor is located, and off which lies the Bay of Three Saints and Lisiansky Bay. There is bold water in the strait, which is free from hidden dangers except near the land. Passing Old Harbor there is a narrow tortuous channel into Sitkalidak Strait through which small vessels have passed, but a stranger should not attempt it with a vessel drawing more than 8 feet."

PORT HOBRON, SITKALIDAK ISLAND.

Fishing station.—While at Old Harbor a call was received from Mr. Ivan Petroff, manager of the Alaska Coast Fishery Company's station, recently established at Port Hobron some 10 or 12 miles to the northward and eastward of Old Harbor. Subsequently a party from the *Albatross* visited the station and found it located in a snug harbor on the north side of Sitkalidak Island, in the second deep bay coming from seaward.

The quarters, mess-room, store-room, and kitchen are under one roof, and the curing house is at the water's edge, where boats or barges can load and discharge at half-tide. It is supplied with running water from a mountain stream, and everything was scrupulously clean and well arranged. A cooper shop, stable, and store-house are conveniently located, and in the harbor were several dories, barges, a fine schooner, and a steam-launch. This is the first season the station has been in operation, and they have thus far confined themselves to taking and salting salmon, but they intend starting a cannery eventually.

The fish are caught chiefly in a lake opposite the station, and about 1½ miles from salt water, in which the salmon enter in incredible numbers to spawn. Eighteen white men and a few Indians are employed to do the fishing. The fish are transported over a horse-railway to the beach, where they are transferred to barges or dories which deliver them at the curing house. Four hundred barrels of salmon had been secured during the preceding three weeks.

The visit to the station was made between the runs of salmon, and the entire force, except the coopers, was engaged in cutting and curing hay for the horses used there. The location seems to be well chosen, not only for salmon fishing but also for cod and halibut.

In 1883 Mr. Petroff built a fishing stand close to the Indian village at Old Harbor, where for a time large quantities of cod were cured and shipped to San Francisco.

ST. PAUL, KADIAK.

Collecting in the harbor.—During the week's stay at St. Paul or Kadiak village, hand-line fishing, seining, boat dredging, and shore collecting were carried on continuously. Many flounders (*Lepidopsetta bilineata*) were taken with the hand lines, but very little else, excepting a few "rock trout" (*Hexagrammus*), and dogfish (*Squalus acanthias*). *Hemilepidotus trachurus*, a species of flounder, not met with elsewhere during the cruise, was also obtained in this manner. Scarcely anything but salmon and flounders were secured by seining. Boat dredging in the bays near the village, and thence outward to a point 4 miles distant from the village, gave excellent results, and disclosed a rich bottom with many species of marine invertebrates different from those discovered on the outer grounds. The groups of crustacea, mollusks, echino-

derms, anthozoa, hydroids, and sponges were all represented, and brachiopods of great size were obtained.

Shore collecting was productive of many interesting fishes and invertebrates. A small red star fish was abundant, and many small shells were found living upon the leaves of kelp. Numerous specimens of *Hemilepidotus trachurus* were taken by jerking them up by means of a sharp boat-hook as they lay upon the bottom in shallow places. They seldom moved if the hook was carefully inserted under them. This species is moderately abundant along the kelp line of the shores, and it is not difficult to secure a dozen or more specimens in an hour's time by the method described above. It proved a nuisance at Kadiak by taking all the bait set for codfish. The variations in color in this fish are remarkable, no two individuals being precisely alike in this respect. They also appear to assume the tints of the rocks and sea-weeds among which they live. The prevailing color is a rusty red on the upper parts, laid on in irregular blotches, and varied with brown or black. There is no variation with respect to the uniformly spotted under surface. Two or three specimens only of the black rockfish (*Sebastichthys*) were taken while at Kadiak.

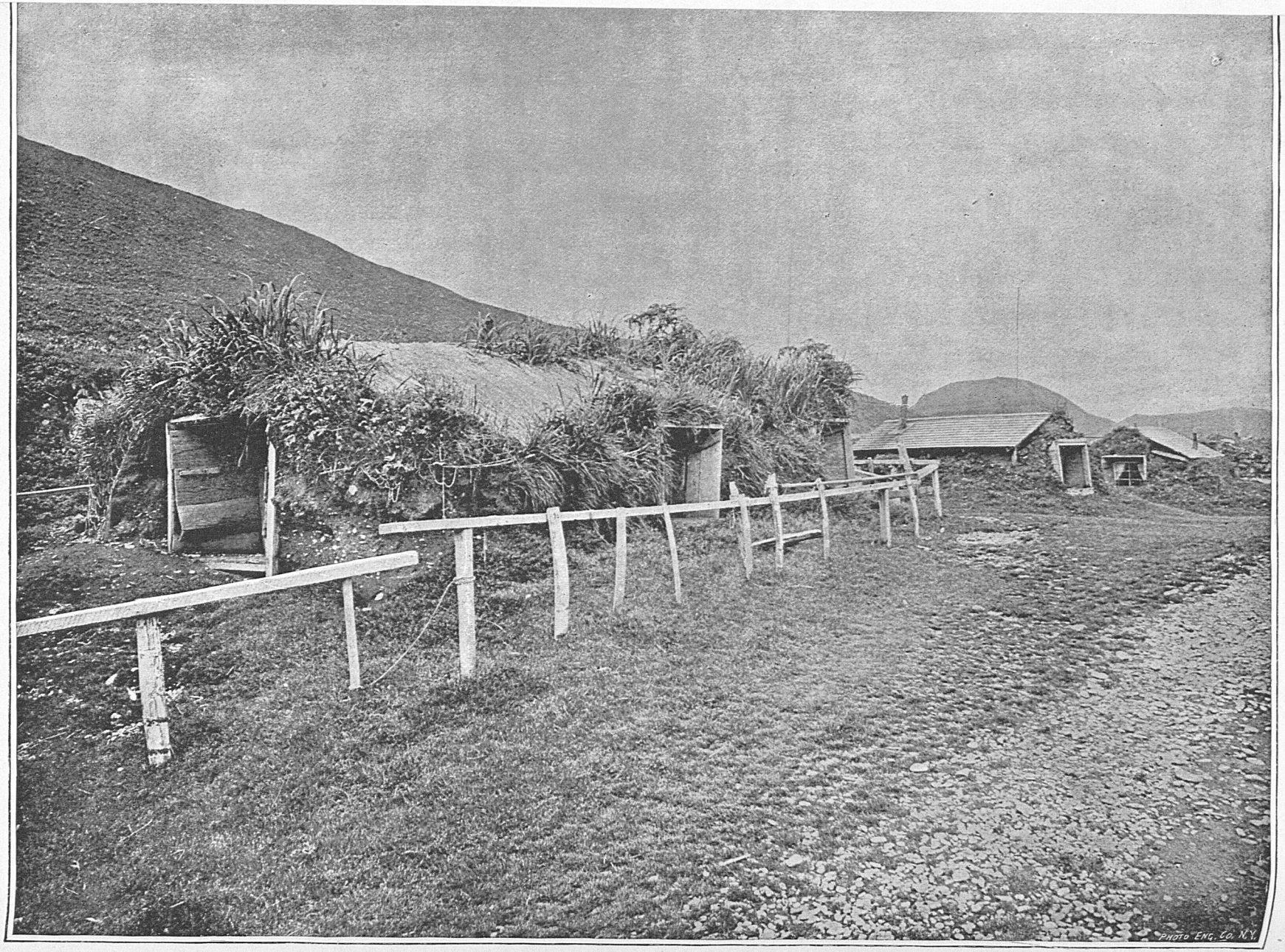
A gill net set in the harbor gave no results. A cod trawl was set across the northeast entrance to the harbor, and a haddock trawl across the southeast entrance. In the first trial a few dogfish and sculpins were obtained; in the second two silver-side salmon, two cod, one halibut, and a large number of dogfish. The halibut was "white."

Advantages of the neighborhood for fishing.—The inhabitants of St. Paul and the adjacent islands do very little fishing for cod, but are now turning their attention chiefly to sea-otter hunting, which they find more profitable. It is stated that cod fishing has never been engaged in to so great an extent by the people of Kadiak as by those of the Shumagin group, although there are many excellent in shore fishing grounds in this region which are easily accessible. A small bank located about 10 miles from William's Reef, in a south southeast direction, has an abundance of cod. Another bank equally as good lies 6 or 8 miles off Cape Pillar, but there are many such spots all along the coast, and many of them are close to the shore. Fishing can be carried on without intermission during five or six months of the year, and bait is always abundant.

Capt. H. R. Bowen, formerly of Gloucester, Mass., but now residing in St. Paul, thinks that fishermen with a limited amount of capital can establish themselves more readily in a lucrative business on Kadiak Island than elsewhere in Alaska. Since his first arrival at St. Paul, Captain Bowen has paid several visits to Gloucester; but no amount of persuasion on his part could induce any of the New England fishermen with whom he talked to move to Alaska, where, in his opinion, they could live just as comfortably and with less exertion.

The Indian sea-otter hunters of St. Paul are taken by steamers and small sailing vessels of the Alaska Commercial Company to the hunting grounds, where they are landed. At the expiration of the season they are brought back, and if the season has been a favorable one they will then have a considerable amount of money due them. Pay day to the Indians is one of the principal events of the year. They show little prudence, however, in the use of money, and often squander their entire earnings in the course of a few days.

Large schools of herring strike the coast in the vicinity of St. Paul about the middle of August, but very few had been taken up to the time of the arrival of the *Albatross*, August 14. They are sometimes exceedingly abundant in Shelikoff Strait,



SOD-HOUSES (BARABARA) OF THE INDIAN VILLAGE OF THREE SAINTS, OLD HARBOR, KADIAK.—*(Continuation of Plate VII; see page 38.)*

between Kadiak Island and the mainland, and several factories have been established along the borders of the strait for the purpose of extracting their oil. Ground sharks, which are also numerous in this strait, are likewise captured for their oil. A few herring are found in Cook's Inlet, where codfish are said to be increasing in abundance every year, being attracted there it is thought by the offal from the salmon canneries in Shelikoff Strait, which is carried into the inlet by the tides. Halibut have been taken in small numbers at the head of Cook's Inlet, and dogfish are very numerous along the coast from the northeast entrance to Shelikoff Strait to Prince William's Sound.

Notes on the fisheries and fishing vessels.—The weather at Kadiak was unexceptionally fine during 1888 up to the middle of August, there having been less fog and rain than for many years past. Cod could have been successfully dried, but in most years this would not be possible, as moist weather generally prevails.

Besides the Indians, there are at St. Paul about twelve or fifteen white men of various nationalities who engage in sea-otter hunting throughout the year. The white hunters have small schooners of about 25 tons burden, in which they make long voyages. The crew consists of two to four men, and occasionally one or two Indians are taken along. They use rifles chiefly during the summer, but in winter, when stormy weather prevails, gill nets are exclusively employed. Some of these hunters are very skillful, and several thousand dollars have been earned by a single individual in a season. Captain Anderson, one of the most successful hunters of St. Paul, and, in fact, of Alaska, landed fifty sea-otter skins as the result of one trip during the present season, receiving for them $100 each. The gill nets are the same as those employed at Belkovsky, and have already been described. Gill-net fishing for sea otters is expensive for the reason that the nets last only a very short time, one month being considered the extreme limit of service for a net in constant use. The short life of the nets is due, not to actual wear, but to neglect on the part of the hunters to properly care for them. After having remained down a few days they become covered with slime and sea-weed, and when taken up they are merely dried and cleaned, no preservative being used upon them. When told of the method of salting the seines, pursued by the mackerel fishermen of the eastern coast, whereby their nets are sometimes kept in good order for several years, much surprise was manifested, and that plan will now probably be tried by some of the Alaskan hunters.

Most of the sailing vessels of Alaska are schooner-rigged. The mainsail is generally triangular in shape, resembling the "riding" sail used by the Grand Bank fishermen. This prevents the use of a main gaff, however, which detracts greatly from the beauty of the rig. It is claimed by those who employ it that this pattern of sail is much safer in squally and otherwise rough weather, and that with it there is less danger of carrying away the main-boom or mainmast in jibing. Its advantages are also said to be greater than those of the ordinary pattern in approaching the many dangerous bays and headlands on the Alaskan coast. It is possible that this style of mainsail may be better adapted to stormy weather, as it presents less area to the wind, but in an ordinary sailing breeze it labors under a great disadvantage in going to windward with schooners carrying a gaff to their mainsails. Furthermore, the New England fishermen enter harbors on the Atlantic coast which are fully as dangerous as any in Alaska. The topmast of these schooners is a continuation of the mast above the eyes of the rigging. Should the topmast be carried away close to the rigging, an

entirely new mast would have to be put in. No light sails are carried except a main-stay-sail, which is set from the deck. A jib and a fore-stay-sail comprise the head sails. The masts are far enough apart to admit of a fair-sized foresail, which is essential on account of the small size of the mainsail. These little schooners are excellent sea boats, from the fact that they are very deep in proportion to their size, and therefore draw a good deal of water. They have a considerable dead-rise and drag-line. The wood chiefly used in their construction is Alaskan spruce and pine. The fastenings are of iron, galvanized iron having been employed during late years. The construction of these vessels, so far from ship-building centers, and with so few facilities at hand, reflects much credit on their designers and builders.

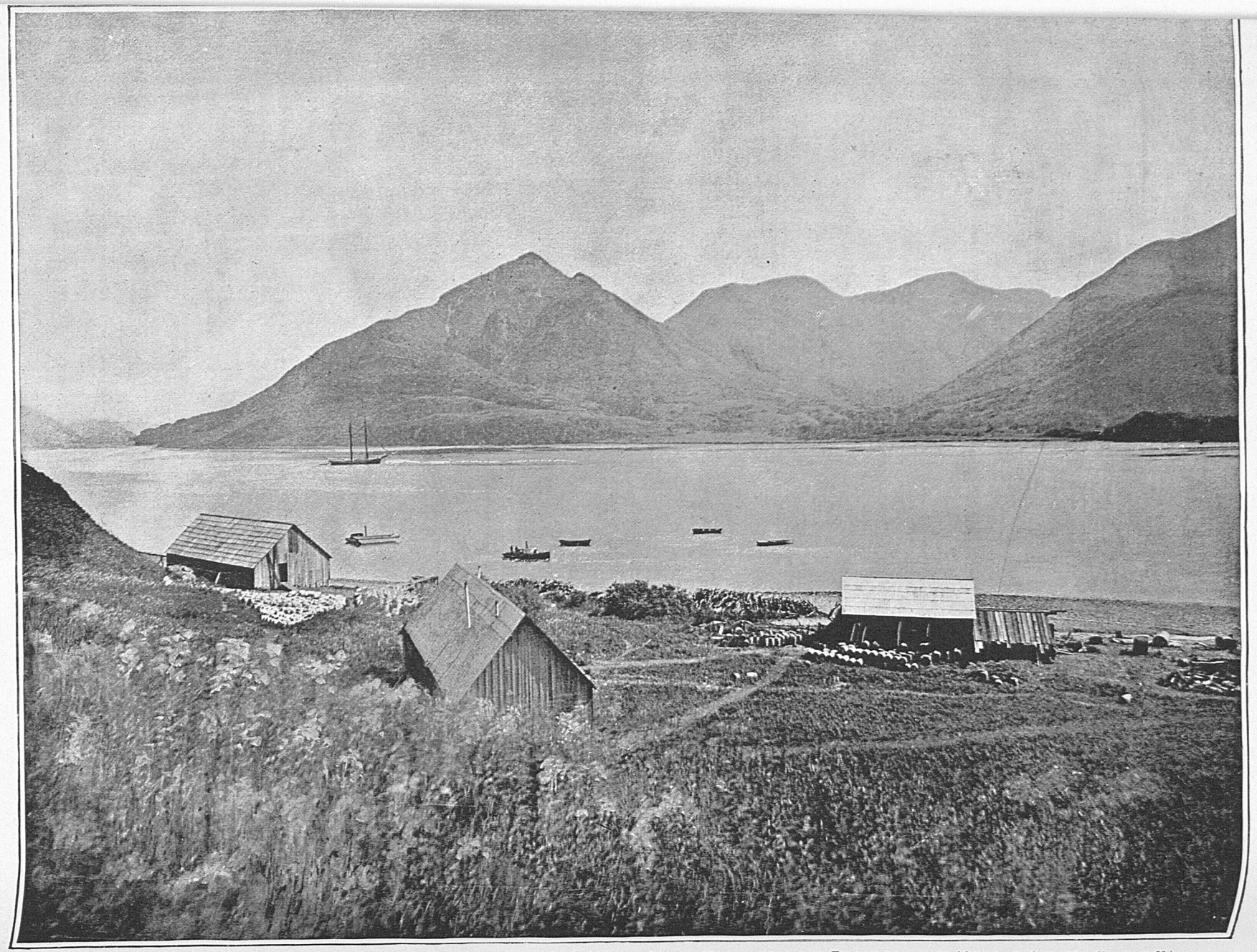
The inhabitants of St. Paul, both Indian and Russian, use dories for general purposes about the harbors and islands. They are constructed by the Indians and creoles employed by the Alaska Commercial Company, out of spruce and cedar. They approximate in shape and general appearance to the Salisbury dory, but must be regarded as inferior to it, although of comparatively good workmanship. The bows and arrows, paddles, and various other articles used in connection with them are made by the Indians, and exhibit much skill and ingenuity.

The hooks and lines employed for catching cod about St. Paul are of a primitive type. Pieces of lead of various sizes, but of no particular shape, are used as sinkers. The hooks are fastened to the lines above the lead, without the intervention of snoods. None of the wooden hooks used by most Indians for catching halibut were observed at this place.

Directions for entering St. Paul Harbor.—"In coming from the southward make Ugak Island, then Cape Greville (known locally as Chiniak Point). The east or seaward side being free from dangers can be approached with safety, but a ledge of rocks, which makes off to the northward, must be left on the port hand. The rocks are above water, and being prominent should be cleared without difficulty if the cape has been sighted, and no vessel would attempt to pass inside without seeing it. The lead should be used in thick weather, as the outer limit of Portlock Bank is well defined and from 35 to 40 miles distant. Having cleared the rocks off the cape, stand west-northwest (magnetic) for Long Island, which will carry a vessel about three-fourths of a mile outside of the Outer Humpback. If it is not seen the island will be the next landfall, and can be approached with comparative safety. Outer Humpback should be seen if the weather is suitable for a stranger to make the harbor, in which case pass within one-fourth to one-half a mile, leaving it on the port hand, and steer W. $\frac{1}{2}$ N. (magnetic) for the south end of Popoff Island. When the passage between Wooded Island and Long Island is shut in, steer N. by W. $\frac{1}{4}$ W. (magnetic) for the channel, passing 100 yards from the point of Wooded Island, off the settlement. Continue the course until the store-house on the wharf at St. Paul opens out, then stand in for the anchorage off the astronomical station (Coast and Geodetic Survey Chart No. 776), anchoring in about 13 fathoms.

"The Wooded Island side of the channel should be favored to avoid a reef on the west side, and the course continued to clear a rock about one-eighth of a mile off the north end of Holiday Island, which is not shown on the chart.

"To enter the inner harbor, keep the crib lying just off the end of the wharf, open about 50 feet from Near Island until nearly up with it, keeping as close as practicable until inside of the reef, then steer for the wharf. A vessel should enter with the tide



SALMON STATION OF THE ALASKA COAST FISHING COMPANY, PORT HOBRON, SITKALIDAK ISLAND, KADIAK, WITH THE FISHING-SCHOONER VIKING AT ANCHOR. (See page 39.)

running a little flood, which sets to the northward. The channel is very narrow, and a stranger should not attempt it without a pilot. It is high water at the wharf, full and change, at 1 hour."

13. ALBATROSS BANK.

Hydrography.—Albatross Bank lies off the southeastern side of Kadiak Island, and extends the entire length of that island, and also in front of the Trinity Islands at the southwest. It is continuous with Portlock Bank at the eastern end, there being no intervening depression between the two. The 100-fathom curve was located approximately in two places—opposite the Trinity Islands by one sounding, and opposite Sitkalidak Island, near the center of the Kadiak coast, by four deep soundings. At the former locality this curve was distant about 25 miles from the nearest point of Tugidak Island, and at the latter from about 42 to 45 miles from land. The total area of the bank inside of the 100-fathom curve is estimated to be about 3,700 square miles.

The depths are irregular, the main portion of the bank being in some places separated from the land by comparatively deep water, while in others shoal water intervenes. Two lines of soundings were run outward from Sithinak Island, one of the Trinity Islands. One, extending southwesterly from that island, shows 28 fathoms within about 3 miles of the land, followed by 54, 75, 66, and 159 fathoms; the other, extending southeasterly, has depths of 23, 52, 46, 52, and 88 fathoms. A depth of 71 fathoms was found 5 miles northeasterly from Two Headed Cape, and 111 fathoms 5 miles southeasterly from that position, followed in the same direction by 60, 44, 46, 38, and 347 fathoms. Four miles southeasterly from Dangerous Cape, 53 fathoms were discovered, followed 3 miles further out in the same direction by 86 fathoms, and then by 44, 49, 58, and 485 fathoms. A line extending off from Ugak Island begins with 25 and 45 fathoms, and another off from Cape Greville shows in succession 81, 57, 39, 71, and 75 fathoms.

The greater number of soundings indicate depths between 40 and 60 fathoms. Beyond the 100-fathom line the slope is very abrupt. All varieties of bottom occur, sand being most prevalent, and rocky patches common.

Dredgings.—The beam trawl was used in a depth of 159 fathoms, sandy bottom, about 28 miles south of the Trinity Islands, in latitude 56° N., longitude 154° 20′ W. (station 2853). Large quantities of fishes, crustaceans, worms, mollusks, echinoderms, and sponges were taken; an especial feature of the haul consisting of over one hundred specimens of a fine large free crinoid, which came up in excellent condition.

Two successful hauls of the beam trawl were also made off the island of Sitkalidak, south of Kadiak. The first station (2854) was located about 7 miles south of the western part of Sitkalidak Island, in 60 fathoms, sandy bottom; the second station (2855) directly off the southwestern end of the same island, in 69 fathoms, green mud. Fishes of many kinds were especially abundant in both hauls. The crustaceans were represented chiefly by an abundance of shrimps and hermit crabs; mollusks were unusually plentiful, about 3 bushels of the larger and commoner forms being obtained; and echinoderms of all classes were also common.

Trials for fish.—At hydrographic station No. 1350, about 16 miles south of Tugidak Island (latitude 56° 07′ N., longitude 154° 38′ W.), 37 fathoms, sandy bottom, nine hand lines were kept in use a little over an hour, resulting in the capture of forty-seven

cod, having an average weight of 10 pounds each, and an average length of 28½ inches. Walrus meat and cod were used as bait. Pair after pair of cod were hauled up in quick succession, and at the close of the trial they were biting as freely as in the beginning. This locality holds out exceptional inducements to fishing vessels, which, judging from the experience of the *Albatross*, might obtain large fares in an incredibly short space of time. Good harbors are within easy reach of the place, fine weather generally prevails excepting during the foggy spells of summer, and bait of many kinds may be taken on the grounds.

About 33 miles southeast of Sitkalidak Island (hydrographic station No. 1372, latitude 56° 51′ N., longitude 152° 50′ W.) several halibut were taken with hand lines in a depth of 37 fathoms, sand and broken shells.

A third trial for fish was made on the inner part of Albatross Bank at hydrographic station No. 1392 (latitude 57° 16′ N., longitude 152° 22′ W.), about 5 miles east of Dangerous Cape, Kadiak Island; depth, 39 fathoms; bottom, black sand and gravel. Nine hand lines, baited with salt salmon, were employed for fifty minutes, during which time sixty-nine cod and one halibut were taken. This was the best trial made on the Alaskan grounds, both as regards the rapidity with which the fish took the bait and their size and quality. The cod averaged 12 pounds each in weight, and 30¾ inches in length. Their stomachs were well filled with food, and they were more thrifty looking than any previously taken. A photograph of the entire lot, as it lay upon the deck, was secured. The spot where these fish were captured is a favorite fishing ground of the inhabitants of St. Paul, Kadiak, and large fares could be obtained in a short time by trawl or hand-line fishing.

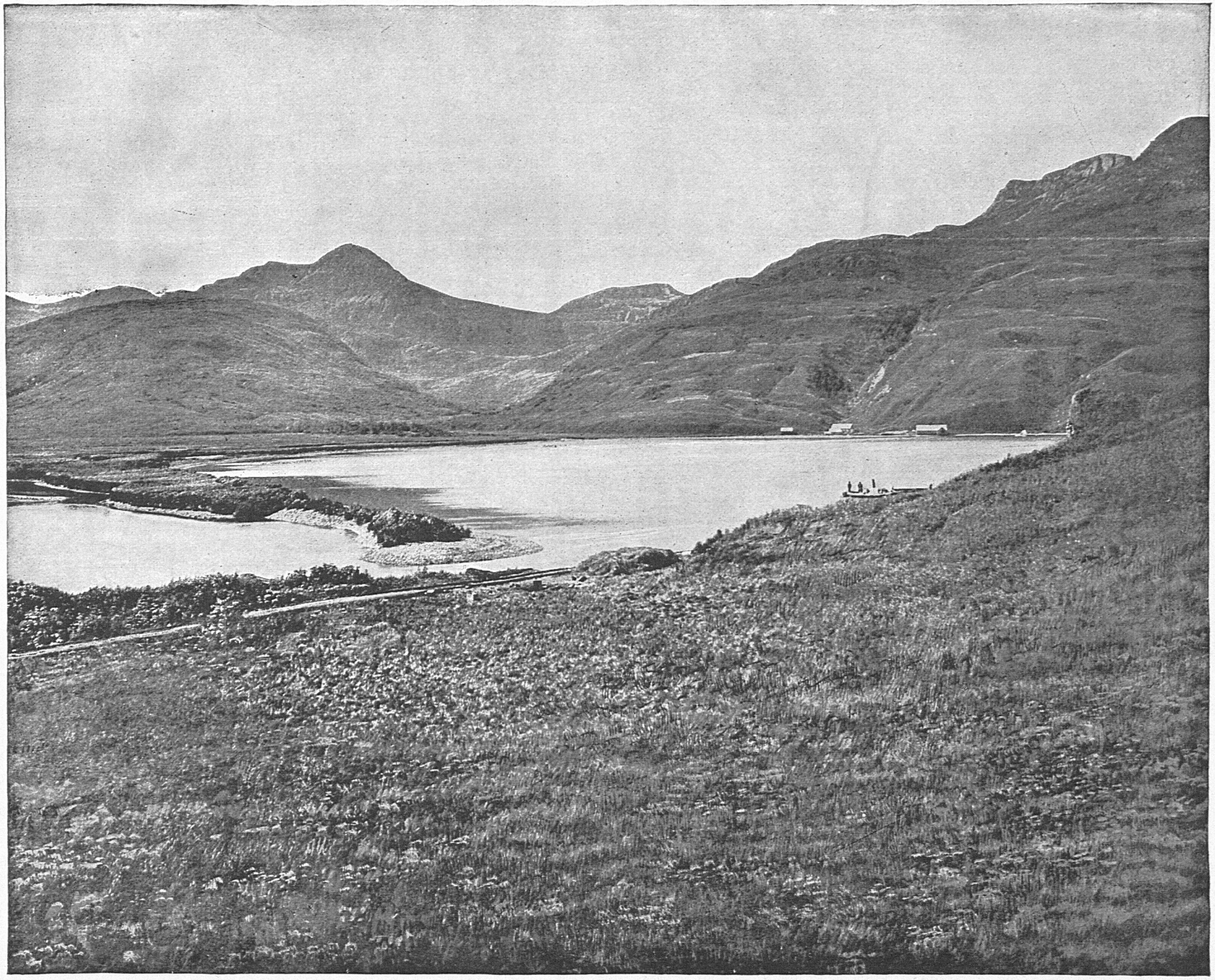
At the next hydrographic station (No. 1393), 11 miles northeast of Dangerous Cape, 25 fathoms, rocky bottom, a brief anchorage was made, and cod and halibut were taken in abundance with the hand lines.

Remarks.—There are many excellent harbors and convenient anchorages in close proximity to this bank, which make it one of the most desirable fishing grounds which has yet been surveyed on the Alaskan coast. It has been resorted to for some years by a few fishermen who locate the rich spots which they have found by bearings from the land.

14. PORTLOCK BANK.

Hydrography.—This is the largest of the Alaskan banks that have been surveyed up to the present time. Its area inside of the 100-fathom line is about 6,800 square miles, that of George's Bank, the second largest bank on the eastern coast of North America, being about 8,400 square miles. Its outline, as indicated by the 100-fathom curve, is irregular. It extends northeastward from Kadiak Island to about longitude 148° 30′ W., a distance of from 110 to 120 miles, and is widest at the western end, where its width equals that of Albatross Bank and Kadiak and Afognak Islands combined. Neither its northern nor southern boundary was positively determined, however, in this region. Depths of 76 to 99 fathoms were found in the direction of Kenai Peninsula, 97 fathoms occurring 16 miles south of Point Gore, the nearest point on the mainland to which soundings were made.

Between longitudes 150° and 151° W. the bank abruptly narrows, and thence maintains a width of 35 to 45 miles to its eastern end. There is a broad indentation,



LAKE IN REAR OF THE STATION OF THE ALASKA COAST FISHING COMPANY, PORT HOBRON, WHERE THE SALMON ARE TAKEN; SHOWING ALSO THE RAILROAD AND STEAM-LAUNCH USED IN THE FISHERY. (See page 39.)

with depths of 102 to 166 fathoms, on the southern side; depths of 105 to 122 fathoms occur just off the northern border, and 106 to 761 fathoms off the eastern end, close to the 100-fathom curve.

On the afternoon of August 23, in making the most northern soundings in longitude 151° and thereabouts, the Chugatz Islands, Point Gore, and Pye Islands were in sight, and cross-bearings were frequently taken to verify positions. Many snow-capped mountains were visible on the mainland, and in Nuka Bay an immense glacier extended apparently to the water's edge.

The soundings made by the *Albatross* between longitude 150° W. and the eastern end of the bank, inside of the 100-fathom line, show depths of 66 to 99 fathoms. Old soundings of 45 and 63 fathoms were not verified, although not shown to be inaccurate. Between longitudes 150° and 151° W. two soundings of 37 fathoms occur near the central part of the bank, while on the southern part depths of 40 to 72 fathoms were found. Between longitudes 151° and 152° W., the latter marking approximately the western boundary of the bank and the coast line, the depths, according to the soundings of the *Albatross*, range from 20 to 81 fathoms, the latter occurring near the land; but there are no indications of a marked or extensive depression between the bank and the shore.

Gray sand prevails over most of the bottom, mixed with pebbles, gravel, and broken shells in places, and with occasional patches of mud, and some rocky spots on the western part of the bank.

Between the eastern end of the bank and Middleton Island depths of 87 to 902 fathoms are shown by the single series of soundings made by the steamer. Two soundings of 87 and 101 fathoms, about midway between the two, indicate a small raised area surrounded by much deeper water.

Corrections.—Two lines of soundings on the southwestern part of Portlock Bank indicate shoaler water in that region than is marked upon the published charts of the Coast and Geodetic Survey, whose soundings are given on the chart accompanying this report in conjunction with the soundings of the *Albatross*. The two lines in question are as follows: One beginning in latitude 57° 52′ N., longitude 151° 47′ W., off Chiniak Harbor, and extending thence south 51° E. 50 miles, with soundings of 47, 30, 33, 35, 38, 42, 48, 57, and 72 fathoms; the other beginning in latitude 57° 26′ N., longitude 150° 06′ W., in 200 fathoms, and extending N. 51° W. 63 miles, with 59, 51, 43, 40, 36, and 78 fathoms. This work was done in fair weather, and it seems to prove the extension of Portlock Bank to Cape Greville without the intervening depression so generally found in this region near the land. The last sounding noted above, 78 fathoms, was made at dredging station No. 2856, which was occupied at noon. The latitude was obtained by meridian altitude of the sun, the longitude by chronometer, and both verified by bearings of the land, all of which showed Marmot Island to be improperly placed on Coast Survey Chart No. 702, by which its nearest point should have been 9 miles distant, yet the surf could be seen breaking on the beach not 5 miles away.

Dredging.—Three successful hauls of the beam trawl were made on Portlock Bank, as follows: Station 2856, latitude 58° 07′ N., longitude 151° 36′ W., about 15 miles east of Pillar Cape, Kadiak Island, in 68 fathoms of water, bottom gray sand, black specks; station 2857, in latitude 58° 05′ N., longitude 150° 46′ W., about 42 miles east of Pillar Cape, 51 fathoms, gray sand and broken shells; station 2858, in latitude

58° 17′ N., longitude 148° 36′ W., on the eastern edge of the bank in 230 fathoms, blue mud and gravel. A large quantity of material was secured at each of these stations. At the two former ones the results were similar to those obtained on Albatross Bank, but at the latter many new forms were taken which belong to deeper water. The principal fishes captured at station 2858 were *Glyptocephalus pacificus*, *Sebastichthys* sp. (red rockfish), and a red species of *Sebastes*.

Trials for fish.—Several trials for fish were made on Portlock Bank with hand lines, both rich and poor bottom being found in different localities.

