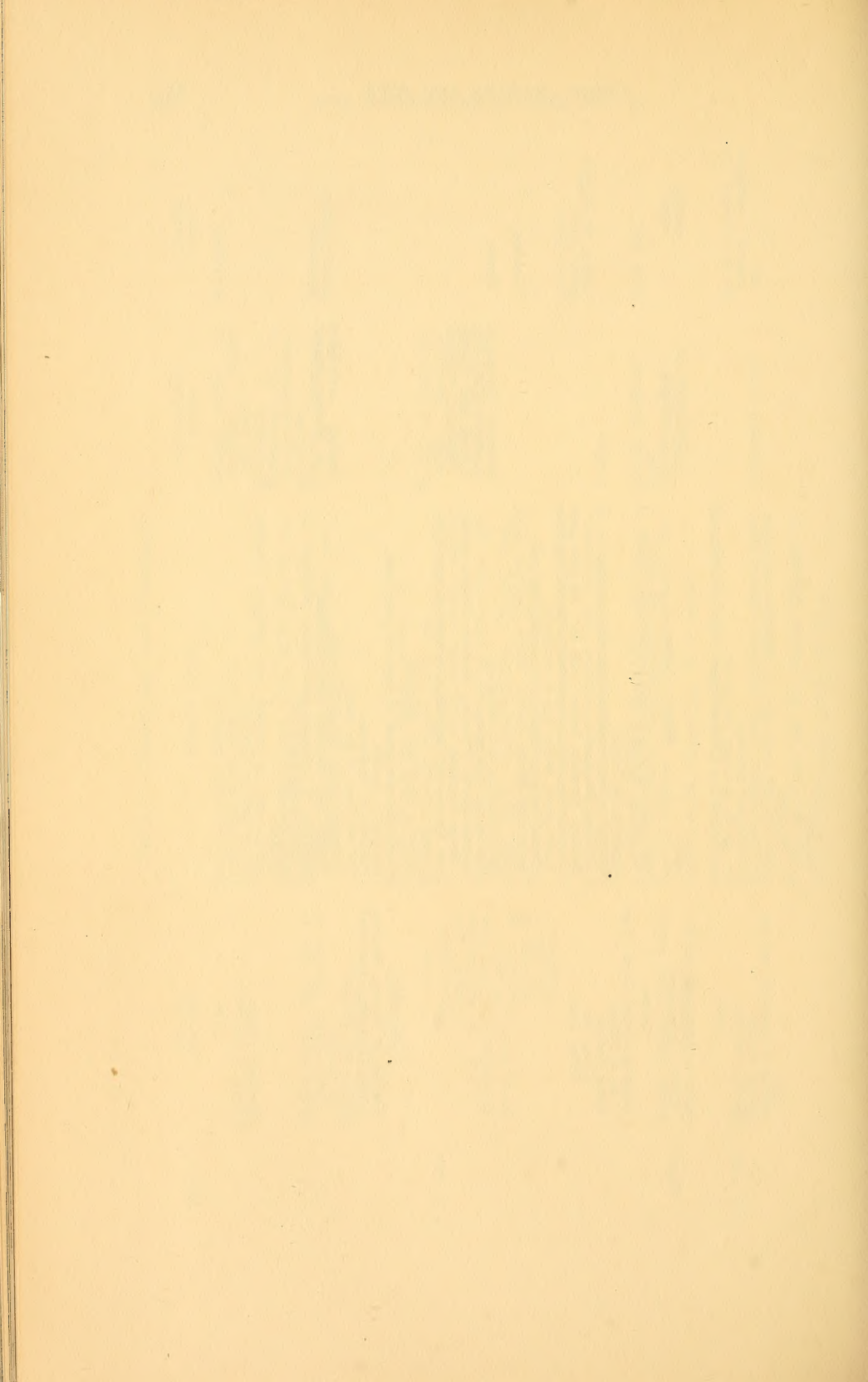


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THE ALEUTIAN ISLANDS:
THEIR PEOPLE *and* NATURAL HISTORY

(With Keys for the Identification of the Birds and Plants)

By

HENRY B. COLLINS, JR.

AUSTIN H. CLARK

EGBERT H. WALKER



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THE ALBUQUERQUE ISLANDS
THEIR PEOPLE AND NATURAL HISTORY
(This key for the identification of the birds and plants)

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THE ALEUTIAN ISLANDS: THEIR PEOPLE *and* NATURAL HISTORY

By HENRY B. COLLINS, JR., AUSTIN H. CLARK, AND EGBERT H. WALKER

(WITH 21 PLATES)

THE ISLANDS AND THEIR PEOPLE

By HENRY B. COLLINS, JR.
Bureau of American Ethnology

INTRODUCTION

The Aleutian Islands, stretching in a long curving arc from the Alaska mainland almost to Kamchatka, are the northernmost of a series of island chains, including the Kuriles, the Japanese islands, the Ryukyu islands and the Philippines, that border the Pacific basin on the north and west. These island chains and archipelagoes have several important structural features in common. They are mainly of volcanic origin and contain numerous active or recently active volcanoes; they are zones of intense earthquake activity; and they are paralleled on the outer or Pacific side by great oceanic troughs reaching depths of from 3,000 to 5,000 fathoms.

Since the war has focused attention on the Aleutians, much has been written of the almost constant rain, wind, and fog that make living so unpleasant on these remote and cheerless islands. Allowing for some exaggeration, the fact remains that the Aleutian weather deserves its bad reputation. Temperatures are moderate and fairly uniform, averaging around 33° F. in winter and 50° F. in summer, and never going as low as zero. In the Aleutians, however, temperature alone means very little. Here the cold winds from Siberia and the ocean currents flowing down from Bering Sea meet the warm air masses and ocean currents moving eastward across the Pacific, and their interaction produces winds of high velocity, dense fog, rain, mist, and snow.

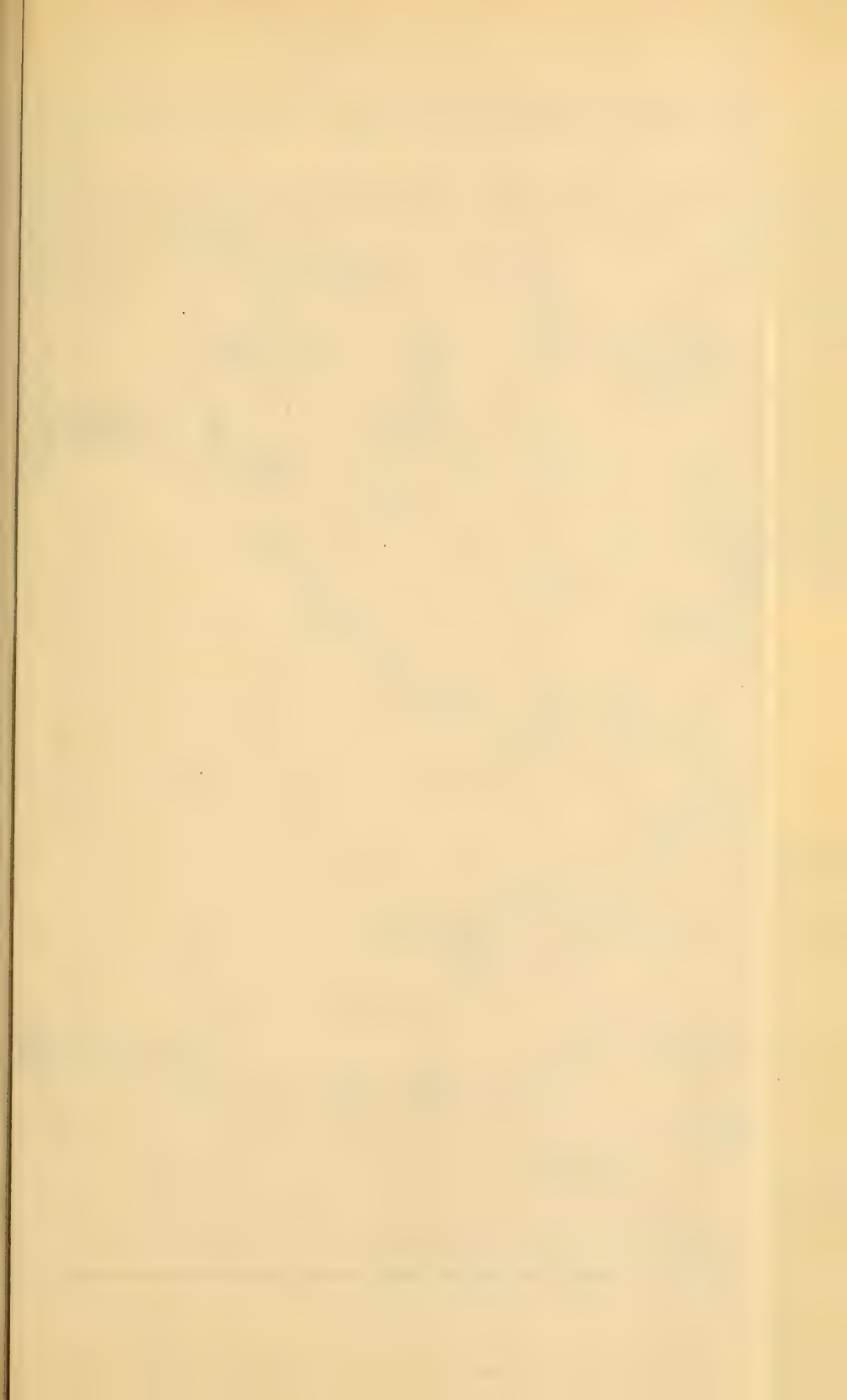
PLATE 1

This striking photograph of cloud-capped Kiska Volcano was made by a U. S. Navy photographer on the day of the initial Allied landing on that Aleutian island, August 15, 1943. The volcano rises to a height of almost 4,000 feet. (Official U. S. Navy photograph.)

Probably nowhere have military operations in this war been carried out under greater difficulties than in the Aleutians. When the war began there were no adequate surveys of many of the islands. Detailed geographic and topographic information was lacking, especially for the islands in the western part of the chain, and none of the latter were fortified. Uncharted reefs and shoals, strong currents and tide rips, the paucity of good harbors, and the unpredictable weather, all combined to make navigation dangerous and difficult. Aviators, having to contend with sudden storms and almost constant fog, faced even greater hazards. Under these handicaps it has required a high degree of courage, determination, and resourcefulness on the part of our men to defeat and drive out a strong and well-entrenched enemy force and to secure the island outposts against further attack.

One might assume that the desolate, treeless, storm-swept Aleutians would have been avoided by primitive man. On the contrary, they were densely populated in prehistoric times. When discovered by Bering in 1741, the native inhabitants of the Aleutian Islands are estimated to have numbered from 20,000 to 25,000, more than the aboriginal Indian population of the Ohio Valley, or of Florida, New York State, or New England. The Aleutians abounded in animal life—whales, seals, sea lions, sea otters, birds, fishes, mollusks and other invertebrates—and it was this assured food supply that made it possible for such a relatively large number of people to live in so limited an area. Whatever other disadvantages it may possess, the Aleutian region, with its myriads of birds, abundant marine life, and rich and varied flora, cannot be described as "lifeless."

The purpose of this paper is to describe briefly the physical features, history, native inhabitants, and fauna and flora of the Aleutian Islands. It will, we hope, provide an opportunity for our servicemen stationed in the Aleutians to identify the plants and animals around them and to learn something of the people who formerly lived on these islands midway between America and Asia. At present there are no readily available publications containing such information, for with a few exceptions American scientists have shown little interest in the Aleutians. The only comprehensive description of the Aleutian fauna—that by O. J. Murie—is as yet unpublished, and our knowledge of the flora is based almost entirely on the publications of the Swedish botanist Hultén and the Japanese botanists Tatewaki and Kobayashi. The ethnological literature is fuller but is contained in scattered publications, most of which are out of print or difficult to obtain.