The first trial was at hydrographic station No. 1421, latitude 57° 57′ N., longitude 151° 08′ W., about 35 miles east of Spruce Island, Kakiak, depth 36 fathoms; bottom, gravel and broken shells. At this place thirty cod and one halibut were taken with nine hand lines in eighteen minutes, salmon being used as bait. The cod averaged 8½ pounds in weight and 27 inches in length; the halibut weighed 10 pounds.

The second trial was at dredging station No. 2857, latitude 58° 05′ N., longitude 150° 46′ W., about 15 miles northeast of the last position, depth 51 fathoms, gray sand and broken shells. Although large quantities of specimens of the lower animals were obtained at this place in the beam trawl, the fishing was not successful, only two cod and four flounders (*Atherestes*) being captured on the hand lines. It is possible that the ship drifted from the rich ground before the lines were put over. A large number of whales were seen during the afternoon of this day, August 22.

A third trial was made at hydrographic station No. 1436, latitude 58° 23′ N., longitude 150° 32′ W., on the northern part of the bank, depth 37 fathoms; bottom, broken shells. Eight hand lines were kept out eighteen minutes, but here again the results were poor, only three cod, averaging about 5½ pounds each in weight, being taken.

The region in which the second and third trials were made is seldom if ever visited by the fishermen, and is therefore practically unknown.

Remarks.—This bank is destined to be recognized as a valuable fishing region, but the vessels that frequent it must go provided with ground tackle, in order to ride out such storms as they may meet with, unless fishing on the western end. A large part of the bank is too far distant from the shore to warrant their heaving up and seeking a harbor at the approach of every gale.

15. MIDDLETON ISLAND TO PUGET SOUND.

MIDDLETON ISLAND.

Approaching the island.—Middleton Island was sighted about 2 p. m., August 25, and late in the afternoon of the same day the *Albatross* anchored about a mile to the northward in 12 fathoms, near the point indicated on the Coast Survey chart, the north end of the island bearing N. 52° E., and the south end S. 27° W. This anchorage was off the outer limit of kelp, which seemed to extend the entire length of the island, from one-half to one and one-half miles from the beach. The ship was on the weather shore, where a moderate northwest wind and strong tide caused a heavy surf, so that landing was deferred until the next morning.

The rock mentioned in the Alaska Coast Pilot as lying 3 miles southwest (magnetic) from the north point of the island, and north-northwest (magnetic) from the anchorage was not seen, and, if it exists, is below the surface, where rocks may be

encountered almost anywhere around this desolate island. The swell was so heavy that no soundings were made except in the immediate vicinity of the anchorage.

Observations of the tides during the night showed a velocity of 2 to 3 knots per hour, the flood setting to the northward and eastward, and the ebb in the opposite direction.

August 26 began with a moderate breeze from the southwest, veering to northwest, northeast, and east-southeast, with clear weather, except for two hours in the early morning. The surf was still too heavy for landing, and being anxious to get observations on shore, as well as to give the naturalists an opportunity to examine the region, the ship was got under way and steamed to the southern end of the island. When about to anchor in 10 fathoms the keel came in contact with a rock, but she was backed off without damage and anchored in 15 fathoms, about 3 miles distant from land, the northern end of the island bearing N. ½ E. (magnetic), and the southern extremity NE. ⅜ N. (magnetic). Captain Tanner, the navigator, and a party of collectors immediately landed.

Geographical position.—The following observations were taken to ascertain the position of the island: Two sets of equal altitudes of the sun for longitude, one meridian altitude, and six ex-meridian altitudes of the sun for latitude, the artificial horizon being used. They were made under favorable conditions and are reliable. The observation spot is one cable to the westward of the southeast extremity of the island, and is marked by a pile of stones on the beach above high water, the mean of all the sights placing it in latitude 59° 23′ 36.7″ N., and longitude 146° 19′ 33.4″ W.

Characteristics and surroundings.—Middleton Island is between 7 and 8 miles long, N. 22° E., and S. 22° W., with reefs extending 2 miles or more north and east of it, and between 3 and 4 miles off the southern end. The anchorage is on the west side, and an approaching vessel should keep well outside of the kelp, as rocks may exist anywhere near the island, which is a terminal moraine, composed of mud, clay, and gravel, with huge bowlders thinly scattered about over the surface, on the beaches, and on ledges above and below the water.

The southern end has perpendicular cliffs of mud and clay from 30 to 80 feet in height, the greatest elevation, toward the center of the island, being about 120 feet above the sea. The strata on this side dip from 30° to 40° about northwest (magnetic). The general appearance of the island is flat, and, the soil being impervious to water, numerous ponds are formed by heavy rains, and the entire surface is moist, almost boggy, covered in summer with a rank growth of grass, flowers, etc., but with no trees.

A band of about fifty fur seals was observed upon the rocky reef on the eastern side of the island. In the spring the island is visited by Indians in pursuit of seals and sea otters, and large parties are sometimes encamped there for several weeks at a time. During recent years, however, it is stated that the island is less resorted to than formerly for that purpose. It has no permanent inhabitants. The high cliff is difficult of ascent, but a means was found of reaching the top, where, near its edge, the puffins have excavated long underground passage-ways, which gave the pedestrians some uncomfortable walking, as the thin crust of earth covering the burrows was not sufficiently strong to withstand their weight. In the interior they encountered level ground, covered with a rich growth of tall grass and other moisture-loving plants, concealing many sluggish little rivulets which slowly tended toward the shore. Search was made for fossils in the beds of clay and gravel, but none were found.

Fishing.—Two trials for fish were made near the island. The first was at the anchorage on the western side, in 12 fathoms of water; but the strong southerly tide which was running at the time swept the leads from the bottom. No edible fish were taken, but dogfish were abundant. At the anchorage off the southern end of the island, while the naturalists were on shore, the sailors captured the two largest halibut that were taken by the *Albatross* on the Alaskan coast. One weighed 42 pounds, the other 61 pounds. Salt salmon was used as bait.

MIDDLETON ISLAND TO PAMPLONA ROCKS.

Hydrographic work.—Leaving Middleton Island at 3 p. m., August 26, the *Albatross* sounded in 22 fathoms, latitude 59° 19′ N., longitude 146° 23′ W., and then running S. 53° E. from that position sounded at a distance of 5 miles in 141 fathoms; thence 10 miles in 620 fathoms, and 20 miles in 2,425 fathoms.

The course was then changed to N. 74° E., for Pamplona Rocks. The day ended with clear, pleasant weather, and smooth sea, which continued on the 27th. Forty miles from the last station a sounding was made in 2,224 fathoms; 27 miles farther, in 2,138 fathoms, and 17 miles still farther in 1,528 fathoms. Changing the course to S. 51° E., the ship ran 17 miles to one of the positions assigned to the rocks; thence S. 16° W. 3 miles, and sounded in 1,763 fathoms; east 5 miles, and S. 28° W. 7 miles, to another reported position, where a depth of 1,745 fathoms was found; N. 70° E. 9 miles, sounding in 1,675 fathoms; N. 84° E. 10 miles, 1,500 fathoms, and S. 43° E. 10 miles, 1,548 fathoms.

Position of Pamplona Rocks.—"The position assigned to Pamplona Rocks on Coast Survey Charts 701 and 702, Hydrographic Office Chart No. 527, and the Alaska Coast Pilot, is latitude 59° 03′ N., longitude 142° 40′ W.; but Coast Survey Chart 960 places them in latitude 59° 35′ N., longitude 142° 04′ W.

"I considered it highly important that these dangers should be located in the interest of commerce as well as the fisheries, and as time would not permit an examination of both localities, we selected that which seemed to have the weight of evidence in its favor. The weather was remarkably clear, and the search was made during the middle of the day, with a lookout on the top-gallant yard, his line of vision extending 10 miles or more on either hand, without detecting any sign of rocks or shoals. The soundings were regular and gave no indication of shoaling water, so that it may be stated positively that the rocks do not exist within 20 miles of the assigned position.

"Coast Survey Chart No. 960 places them nearer land, where 40 to 50 fathoms are found in their vicinity, and where rocks, banks, or a ledge, as these dangers are called by different authorities, might be expected to exist. The snow-clad heights of Mount St. Elias, from 90 to 100 miles distant, were visible during the day, and many snowy peaks of less magnitude could also be seen from time to time."

PAMPLONA ROCKS TO PUGET SOUND.

Hydrographic work and narrative.—Leaving the locality where search was made for Pamplona Rocks, a course was laid for the northern end of Vancouver Island. On August 28 two soundings were made, the first, 50 miles S. 43° E. from the last station (latitude 58° 17′ N., longitude 140° 35′ W.), in 1,815 fathoms, gray ooze; the second, 50 miles farther in the same direction, 1,778 fathoms, brown and gray ooze.

During the three following days soundings were made as follows:

Latitude 56° 35′ N., longitude 137° 55′ W., 1,433 fathoms;

Latitude 55° 20′ N., longitude 136° 20′ W., 1,569 fathoms, accompanied by dredging;

Latitude 54° 02′ N., longitude 134° 34′ W., 1,571 fathoms;

Latitude 52° 32′ N., longitude 133° 05′ W., 1,601 fathoms; 25 miles SW. ½ S. (magnetic) from Cape St. James, 1,099 fathoms;

Latitude 51° 23′ N., longitude 130° 43′ W., 876 fathoms, accompanied by dredging;

Latitude 51° 14′ N., longitude 129° 50′ W., 204 fathoms, accompanied by dredging;

Latitude 51° 09′ N., longitude 129° 07′ W., 83 fathoms;

Latitude 51° 01′ N., longitude 128° 25′ W., 52 fathoms.

The last station was off the northwestern extremity of Vancouver Island, where an anchorage was made on the night of August 31. From there the ship proceeded by way of the inner passages between Vancouver Island and the mainland to Seattle, Wash., where she arrived September 6, having made several stops on the way for the purposes of sounding, dredging, coaling, etc.

Sounding and dredging stations were made in Queen Charlotte Sound, off the southern entrance to Goletas Channel, depth 238 fathoms; in the Gulf of Georgia, off Fraser River, 67 fathoms; in the southern part of Washington Sound, 48 fathoms; and off the northern entrance to Admiralty Inlet, 40 fathoms.

Night anchorages were made in Alert Bay, Tribune Harbor, and Burrows Bay, and a supply of coal was taken in at Departure Bay. Burrows Bay is a good harbor, and is protected from all but southerly winds.

On the trip to Alaska during the first part of July the steamer *Albatross* made the same inner passage, but no hydrographic or dredging work was done. While going through, however, stops for various purposes were made at Esquimalt, Departure Bay, Tribune Bay, Alert Bay, and Fort Rupert, at all of which places collections and observations of greater or less extent were made, as explained further on.

Dredging.—Two casts of the beam trawl were made in deep water on the way south from Pamplona Rocks to Vancouver Island. The first was at station No. 2859, latitude 55° 20′ N., longitude 136° 20′ W., to the eastward of Prince of Wales Island; depth, 1,569 fathoms; bottom, gray ooze. The second was at station No. 2860, latitude 51° 23′ N., longitude 130° 34′ W., off Cape St. James, Queen Charlotte Islands, 876 fathoms, green mud. Both of these hauls developed a rich deep-sea fauna, and a large number of interesting specimens were obtained. Among fishes the genus *Macrurus* was represented by several species and over a hundred specimens, a large species of *Lithodes* (deep-sea spiny crab), several species of shrimps, several genera of echinoderms and *Umbellula* were very abundant.

At station 2861, latitude 51° 14′ N., longitude 129° 50′ W., 204 fathoms, the assemblage of forms was more like those obtained on the deeper parts of the Alaskan fishing banks. Both fishes and invertebrates were taken in great abundance, and among the latter were several specimens of a species of *Anthomastus*, which was here seen for the first time.

Station 2862 was in Queen Charlotte Sound, off the southern entrance to Goletas Channel, Duncan Island bearing ENE. ⅛ E. (magnetic); Noble Island, N. ¼ W. (magnetic); depth, 238 fathoms; bottom, gray sand and mud. The trawl came up with a heavy load of mud, which detained the ship two hours or more, as it was necessary to

tow it through the water until relieved of sufficient weight to allow of its being landed on deck. This proved to be an exceedingly rich haul, the bulk consisting of sponges, of which there were several bushels. Fishes, crustaceans, and brachiopods were also abundant, the latter group being represented by apparently three species.

Three dredgings were made between Departure Bay and Puget Sound, as follows: No. 2863, in the Gulf of Georgia, off the mouth of Fraser River (latitude 48° 58′ N., longitude 123° 10′ W.), 67 fathoms, fine sand; No. 2864, in the southern part of Washington Sound (latitude 48° 22′ N., longitude 122° 51′ W.), 48 fathoms, mud, sand, and broken shells; No. 2865, off the northern entrance to Admiralty Inlet (latitude 48° 12′ N., longitude 122° 49′ W.), 40 fathoms, pebbles. At the two former stations a large quantity of material was obtained, but at the last the trawl capsized and only a few specimens came up. Fishes, mollusks, crustaceans, annelids, echinoderms, and hydroids were abundant. Two bushels of large red shrimps, representing several species, and a few cup corals, were secured at station No. 2864.

FORT RUPERT, VANCOUVER ISLAND.

July 12 the *Albatross* called at Fort Rupert, or Beaver Harbor, for the purpose of obtaining a supply of clams, to be used as bait on the Alaskan grounds. Clams are unusually plentiful in this locality, and with a force of fifteen sailors ten bushels were dug at one low tide. Three species occur here in about equal abundance. The large gaper clam (*Schizothærus*) is obtained by digging deeply at lowest water mark. *Saxidomus nuttallii* (quahog) and the little *Tapes staminea* are usually only 6 or 8 inches below the surface, and may be found anywhere between high and low water mark. During unfavorable fishing seasons the salmon cannery at Alert Bay has put up clams, obtaining its supplies from Beaver Harbor. The chief occupation of the Indians is hunting and fishing. All the furs they obtain are sold to Mr. Robert Hunt, who pays for them in flour, clothing, and other necessary articles. Money is sometimes demanded, but not often.

Discovering the object of the visit of the *Albatross*, the Indians brought many clams alongside the ship in their graceful canoes. An entire canoe load was obtained in exchange for articles of barter of most trifling value. There are at Fort Rupert only two white settlers and about one hundred Indians.

ALERT BAY, VANCOUVER ISLAND.

Short stops were made at Alert Bay both going and returning. There is an Indian village at this place, and also a salmon cannery, where, up to September, 46,000 cases of salmon had been put up.

Salmon are sometimes very abundant about the bay and neighboring islands, and are fished for chiefly with seines and gill nets. The fishermen are paid 5 cents each for all the salmon landed at the cannery. The Indians of the village are principally occupied in fishing for the cannery. A few of them use spears for this purpose, and at times they do fairly well, frequently earning as much as $5 a day. At the time of the first visit to the cannery, July 11, seven or eight hundred of the Suk-kegh salmon (*Oncorhynchus nerka*) were piled upon the floor.

DEPARTURE BAY, VANCOUVER ISLAND.

Collecting.—A delay of two days while coaling at Departure Bay, July 10 and 11, was utilized to advantage in seining along the neighboring shores, during which many interesting fishes and marine invertebrates were secured. The larger fishes obtained were *Ditrema laterale* (blue perch), *Damalichthys argyrosomus* (white perch), *Micrometrus aggregatus*, *Sebastichthys paucispinis*, *Ophiodon elongatus*, and *Chimæra colliei*. The first four species were taken in considerable numbers at each haul of the seine. *Ditrema* and *Micrometrus* are highly esteemed as pan fish. From one adult specimen of *Damalichthys argyrosomus* thirty young ones were obtained, one of which lived in the aquarium on board the ship for two days. The young were much compressed laterally; body above lateral line faint purplish, below more inclined to silvery; fins transparent, pinkish, very soft and membranous, larger in proportion to size of body than in the adult. This species was not found with its young later in the season. The great rise and fall of tide which occurs in this region, amounting to about 15 feet, makes it very easy to collect the marine invertebrates along the shores. The large many-armed star fish (*Pycnopodia helianthoides*) is abundant at Departure Bay.

Fishery notes.—There are only a few fishermen at Departure Bay, all of whom are Italians. They fish chiefly for dogfish, which school in vast numbers in the bay and in the neighboring indentations of the coast during the winter months. As spring approaches the dogfish migrate to the Gulf of Georgia to feed upon herring and other small fish. About the first of December a large school of herring seeks the waters of Departure Bay, closely pursued by the dogfish. At this time the Italians begin their fishing, which is actively continued until March, when the herring leave the bay for deeper water. Gill nets only are used for the capture of dogfish. They are 40 fathoms long, from 20 to 25 feet deep, and have a 6-inch mesh. They are made of hemp and cost from $12 to $15 each. The floats are of cork and have the same size and shape as those used on the mackerel purse seines; they are obtained in San Francisco.

The rainy season begins in November and lasts until February. The prevailing winter winds are from the southeast. Strong northerly winds, however, occasionally sweep down the coast during that season, and at such times the dogfish generally leave the bay for a few days, or until the wind changes back. Salmon are most abundant in September. Spring salmon strike the coast in November, and are caught during the winter months; a few are occasionally taken in the dogfish nets. No halibut are caught at this place, but skates are numerous. Cod seldom enter the bay, but are found outside in deeper water. Those taken are not large, averaging about 5 pounds each. They are not often fished for and are not considered of much commercial value.

It has not, apparently, occurred to the Italian fishermen that the herring, so abundant in Departure Bay, is a valuable oil-producing fish. A few have been smoked for the local trade, and it is stated that during the coming winter this method of preparing them will be attempted on a much larger scale. Dogfish oil brings 50 cents per gallon at Nanaimo, and "ratfish" oil (the oil from *Chimæra colliei*), 75 cents per gallon. These oils are used by the Wellington Coal Company for lubricating purposes. The fishermen carry on their business on a small island in the bay, and at times they realize considerable profit from it. Three dollars per day is said to be regarded as fair wages. They are very primitive and uncleanly both in their way of living and in their methods of extracting the oil. With proper facilities the preparation of herring and dog-

fish oil in this locality might be made a profitable business. There are numerous islands along the inner coast of Vancouver Island, where dogfish try-works could be established, and the fishing continued during the entire year.

A few Indians fish in the bay chiefly for salmon, to supply the market at Nanaimo as well as their own wants. Their method of fishing is to troll with hook and spoon. They use dug-out canoes measuring from 12 to 20 feet in length, which, in their construction, show great attention to symmetry of outline, and much care and ingenuity in workmanship. They cost, when new, from $5 to $20 each, according to size.

The fishing boats used by the white men mostly range in length from 15 to 20 feet, and are both clinker and carvel built. Some are sloops, while others have a two-masted sprit-sail rig. They are all rudely constructed and are not neat in their appearance.

Fishing in Departure Bay and Harbor is seldom interfered with by the presence of ice during the winter months.

C.—REPORT OF THE EXPLORATIONS ON THE COASTS OF WASHINGTON TERRITORY AND OREGON.

16. NARRATIVE.

Returning from Alaska, the *Albatross* arrived at Seattle, Wash., on the afternoon of September 6, and was detained there until the 17th, in making a few repairs to her machinery. During the stay a visit was received from the mayor and city council, who inspected the steamer and expressed great interest in her work. September 17 the ship proceeded to Port Townsend, where a conference was had with Judge James G. Swan, of that place, relative to the fisheries of Washington Territory and the proposed investigations in that region. The Coast Survey steamer *McArthur* arrived at Port Townsend the same day, and an account of her soundings in the neighborhood of Cape Flattery was obtained, which resulted in a great saving of time and labor, as otherwise the *Albatross* would have been obliged to sound over a portion of the same ground.

The steamer left Port Townsend on the 18th, and, passing through the Straits of Fuca, began the examination of the outer coast, which, during this trip, covered the area lying between Shoalwater Bay (latitude 46° 31′) and the coast of Vancouver Island in latitude 49° N., including the halibut banks at the mouth of the Straits of Fuca. An anchorage for the night was made at Neeah Bay, September 24; the 26th and 27th of the same month were spent in Barclay Sound, Vancouver Island; and the *Albatross* returned to Port Townsend September 30, and to Seattle October 1, remaining four days for repairs at the latter place.

Leaving Seattle October 4, a short stop was made at Port Townsend, where, on the invitation of Captain Tanner, Judge James G. Swan joined the ship for a part of the second and final cruise before returning to San Francisco. A visit was made to Victoria, Vancouver Island, to obtain information respecting the recent attempts to establish a fishery for the beshowe or black cod, and the ship was also coaled at Departure Bay. Passing Cape Flattery on the evening of October 10, and sailing down the coast, operations were begun in the vicinity of Shoalwater Bay, and carried thence to the latitude of Tillamook Rock, Oregon, a short distance below the mouth of the Columbia River. The steamer entered the Columbia River October 14 and anchored off Astoria. Visits were received from Mr. F. C. Reed, State fish commissioner for Oregon; from the Hon. J. H. D. Gray, Colonel Taylor, and other prominent residents of Astoria, with whom the fishery interests of the region were discussed. Judge Swan left the *Albatross* at this place and returned to Port Townsend. The *Albatross* proceeded to sea on the 18th, made trials for fish and several dredgings about Tillamook Rock, and also a brief examination of Heceta Bank. From the latter region she sailed directly to San Francisco, where she arrived October 21.

17. PUGET SOUND AND THE STRAITS OF FUCA.

DREDGING AND FISHING TRIALS.

No soundings or dredgings were attempted by the steamer *Albatross* either in Puget Sound or directly in the Straits of Fuca, but two trials for fish were made in the latter region and two dredgings (stations No. 2864 and 2865) in the southern part of Washington Sound, as previously described. Important information respecting the fisheries and fishery industries of the region were, however, obtained.

Off Race Island.—October 19, after coaling at Departure Bay, a cod trawl was set in a depth of 101 fathoms, off Race Island, at the southeastern end of Vancouver Island, for the purpose of discovering the presence of beshowe or black cod, which were supposed to occur there. It was allowed to remain down only half an hour, at the end of which time it had secured forty dogfish, all the bait having been taken from the remaining hooks.

Neeah Bay.—On the evening of September 24 the halibut trawl was baited and set off Kaihsla Point, the inner buoy being in 20 fathoms, the outer in 25 fathoms. It was allowed to remain down until the following morning, but on hauling it only twenty-four dogfish and two skates were found. Halibut and beshowe are sometimes taken in close proximity to Neeah Bay earlier in the season. The last-named species is never abundant here, however; but some years it is sufficiently common in the spring to furnish the Indians of the vicinity with a considerable supply of food.

SEATTLE.

Fresh-fish markets and fresh trade.—Since the arrival of the schooners *Mollie Adams*, *Edward Webster*, and *Oscar and Hattie*, bringing with them New England fishermen, a conspicuous change is said to have taken place in the manner of presenting fresh fish for sale in the city markets. Previously the fish brought in for this trade, and which were chiefly caught by the Italian and Greek fishermen, were left in the bottom of their boats or thrown upon some convenient wharf exposed to dirt and flies until sold. Now there are six or seven well-kept markets in the city, where the fish have an inviting appearance. One of these is owned by a Mr. Butler, formerly of Gloucester, Mass., who is doing fairly well at retailing and shipping small quantities of fresh salmon to St. Paul and Minneapolis, Minn. Mr. Butler states that the demand for salmon by the eastern markets far exceeds the supply on account of the small catch at the present time. No other person in the city has attempted to ship fresh salmon to the inland cities. Strange to say, the fresh salmon consumed in Port Townsend are shipped there from Seattle.

During the two stops made at Seattle, from September 6 to 17, and from October 1 to 4, the fish markets were visited every morning, with the result of finding the following species exposed for sale: Columbia salmon (*Oncorhynchus chouicha*), silver salmon (*O. kisutch*), white perch (*Damalichthys argyrosomus*), perch (*Micrometrus aggregatus*), brown rockfish (*Sebastichthys maliger*), surf smelt (*Hypomesus pretiosus*), starry flounder (*Pleuronectes stellatus*), deep-water flounder (*Glyptocephalus zachirus*), flounders (*Psettichthys melanosticus*, *Parophrys vetulus*, and *Pleuronectes isolepis*), tom cod (*Microgadus proximus*), and a number of smaller and less valuable species. Salmon

were the prevailing species at this season, being taken daily in the channels opposite the town by the Greek and Italian fishermen. There are several squads of these men who go out in large, unwieldy, broad-sterned boats, which they laboriously but patiently propel from the landings to the seining grounds at each high tide, whether in the day or night.

The salmon seemed to be sufficiently plentiful to supply the demands of the town and to keep the few canneries in this vicinity in operation most of the time. A favorite amusement of the towns-people is trolling for salmon, which is done with fair success directly in front of the city wharves. Many Indians also fish for salmon in dug-out canoes of their own manufacture.

The salmon fishermen and salmon nets.—There are about three hundred Austrian, Italian, Greek, and Scandinavian fishermen in Seattle and vicinity. The greater number of these are now engaged in fishing for the canneries, of which there are three within a radius of 5 miles of the city. Purse seines and gill nets chiefly are used for taking salmon in Puget Sound. Fish traps were introduced into the region in 1888 by a Mr. Felters, formerly a fisherman on the Great Lakes. Purse seines were first employed in the Sound two years ago, and it is stated that they were brought here by the Chinese. They do not differ materially from the mackerel seine of the eastern coast, except in the addition of an apron which is hauled under the bunt in pursing. Some of the seines, however, are said not to have the apron. These seines are 200 fathoms long, 25 fathoms deep in the bunt, and 20 fathoms in the wings; they have a 3-inch mesh. The twine used in their construction is of three sizes, Nos. 12, 15, and 18; No. 12 being used in the bunt, No. 15 at each side of the bunt, and No. 18 in the wings. The foot-line is heavily leaded, and the bridles are about 10 feet long. One and one-half inch Russian hemp is used for the purse line. The rings through which the purse line is rove measure about 5 inches in diameter, and are made of small-sized galvanized iron.

The Puget Sound fishermen claimed that this style of purse ring was superior to that used upon the mackerel seines of the eastern coast. They had given the mackerel purse rings fair trial and were forced to abandon them, as the purse line would invariably draw twine into the rings, thereby preventing the pursing of the seine. Schools of salmon were often lost from this cause. A subsequent examination of some of the condemned "Gloucester rings," as they were called, showed them to be of the small composition make, such as were employed at one time on the "shoal" or small seines. This kind of ring has not been in use by the mackerel fishermen for eight or ten years, having been given up by them for the same reason explained above. There is no apparent reason why the modern mackerel purse ring would not work to advantage on the salmon purse seines of Puget Sound.

The time is not far distant when the combination of Oriental ideas which now prevail in this region will give way to the modern improvements which the American fishermen are bringing with them to the Pacific coast. It will, however, probably take some time to overcome the prejudice which now exists against the introduction of new methods of fishing, as the Greek and Italian fishermen are very conservative and look with disfavor upon any change from the old ways.

The salmon boats, method of stowing the seines, etc.—The boats used in the salmon fishery are about 25 feet long and 7 feet wide, the greatest width being at the stern, which is square. The bottom is flat, but turns up slightly at the stern. These boats

have three thwarts, adapted for two men rowing at each. About 8 feet of the after part of the boat is decked over, and upon this deck the seine is stowed. The method of stowing and throwing the seine differs somewhat from that followed in the mackerel fishery. The salmon seine being thrown over the stern of the boat, it has to be stowed fore and aft instead of athwartship. The corks are placed on the port side, the twine on the starboard side. The twine is thrown in a heap, not arranged neatly in "flakes" and "bits," as upon a mackerel boat, because the man who throws it is not particular to have it clear the stern so as not to retard the speed of the boat in going around a school. The result is that the oarsmen have an extra amount of work to perform.

The scow upon which most of the work is done, and which is considered indispensable in setting the seine, is 20 feet long by 8 wide, and at each end of it is an iron winch. These winches are used for the pursing up, the seine being pursed from the scow. There is a wooden purse davit, which is stepped into the side of the scow, and to which are attached two 3-inch wooden blocks, the purse line leading from them to the winches at either end. Eleven to fourteen men are required to set the seine—six at the oars, two at the seine, and two on the scow. Of those at the seine, one throws the corks, the other the twine.

The cost of a salmon seine, boat, and scow is from $1,200 to $1,300.

Method of fishing with the purse seine.—Starting upon a fishing trip, the boat, with its scow in tow, is rowed to a favorable locality where salmon are likely to occur, and, having anchored the scow, a lookout is kept for fish. As soon as a school is sighted the boat is shoved off, leaving one end of the seine attached to the scow. A circle is made around the fish, the boat returning again to the scow, when all hands jump aboard of it and commence to haul in on the twine and corks, two men standing at the winches and slowly taking in the slack on the purse line. It is not, however, until half the length of the seine has been pulled in that they begin to purse up in earnest. At this time the anchor rope is slacked off, and, all hands laying hold of the purse line, purse the scow into the middle of the seine. Were this done in the beginning, much hard labor could be saved. Time and labor would also be economized by slacking the anchor rope while the first half of the seine is being hauled in, instead of which the seine is hauled bodily through the water.

During the slow process of pursing a man stands at the davit with a long pole, having a block of wood called a "plunger" fastened to it. This is kept working up and down between the purse lines, for the purpose of frightening the fish away from the center of the net; and it is, no doubt, very effective in saving the school, as the bottom of the seine is left open from twenty-five to forty minutes, which is ample time for a salmon to find its way out.

From an hour and a half to two hours are required for setting, pursing up, and stowing the seine ready for another trial. On two occasions, when the operations were timed, they consumed on an average one hour and forty-five minutes. The result of both sets was fifty-odd salmon. As many as two thousand salmon were taken in this manner off Seattle at a single haul during 1886, but no such captures have been made since that year. Later in 1888 than the time of the above observations salmon became more abundant in the vicinity of Seattle.

Prices paid for salmon.—The fishermen receive from the canneries 25 cents for large and 10 cents for small salmon. Toward the latter part of the season prices are reduced. The proceeds of a sale are divided equally among the crew. The boats,

seines, and all other gear employed are furnished by the canneries. Three hundred dollars is considered fair earnings for a season's work, the season beginning the 1st of August and continuing until the latter part of October.

Fish traps for salmon.—There are seven fish traps in Puget Sound, all of which were put down during the spring of 1888. Four are owned by Parker & Felters, proprietors of the Columbia River Cannery at Seattle, who were the first to introduce traps in this locality. Mr. Felters is of the opinion that these appliances will take the place of seines, as there is less expense attendant upon their management. One or two men are sufficient to tend them and keep them in repair. The fishermen about Seattle are strongly opposed to the building of traps, as threatening the future prosperity of the salmon fishery if they are used to any great extent. With the general introduction of traps, requiring much fewer men to carry on the work, the majority of the present fishermen would be forced to seek other employment during the salmon season; and, furthermore, the fishery would soon be broken up, at least to such an extent as to make it unprofitable to more than a very limited number of fishermen.

Up to September, 1888, the traps had taken a large proportion of the salmon brought to the Columbia River Cannery at Seattle. In addition to the traps, this cannery also has two drag and two purse seines fishing for it. The purse seines are used in the harbor of Seattle or in Dwamish Bay. Fishing is carried on both day and night, according as the tide serves. No attempts are made to fish excepting near the time of high water, when the larger catches can be made.

Salmon canneries.—Each cannery has a small steamer to visit the traps in different parts of the Sound, carrying out supplies and bringing back the nightly catch. The catch of salmon for 1888 was not large. Up to September 9 the Columbia River Cannery had put up 750 cases; the King County Packing Company, 600 cases; and the cannery at Dwamish Head, owned by Mr. George Myers, 1,200 cases. Mr. Myers has seven purse seines fishing for him, and has in his employ about forty men, mostly Chinese. He claims to have facilities for putting up 650 cases of salmon per day, and could average 450 cases per day with his present help if fish were sufficiently abundant. Nearly all the canning is now done under contract with Chinamen, who catch the salmon and prepare them ready for shipment at a specified sum per case. The price paid under this system during 1888 was 42 cents per case.

Many improvements have been made in canning machinery, the filling and sealing of the cans being now accomplished by means of automatic devices.

Decrease of salmon.—A Mr. Herrick, formerly connected with a cannery on Columbia River, but now in the employ of Parker & Felters at Seattle, claims from an experience extending over the past twenty years that salmon are rapidly decreasing in this region. This decrease is due not only to the great annual catch, but also to the presence of much floating refuse from the saw-mills of the neighborhood. Mr. Myers, of the Dwamish Head Cannery, on the contrary, considers that there has been no general decrease, and that there are no indications of the salmon becoming exterminated, as some predict. He has been connected with the fishery in Puget Sound for the past twelve years, and states that salmon are as abundant now as at any time in the past. They fluctuate in abundance, however, from year to year.

Size of salmon, etc.—Salmon run much smaller in Puget Sound than in the Columbia River. Mr. Herrick states that in the former region twelve salmon on an average are required to make a case, while in the latter three are sufficient for this purpose. A

case of salmon contains forty-eight 1-pound cans. The greatest output for the United States in one year has been 1,000,000 cases, or 48,000,000 cans.

Proposed change in location of canneries.—As thirteen of the Columbia River canneries have been closed during the past year, it is probable that the production for this year will fall considerably short of the maximum reached in this fishery. The owners of many of the closed canneries talk of establishing themselves in Alaska, where the cost of catching and canning the fish will be very much less than on the Columbia River, and where their general expenses will be lower.

The winter fishery.—As soon as the run of salmon is over the fishermen seek other employment. Some engage in dogfishing, which begins in November and lasts until spring; others fish for cod, smelts, and other small species. Gill nets are used for the capture of cod and trawls for dogfish. The trawls are very heavy. The ground lines are made of six and nine thread manila, the gangings of 18 to 20 pound line, while the hooks are about the same that are used in the Atlantic coast halibut fishery. The anchors are exceptionally heavy, some weighing as much as 75 pounds, the average weight being about 50 pounds. A few of the fishermen in the Sound realize that lighter anchors and smaller gear generally would answer every purpose, and talk of adopting the eastern style of trawl, but the majority are prejudiced in favor of their present methods.

PORT TOWNSEND.

Port Townsend has a much finer harbor than Seattle, capable of sheltering a large fleet of vessels, and already has excellent wharf privileges, where vessels of deep draught can remain afloat at all times of the tide. There are also many places in the harbor well adapted to the construction of marine railways. With the development of the ocean fisheries on the northwest coast, especially in the event of the completion of the railroad to Port Townsend, now under construction, this harbor seems destined to become the center of an important industry, as it apparently possesses greater facilities and offers more inducements to the fishermen than any other place on Puget Sound.

VICTORIA, VANCOUVER ISLAND.

Local fish markets.—During the brief stay at Esquimalt in July advantage was taken of the opportunity to examine the fish markets of Victoria, which is only 3 miles away. It was observed that the fish stalls at that place were superior in most respects to those of any other city on the Pacific coast, the superiority appearing to be due mainly to the manner of handling the fish. The stalls were well supplied with ice and the fish looked fresh and wholesome, in marked contrast with the stalls of San Francisco, a city vastly larger and with equal resources, so far, at least, as possibilities for cleanliness and care in handling the catch are concerned. At this season, and again in October, when a second visit was paid to Victoria, there was an abundant supply of the following local species: Halibut, averaging probably 50 pounds each; flounders (*Pleuronectes stellatus*); rockfish (*Sebastichthys*), two species; rock-trout (*Hexagrammus*), three species; salmon, two species.

The halibut, flounders, and other marine fishes are caught in the Straits of Fuca, the fishermen using trawl lines of the same pattern that are employed in Puget Sound. Neither fresh nor salt codfish were seen in the markets, this species being replaced

by the more abundant and more highly prized salmon. The fishing fleet consists of a few small vessels and boats, manned chiefly by Italians and Greeks.

THE BESHOWE, OR BLACK COD.

In October the naturalists had an opportunity of examining some of the so-called "black cod," or "beshowe," of the Indians, which had been recently landed by the fishing schooner *Theresa*, of Victoria. They were in pickle, and had been split down the back in precisely the same manner in which mackerel are dressed on the Atlantic coast. It is difficult to explain the reasons for having adopted this method of preparation. The labor of caring for a cargo of these fish in such a manner must have been very great, as the hard, bony head of the beshowe must interfere greatly with the operations of the splitter, which is not the case with the mackerel. This successful trip of the *Theresa* has occasioned renewed interest in this valuable species of food-fish, concerning which so much has been written during recent years, and several of those engaged in the fishing business at Victoria think seriously of immediately fitting out vessels for their capture. The *Theresa* fished in a depth of 210 fathoms, about 5 miles off the Queen Charlotte Islands, with a trawl line furnished with two hundred hooks. A part of the cargo was purchased from the Indians at the rate of 25 cents per fish. The entire fare brought in consisted of nearly three thousand beshowe, many of which weighed from 20 to 25 pounds each.

The Portland Oregonian, in speaking of this trip, says:

> The return of the schooner *Theresa* from the black-cod banks with a full catch has determined a number of others to engage in the fisheries. Epicures pronounce these fish delicious—superior to shad and infinitely superior to the tomcod. Consignments will soon be forwarded to eastern markets.

On the trip above described the *Theresa* had an Indian crew. She afterwards left on a second cruise with Newfoundland fishermen, and better results were expected.

In 1884 considerable interest was evinced in British Columbia respecting the beshowe, and several vessels were fitted out to go north. Little or nothing was accomplished, however, as those who were willing to engage in the business had no capital, and those who had did not care to risk it. The great depth at which these fish generally live, 150 to 200 fathoms, has undoubtedly had much to do with hindering the establishment of this industry, as the northwestern coast fishermen have never been obliged to go beyond a depth of 50 fathoms for their cod and halibut, and are totally unused to deep-water fishing.

18. OFF CAPE FLATTERY.

SOUNDING, DREDGING, AND TRIALS FOR FISH.

The region defined.—Under this title we include the outer coast from Flattery Rocks north to latitude 49° N., and the waters lying at the mouth of the Straits of Fuca.

Hydrographic work.—As the region above defined had already been surveyed to a sufficient extent for the purposes of this preliminary investigation, sounding operations were omitted by the steamer *Albatross*, excepting to the south of Cape Flattery. These soundings, however, having reference mainly to supposed off-shore banks, their discussion is deferred to the next section.

Dredging and fishing trials.—Three dredgings, all with the beam trawl, were made in the vicinity of Flattery Rocks, and between there and Cape Flattery. The first was at station No. 2866, 19 miles S. 40° W. from Flattery Light-house, 171 fathoms, gray sand; the second at station 2867, 17 miles S. 23° W. from Flattery Light, 37 fathoms, fine sand; the third at station 2872, 8 miles S. 40° W. from the same light-house, 38 fathoms, gray sand.

Near station 2867 the halibut trawl, baited with salt salmon, was set at 3 p. m. and hauled at 5 p. m., securing eight sharks, two dogfish, and one halibut, the latter weighing 140 pounds and measuring 5 feet 9 inches in length. A few hand lines were also tried in the same locality, one red rockfish and several dogfish being taken by them. A skate of halibut trawl, baited with salt salmon and red rockfish, was also set in the position of dredging station 2872, but only two sharks and one star-fish were taken on it. In the spring the Indians fish for halibut in this locality, but it is as yet impossible to say whether they are sufficiently abundant there to insure good fares to the vessel fishermen.

Three dredging stations were made September 24 on the halibut bank at the mouth of the Straits of Fuca, at distances of 10 to 12 miles northwesterly from Cape Flattery. These stations are numbered from 2873 to 2875, inclusive. The depths ranged from 27 to 40 fathoms, and the bottom was exceedingly variable in character, consisting in different places of rocks, shells, mud, and sand. The first trial was made with the beam trawl at No. 2873, depth 40 fathoms. The trawl was lowered, but caught at once on the rough rocky bottom, and the frame was lost, the wreck of the net coming up with the bridle. The tangles were then lowered in 27 fathoms, rocks and shells, the result showing a rich fauna, or "live bottom," in the vernacular of the fishermen. Another haul with the tangles (No. 2875) was made over the same ground with similar results.

The halibut trawl was set in the same position as the above dredging stations, the depth being 40 fathoms, and the bottom rocky. Salt salmon and red rockfish were used as bait. It was allowed to remain on the bottom about three hours, and when hauled up four halibut, two sharks, four red rockfish, and two star fish were found upon the hooks. The average weight of the halibut was 47¾ pounds; three were females and one was a male; they were all white. Gray halibut are seldom found in these waters.

The above operations were on the well-known bank where, in the spring and early summer, halibut are found in great numbers, and where the Indians for many years have procured their winter supplies.

September 25 work was continued in nearly the same locality as on the previous day. The beam trawl was cast at station No. 2876, 2 or 3 miles northeasterly from stations 2873 to 2875, and the trawl line, baited with salmon, red rockfish, and fresh halibut, was set at the same time. The depth was 59 fathoms, and the bottom consisted of black sand and mud. The beam trawl dragged but a few yards, when it caught on a rocky patch, parted the bridle stops, and came up tail first. It was, however, a successful haul, and many specimens were found in the net. The tangles were subsequently hauled over the same ground (station 2877) with good results, giving evidence of the richness of the bottom. The towing net, which was frequently used in this region, however, gave very little evidence of surface life. The halibut trawl remained on the bottom three hours, and the catch consisted of two halibut, one red

rockfish, and nine dogfish, the average weight of the halibut being 55 pounds. Halibut were taken at every trial made off the Straits of Fuca, and, although there appeared to be no large body of these fish on the coast at this season, a vessel could readily have picked up a good fare in a comparatively short time.

On the afternoon of September 25 the trawl line was set and the dredge lowered in 66 fathoms, gravel and pebbles (station 2878), S. 48° W., 16 miles from Cape Beale Light-house, on the southern side of the entrance to Barclay Sound, Vancouver Island. The contents of the dredge, consisting for the most part of small mollusks, did not bear evidence of a rich bottom. The same bait was used upon the trawl line as in the previous trial, and the capture after two hours' time consisted of two beshowe or black cod, fifteen dogfish, two common sharks, and two ground sharks, one of the latter being hauled on board and photographed. Only a small quantity of surface organisms was taken in the tow nets.

Early on the following day two dredge hauls were made at stations 2879 and 2880, 27 miles N. 79° W. from Cape Beale, in 34 fathoms, rocky bottom, with about the same results as at station 2878, the bottom not being rich so far as the contents of the dredge indicated. A trial with the halibut trawl in the same locality, lasting about three hours, afforded one halibut weighing 25 pounds, two sharks, and three dogfish.

At station 2881, in the same neighborhood, but much nearer the coast, Cape Beale bearing S. 26° E., distant 26 miles, the dredge was cast in 24 fathoms, on a rough bottom, with fine gray sand in places. The results were not favorable to good fishing. The trawl line set in the same position took one halibut weighing 15 pounds, five dogfish, one shark, and one skate. The trawl, when it came up, was covered with "slime," which was contrary to expectations, as the dredging which preceded it indicated clean bottom. The ground probably varies greatly in this region, as in many other fishing areas, there being numerous distinct spots where the fish resort to feed and spawn.

September 27 and 28 were spent in Barclay Sound, and the following day a skate of halibut trawl was set in 60 fathoms of water, sandy and rocky bottom, 22 miles S. 14° E. from Cape Beale. The trawl was kept down about two hours, with the result of capturing sixteen dogfish, one beshowe or black cod, one cultus cod, and three small halibut. This spot would probably be a good one for halibut earlier in the season, before the dogfish set in, and is convenient to the Straits of Fuca. It requires examination in the spring or winter to determine its merits.

BARCLAY SOUND, VANCOUVER ISLAND.

The *Albatross* anchored September 26 in Barclay Sound, where she was detained by fog two days. A cod trawl, baited with halibut and salmon, was set one evening in a depth of 17 fathoms, and allowed to remain down over night. On hauling it the next morning, twenty-eight dogfish and one red rockfish were found upon the hooks. There are not many beaches suitable for seining in this sound, but a few were found on which a large variety of shore fishes was obtained. Salmon were seen darting about in every direction; they are said to be very plentiful at the headwaters of the sound, where they enter the creeks and inlets to spawn. A few fine large specimens were taken by trolling. Marine invertebrates are also very abundant, and many interesting forms were collected along the shore, among which were several species of starfishes and fine large specimens of *Lunatia lewisi* and *Haliotis kamtschatkensis*.

The only evidence of civilization about the sound was the light-house on Cape Beale, the Indian villages being mostly abandoned, and the occupants gone to the salmon canneries in the interior. Several canoe-loads were seen passing, a few came alongside, and occasionally one was seen trolling for salmon.

GENERAL RESULTS OF TRIALS FOR FISH ON THIS COAST.

After the numerous trials made for halibut on this part of the coast, both with trawl lines and hand lines, it became evident that sharks and dogfish had taken possession of the fishing banks at this season to the exclusion of food-fishes, while in the spring and early summer, when halibut are abundant, only a few of these pests are found. There has been no fall fishing heretofore, and consequently it is not known when the sharks and dogfish leave the grounds, and the halibut and other food-fishes return to them.

SEALING AND HALIBUT TRIPS BY GLOUCESTER VESSELS OFF CAPE FLATTERY, ETC.

The halibut fishery of the northwestern coast is destined to become an important industry. Until a year ago halibut were taken in this region only in small quantities to supply the local markets, and the fishery was carried on exclusively with open boats. Within the past year two or three large vessels from the Gloucester fishing fleet have obtained successful fares upon the Pacific grounds off Cape Flattery, shipping large cargoes of fresh fish by railroad to the markets of the Eastern States. With proper management this industry might have a rapid growth.

Halibut grounds.—The nearest bank to Puget Sound, where halibut are abundant, is located off Cape Flattery at the mouth of the Straits of Fuca, and extends from close in shore to some 12 or 15 miles off the cape, in depths of water ranging from 35 to 75 fathoms. From early in the spring until the middle of June halibut can be obtained on these grounds in paying quantities, but later in the season dogfish and sharks strike in, driving nearly all the edible fish away. During the summer more northern localities would have to be resorted to. This information is based upon the statements of Capt. Silas Calder, commanding the schooner *Mollie Adams*, and at the time this region was examined by the *Albatross*, the dogfish were found in full possession of all the important grounds.

A sealing voyage.—Shortly after her arrival in Puget Sound, the *Mollie Adams* was fitted out for a sealing voyage. She carried twelve sealing boats and a crew of twenty-six men, composed of fishermen from Gloucester, and sealers from Newfoundland. The boats were built by Higgins & Gifford, of Gloucester, Mass. Seven hundred seals were captured during the trip, the most of them having been obtained in the vicinity of Cape Flattery. Some bad weather was experienced, and on several occasions the water was so rough that other sealers (from San Francisco) cruising in the same vicinity did not venture to lower their boats. Not a day was lost, however, by the *Mollie Adams*, whose sailors were accustomed to the greater hardships of the North Atlantic. The next highest fare taken by other vessels during the same period amounted to two hundred and fifty seals.

Fresh-halibut trips.—After disposing of her cargo of seals, the *Mollie Adams* at once refitted for the fresh-halibut fishery, and made four trips in quick succession, landing 145,000 pounds of halibut, the stock of which amounted to $3,000, the crew

sharing $75 each. The expenses of the trips were high, however, $15 per ton being paid for ice on the first one, although on a subsequent trip it was obtained at $8 per ton, which was considered very low by the dealers. The high price demanded for ice is one of the chief obstacles to the development of the fresh-halibut business on the Pacific coast. Could this necessary article be obtained at reasonable figures, the western fishermen would stand a better chance of competing successfully with the eastern markets in supplying the fresh trade.

The *Mollie Adams* landed her cargo at Seattle. A fare of 50,000 pounds of fresh halibut was recently taken to Tacoma, Wash., by the schooner *Oscar and Hattie*, this being the first cargo landed and shipped from that port. The fish were taken in the vicinity of Cape Flattery. Little or nothing was realized from the trip. The ice cost $22.50 per ton, and high rates across the continent were charged by the Northern Pacific Railroad Company, over whose road the shipment was made. After discharging her cargo, the *Oscar and Hattie* proceeded to Port Townsend, where preparations were made for a second trip. An agreement was entered into with a firm at Vancouver to furnish the ice at $10 per ton, but three weeks passed without receiving any, and the schooner was forced to go north in the hope of obtaining a supply from the glaciers in southeastern Alaska.

Capt. S. Jacobs and others interested in the fishery are seriously considering the expediency of building ice-houses at Seattle, and making the attempt to cut ice for their own use the coming winter. It is stated that ice 6 inches thick was cut in the vicinity of Seattle during the winter of 1887–'88. If this fact is true, however, it was an exceptional season, as many of the old residents in the region claim that the weather is never cold enough there to make ice over 3 inches thick. Should the effort to obtain the ice in Puget Sound prove unsuccessful, it is thought to be feasible to make use of large scows in bringing down supplies from the glacier region of Alaska. The expense of obtaining the ice by this method, including the cost of building and towing the scows and of cutting the ice, it is considered will be much less than by the present one.

A FLETCHED-HALIBUT TRIP.

July 24 the schooner *Mollie Adams* left Seattle, bound north on a fletched-halibut trip, the first one of its kind that had been undertaken on the Pacific coast. But few halibut were captured until the schooner arrived off the southern extremity of the Queen Charlotte Islands, where they were found in great abundance and of larger size than on the grounds off Cape Flattery. A few of those taken were estimated to weigh over 300 pounds each. About half of the number obtained were large enough for fletching, the remainder being used as bait or thrown away. The trawls were not left down over night, the fish biting so rapidly that all the available time was occupied in caring for the day's catch. Only one cod was caught during the trip. Dogfish were numerous, but did not seem to interfere with the halibut taking the bait, as is the case at this season farther south.

The fishing was carried on in depths of only 30 to 45 fathoms, so that the use of hurdy-gurdies was not resorted to. Halibut fishing in this region is very much easier than on the Grand Bank. Operations were continued without intermission until August 26, when a severe gale of wind sprang up from the southeast, lasting two days.

The heavy sea produced by the storm caused the *Adams* to drag her anchor several times, but she finally "brought up" and rode out the gale without sustaining any damage or loss. This was the first time that this vessel had been tested at her anchor in a heavy sea, and her sea-going qualities were thoroughly established. From the experience of the *Adams* it is probable that fishing vessels would have no difficulty in making two or more fletched trips for halibut each season to the neighborhood of the Queen Charlotte Islands. Such trips made to Greenland and Iceland consume an entire season, and to this extent the fishermen of the western coast have an advantage over those of the eastern coast.

On the morning of September 8, the *Adams* having "wet" all her salt, started for home with 150,000 pounds of fish. Light winds prevailed during the passage of eight days to Seattle. Previous to the return of the *Adams*, her owner, Captain Jacobs, had negotiated with the Northern Pacific Railroad Company to transport her cargo across the continent to Gloucester, Mass., at the rate of $1.25 per hundredweight. Immediately upon her arrival the rate was increased to $1.40 per hundredweight, which rendered it very doubtful if anything could be realized upon the trip; but the company was finally prevailed upon to return to its earlier figure, and the shipment was accordingly made. The cost of discharging, packing, and shipping the cargo amounted to $1,950. After deducting expenses the members of the crew received $175 each, or at the rate of $9 a day for nineteen days' fishing.

Captain Jacobs is considering the expediency of converting the *Mollie Adams* into a steamer. Shorter passages to and from the grounds could be made under steam, especially during the summer when calms and light variable winds prevail in this region. The amount of time that could be saved in that way would amply repay the cost of altering the vessel.

19. CAPE FLATTERY TO SHOALWATER BAY, WASHINGTON TERRITORY.

EXPLORATIONS.

Hydrographic work.—Sounding operations were commenced off Cape Flattery, September 19, and were continued down the coast as far as Shoalwater Bay until September 23. They were again taken up in the neighborhood of Shoalwater Bay, October 11, and continued to the region off the Columbia River until October 13. Dredgings and trials for fish were made at intervals during the same periods, as explained below.

On the morning of September 19, the *Albatross* began a line of soundings in 82 fathoms, 10 miles S. 68° W. from Cape Flattery Light. It was extended 65 miles S. 68° W., sounding at intervals of 5 miles to develop banks reported to exist 60 and 75 miles from the cape. The depths were irregular for 30 miles, then increased uniformly to 768 fathoms at the former, and 1,239 fathoms at the latter position. The reports of these banks were given by shipmasters, who said they had sounded upon them and knew that they were there. They no doubt found bottom in 60 or 70 fathoms, as reported, but they were 15 or 20 miles out in their reckoning. A severe storm which began in the morning prevented further work during that day after the line had been completed at 4 p. m. The next morning dredging stations Nos. 2866 and 2867 were made off Flattery Rocks as described in the preceding section, and in the afternoon a second line of soundings was begun at a point 19 miles S. 34° W. from

Flattery Light, and carried seaward 30 miles in a line parallel to that of the previous day, the outermost sounding being in 378 fathoms.

Subsequently four other regular lines were run farther south, in about the same direction, or practically at right angles to the coast line and at distances apart of about 16 miles, these lines being connected by intermediate soundings alternately at their outer and inner ends. They extended outward from depths of 28 to 31 fathoms near the coast into depths of 287 to 758 fathoms; the last line terminating in the latitude of Gray's Harbor, about 47° N. The bottom in this region was mainly gray sand, excepting in the deeper areas off shore where mud and ooze predominated. Rocky patches alternated with fine gray sand and mud on the last line, denoting a marked change from the uniform gray sand found thus far south of Cape Flattery. A report, of Indian origin, placed a bank 30 miles west (magnetic) from Shoalwater Bay. The change in the character of the bottom led to the belief that the report might be correct, and a careful examination of the region resulted in the development of a bank about 20 miles in length, southwest and northeast (magnetic), and 12 miles in extreme width. Its eastern extremity, on which there is 42 fathoms, rocky bottom, lies 15 miles southwest (magnetic) from Point Chehalis, on the southern side of the entrance to Gray's Harbor. The soundings are quite regular, but the bottom alternates in character between rocks, gray sand, and mud. The dredgings and trials for fish on this bank proved more successful than any previously made south of Cape Flattery, as explained below. There is little doubt that at the proper season good fishing would be found in this locality.

Dredgings and trials for fish.—The beam trawl was used at station 2868, off Cape Johnson, and station 2869, off Destruction Island, in depths of 31 and 32 fathoms, respectively, the bottom consisting of sand. At the former station tomcod, flounders, and one beshowe were taken in the beam trawl, but otherwise very little material was obtained. At the latter the bottom was composed of fine gray sand, perfectly clean, without adhering growths of any kind. A skate of halibut trawl, baited with salt salmon and clams, was set at station 2868. But few baits were disturbed and fish appeared to be scarce, only two red rockfish, three dogfish, and one skate being captured. Trial lines were also put over the side of the steamer at this place, but without result.

The beam trawl was next used at station 2870, on the southern edge of the bank off Gray's Harbor described above. The depth was 58 fathoms, the bottom rocky, and very rich in the lower forms of life serving as food for fishes. The halibut trawl, set for four hours at the same position, took ten red rockfish, two beshowe, and four sharks. Three red rockfish were also caught with hand lines from the ship at the same time. This species seemed to be fairly abundant, but it is not much in demand as a market fish. Hand lines were subsequently tried for fifteen minutes about 10½ miles off Shoalwater Light, but no fish were secured.

Station 2871, with the beam trawl, was about 45 miles off the entrance to Gray's Harbor, in a depth of 559 fathoms, brown ooze. Many deep-water forms were obtained at this place.

PROSPECTS OF A HALIBUT FISHERY SOUTH OF CAPE FLATTERY.

In a conference with Captain Tanner, Judge James G. Swan, of Port Townsend, stated that his knowledge of the Indian tribes and their habits has led him to believe that halibut will not be found in paying quantities south of Cape Flattery. It was, he said, a time-honored custom for the tribes living as far south as Flattery Rocks to go to Cape Flattery every spring for their winter's supply of halibut, which were taken on the well-known bank, from 9 to 12 miles west-northwest (magnetic) from Tatoosh Island.

Halibut have seldom been taken south of Cape Flattery, and never, to his knowledge, south of Flattery Rocks. They form no part of the winter's food of the tribes inhabiting that part of the coast, rock cod, surf smelt, tomcod, salmon, etc., constituting the staple supply. He thinks if halibut existed near the shore the Indians would have known it, and, like the tribes further north, have taken them for winter's use. He predicted that the *Albatross* would find a clean sand bottom, with very little life, between Cape Flattery and Gray's Harbor.

Judge Swan has lived for many years on different parts of the coast between Gray's Harbor and Neeah Bay, and having paid close attention to the subject his opinions are worthy of every consideration. While a few halibut were subsequently taken by the *Albatross* south of Cape Flattery, as mentioned elsewhere, there are no indications that they occur in quantities sufficient to pay for their exclusive capture.

20. SHOALWATER BAY, WASHINGTON TERRITORY, TO TILLAMOOK ROCK, OREGON.

EXPLORATIONS.

Hydrographic work.—The *Albatross* returned to the neighborhood of Shoalwater Bay October 11, and began sounding in 20 fathoms 10½ miles S. 32° W. from the lighthouse at the entrance to that bay. From this point a line was run S. 78° W. 20 miles, sounding in 38, 51, 153, and 432 fathoms; S. 68° E., 15 miles, in 98, 55, and 40 fathoms; S. 78° W. 15 miles, in 60, 78, and 260 fathoms. The last line was only a short distance north of the latitude of the entrance to Columbia River.

Stormy weather interrupted operations during the 12th, but on the 13th three nearly parallel lines of soundings, at right angles to the coast, were made in the region off the mouth of the Columbia River between the latitudes of Cape Disappointment and Tillamook Rock. The northern line began 12¾ miles N. 78° W. of Cape Disappointment in 81 fathoms, and extended 20 miles S. 78° W., with soundings in 231, 421, 475, and 506 fathoms; the southern began at a point 16½ miles N. 64° W. from Tillamook Light, and extended 15 miles S. 72° W., with soundings in 73, 82, 96, and 199 fathoms. By reference to the chart of this region it will be observed that the soundings on the former line show depths two or three times greater than those in similar positions on adjacent lines 7 or 8 miles distant, both to the north and south. The great submarine trough thus indicated is probably the ancient bed of the Columbia River.

Dredgings and trials for fish.—At station 2882, about 27 miles directly off the mouth of the Columbia River, a cast of the beam trawl was made and the trawl line was set in a depth of 68 fathoms, gray sandy bottom. On the latter only one beshowe

or black cod, and four dogfish were taken. In most of the soundings made in this region the character of the bottom was found to be unsuitable for cod or halibut, or such, at least, as they usually inhabit.

Supposed fishing grounds off the Columbia River.—At Astoria there is a general belief in the existence of fishing banks 50 to 60 miles off the mouth of the Columbia River, but its origin could not be traced. Heceta Bank lies off the coast in latitude 44° N., longitude 124° 50′ W., and may possibly have had something to do with it. The explorations of the steamer *Albatross* developed over 600 fathoms in the locality where the banks were supposed to lie; but they may be found farther south, as the region between the Columbia River and Heceta Bank is still unexplored.

Tillamook Rock.—A cod and a halibut trawl were set off the northern side of the island, the former being placed near the can buoy off its northern end. The inner trawl buoy was dropped in about 18 fathoms, the outer in about 25 fathoms, the bottom being rocky. There was a southerly current running at the time, but it was not strong. After the trawls had been set, the men remaining by them, the ship proceeded off the southwestern side of the rock, where three casts were made with the dredge, at stations 2883, 2884, and 2885, depths 29 to 30 fathoms, bottom gray sand. Subsequently the trawl lines were hauled, with the result of obtaining seven dogfish and about a dozen star fish.

In the locality where this set was made it has been stated that the Indians obtain large quantities of halibut. At Astoria, however, it was said that the fish taken off Tillamook Rock were not the halibut, but the so-called turbot (*Atherestes stomias*). Judge Swan is of the opinion that a few halibut may have been taken there, but that the common flatfish of the region is the species of *Atherestes* above mentioned. It is customary for the fishermen of the Pacific coast to speak of all large edible species of flounders as halibut. Captain Richardson, of the light-house steamer *Manzanita*, reports having taken red rock cod (called red groupers in Astoria) in great numbers, and an occasional halibut, in this region. The indications are that good fishing may be found in this neighborhood at the proper season.

ASTORIA, OREGON.

Fresh markets.—The fish exposed for sale in the markets of Astoria during the brief visit made to that place, October 14 to 18, were chiefly salmon, flounders, and tomcod. The last-named species was very abundant about the wharves, where they were being taken in large quantities by many men and boys fishing with hook and line.

Bait.—Much difficulty was found in procuring bait at this place for the remainder of the cruise. Two days were spent in a search for clams and salmon, which were considered to form the best bait for cod and halibut. Clams are sometimes brought to Astoria from Shoalwater Bay by the Indians, but with no regularity, and none were obtained by the *Albatross*. A small lot of salt salmon was all that could be purchased. Tomcod were not regarded as of sufficient value for this purpose to lay in a supply.

Attempted sea fisheries.—Sea fisheries off the Columbia River were commenced a few years ago with a small schooner, which operated a 40-foot beam trawl, over the ground between Cape Disappointment and Shoalwater Bay. This vessel being found unsuited for the purpose, the steamer *Dolphin* was built, and made forty trips between April

and October, 1887, but she also proved a failure. Her catch was fairly good, and had she been able to market her fish promptly the venture would have turned out profitably. The different fish taken by the *Dolphin* were classified as follows, namely: Sole, flounders, hake, cod, rock cod, and halibut; very few cod and halibut were obtained, but sole predominated, although, at times, rock cod were abundant. Crabs and a few large clams were also included in her capture.

Fishing vessels.—The fisheries of Astoria are chiefly confined to the capture of salmon. Several attempts have been made to establish other kinds of fisheries, but without success. The principal cause of these repeated failures has undoubtedly been the unseaworthiness of the boats and vessels fitted out to engage in fishing off the coasts of Oregon and Washington Territory, where gales of wind frequently occur during both summer and winter. This coast, south of the Straits of Fuca, also has very few harbors, which are indispensable to a fishing fleet in time of storms, especially when the fishing grounds are so near the land as to leave but little sea room to leeward, with the wind blowing on the shore. The class of vessels that resort to George's and the Grand Bank could easily work off shore in an ordinary gale of wind, but there are times when even such staunch crafts as these would find the task difficult, if not impossible. The introduction of a better class of sea-going boats would, however, greatly lessen the dangers which now exist.

Salmon canneries.—The salmon canneries were closed at the time of the visit of the *Albatross*, and no particulars of their operations during the previous season could be obtained.

Gill nets.—Salmon are caught in the Columbia River principally in gill nets, although a few are taken by means of drag seines and traps. The gill nets measure from 250 to 300 fathoms in length, from 36 to 45 feet in depth, and have a mesh of 8½ and 9 inches. Their cost is from $300 to $400. All of the nets were formerly knit by the fishermen during the winter months, but many of them are now obtained from eastern manufacturers.

Boats.—The boats from which the gill nets are set and hauled are 28 to 35 feet long, 7 to 10 feet wide, and 2½ feet deep. Two men generally go in each boat, but sometimes three, dependent upon the abundance of salmon. Most of the boats are carvel-built, but a few are clinker. Their cost, fully rigged for work, is about $200. They are all furnished with center-boards, and have but little dead-rise. The customary rig is that of a sloop, but a few are cat-rigged. A wash-rail runs fore and aft, about 1 foot inboard. This, together with the short deck forward, through which the mast is stepped, is all there is to prevent a sea from boarding them. Both fore and aft of the center-board casing there is a bulkhead running athwartships. The intervening space is covered with boards, and forms the hold, into which the fish are thrown as they are released from the net. In their general shape these boats resemble the so-called "carry-away boats" used in the early days of the menhaden fishery on the New England coast. The accommodations for living in these Columbia River boats are wretched; but the men sleep and eat upon them, taking their rest at night in the bottom of the boat, where there is barely room for one man to lie, even in a cramped position. The mode of living of these men is similar to that of the French boat fishermen in the Gulf of St. Lawrence; but it contrasts strangely with the condition of affairs existing on the typical New England fishing vessel.

About thirteen hundred fishing boats are employed upon the Columbia River during the salmon season, which continues from the first of April to the first of July. No fishing is permitted in the river after July. The majority of the boats and nets are owned by the canneries, but a few belong to the fishermen.

Prices paid for salmon.—The fishermen have a well-organized society, in which the price of salmon is agreed upon before beginning the season's work. To those who own their boats and nets a higher price is paid than to those who use the gear belonging to the canneries. In 1888 the price stipulated was $1 apiece for salmon caught by the cannery boats, and $1.25 each for those taken in the boats of the fishermen. The high prices demanded for salmon have caused many to withdraw from the business in this region, and some of them talk seriously of establishing canneries in Alaska.

21. HECETA BANK.

Hydrographic work.—October 19, lines of soundings were run across Heceta Bank to the westward, to the southward, and then to the southward and eastward, defining its extent. It was not fully developed, but from present knowledge it may be said to be about 20 miles in length and 10 miles in width, its center lying in latitude 44° 04′ N., longitude 124° 53′ W. It has a rocky bottom, alternating with patches of clay and pebbles, and presents every requisite for an excellent fishing bank, which it will undoubtedly prove to be at the proper season of the year.

Dredging and trials for fish.—At 7.30 a. m., the dinghy left the ship with a skate of halibut trawl and a tub of cod trawl, baited with salmon and herring. A set was made in a depth of 50 fathoms as soon as the boat was well clear of the ship, which immediately began dredging at station 2886, latitude 43° 59′ N., longitude 124° 56′ 30″ W. At the end of an hour and a half the trawls were taken up with the following catch: one halibut weighing 10½ pounds, one beshowe or black cod, one shark, and one dogfish. Four dredging stations (2886 to 2889) were made, all being within about a mile of the position given above, one with the dredge, the remainder with the beam trawls, which, on two occasions, were wrecked on the rocky bottom. The depths covered by the dredging ranged from 41 to 50 fathoms, the bottom consisting of rocks, pebbles, shells, etc. The bottom was rich in life and many interesting forms were taken, including several species of corals. This locality was by far the most promising of any that had been examined south of Cape Flattery. A specimen of halibut was captured, proving that the species occurs in this region, where it may be abundant in the proper season, but further investigations are necessary to prove this fact conclusively. The amount and character of the lower forms of life brought up in the dredge and beam trawl recalled the fauna of some of the eastern halibut grounds.

Just south of Heceta Bank, in latitude 43° 46′ N., longitude 124° 57′ W., the beam trawl was used in a depth of 277 fathoms, bottom gray sand, with the result of obtaining many deep-water forms, including *Macrurus*, *Sebastes*, *Nemichthys*, etc., among fishes; *Lithodes*, *Munida*, and shrimps among crustaceans, and large quantities of *Schizaster*, ophiurans, etc., among echinoderms.