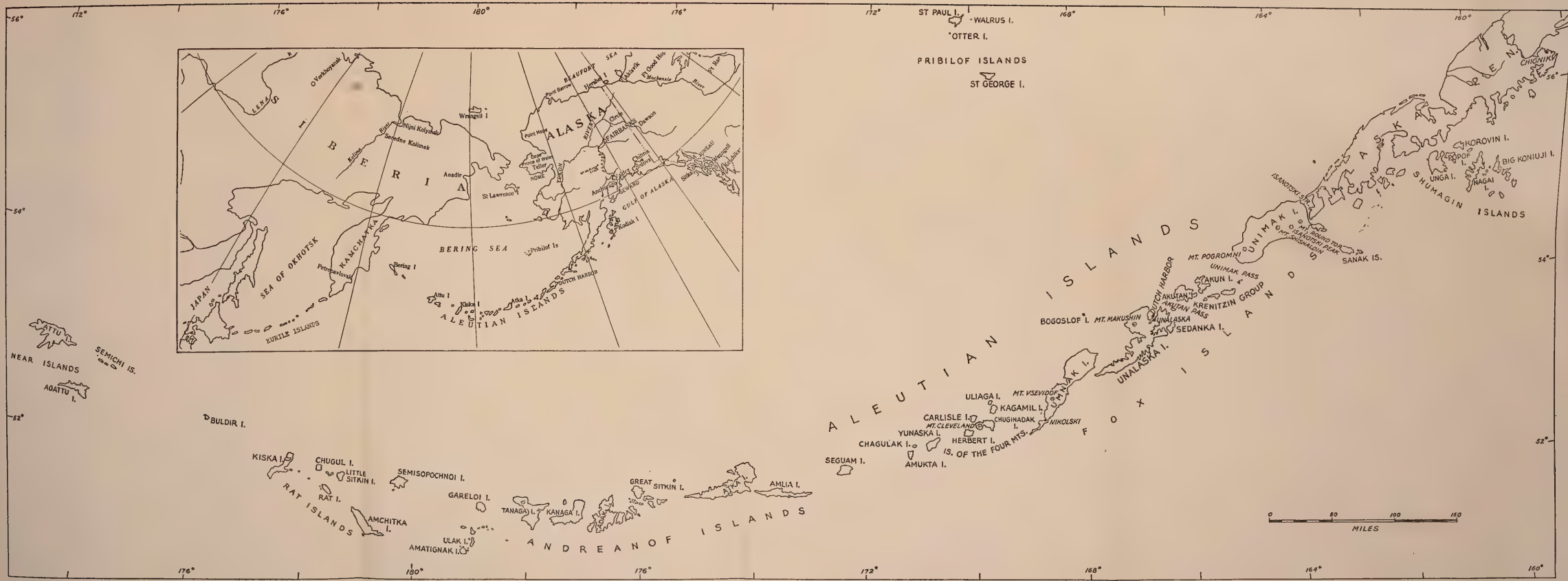


FIG. 1.—Map of the Aleutian Islands. Insert shows position of the Islands with relation to Alaska and Siberia. The southern Aleutians are in the same latitude as London.

The Aleutians have, of course, seen great changes within the past few years. Some islands described here as sparsely populated or uninhabited may now be naval or military bases. The Japanese occupation of Kiska and Attu opened a dramatic chapter in the history of the present war and the Aleutians may be the scene of other important developments before the war is over. However, military operations and changes brought by the war are not within the scope of the present paper, which aims to describe the islands as they were originally.

DESCRIPTION

The islands of the Aleutian chain form a continuation of the Alaska Range of mountains extending 900 miles or more westward from the tip of the Alaska Peninsula. They include 14 large and about 55 small islands in addition to innumerable rocks and islets. Though commonly thought of as part of the Far North, the Aleutians are actually 800 to 1,000 miles south of the Arctic Circle. Lying between the 51st and 55th parallels, they are in the same latitude as England, Ireland, Belgium, Holland, northern France, and Germany. The climate is oceanic—wet and cool—rather than boreal, and the islands are ice-free and open to navigation the year around.

Most of the islands, particularly the larger ones, are rugged and mountainous. The shore lines are irregular and deeply indented, with towering rocky cliffs rising abruptly from the sea. In contrast to the prevailing jagged coast lines and high relief of the larger islands, some of the smaller ones are more regular in outline, with low and relatively flat surfaces.

The Aleutians are divided into five main groups from west to east: the Near Islands, i.e., those nearest Kamchatka; the Rat Islands; Andreanof Islands; Islands of Four Mountains; and Fox Islands.

The Fox Islands, or eastern Aleutians, include the three large islands Unimak, Unalaska, and Umnak, in addition to the six smaller islands of the Krenitzin group—Ugamak, Tigalda, Avatanak, Rootok, Akun, and Akutan.

Unimak, the easternmost and largest of all the Aleutians, is separated from the Alaska Peninsula by the very narrow and shallow Isanotski Strait (False Pass). At the center of the island the symmetrical, snowy peak of Mount Shishaldin, the largest mountain in the Aleutian chain, rises to a height of 9,387 feet. This volcano, also known as Smoking Moses, has been more or less continuously active since first reported by the Russians in 1796. On the western end of the island are several other

volcanic peaks, including Mount Pogromni, 6,500 feet high. To the east of Shishaldin are Isanotski Peak, or Ragged Jack, and Round Top, with elevations of 8,088 feet and 6,155 feet. On the latter two there are active glaciers, and ice is also found on the flanks of Shishaldin. When the Russians arrived, there was a large Aleut population on Unimak, but for many years the island has been practically deserted.

Unimak Pass, between Unimak and the Krenitzin Islands, is the principal passage for vessels entering the Bering Sea.

Southeast of Unimak is the Sanak group, including Sanak and Caton Islands and a large number of islets, reefs, and rocks covering an area about 20 miles long and 10 miles wide. The reefs and shoals of the Sanak Islands once abounded in sea otters, and Aleuts from hundreds of miles away made annual voyages to this famed hunting ground.

Of the islands comprising the Krenitzin group, only the two largest, Akun and Akutan, have been permanently inhabited in recent years. Akun is very irregular in shape, with deep indentations formed by Akun Cove and Lost Harbor. On the north side of Lost Harbor is Akun Peak, an extinct volcano 2,500 feet high. About a mile northeast of Akun Peak is a ridge 1,800 feet high, near the base of which is an abandoned sulfur mine with cable tramway leading to a sulfur deposit about 1,300 feet up the slope.

The highest elevation in the Krenitzin group is Akutan Peak, a smoking volcano 4,244 feet high, on Akutan Island. A whaling station is operated at Akutan Harbor on the east side of the island.

Akutan Pass and Unalga Pass, between the islands of Akutan and Unalaska, are the two other principal passes through the eastern Aleutians.

Unalaska, the second largest of the Aleutian Islands, is about 67 miles long, its irregular coast line extending in a northeast-southwest direction. It is indented by many narrow bays, with abrupt shores rising to a rugged mountainous interior. The highest point is Mount Makushin, in the northwestern part of the island, with an elevation of over 5,000 feet. The crater of Makushin Volcano is about $1\frac{1}{2}$ by 2 miles wide and 300 to 500 feet deep. The greater part of the crater is filled with ice, and glaciers extend through gaps in the rim down to a height of about 2,500 feet. A little southwest of the center, the floor of the crater is visible over an area of some 20 to 30 acres. A considerable amount of sulfur is contained in this exposed area, where subterranean heat prevents ice from accumulating.

The village of Unalaska, or Iliuliuk as it was called by the Russians, is the commercial center of the Aleutians. Established by Solovief between



PLATE 2

Upper: Aerial view of Unimak Island, taken from an altitude of 4,000 feet, looking west from Cape Lazaref on the south coast. The mountain at right is Isanotski Peak (Ragged Jack). The conical snow-covered peak at left is Shishaldin Volcano, the highest mountain in the Aleutian chain, elevation 9,387 feet.

Lower: Aerial view of Akun Head, north end of Akun Island, Krenitzin group, looking southeast from an elevation of 3,500 feet.

(Official U. S. Navy photographs.)

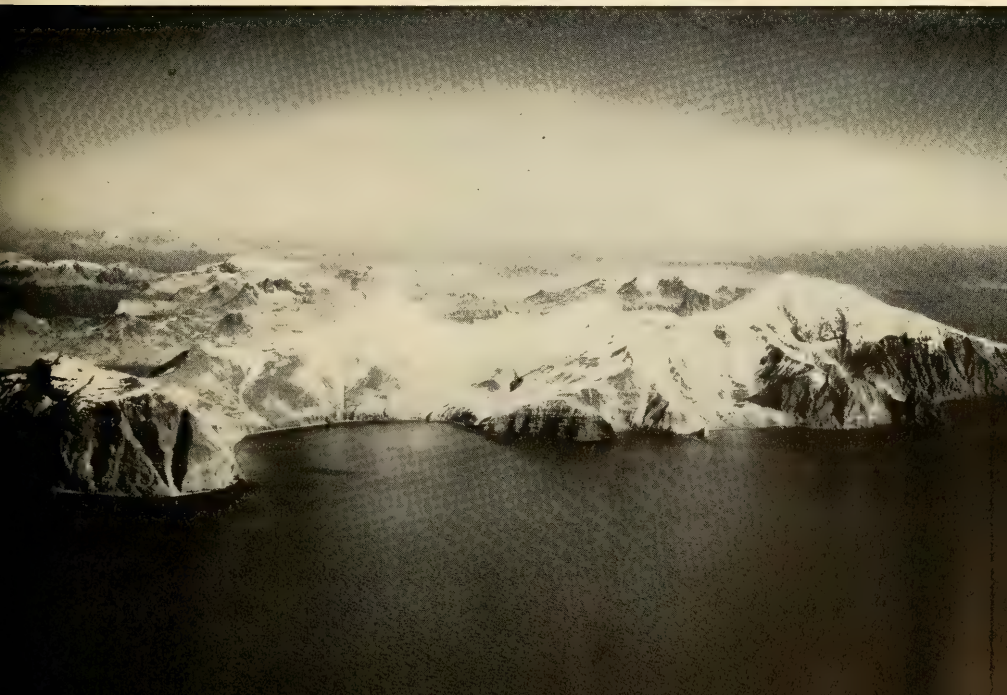




PLATE 3

Upper: U. S. Navy submarine docking at Dutch Harbor, Unalaska. (Official U. S. Navy photograph.)

Lower: The village of Unalaska (Iliuliuk) on Unalaska Island, established between 1764 and 1770. Unalaska for many years has been the largest town and commercial center in the Aleutians. (Photograph from Ewing Galloway.)





PLATE 4

Upper: Aerial view of Cathedral Rocks, west side of Unalaska Island, looking east.

Lower: An R4D naval air transport Douglas plane on the way to Kiska, photographed against the peaks of the Islands of Four Mountains.

(Official U. S. Navy photographs.)



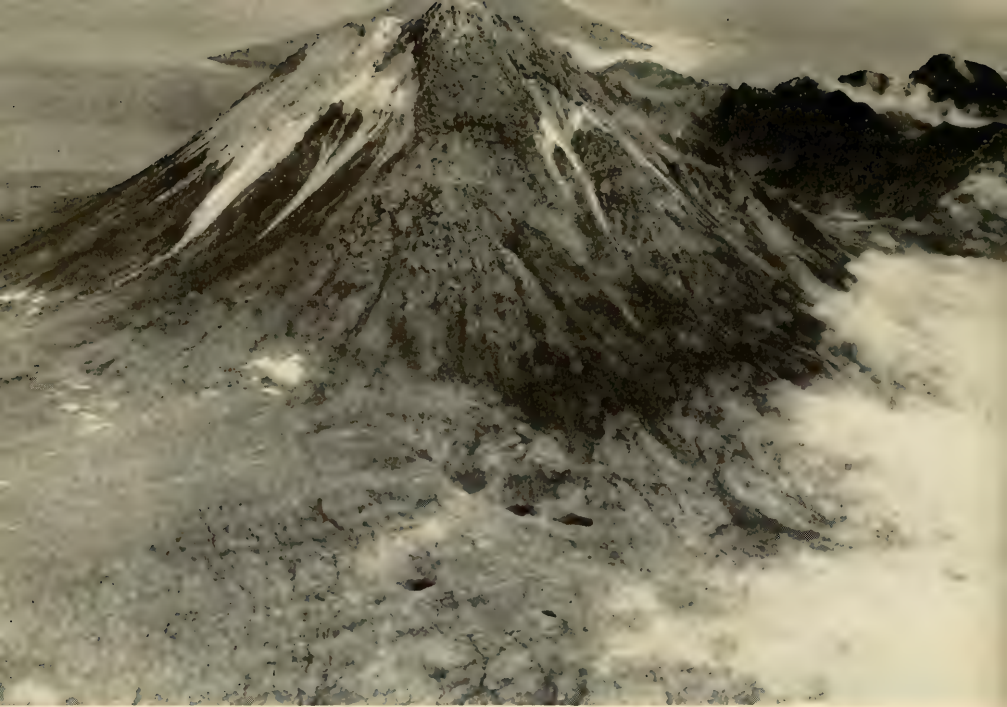
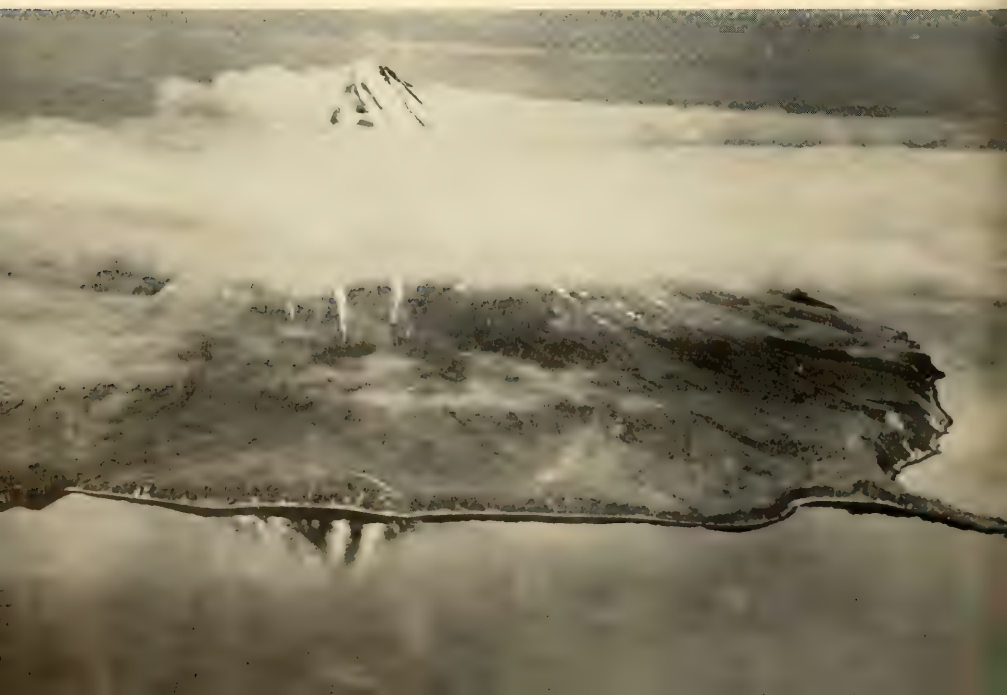


PLATE 5

Upper: Two of the mountain peaks of the Islands of Four Mountains. Kagamil Island, with Uliaga Island in the background.

Lower: Mount Cleveland, elevation 8,150 feet, on Chuginadak Island, one of the Islands of Four Mountains.

(Official U. S. Air Forces photographs.)



1764 and 1770, it was for many years the principal center of the Russian fur trade. Later, during the gold rush, it was a supply center for ships bound for Nome and the Yukon. Before the war Unalaska had a population of about 300, and was headquarters for the United States Coast Guard vessels of the Bering Sea patrol. Dutch Harbor, formerly a naval radio station on adjacent Amaknak Island, is now an important naval and military base.

Southwest of Unalaska is Umnak, the third largest of the Aleutian Islands. It is approximately 70 miles long with a maximum width at the north of about 16 miles, the southwest end tapering to a long narrow point. At about the center of the island near the western shore is a conical, snow-covered volcano, Mount Vsevidof, 7,236 feet high. Five miles away is another less symmetrical peak of about the same height. In the eighteenth century there were many large Aleut villages on Umnak, but now there is only the small settlement of Nikolski near the south end of the island.

West of Umnak the Islands of Four Mountains rise abruptly from the sea. There are actually five islands—Chuginadak, Herbert, Carlisle, Kagamil, and Uliaga. One of the peaks, Mount Cleveland on Chuginadak Island, reaches a height of 8,150 feet. These desolate volcanic islands have been uninhabited for many years, but they contain remains of old villages, and Aleut mummies have been found in burial caves on Kagamil.

Beyond the Islands of Four Mountains are four rather widely separated, medium-sized islands—Yunaska, Amukta, Chagulak, and Seguam, with elevations ranging from 2,800 to 4,300 feet.

Next, to the west, is the Andreanof group, which includes Atka, Amlia, Great Sitkin, Adak, Kanaga, Tanaga, and a number of smaller islands. The group is named for Andrean Tolstykh, who explored the islands in 1760-64. At that time they were densely populated, and Tolstykh wrote an interesting description of the inhabitants. (See Jochelson, 1933.) Atka, with a small native village and government school, is the only island of the group that has been permanently inhabited in recent years. In outline, Atka is rather similar to Unalaska, the northeast half being wide and mountainous and the southwest end long and narrow. Amlia, a very narrow island 40 miles long, extends in a straight line east of Atka, from which it is separated by a strait 1 to 1½ miles wide. Amatignak, one of the smaller islands of the Andreanof group, is the southernmost of all the Aleutians, and is an important landmark for ships following the Great Circle route across the North Pacific.

The Rat Islands, all of which are uninhabited, include Amchitka, Semisopchnoi, Kiska, and five smaller islands called Little Sitkin, Rat, Chugul, Davidof, and Khwostof. Amchitka is remarkable in that it is relatively low and flat, the only large island in the Aleutian chain that is not mountainous.

The westernmost of the Aleutians—Attu, Agattu, and the Semichis, forming the Near group—are 145 miles from Kiska, with only the small Buldir Island in between.

GEOLOGY

As no systematic geological studies have been made in the Aleutians, there is little detailed information on the rock formations. The islands are composed for the most part of tuffs, lavas, basalts, porphyries, andesites, and other igneous rocks thrust up above sea level by volcanic action. In addition to these volcanic or basic rocks which were extruded above the surface, there are granites, diorites and other acidic rocks that were injected or intruded into the earlier volcanic formations.

On the Alaska Peninsula the underlying formations include sedimentary deposits of Jurassic and Cretaceous age, through which the volcanoes have broken. In the Aleutians, however, there is no evidence of either igneous or sedimentary rocks older than the Tertiary, the indications being that the islands came into existence in early Tertiary time, probably during the Eocene. Sedimentary rocks—sandstones and shales of Tertiary age—occur sporadically in the Shumagins and Aleutians, and in a few localities, including Unga, Umnak, Unalaska, Akutan, and Atka, they have been found to contain fossil plants and invertebrates.

The volcanoes that are so prominent a feature of the Aleutian landscape continue in a remarkably regular curving line northeastward along the Alaska Peninsula to the west side of Cook Inlet. Many of the volcanoes are still active, others are extinct but retain their characteristic conical form. Bogoslof, a small island 22 miles north of Umnak, is the tip of a great submerged volcano with a total height of more than 5,000 feet and a basal diameter of 8 miles. Bogoslof rose from the sea in a violent eruption in 1796. Since then the topography of the island has changed from time to time, partly due to erosion but principally through eruptions that occurred in 1883, 1906, 1910, and 1923-27. Countless numbers of murre and other sea birds nest on the cliffs of Castle Rock at the southwest end of the island, and the black sandy beach on the southeast is the breeding ground for a large colony of sea lions.

Though Alaska was not subjected to continental glaciation in the Pleistocene, the higher mountain ranges supported local glaciers. One of the areas of local glaciation was the Alaska Peninsula, and according to Capps the larger islands of the Aleutian chain also had individual ice caps. The lowlands and upland valleys of the islands were completely covered, only the tops of the higher ridges and mountains standing above the ice. There has been relatively little erosion of the islands since the ice disappeared, the only changes of any consequence being the weathering of sea cliffs, the development of deep gulches and stream canyons, and the building up of beaches, bars, and spits by waves and currents.

DISCOVERY AND EARLY HISTORY

The northern Pacific, with the lands bordering its shores in Asia and America, was the last great section of the habitable world to be explored by Europeans. Though California had been known to the Spaniards for 200 years and European commerce with the East Indies had been long established, it was not until after the voyages of Bering in the eighteenth century that the vast expanse of the North Pacific was made known to the world. Geographers had speculated as to whether the region was one of sea or land and had made maps showing fanciful islands and lands that were thought to lie between, or to connect, the continents of Asia and America.

During the seventeenth century Russian traders and adventurers were pushing steadily eastward across Siberia. By 1632 they had reached the upper Lena. A few years later the other great rivers flowing into the Arctic—the Yana, Indigirka, and Kolyma—had been reached, and before the close of the century Kamchatka had been discovered. These unofficial and unorganized land explorations of the Cossacks prepared the way for the later voyages that were to settle the long-disputed question of the geographical relationship of Asia and America.

The Russian Emperor Peter the Great had followed the exploits of the Cossacks with the greatest interest, and in 1718, wishing to know more of the nature and extent of the new lands that had been brought under his dominion, he dispatched two naval officers to the Pacific with instructions to sail north and east of Kamchatka to determine whether or not Asia and America were united. This attempt proving fruitless, he issued instructions in December 1724 for another expedition, which he entrusted to the command of Fleet-Captain Vitus Bering, a Danish officer in the Russian Navy.

After three years of preparation Bering sailed from Kamchatka on July 14, 1728. Following the coast northward, he discovered St. Lawrence

Island and entered the Strait that now bears his name, but because of the dense fog saw neither the Diomed Islands nor the opposite coast of Alaska. After passing East Cape, Siberia, and observing no further land north of latitude $69^{\circ} 18'$, he returned to Kamchatka.

Though he had not accomplished his primary objective, Bering had charted the shores of Kamchatka, rounded the northeastern extremity of Asia, and brought back the first map of these regions based on actual astronomical survey. Through his efforts the main outlines of the geography of northeastern Asia had been determined. He had not, however, seen the American Continent, and though he felt convinced it did not connect with Asia, he had no conclusive proof to offer.

Returning to Russia in 1730 and finding the Admiralty officials skeptical of his evidence, Bering sought and received authority to undertake a second expedition which would settle beyond doubt the question of the geographical relationship of Asia and America. Described at the time as "the most gigantic geographic enterprise undertaken by any government at any time," it called for the construction of five ships which were to explore and chart the northern and eastern shores of Siberia and Japan and the opposite coasts of America. Hundreds of sailors, marines, and laborers, with food and equipment for several years, were to be transported thousands of miles to eastern Siberia. Mines were to be developed, and iron foundries, shipyards, and lighthouses were to be built—all this in a vast region where there were no roads, no developed resources, no facilities of any kind. In addition, the Academy of Sciences was to send its professors with their retinue of servants and assistants, their libraries and scientific equipment, to make a complete biological, ethnological, and historical survey of these little-known regions—the most ambitious scientific project that had ever been undertaken. It is not surprising that 8 years were required in preparation, and that Bering, who was held responsible for the whole enormous undertaking, should have been discouraged and disillusioned by the many vexatious delays and accidents, by the dissension among his subordinates, and by the inaction and inefficiency of the civil authorities who were supposed to help him.

On June 4, 1741, the expedition sailed from Avacha Bay, Kamchatka. There were two vessels, the *St. Peter*, under Captain-Commander Bering, and the *St. Paul*, under Captain Alexei Chirikof. For the first 9 days the ships sailed southeast following instructions to search for a great land area known as Gama Land, which European geographers thought lay to the north and east of Japan up to the 47th degree of north latitude.

Reaching latitude 46° and finding no land the course was changed to E. by N. On June 20 the two ships became separated and never met again.

Chirikof's ship, the *St. Paul*, continued eastward and on July 15 discovered land, a small island off Prince of Wales Island, in southeast Alaska. Following the coast northward to Chichagof Island, Chirikof sent a boat with 10 men to examine the shore of Lisianski Strait, just south of Cross Sound. The boat never returned, nor did a second boat with 5 men who were sent to look for it. The fate of these 15 men, the first Europeans to set foot on Alaskan soil, remains a mystery. Chirikof suspected, however, that they were captured or killed by the Indians (Tlingits), some of whom were seen leaving in canoes as the Russians approached.

Another serious consequence of the loss of the two boats was that it was now impossible to make landings to take on water. Because of this it was decided to return to Kamchatka. On the return voyage the Kenai Peninsula, Afognak, Umnak, and the Islands of Four Mountains were sighted. On September 9 the *St. Paul* anchored in a small bight on the south side of Adak Island. The following morning when the fog cleared seven Aleuts in skin boats came out toward the ship. They would not come aboard though they accepted presents thrown out to them. Having no boats to send ashore, Chirikof was especially anxious to have the Aleuts bring drinking water to the ship. The Aleuts proved to be shrewd traders, as the account in Chirikof's journal shows:

We gave them a small barrel in which to bring us water from the shore. They understood what we meant, but they would not take the barrel and showed us that they had bladders for that purpose. Three of them paddled towards the beach and returned with water. When they came alongside one of them held up a bladder and indicated that he wished to have a knife in payment. This was given him, but instead of handing over the bladder, he passed it to the second man, who also demanded a knife. When he got it he passed the bladder to the third man, who equally insisted on a knife. This act, as well as some other things they did, proves that their conscience is not highly developed. (Golder, 1922, vol. 1, pp. 304-305.)

Continuing westward, they sighted no land until September 21, 1741, when the *St. Paul* sailed close by the eastern end of Agattu Island. The Semichi Islands and the peaks of Attu were also sighted. When the *St. Paul* finally reached Avacha Bay, Kamchatka, on October 10, every man on board was suffering from scurvy, and seven had already died.

When the two ships became separated June 20, Bering, on the *St. Peter*, made a second futile attempt to locate the imaginary Gama Land, then resumed an E. by N. course and on July 16 sighted land, a high

snow-covered mountain on the Alaska mainland which he named Mount St. Elias. On the 20th the *St. Peter* anchored off Kayak Island and two boats were sent ashore to explore the new land and take on water. Georg Wilhelm Steller, the naturalist of the expedition, was thus afforded the opportunity of making the first scientific observations in this part of the New World.

After leaving Kayak Island and skirting Prince William Sound, Bering sailed SW. along the east side of Kodiak Island. On August 3 another view was had of the mainland, a high snow-covered volcano, Mount Chiginagak, on the Alaska Peninsula.