D.—TABLES AND SPECIAL OBSERVATIONS.

22. *Record of hydrographic soundings of the U. S. Fish Commission steamer Albatross from July* 1 *to December* 31, 1888.

Serial number.	Date.	Time.	Position.		Depth in fathoms.	Character of bottom.	Temperature.			Kind of reel.	Weight of sinker.
			Lat. N.	Long. W.			Air.	Surface.	Bottom.		
	1888.		° ′ ″	° ′ ″							*Lbs.*
1130	July 19	6.16 a. m.	52 15 00	156 37 00	2,550	br. Oz	51	51	34.9	Baird	60
1131	....do ...	2.36 p. m.	52 12 00	158 20 00	2,581	wire carried away	51	49	.....	....do	60
1132	....do ...	10.29 p. m.	52 15 00	160 00 00	2,558	gy. Oz. P	50	48	35.0	....do	60
1133	July 20	6.33 a. m.	52 15 00	161 40 30	2,573	wire carried away	51	50	.....	....do	60
1134	....do ...	11.57 a. m.	52 17 00	162 48 00	2,678	gy. Oz	55	51	35.2	....do	60
1135	....do ...	5.33 p. m.	52 18 00	163 54 00	2,848	gy. Oz	54	50	35.2	....do	60
1136	....do ...	11.46 p. m.	52 20 00	165 00 00	3,820	gy. Oz	52	50	35.7	....do	60
1137	July 21	6.14 a. m.	52 20 00	166 05 00	2,654	gy. Oz	55	50	35.2	....do	60
1138	....do ...	10.03 a. m.	52 40 00	166 35 00	2,267	gy. Oz	52	51	35.2	....do	60
1139	....do ...	12.07 p. m.	52 53 00	166 44 00	1,961	gy. Oz	52	50	35.2	....do	38
1140	....do ...	2.19 p. m.	53 05 00	166 49 00	169	bk. S	53	50	41.2	....do	38
1141	....do ...	3.06 p. m.	53 11 00	166 51 00	84	bk. S. P	52	50	40.6	Tanner ...	25
1142	....do ...	4.08 p. m.	53 17 00	166 54 00	57	S. bk. Sp	54	50	.....	....do	25
1143	....do ...	5.08 p. m.	53 22 00	166 55 30	41	S. bk. Sp	54	50	42.7	....do	25
1144	....do ...	5.31 p. m.	53 23 00	166 56 00	28	S. bk. Sp	54	50	42.2	....do	25
1145	....do ...	6.40 p. m.	53 19 00	166 50 00	55	bk. S. P	51.5	48	41.7	....do	25
1146	....do ...	8.28 p. m.	53 17 00	166 42 00	58	gy. S	51	48	41.2	....do	25
1147	....do ...	9.11 p. m.	53 15 00	166 35 00	83	bk. S	51	48	41.2	....do	25
1148	.. do ...	9.58 p. m.	53 13 00	166 27 00	174	bk. S	51	49	41.2	....do	25
1149	....do ...	11.27 p. m.	53 16 00	166 10 00	228	bk. S	51	49	39.5	Baird	38
1150	July 22	1.01 a. m.	53 25 00	166 02 30	94	crs. bk. S	51	49	41.2	Tanner ...	25
1151	....do ...	2.25 a. m	53 27 00	165 46 00	113	crs. bk. S. P	51	49	41.2	....do	25
1152	....do ...	3.47 a. m.	53 30 00	165 30 00	261	gn. M	51	49	39.7	Baird	38
1153	....do ...	5.16 a. m.	53 37 00	165 18 30	99	gy. S. P.	50	48	40.7	....do	38
1154	....do ...	6.39 a. m.	53 39 00	165 04 00	133	fne. gy. S	50	48	41.2	Tanner ..	25
1155	....do ...	8.05 a. m.	53 42 00	164 46 00	163	bk. S	50	49	40.2	....do	25
1156	....do ...	9.34 a. m.	53 48 00	164 32 00	66	bk. S. G	59	49	40.2	....do	25
1157	....do ...	10.23 a. m.	53 43 00	164 38 00	111	bk. S. Sh	52	49	40.7	....do	25
1158	....do ...	11.20 a. m.	53 43 00	164 31 00	73	bk. S. fne. G	52	50	40.7	....do	25
1159	....do ...	12.14 p. m.	53 39 00	164 34 00	185	lt. S	52	50	40.2	....do	25
1160	....do ...	1.03 p. m.	53 39 00	164 26 00	211	gy. S. bk. Sp	52	50	40.1	....do	25
1161	....do ...	1.47 p. m.	53 41 30	164 20 00	89	bk. S	52	50	40.5	....do	25
1162	....do ...	2.32 p. m.	53 43 00	164 13 00	68	gy. S. bk. Sp. P	52	50	40.4	....do	25
1163	....do ...	3.16 p. m.	53 42 30	164 05 00	63	gy. S. bk. Sp	51	49	40.4	....do	25
1164	....do ...	4.01 p. m.	53 42 00	163 57 30	95	gn. M	51	49	40.2	....do	25
1165	....do ...	5.17 p. m.	53 51 00	163 51 00	43	bk. S	51	49	40.2	....do	25
1166	....do ...	6.39 p. m.	54 00 00	163 45 00	45	fne. gy. S	51	50	41.7	....do	25
1167	....do ...	9.24 p. m.	54 09 00	163 41 00	45	bk. S. brk. Sh	51	50	41.2	....do	25
1168	....do ...	11.31 p. m.	54 13 00	164 02 00	51	R. fne. G	51	49	39.2	....do	25
1169	July 23	1.21 a. m.	54 16 00	164 23 00	56	gy. S. bk. Sp	52	49	41.2	....do	25
1170	....do ...	2.37 a. m.	54 18 00	164 38 00	45	gy. S. bk. Sp	52	50	42.2	....do	25
1171	....do ...	3.29 a. m.	54 20 00	164 49 00	30	G	51	48	43.9	....do	25
1172	....do ...	4.31 a. m.	54 22 00	165 00 00	42	crs. bk. S. G.	51	48	45.2	....do	25
1173	....do ...	5.12 a. m.	54 23 00	165 09 00	72	crs. bk. S	50	45	42.2	....do	25
1174	....do ...	5.54 a. m.	54 25 00	165 19 00	80	bk. S	50	45	40.7	....do	25
1175	....do ...	6.36 a. m.	54 24 00	165 25 00	85	bk. S. G	50	45	40.2	....do	25
1176	....do ...	7.18 a. m.	54 22 00	165 34 30	73	bk. S. G	48	44	40.7	....do	25
1177	....do ...	7.54 a. m.	54 21 00	165 41 00	51	bk. S. G	51	45	41.2	....do	25
1178	....do ...	8.38 a. m.	54 19 00	165 49 00	53	P	51	45	41.2	....do	25
1179	July 28	11.39 a. m.	53 56 00	166 07 00	36	bk. S. brk. Sh	48	49	44.4	....do	25
1180	....do ...	2.18 p. m.	53 56 00	165 48 00	51	brk. Sh. G	52	46	43.2	....do	25
1181	....do ...	4.53 p. m.	53 55 30	165 22 00	57	bk. S	51	48	41.2	....do	25
1182	....do ...	6.17 p. m.	53 55 00	165 05 30	53	bk. S. G	52	52	43.2	....do	25
1183	....do ...	7.40 p. m.	54 00 00	164 51 00	59	brk. Sh. P	51	51	44.2	....do	25
1184	....do ...	10.14 p. m.	53 58 00	164 39 00	61	gy. S. G	49	50	41.2	....do	25
1185	....do ...	11.33 p. m.	53 55 00	164 22 00	50	crs. bk. S	50	50	40.2	....do	25
1186	July 29	12.59 a. m.	53 53 00	164 05 00	45	gy. S.	51	50	41.2	....do	25
1187	... do ...	3.23 a. m.	53 49 00	163 40 00	342	bk. S	51	50	39.2	Sigsbee ...	60

22. *Record of hydrographic soundings of the U. S. Fish Commission steamer Albatross, etc.*—Continued.

Serial number.	Date.	Time.	Position.		Depth in fathoms.	Character of bottom.	Temperature.			Kind of reel.	Weight of sinker.
			Lat. N.	Long. W.			Air.	Surface.	Bottom.		
	1888.		° ′ ″	° ′ ″							*Lbs.*
1188	July 29	5.00 a. m.	54 00 00	163 37 00	62	bk. S	52	51	41.2	Tanner	25
1189	....do	5.46 a. m.	54 01 00	163 45 00	49	bk. S	52	51	40.2	....do	25
1190	....do	6.30 a. m.	54 02 00	163 53 30	48	bk. S	52	51	41.7	....do	25
1191	....do	7.11 a. m.	54 04 00	164 01 00	46	bk. S	52	51	42.2	....do	25
1192	....do	9.31 a. m.	54 06 00	164 17 00	41	bk. S. G	53	51	43.2	....do	25
1193	....do	10.14 a. m.	54 08 00	164 25 00	52	bk. S	53	51	42.2	....do	25
1194	....do	11.03 a. m.	54 09 00	164 33 00	52	bk. S. G	52	50	41.2	....do	25
1195	....do	11.48 a. m.	54 10 00	164 42 00	49	brk. Sh	51	50	41.2	....do	25
1196	....do	12.21 p. m.	54 11 00	164 48 00	52	rky	51	50	43.2	....do	25
1197	....do	1.05 p. m.	54 15 00	164 41 00	71	crs. bk. S	50	51	40.7	....do	25
1198	....do	3.20 p. m.	54 25 00	164 21 00	63	R. bk. S	52	51	40.6	....do	25
1199	....do	6.20 p. m.	54 22 00	164 01 00	55	bk. S	51	49	41.2	....do	25
1200	....do	8.30 p. m.	54 20 00	163 41 00	72	bk. S	51	49	40.2	....do	25
1201	....do	10.40 p. m.	54 18 00	163 21 00	44	bk. S. G	51	50	40.2	....do	25
1202	....do	11.19 p. m.	54 18 00	163 18 00	32	rky	51	50	42.2	....do	25
1202a	....do	.....	54 16 00	163 19 30	28	{ No bottom specimens obtained. }	51	50	.....	.....	.....
1202b	....do	.....	54 15 00	163 21 00	25		51	50	.....	.....	.....
1203	July 30	12.44 a. m.	54 14 00	163 21 30	39	gy. S. bk. Sp.	51	50	40.2	Tanner	25
1204	....do	2.12 a. m.	54 10 00	163 24 00	42	gy. S. bk. Sp	51	51	42.3	....do	25
1205	....do	4.48 a. m.	54 09 00	163 14 00	44	bk. S. G	50	50	42.2	....do	25
1206	....do	5.33 a. m.	54 09 00	163 04 00	43	G	51	50	42.2	....do	25
1207	....do	5.58 a. m.	54 09 00	162 58 00	43	bk. S	51	50	.....	....do	25
1208	....do	6.18 a. m.	54 08 00	162 54 00	41	gy. S. bk. Sp	51	50	42.2	....do	25
1209	....do	8.59 a. m.	54 03 00	162 43 00	51	G	51	50	41.2	....do	25
1210	....do	9.49 a. m.	53 58 00	162 42 00	464	rky	51	50	42.2	....do	25
1211	....do	10.55 a. m.	54 03 00	162 33 00	265	rky	51	50	39.2	....do	25
1212	....do	11.55 a. m.	54 08 00	162 22 00	60	crs. S. P	51	50	40.2	....do	25
1213	....do	12.40 p. m.	54 12 00	162 17 00	47	bk. S. fne. G	51	50	42.2	....do	25
1214	....do	2.06 p. m.	54 09 00	162 10 00	67	rky	51	51	40.2	....do	25
1215	....do	2.52 p. m.	54 12 00	162 02 00	51	rky. fne. G	51	50	41.2	....do	25
1216	....do	3.40 p. m.	54 16 00	161 53 00	37	rky	51	50	42.2	....do	25
1217	....do	4.28 p. m.	54 20 00	161 46 00	38	P	51	50	40.7	....do	25
1218	....do	5.14 p. m.	54 26 00	161 45 00	80	gn. M	52	50	39.8	....do	25
1219	....do	5.56 p. m.	54 31 00	161 44 00	82	gn. M	52	50	40.2	....do	25
1220	....do	6.49 p. m.	54 34 00	161 48 00	58	rky	52	50	41.2	....do	25
1221	....do	7.57 p. m.	54 27 00	161 53 00	81	gn. M	51	49	40.2	....do	25
1222	....do	9.32 p. m.	54 32 00	161 39 00	81	rky	51	49	40.2	....do	25
1223	....do	11.51 p. m.	54 37 00	161 27 00	59	bk. S	51	49	41.7	....do	25
1224	July 31	12.13 a. m.	54 42 00	161 13 00	64	bk. S	51	49	42.2	....do	25
1225	....do	1.40 a. m.	54 47 00	161 00 00	47	bk. S. G	51	49	42.2	....do	25
1226	....do	4.55 a. m.	54 51 00	160 47 00	45	gy. S. P	51	49	.....	....do	25
1227	....do	6.17 a. m.	54 56 00	160 33 00	52	gy. S	51	50	41.8	....do	25
1228	....do	7.25 a. m.	54 59 00	160 26 00	60	gy. S	51	51	41.7	....do	25
1229	Aug. 2	9.14 a. m.	55 08 00	160 05 00	18	fne. gy. S	51	49	40.9	....do	25
1230	Aug. 3	6.37 a. m.	55 04 00	160 26 00	34	brk. Sh	58	50	45.7	....do	25
1231	....do	7.46 a. m.	55 05 00	160 42 00	38	rky	54	51	44.2	....do	25
1232	....do	9.03 a. m.	55 00 00	160 56 00	71	dk. M	53	52	40.2	....do	25
1233	....do	10.18 a. m.	54 52 00	161 17 00	74	dk. M	54	51	41.7	....do	25
1234	....do	11.35 a. m.	54 47 00	161 26 00	41	rky	54	51	43.2	....do	25
1235	....do	11.57 a. m.	54 44 00	161 27 00	45	rky	52	51	.....	....do	25
1236	....do	1.13 p. m.	54 38 00	161 39 00	49	bk. S. G	52	51	43.2	....do	25
1237	....do	2.32 p. m.	54 32 00	161 53 00	75	bk. S	52	51	41.2	....do	25
1238	....do	3.53 p. m.	54 25 00	162 05 00	63	bk. S	52	51	40.2	....do	25
1239	....do	4.45 p. m.	54 23 00	161 56 00	34	P	51	51	43.5	....do	25
1240	....do	5.55 p. m.	54 20 00	162 02 00	30	Sh	51	50	43.0	....do	25
1241	....do	6.39 p. m.	54 16 00	162 08 00	40	brk. Sh. G	52	50	42.2	....do	25
1242	....do	8.33 p. m.	54 07 00	162 07 00	435	dk. M	51	50	38.2	Sigsbee	38
1243	....do	9.35 p. m.	54 10 00	161 54 00	52	rky	52	50	39.7	....do	38
1244	....do	10.21 p. m.	54 13 00	161 47 00	50	bk. S. P	52	51	40.2	Tanner	25
1245	....do	11.04 p. m.	54 17 00	161 40 00	44	crs. S	52	51	41.7	....do	25
1246	....do	11.44 p. m.	54 18 00	161 34 00	42	S. R	52	51	42.2	....do	25
1247	Aug. 4	1.05 a. m.	54 22 00	161 22 00	61	R. G	52	51	41.2	....do	25
1248	....do	2.17 a. m.	54 27 00	161 08 00	59	bk. S	52	50	41.2	....do	25
1249	....do	3.31 a. m.	54 31 00	160 54 00	71	bk. S	52	50	40.2	....do	25
1250	....do	4.48 a. m.	54 35 00	160 41 00	72	bu. M	52	51	40.2	....do	25
1251	....do	6.04 a. m.	54 39 00	160 28 00	62	gy. S. P	52	50	40.4	....do	25
1252	....do	7.24 a. m.	54 43 00	160 14 00	50	fne. gy. S	53	51	40.6	....do	25
1253	....do	8.34 a. m.	54 47 00	160 00 00	43	gy. S. bk. Sp	53	51	42.2	....do	25
1254	....do	9.21 a. m.	54 49 00	159 54 00	40	fne. gy. S	53	51	43.7	....do	25
1255	....do	12.08 p. m.	54 57 00	159 55 00	25	gy. S	51	50	48.3	....do	25
1256	....do	12.48 p. m.	55 00 00	159 54 00	27	rky	51	50	45.2	....do	25
1257	....do	1.24 p. m.	54 59 00	159 45 00	26	bk. S. P	51	50	45.2	....do	25
1258	....do	2.15 p. m.	55 02 00	159 41 00	37	gy. S. brk. Sh	53	50	44.7	....do	25
1259	....do	3.00 p. m.	55 06 00	159 39 00	57	S. brk. Sh	53	48	44.2	....do	25
1260	....do	3.30 p. m.	55 10 00	159 40 00	39	S. brk. Sh	53	48	44.2	....do	25
1261	....do	5.13 p. m.	55 15 00	159 28 00	23	R. Co	53	48	42.0	....do	25
1262	Aug. 5	4.49 a. m.	55 03 00	159 15 00	27	brk. Sh	51	49	45.7	....do	25
1263	....do	5.29 a. m.	55 01 00	159 08 00	44	G	51	49	43.2	....do	25

22. *Record of hydrographic soundings of the U. S. Fish Commission steamer Albatross, etc.*—Continued.

Serial number.	Date.	Time.	Position.		Depth in fathoms.	Character of bottom.	Temperature.			Kind of reel.	Weight of sinker.
			Lat. N.	Long. W.			Air.	Surface.	Bottom.		
	1888.		° ′ ″	° ′ ″							*Lbs.*
1264	Aug. 5	6.05 a.m.	54 59 00	159 00 00	48	gy. S	51	49	42.2	Tanner	25
1265	do	6.42 a.m.	54 57 00	158 52 00	43	gy. S. G	51	49	42.2	do	25
1266	do	7.13 a.m.	54 55 00	158 46 00	46	gy. S. brk. Sh	51	49	42.2	do	25
1267	do	8.13 a.m.	54 53 00	158 38 00	70	gy. S	52	51	40.2	do	25
1268	do	9.01 a.m.	54 49 00	158 42 00	56	gy. S. P	51	51	40.9	do	25
1269	do	9.46 a.m.	54 51 00	158 49 00	46	gy. S. brk. Sh	51	51	42.2	do	25
1270	do	10.07 a.m.	54 52 00	158 54 00	45	rky	51	51	.....	Bassnet	25
1271	do	10.31 a.m.	54 53 00	158 57 00	41	S. R	51	51	42.7	Tanner	25
1272	do	10.55 a.m.	54 54 00	159 01 00	45	rky	51	52	.....	Bassnet	25
1273	do	11.16 a.m.	54 55 00	159 05 00	35	rky	52	52	43.2	Tanner	25
1274	do	11.38 a.m.	54 52 00	159 07 00	38	gy. S. P. brk. Sh	52	52	.....	Bassnet	25
1275	do	11.58 a.m.	54 50 00	159 08 30	35	rky	52	52	44.2	Tanner	25
1276	do	12.19 p.m.	54 49 00	159 05 00	57	rky	52	52	.....	Bassnet	25
1277	do	12.38 p.m.	54 48 00	159 01 00	44	Sh. fne. G	52	52	43.2	do	25
1278	do	1.04 p.m.	54 47 00	158 55 00	47	R. Sh	54	51	42.2	Tanner	25
1279	do	1.22 p.m.	54 46 00	158 53 00	49	R	54	51	42.5	do	25
1280	do	2.01 p.m.	54 44 00	158 44 00	55	rky	54	51	41.7	do	25
1281	do	3.18 p.m.	54 35 00	158 51 00	99	bu. M. P	54	51	40.7	do	25
1282	do	4.04 p.m.	54 37 00	158 58 00	69	gy. S. P	54	51	40.2	do	25
1283	do	4.39 p.m.	54 38 00	159 02 00	56	gy. S. P	53	51	41.3	do	25
1284	do	5.27 p.m.	54 39 00	159 09 00	46	P	53	51	42.5	do	25
1285	do	6.07 p.m.	54 41 00	159 16 00	41	gy. S. Sh	53	51	43.2	do	25
1286	do	7.48 p.m.	54 42 00	159 24 00	35	rky	51	49	44.2	do	25
1287	do	7.55 p.m.	54 41 00	159 29 30	35	rky	51	49	44.2	do	25
1288	do	8.37 p.m.	54 37 00	159 25 00	43	rky	51	49	.....	Bassnet	25
1289	do	9.52 p.m.	54 32 00	159 17 00	115	rky	51	51	.....	Tanner	25
1290	do	11.53 p.m.	54 25 00	159 40 00	105	bk. S	50	50	41.2	do	25
1291	Aug. 6	1.16 a.m.	54 36 00	159 39 00	49	bk. S	50	51	42.4	do	25
1292	do	1.57 a.m.	54 41 00	159 39 00	42	P	50	51	43.0	do	25
1293	do	2.45 a.m.	54 42 00	159 47 00	44	R	50	51	43.2	do	25
1294	do	3.29 a.m.	54 37 00	159 52 00	49	R. gy. S	50	51	42.2	do	25
1295	do	4.51 a.m.	54 28 00	160 00 00	67	P	50	51	40.6	do	25
1296	do	5.25 a.m.	54 25 00	160 03 00	119	fne. gy. S	50	51	41.2	do	25
1297	do	12.48 p.m.	54 39 00	158 43 00	52	rky	58	51	41.2	do	25
1298	do	1.23 p.m.	54 40 00	158 35 00	57	rky	55	51	40.7	do	25
1299	do	2.04 p.m.	54 41 00	158 25 00	86	P	54	53	41.2	do	25
1300	do	2:45 p.m.	54 40 00	158 22 00	110	gy. S	54	53	41.2	do	25
1301	do	3.30 p.m.	54 50 00	158 30 00	87	gy. S	54	53	41.2	do	25
1302	do	4.12 p.m.	54 56 00	158 30 00	90	G	55	53	40.4	do	25
1303	do	4.54 p.m.	55 01 00	158 30 00	114	gn. M	53	53	40.6	do	25
1304	do	5.37 p.m.	55 03 00	158 38 00	87	G	53	52	39.9	do	25
1305	do	6.15 p.m.	55 04 00	158 48 00	79	gy. S	53	52	40.4	do	25
1306	do	6.55 p.m.	55 07 00	158 55 00	50	gy. S	51	50	41.5	do	25
1307	do	7.36 p.m.	55 09 00	159 03 00	47	gy. S. P	51	50	41.9	do	25
1308	do	8.17 p.m.	55 11 00	159 11 00	53	gy. S	52	51	43.2	do	25
1309	do	8.59 p.m.	55 13 00	159 18 00	58	gy. S	51	51	42.2	do	25
1310	do	9.43 p.m.	55 17 00	159 19 00	102	bu. M	51	51	40.4	do	25
1311	do	11.06 p.m.	55 18 00	159 02 00	103	bu. M	51	51	40.2	do	25
1312	Aug. 7	12.27 a.m.	55 20 00	158 45 00	97	gy. S	51	51	41.2	do	25
1313	do	1.47 a.m.	55 21 00	158 29 00	80	gy. S	50	52	40.2	do	25
1314	do	3.10 a.m.	55 22 00	158 12 00	68	M	50	52		do	25
1315	do	4.31 a.m.	55 23 00	157 55 00	56	G. brk. Sh	50	50	42.1	do	25
1316	do	5.48 a.m.	55 25 00	157 37 00	46	yl. S	51	50	42.0	do	25
1317	do	6.25 a.m.	55 26 00	157 28 00	47	gn. M	51	50	42.1	do	25
1318	do	8.21 a.m.	55 30 00	157 44 00	53	gy. S. G	50	50	41.9	do	25
1319	do	9.38 a.m.	55 34 00	158 00 00	73	fne. gy. S	51	51	40.1	do	25
1320	do	10.53 a.m.	55 39 00	158 14 00	73	M. fne. gy. S	51	51	42.1	do	25
1321	do	12.07 p.m.	55 47 00	158 27 00	64	fne. gy. S	51	51	41.9	do	25
1322	do	1.23 p.m.	55 54 00	158 40 00	68	bu. M	53	51	43.1	do	25
1323	do	2.03 p.m.	55 57 00	158 47 00	82	bu. M	53	52	42.1	do	25
1324	Aug. 8	6.56 a.m.	55 52 00	158 29 00	67	fne. Gy. S	52	50	42.1	do	25
1325	do	8.00 a.m.	55 49 00	158 12 00	44	Sh. G	53	51	43.3	do	25
1326	do	9.15 a.m.	55 47 00	157 55 00	57	gy. S	53	51	44.3	do	25
1327	do	10.28 a.m.	55 45 00	157 39 00	67	fne. bk. S	54	53	41.3	do	25
1328	do	11.08 a.m.	55 44 00	157 30 00	59	bk. S	54	53	41.5	do	25
1329	do	12.24 p.m.	55 42 00	157 24 00	54	rky	54	53	.....	do	25
1330	do	12.29 p.m.	55 41 00	157 24 00	49	bu. S, G	54	53	.....	do	25
1331	do	4.48 p.m.	55 40 00	157 16 00	48	bk. S. G	56	52	43.9	do	25
1332	do	5.27 p.m.	55 39 00	157 07 00	47	crs. gy. S	56	52	45.1	do	25
1333	do	6.02 p.m.	55 37 00	156 57 00	50	gy. S	54	51	42.9	do	25
1334	do	6.36 p.m.	55 36 00	156 47 00	55	fne. gy. S	53	52	41.7	do	25
1335	do	7.52 p.m.	55 34 00	156 30 00	135	gn. M	53	52	41.1	do	25
1336	do	9.12 p.m.	55 44 00	156 19 00	137	bu. M	54	52	41.1	do	25
1337	do	11.02 p.m.	55 53 00	156 08 00	119	bu. M	54	52	41.3	do	25
1338	Aug. 9	12.20 a.m.	55 46 00	155 55 00	89	P	53	50	41.1	do	25
1339	do	1.37 a.m.	55 39 00	155 44 00	60	rky	52	50	42.6	do	25
1340	do	2.51 a.m.	55 32 00	155 32 00	96	gy. S. P	52	50	42.1	do	25

22. *Record of hydrographic soundings of the U. S. Fish Commission steamer Albatross, etc.*—Continued.

Serial number.	Date.	Time.	Position.		Depth in fathoms.	Character of bottom.	Temperature.			Kind of reel.	Weight of sinker.
			Lat. N.	Long. W.			Air.	Surface.	Bottom.		
	1888.		° ′ ″	° ′ ″							*Lbs.*
1341	Aug. 9	4.11 a. m.	55 39 00	155 27 00	57	gy. S	52	50	46.1	Tanner	25
1342	do	4.53 a. m.	55 47 00	155 22 00	26	gy. S	52	50	48.2	do	25
1343	do	5.09 a. m.	55 49 00	155 20 00	27	gy. S. bk. Sp	52	50	48.0	do	25
1344	do	6.14 a. m.	55 44 00	155 14 00	76	gy. S	50	48	41.9	do	25
1345	do	6.59 a. m.	55 39 00	155 09 00	287	gy. S	50	48	38.9	do	25
1346	do	8.17 a. m.	55 47 00	155 00 00	89	gy. S	52	52	41.6	do	25
1347	do	9.25 a. m.	55 55 00	154 51 00	81	fne. bk. S	55	54	41.3	do	25
1348	do	10.08 a. m.	55 59 00	154 47 00	76	fne. gy. S	58	54	42.5	do	25
1349	do	10.43 a. m.	56 04 00	154 44 00	60	ne. gy. S	58	54	41.5	do	25
1350	do	11.21 a. m.	56 07 00	154 38 00	37	gy. S	58	54	42.5	do	25
1351	do	12.43 p. m.	56 05 00	154 33 00	61	fne. gy. S	55	55	41.6	do	25
1352	do	1.25 p. m.	56 03 00	154 25 00	66	gy. S. P. Co	55	55	41.6	do	25
1353	do	4.03 p. m.	56 09 00	154 15 00	75	bk. S	55	53	41.9	do	25
1354	do	5.18 p. m.	56 18 00	154 10 00	54	gy. S. bk. Sp	54	53	43.1	do	25
1355	do	6.29 p. m.	56 28 00	154 05 00	28	gy. S	53	50	48.2	do	25
1356	do	7.09 p. m.	56 27 00	153 55 00	23	brk. Sh	53	52	48.0	do	25
1357	do	7.47 p. m.	56 24 00	153 47 00	52	bk. S	53	52	43.1	do	25
1358	do	9.01 p. m.	56 18 00	153 33 00	46	G	53	52	43.2	do	25
1359	do	9.40 p. m.	56 15 00	153 25 00	52	gy. S. P	54	53	41.4	do	22
1360	do	10.19 p. m.	56 12 00	153 18 00	88	fne. gy. S	54	53	41.5	do	25
1361	do	11.42 p. m.	56 23 00	153 24 00	36	Sh	54	52	44.5	do	25
1362	Aug. 10	12.27 a. m.	56 28 00	153 26 00	45	gy. S. Sh	53	51	44.1	do	25
1363	do	1.09 a. m.	56 34 00	153 29 00	73	bu. M	52	51	41.1	do	25
1364	do	1.50 a. m.	56 35 00	153 19 00	53	gy. S. C	54	53	42.1	do	25
1365	do	2.33 a. m.	56 36 00	153 10 00	58	bu. M	54	51	42.6	do	25
1366	do	3.10 a. m.	56 37 00	153 00 00	49	bu. M	53	51	42.1	do	25
1367	do	3.49 a. m.	56 39 00	152 50 00	44	rky	52	51	42.1	do	25
1368	do	4.30 a. m.	56 40 00	152 40 00	51	gy. S	53	51	42.6	do	25
1369	do	5.08 a. m.	56 41 00	152 30 00	49	rky	53	51	42.1	do	25
1370	do	5.46 a. m.	56 42 00	152 21 00	37	S. P	54	52	43.3	do	25
1371	do	8.26 a. m.	56 46 00	152 35 00	61	S. P	66	54	41.9	do	25
1372	do	8.37 a. m.	56 51 00	152 50 00	37	gy. S., brk. Sh	66	54	44.7	do	25
1373	do	11.05 a. m.	56 58 00	153 10 00	18	brk. Sh	57	55	47.3	do	25
1374	do	1.09 p. m.	57 04 00	153 18 00	68	bk. M	57	55	43.2	do	25
1375	do	1.47 p. m.	57 07 00	153 18 00	57	bk. M	57	55	44.1	do	25
1376	Aug. 12	4.17 p. m.	56 55 00	153 19 00	71	fne. gy. S	54	53	43.8	do	25
1377	do	4.55 p. m.	56 51 00	153 18 00	111	gn. M	54	55	39.9	do	25
1378	do	6.03 p. m.	56 43 00	153 00 00	60	rky	53	54	40.9	do	25
1379	do	7.10 p. m.	56 35 00	152 48 00	46	S. P	53	54	41.9	do	25
1380	do	8.14 p. m.	56 28 00	152 36 00	38	P	52	53	42.6	do	25
1381	do	9.23 p. m.	56 20 00	152 23 00	347	gn. M	52	54	39.1	do	25
1382	do	10.53 p. m.	56 29 00	152 11 00	173	gy. S	52	54	40.1	do	25
1383	Aug. 13	12.14 a. m.	56 38 00	151 59 00	28	rky	53	54	44.6	do	25
1384	do	12.52 a. m.	56 35 00	151 50 00	60	gy. S. R	53	54	42.1	do	25
1385	do	1.29 a. m.	56 33 00	151 42 00	298	gy. S	53	54	39.6	do	25
1386	do	2.40 a. m.	56 42 00	151 29 00	485	rky	53	54	39.1	do	25
1387	do	3.59 a. m.	56 49 00	151 42 00	58	gy. S	53	54	42.9	do	25
1388	do	5.12 a. m.	56 56 00	151 56 00	49	gy. S	53	53	44.8	do	25
1389	do	6.20 a. m.	57 03 00	152 10 00	44	rky	53	52	43.9	do	25
1390	do	7.27 a. m.	57 10 00	152 23 00	86	fne. gy. S	54	52	41.4	do	25
1391	do	8.08 a. m.	57 12 00	152 27 00	53	fne. gy. S	55	53	44.4	do	25
1392	do	9.07 a. m.	57 16 00	152 22 00	39	bk. S. G	55	50	45.3	do	25
1393	do	10.34 a. m.	57 20 00	152 15 00	25	rky	57	52	47.5	do	25
1394	do	1.36 p. m.	57 17 00	152 07 00	45	brk. Sh	52	49	44.6	do	25
1395	do	2.37 p. m.	57 11 00	151 52 00	43	gy. S., brk. Sh	52	49	45.1	do	25
1396	do	3.44 p. m.	57 05 00	151 37 00	46	Co	52	53	45.1	do	25
1397	do	4.51 p. m.	57 00 00	151 23 00	90	gy. S	56	53	41.4	do	25
1398	do	6.30 p. m.	57 11 00	151 05 00	75	gy. S	55	53	41.8	do	25
1399	do	7.39 p. m.	57 18 00	151 19 00	71	G	53	53	43.4	do	25
1400	do	8.46 p. m.	57 24 00	151 33 00	39	rky	52	50	45.5	do	25
1401	do	9.53 p. m.	57 30 00	151 46 00	57	rky	52	50	44.9	do	25
1402	do	10.31 p. m.	57 35 00	151 52 00	81	rky	52	50	42.9	do	25
1403	Aug. 21	3.26 p. m.	57 43 00	152 14 00	69	bu. M	60	54	46.5	do	25
1404	do	3.52 p. m.	57 42 00	152 09 00	17	rky	60	54		do	25
1405	do	4.33 p. m.	57 46 00	152 01 00	28	Sh	57	53	48.5	do	25
1406	do	5.14 p. m.	57 49 00	151 53 00	56	gy. S., brk. Sh	57	53	44.6	do	25
1407	do	5.54 p. m.	57 52 00	151 47 00	47	gy. S	56	55	45.1	do	25
1408	do	6.34 p. m.	57 49 00	151 39 00	30	G. Sh	56	55	47.3	do	25
1409	do	7.14 p. m.	57 46 00	151 32 00	33	G. Sh	62	55	48.8	do	25
1410	do	7.46 p. m.	57 43 00	151 25 00	35	crs. gy. S., brk. Sh	56	52	48.1	do	25
1411	do	8.25 p. m.	57 39 00	151 18 00	38	Sh. Co	56	52	47.3	do	25
1412	do	7.08 p. m.	57 36 00	151 11 00	42	Sh	55	52	46.0	do	25
1413	do	10.22 p. m.	57 29 00	150 56 00	48	gy. S., Sh	54	53	44.3	do	25
1414	do	11.36 p. m.	57 23 00	150 41 00	57	gy. S	55	55	42.7	do	25
1415	Aug. 22	12.18 a. m.	57 19 00	150 35 00	72	gy. S. P	55	56	41.6	do	25
1416	do	2.35 a. m.	57 26 00	150 06 00	200	gy. S., bk. Sp	56	57	39.6	do	25
1417	do	4.00 a. m.	57 32 00	150 18 00	59	gy. S. G	56	56	42.6	do	25
1418	do	5.17 a. m.	57 39 00	150 38 00	51	S. brk. Sh	54	52	45.1	do	25

22. *Record of hydrographic soundings of the U. S. Fish Commission steamer Albatross, etc* —Continued.

Serial number.	Date.	Time.	Position.		Depth in fathoms.	Character of bottom.	Temperature.			Kind of reel.	Weight of sinker.
			Lat. N.	Long. W.			Air.	Surface.	Bottom.		
	1888.		° ′ ″	° ′ ″							*Lbs.*
1419	Aug. 22	6.43 a.m.	57 44 00	150 46 00	43	S. brk. Sh	65	53	46.8	Tanner	25
1420	do	8.00 a.m.	57 51 00	151 00 00	40	S. G	58	53	46.5	do	25
1421	do	9.18 a.m.	57 57 00	151 08 00	36	brk. Sh. G	55	54	46.5	do	25
1422	do	10.54 a.m.	58 03 00	151 26 00	78	fne. gy. S	55	54	44.1	do	25
1423	do	1.27 p.m.	58 14 00	151 23 00	41	G	59	56	44.1	do	25
1424	do	2.40 p.m.	58 20 00	151 11 00	60	gy. S. G	59	53	43.6	do	25
1425	do	4.00 p.m.	58 12 00	151 01 00	56	gy. S., brk. Sh	63	53	44.1	do	25
1426	do	8.31 p.m.	57 58 00	150 32 00	102	gy. S	59	56	41.3	do	25
1427	do	9.46 p.m.	57 52 00	150 16 00	114	gy. S., bk. Sp	56	55	41.1	do	25
1428	do	11.03 p.m.	57 47 00	150 00 00	113	gy. S., bk. Sp	54	55	41.3	do	25
1429	Aug. 23	12.22 a.m.	57 41 00	149 44 00	140	gy. S., bk. Sp	55	56	41.1	do	25
1430	do	1.45 a.m.	57 47 00	149 31 00	119	gy. S., bk. Sp	55	56	41.6	do	25
1431	do	3.04 a.m.	57 53 00	149 19 00	166	gy. S., bk. Sp	55	56	41.1	do	25
1432	do	4.24 a.m.	57 59 00	149 33 00	112	gy. S	54	56	41.5	do	25
1433	do	5.43 a.m.	58 05 00	149 48 00	128	gy. S	59	55	41.3	do	25
1434	do	7.01 a.m.	58 11 00	150 03 00	69	gy. S. P	63	56	44.1	do	25
1435	do	8.28 a.m.	58 17 00	150 17 00	37	brk. Sh. G	64	56	49.1	do	25
1436	do	9.43 a.m.	58 23 00	150 32 00	37	brk. Sh	58	53	48.5	do	25
1437	do	11.17 a.m.	58 29 00	150 48 00	50	S. P. brk. Sh	58	54	44.1	do	25
1438	do	12.39 p.m.	58 35 00	151 03 00	99	gy. S	57	54	41.1	do	25
1439	do	1.53 p.m.	58 40 00	151 16 00	99	rky	56	54	41.1	do	25
1440	do	3.06 p.m.	58 50 00	151 07 00	76	gy. S	56	54	41.6	do	25
1441	do	4.18 p.m.	58 57 00	151 00 00	97	gy. M	56	54	41.2	do	25
1442	do	5.35 p.m.	58 51 00	150 47 00	84	gy. S	55	56	41.2	do	25
1443	do	6.54 p.m.	58 46 00	150 33 00	105	bk. S. P	55	55	41.3	do	25
1444	do	8.13 p.m.	58 40 00	150 17 00	69	gy. S., brk. Sh	55	54	41.1	do	25
1445	do	9.32 p.m.	58 33 00	150 03 00	67	gy. S. P	55	54	41.1	do	25
1446	do	10.56 p.m.	58 27 00	149 47 00	84	bk. S	55	54	40.9	do	25
1447	Aug. 24	12.21 a.m.	58 21 00	149 33 00	90	gy. S	56	56	41.3	do	25
1448	do	1.41 a.m.	58 14 00	149 17 00	85	gy. S	56	56	41.2	do	25
1449	do	3.02 a.m.	58 08 00	149 04 00	77	gy. S. P	56	56	41.7	do	25
1450	do	4.28 a.m.	58 01 00	148 49 00	98	gy. S	56	56	41.6	do	25
1451	do	6.21 a.m.	57 54 00	148 34 00	507	bu. M	57	56	38.1	Sigsbee	38
1452	do	8.25 a.m.	58 00 00	148 20 00	594	bk. S. G	60	59	37.6	do	38
1453	do	10.03 a.m.	58 10 00	148 20 00	761	bu. M	62	59	37.0	do	38
1454	do	1.38 p.m.	58 24 00	148 46 00	71	gy. S	60	59	41.7	Tanner	25
1455	do	2.56 p.m.	58 31 00	148 57 00	66	gy. S., G. Sh	58	57	41.8	do	25
1456	do	4.15 p.m.	58 39 00	149 08 00	72	gy. S	58	57	42.1	do	25
1457	do	5.33 p.m.	58 46 00	149 17 00	103	bu. M	57	56	41.6	do	25
1458	do	6.55 p.m.	58 53 00	149 30 00	122	gy. M	57	57	41.6	do	25
1459	do	9.03 p.m.	58 44 00	149 02 00	118	gy. S	57	56		do	25
1460	do	10.23 p.m.	58 37 00	148 45 00	99	gy. S	57	56	41.8	do	25
1461	do	11.42 p.m.	58 30 00	148 29 00	106	G. S	57	57	41.5	do	25
1462	Aug. 25	1.31 a.m.	58 23 00	148 07 00	902	bu. M	57	57	36.0	Sigsbee	38
1463	do	3.10 a.m.	58 32 00	148 07 00	358	bu. M	57	58	39.1	Tanner	25
1464	do	4.30 a.m.	58 41 00	148 07 00	151	gy. S	57	58	40.9	do	25
1465	do	5.46 a.m.	58 37 00	147 50 00	301	S. G	57	58		do	25
1466	do	7.30 a.m.	58 45 00	147 50 00	537	bu. M	62	59	38 0	Sigsbee	38
1467	do	9.06 a.m.	58 54 00	147 50 00	87	Sh	63	57	41.8	do	38
1468	do	10.21 a.m.	59 02 00	147 50 00	101	M. G	64	56	41.7	do	38
1469	do	11.37 a.m.	59 05 00	147 33 00	308	S. R	62	56	39.2	Tanner	25
1470	do	12.54 p.m.	59 10 00	147 17 00	252	rky	61	57	40.1	do	25
1471	do	2.09 p.m.	59 15 00	147 00 00	109	bu. M	59	53	41.1	do	25
1472	do	3.23 p.m.	59 20 00	146 42 00	92	bu. M	57	53	42.6	do	25
1473	do	4.34 p.m.	59 21 00	146 26 00	45	rky	59	53	44.8	do	25
1474	do	5.11 p.m.	59 24 00	146 19 00	11	rky	58	53	51.8	do	25
1475	Aug. 26	8.39 a.m.	59 20 00	146 23 00	15	G. P	61	53	49.8	do	25
1476	do	3.40 p.m.	59 12 00	146 20 00	22	No specimen obt	58	53		Hand lead	
1477	do	4.26 p.m.	59 09 00	146 13 00	141	P	58	53	41.2	Tanner	25
1478	do	5.39 p.m.	59 03 00	145 56 00	620	bu. M	61	57	37.0	Sigsbee	38
1479	do	8.30 p.m.	58 51 00	145 25 00	2,425	M	59	58	35.0	do	38
1480	Aug. 27	2.54 a.m.	59 01 00	144 22 00	2,220	gy. Oz	59	59	35.0	do	60
1481	do	7.31 a.m.	59 08 00	143 30 00	2,138	gy. Oz	60	59	35.0	do	60
1482	do	10.39 a.m.	59 12 00	143 00 00	1,528	gy. Oz	63	59	35.1	do	60
1483	do	1.32 p.m.	59 00 00	142 37 00	1,764	gy. Oz	65	60	35.0	do	60
1484	do	3.38 p.m.	58 54 00	142 33 00	1,745	br. and gy. Oz	64	60	35.0	do	60
1485	do	5.33 p.m.	58 56 00	142 18 00	1,675	br. and gy. Oz	62	60	35.0	do	60
1486	do	7.24 p.m.	58 58 00	141 59 00	1,500	gy. Oz	60	59	35.0	do	60
1487	do	9.19 p.m.	58 51 00	141 46 00	1,548	gy. Oz	60	60	35.1	do	60
1488	Aug. 28	3.51 a.m.	58 17 00	140 35 00	1,815	gy. Oz	60	60	35.0	do	60
1489	do	11.26 a.m.	57 45 00	139 25 00	1,778	br. and gy. Oz	56	58		do	60
1490	Aug. 29	12.48 a.m.	56 35 00	137 55 00	1,433	No specimen	57	57		do	60
1491	Aug. 30	5.50 a.m.	54 02 00	134 34 00	1,571	br. and gy. Oz	57	57	35.3	do	38
1492	do	6.29 p.m.	52 32 00	133 05 00	1,601	gy. Oz	67	60	35.1	do	38
1493	Aug. 31	4.38 a.m.	51 34 00	131 25 00	1,099	gn. M	59	59	35.9	do	38
1494	do	6.44 p.m.	51 09 00	129 07 00	83	bu. M	69	60	44.2	Tanner	25
1495	do	10.02 p.m.	51 01 00	128 25 00	52	gy. S	61	55	46.5	do	25
1496	Sept. 1	9.23 a.m.	50 56 00	128 09 00	22	No specimen obtained	56	56		Hand lead	

22. *Record of hydrographic soundings of the U. S. Fish Commission steamer Albatross, etc.*—Continued.

Serial number.	Date.	Time.	Position.		Depth in fathoms.	Character of bottom.	Temperature.			Kind of reel.	Weight of sinker.
			Lat. N.	Long. W.			Air.	Surface.	Bottom.		
	1888.		° ′ ″	° ′ ″							*Lbs.*
1497	Sept. 1	9.53 a.m.	50 55 00	128 04 30	16	No specimen obtained	56	56	.....	Hand lead	.....
1498	Sept. 19	3.53 a.m.	48 20 00	124 58 00	82	rky	54	52	44.2	Tanner	25
1499	....do	4.34 a.m.	48 18 00	125 05 30	106	bk. S	54	52	44.2	....do	25
1500	....do	5.17 a.m.	48 16 00	125 12 30	108	R	57	52	43.7	....do	25
1501	....do	6.02 a.m.	48 14 00	125 19 30	55	yl. S	57	57	.....	....do	25
1502	....do	6.33 a.m.	48 12 00	125 26 30	70	bk. S	57	57	45.7	....do	25
1503	....do	7.14 a.m.	48 10 00	125 33 30	86	bk. S	59	60	45.2	....do	25
1504	....do	7.56 a.m.	48 08 00	125 40 30	105	bk. S	59	61	44.8	....do	25
1505	....do	9.12 a.m.	48 06 00	125 47 30	586	gn. M	59	61	38.2	Sigsbee	38
1506	....do	10.18 a.m.	48 04 00	125 54 30	505	gn. M	59	59	38.6	....do	38
1507	....do	11.18 a.m.	48 03 00	126 01 30	692	gn. M	60	59	38.0	....do	38
1508	....do	12.25 p.m.	48 01 00	126 09 00	768	br. M	62	60	37.2	....do	38
1509	....do	1.41 p.m.	47 59 00	126 15 00	856	br. M	62	60	36.7	....do	38
1510	....do	3.04 p.m.	47 57 00	126 22 30	816	br. M	62	60	36.7	....do	38
1511	....do	4.24 p.m.	47 55 00	126 29 00	1,239	br. M	61	59	.....	....do	38
1512	Sept. 20	12.47 p.m.	48 07 00	125 03 00	80	gn. M	57	58	44.7	Tanner	25
1513	....do	7.34 p.m.	48 07 00	125 00 30	178	fne. gy. S	58	58	.....	....do	25
1514	....do	8.40 p.m.	48 05 00	125 08 00	77	gy. S and P	58	58	44.7	....do	25
1515	....do	9.42 p.m.	48 03 00	125 15 00	82	P	59	57	44.7	....do	25
1516	....do	10.47 p.m.	48 01 00	125 22 00	218	bu. M. and G	59	59	42.7	....do	25
1517	Sept. 21	12.04 a.m.	47 59 00	125 29 00	90	S. and G	59	59	44.7	....do	25
1518	....do	1.20 a.m.	47 58 00	125 35 00	141	S. and G	58	57	43.2	....do	25
1519	....do	2.24 a.m.	47 56 00	125 42 30	378	gn. M	59	59	39.7	Sigsbee	38
1520	....do	3.39 a.m.	47 52 00	125 35 00	274	G	59	58	40.2	Tanner	25
1521	....do	4.57 a.m.	47 49 00	125 28 00	462	yl. Oz	58	58	39.7	Sigsbee	38
1522	....do	5.57 a.m.	47 46 00	125 20 30	522	yl. Oz	58	58	39.1	....do	38
1523	....do	6.55 a.m.	47 47 00	125 14 00	378	yl. Oz	60	58	40.1	....do	38
1524	....do	7.44 a.m.	47 48 00	125 07 00	206	gy. Oz	60	58	42.9	Tanner	38
1525	....do	8.33 a.m.	47 49 00	124 59 00	67	No specimen obt	60	58	45.1	....do	38
1526	....do	9.13 a.m.	47 51 00	124 52 00	52	gy, S, and P	63	58	46.5	....do	38
1527	....do	2.41 p.m.	47 48 00	124 43 00	30	gy. S	61	58	48.1	....do	38
1528	....do	3.22 p.m.	47 43 00	124 41 00	33	fne. gy. S	61	59	48.1	....do	38
1529	....do	5.25 p.m.	47 36 00	124 46 00	53	bk. S	63	58	49.1	....do	38
1530	....do	6.10 p.m.	47 35 00	124 53 00	75	fne. gy. S	63	58	45.7	....do	38
1531	....do	6.55 p.m.	47 33 00	125 01 00	111	fne. bk. S	63	58	44.9	....do	38
1532	....do	7.44 p.m.	47 32 00	125 08 00	287	bu. M	63	58	41.1	Sigsbee	38
1533	....do	8.38 p.m.	47 27 00	125 06 00	535	bu. M	60	59	39.2	do	38
1534	....do	9.36 p.m.	47 22 00	125 03 30	758	gy. Oz	60	59	37.1	...do	38
1535	....do	10.34 p.m.	47 17 00	125 01 30	578	gy. Oz	59	59	38.3	...do	38
1536	....do	11.32 p.m.	47 18 00	124 54 00	386	No specimen obt	58	58	40.1	...do	38
1537	Sept. 22	12.23 a.m.	47 19 00	124 47 00	82	bu. M	58	58	44.9	Tanner	25
1538	....do	1.04 a.m.	47 21 00	124 39 30	51	fne. bk. S	57	57	45.9	do	25
1539	....do	1.45 a.m.	47 22 00	124 32 00	28	G. and P	57	57	46.9	...do	25
1540	....do	2.26 a.m.	47 17 00	124 30 00	28	gy. S	57	57	47.6	...do	25
1541	....do	3.04 a.m.	47 12 00	124 28 00	28	P	57	57	46.9	...do	25
1542	....do	3.43 a.m.	47 07 00	124 26 00	28	gy. S	56	57	48.1	....do	25
1543	....do	4.26 a.m.	47 05 00	124 32 30	41	bk. S	56	57	46.6	....do	25
1544	....do	5.07 a.m.	47 04 00	124 39 30	56	bk. S	56	57	46.0	...do	25
1545	....do	5.45 a.m.	47 02 00	124 47 00	74	bk. S. P	56	57	45.9	....do	25
1546	....do	6.25 a.m.	47 00 00	124 53 30	93	gn. M	54	56	44.9	....do	25
1547	....do	7.07 a.m.	46 58 00	125 00 30	438	gn. M	54	56	39.7	do	25
1548	....do	8.03 a.m.	46 53 00	124 57 00	450	gn. M	56	58	39.4	....do	25
1549	....do	8.48 a.m.	46 54 00	124 50 00	91	No specimen obt	56	58	.....	....do	25
1550	....do	9.41 a.m.	46 56 00	124 43 00	78	G. S	57	59	.....	....do	25
1551	....do	10.21 a.m.	46 51 00	124 41 00	76	G. M	57	59	46.0	....do	25
1552	....do	11.01 a.m.	46 50 00	124 48 00	87	rky	57	60	46.0	....do	25
1553	....do	11.41 a.m.	46 48 00	124 55 00	250	rky	57	59	.....	....do	25
1554	....do	12.38 p.m.	46 43 00	124 52 00	181	rky	58	60	44.9	....do	25
1555	....do	1.23 p.m.	46 45 00	124 44 00	80	gy. S	58	60	46.0	....do	25
1556	....do	2.00 p.m.	46 47 00	124 37 00	64	rky	60	60	46.1	....do	25
1557	....do	2.41 p.m.	46 49 00	124 30 00	42	rky	60	59	47.0	....do	25
1558	....do	3.18 p.m.	46 51 00	124 22 30	33	gy. and bk. S	60	59	48.1	....do	25
1559	....do	3.56 p.m.	46 54 00	124 15 00	18	gy. S	60	59	57.8	....do	25
1560	....do	4.47 p.m.	46 54 00	124 22 30	35	fne. gy. S	57	59	48.3	....do	25
1561	....do	5.32 p.m.	46 54 00	124 30 00	48	fne. gy. S	58	59	47.0	....do	25
1562	....do	6.10 p.m.	46 51 00	124 35 00	58	fne. gy. S	57	59	46.4	....do	25
1563	....do	6.52 p.m.	46 55 00	124 39 00	64	fne. gy. S	57	59	55.8	....do	25
1564	....do	7.25 p.m.	46 52 00	124 45 00	78	fne. bk. S	57	58	46.0	....do	25
1565	....do	8.18 p.m.	46 47 00	124 43 00	81	gy. S	58	60	45.5	....do	25
1566	....do	9.33 p.m.	46 36 00	124 39 00	132	rky	58	60	45.0	....do	25
1567	....do	10.28 p.m.	46 53 00	124 32 00	72	gy. M	58	60	45.4	....do	25
1568	....do	11.24 p.m.	46 40 00	124 25 00	50	gy. S	58	59	46.0	....do	25
1569	Sept. 23	12.15 a.m.	46 41 00	124 18 00	37	gy. S	57	58	46.7	....do	25
1570	....do	1.11 a.m.	46 37 00	124 17 30	37	hrd. S	57	58	46.1	....do	25
1571	....do	1.58 a.m.	46 35 00	124 24 30	51	hrd. S	58	58	.....	....do	25
1572	....do	2.37 a.m.	46 33 00	124 31 00	82	hrd. S	58	58	45.1	....do	25
1573	....do	3.36 a.m.	46 31 00	124 38 00	433	No bottom specimen.	58	58	39.2	....do	25
1574	Sept. 25	9.43 a.m.	48 34 00	124 53 00	65	gn. M	55	51	45.8	....do	25

22. *Record of hydrographic soundings of the U. S. Fish Commission steamer Albatross, etc.*—Continued.

Serial number.	Date.	Time.	Position.		Depth in fathoms.	Character of bottom.	Temperature.			Kind of reel.	Weight of sinker.
			Lat. N.	Long. W.			Air.	Surface.	Bottom.		
	1888.		° ′ ″	° ′ ″							*Lbs.*
1575	Sept. 29	10.22 a. m.	48 27 00	125 09 00	60	S. R	54	53	45.2	Tanner	25
1576	Oct. 10	3.51 p. m.	48 16 00	123 40 00	101	S. G	52	49	45.2	do	25
1577	Oct. 11	3.36 p. m.	46 34 00	124 12 30	20	gy. S	60	57	52.9	do	25
1578	do	4.36 p. m.	46 33 00	124 19 00	38	fne. gy. S	61	58	47.0	do	25
1579	do	5.17 p. m.	46 32 00	124 26 00	51	fne. gy. S	61	58	47.0	do	25
1580	do	5.58 p. m.	46 31 00	124 33 00	153	gr. M	61	58	45.0	do	25
1581	do	6.42 p. m.	46 30 00	124 39 30	432	br. Oz	61	58	39.6	Sigsbee	38
1582	do	7.38 p. m.	46 28 00	124 33 00	98	fne. gy. S	61	58	44.8	Tanner	25
1583	do	8.22 p. m.	46 27 00	124 26 00	55	bk. S	61	58	47.0	do	25
1584	do	9.10 p. m.	46 25 00	124 20 00	40	bu. M	60	58	47.9	do	25
1585	do	9.59 p. m.	46 23 00	124 27 00	59	fne. bk. S	60	58	47.0	do	25
1586	do	10.52 p. m.	46 22 00	124 34 00	78	fne. gy. S	58	59	46.5	do	25
1587	do	11.49 p. m.	46 21 00	124 41 00	260	bu. M	58	59	42.5	do	25
1588	Oct. 13	6.58 a. m.	46 03 00	124 22 00	73	fne. gy. S	57	57	45.1	do	25
1589	do	7.48 a. m.	46 02 00	124 29 00	82	fne. gy. S	57	57	45.8	do	25
1590	do	8.38 a. m.	46 00 00	124 36 00	96	br. S	58	56	46.0	do	25
1591	do	9.26 a. m.	45 50 00	124 42 30	199	gy. Oz	58	56	43.8	do	25
1592	do	10.18 a. m.	46 03 00	124 45 00	174	gy. Oz	60	61	44.2	do	25
1593	do	11.35 a. m.	46 07 00	124 48 00	601	br. Oz	62	62	38.8	do	25
1594	do	12.30 p. m.	46 08 00	124 39 00	102	bk. S	64	60	55.9	do	25
1595	do	1.15 p. m.	46 08 00	124 31 00	78	fne. gy. S	64	60	46.1	do	25
1596	do	4.46 p. m.	46 17 00	124 21 30	81	bu. M	62	60	46.6	do	25
1597	do	5.35 p. m.	46 16 00	124 28 30	231	bu. M	58	57	43.1	do	25
1598	do	6.36 p. m.	46 15 00	124 36 00	421	br. Oz	57	57	39.8	Sigsbee	38
1599	do	7.46 p. m.	46 14 00	124 42 30	475	gy. Oz	57	56	39.6	do	38
1600	do	9.01 p. m.	46 13 00	124 50 00	506	br. Oz	56	56	39.3	do	38
1601	Oct. 19	6.40 a. m.	44 04 00	124 53 00	56	M	57	57	47.1	Tanner	25
1602	do	7.06 a. m.	44 02 00	124 55 00	51	crs. bk. S	57	57	47.6	do	25
1603	do	11.52 a. m.	43 59 00	125 02 00	91	bk. S. G	60	58	46.2	do	25
1604	do	12.20 p. m.	43 59 00	125 05 00	563	gy. M	60	58	38.7	Sigsbee	38
1605	do	1.14 p. m.	43 54 00	125 05 00	355	bk. S	60	59	40.3	do	38
1606	do	2.04 p. m.	43 50 00	125 01 30	299	gy. C	60	59	42.1	do	38

23. *Record of dredging and trawling stations of the U. S. Fish Commission steamer Albatross, July 1 to December 31, 1888.*

Serial number.	Date.	Time.	Position.		Temperature.			Depth in fathoms.	Character of bottom.	Wind.		Drift.		Instrument used.
			Latitude N.	Longitude W.	Air.	Surface.	Bottom.			Direction.	Force.	Direction.	Dist.	
	1888.		° ′ ″	° ′ ″										
2841	July 23	9.05 a. m.	54 18 00	165 55 00	53	46	41	56	P	SSE.	4	WNW.	0.2	S. B. T.
2842	do	10.27 a. m.	54 15 00	166 03 00	50	46	41	72	P	SSE.	4	SW.	0.3	S. B. T.
2843	July 28	12.37 p. m.	53 56 00	165 56 00	52	50	43.5	45	brk. Sh. and P	NW.	3	ENE.	1.5	S. B. T.
2844	do	2.47 p. m.	53 56 00	165 40 00	51	48	42	54	gy. S	NW.	4	E. ¼ S.	1.5	L. B. T.
2845	July 29	8.30 a. m.	54 05 00	164 09 00	53	51	42	42	crs. bk. S	SSE.	2	SW.	0.8	L. B. T.
2846	July 30	7.45 a. m.	54 08 00	162 44 00	51	50	42	44	G	South.	3	S. by E.	0.5	L. B. T.
2847	July 31	8.00 a. m.	55 01 00	160 12 00	51	51	42	48	fne. gy. S	South.	3	SSW.	0.8	L. B. T.
2848	do	9.40 a. m.	55 10 00	160 18 00	51	49	41	110	gn. M	SSE.	3	South.	0.3	L. B. T.
2849	Aug. 2	7.30 a. m.	55 16 00	160 28 00	54	51	43	69	gn. M	SSE.	3	South.	0.7	L. B. T.
2850	Aug. 4	10.00 a. m.	54 52 00	159 46 00	53	51	48.2	21	brk. Sh	SW.	4	W. by N.	0.5	L. B. T.
2851	do	11.15 a. m.	54 55 00	159 52 00	53	51	44.8	35	gy. S., brk. Sh	SW.	3	W. by N.	1.0	L. B. T.
2852	do	4.08 p. m.	55 15 00	159 37 00	53	48	41.8	58	bk. S	West.	3	NNW.	0.7	L. B. T.
2853	Aug. 9	2.04 p. m.	56 00 00	154 20 00	55	55	41	159	gy. S	West.	2	N. ¾ E.	1.0	L. B. T.
2854	Aug. 10	9.55 a. m.	56 55 00	153 04 00	57	55	42.8	60	bk. S	SW.	2	SW.	1.0	L. B. T.
2855	do	11.44 a. m.	57 00 00	153 18 00	58	56	44	69	gn. M	SW.	1	NNW.	1.0	L. B. T.
2856	Aug. 22	11.35 a. m.	58 07 00	151 36 00	55	54	44	68	gy. S., bk. Sh	WNW.	2	NW.	0.5	L. B. T.
2857	do	6.30 p. m.	58 05 00	150 46 00	68	57	44.6	51	brk. Sh., gy. S	Calm.	0	SE. ¼ E.	0.5	L. B. T.
2858	Aug. 24	11.40 a. m.	58 17 00	148 36 00	61	59	39.8	230	bu. M. G	NE.	2	WSW.	0.2	L. B. T.
2859	Aug. 29	2.00 p. m.	55 70 00	136 20 00	61	60	34.9	1,569	gy. Oz	Calm.	0	SE.	2.5	L. B. T.
2860	Aug. 31	9.30 a. m.	51 23 00	130 34 00	61	58	36.5	876	gn. M	West.	2	E. ¼ N.	1.5	L. B. T.
2861	do	2.50 p. m.	51 14 00	129 50 00	69	60	42.6	204	No spec. in cup	NW.	2	East.	1.0	L. B. T.
2862	Sept. 1	12.32 p. m.	50 49 00	127 36 30	61	58	44.7	238	gy. S. and P	West.	3	ESE.	0.5	L. B. T
2863	Sept. 5	10.58 a. m.	48 58 00	123 10 00	60	62	48.5	67	fne. S., brk. Sh	SE.	2	SSE.	0.8	L. B. T.
2864	Sept. 6	7.16 a. m.	48 22 00	122 51 00	59	52	47.7	48	M. brk. Sh. S	South.	0.1	SSW.	0.5	L. B. T.
2865	do	8.56 a. m.	48 12 00	122 49 00	58	52	51.7	40	P	Calm.	0	S. by E.	0.6	L. B. T.
2866	Sept. 20	11.10 a. m.	48 09 00	125 03 00	59	59	43.2	171	gy. S	SSE.	2	SE. by E.	0.8	L. B. T.

23. *Record of dredging and trawling stations of the U. S. Fish Commission steamer Albatross, etc.*—Cont'd.

Serial number.	Date.	Time.	Position.		Temperature.			Depth in fathoms.	Character of bottom.	Wind.		Drift.		Instrument used.
			Latitude N.	Longitude W.	Air.	Surface.	Bottom.			Direction.	Force.	Direction.	Dist.	
	1888.		° ′ ″	° ′ ″										
2867	Sept. 20	1.47 p. m.	48 07 00	124 55 00	58	58	....	37	fne. gy. S.	SSE.	3	SE.	0.8	L. B. T.
2868	Sept. 21	1.27 p. m.	47 52 00	124 44 00	63	58	46.9	31	gy. S.....	SSE.	2	SE.	0.5	L. B. T.
2869	...do ...	4.09 p. m.	47 38 00	124 39 00	64	60	48.4	32	bk. S.....	South.	2	West.	1.0	L. B. T.
2870	Sept. 23	9.04 a. m.	46 44 00	124 32 00	58	58	46.5	58	rky.....	NE.	2	E. by S.	1.5	L. B. T.
2871	...do	1.32 p. m.	46 55 00	125 11 00	60	62	38.4	559	br. Oz.....	WNW.	2	NW.	1.3	L. B. T.
2872	Sept. 24	10.09 a. m.	48 17 00	124 52 00	62	59	45.5	38	gy. S.....	North.	3	ENE.	0.4	L. B. T.
2873	.. do	12.45 p. m.	48 30 00	124 57 00	61	54	47.8	40	R.....	NNE.	3	West.	0.3	L. B. T.
2874	...do	1.25 p. m.	48 30 00	124 57 00	55	52	50.3	27	R. and Sh.....	NNE.	3	SE.	0.2	Tangles.
2875	...do ..	1.58 p. m.	48 30 00	124 57 00	55	52	47.8	40	R. and Sh.	NE.	3	WSW.	0.4	Tangles.
2876	Sept. 25	10.34 a. m.	48 33 00	124 53 00	58	49	45.5	59	bk. S. and M..	ENE.	2	WSW.	0.4	L. B. T.
2877	...do ...	10.59 a. m.	48 33 00	124 53 00	58	49	45.5	59	bk. S. and M..	ENE.	3	SE. by S.	0.2	Tangles.
2878	..do	3.02 p. m.	48 37 00	125 32 00	60	57	45.5	66	P	WNW.	1	South.	0.3	Dredge.
2879	Sept. 26	8.35 a. m.	48 53 00	125 53 00	56	54	50.3	34	R.....	NE.	1	WNW.	0.2	Do.
2880	...do ..	8.49 a. m.	48 53 00	125 53 00	56	54	50.3	34	R.....	ESE.	1	E. by S.	0.2	Do.
2881	.. do	11.44 a. m.	49 00 00	125 48 00	63	57	52.3	24	gy. S.....	ESE.	1	SE. ½ E.	0.2	Do.
2882	Oct. 13	2.12 p. m.	46 09 00	124 22 30	64	60	45.8	68	gy. S.....	SE.	1	North.	1.0	L. B. T.
2883	Oct. 18	3.01 p. m.	45 56 00	124 01 30	62	60	50.1	29	fne. gy. S.	NE.	2	SSE.	0.2	Dredge.
2884	...do	3.16 p. m,	45 55 00	124 02 00	62	60	50.2	29	fne. gy. S. ...	NE.	2	WNW. by N.	0.3	Do.
2885	...do	3.44 p. m.	45 56 00	124 02 00	62	60	49	30	fne. gy. S.	Calm.	0	NW.	0.5	Do.
2886	Oct. 19	9.05 a. m.	43 59 00	124 56 30	57	57	48.1	50	rky.....	SE.	1	SSW.	0.2	Do.
2887	...do	9.28 a. m.	43 58 00	124 57 00	60	59	47.1	42	C. and P.....	SE.	1	SW.	0.4	L. B. T.
2888	.. do	10.01 a. m.	43 58 00	124 57 30	60	59	47.6	41	C. and P.....	SE.	1	West.	0.1	L. B. T.
2889	...do	10.42 a. m.	43 59 00	1:4 56 00	59	57	47.7	46	C. Sh.....	SE.	1	SSW.	0.4	L. B. T.
2890	...do	2.58 p. m.	43 46 00	124 57 00	62	59	42.2	277	gy. S.....	Calm.	0	SSE.	2.3	L. B. T.