Land was sighted again on August 27, and on the 30th the *St. Peter* anchored between two islands. Ten men who were sick with scurvy were taken ashore for rest and fresh air, but one of them, Nikita Shumagin, died soon after landing. In his memory the island was named Shumagin, a name now applied to the entire group. A tragic mistake was made here in filling the barrels with water from a brackish pool near the beach. Steller, who was a physician, knew that the water was unsuitable for drinking and protested strongly against taking it, warning that its use would lead to a rapid increase of scurvy. His objections were ignored, but his prediction later proved true.

While anchored off the Shumagin Islands, Bering and his men had their first meeting with the Aleuts, an interesting account of which is given in Steller's journal (Golder, 1922, vol. 2, pp. 90-105).

After leaving the Shumagins the *St. Peter* resumed her westward course just to the south but beyond sight of the Aleutian Islands. On September 25 Great Sitkin, Adak, and Atka Islands in the Andreanof group were sighted. Terrific storms were now encountered and for the next 2 weeks the ship was driven back to the eastward and all but foundered. The situation was becoming increasingly serious as more and more men fell ill with scurvy. By the end of October, 36 men, including Bering himself, were on the sick list, 7 had already died, and it was only with the greatest difficulty that the others were able to manage the ship.

On October 23 the course was changed to NW., carrying the ship through the westernmost of the Aleutian Islands. Kiska was discovered on the 25th, and named St. Markiana. On the 28th and 29th Buldir and the easternmost of the Semichi Islands were sighted and named St. Stephen and St. Abraham. On November 4 land was sighted which was thought to be Kamchatka. By now the situation was desperate. The ship was battered and weakened, the mainmast and rigging damaged beyond repair. Only 6 barrels of bad water remained. Twelve men had died

and of the remaining 65, only 3 were able to be on deck. Though Bering himself wished to continue on to Avacha Bay, the other officers voted to seek an anchorage where they might spend the winter.

With the crew so weakened, the landing was extremely difficult. The wind rose and the ship drifted dangerously near the shore, barely escaping destruction as one anchor after another failed to hold. The task of getting the sick men to shore began on November 7 and continued until the 15th, during which interval 7 more men died. On the 28th the ship was driven in by a heavy gale and wrecked on the beach.

The land on which Bering and his men found refuge was not Kamchatka as they had hoped, but an unknown island, now called Bering Island, of the Commander group. Temporary shelters in the sand, and later driftwood huts, were constructed, and here the men passed the winter of 1741-42. With good water and fresh meat available they began to regain their strength, and by Christmas most of them had recovered. So advanced was the scurvy, however, that 14 more men died on shore after November 15. Included among these was Captain-Commander Bering, who died December 8, 1741.

Like the Aleutians, Bering Island is completely devoid of trees, though low shrubs, herbaceous plants, grasses, and moss are abundant. The fauna of the island was noteworthy in several respects and afforded Steller the opportunity of discovering and describing a number of previously unknown animals. Blue foxes and sea otters, with which he was already familiar, occurred here in great numbers. These animals showed not the slightest fear of man, and this was one of Steller's reasons for believing that they were on an uninhabited island. There were also rookeries of fur seals and sea lions, animals that Steller was the first to describe. An even more exciting discovery was the great northern sea cow, or manatee, *Hydrodamalis gigas*. This huge animal, 25 feet long and weighing up to 3 tons, frequented the shallow waters near shore, where it drifted in and out with the tide, feeding on seaweeds. Steller's sea cow has never been discovered outside the Commander Islands. Like the great spectacled cormorant, another of Steller's discoveries on Bering Island, it has been extinct for many years.

When they knew definitely that they were marooned on an island, the shipwrecked crew held a council at which it was decided to break up the old ship and construct a smaller vessel from its timbers. This formidable task was begun in April and completed in August, 1742. Thirteen days after leaving Bering Island the surviving members of Bering's expedition arrived safely in Kamchatka.

Among the possessions they brought back were many skins of sea otters, foxes, and fur seals. The 900 sea otter skins alone, worth from 30 to 40 rubles each, represented a value of \$30,000. News of the fabulous fur islands spread rapidly and soon the *promysblenniki*, or fur hunters of Siberia, were sailing eastward in small, poorly built vessels to reap a rich harvest in the new El Dorado.

First of the fur hunters to reach Bering Island was Emelian Basov, who made three voyages between 1743 and 1747. On one of these he collected 1,600 sea otter skins, 2,000 fur seals, and 2,000 blue foxes. Other ships brought back cargoes valued at a hundred thousand rubles or more. The *promysblenniki* made it a practice to stop at Bering Island not only for furs but also to lay in a supply of sea cow meat, with the result that these huge, sluggish animals were soon exterminated.

For the next 40 years the Russian fur hunters roamed the Aleutians, carrying their explorations—and their depredations—as far east as Kodiak. The inoffensive Aleuts were subjected to every kind of abuse and persecution. They were murdered by the thousands, cruelly exploited, and in the end reduced to virtual slavery. Efforts of the Russian Government to bring about more humane treatment of the natives were unavailing, and the *promysblenniki* continued their outrages in the comfortable knowledge that "Heaven is high, and the Czar far away." By the end of the eighteenth century the Aleuts numbered less than 2,000, the impoverished, dejected remnants of a population once 10 times as large.

In 1778 the great English navigator Capt. James Cook explored and charted the southeast coast of Alaska, Prince William Sound, and Cook Inlet. Sailing to the southwest along the Alaska Peninsula, he entered Unalga Pass between Unalga and Unalaska Islands and after a short stay at Samganuda Bay (English Bay) continued north into the Bering Sea. For 3 months he cruised these unknown waters, making the first charts of the north coast of the Alaska Peninsula, Bristol Bay, Norton Sound, Seward Peninsula, and the Arctic coast as far as Icy Cape.

On October 3 Cook returned to English Bay on Unalaska Island and remained until the 26th while his ships were being repaired. Cook was hospitably received by the Russian navigator, Gerassim Grigorovich Ismailof, who was stationed at Captains Harbor, Unalaska Bay. Ismailof showed Cook some manuscript charts of the Aleutian Islands, and Cook told of the discoveries he had made in the north and around Prince William Sound and Cook Inlet. At the time of Cook's visit the operations of the Russian fur hunters had hardly extended beyond the Aleutian Islands. Stephen Glottof had discovered Kodiak Island where

he spent the winter of 1763-64, but since that time the island had been visited only once. Of the mainland to the north of the Alaska Peninsula the Russians knew nothing at all, though Gvozdev had crossed Bering Strait and sailed along the south coast of Seward Peninsula as early as 1730.

The published maps that Cook had to guide him were hopelessly confused, showing practically nothing of what the Russians had discovered in Alaska. European geographers, receiving only garbled accounts of the Russian discoveries, had placed a maze of imaginary islands in the sea between northeastern Asia and America. Alaska itself, the great land known to lie east of Bering Strait, was depicted as an island. Cook's explorations brought order from this chaos and revealed for the first time an approximately correct outline of the northwest extremity of America. The Russian manuscript charts which Cook saw at Unalaska enabled him to enlarge and correct his own map by adding the Aleutian Islands, and by showing Unimak Island as separated from the mainland.

The first detailed charts of the Aleutians were made by Sarichef, a member of the Billings expedition sent out by the Russian Government in 1790-92. Surveys of the Aleutian and adjacent areas were continued by Lütke and Staniukovich (1827-28), Chernof (1832-38), Tebenkof (1831-50), and Woronkofski (1836). The latest published charts available at the beginning of the present war, especially those of the western islands, are based principally on these early Russian surveys.

The official Russian expeditions from the beginning had made it a practice to carry on scientific investigations. Bering's expeditions (1725-30, 1733-42), in addition to discovering the northwest coast of America and charting the Asiatic coast from Japan to the Arctic, had yielded a wealth of scientific and historical information on these unknown regions. Steller, the naturalist of the second expedition, made the first scientific explorations in Alaska and the Commander Islands, discovering many new plants and animals, and giving the first description of the Aleuts. Krashenninikof and Steller described Kamchatka and its inhabitants. Müller, the historian and geographer of the expedition, Steller, the naturalist, and Gmelin, the botanist, made basic contributions to the scientific knowledge of other parts of Siberia. The three other expeditions sent out by the Russian Government in the eighteenth century—those of Synd (1764), Krenitzin and Levashef (1768-69), and Billings and Sarichef (1786-91)—accomplished relatively little in the field of natural history, though Levashef and Sarichef left valuable descriptions of the

Aleutian Islands and their inhabitants and Sarichef made the first topographic surveys in the region.

In the early part of the nineteenth century important contributions to the natural history of the North Pacific were made by Tilesius and Langsdorf of the Krusenstern expedition (1803-6); by Chamisso and Eschscholtz of the Kotzebue expedition (1815-18); and by Mertens and Von Kittlitz of the Lütke expedition (1826-29). Pioneer studies on the currents, temperatures, specific gravity, and salinity of the North Pacific waters were made in 1824 by E. H. Lenz, physicist of the second Kotzebue expedition, and by other Russian expeditions of that period.

In 1786 Gerassim Pribilof discovered the island of St. George in the group now named after him; St. Paul, the second large island of the Pribilof group, was reached the following year. These islands, which were uninhabited by man, swarmed with animal life—sea otters, sea lions, foxes, walrus, and birds—but most important of all fur seals, which bred there in incredible numbers. Pribilof's discovery came at an opportune time. Under relentless hunting, the sea otter, once so abundant in the Aleutian and Commander Islands, had been steadily decreasing in numbers, and the Russians had been forced to extend their operations east toward Kodiak and Prince William Sound. Fur seals had already begun to rival the sea otter as a source of revenue, the animals being killed as they passed through the Aleutian chain to and from the Pribilofs in spring and fall. The discovery of the two small islands where they congregated by the millions in the breeding season enabled the Russians with very little effort to obtain fur seals in almost any quantity.

Two years prior to Pribilof's discovery, in August 1784, the first Russian colony in Alaska had been established by Grigorii Ivanovich Shelikof at Three Saints Bay, on the southeast side of Kodiak Island. A rival fur company established an outpost at Cook Inlet in 1786 and another at Nuchek on Hinchinbrook Island, Prince William Sound, in 1793.

As manager of his company, Shelikof appointed a Russian merchant, Alexander Baranof, who arrived at Three Saints Bay in 1791. The following year Baranof moved the company headquarters to St. Paul, the present town of Kodiak, at the northeast end of Kodiak Island. Meanwhile, English, French, Spanish and American ships were carrying on a profitable fur trade with the Chugachigmiut, the Eskimo inhabitants of Prince William Sound, and the Kolosh, or Tlingit Indians of southeast Alaska. To meet this competition and to secure Russia's claim to possession

of the territory, Baranof established a post at Yakutat, east of Prince William Sound, in 1796, and another called New Archangel, 6 miles north of Sitka, in 1799.

During the period of Russian expansion to south and southeast Alaska the Aleuts played an important, though not particularly happy, role. Because they were exceptionally skillful hunters and long accustomed to Russian supervision, hundreds of them were sent out in their small skin-covered bidarkas to scour the seas in search of sea otter. First they were taken to Kodiak and from there accompanied exploring parties to Prince William Sound and farther south, eventually even to the Russian colony in California. In 1794 about 1,000 Aleuts in 500 bidarkas were sent to Yakutat to hunt sea otter, and a like number of Aleuts and Kodiak Eskimos were in Baranof's party when it left Kodiak for Sitka Harbor in 1799. The Prince William Sound Eskimos and the fierce and warlike Tlingit resented the encroachments of the Aleut hunters and attacked them at every opportunity. Hundreds of Aleuts were killed when the Tlingits attacked and destroyed New Archangel (Old Sitka) in 1802, and other hundreds formed a large part of the force with which Baranof recaptured the settlement in 1804.

When Alaska was purchased by the United States in 1867 the active period in Aleutian history had come to an end. The period following the purchase was one of lawlessness and reckless exploitation. During the later years of the Russian regime a policy of conservation and control of the fur resources had been in effect. To insure the fur supply of the Pribilof Islands the Russians had made it a practice to kill only the bachelors, or young male fur seals, and a strict system of supervision prevented overhunting of sea otter on the Aleutian Islands. When Alaska passed into possession of the United States all this was changed. American fur hunters began to operate in Alaskan waters and, unrestrained by law or conscience, made easy fortunes by the indiscriminate slaughter of fur seals and sea otters. Especially disastrous was pelagic hunting, the killing of seals, males and females, on the open seas as they migrated annually through Pacific waters to and from the rookeries in Bering Sea. American, Canadian, Japanese, and Russian ships all engaged in this wasteful method of hunting, as a result of which the fur seals soon were threatened with extinction. Efforts at suppression were of little avail until finally, in 1910, the American Government assumed full control of the seal herds and in 1911 signed a treaty with Great Britain, Russia, and Japan which prohibited pelagic sealing. The hunting of sea otters, which by that time had been almost exterminated, was also pro-

hibited by the treaty. Under Government supervision the sea otter has been saved from extinction, and the Pribilof fur seals have increased to the point where they again number well over a million animals.

In recent years commercial activity in the Aleutians has been confined to fox farming on some of the islands, the operation of a whaling station at Akutan, and sheep raising and herring fishing on a limited scale. Prior to the war the islands had not shared in the economic development that came to other parts of Alaska through exploitation of rich mineral deposits, fisheries, and other resources. A few gold-bearing quartz veins have been found on Unalaska, copper ores have been reported in a few localities, and sulfur deposits also occur. But as none of these was important enough to justify mining operations, the islands had not been surveyed geologically or topographically. And as there was practically no commercial shipping west of Unalaska, hydrographic surveys had not been made in the western part of the chain.

The Navy had recognized the strategic importance of the Aleutians, but because of the remoteness of the islands, the severity of the weather, and difficulties of maintenance and operation, it had not been considered practicable under peacetime conditions to establish primary air bases west of Kodiak. In 1934 Navy planes made an aerial survey of the islands. Kiska, with its excellent harbor, was made a closed area and placed under Navy control, and the naval facilities at Dutch Harbor were enlarged. Aside from activities of this nature, however, there was little public interest in or knowledge of the Aleutians. These remote and fog-bound islands, where the history of Northwest America began 200 years before, still remained the least known part of Alaska.

The Japanese, however, did not forget the Aleutians. The remoteness of the islands from any center of commercial activity, the exceedingly sparse population, the absence of American shipping—the very reasons responsible for our own lack of interest—enabled them to carry out their plans undetected. For many years Japanese fishing boats had operated in Alaskan waters, often just outside the 3-mile limit. In this and doubtless other ways they acquired information, in some ways probably better than that we possessed, on the western Aleutian islands and surrounding waters. On June 3, 1942, the Japanese bombed Dutch Harbor from the air and soon afterward strong Japanese forces occupied the undefended islands of Attu and Kiska at the western end of the chain. The inhabitants of Attu, consisting of 45 Aleuts and Mr. and Mrs. C. Foster Jones, the Government school teachers, were either captured or killed. Kiska was uninhabited.

In May 1943 American troops landed on Attu, and after 3 weeks of bitter fighting the Japanese forces were wiped out. In August American and Canadian troops landed on Kiska but met with no resistance, as the Japanese, realizing the hopelessness of their position, had escaped under cover of fog.

ETHNIC RELATIONSHIPS OF THE ALEUTS

The Aleuts inhabited the Aleutian and Shumagin Islands and the Alaska Peninsula eastward to the Ugashik River on the north and to Pavlof Bay on the south. Their neighbors to the east were the Aglemiut Eskimos who occupied the upper part of the Peninsula and Nushagak Bay, and the Kaniagmiut, another Eskimo tribe inhabiting Kodiak and surrounding islands and the adjacent coast of the Peninsula. The Kodiak people were mistakenly referred to as Aleuts by the early Russians.

The Aleuts speak a language remotely related to Eskimo, and hence are classed among the Eskimoan peoples. But while their language belongs to the Eskimo stock, it is so different from the mainland dialects that an Aleut himself would not be aware of the relationship. An Aleut and an Eskimo from Kodiak or the mainland could no more understand one another than could an Englishman and a German.

Physically the Aleuts resemble the Kodiak and other Eskimo peoples of southwest Alaska. They are of medium height, have swarthy complexions, coarse black hair, broad heads and wide faces. The first description of the Aleuts is that of Steller, who saw them on the Shumagin Islands in 1741:

They are of medium stature, strong and stocky, yet fairly well proportioned, and with very fleshy arms and legs. The hair of the head is glossy black and hangs straight down all around the head. The face is brownish, a little flat and concave. The nose is also flattened, though not particularly broad or large. The eyes are as black as coals, the lips prominent and turned up. In addition they have short necks, broad shoulders, and their body is plump though not big-bellied . . . Finally, I observed also on all these Americans that they had a very scant beard, but most of them none at all, in which respect they again agree with the inhabitants of Kamchatka and with other East Siberian peoples. (Golder, 1922, vol. 2, pp. 96, 104.)

A number of authors after Steller have suggested that the Aleuts were of Asiatic origin. Most authorities, however, believe they are an Eskimoid people who moved into the islands from the Alaska mainland.

The latest evidence bearing on the question comes from Dr. Aleš Hrdlička's archeological excavations on Amaknak, Umnak, Amchitka, Kiska, Agattu, and Attu (Hrdlička, 1938, 1940). The modern Aleuts,

represented by skeletons found in the upper levels of the old village sites, had broad and low skulls, in this respect resembling the Tungus and other east Siberian tribes more closely than they did American Indians or northern Eskimos. The significance of this is not clear. It cannot mean that within the past few hundred years Tungus or any other known Asiatic people crossed over directly to the Aleutians in such numbers as to affect the physical type of the entire population. If the Aleutians served as "stepping stones" for recent Asiatic migrants, the Commander Islands would have been the first and most important "step" to break the 380 miles of open ocean between Kamchatka and Attu. However, the Commanders were uninhabited when discovered in 1741 and despite careful search no traces of human occupancy antedating the Russian period have been found. Moreover, the Aleut language is related to Eskimo, and is unlike any spoken in Asia. In addition, their customs, their material equipment such as skin boats, harpoons, and other hunting devices, their implements and utensils, and their dress and ornaments show unmistakably that the Aleuts, prehistoric and modern, are Eskimoid rather than Asiatic.

The skeletons which Dr. Hrdlička found in the lower levels of the old sites showed that the people who originally occupied the Aleutian Islands and also Kodiak, probably 2,000 years ago, were a different physical type from those found there by the Russians. Their skulls, instead of being very broad and low, were oblong and relatively high. The type represented by this earlier population might be described as generalized Eskimo, though also resembling prehistoric Indian crania from the coast of British Columbia. The culture of the earlier population did not differ greatly from that of the later Aleuts. The fact that the basic physical, linguistic, and cultural relationships are with America and not Asia seems clearly to indicate that the Aleutian Islands were peopled from the Alaskan side.

This is not to deny that at various times in the past there may have been accidental and transitory contacts by means of which cultural influences were carried in both directions across the Aleutian chain. In this connection there was probably more opportunity for American, i.e., Aleutian, influences to have reached Asia than the reverse. The Aleuts were a maritime people, accustomed to making long voyages in their light but sturdy skin boats, whereas the Kamchadal, Kurilian Ainu, and other primitive tribes of eastern Siberia possessed only crude dugout canoes and were not skilled in navigation. It was probably easier for an occa-

sional Aleut to reach the broad shores of Asia than for Kamchadals or Ainu to make a fortunate landing on the Aleutians.

THE ALEUTIAN LAND-BRIDGE THEORY

Aside from the specific question of the origin of the Aleuts themselves or of possible trans-Aleutian voyages or contacts within relatively recent times, we may also consider the possibility that in the far distant past the Aleutian Islands formed a land bridge over which man first came to America from Asia. Though this has often been suggested, there is no geological or other evidence of the existence of such a land bridge in the Pleistocene or Recent periods, that is, at a time late enough for it to have been used by man. In 1936 the Coast Guard Cutter *Chelan* discovered a submarine ridge west of Attu and at one place obtained a sounding of only 49 fathoms. However, there still remain depths of 1,000 fathoms or more between Attu and the Commander Islands, and of 3,000 fathoms between the latter and Kamchatka. Volcanic activity is still pronounced in the Aleutian region, but in general its effect has been to produce elevation rather than depression of land areas. In short, there is no evidence, geological or otherwise, to indicate that the 380-mile-wide ocean gap between Attu and Kamchatka was formerly a land mass that sank to its present great depths during or after the Pleistocene period.

In the northern and eastern half of Bering Sea the situation is entirely different. A line drawn from Unimak Pass northwest to the Siberian coast a little south of Anadyr Bay would enclose on the right a vast area extending 1,000 miles from north to south where the maximum depth of water is 100 fathoms or less. Moreover, in the greater part of this area, including Bering Strait and the adjacent waters to the north and south, the maximum depth is 30 fathoms or less. The shallower parts of Bering Sea undoubtedly formed a broad land connection between Asia and America during the Pleistocene, or Glacial, period. To account for this former land connection it is unnecessary to postulate an uplift of the sea bottom itself. During the Pleistocene there was a world-wide lowering of sea level, to an extent estimated at between 30 and 60 fathoms, because of the vast quantities of water abstracted from the oceans to form the ice sheets. The mere withdrawal of water from the Bering Strait vicinity opened a broad highway over which mammoths, mastodons, bison, bears, and other Asiatic mammals moved into America between 15,000 and 20,000 years ago. The bones of these animals are

found in abundance in Pleistocene deposits on the Alaska mainland and in Siberia; they have not, however, been found in the Aleutian Islands.

The ancestors of the American Indians probably followed the migrating animals across the Bering Strait land bridge, and continuing inland east and south, spread gradually over the two continents. According to present evidence the ancestors of the Eskimos came later, leaving their Siberian homeland and crossing Bering Strait in skin boats after the melting ice caps had raised the sea level approximately to its present height. Instead of proceeding inland, the Eskimos clung to the shores, moving north and east along the Arctic coast and south to Bristol Bay, the Alaska Peninsula, Kodiak Island, Cook Inlet, and Prince William Sound. Having reached the Alaska Peninsula, some of the early Eskimos continued into the Aleutian Islands and there developed into the branch of the family known as Aleuts.

ETHNOLOGY

Population.—The Aleuts were divided into two groups speaking slightly different dialects—the Unalaskans, of the west end of the Alaska Peninsula, the Shumagin and Fox Islands, and the Atkans, inhabiting the Andreanof, Rat, and Near Islands. When the Russians reached the Aleutians in the 1740's practically every island was inhabited. Agattu was reported to have had 31 villages, Unalaska had 24, and there were numerous settlements on the other large islands. In 1831 there were 10 villages on Unalaska, only 15 of the other islands were inhabited, and the total population was less than 2,000. In recent years only Akun, Akutan, Sedanka, Unalaska, Umnak, Atka, and Attu, in the Aleutian Islands proper, have had permanent native settlements. Four other Aleut villages are located on Sanak and Unga, and at Belkofski and Morzhovoi Bays near the end of the Alaska Peninsula. The Pribilof and Commander Islands, which were uninhabited when discovered, were later colonized with Aleuts. The Attu Aleuts were captured when the Japanese occupied the island in 1942, and those on the other islands were evacuated to the mainland by the United States Government.

There are very few full-bloods among the modern Aleuts, as might be expected after a hundred years of contact with Europeans. Practically all of them are members of the Russian Catholic church, and their mode of life differs little from that of the white man. The following brief description refers to the Aleuts as they were originally, before their culture had been modified by white contact. The earliest descriptions

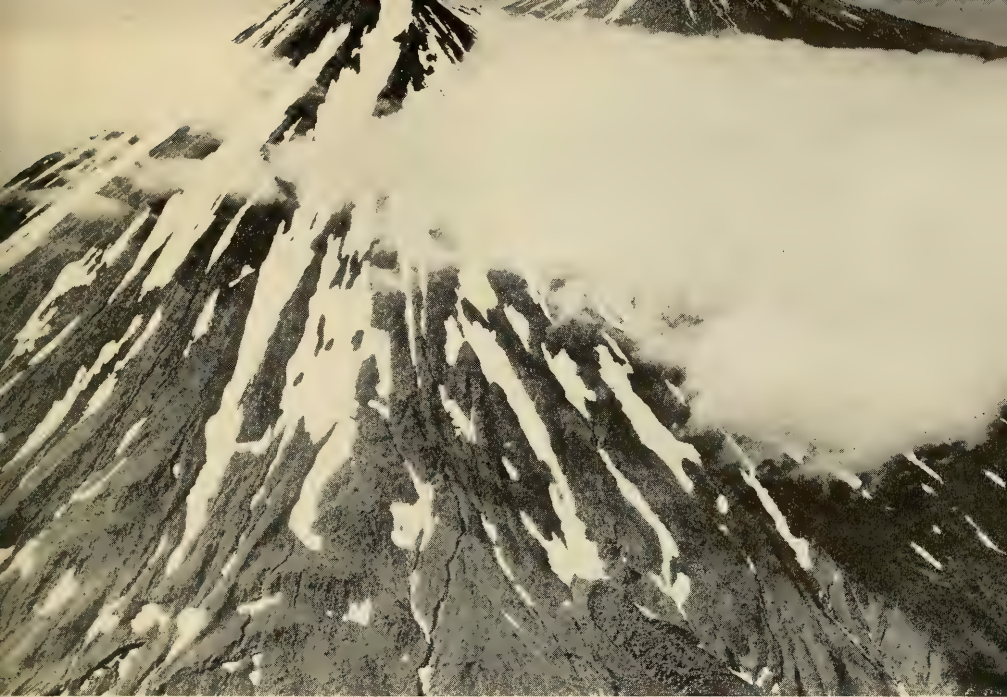


PLATE 6

Upper: Mount Cleveland. Behind it is Mount Herbert on Herbert Island. These form a part of the Islands of Four Mountains. (Official U. S. Air Forces photograph.)