24. Tabular statement of trials made for fish.

Station No.	Date.	Hour.	Locality. Latitude N.	Locality. Longitude W.	Depth of water.	Character of bottom.	Bait used.
Hyd.	1888.		° ′ ″	° ′ ″	*Fath.*		
1141	July 21	3.00 p. m.	53 11 00	166 51 00	84	bk. S. Peb	Salt clams
1142	...do	4.07 p. m.	53 17 00	166 54 00	57½	S. bk. Sp	do
1143	...do	5.07 p. m.	53 22 00	166 55 30	41	S. bk. Sp	do
1145	...do	6.40 p. m.	53 19 00	166 50 00	55½	bk. S. Peb	do
1166	July 22	6.39 p. m.	54 00 00	163 45 00	45	fne. gy. S	do
Dredging.							
2843	July 28	12.38 p. m.	53 56 00	165 56 00	45	bk. S. Peb	Clams; salmon
2844	...do	2.49 p. m.	53 56 00	165 40 00	54	gy. S	do
2845	July 29	7.55 a. m.	54 05 00	164 09 00	42	crs. bk. S	do
2846	July 30	7.00 a. m.	54 08 00	162 44 00	44	Gravel	do
Hyd.							
1213	...do	12.42 p. m.	54 12 00	162 17 00	47	bk. S. fne. G	do
1227	July 31	6.20 a. m.	54 56 00	160 33 00	52	gray S	Clams; salmon; sculpins
.....	Aug. 2	.....	Eagle Harbor.		.....	soft Mud	Clams; salmon
1239	Aug. 3	4.45 p. m.	54 23 00	161 56 00	34	Pebbles	do
1258	Aug. 4	2.05 p. m.	55 02 00	159 41 00	37	gy. S. and brk. Sh	do
1266	Aug. 5	7.15 a. m.	54 55 00	158 46 00	46	gy. S. and brk. Sh	Pollock; salmon
1286	...do	6.50 p. m.	54 42 00	159 24 00	36	Rocky	Salmon; pollock
1317	Aug. 7	6.25 a. m.	55 26 00	157 28 00	47	green M	do
1343	Aug. 9	5.10 a. m.	55 49 00	155 20 00	27	gy. S. brk. Sh	Pollock; cod
1350	.. do	11.21 a. m.	56 07 00	154 38 00	37	gy. S	Walrus; cod
1392	Aug. 13	9.07 a. m.	57 16 00	152 22 00	39	bk. S. G	Salmon
.....	Aug. 18	.....	St. Paul.		13	Mussels and kelp	Cod; salmon
1421	Aug. 22	9.18 a. m.	57 57 00	151 08 00	36	brk. Sh. and G	Salmon
Dredging.							
2857	...do	6.31 p. m.	58 05 00	150 46 00	51	gray S	do
Hyd.							
1436	Aug. 23	9.43 a. m.	58 23 00	150 32 00	37	brk. Sh	do
.....	Aug. 26	1.00 p. m.	Middleton Island.		.....	Rocks and kelp	do
Dredging.							
2867	Sept. 20	3.00 p. m.	48 07 00	124 55 00	37	fne. gy. S	do
2868	Sept. 21	10.00 a. m.	47 52 00	124 44 00	31	gy. S	Salmon; clams
2870	Sept. 23	6.30 a. m.	46 44 00	124 32 00	58	Rocky	do
2872	Sept. 24	7.30 a. m.	48 17 00	124 52 00	38	gy. S	Salmon; clams; red rockfish
2873	...do	12.30 p. m.	48 30 00	124 57 00	40	Rocky	Salmon; red rockfish
.....	...do	Over night	Neeah Bay.		20	Rocky	Salmon; halibut
2876	Sept. 25	10.15 a. m.	48 33 00	124 55 00	59	blk. S. and M	do
2878	...do	3.00 p. m.	48 37 00	125 32 00	66	Peb	Salmon; halibut; red rockfish
2879	Sept. 26	5.30 a. m.	48 53 00	125 53 00	34	Rocky	do
2881	...do	11.15 a. m.	49 00 00	125 48 00	24	gy. S	do
.....	Sept. 28	Over night. 7.00 p. m.	Barclay Sound.		.....	Rocks and slime	Salmon; halibut
Hyd.							
1577	Oct. 11	3.45 p. m.	46 34 00	124 12 00	20	gy. S	Salmon
Dredging.							
2882	Oct. 13	3.30 p. m.	46 09 00	124 22 00	68	gy. S	do
2883	Oct. 18	3.00 p. m.	Tillamook Rock.		25 to 18	Rocky	Salmon; herring
2886	Oct. 19	7.39 a. m.	43 59 00	124 56 30	50	Rocky	do

24. *Tabular statement of trials made for fish.*

No. lines used.	Length of trial.	Fish taken.	Cod.				Halibut.		
			Sexes.		Average weight.	Average length.	Sexes.		Average weight.
	Minutes.		♂	♀	*Pounds.*	*Inches.*	♂	♀	*Pounds.*
1	29	2 cod	1	1	11¾	21			
2	23	3 cod	2	1	8	27			
5	18	4 cod	1	3	10	28¾			
8	15	13 cod; 1 halibut; 2 flounders	7	6		26½	1		15½
8	62	21 cod; 1 halibut	8	13	11¾	29½	1		6½
1	20	None							
6	17	2 cod; 1 flounder; 3 halibut	2		6½	24	1	2	20
6	20	25 cod	11	14	11¾	28			
7	15	10 cod; 2 halibut	4	6	11	23½	1	1	14½
9	29	6 cod; 1 halibut	1	5	8½	25	1		30
9	25	9 cod; 3 flounders	3	6	11	30			
(*)		6 cod; 3 halibut	2	4	8½	26¾		3	14½
9	15	2 cod; 5 halibut	1	1	8½	23¾	3	2	9¾
9	15	1 halibut							4
8	20	1 halibut; 3 sculpins						1	5
9	35	8 cod; 3 halibut; 3 sculpins	4	4	8	26½	2	1	18½
9	40	None							
7	25	15 cod	10	5	9½	23¾			
9	38	47 cod	20	27	10	28½			
9	50	69 cod	25	44	12	30½			
(†)		2 cod; 1 halibut; 2 salmon	1	1	10	20½		1	22
9	18	30 cod; 1 halibut	18	12	8½	27		1	10
9	15	2 cod; 4 flounders	1	1	8½				
8	18	3 cod	3		5½				
6		2 halibut					1	1	53
(‡)	120	1 halibut; 8 sharks; 3 dogfish						1	140
(‡)	180	1 skate; 3 dogfish; 2 red rockfish							
(‡)	180	10 red rockfish; 2 black cod; 4 sharks							
(‡)	120	2 sharks; 1 star fish							
(‡)	120	4 halibut; 4 red rockfish; 1 shark					1	3	47¼
(‡)		21 dogfish; 2 skates							
(‡)	120	2 halibut; 1 red rockfish; 9 dogfish					1	1	55
(‡)	120	3 black cod; 2 ground sharks; 2 common sharks; 15 dogfish.							
(‡)	180	1 halibut; 2 sharks; 3 dogfish						1	25
(‡)	120	1 halibut; 5 dogfish; 1 shark; 1 skate						1	15
(§)		1 red rockfish; 28 dogfish							
9	12	None							
(§)	60	1 black cod; 4 dogfish							
(‖)	90	7 dogfish							
(‖)	150	1 halibut; 1 shark; 1 black cod; 1 dogfish					1		10½

* 1 trawl (500) hooks. ‡ 1 trawl line. ‖ Cod and halibut trawl.

† 1 trawl (400) hooks. § Cod trawl.

25. *Record of temperatures and water densities by the steamer Albatross, July 1 to December 31, 1888.*

Date.	Time of day.	Latitude north.	Longitude west.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temperature of specimen at time specific gravity was taken.	Specific gravity.	Specific gravity reduced to 60° F.
1888.		° ′ ″	° ′ ″		°	°	°		
July 4	12 m	Off Ballenas Point.		Surface	59	63	70	1.0240	1.025450
4	6 p. m.	38 26 00	123 00 00	do	53	55	68	1.0244	1.025536
4	12 p. m.	39 04 00	123 31 00	do	50	52	68	1.0246	1.025736
5	6 a. m.	39 42 00	124 01 00	do	50	52	68	1.0246	1.025736
5	12 m	40 21 00	124 29 00	do	48	52	68	1.0250	1.026136
5	6 p. m.	40 58 00	124 32 30	do	52	55	69	1.0244	1.025687
5	12 p. m.	41 35 00	124 36 00	do	53	52	69	1.0244	1.025687
6	6 a. m.	42 12 00	124 39 30	do	50	51	69	1.0244	1.025687
6	12 m	42 50 00	124 43 00	do	48	53	69	1.0246	1.025887
6	6 p. m.	43 23 00	124 34 00	do	49	53	69	1.0244	1.025687
6	12 p. m.	43 56 00	124 23 00	do	48	54	69	1.0232	1.024487
7	6 a. m.	44 29 00	124 15 00	do	51	56	69	1.0232	1.024487
7	12 m	45 04 00	124 04 00	do	50	55	69	1.0232	1.024487
7	6 p. m.	45 50 00	124 16 00	do	59	62	69	1.0226	1.023887
7	12 p. m.	46 36 00	124 28 00	do	58	59	69	1.0226	1.023887
8	6 a. m.	47 22 00	124 40 00	do	58	58	69	1.0212	1.022487
8	12 m	48 09 00	124 51 00	do	56	61	69	1.0218	1.023087
8	6 p. m.	Victoria, British Columbia.		do	52	58	69	1.0222	1.023487
9	6 p. m.	Gulf Georgia.		do	59	60	69	1.0146	1.015887
11	4 p. m.	Departure Bay.		do	64	68	69	1.0146	1.015887
11	6 p. m.	Off Departure Bay.		do	64	65	69	1.0146	1.015887
11	12 p. m.	Tribune Bay.		do	59	57	68	1.0160	1.017136
12	12 m	Johnston's Strait.		do	56	56	62	1.0224	1.022670
12	6 p. m.	Off Beaver Harbor.		do	50	55	69	1.0226	1.023887
13	12 m	Beaver Harbor.		do	55	56	68	1.0224	1.023536
13	6 p. m.	Off Cape Scott.		do	56	56	68	1.0232	1.024336
13	12 p. m.	50 56 00	129 40 00	do	55	55	68	1.0236	1.024736
14	6 a. m.	51 05 00	131 02 00	do	56	55	68	1.0236	1.024736
14	12 m	51 14 00	132 30 00	do	54	54	68	1.0236	1.024736
14	6 p. m.	51 29 00	133 40 00	do	54	55	68	1.0236	1.024736
14	12 p. m.	51 44 00	134 50 00	do	54	54	68	1.0234	1.024536
15	6 a. m.	51 59 00	136 00 00	do	53	53	68	1.0236	1.024736
15	12 m	52 15 00	137 13 30	do	52	54	68	1.0236	1.024736
15	6 p. m.	52 18 00	138 33 00	do	53	53	68	1.0236	1.024736
15	12 p. m.	52 23 00	139 43 00	do	52	53	68	1.0236	1.024736
16	6 a. m.	52 29 00	141 03 00	do	51	51	68	1.0236	1.024736
16	12 m	52 35 00	142 34 00	do	52	52	68	1.0236	1.024736
16	6 p. m.	52 37 00	143 44 00	do	52	52	68	1.0236	1.024736
16	12 p. m.	52 34 00	144 54 00	do	51	50	68	1.0236	1.024736
17	6 a. m.	52 36 00	146 04 00	do	50	50	68	1.0236	1.024736
17	12 m	52 35 00	147 35 00	do	50	49	68	1.0236	1.024736
17	6 p. m.	52 26 00	148 29 00	do	50	50	68	1.0236	1.024736
17	12 p. m.	52 17 00	149 43 00	do	50	49	68	1.0236	1.024736
18	6 a. m.	52 08 00	150 57 00	do	50	49	68	1.0240	1.025136
18	12 m	51 58 00	152 12 00	do	51	51	68	1.0240	1.025136
18	6 p. m.	52 04 00	153 35 00	do	51	52	68	1.0240	1.025136
18	12 p. m.	52 10 00	154 58 00	do	50	51	68	1.0240	1.025136
19	6 a. m.	52 15 00	156 37 00	do	51	51	68	1.0240	1.025136
19	12 m	52 11 00	157 44 00	do	49	50	68	1.0240	1.025136
19	6 p. m.	52 13 00	158 58 00	do	48	50	68	1.0238	1.024936
19	12 p. m.	52 11 00	160 12 00	do	49	50	68	1.0240	1.025136
20	6 a. m.	52 15 00	161 40 30	do	50	50	68	1.0240	1.025136
20	12 m	52 25 00	162 40 00	do	50	55	68	1.0240	1.025136
20	6 p. m.	52 18 00	163 54 00	do	50	54	68	1.0240	1.025136
20	12 p. m.	52 20 00	165 00 00	do	50	52	68	1.0238	1.024936
21	12 m	52 50 00	166 42 00	do	50	52	68	1.0238	1.024936
21	6 p. m.	53 19 00	166 50 00	do	50	53	68	1.0236	1.024736
21	12 p. m.	53 16 00	166 10 00	do	49	51	68	1.0234	1.024536
22	6 a. m.	53 39 00	165 04 00	do	48	50	69	1.0232	1.024487
22	12 m	53 40 00	164 28 30	do	50	52	69	1.0234	1.024687
22	6 p. m.	54 00 00	163 45 00	do	50	51	69	1.0234	1.024687
22	12 p. m.	54 13 00	164 02 00	do	49	51	69	1.0236	1.024887
23	6 a. m.	54 22 00	165 34 30	do	45	50	69	1.0236	1.024887
23	12 m	54 10 00	166 13 00	do	45	52	69	1.0232	1.024487
23	6 p. m.	Unalashka Harbor.		do	52	59	69	1.0202	1.021487
28	12 m	53 56 00	166 07 00	do	50	52	68	1.0240	1.025136
28	6 p. m.	53 55 00	165 05 30	do	52	52	68	1.0236	1.024736
28	12 p. m.	53 55 00	164 22 00	do	50	50	68	1.0234	1.024536
29	6 a. m.	54 02 30	163 53 30	do	51	52	68	1.0234	1.024536
29	12 m	54 11 00	164 46 00	do	50	51	68	1.0234	1.024536
29	6 p. m.	54 22 00	164 01 00	do	49	51	68	1.0234	1.024536
29	12 p. m.	54 18 00	163 18 00	do	50	51	68	1.0234	1.024536
30	6 a. m.	54 09 00	162 58 00	do	50	51	68	1.0234	1.024536

25. *Record of temperatures and water densities by the steamer Albatross, etc.*—Continued.

Date.	Time of day.	Latitude north.	Longitude west.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temperature of specimen at time specific gravity was taken.	Specific gravity.	Specific gravity reduced to 60° F.
1888.		° ′ ″	° ′ ″		°	°	°		
July 30	12 m	54 08 00	162 43 30	Surface	50	51	68	1.0234	1.024536
30	6 p. m.	54 31 00	161 44 00	do	50	52	68	1.0234	1.024536
30	12 p. m.	54 42 00	161 13 00	do	49	51	68	1.0230	1.024136
31	6 a. m.	54 56 00	160 33 00	do	50	51	68	1.0230	1.024136
31	1 p. m.	Humboldt Harbor.		do	49	53	68	1.0226	1.023736
Aug. 2	12 m	Eagle Harbor.		do	51	55	68	1.0230	1.024136
3	12 m	54 44 00	161 27 30	do	51	52	68	1.0230	1.024136
3	6 p. m.	54 20 00	162 02 00	do	50	51	68	1.0230	1.024136
3	12 p. m.	54 18 00	161 34 00	do	51	52	68	1.0230	1.024136
4	6 a. m.	54 39 00	160 28 00	do	50	52	68	1.0230	1.024136
4	12 m	54 56 00	159 54 00	do	50	51	71	1.0230	1.024606
4	7 p. m.	Yukon Harbor.		do	50	52	71	1.0230	1.024606
5	12 m	54 50 00	159 08 00	do	52	52	71	1.0230	1.024606
5	6 p. m.	54 41 00	159 16 00	do	51	52	71	1.0230	1.024606
5	12 p. m.	54 34 00	159 40 00	do	50	50	71	1.0230	1.024606
6	6 a. m.	54 25 00	160 03 00	do	51	50	71	1.0230	1.024606
6	12 m	54 34 00	158 43 00	do	51	58	71	1.0230	1.024606
6	6 p. m.	55 04 00	158 48 00	do	52	53	71	1.0230	1.024606
6	12 p. m.	55 20 00	158 48 00	do	51	51	71	1.0230	1.024606
7	6 a. m.	55 25 00	157 37 00	do	50	51	71	1.0230	1.024606
7	12 m	55 45 00	158 25 00	do	51	52	71	1.0226	1.024206
7	6 p. m.	Ivanoff Bay.		do	51	55	71	1.0224	1.024006
8	6 a. m.	Off Mitrofania Island.		do	50	53	71	1.0163	1.017906
8	12 m	55 43 00	157 24 00	do	53	54	71	1.0226	1.024206
8	6 p. m.	55 37 00	156 57 00	do	51	54	71	1.0228	1.024406
8	12 p. m.	55 46 00	155 55 00	do	50	51	71	1.0230	1.024606
9	6 a. m.	55 44 00	155 14 00	do	48	50	71	1.0230	1.024606
9	12 m	56 07 00	154 39 00	do	54	58	71	1.0230	1.024606
9	6.30 p. m.	56 28 00	154 05 00	do	50	53	71	1.0230	1.024606
9	12 p. m.	56 23 00	153 24 00	do	51	53	71	1.0230	1.024606
10	6 a. m.	56 42 00	152 21 00	do	52	54	71	1.0230	1.024606
10	12 m	57 00 00	153 20 30	do	56	58	71	1.0228	1.024406
11	6 p. m.	Old Harbor, Kadiak Island.		do	58	73	71	1.0220	1.023606
12	12 p. m.	56 38 00	151 59 00	do	54	53	71	1.0234	1.025006
13	6 a. m.	57 03 00	152 10 00	do	52	53	70	1.0234	1.024850
13	12 m	57 20 00	152 13 00	do	54	53	70	1.0234	1.024850
13	6 p. m.	57 11 00	151 05 00	do	53	55	70	1.0234	1.024850
20	12 m	St. Paul, Kadiak.		do	54	60	70	1.0230	1.024450
21	6 p. m.	57 52 00	151 47 00	do	55	56	70	1.0230	1.024450
21	12 p. m.	57 19 00	150 35 00	do	56	55	70	1.0230	1.024450
22	6 a. m.	57 44 00	150 46 00	do	52	54	70	1.0232	1.024650
22	12 m	58 07 00	151 33 00	do	54	55	70	1.0230	1.024450
22	6.30 p. m.	58 05 00	150 46 00	do	56	62	70	1.0230	1.024450
22	12 p. m.	57 41 00	149 44 00	do	56	55	70	1.0230	1.024450
23	6 a. m.	58 05 00	149 48 00	do	55	59	70	1.0230	1.024450
23	12 m	58 31 00	150 56 00	do	54	57	70	1.0228	1.024250
23	6 p. m.	58 51 00	150 47 00	do	56	55	70	1.0222	1.023650
23	12 p. m.	58 21 00	149 33 00	do	56	56	70	1.0226	1.024050
24	6 a. m.	57 54 00	148 34 00	do	56	57	70	1.0230	1.024450
24	12 m	58 17 00	148 36 00	do	59	61	70	1.0226	1.024050
24	6 p. m.	58 46 00	149 17 00	do	56	57	69	1.0226	1.023887
24	12 p. m.	58 30 00	148 29 00	do	57	57	69	1.0226	1.023887
25	6 a. m.	58 37 00	147 50 00	do	58	59	69	1.0234	1.024687
25	12 m	59 06 00	147 30 00	do	58	62	69	1.0234	1.024687
25	6 p. m.	Middleton Island.		do	53	57	69	1.0226	1.023887
26	2 p. m.	59 01 00	144 22 00	do	53	59	69	1.0236	1.024887
27	6 a. m.	59 08 00	143 30 00	do	59	59	69	1.0236	1.024887
27	12 m	59 09 00	142 51 00	do	60	64	69	1.0236	1.024887
27	6 p. m.	58 56 00	142 18 00	do	60	62	69	1.0234	1.024687
27	12 p. m.	58 27 00	141 11 00	do	59	60	69	1.0234	1.024687
28	6 a. m.	58 08 00	140 21 00	do	58	56	69	1.0232	1.024487
28	12 m	57 44 00	139 30 00	do	58	56	69	1.0230	1.024287
28	6 p. m.	57 10 00	138 44 00	do	58	58	69	1.0232	1.024487
28	12 p. m.	56 36 00	137 58 00	do	58	58	69	1.0234	1.024687
29	6 a. m.	56 02 00	137 11 00	do	57	57	69	1.0230	1.024287
29	12 m	55 28 00	136 25 00	do	59	60	69	1.0230	1.024287
29	6 p. m.	54 56 00	135 47 00	do	60	65	69	1.0232	1.024487
29	12 p. m.	54 23 00	135 09 00	do	57	57	69	1.0234	1.024687
30	6 a. m.	53 52 00	134 31 00	do	57	57	69	1.0234	1.024687
30	12 m	53 18 00	133 55 00	do	57	59	69	1.0234	1.024687
30	6.30 p. m.	52 48 00	133 04 00	do	60	79	69	1.0234	1.024687
30	12 p. m.	52 22 00	132 11 00	do	58	59	69	1.0234	1.024687
31	6 a. m.	51 54 00	131 21 00	do	59	59	69	1.0232	1.024487
31	12 m	51 24 00	130 29 00	do	59	65	69	1.0234	1.024687

25. *Record of temperatures and water densities by the steamer Albatross, etc.*—Continued.

Date.	Time of day.	Latitude north.	Longitude west.	Depth.	Temperature by attached thermometer.	Temperature of the air.	Temperature of specimen at time specific gravity was taken.	Specific gravity.	Specific gravity reduced to 60° F.
1888.		° ′ ″	° ′ ″		°	°	°		
Sept. 5	6 p. m.	Burrows' Bay.		Surface	57	59	69	1.0214	1.022687
6	12 m	47 36 00	122 20 00	do	56	61	69	1.0216	1.022887
7	High water	Seattle, Wash.		do	60	68	60	1.0192	1.019200
7	Low water	Do.		do	60	59	60	1.0152	1.015200
17	4 p. m.	Port Townsend.		do	54	59	69	1.0224	1.023687
18	12 p. m.	Off Cape Flattery.		do	51	52	69	1.0230	1.024287
19	12 m	48 00 00	126 02 00	do	59	61	69	1.0230	1.024287
19	5 p. m.	47 55 00	126 29 00	do	59	61	69	1.0230	1.024287
20	12 m	48 08 00	125 02 00	do	59	59	69	1.0232	1.024487
20	6 p. m.	Off Flattery Rocks.		do	56	59	69	1.0232	1.024487
20	12 p. m.	47 59 00	125 29 00	do	59	59	69	1.0234	1.024687
21	6 a. m.	47 46 00	125 20 00	do	58	58	69	1.0230	1.024287
21	12 m	47 52 00	124 45 00	do	56	60	69	1.0226	1.023887
21	6 p. m.	47 35 00	124 53 00	do	58	63	69	1.0228	1.024087
21	12 p. m.	47 18 00	124 54 00	do	58	58	69	1.0230	1.024287
22	6 a. m.	47 00 00	124 53 00	do	56	56	69	1.0230	1.024287
22	12 m	46 48 00	124 55 00	do	59	57	69	1.0230	1.024287
22	12 p. m.	46 41 00	124 18 00	do	59	58	69	1.0220	1.023287
23	6 a. m.	46 44 00	124 32 00	do	58	58	69	1.0230	1.024287
23	12 m	46 48 00	124 54 00	do	60	58	69	1.0230	1.024287
24	6 p. m.	Neeah Bay, Wash.		do	50	59	65	1.0244	1.025090
27	12 m	Barclay Sound, B. C.		do	58	68	65	1.0192	1.019890
Oct. 13	12 m	46 08 00	124 45 00	do	62	62	65	1.0240	1.024690
14	7 a. m.	Mouth Columbia River.		do	56	56	65	1.0194	1.020090
17	12 m	Astoria, Oregon, high water.		do	59	56	65	1.0054	1.006090
17	8 p. m.	Astoria, Oregon, low water.		do	59	56	64	1.0000	1.000548
18	3 p. m.	Tillamook Rock.		do	60	62	65	1.0226	1.023290
19	12 m	43 59 00	125 03 00	do	58	60	65	1.0244	1.025090
20	2 p. m.	Cape Mendocino.		do	50	58	65	1.0250	1.025690

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26. *Record of meteorological observations by the steamer Albatross, July* 1 *to December* 31, 1888.

Date.	Latitude north.	Longitude west.	Barometer.			Thermometer, Fahrenheit.									Winds.		Weather.	Clear sky, in tenths.	Rain.
						Dry bulb.			Wet bulb.			Sur. water.							
			Highest.	Lowest.	Mean.	Highest.	Lowest.	Mean.	Highest.	Lowest.	Mean.	Highest.	Lowest.	Mean.	Direction.	Force.			
1888.	° ′ ″	° ′ ″																	
July 1	San Francisco.		30.14	29.98	30.06	71	54	62.5	65	53	59	63	58	60.5	SW	0–3½	Clear	6–9	0
2	do.		29.98	29.84	29.91	73	57	65	67	57	62	66	59	62.5	SW. and WSW.	1–2	do	7–9	0
3	do		30.02	29.90	29.96	70	57	63.5	65	57	61	62	58	60	SW	0–4	do	8–9	0
4	37 54 00	122 40 30	30.04	29.96	30.00	71	52	61.5	65	52	58.5	63	49	56	SW., NNW., WNW.	1–4	Fair	2–9	0
5	40 18 00	124 28 00	30.06	29.98	30.02	55	51	53	54	52	53	53	48	50.5	WNW., NW., NW. by N.	2–7	do	7–9	0
6	42 29 00	129 34 00	30.10	30.00	30.05	55	55	55	55	50	51.5	52	48	50	NNW., NW., N	4–7	do	8–9	0
7	45 04 00	124 04 00	30.08	29.98	30.03	62	53	57.5	60	54	57	59	47	53	N., NW., W	1–6	do	5–9	0
8	48 09 00	124 57 00	30.08	29.92	30.00	63	58	60.5	60	57	58.5	60	52	55.5	W., NW., NNW., SW.	1–4	Overcast to fair	0–9	0
9	Esquimalt.		30.16	29.98	30.07	61	54	57.5	60	54	57	64	51	55.5	SW., SE., SSE	0–6	Fair	0–8	Light.
10	Departure Bay.		30.16	30.08	30.12	69	50	59.5	68	50	59	66	53	58.5	ESE., E	0–2	do	5–9	0
11	do		30.18	29.94	30.06	69	52	60.5	67	50	58.5	66	58	62	E., NE	0–2	Clear	6–9	0
12			30.16	29.94	30.05	58	56	57	57	55	56	60	50	55	SSW. to NW	1–5	Overcast to fair	0–8	Light.
13	Beaver Harbor.		30.30	30.14	30.22	56	53	54.5	55	53	54	56	52	54	SW. to ENE	0–3	Overcast to cloudy.	0–4	Light.

26. *Record of meteorological observations by the steamer Albatross, etc.*—Continued.