Lower: An Army observation post overlooking Kuluk Bay on Adak Island. A few minutes after this photograph was taken an Aleutian storm, known as a williwaw, moved in across the bay. (Official U. S. Navy photograph.)





PLATE 7

Upper: Kanaga Island, Andreanof group. Although the striking and conspicuous parts of the Aleutians are mountainous, there is considerable land that is low, flat, and poorly drained, as is this peninsula.

Lower: Aerial view of Little Sitkin Island in the Rat Island group. Here the sea has cut cliffs in the radiating ridges of this cloud-capped volcano.

(Official U. S. Navy photographs.)





PLATE 8

Upper: The initial landings on Kiska, August 1943. This photograph, taken by a Navy patrol bomber, shows the landing barges backing away after discharging troops. No one then knew whether or not the enemy was hiding on the hills overlooking the beach.

Lower: Allied amphibious forces beginning ascent of the sloping shore of Kiska, August 1943. Fog blankets the island harbor in the background.

(Official U. S. Navy photographs.)





PLATE 9

Upper: Landing on the beach at Kiska, August 1943.

Lower: Unloading ammunition and supplies on the Kiska beach, August 1943. Army bulldozers built an earthen ramp extending out to deeper water.

(Official U. S. Navy photographs.)



of the Aleuts, resulting from the expeditions of Steller in 1741, Tolstykh in 1761, Korovin in 1763, Soloviev in 1764, Krenitzin and Levashev in 1768, have been made available in English by Coxe (1780), Bancroft (1886), Golder (1922), and Jochelson (1933). Following these are the fuller descriptions of Cook, Sarichev, Sauer, Davidof, Lisianski, Langsdorf, Veniaminov, Dall, and Petroff. To supplement these contemporary accounts we have archeological information derived from excavation of prehistoric Aleut village sites by Dall, Jochelson, and Hrdlička. Despite the rather numerous accounts that have been written it cannot be said that we possess a detailed or rounded picture of Aleut ethnology. The early descriptions consist for the most part of brief and general statements regarding the appearance of the people, their clothing, weapons, hunting practices, food habits, etc., and contain little information on other aspects of their culture.

Villages and houses.—Aleut villages were always situated on the sea-coasts; the interior of the islands was completely unoccupied and seldom visited. No people were ever more dependent on the sea than the Aleuts. The land provided only a few of their needs—stones for knives and other implements, grass for weaving, heath for fuel, and a few plants for food. Everything else came from the sea. For most of their food they depended on sea mammals, fish, sea birds, sea urchins, and mollusks; their clothing was made from skins of sea mammals and birds and their boats from driftwood and skins; implements, weapons, and household utensils were made of bone or driftwood, and the material for their houses was driftwood and whale bones.

Three factors governed the choice of a village site—a nearby supply of fresh water, a beach where boats could be landed in rough weather, and a situation offering safety against surprise attack. Villages, therefore, were not usually located in protected coves or at the mouths of large streams but in such exposed places as sand spits, isthmuses or narrow necks of land accessible to two bodies of water, so that the boats could be carried from one to the other in case of attack. After the arrival of the Russians, when internal warfare had ceased, villages were located at river mouths where salmon could be caught in the spawning season.

The sites of the old Aleut villages appear today as elevated ridges or mounds known as shell heaps or kitchen middens. They are usually covered with a dense growth of grass and other vegetation (see p. 68), and the partly filled-in pits of the old underground houses can still be seen. The larger sites may reach a depth of 20 feet or more, and are

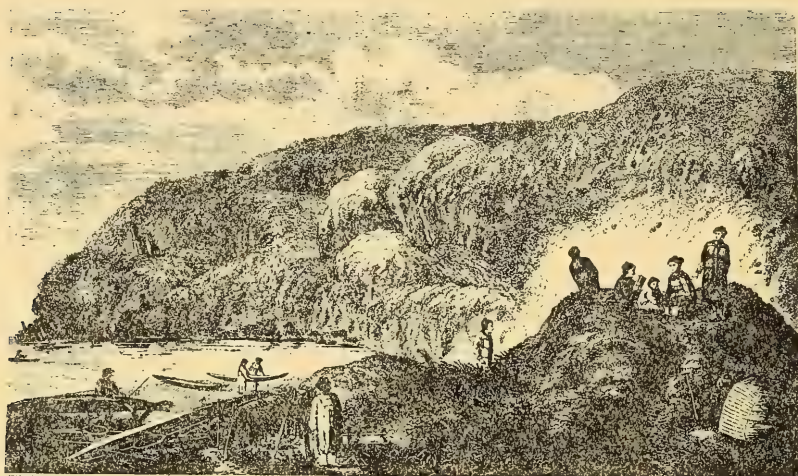


FIG. 2.—Reproduction of the first published illustration of an Aleut house and natives, Unalaska Island. Drawing by John Webber, artist on Cook's expedition of 1778. From "A Voyage to the Pacific Ocean," by Capt. James Cook, London, 1784.



FIG. 3.—Interior of underground Aleut house, Unalaska Island, 1778. From a drawing by John Webber in "A Voyage to the Pacific Ocean," by Capt. James Cook, London, 1784.

composed for the most part of shells, animal bones, and other village refuse that slowly accumulated through centuries of occupation.

The original Aleutian house was a large communal structure up to 240 feet long and 40 feet wide. From 10 to 40 families, sometimes as many as 150 people, lived in one house. Sunk to a considerable depth in the ground and covered over with earth, the houses appeared to be wholly underground; the early Russians, in fact, usually referred to them as "caves." Walls and roof supports consisted of upright driftwood timbers and sometimes whale bones. The roof was made of poles or planks covered with a layer of dry grass and over that a layer of sod. The houses were entered through small openings in the roof by means of notched logs used as ladders. The smaller houses had two or three entrances of this kind, the larger ones five or six. Each family had its separate living quarters, partitioned off by stakes and grass mats. There were no fireplaces in the houses; heat and light were provided by oil-burning stone lamps. The modern Aleutian house, or barabara, is very different from the original form. It is a single family dwelling, much smaller than the old communal house, and the entrance is at the side instead of through the roof. Like the old type of house, it is partly underground and covered with sod.

Clothing and adornment.—Men and women wore a long shirtlike garment resembling the Eskimo parka, but without a hood. Those of the men were made from the skins of puffins, cormorants, guillemots, or murre; the womens' were made of sea otter or seal skins. Little children's parkas were sometimes made of downy young eagle skins.

When hunting at sea or walking in rainy weather a light waterproof garment called a kamleika was worn over the parka. It was made of thin, translucent strips of sea lion or seal intestines, decorated with little tufts of brightly colored feathers sewed in at the seams. It had a hood which was tied close around the face with a drawstring and the sleeves were similarly tied at the wrists.

The men wore a peculiar kind of hunting helmet, made from a flat piece of wood which had been scraped very thin, steamed, and bent over and sewed together at the back (fig. 4). It was conical in shape with the front elongated to project over the eyes. A variant form was a wooden visor, open at the top. These hunting hats and visors were elaborately decorated with painted designs, bone and ivory carvings, and sea lion whiskers strung with glass beads.

The Andreanof Aleuts and perhaps those on the more westerly islands went barefooted the year around. In the Fox Islands fur stockings and

waterproof leather boots were sometimes worn. The legs of the boots were made from the esophagus of the sea lion and the soles from sea lion's flippers.

The men cut their hair short on the top of the head; the women cut theirs in front so as to hang over the forehead, tying the rest into a knot at the top. The women's faces were tattooed, and both sexes wore stone or ivory labrets in the lower lip and a variety of other ornaments—bone pins, beads, small stones, feathers—in the nose and ears.



FIG. 4.—A man and a woman of Unalaska. Drawn by John Webber, 1778. From "A Voyage to the Pacific Ocean," by Capt. James Cook, London, 1784.

Food and food gathering.—The Aleuts subsisted on sea mammals, fish, shellfish, birds, and plants. The principal food mammals were seals, sea lions, sea otters and whales; walrus were also obtained occasionally, and on Unimak Island caribou and bears were hunted.

Codfish and halibut were caught with hook and line from boats. The hooks were of bone, consisting of a slightly curved shank to which was fastened a curved barbed point. The lines were made of dried and braided strips from long stalks of the giant kelp. They are described by Tolstykh as "about 150 fathoms long, made of sea-weeds, as thick as an ordinary iron wire and twice more enduring than a hemp cord." Notched stones were used as sinkers. For catching smaller fish such as sculpin and flounders they used a small rounded hook made from a single piece of bone or shell.

Salmon and salmon trout were caught in nets, or speared, in streams and lakes; herring were also caught in nets. Fish spears, with long handles and barbed bone points, were also used to catch the Atka mackerel and various other kinds of fish, as well as octopus.

Smelt (capelin) were scooped up in dip nets or pails, or simply picked up on the beach, as they came to spawn in the surf.

Birds and eggs formed an important part of the Aleuts' summer diet. Cormorants, murres, ducks, geese, loons, ptarmigans, and gulls were among the many kinds of birds that were eaten. Some of them were caught in nets and in snares made of baleen or sinew. Birds in flight were caught with the bolas, a kind of sling consisting of from 4 to 6 cords about 30 inches long tied together at one end, and each with a small stone at the free end. When the bolas was thrown into the air, the cords spread out like the spokes on a wheel and when one of them touched a bird the others would immediately wrap around its wings and body, bringing it to the ground. Another device for catching birds was a light spear with a single barbed point at the end and a cluster of three other points projecting at an angle from near the center of the shaft. These bird darts, like most of the harpoons and darts used by the Aleuts, were cast by means of a throwing board. This was a narrow wooden board about 20 inches long with a slightly concave upper surface, with hole and notches at the lower end for finger grips, and a spur or hook at the upper end for engaging the butt of the dart. In effect the throwing board increases the length of the arm, making possible a longer and more accurate cast.

Numerous varieties of clams and other mollusks were eaten by the Aleuts. The extent to which such food was consumed can be judged by the great piles of shells found around their old village sites. The most important food mollusk was the common black or purplish mussel (*Mytilus edulis*). South of the Aleutians this mussel is sometimes poisonous at certain times of the year. Peril Strait, north of Sitka, was so named because over a hundred Aleuts, accompanying Baranof's colonizing expedition in 1799, died there from eating black mussels.

One of the most important of all food animals was the green spiny sea urchin, enormous quantities of which were consumed by the Aleuts. They were gathered among the rocks and in shallow pools at low tide. The spines were rubbed off and the shell broken between two stones to obtain the masses of bright yellow eggs, the only part that was edible. One sea urchin provides as much as a tablespoonful of eggs.

Vegetable foods were used somewhat more extensively in the Aleutians than in other parts of Alaska. Among the plants eaten were salmon-berries, blueberries, crowberries, the roots of the anemone and lupin, the bulbs of the Kamchatka lily, the stalks of the wild parsnip and cow-parsnip, and various kinds of kelp and other seaweeds (see p. 69).

Fish and meat were sun-dried and stored for future use. Food of all kinds was usually eaten raw. The Aleuts had no cooking pots of stone or clay such as were used by the Eskimos, and food boiling was not generally practiced until iron and copper pots were introduced by the Russians. Meat was cooked on flat stone "frying pans," or roasted between two hollow stones cemented with clay. One early account describes meat and fish being boiled in springs of hot water on Kanaga Island in the Andreanof group.

Fuel and fire making.—The limited supply of driftwood was too essential for other purposes to be extensively used for fuel. The houses were lighted and heated with bowl-shaped lamps of stone or bone; seal, sea lion, or whale blubber was used as fuel, and the wicks were made of moss or grass. In cold weather the Aleuts warmed themselves by standing or squatting over a lamp or a small fire made of grass, the heated air rising and being held in by their parkas. The fuel most commonly used for cooking was the heath plant, crowberry (*Empetrum*), or the roots of the ground willow. Grass and the dry dead stalks of the wild parsnip were also used.

Fire was made in two ways, with the wooden fire drill and by striking two stones together. The stones were rubbed with sulfur and the sparks were caught in a tinder of bird down or finely shredded grass sprinkled with sulfur.

Handicrafts.—When the Russians arrived the Aleuts already had some knowledge of metal. Steller and others state that a few of the men had iron knives, their most precious possessions, and iron knives and hatchets were the only Russian trade goods that they seemed eager to receive. The few pieces of metal they possessed might have come from wrecked Japanese or European ships, or might have reached them through trade with the mainland tribes. It is known from archeological excavations on St. Lawrence Island and at Bering Strait that small quantities of iron from some Asiatic source reached the Eskimos of that section probably a thousand years ago. From there it might have been passed on in trade to the Eskimos of southwest Alaska and finally to the Aleuts.

Essentially, however, the eighteenth-century Aleuts were living in the Stone Age. The blades of knives, scrapers, adzes, harpoons, arrows, and

sometimes darts were made of chipped or rubbed stone, usually andesite. Wood was split with bone wedges and mauls, the objects were hewed into shape with stone adzes, and the final cutting and smoothing was done with knives and scrapers. A high degree of skill was shown in the carving of their wooden boat frames, wooden dishes, and their many weapons and other objects of wood, bone, and ivory.

The women were no less skillful artisans in their own sphere, particularly in sewing and weaving. Theirs was the laborious and difficult task of making the skin garments, from the cleaning and preparing of the skins to the final sewing. The skins for parkas—bird skins for men, and seal and sea otter for women—were soaked in a wooden tub containing urine, which the Aleuts also used instead of soap for washing their hands. The skins were cut with a broad-bladed stone knife with the handle above, the implement known to the Eskimos as the ulu, or woman's knife. The skins were then scraped to remove adhering particles of fat, washed in water, carefully dried, and sewed together. Fine strips of seal or whale sinew, split with the fingernails, and thin strips of twisted gut were used for thread. Sharp-pointed bone awls or bodkins were used to make the holes. The needles were made from the small wing bones of gulls or other birds, with a notch at the end instead of an eye.

Many kinds of grass mats, bags, and baskets were woven by the women. The mats had a variety of uses, serving as bed covering, screens, kayak seats, etc. Bags and baskets were used for carrying fish and meat and as receptacles for many other purposes. The women showed consummate skill in making the small, tightly woven baskets for which the Aleutian Islands are famous. They were made of fine strips of grass (*Elymus mollis*) often as thin as silk. The fibers were split with the fingernails which the women allowed to grow long for this purpose. In later times threads of colored silk or worsted were woven in for decorative effect.

Skin boats.—The Aleuts had two kinds of boats, a light skin-covered craft which the Russians called a bidarka, the equivalent of the Eskimo kayak, and a large, open, skin-covered boat corresponding to the Eskimo umiak. The small boats were about 12 feet long, 2 feet wide, and 2 feet deep. The framework was made of driftwood, the pieces carefully fitted and lashed together with leather thongs; the covering was of seal or sea lion skins. The hunter sat in a round opening in the top and used a double-bladed paddle. A piece of gutskin fastened around the rim of the hatch was drawn up and tied around the man's body under the arm pits to prevent water from entering. The smaller bidarkas were so light they

could be picked up and carried easily with one hand. Stones were used as ballast, to give a measure of stability; and an inflated bladder was sometimes fastened to the deck of the boat to prevent it from capsizing. Originally the bidarka had only one hatch, like the Eskimo kayak. Later they were made with two, but the three-holed type was a Russian innovation.

The open skin boats of the umiak type are no longer used in the Aleutians. They were about 30 feet long, were propelled by oars, and were capable of carrying 30 or 40 people. They were used for transportation rather than hunting.

Hunting sea mammals.—The Aleuts were the most skillful of the northern sea hunters. In their single- or double-hatched light skin boats they made long coastal voyages and often ventured far from shore in



FIG. 5.—Aleut hunter in skin-covered bidarka, Unalaska Island, 1778. From a drawing by John Webber in "A Voyage to the Pacific Ocean," by Capt. James Cook, London, 1784.

pursuit of sea otters, seals, sea lions, and even whales. Their weapons were light darts and spears cast with the throwing board.

Sea otter hunting was a cooperative activity, requiring from 4 to 20 bidarkas, each carrying one or two hunters. The boats would start out in a wide semicircle, keeping from 50 to 100 yards apart. The sea otter comes to the surface to breathe at about 10-minute intervals, its head remaining visible for only a few seconds. When one of the hunters sighted an otter he would lift his paddle and point it toward the animal. The other boats would hasten to the place indicated and attempt to surround the quarry. When it came up within casting distance one of the hunters would throw his dart, using a throwing board such as described under bird hunting. The barbed bone dart point, which was fastened to a line connected with the shaft, slipped from the shaft when it penetrated the body of the animal. The otter was not likely to be killed outright by the small bone point of the dart, but its movements were impeded by

the shaft, to which was fastened an inflated bladder or section of seal gut, or by a bladder at the end of the line attached to the dart point. With the position of the wounded otter indicated by the bobbing float or dart shaft, the boats formed a close circle around it and when the animal reappeared other darts were thrown until it was killed.

Whales were hunted in an entirely different manner. Instead of being surrounded they were killed with a poisoned lance. The blade of the lance was of stone, on which was smeared a powerful poison extracted from roots of the monkshood (*Aconitum*), a plant common in the Aleutians. Two bidarkas usually went out together, so that if one were overturned by the violent thrashing of the wounded whale the other could come to the rescue. The hunters approached the whale carefully from the rear, cast their spears and rapidly retreated. The lance head with its poisoned blade became detached from the shaft and remained in the whale's flesh, causing it to die after about 3 days. If the hunter was fortunate, the whale would drift ashore. Many of those killed, however, were never obtained. The lance head bore the owner's mark, so that possession could be established if the whale drifted in. There was no danger in eating the meat or blubber of a whale killed with poison, it being necessary only to cut away the flesh immediately around the wound.

The Russian missionary Veniaminof, who lived among the Unalaska Aleuts from 1824 to 1834 thus describes the ceremonial aspects of whaling:

The pursuit of whales was encumbered with many observances and superstitions. The spear-heads used in hunting the whale were greased with human fat, or portions of human bodies were tied to them, obtained from corpses found in burial caves, or some poisoned roots or weed. . . . From these corpses the hunters endeavored to detach some pieces of the body, or perhaps a fragment of clothing. The hunters who obtain such charms are always fortunate in their pursuit, but meet with an untimely and painful death. They begin to putrefy while yet in their prime. All such objects had their own special properties and influence, and the whalers always kept them in their bidarkas. The hunter who launched a spear provided with such a charm upon a whale at once blew upon his hands, and having sent one spear and struck the whale, he would not throw again, but would proceed at once to his home, separate himself from his people in a specially-constructed hovel, where he remained 3 days without food or drink, and without touching or looking upon a female. During this time of seclusion he snorted occasionally in imitation of the wounded and dying whale, in order to prevent the whale struck by him from leaving the coast. On the fourth day he emerged from his seclusion and bathed in the sea, shrieking in a hoarse voice and beating the water with his hands. (Petroff, 1884, p. 154.)

It seems likely that the preparation and use of the aconite poison was a closely guarded secret known only to the whalers themselves and that

their explanation of the efficacy of fat from human corpses was merely a device to prevent outsiders from learning the nature of the real poison. (Heizer, 1943.) The use of aconite poison was widespread in Asia—from India and Malaysia to the Kurile Islands and Kamchatka—and it was probably from this direction that the practice spread to the Aleutians and Kodiak.

Warfare.—Before the arrival of the Russians there was frequent warfare between the Aleuts and neighboring tribes as well as internal conflict among the Aleuts themselves. The principal weapons of war were the lance and the bow and arrow. For defense the Aleuts carried wooden shields and wore body armor consisting of rows of wooden rods lashed together. If threatened by a superior force they would seek refuge on some small steep-sided island or promontory. Prisoners of war became the slaves of their captors.

Aleut war parties went as far as the Nushagak River on Bristol Bay to attack the Aglemiut Eskimos and made frequent raids against the Eskimos on Kodiak Island. They were attacked in turn, and severe losses were sometimes suffered by both sides. The Unimak Aleuts fought with those on the Shumagin Islands, the Alaska Peninsula, Unalaska, Akun, Akutan, and Umnak. There were also conflicts between the Unalaskans and the people of Unalga, Umnak, and some of the more westerly islands.

With the arrival of the Russian fur hunters internal warfare ceased, and the eastern Aleuts joined forces in a determined but futile effort to oppose the newcomers. The Aleuts fought bravely but their lances and bows were pitifully inadequate against Russian muskets and cannon. In surprise attacks they managed to kill a number of Russians and to destroy several ships, but they paid dearly for these successes. In retaliation Glottof destroyed all the villages on the south side of Umnak, and the punitive measures undertaken by Solovief resulted in the death of some 3,000 Aleuts. The reign of terror instituted by the lawless *promyshlenniki* ended in 1790 with the arrival of the Billings expedition, sent out by the Russian Government. After that the Aleuts, thoroughly subdued and apparently reconciled to their new status, lived at least in peace.

ANIMAL LIFE OF THE ALEUTIAN ISLANDS

By AUSTIN H. CLARK

U. S. National Museum

GENERAL CONSIDERATIONS

The most striking feature of the animal life of the Aleutian Islands is the immense number and variety of the sea birds, many of which in former years played an important part in the economy of the native Aleuts who ate their flesh and eggs and used their skins for clothing. Some of these birds are now much less abundant than they used to be, largely as the result of placing blue foxes on uninhabited islands where previously the birds had lived quite undisturbed in enormous numbers.

Next in interest, and greater in economic importance, are the sea mammals—sea lions, seals, whales, dolphins, and porpoises—which in the past provided for the natives food and clothing, light and heat, materials used for boats and dwellings, and other necessities. The sea mammals occur in great variety and formerly were exceedingly abundant, but many of them have been much reduced in numbers by persistent hunting. Thus the sea lion has disappeared from a large part of its former range, and the bowhead whale now is rarely seen in Bering Sea.

This whale was of such value that ships came all the way from New Bedford to obtain its oil and whalebone. During the War between the States the Confederate raider *Shenandoah* was sent to Bering Sea in an effort to cut off the supply of whale oil from this region and fought 24 engagements with New England whalers.

Most of the sea mammals, especially the smaller whales, dolphins, and porpoises, are difficult to identify until one has become very familiar with them, particularly with their actions. They commonly appear suddenly and unexpectedly, often when it is very foggy or the sea is very rough, and it is seldom that they show more than a portion of their bodies above the water. Photographs of these, especially photographs taken from the air, would make interesting and valuable records, as our knowledge in regard to them is very deficient.

Fishes are exceedingly abundant and of very many different kinds. Some of them, as the cod, halibut, capelin, herring, and sand lance, recall those of the North Atlantic, while others, especially the North Pacific salmon, the Atka mackerel, and the numerous sculpins, liparids, and rockfish, are more or less strictly confined to the North Pacific, many

of them ranging in the west as far south as Japan. Several of the fishes are of great importance both to the natives and to Europeans. Some of the most valuable fishes, such as the cod and the Atka mackerel, are said by the natives to have increased greatly in numbers among the western islands since the disappearance of the sea lions.

Broadly speaking, the marine invertebrates seem less strange than the vertebrates, for although most of them differ from the corresponding North Atlantic species, the differences are such as would be appreciated only by experts. Some are found in all cold northern waters, some occur only in Bering Sea and the Gulf of Alaska, some range northeastward from Japan, and some are Antarctic in their affinities, occurring along the whole west coast of South and North America.

The insects and spiders are Arctic and sub-Arctic, many ranging throughout the Arctic, or Arctic and Boreal regions; others are characteristic of Arctic North America, still others of Arctic Asia. Many are known only from the Bering Sea islands, though at least a few of these may later be discovered elsewhere.

In the preparation of the following account of the zoology of the Aleutian Islands I have been most generously assisted by O. J. Murie, of the Fish and Wildlife Service, and for interesting notes on the fauna of Kiska I am indebted to Capt. George Andrew Ammann, Lt. Morlan W. Nelson, Sgt. Harold J. Dyer, Sgt. Donald P. Duncan, and Pvts. Franklin C. French, Edward McDonald, and Sumner Dole.

BIRDS

A dark and murky sea swarming with living things and free of ice throughout the year, together with myriads of islands, islets, and rocks to serve as breeding places, makes the southern Bering Sea, especially the vicinity of the Aleutian chain of islands, the world's most ideal place for sea birds, and many more different kinds of sea birds are found here than live in any other region. Their numbers, too, at least about the more remote and uninhabited islands, such as Bogoslof, are incredibly great, and certainly are not exceeded elsewhere.

An interesting characteristic of the sea birds in this region is that the frequent thick fogs do not seem to hamper their activities. Most of them fly to and from their nesting places through the thickest fog with the same speed and assurance as in clear weather.

But the islands are treeless and largely barren, with areas of rank grass in the lowlands, dense herbage in occasional secluded valleys, bog vegetation, and at moderate elevations a sparse alpine flora. A few low

bushes struggle for existence in situations where they are sheltered from the frequent gales. So the Aleutians are as unfavorable for land birds as they are ideal for sea birds. Only 17 kinds of land birds breed in the islands, some of these no farther west than Unimak, which may be regarded as in effect a continuation of the Alaska Peninsula, and a few more regularly or casually visit them during their migrations. In addition to these, a considerable number of accidental visitors have been reported.

The land birds are either inhabitants of all far northern regions, or are chiefly American types, a westward extension of the fauna of the Alaska Peninsula region. Most of the sea birds are North Pacific types, but some occur throughout the Arctic regions. The two albatrosses breed within or just outside the Tropics, migrating northward to the Bering Sea, while the three shearwaters have their true home in the sub-Antarctic islands, journeying thence each winter (our summer) to the Aleutian region, and the sharp-tailed sandpiper, an Australian bird, is an occasional visitor to the Aleutians.