Date.	Latitude north.	Longitude west.	Barometer.			Thermometer, Fahrenheit.									Winds.		Weather.	Clear sky, in tenths.	Rain.
						Dry bulb.			Wet bulb.			Sur. water.			Direction.	Force.			
			Highest.	Lowest.	Mean.	Highest.	Lowest.	Mean.	Highest.	Lowest.	Mean.	Highest.	Lowest.	Mean.					
1888.	° ′ ″	° ′ ″																	
July 14	51 19 00	132 26 00	30.34	30.26	30.30	55	54	54.5	55	53	54	56	54	55	SW. by S. to SE. by S.	2–4	Overcast, fog	0–3	Moderate.
15	52 15 00	137 13 30	30.40	30.28	30.34	54	53	53.5	54	53	53.5	54	52	53	SSW. to SE	2–4	Overcast	0–3	Light.
16	52 35 00	142 34 00	30.30	30.20	30.25	53	49	51	53	50	51.5	52	51	51.5	SW. to SE	2–5	Fog to fair	0–8	Light.
17	52 35 00	147 14 00	30.40	30.30	30.35	51	48	49.5	50	49	49.5	51	50	50.5	SW	2–3	Overcast	0–7	Light.
18	51 58 00	152 12 00	30.40	30.26	30.33	52	49	50.5	52	48	50	51	50	50.5	S. by W. to ESE.	1–3	Overcast to fair	0–5	Light.
19	52 11 00	157 44 00	30.24	30.16	30.20	51	50	50.5	51	49	50	51	48	49.5	SE. to NW	0–4	Fog	0	Light.
20	52 25 00	162 40 00	30.22	30.14	30.18	55	50	52.5	55	50	52.5	51	49	50	NNW. to ESE.	0–2	Fog to cloudy	0–2	Light.
21	52 50 00	166 42 00	30.26	30.22	30.24	54	51	52.5	53	51	52	51	48	49.5	E. to SSW.	2–3	Fog	0	Light.
22	53 40 00	164 28 50	30.30	30.20	30.25	52	50	51	52	50	51	50	48	49	SSE., SE., ESE., E.	2–3	do	0	Light.
23	54 10 00	166 13 00	30.20	29.90	30.05	58	48	53	57	48	52.5	52	45	48.5	ESE., ENE., SE	2–5	Foggy to fair	0–4	Light.
24	Iliuliuk.		29.90	29.80	29.85	58	54	56	56	53	54.5	53	52	52.5	SE., ENE., ESE	2–6	Fog, cloudy, and misty.	0–4	Light.
25	do		30.00	29.86	29.93	59	50	54.5	56	49	52.5	56	51	53.5	SE	1–5	Foggy	0–3	Light.
26	do		30.00	29.88	29.94	57	50	53.5	55	49	52	51	49	50	SE., NNW	0–2	Overcast fair	0–7	0
27	do		30.00	29.80	29.90	55	50	52.5	54	50	52	51	49	50	NE	0–2	Fog	0–	Light.
28	53 56 00	166 07 00	29.86	29.72	29.79	52	48	50	52	47	49.5	52	47	49.5	NE	0–2	do	0	Light.
29	54 11 00	164 46 00	29.90	29.86	29.88	53	50	51.5	52	50	51	52	49	50.5	NE. to SW	1–4	do	0	Mod.
30	54 08 00	162 43 30	29.86	29.79	29.82	52	50	51	51	50	50.5	50	49	49.5	SE	3–4	do	0	Light.
31	55 17 00	160 31 00	29.86	29.72	29.79	53	51	52	53	51	52	51	49	50	S. to SE	2–4	do	0	Mod.
Aug. 1	55 20 00	160 32 00	29.90	29.78	29.84	55	52	53.5	55	52	52.5	51	50	50.5	SE. and SSE	2	do	0–4	Light.
2	55 07 00	160 04 30	30.18	29.76	29.92	59	51	55	58	51	54.5	51	49	50	SE. to NW	0–4	Fog, fair	0–7	Light.
3	54 44 00	161 27 30	30.24	30.10	30.17	56	50	53	55	49	52	51	49	50	SE., ESE	0–3	Fair, foggy	7–0	Light.
4	54 56 00	159 54 00	30.30	30.10	30.20	53	51	52	53	49	51	51	47	49	SW	3–5	Fog, fair	0–5	Light.
5	54 50 00	159 08 00	30.50	30.30	30.40	54	50	52	53	49	51	52	48	50	SE. to SW	1–4	Fair	9–1	Light.
6	54 34 00	158 43 00	30.54	30.50	30.52	58	50	54	56	50	53	53	50	51.5	SSW	2–3	Overcast, fair	0–7	0
7	55 45 00	158 25 00	30.50	30.38	30.44	55	50	52.5	54	49	51.5	52	50	51	SSW	1–3	Fair	0–6	0
8	55 43 00	157 24 00	30.38	30.30	30.34	57	53	55	56	52	54	53	50	51.5	SSW	0–3	Fog	0	Light.
9	56 07 00	154 39 00	30.30	30.26	30.28	58	50	54	57	50	53.5	54	48	51	WSW	1–3	Fog, fair	0–9	Light.
10	57 00 00	153 20 30	30.32	30.24	30.28	73	52	61.5	73	51	61	58	51	54.5	SW., WSW	0–3	Clear	7–9	0
11	57 01 00	155 12 00	30.42	30.32	30.37	67	51	59	66	51	58	60	51	55.5	SSW	0–2	do	6–10	0
12	Old Harbor, Kadiak.		30.58	30.44	30.51	60	52	56	59	52	55.5	56	53	54.5	SW	0–4	Fog, fair	0–9	Light.
13	57 20 00	152 13 00	30.56	30.48	30.52	57	51	54	56	50	53	54	49	51.5	SW	3–4	do	0–9	Light.
14	St. Paul, Kadiak.		30.48	30.32	30.40	63	51	57	60	53	56.5	55	49	52	SW	0–3	Fog, clear	0–10	0
15	do		30.32	30.10	30.21	69	51	60	66	51	58.5	55	49	52	SW	0–2	Fair	4–9	0
16	do		30.10	29.84	29.97	57	53	55	57	52	54.5	53	51	52	NE. to SE	0–2	*Fair, fog*	8–0	Light.
17	do		29.80	29.58	29.69	63	52	57.5	59	50	54.5	54	50	52	ESE. to ENE	1–2	Foggy to fair	0–6	Light.
18	do		29.64	29.5	29.61	57	54	55.5	56	54	55	52	51	51.5	N	2–4	Fog	0	Light.
19	do		29.90	29.64	29.77	60	53	56.5	57	52	54.5	54	51	52.5	N	1–2	Fog to fair	0–6	Light.
20	do		30.00	29.90	29.95	61	53	57	60	52	56	54	51	52.5	N. to NE	0–2	Fair	2–8	0
21	do		30.06	30.00	30.03	61	51	56	60	51	55.5	54	50	52	N. to NE. by E	0–3	Fair to overcast	9–0	0
22	58 07 00	151 33 00	30.14	30.04	30.09	68	54	61	63	53	58	57	52	54.5	N. to WSW	0–3	Fair	2–9	0
23	58 31 00	150 56 00	30.18	30.12	30.15	64	55	59.5	60	54	57	56	53	54.5	Variable	0–2	Fair to overcast	9–0	0
24	58 17 00	148 36 00	30.20	30.16	30.18	62	50	59	59	56	57.5	59	56	57.5	N. to E	0–3	Fair	3–9	0
25	59 06 00	147 30 00	30.16	29.70	29.93	64	54	59	61	54	57.5	59	53	56	ENE., N. to WNW	0–4	Overcast to fair	0–9	Light.
26	Middleton Island.		29.72	29.56	29.64	61	54	57.5	59	54	56.5	58	52	55	Variable	2–4	Fair	5–9	0
27	59 09 00	142 51 00	29.72	29.60	29.66	66	59	62.5	66	58	62	60	58	59	do	2–3	Fair to overcast	7–0	Light.
28	57 44 00	139 30 00	30.16	29.66	29.91	60	56	58	60	55	57.5	60	58	59	W., S. to ESE	0–3	Overcast to fair	0–9	Mod.
29	55 28 00	136 25 00	30.30	30.18	30.24	65	57	61	65	56	60.5	60	56	58	Variable	0–2	Fair	4–9	0
30	53 18 00	133 55 00	30.22	30.10	30.16	79	56	67.5	70	56	64	60	57	58.5	NNW., SW	1–4	Overcast to fair	0–9	0
31	51 24 00	130 29 00	30.26	30.12	30.19	79	59	69	72	59	65.5	60	55	57.5	N. to WSW	0–2	Clear, foggy	9–0	0
Sept. 1	50 50 00	127 43 00	30.28	30.12	30.20	67	54	60.5	65	53	57	60	52	56	NE. to WSW	0–3	Fog, fair	0-7to9	Light.
2	50 15 00	125 25 00	30.14	29.96	30.05	79	52	65.5	73	52	62.5	69	50	59.5	W. to E	0–2	Fog, clear	0–10	0
3	Departure Bay.		30.00	29.86	29.93	70	62	66	66	61	63.5	67	60	63.5	SW., E., NE	0–3	Clear to fair	10–2	0
4	do		30.08	29.98	30.03	64	59	61.5	63	59	61	64	59	61.5	NE., E	0–2	Overcast to fair	0–8	Mod.
5	48 57 00		30.24	30.08	30.16	60	55	57.5	59	55	57	62	53	57.5	E. to SSE	0–3	Fair, overcast	8–0	Light.
6	Seattle, Wash.		30.34	30.24	30.29	70	58	64	68	57	62.5	64	52	58	Variable	0–2	Overcast, fair	0–8	0
7	do		30.32	30.12	30.22	68	58	63	65	57	61	61	54	57.5	N., W	0–3	Clear	8–10	0
8	do		30.20	30.04	30.12	68	55	61.5	66	55	60.5	62	56	59	W	0–1	Clear, foggy, fair.	10–0–8	0
9	do		30.18	30.12	30.15	64	57	60.5	64	56	60	61	56	58.5	S., SW	0–1	Foggy, clear	0–10	0
10	do		30.16	29.92	30.04	73	51	62	65	52	58.5	60	55	57.5	N., W	0–4	Clear	9–10	0
11	do		29.96	29.82	29.89	72	51	61.5	67	51	59	62	56	59	SE., W	0–2	Fair, fog	9–0	0
12	do		30.04	29.88	29.96	70	54	62	67	54	60.5	60	57	58.5	SE. to WSW	0–2	do	9–0	Light.
13	do		30.26	30.06	30.16	67	58	62.5	65	57	61	64	56	60	Variable	0–4	Misty to clear	0–9	Light.
14	do		30.16	29.86	30.01	76	55	65.5	70	55	62.5	61	55	58	NW., WSW., W	0–3	Clear	10	0
15	do		30.00	29.84	29.92	65	59	62	63	59	61	61	55	58	W., WSW	0–2	Foggy	0	0
16	do		29.96	29.90	29.93	66	59	62.5	65	58	61.5	59	56	57.5	E. to S	0–2	Foggy and misty.	0–4	Light.
17	47 44 00	122 26 00	30.16	29.96	30.06	64	54	59	61	54	57.5	58	50	54	S. to NNW	0–4	Squally to clear	0–9	Light.
18	Port Townsend.		30.30	30.08	30.19	60	51	55.5	58	51	54.5	54	50	52	SSE., NE., N., SW., SW.	0–1	Clear, fair, misty.	10–7–0	0

26. *Record of meteorological observations by the steamer Albatross, etc.*—Continued.

Date.	Latitude north.	Longitude west.	Barometer.			Thermometer, Fahrenheit.									Winds.		Weather.	Clear sky, in tenths.	Rain.
						Dry bulb.			Wet bulb.			Sur. water.			Direction.	Force.			
			Highest.	Lowest.	Mean.	Highest.	Lowest.	Mean.	Highest.	Lowest.	Mean.	Highest.	Lowest.	Mean.					
1888.	° ′ ″	° ′ ″																	
Sept. 19	48 00 00	126 02 00	30.06	29.82	29.94	62	53	57.5	62	53	57.5	61	52	56.5	ENE., ESE., SSE., S.	2–6	Squally and misty.	0–2	Light.
20	48 08 00	125 02 00	30.02	29.84	29.93	60	56	58	61	55	58	59	56	55.5	SE. by E. to S.	2–5	Squally	0–7	Light.
21	47 52 00	124 45 00	30.34	30.02	30.18	63	58	60.5	62	58	60	59	56	57.5	Variable	1–3	Fair to clear	5–9	Light.
22	46 48 00	124 55 00	30.40	30.32	30.36	60	56	58	59	55	57	60	56	58	NNW. to NNE.	2–4	Clear to fair	10–7	0
23	46 48 00	124 54 00	30.50	30.42	30.46	63	57	60	62	57	59.5	62	58	60	WNW. to NE	2–4	Clear	8–10	0
24	48 27 00	124 56 00	30.50	30.36	30.43	63	55	59	59	55	57	58	50	54	NW. by N. to ENE	1–4	do	8–10	0
25	48 33 00	125 14 00	30.34	30.14	30.24	67	55	61	63	54	58.5	59	49	54	WNW. to E	0–3	do	10	0
26	49 00 00	125 48 00	30.14	30.02	30.08	74	56	65	68	56	62	62	54	58	N to ESE	0–1	do	10	0
27	Barclay Sound, British Columbia.		30.04	29.94	29.99	84	59	71.5	71	59	65	60	57	58.5	Variable	0–1	do	10	0
28	do		30.18	30.04	30.11	60	55	57.5	60	55	57.5	59	57	58	do	0–1	Foggy to clear	0–9	0
29	48 27 00	125 09 00	30.16	30.08	30.12	58	53	55.5	57	52	54.5	58	52	55	NE., SE., S., SSW.	0–3	Foggy	0–4	Light.
30	48 13 00	123 32 00	30.20	30.14	30.17	58	54	56	57	54	55.5	54	51	52.5	NNE., SSE	0–2	do	0	0
Oct. 1	47 44 00	122 26 00	30.20	30.14	30.17	62	57	59.5	61	56	58.5	60	53	56.5	SE., WSW	0–1	do	0	0
2	Seattle, Wash.		30.14	30.08	30.11	63	59	61	62	58	60	60	57	58.5	SW., WSW	0–2	Overcast	0	0
3	do		30.08	30.00	30.04	63	57	60	62	56	59	61	56	58.5	SW	0–1	Foggy, fair, clear.	0–7–10	0
4	47 43 00	122 27 00	30.08	29.94	30.01	63	53	58	61	52	56.5	58	52	55	NW., to NE	0–2	Fair	8–9	0
5	Port Townsend, Wash.		29.98	29.80	29.89	65	52	58.5	61	51	56	55	50	52.5	NE., WNW	0–2	Fair to clear	7–10	0
6	Victoria Harbor, British Columbia.		30.02	29.88	29.95	58	53	55.5	59	52	55.5	53	50	51.5	SSE., NNE., NW., NE.	0–2	Clear to overcast	10–0	Light.
7	48 59 00	123 24 00	30.04	29.94	29.99	58	52	55	57	51	54	57	50	53.5	NW., NNE. to SSE.	0–2	Overcast	0–5	Moderate.
8	Departure Bay, British Columbia.		30.22	29.94	30.08	60	51	55.5	59	50	54.5	57	52	54.5	Variable	0–3	Overcast to fair	0–8	Light.
9	do		30.26	30.20	30.23	63	51	57	61	49	55	56	51	53.5	do	0–3	Fair to overcast	8–0	Light.
10	48 39 00	123 15 00	30.28	30.22	30.25	55	51	53	64	50	57	55	49	52	do	0–3	Overcast to fair	0–8	Light.
11	47 03 00	124 20 00	30.22	29.80	30.01	61	54	57.5	61	53	57	60	55	57.5	E. by N. to S	1–7	Fair to overcast	8–0	Light.
12	46 07 00	125 14 00	30.34	29.84	30.09	61	58	59.5	60	56	58	63	59	61	SE. to WNW	3–8	Squally, fair	2–6	Light.
13	46 08 00	124 45 00	30.40	30.38	30.42	64	57	60.5	60	54	57	62	56	59	WNW. to SE	0–4	Overcast to fair	0–8	Light.
14	Astoria, Oregon.		30.40	30.22	30.31	63	56	59.5	60	55	57.5	61	56	58.5	Variable	0–3	do	0–8	Light.
15	do		30.20	29.96	30.08	63	54	58.5	60	53	56.5	62	57	59.5	do	0–2	do	0–7	Light.
16	do		30.02	29.94	29.98	71	55	63	64	53	58.5	60	57	58.5	do	0–3	Overcast	0–2	Light.
17	do		30.38	30.04	30.21	71	50	60.5	63	49	56	61	57	59	NW. to W., E.	1–4	Overcast to clear.	0–9	0
18	46 14 00	124 03 00	30.38	30.04	30.21	62	49	55.5	61	49	55	61	55	58	N. to SSE	0–4	Fair	2–7	0
19	43 59 00	125 03 00	30.36	30.08	30.22	68	56	62	64	54	59	60	57	58.5	Variable	0–3	Overcast to clear.	0–10	Light.
20	40 42 00	124 52 00	30.36	30.16	30.26	63	55	59	61	54	57.5	59	50	54.5	N. to NW	3–6	Fair to clear	7–10	0
21	37 49 00	122 28 30	30.16	30.02	30.09	75	54	64.5	70	53	61.5	63	52	57.5	W. to NNE	1–4	Clear	9–10	0

27. OBSERVATIONS OF WIND, WEATHER, AND BAROMETER.

From the 1st to the 4th of July daily sea breezes prevailed in San Francisco from the southwest with clear weather, the barometer ranging from 29.84 to 30.06.

Leaving port on the latter date, we carried a light southwest wind nearly to Point Reyes, where it hauled to the northward and westward, increasing to a moderate gale the following day, with a heavy head sea.

It moderated after we passed 45° 00′ 00″ north latitude, and in the Straits of Fuca we had a fresh breeze from southwest to southeast. It was fair to clear weather, except in the region of Cape Flattery and the Straits of Fuca, where it was partially overcast.

Light to moderate southeast to southwest winds with generally fair weather prevailed in the inland waters of British Columbia from the 10th to the 13th of July,

although some portion of each day was foggy. The barometer ranged from 29.94 to 30.30.

From Vancouver Island to Unalashka, light to moderate southwest and southeast winds were encountered until the 20th, and easterly winds thence to port, where we arrived on the 23rd. The weather was misty at all times, and frequently overcast or foggy, the sun appearing at intervals, however, until the 20th, after which a dense fog prevailed. Light rain fell during some portion of each day. The barometer was high during the prevalence of southwest winds, ranging from 30.16 to 30.40, but fell gradually to 29.80, with winds from the eastward.

Easterly winds and foggy, rainy weather prevailed in Iliuliuk until the 28th, although the sun came out brightly on one or two occasions. The barometer ranged from 29.72 to 30.00.

It partially cleared for a few hours on the afternoon of the latter date, then the fog shut down until our arrival in Humboldt Harbor on the 31st. The winds were from northeast to southeast, light to moderate, the barometer ranging from 29.90 to 29.72. A breeze came out from northwest on the following day, and from 6 a. m. to meridian it was clear, but a change to southeast brough. the fog in again for the remainder of the day.

It cleared for an hour on the morning of the 2nd, shut in again until noon, then cleared for several hours during the afternoon.

August 3 was clear most of the time until 2 p. m., when the fog shut in for the remainder of the day. The winds continued from the eastward until the 4th, then hauled to southwest with rising barometer and clearing weather.

They held in the same quarter from light to moderate in force until August 15, the day following our arrival in St. Paul, Kadiak. Four days were fair or clear, six days foggy, with clear weather at intervals, and one day of dense fog. Rain fell on five days, very light, however, little more than a heavy mist. The barometer ranged from 30.10 to 30.58.

We remained in St. Paul until the 21st, north to east winds prevailing. The weather was generally fair with intervals of fog and rain. A dense fog prevailed during the 18th, wind north, light to moderate, the barometer falling to 29.58. Light rain fell during four days.

Light northerly winds prevailed until our arrival at Middleton Island on the 25th. The weather was generally fair, although there were intervals of fog on two days; barometer from 30.20 to 29.70, falling to 29.56 the following day, yet the weather continued clear and pleasant, except two or three hours of fog in the evening. Light rain fell on the 25th.

Leaving the island on the evening of the 26th, we had light variable winds and frequent calms until our arrival in Departure Bay on the morning of September 3. The weather was generally fair, with intervals of fog, except on two days, which were from fair to clear. Light rains are recorded on two days and moderate rain one day. The barometer ranged from 29.60 to 30.30.

Leaving port on the morning of September 5, we had rainy, misty weather during the day, and overcast, partially foggy weather the following morning, clearing after we entered Puget Sound. We arrived in Seattle during the afternoon, where we remained until the 17th. Light variable winds and frequent calms prevailed, with generally fair weather, although the mornings were foggy as a rule, and light rains occurred on five days, usually at night or early morning. Barometer 29.82 to 30.34.

We left Port Townsend on the 18th of September and cruised off the coast of Washington Territory until the 23rd, and Vancouver Island until the 29th, finally returning to Seattle October 2. Light variable winds prevailed on the day of our departure, followed by a moderate gale from southeast the following day, variable winds on the 21st, light to moderate breeze from northwest to northeast until the 26th, and light variable airs with frequent calms until our return to port. The first three days were misty or rainy, followed by six fair or clear days, then five days of continuous fog, light rain falling during four days. The barometer ranged from 29.82 to 30.50.

Light variable winds with fair weather prevailed in Seattle from October 2 to 4, light northeast to west-northwest winds in Port Townsend on the 5th, with clear weather. Variable winds and light rain were encountered in Victoria, British Columbia, on the 6th. Fair weather prevailed at Departure Bay from the 7th to the 10th, with intervals of fog and rain. The same conditions prevailed on the 11th in the Straits of Fuca and off Cape Flattery, and on the 12th a fresh gale from southeast to west-northwest occurred off the Columbia River, followed by moderate winds from west-northwest on the 13th, light rain having fallen every day since the 6th. Light variable winds and frequent calms with partially clear weather prevailed in Astoria, Oregon, from the 14th to the 18th. Light rains fell on three days. The same conditions prevailed on the 19th on Heceta Bank, followed on the 20th by a moderate gale from northwest to north, moderating the following day as we approached the harbor of San Francisco.

The barometer was very unsteady from the 1st of October, oscillating between 29.80 and 30.46, the average being 30.12.

Attention is called to the meteorological table on pages 82 to 84 of this report where the extreme and mean climatic conditions are recorded for each day.

28. OBSERVATIONS RELATIVE TO OCEAN CURRENTS.

From San Francisco to the Straits of Fuca the currents were to the southward and eastward, in the general direction of the coast line, and averaged 15 miles per day.

Tidal influences only were felt through the inland passages of British Columbia; and from the north end of Vancouver Island to 143° 00′ 00″ west longitude the set was northerly, about 13 miles per day. It then changed to the southward and eastward (about S. 22° E.), averaging 8 miles per day until we reached the island of Unalashka, near its western end. Thence to Unimak Pass it was about N. 75° W. one-half mile per hour.

From the pass to Unalashka we were near the land and affected by tidal influence.

The same may be said when on leaving port we steamed through Unalga Pass and to the eastward parallel with the islands until we took a departure for Ugomok.

A current of about one-half mile per hour N. 70° W. was encountered in running a line of soundings 45 miles off shore and returning. It may have been the result of tides, as the vessel was within their influence several hours.

Steaming across Unimak Pass to Promontory Cape the tide only was noticed. Thence to the east side of the Sannakhs a current of three fourths mile per hour was encountered setting to the northward and eastward, and between the latter group and the Shumagins the set was in the same direction, about one-half mile per hour.

Strong tides were found among the islands of the above group.

A subsequent run from the Sannakhs to Bird Island on August 4, developed a current of 1 knot per hour S. 68° W., so it will be seen that the currents are not uniform, and it is more than probable that they are affected by the tides.

While engaged in sounding off the east and south shores of the Shumagins, from Atkin Island to Chernabour, a current of seven-tenths mile per hour was found setting S. 53° E.; and from Castle Rock N. 84° E. 65 miles, thence to Mitrofania Island we found it was setting N. 18° W., about one-half mile per hour.

From Mitrofania Island to Light-house Rocks, and thence to Trinity Islands, the current was about N. 78° E., three-fourths mile per hour.

We were within the influence of the tidal streams much of the time while off the east coast of Kadiak, which affected us more or less according to our distance from land, and made it difficult to determine the amount of drift. The resultant of tides and currents indicated a set of about one-fourth mile per hour to the northward and eastward.

On Portlock Bank north and east from Kadiak we found a current of four-tenths mile per hour S. 24° W. to longitude 151° 00′ 00″ W., S. 65° W. three-tenths mile per hour to 148° 30′ 00″ W., and S. 10° E. four-tenths mile per hour to 147° 30′ 00″ W., increasing in force and taking a more easterly direction as we approached Middleton Island.

From the island to the reported position of Pamplona Rocks, and thence to latitude 55° 30′ 00″ north, the current was to the northward and westward, averaging six-tenths mile per hour, and S. 60° W. one-half mile per hour to the south end of the Queen Charlotte Islands when we again came within the influence of the tides.

From September 19 to October 21, between Cape Flattery and San Francisco, the current was to the southward and eastward, averaging about three-tenths mile per hour, except during one day off Gray's Harbor and Shoalwater Bay, where it set north four-tenths mile per hour.

29. PARTIAL LIST OF HARBORS AND ANCHORAGES BETWEEN KADIAK ISLAND AND UNALASHKA ISLAND.

The following list of harbors and anchorages is inserted in this report chiefly for the purpose of calling the attention of strangers to localities where vessels have found shelter. The information respecting them was obtained principally from local authorities, very few having been visited by the *Albatross*. In dealing with this information it should be borne in mind that the vessels navigating the regions in question are for the most part light, handy schooners, and the availability of a harbor is very apt to be considered with reference to the craft in which the informant has been in the habit of sailing. Some of the harbors are designated as good for all classes of vessels, and here again a word of caution may be necessary, as the largest vessel ever seen among the islands was probably a sloop-of-war.

The positions given are approximate, and are only intended as a guide to enable the navigator to recognize localities in case of confusion or absence of names on his chart. The list is arranged with reference to longitude, from east to west. Too much dependence should not be placed on any of the charts of this region, as very few accurate surveys have been made, and most of the data are from the reconnaissances of early Russian navigators. The eye and the lead will continue to be the most reliable guides until the region has been properly surveyed.

List of harbors and anchorages.

Latitude N.	Longitude W.	Harbors and anchorages.
° ′ ″	° ′ ″	
57 37 00	152 00 00	Cape Greville to Low Cape, Kadiak Island. Anchorage may be found near the shore protected
57 26 00	152 09 00	from northerly winds.
57 37 00	152 05 00	Chiniak Bay, Kadiak Island. Anchorage protected from winds from west to southeast.
57 47 57	152 21 21	Harbor of St. Paul, Kadiak Island. Outer and inner harbor, the former good for all classes. See Coast Survey chart No. 776.
57 24 00	152 08 00	Ugak Island. Anchorages on northwest and northeast extremities of the island, on either side of the sand point.
58 12 00	152 18 00	Ujut Bay, Afognak Island. Good harbor for all classes of vessels on the west side of the bay.
57 55 00	152 25 00	Narrow Strait. Anchorage for all classes, off the settlement near the west end of Spruce Island, between it and Kadiak.
57 28 00	152 36 00	Ugak Bay, Kadiak Island. Good harbor for all classes. There are rocks in the entrance which are easily avoided in moderately clear weather.
57 58 00	152 48 00	Between Kadiak, Afognak, Raspberry, and Whale Islands, at the eastern end of Northern Strait. Good anchorage for all classes.
57 10 00	152 57 00	Port Hobron, Sitkalidak Island. The second bay inside Cape Barnabas. Good harbor for all classes. There are other harbors on the northeast and southwest sides of the island.
57 18 00	153 00 00	Kiliuda Bay, Kadiak Island. Good harbor for all classes. Several good harbors in the bay.
57 11 00	153 13 00	Old Harbor, Kadiak Island. A good harbor for all classes. Surrounded by land of moderate elevation, and not liable to violent squalls. It lies in the strait north of Lisiansky Bay off an Indian village formerly called Old Village, now called Three Saints by the natives.
57 09 00	153 17 00	Lisiansky Bay, north of Bay of Three Saints. Good harbor for all classes. It lies between the Bay of Three Saints and Old Harbor.
57 10 00	153 20 00	Bay of Three Saints, Kadiak Island. Good harbor for all classes, but it is surrounded by high land and subjected to furious "woollies" (squalls) in bad weather.
57 00 00	153 20 00	Kiyavak Bay, Kadiak Island. There are several anchorages in this bay.
56 51 00	153 40 00	Alsentia Bay, Kadiak Island. Anchorage for all classes, but open to northeast winds when a heavy swell rolls in.
56 43 00	153 58 00	Russian Harbor, Kadiak Island. Good harbor for all classes.
56 29 00	154 00 00	Trinity Islands, south of Kadiak. Anchorage may be found off the islands in good weather, but they have no harbors. Tugidak is very low with shoal water extending some distance from the shore.
55 53 00	155 24 00	Chirikoff Island. See Coast Survey chart No. 786. Anchorage near northeast extremity.
55 48 00	155 33 00	Chirikoff Island. See Coast Survey chart No. 796. Anchorage off southwest extremity.
57 08 00	156 18 00	Agripin Bay, mainland. Good harbor for small vessels.
57 05 00	156 28 00	Port Wrangel, mainland. Good harbor for all classes.
56 02 00	156 41 00	Chowee-et Island, Semidi Islands. Anchorage for all classes under northeast end of island. See Coast Survey chart No. 786.
56 01 00	156 44 00	Chowee-et Island. See Coast Survey chart No. 786. Anchorage under northwest side of the island for all classes.
56 18 00	156 51 00	Aghik Island, Semidi Islands. Anchorage for all classes on the east side of the island. See Coast Survey chart No. 786.
56 18 00	156 55 00	Aghik Island. See Coast Survey chart No. 786. Anchorage for all classes on the west side of the island.
56 24 00	158 07 00	Chignik Bay, mainland. There are several anchorages in the bay, the best one being under Southwest Point. The outer one between Chankliut Island and the Point. See Coast Survey chart No. 797.
55 57 00	158 39 00	Mitrofania Bay, mainland. Mitrofania Harbor, first bay on the east side of the entrance to Mitrofania Bay. Good harbor for all classes. Fish Ranch Bay, second bay on east side of entrance to Mitrofania Bay. Anchorage for all classes. Open to southerly winds.
55 58 00	158 47 00	Long Beach. West side of Mitrofania Bay. Anchorage for all classes. Open to southerly winds.
55 52 00	159 05 00	Chiachi Island. Anchorage for all classes on the northeast and north sides of the islands. See Coast Survey chart No. 798.
55 52 00	159 08 00	Chiachi Island. See Coast Survey chart No. 798. Anchorage for all classes on northwest side of the island.
54 55 30	159 15 03	Simeonoff Island, Shumagin Group. Simeonoffsky Harbor. Good for small vessels, but difficult of entrance. See Coast Survey chart No. 808.
55 46 00	159 18 00	Jacob Island. Harbor at north end of Jacob Island, between it and Paul Island. Good for all classes.
54 56 00	159 19 00	Twelve Fathom Straits, Shumagin Islands. Anchorage for all classes with protection from easterly winds. See Coast Survey chart No. 806.
55 02 00	159 21 00	Little Koniushi, Shumagin Group. Sandy Cove. Good anchorage for all classes. Open to easterly winds. See Coast Survey chart No. 806.
55 49 00	159 21 00	Alexander Point, mainland. Anchorage on the east side of the Point for 10 miles. Small islands break the swell.
54 58 25	159 22 18	Northeast Harbor, Little Koniushi, Shumagins. Good harbor for all classes. See Coast Survey chart No. 808.
55 03 18	159 23 25	Northwest Harbor, Little Koniushi. Good harbor for all classes. See Coast Survey chart No. 756.
55 33 00	159 27 00	Ivanoff Bay, mainland. Good harbor for all classes.
55 04 00	159 30 00	Big Koniushi Island, Yukon Harbor. Good for all classes. Anchorage may be had in many places on both sides of Big Koniushi Island. See Coast Survey chart No. 756.
54 46 00	159 31 00	Chernabour Island, Shumagin Group. Anchorage on east side of island. Open to all except westerly winds.
55 44 00	159 42 00	Fox Bay, mainland. Harbor for all classes. Partially exposed to westerly winds.
55 37 00	159 46 00	Boulder Bay, mainland. Anchorage for small vessels. Protected from easterly winds.
55 08 00	159 48 00	Mist Harbor, Nagai Island, Shumagin Group. Good harbor for small vessels.
55 06 00	159 55 00	East Bight, Nagai Island. Good harbor for small vessels. Anchorages may be found in many places on either side of Nagai, near the island.
55 07 36	159 56 06	Sanborn Harbor, Nagai Island. Excellent harbor for all classes. It is a deep bay surrounded by high land, and sailing vessels avoid it on account of frequent and long-continued calms. See Coast Survey chart No. 813.

List of harbors and anchorages.—Continued.

Latitude N.	Longitude W.	Harbors and anchorages.
° ′ ″	° ′ ″	
55 08 00	160 03 00	Eagle Harbor, Nagai Island. Excellent harbor for all classes. See Coast Survey chart No. 808.
55 03 30	160 06 00	Falmouth Harbor, Nagai Island. Excellent harbor for all classes. See Coast Survey chart No. 808.
55 28 00	160 10 00	Korovin Island. Anchorage under northeast end of the island. Open to the northward and eastward.
55 22 00	160 19 00	Popoff Island. Pirate Cove. Good harbor for small vessels.
55 17 00	160 24 00	Popoff Island. Red Cove. Anchorage for all classes. Open to south and southwest. See Coast Survey chart No. 814.
55 11 00	160 30 00	Delaroff Harbor, Unga Island, Shumagin Group. For all classes. Open to southeast winds which send in a heavy swell.
55 13 00	160 30 00	Barloff Harbor, Unga Island. Good harbor for all classes.
55 19 17	160 30 58	Humboldt Harbor, or Sandy Point, Popoff Island. Good harbor for all classes. Position given is for Sandy Point. See Coast Survey chart No. 814.
55 36 00	160 35 00	Portage Bay, mainland. Good harbor for all classes.
55 20 45	160 38 39	Coal Harbor, Unga Island. Good harbor for all classes. Position given—east extremity of Round Island. See Coast Survey chart No. 815.
55 21 00	161 10 00	Coal Bay, mainland. Good harbor for all classes.
55 13 00	161 23 00	Wosnesensky Island. Anchorage under the southeast end.
55 14 00	161 24 00	Wosnesensky Island. Anchorage under the northeast end.
55 07 00	161 48 00	Dolgoi Bay, Dolgoi Island. Harbor for small vessels.
55 18 00	161 56 00	Volcano Harbor, Bear Bay, mainland. Good harbor for all classes.
55 09 00	161 58 00	Nicoloffsky Anchorage, mainland. First bay north of Moss Cape. Anchorage for all classes. Open to westerly winds.
55 04 00	162 00 00	Belkovsky Anchorage, Belkovsky Bay. Good anchorage for all classes. Open to easterly winds.
55 09 00	162 07 00	Bailey's Harbor, Belkovsky Bay. Good harbor for all classes.
55 07 00	162 09 00	Kitchen Anchorage, Belkovsky Bay. Good anchorage for all classes. Open to westerly winds.
54 58 00	162 16 00	Deer Island, Fox Island. Anchorage between Deer and Fox Islands. Good for all classes.
55 05 00	162 19 00	King's Cove, mainland. Harbor for all classes.
54 25 00	162 28 00	Caton Island, Sannakh Group. Anchorage between Caton and Sannakh Islands. For small vessels. It is a dangerous locality.
54 25 00	162 40 00	Pavloff Harbor, Sannakh Island. For small vessels.
54 26 00	162 48 00	Acherk Harbor, Sannakh Island. For all classes. Open from north to northwest. See Coast Survey chart No. 756.
54 55 00	162 50 00	Amagat Island. Anchorage for all classes under the north side of the island.
54 43 00	163 09 00	East Anchor Cove, Unimak Island. Anchorage for all classes.
54 42 00	163 12 00	West Anchor Cove, Unimak Island. Anchorage for all classes.
54 44 00	163 18 00	Loras Harbor, Unimak Island. For small vessels.
54 10 00	164 57 00	Ugamok Island—Ashmiahk Island. Anchorage between the islands for all classes.
54 05 00	165 04 00	The Nook, Tigalda Island. For small vessels.
54 14 00	165 34 00	Akun Cove, Akun Island. Anchorage for all classes. Open to easterly winds.
54 04 00	165 51 00	Vulcan Cove, Akutan Island. Anchorage for all classes. Open to southerly winds.
54 07 00	165 57 00	Akutan Harbor, Akutan Island. Good for all classes. Best anchorage near the north shore.
53 50 00	166 13 00	Gull Bay, Spirkin Island. For all classes.
53 56 00	166 17 00	English Bay, Unalashka Island. Good harbor for all classes.
53 53 00	166 32 00	Unalashka Bay. Iliuliuk Harbor and several good anchorages. See Coast Survey chart No. 821.
53 43 00	166 41 00	Makushin Bay, Unalashka Island. Good harbor for all classes.
53 29 00	167 03 00	Kashuga Harbor, Unalashka Island. Good for all classes.
53 25 00	167 22 00	Chernoffsky Harbor, Unalashka Island. Good for all classes.

30. *Record of whales seen during the season of* 1888.

Date.	Time.	Position.		Species.	Date.	Time.	Position.		Species.
		Latitude north.	Longitude west.				Latitude north.	Longitude west.	
1888.		° ′ ″	° ′ ″		1888.		° ′ ″	° ′ ″	
July 17..	10 a. m	52 36 00	146 51 00	Unknown.	Aug. 23 .	Meridian	58 31 00	150 56 00	Finback.
Do....	3 p. m	52 33 00	147 49 00	Do.	Do....	....do	58 31 00	150 56 00	Killer.
Do....	4 to 6 p. m	52 23 00	148 09 00	Do.	Aug. 24 .	....do	58 17 00	148 36 00	Finback.
July 20..	Meridian	52 25 00	162 40 00	Do.	Do....	....do	58 17 00	148 36 00	Killer.
July 21..	4 to 6 p. m ..	53 02 00	166 56 00	Do.	Sept. 2 ..	4 to 8 a. m	50 31 00	126 38 00	Blackfish.
July 28..	8 a. m. to mer.	53 56 00	166 07 00	Killer.	Sept. 3 ..	Meridian	49 13 00	123 58 00	Do.
July 30..	Mer. to 4 p. m.	54 11 00	162 30 00	Unknown.	Sept. 21 .	4 to 6 p. m	47 36 00	124 46 00	Unknown.
Aug. 5 ..	8 a. m. to mer.	54 53 00	158 50 00	Do.	Sept. 22 .	5 a. m.....	47 04 00	124 39 00	Do.
Aug. 6 ..	Meridian	54 34 00	158 43 00	Do.	Sept. 23 .	10 a. m. to mer.	46 41 00	124 40 00	Do.
Do....	....do	54 34 00	158 43 00	Killer.	Oct. 7 ...	8 a. m. to mer.	48 51 00	123 22 00	Killer.
Aug. 12 .	4 to 6 p. m	56 52 00	153 08 00	Unknown.	Oct. 10 ..	... do	48 54 00	123 18 00	Unknown.
Do....	6 to 8 p. m	56 35 00	152 54 00	Do.	Oct. 13 ..	4 to 6 p. m	46 16 00	124 28 00	Do.
Aug. 13 .	Meridian	57 20 00	152 13 00	Finback.	Oct. 19 ..	Meridian	43 59 00	125 03 00	Do.
Aug. 21 .	6 to 8 p. m	57 46 00	151 32 00	Unknown.					

31. REPORT OF THE ENGINEER'S DEPARTMENT.

BY C. R. ROELKER,

Passed Assistant Engineer, U S. Navy, in charge.

The following statement shows the work done in the engineer's department of this vessel from July 1 to October 21, 1888:

Total time covered by present report	days	113
Total time the fires were lighted in main boilers	hours	2,486$\frac{50}{60}$
Total time the fires were lighted in donkey boiler	do	240$\frac{15}{60}$
Total time the engines were in operation, including time spent in sounding, dredging, getting under way, etc	hours	1,311$\frac{23}{60}$
Total time the engines were in operation, with vessel on her course	do	1,078$\frac{33}{60}$
Total revolutions made by engines with vessel on her course:		
Starboard engine	number	4,249,444
Port engine	do	4,243,530
Mean revolutions made per minute	do	65.5
Total knots run	do	8,771.1
Mean knots run per hour	do	8.13
Mean slip of screws	per cent	15.33
Weight of fuel consumed in main and donkey boilers	tons	636$\frac{1700}{2240}$
Weight of fuel consumed in steam cutters	do	2$\frac{140}{2240}$
Weight of fuel consumed in galley	do	12$\frac{1400}{2240}$
Total weight of fuel consumed	do	652$\frac{460}{2240}$
Amount of refuse in fuel consumed	per cent	15.3
Total weight of fuel consumed while engines were in operation	tons	521$\frac{200}{2240}$
Mean number of pounds of fuel consumed per hour	pounds	890
Total time the dynamo has been in operation	hours	566$\frac{23}{60}$

The main engines have worked quite satisfactorily, notwithstanding they were frequently subjected to severe strains. A single main boiler has been used at a time; up to July 13 the full grate surface of each boiler (58½ square feet) was used; after that date the grate surface was reduced to 45 square feet by bricking off 18 inches at the back of the grate in each furnace. Leaks have developed again in the bottom of the boilers, and some blisters have been formed in furnaces and back connections.

The fuel used during this cruise has been mainly Wellington and Nanaimo coal. The rapidity with which these coals ignite and produce steam is of special advantage when this vessel is engaged in sounding and dredging, and the demand for steam is intermittent and irregular. The large volumes of black smoke and soot produced are not only a source of annoyance and necessitate frequent sweeping of tubes and connections, but cause serious trouble, as the soot in the smoke-pipe ignites easily. The Wellington coal, which was mostly procured fresh from the mines at Departure Bay, Vancouver Island, gave results in steaming efficiency only slightly inferior to Welsh coal. Great precautions are necessary to prevent the spontaneous combustion of this coal in the bunkers. At Astoria, Oregon, smoke was observed to issue from the after port bunker. It was found that the rope covering on the auxiliary steam pipe was completely charred, and that a great heat had been developed in the surrounding coal. No actual ignition of the coal had taken place. The rope covering has been removed

from all the pipes in the bunkers, and asbestus and hair-felt covering is being substituted and the pipes will be encased in wood.

The Nanaimo coal obtained at Unalashka had been stored in a closed warehouse; in steaming efficiency it was 13 per cent. inferior to Wellington coal. The Nanaimo coal taken on board at Kadiak had been left exposed to the weather, without any covering, and it appeared to have lost 18 per cent. in steaming efficiency on that account.

Thirty tons of Seattle coal, taken on board at Unalashka, were more or less mixed with the Nanaimo coal in the bunkers, so that no accurate test of its steaming efficiency could be made, but a marked falling off in the steam supply and an increase in the quantity of refuse were observed as soon as this lot of coal was used.

Twenty tons of patent fuel (Anchor brand), manufactured from Welsh coal slack, were taken on board at Esquimalt, Vancouver Island. Its steaming efficiency was about 12 per cent. less than that of good Welsh coal.

The selection of the most economical fuel depends on the cost of the fuel per ton and its steaming efficiency. In a vessel engaged in making regular passages between certain ports, the steaming efficiency is easily measured by the weight of fuel consumed per mile steamed. But when this vessel is engaged in its regular duties of sounding, dredging, and fishing, the value of the fuel must be determined by the amount of work which can be done, starting out with a full supply of fuel on board, before it is necessary to return to a base in order to replenish the supply. As the space available for the storage of fuel in the bunkers and on deck is limited, the bulk of a given weight of fuel is of importance; and as the demand for steam supply is intermittent and very irregular while the vessel is engaged in sounding, dredging, and fishing, a coal which ignites easily and produces steam rapidly, possesses considerable economic advantages.

I find that in our boilers Wellington coal, fresh from the mines, has produced about 2 per cent. less steam than an equal weight of good Welsh coal; but that about 10 per cent. more space is required to store a ton of Wellington coal than of Welsh coal. This vessel is therefore capable of carrying about twenty tons more of Welsh coal than of Wellington coal, and at our usual moderate rate of speed she would steam about 450 miles farther with the former coal. The superiority of Wellington coal, on account of the greater rapidity with which it ignites and generates steam, can not be expressed in exact figures, and varies according to the character of the work in which the vessel is engaged.

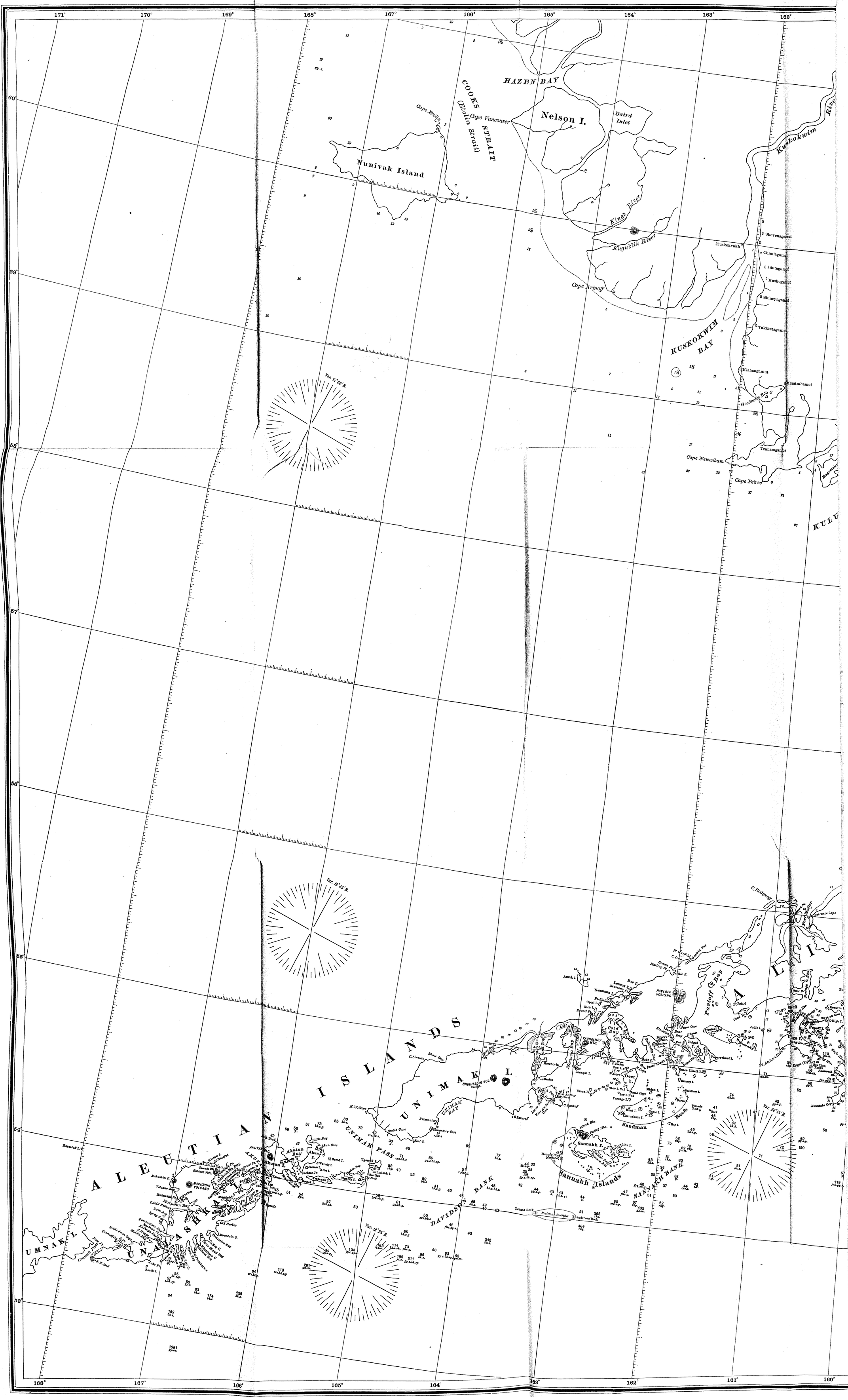
The Nanaimo and Seattle coals have about the same bulk as Wellington coal, and ignite with equal ease. The better quality of Nanaimo coal used by us was 13 per cent. inferior to Wellington coal in steaming efficiency. The relative value of the two coals, as measured by the actual useful work to be obtained from a full supply, would depend greatly on the distance of the base of supply from the field of work; the greater this distance the smaller the value of the inferior coal.

It would be wrong to draw general conclusions from the unsatisfactory results obtained by us from the small amount of Seattle coal taken on board at Unalashka. An examination of the coal shipped from the coal wharves at Seattle, Wash., disclosed great differences in character and in the amount of incombustible matter mixed with it.

Our experience with the Nanaimo coal procured at Kadiak proved how rapidly these coals deteriorate when exposed to the influence of the weather, especially in the

damp climate of western Alaska. The coal should always be procured freshly mined, if possible, and when stored for future use it should be kept in a closed house.

The only serious accident to the machinery was the breaking of the connecting-rod strap of the dynamo engine, caused by an original flaw. Fortunately no further damage was done. As the accident occurred at sea we were deprived of the use of the electric plant for nearly two weeks, until a new steel strap was obtained at Seattle, Wash. The new gypsy-head fitted to the dredging engine for the purpose of reeling in the steel hawser works satisfactorily.


171°
170°
169°
168°
167°
166°
165°
164°
163°
162°
60°
59°
58°
57°
56°
55°
54°
53°
HAZEN BAY
COOKS STRAIT
(Etolin Strait)
Cape Etolin
Cape Vancouver
Nelson I.
Baird Inlet
Nunivak Island
Kuskokwim River
Kinak River
Kuguklik River
Kuskokvakh
Shevenagamut
Chimlagamut
Iliutagamut
Kuskogamut
Shineyagamut
Takiketagamut
KUSKOKWIM BAY
Klahnagamut
Mumtrahamut
Goodnews Bay
Tzaharagamut
Cape Newenham
Cape Peirce
Cape Avinoff
Var. 16°50' E.
Var. 19°45' E.
Var. 18°25' E.
Var. 20°15' E.
ALEUTIAN ISLANDS
UNIMAK I.
SHISHALDIN VOL. 9372 ft.
UNIMAK BAY
UNIMAK PASS
Scotch Cape
Akutan Bay
Akutan I.
AKUTAN VOLCANO
Little Bay
Akun Cove
Akun I.
Broad I.
Warrely I.
Jackass I.
Pan I.
Jackass Ft.
Ugamak I.
Ashmalak I.
Tigalda I.
DAVIDSON BANK
Lehard Rock
Position Doubtful
Anderson Rock
Sannakh I.
Sannakh Islands
SANNAKH BANK
Sandman Reefs
Deer I.
Cold Bay
Morzhovia Bay
TACHELHEY MTS.
Amak I.
Amagat I.
Unga I.
Unga Spit
Unga Strait
PAVLOFF VOLCANO
Pavloff Bay
C. Tolstoi
C. Rodgman
Entrance Cape
Mountain Cape
Hagemeister I.
UNALASHKA I.
MAKUSHIN VOLCANO
Makushin Bay
Volcano Bay
Dutch Harbor
Old Harbor
Mountain C.
Beaver Inlet
Captains Bay
Iliuliuk Bay
Bogoslof I.
Umnak I.
Tigmak Pass
Cape Lazaroff
Cape Morgan
Cape Lincoln
Shaw Bay
Morzhovia
Baskin
N.W. Cape
Promontory
Promontory Cove
Scotch Cape
Seal C.
Unga Strait
Ft. Alcheredine
Ft. Mears
Ft. Kenay
Ft. Worth
Ft. Tolstoi
Ft. Glenn
Ft. Randall
Ft. Morrow
Ft. Liscum
Ft. Gibbon
Ft. Roberts
Ft. Kodiak
Ft. Greely
Ft. Wm. Henry
Ft. Abercrombie
Ft. Egbert
Ft. Seward
Ft. Davis
Ft. Gilmore
Ft. Hamlin
Ft. Constantine
Ft. Wainwright
Ft. Gaston
Ft. Canby
Ft. Stevens
Ft. Townsend
Ft. Flagler
Ft. Casey
Ft. Worden
Ft. Whipple
Ft. Lawton
Ft. Wright
Ft. Spokane
Ft. Sherman
Ft. Preble
Ft. Williams
Ft. Scammel
Ft. Popham
Ft. Baker
Ft. Rosecrans
Ft. Mason
Ft. Point
Ft. Winfield Scott
Ft. Stevens
Ft. Canby
Ft. Columbia
Ft. Shaw
Ft. Custer
Ft. Keogh
Ft. Assiniboine
Ft. Maginnis
Ft. Ellis
Ft. Logan
Ft. Lewis
Ft. Garland
Ft. Lyon
Ft. Wingate
Ft. Bayard
Ft. Selden
Ft. Stanton
Ft. Union
Ft. Marcy
Ft. Riley
Ft. Leavenworth
Ft. Sill
Ft. Reno
Ft. Supply
Ft. Gibson
Ft. Smith
Ft. Arbuckle
Ft. Washita
Ft. Clark
Ft. Duncan
Ft. Brown
Ft. Ringgold
Ft. McIntosh
Ft. Bliss
Ft. Hancock
Ft. Davis
Ft. Stockton
Ft. Concho
Ft. Griffin
Ft. Richardson
Ft. Sill
Ft. Reno
Ft. Supply
Ft. Gibson
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Ft. Arbuckle
Ft. Washita
Ft. Clark
Ft. Duncan
Ft. Brown
Ft. Ringgold
Ft. McIntosh
Ft. Bliss
Ft. Hancock
Ft. Davis
Ft. Stockton
Ft. Concho
Ft. Griffin
Ft. Richardson

169° 168° 167° 166° 165° 164° 163° 162° 161° 160° 159° 158° 157°

HAZEN BAY

COOKS STRAIT (Etolin Strait)

Cape Etolin

Cape Vancouver

Nelson I.

Baird Inlet

Nunivak Island

Kinak River

Kuguklik River

Kuskokvakh

Kuskokwim River

Shevenagamut

Chimiagamut

Nutagamut

Kuskogamut

Shineyagamut

Takliketagamut

Lake Nushagak

Cape Avinoff

KUSKOKWIM BAY

Klahangamut

Mumtrahamut

Goodnews B.

Togiagamut

Togia

Aleknagik Lake

Nushagak River

Anagnak

Ft. Alexander

Koggiung

Kvichak River

Tzaharagamut

Cape Newenham

Hagemeister I.

Cape Peirce

Walrus Islands

Ooalilkh

Ekuk

Etolin Pt.

Ft. Suvaroff

Kvichak

KULULAK BAY

Cape Constantine

C. Chichagoff

Igugik

Tyaguk River

BRISTOL BAY

C. Grey

Sulima River

C. Menshikoff

Ugashik

PENINSULA

MT. CHIGINAGAK

C. Providence

Ugaluschak I.

Hydra I.

Anakshak Bay

Strogonoff Pt.

Ft. Paiden

Oonangashik

Seal Is.

BLACK PEAK

Kejulik Bay

Selkwik I.

Foggy Cape

C. Kumliun

C. Sentavin

C. Kutuzoff

Chignik Bay

Kaliuluk

Nackelamik I.

Aghiyuk I. 1500 ft.

Aghik I. 1,250 ft.

Chankliut I.

C. Ilkhi

Semidi Islands

Anowik I. 650 ft.

Keetlkbingikh I. 250 ft.

Sukhlikh I. 800 ft.

Chowee-Es I. 1850 ft.

Alkhasmik I. 800 ft.

Kuliuut or South I. 250 ft.

C. Rodgnoff

Entrance Cape

Foul Pt.

Point Hutter

Ft. Gerrish

Gerstle Bay

C. Lees

Starling Pt.

Gerstle R.

Amak I.

Bow C.

Lennox I.

Neumann Pt.

Neumann I.

Pt. Blaine

Operi I.

Glen I.

Blount Pt.

Grant

PAVLOFF VOLCANO

Pavlof Bay

C. Tolstoi

Cold Bay

Lake

TACHELNEY MTS.

Morzhovia

Bear Cape

Nicolai Bay

Belkofski Bay

Bear Bay

Dolgoi I.

Ikolnoi Inl.

Paperechnoi I.

Judic I.

Otter Pt.

Portage Bay

Coal Pt.

Stepanovcho Bay

Dome Pt.

Fox Bay

Cub Pt.

Boulder Bay

Boulder I.

Bluff Pt.

Scotland Rock

Fox Cape

Cape St. John

Jacob I.

Pinnak I.

Chlachi I.

Mitrofania I.

Shaiyka I.

Unga Strait

Korovin I.

Dilligh I.

Gorgona Strait

Andronica I.

Wedge Cape

Castle Rock

Mt. Thompson

Lighthouse Rocks

Shumagin Islands

SHUMAGIN BANK

Simeonof I.

Little Koniushi I.

Nagai I.

Twins

Chernabura I.

Mountain Cape

Sandman Reefs

Sannakh I.

Lida I.

Caton I.

Sannakh Islands

SANNAKH BANK

Hennig Rock (doubtful)

Achark Hbr.

Portoff Hbr.

Lizard Rock

Position doubtful

Anderson Rock

DAVIDSON BANK

UNIMAK I.

SHISHALDIN VOL. 9385 ft.

Sheer Bay

C. Lincoln

Morzhovia Bay

Amagat I.

Deer I.

Fox I.

W. Cape

C. Chaby

Unga Is.

Low I. No. 1

Low I. No. 2

Midun I.

Passage I.

South Capes

Goose I.

Hunt I.

Chernabura I.

Bluff Pt.

Sea Lion Rocks

Falmouth Hbr.

Wide B.

Kenai I.

Wide Bay

Mist Hbr.

Wide I.

Wide Bay Rocks

Wide I. 1,100 ft.

Wide Bay Reefs

Mountain Cape

Twins

Chernabura I.

UNIMAK PASS

UNIMAK BAY

Scotch Cape

Promontory

Promontory Cove

Seal C.

N. W. Cape

C. Lazaroff

Lava Flow

West Anchorage Cove

East Anchorage Cove

Unga Is.

Akutan I.

AKUTAN VOLC.

Akutan Bay

Akun I.

Akun Cove

Little Bay

Broad I.

Wavertly I.

Jackass I.

Pan I.

Jackass Pt.

Ugamak I.

Ashmiakh I.

Sea Lion Rock

The Nook

Tigalda I.

Tigalda Bay

Tigalda Pass

Volcanic I.

Rootok I.

Akutan Pass

Akutan Harbor

Beaver Inlet

Spy Bay

Spy I.

Signals

Var. 15° 30′ E.

Var. 18° 45′ E.

Var. 16° 25′ E.

Var. 21° 55′ E.

Var. 20° 15′ E.

Var. 21° 55′ E.

158° 157° 156° 155° 154° 153° 152° 151° 150° 149° 148° 147° 146°

PENINSULA

Wushagak River
Kvichluk River
Kogglung
Alexander
Pt. Suvaroff
Kiniaak
C. Chichagoff
Ugaguk River
Igusik
Betchareff Lake
C. Grey
Sulima River
Ugasilik
MT. BETCHAREFF
MT. OLAI
Portage Bay
Cape Igvak
C. Kayagliuk
MT. CHIGINAGAK
Port Provident
Orpina B.
Providence
Aiugnak Columns
Ugaluschak I.
Hydra I.
Antakshak Bay
Ugnuk Bay
C. Kumliun
Selkwik I.
Foggy Cape
Markchamik I.
Aghiyuk I. 1500 ft.
Aghik I. 1250 ft.
Chanikuit I.
Semidi Islands
Egushak I. 1200 ft.
Anowik I. 650 ft.
Keelikhagikh I. 750 ft.
Sukhlikh I. 1200 ft.
Chowee-Et I. 1200 ft.
Alikhsemit I. 300 ft.
Kutloot or South I. 250 ft.
Lighthouse Rocks
Var. 21° 55′ E.

SHELIKOFF STRAIT

REDOUBT VOLCANO
ILIAMNA VOLCANO
Pt. Harriet
Iliamna L.
Kontilli R.
Reindeer Bay
Tuxedni Bay
West Foreland
North Foreland
Trading Bay
Pt. Campbell
Pt. Possession
Turnagain Bay
Knuiet River
Second Lava R.
East Foreland
Pt. Nicholas
Kakhu River
Skilloksh Lake
C. Kussiloff M.S.
Kussiloff R.
Tustumena Lake
Munina
Starichkof R.
Anchor Pt.
Coal Pt.
Kachekmuk Bay
Tutke Bay
Dangerous Cape
Graham Hbr.
Pt. Belle
Port Chatham
Cape Elizabeth
Chugatz Islands
Pt. Gore
Port Dick
Nuka Inst.
Tyo Mts.
Chiswell Ids.
Seal Rocks 83 M.
Cape Resurrection
Aialik Bay
Harris Bay
BLYING'S SOUND
Cape Puget
Pt. Elrington
Macleod R.
Coral Rocks
Cape Cleare
Seal Rocks
Pt. Fremantle
Port Valley
Bligh I.
Port Fidalgo
Port Wells
Esther I.
Pt. Pivot
Pt. Chiswell
Pt. Pellew
Port Gravina
Cordova Bay
Hawkins I.
Pt. Johnstone
Hinchinbrook
Pt. Steel
Cape Hinchinbrook
Pt. Nowell
Pt. Eleanor
Knights Island
CHUGACH OF PRINCE WILLIAM SOUND
MONTAGUE ISLAND
Icy Bay
Pt. Countess
Pt. Grace
Green I.
Chalmers Bay
Pt. Pyke
Port Bainbridge
Latouche I.
Hanning Bay
Port Nellie Juan
Icy Cape
Pt. Elrington
Cape Puget
Macleod R.
Coral Rocks
Cape Cleare
Seal Rocks
Var. 25° 30′ E.

KAMISHLAK BAY
Augustin I.
Shaws I.
Ushugat I.
Amatuli I.
Barren Islds.
Cape Douglas
FOUR PEAKED MT.
Sea Otter Ids.
Kayayak
Kaluklipalik I.
Schakhun Rock
Cape Chiniak
Hallo Bay
Cape Nukshak
Kukak Bay
Cape Ugyak
Cape Kutlak
Katmai
Takhli I.
C. Kubugakhli
C. Kahurnoi
C. Yaklek
C. Unalishogvak
C. Kanatak
Point Banks
Chuyak I.
Chuyak Strait
Sea Otter I.
Cape Current
Black Cape
Amit Cape
Sea Lion Rocks
Paramanof Bay
Cape Paramanof
Steep Cape
C. St. Hermogenes
Marmot I.
Pillar Cape
Northern Strait
Raspberry I.
Marmot Bay
ARGONAUT I.
Cape Ugamuk
Ugamuk I.
Cape Ugak
Noisy I.
Cape Kuliumut
Ugamuk Bay
Spruce I.
Narrow Strait
Williams Reef
St. Paul
St. Paul Hbr.
Kadiak Rock
Chiniak Bay
Humpback Rock
Cape Greville
Cape Uyak
Karluk R.
Karluk
Stepovoi R.
Seal Rocks
Cape Ikolik
Ayakulik R.
Ayakulik I.
Foreign R.
St. Orlovsk
Zeke Cape
Ugak I.
Kiliuda Bay
Old Harbor
Shakalinak Strait
Dangerous Cape
3 Saints Bay
Litnanski Bay
Sitkalidak I.
Cape Barnabas
Low Cape
Black Point
Cape Alitak
Alitak Bay
Alsentia
Two Headed Cape
Alentia Bay
Cape Trinity
Russian Hbr.
Geese Ids.
Sithinak I.
Tuxdak I.
TRINITY ISLANDS
Ukamok or Chirikof I.
KODIAK
ALBATROSS BANK
PORTLOCK BANK
Var. 29° 50′ E.

Cape Douglas
Cape Chiniak
Cape Nukshak
Cape Ugyak
Cape Kutlak
Cape Uyak
Cape Kuliumut
Cape Ugamuk
Cape Karluk
Cape Ikolik
Cape Greville
Cape Barnabas
Cape Alitak
Cape Trinity
Cape Paramanof
Cape Current
Cape Elizabeth
Cape Resurrection
Cape Puget
Cape Cleare
Cape Hinchinbrook

U. S. COMMISSION OF FISH AND FISHERIES.

MARSHALL McDONALD, COMMISSIONER.

ALIASKA PENINSULA

AND ADJACENT ISLANDS

1888.

To accompany Report on Explorations of Alaskan Fishing Grounds, in Bulletin U. S. Commission of Fish and Fisheries for 1888.

Compiled from U. S. C. Survey Charts Nos. 701, 702, 756, 786, 798, 806 and 960; Hydrographic Chart No. 68; Russian Charts; and from data obtained by Messrs. Sandman, Pavloff, and Lieut. Commander J. L. Tanner, U. S. N., and Officers of the U. S. F. C. Str. "Albatross."

SOUNDINGS.

The Soundings are expressed in fathoms. Soundings marked thus, $\frac{0}{130}$ etc., signify that no bottom was reached at that depth. Upright figures denote soundings taken by the U. S. F. C. Str. "Albatross" in 1888. All others are taken from existing Charts.

ABBREVIATIONS OF BOTTOMS.

MATERIALS.						Colors or shades and other qualities.					
M. or m.	for	Mud.	St. or st.	for	Stone.	blc.	for	black.	dk.	for	dark.
S. " s.	"	Sand.	Oz. " oz.	"	Ooze.	gy.	"	grey.	fne.	"	fine.
G. " g.	"	Gravel.	Sp. " sp.	"	Specks.	bu.	"	blue.	crs.	"	coarse.
Sh. " sh.	"	Shells.	P. " p.	"	Pebbles.	gn.	"	green.	rky.	"	rocky.
C. " c.	"	Coral.	R. " r.	"	Rock.	yl.	"	yellow.	brk.	"	broken.

+ *signifies rock.*

MAGNETIC DECLINATION.

Magnetic Declinations are taken from the U. S. Coast Survey Report for 1882, Appendix No. 13, as calculated therein for January 1885.

NAUTICAL MILES.

10 0 10 20 30 40 50 60

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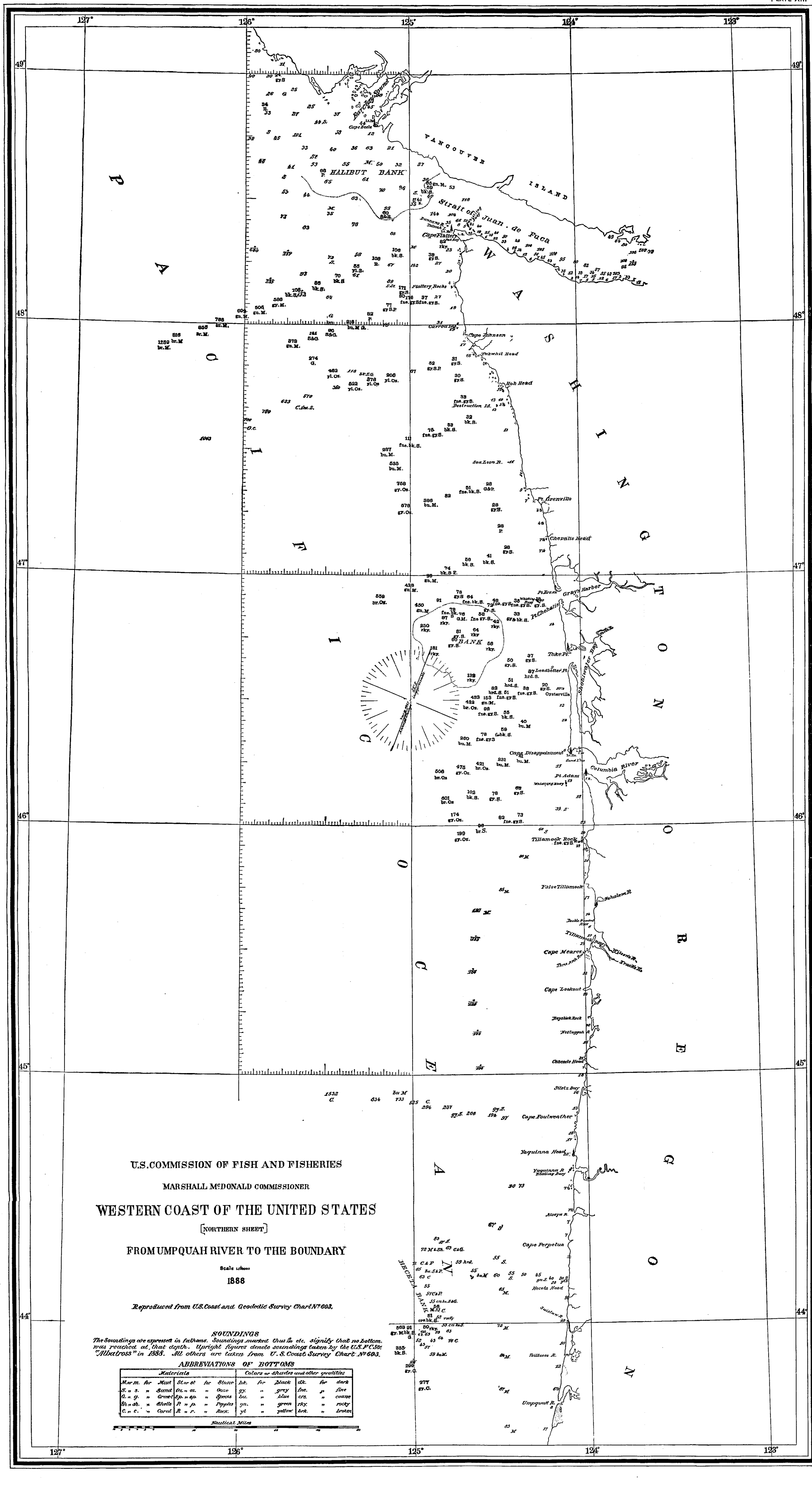

U.S. COMMISSION OF FISH AND FISHERIES

MARSHALL McDONALD COMMISSIONER

WESTERN COAST OF THE UNITED STATES

[NORTHERN SHEET]

FROM UMPQUAH RIVER TO THE BOUNDARY

Scale 1:480000

1888

Reproduced from U.S. Coast and Geodedic Survey Chart No 603.

SOUNDINGS

The Soundings are expressed in fathoms. Soundings marked thus 25 etc. signify that no bottom was reached at that depth. Upright figures denote soundings taken by the U.S.F.C.St. "Albatross" in 1888. All others are taken from U. S. Coast Survey Chart No 603.

ABBREVIATIONS OF BOTTOMS

Materials						Colors or shades and other qualities					
M. or m.	for	Mud	St. or st	for	Stone	bk.	for	Black	dk.	for	dark
S. " s.	"	Sand	Ox. " ox.	"	Ooze	gy.	"	grey	fne.	"	fine
G. " g.	"	Gravel	Sp. " sp.	"	Specks	bu.	"	blue	crs.	"	coarse
Sh. " sh.	"	Shells	P. " p.	"	Pepples	gn.	"	green	rky.	"	rocky
C. " c.	"	Coral	R. " r.	"	Rock.	yl	"	yellow	brk.	"	broken

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