Among these islands familiar birds may have unfamiliar habits. For instance, the song sparrow, with us a characteristic inhabitant of low meadows, and the little winter wren, which we usually associate with rugged regions chiefly in the mountains, here become birds of the rocky sea coast and adjacent grassy or weedy patches. When a strong wind blows against a cliff creating a powerful updraft, many different kinds of birds take advantage of the opportunity for indulging in aerial acrobatics. Even geese may be seen soaring in circles high in air with motionless outstretched wings, like hawks. That greatest of aerial acrobats, the raven, performs all sorts of comical and seemingly impossible evolutions, while puffins and other sea birds whizz back and forth, and the gulls soar and twist about.

Of the land birds the most conspicuous is the raven, which is common everywhere. It is the scavenger of the villages, in which it is very bold; but, though impertinently bold, it is always wary, and away from the villages is very shy and difficult to approach. This raven differs from our eastern raven in its notes. It does not give the crowlike though shorter and more clear-cut "caw-caw-caw" when on the wing. As in all the regions where it lives the raven here plays an important part in the myths and legends of the people.

The most familiar bird song in the Aleutians is that of the Aleutian song sparrow. The bird itself is larger and grayer than the continental song sparrows. During the breeding season it is found in the low areas near the sea which are overgrown with an abundance of wild rye. Here

it is very shy, dropping into the grass at the least alarm. At other seasons it frequents rocky shores and boulder-strewn beaches. It is a very persistent songster, performing even in the worst weather.

The lively bubbling trill of the winter wrens, the smallest of the Aleutian birds, is a characteristic bird note of the islands. These vivacious and pert little creatures are common, always keeping close to the sea, along the high rocky shores or in the lower portions of the valleys, where their surprisingly loud and clear notes betray their presence. These wrens are variable, and several different local forms are recognized in the Aleutian population.

Handsomest of the land birds is the Aleutian rosy finch—dark chocolate brown with the wing coverts, sides, and rump heavily washed with a beautiful rose color, and the nape and sides of the head light gray. It is common everywhere, about rocky cliffs and beaches as well as inland in the mountains, feeding about the patches of snow on the rocky slopes.

Much more conspicuous is the Pribilof snow bunting, black and white with usually a wash of rusty color. Other varieties of this bird are found throughout far northern regions, and in winter in the northern United States. The snow bunting is found either inland in the mountains about the patches of snow, or along the sea coast, especially along the rocky beaches. It is a common permanent resident of the western islands, but is seasonally variable on Unalaska and eastward. Outside the breeding season it is exceedingly shy and difficult to approach.

Commonest of the land birds of the Aleutians is the Alaskan longspur, the males of which are easily distinguished by the black head and breast with a broad white stripe running back from the eye, broad chestnut band across the back of the neck, streaked brown back, and white lower breast and belly. Although it occurs everywhere except at the highest altitudes, it is most numerous in the lower and less rugged regions. Like a lark, this bird often sings while fluttering high in the air.

Locally common in grassy areas as far west as Amukta in the Islands of Four Mountains, but rare farther westward, is the Aleutian Savannah sparrow, a small, streaked brown bird.

In the higher regions everywhere lives the western pipit, a small, trim gray-brown bird streaked below and with the outer tail feathers largely white, that walks about wagging its tail up and down, and sings when on the wing high above the earth after the manner of the skylark. There is a vague and somewhat dubious record of the red-throated pipit.

The Unalaska fox sparrow, distinguished by its bright rufous lower back and tail, occurs on Unalaska, but not farther west. A few barn

swallows live in the buildings on Unalaska, and the dipper also is found here along the streams and has been reported from Attu. The northwestern shrike, golden-crowned sparrow, and Alaskan hermit thrush are known from Unimak, though not from farther west. Regular seasonal visitors to the islands are the redpoll on Unimak and Unalaska, which O. J. Murie tells me has been seen as far west as Ogliuga, and the Alaskan yellow wagtail, which on its migrations visits Attu.

Casual visitors to the Aleutians are the Kamchatkan nightingale (Kiska), a small dull olive bird with a bright red throat, the finest and most persistent songster in Kamchatka; the black-backed and Swinhoe's wagtails (Attu), small black and white birds with long tails that are constantly waved up and down as they walk about; and the rustic bunting (Kiska).

Of the larger land birds, the ptarmigan are of special interest. On the extreme eastern islands as far as Unimak lives the willow ptarmigan, a close relative of the famous "grouse" of Scotland. This bird inhabits the low country, preferring the more level and open localities, and is abundant wherever it is found, often occurring in enormous flocks. The males are very pugnacious. Mr. Murie writes me that he has records of two specimens of this bird from Atka.

Another ptarmigan, the rock ptarmigan, is found on all the islands, and on some of them is rather common. This bird prefers the higher rocky regions, coming down into the valleys to rear its young. It rarely assembles in large flocks, usually not more than a dozen or perhaps a score being found together. Patches of rock protruding from the snow and the vicinity of snow banks are favorite localities for it. In such localities in the spring the curious croaking rattle of the males can be heard on all sides. The rock ptarmigan is a swift and powerful flier, and often on being flushed simply disappears in the distance. Although in any one locality it varies greatly in numbers from year to year as a result of local wandering, it does not go from one island to another. Each island or group of islands has a special variety—Nelson's ptarmigan on the Islands of Four Mountains and eastward, Turner's ptarmigan on Atka, Chamberlain's ptarmigan on Adak, Sanford's ptarmigan on Tanaga, Townsend's ptarmigan on Kiska, Gabrielson's ptarmigan on Amchitka, and Evermann's ptarmigan on Attu. The ptarmigan on Unalaska and Attu are very dark in color, those on the intermediate islands lighter, some of them very light. In winter all the ptarmigan are pure snowy white with black tails, the rock ptarmigan usually with a black line from the base of the bill to the eye.

Conspicuous among the land birds of the Aleutians are the eagles, of which four kinds have been recorded. One of these is a common resident, one a very uncommon resident, and two casual or accidental visitors. Most frequently seen is the northern bald eagle, easily recognized when adult by its white head and tail. It occurs everywhere, though in the extreme west, on Attu, it is only a visitor. This bird has a habit of sitting on the edge of some high bluff or on a rock by the shore with its wings partly opened, a surprisingly effective form of camouflage which more than once has deceived me. It is not a shy bird, usually allowing a close approach. Turner says that this eagle is undoubtedly the original of the "bayglei," a mythical creature formerly much feared by the eastern Aleuts.

The golden eagle is much less common than the bald eagle—indeed, Mr. Murie tells me that it is decidedly rare. Like the bald eagle, it is only a visitor to Attu. It is more active and more agile than the bald eagle, and much more shy, although when flying it will sometimes pass very near—within a dozen feet or so. It is said to be rarely seen along the cliffs and beaches, being more at home in the interior of the islands where the bald eagle does not often venture. But it is seldom seen, most of the records of its occurrence being based apparently on the young of the bald eagle. I have seen one on Unalaska, and several on Atka, one in low grassy land near the sea where it passed over me not 10 feet above my head. The gray sea eagle, more grayish than the bald eagle and with only the tail white, has been reported from Unalaska, and on the same island, near Iliuliuk, I once saw a Kamchatkan sea eagle, resembling a bald eagle but with a long pointed tail and with the shoulders as well as the head and tail white.

Commonest of the hawks on the Aleutians is Peale's falcon, the dark local variety of the peregrine falcon, famous in the old days when falconry was the great sport of the nobility. This fine bird nests on nearly all the islands and is a permanent resident, at least in the western portion of the chain. From time to time it is seen dashing along the rocky shores and cliffs, appearing usually nearly black; but it is not very numerous. The nest is commonly built on a high point on a slope where numerous eiders are nesting. Turner suggests that this is done with an eye to the prospective crop of young eiders.

Capt. George A. Ammann and Lt. Morlan W. Nelson were the first to report the duck hawk from the Aleutians, having observed it on Kiska in the latter part of 1943. Lieutenant Nelson gives the following interesting account of Peale's falcon and the duck hawk:



PLATE 10

Upper: Buldir Island, between Kiska and Agattu. First sighted by Bering on October 28, 1741. It was given the name "St. Stephen." Fog settles low on the leeward side.

Lower: An aerial photograph of Attu Island. In the foreground is Cape Wrangell, the westernmost point of the United States; Massacre Bay at upper right. The average elevation of the peaks is 4,000 feet.

(Official U. S. Navy photographs.)





PLATE 11

Upper: The village of Attu on Attu Island. When this photograph was taken in 1934 there were 38 natives on Attu. Between the Government school house, at right, and the Russian Catholic church are the neat frame houses of the Aleuts. These have largely replaced the old sod-covered houses, although a few of the latter are shown in the background.

Lower: A tent city raised by the Seabees of the Navy Construction Battalion on the beach at Massacre Bay, Attu. Landing craft were still bringing supplies ashore.

(Official U. S. Navy photographs.)





PLATE 12

Upper: Camouflaged Japanese cook shack and tents in the outer ring of Jap defenses on Attu, the first defenses to fall to the Americans. Note the Japanese characters on the cook shack, and the abundant strand wheat or wild rye.

Lower: This photograph was taken by a Navy combat photography unit when the first wave of American troops were put ashore on Japanese-occupied Attu. A detail of soldiers is carrying back a wounded comrade. Japanese snipers generally kept just above the fog line shown on the opposite hills.

(Official U. S. Navy photographs.)





PLATE 13

Upper: Aleut woman weaving a basket of finely shredded grass.

Lower: A semisubterranean house, or barabara, used by the Aleuts. The abundant strand wheat or wild rye grows on top. (Photograph from Ewing Galloway.)



Peale's falcon would hunt just above the cliffs and stoop in at the finches and song sparrows below, missing them most of the time. On several occasions I observed a male that worked a cliff about 300 yards long for 20 minutes and never touched a bird. He did not get discouraged or lessen his flashing attack in the least. Likewise on numerous occasions I would serve the wild falcons waiting on as if they were trained birds. By this I mean that when the wild falcon came over, the sandpipers and shore birds would all turn their backs and freeze; then to aid the falcon I would make these birds fly, giving the falcon a chance to stoop in on them. Only once, however, did any of the falcons make a kill under these conditions, as the pursued birds were less afraid of me than the falcon and would fly only 25 yards and land in the rocks again. Peale's falcon was very tame compared to the wilder duck hawk, and would stoop in to within 20 feet of me while I was chasing out birds for them. Between Kiska Harbor and Gertrude Cove a column of men about 50 in number marching at the base of a cliff, between the ocean and the cliff, kept scaring out shorebirds for a falcon waiting on overhead. The men could not understand why these birds would fly and land practically between their legs each time the falcon would stoop in at them. None of them saw the falcon come within 10 feet of their heads, attempting to catch the birds they chased up.

The duck hawks were very much like those we find in the States. They would hold a higher pitch while hunting and were deadlier in their stoop. Likewise they spent more of their time inland than Peale's falcon. They were not as common as Peale's falcon, although they were still very common compared to what we find in the States. I think I am safe in saying that the native birds in the Aleutians are much more adept in evading a falcon's stoop than we ordinarily find. It is very obvious in observing the pursued birds that they are champions at foiling the falcons. The older birds stay on the wing when pursued in a flock, allowing the younger birds to land or seek protection first, and then by their superior coordination and timing turn sharply at the last split second before the falcon strikes. The birds I speak of as using such tactics are the rosy finches and snow buntings. The song sparrows do not travel in flocks and therefore do not use such tactics. All the falcons had to work much harder for their food on those islands, due to such tactics, than you would think or expect.

Lieutenant Nelson, an experienced falconer, believes he saw gyrfalcons on Kiska, though only one, in the white phase, was identified with certainty. The gyrfalcon, larger and more powerful than the peregrine and its American varieties, Peale's falcon and the duck hawk, and the most prized of all the falcons in the olden days, has been obtained several times on the Pribilofs, but has never previously been reported from the Aleutians.

The rough-legged hawk occurs as far west as Umnak, the marsh hawk is casual on Unalaska and has been reported from Attu as a rare summer visitor, and the western pigeon hawk is recorded from Unalaska. The gyrfalcon, Peale's falcon, and the pigeon hawk never soar as do our more familiar hawks and eagles.

Two kinds of owls are known from the islands. The short-eared owl, a small, light brown, streaked owl, occurs throughout the group in the larger ravines and grassy areas, but is not very common and becomes very scarce west of Umnak. The Aleuts in former times did not like this bird, and the women were afraid to touch it. The much larger snowy owl is reported to have been formerly a fairly common resident on Agattu and a visitor to the other islands. I did not see it on any of the islands, and Mr. Murie writes me that he has never seen it.

The only other bird that can be considered as strictly a land bird is the little brown crane. I once saw two of these on Agattu, and it was long ago reported as an accidental visitor on Attu.

Everywhere on all the islands and as far east as the western end of the Alaska Peninsula, in the lowlands and as high in the mountains as the ground is free of snow, lives the Aleutian sandpiper. This is a typical grassland bird, its habits much like those of our upland plover, its loud, clear cry bearing a striking resemblance to the call of our golden-winged woodpecker or flicker. In winter this bird withdraws from the interior to the rocky shores, where it is to be seen in small companies on the seaweed-covered shelves and among the boulders, recalling our eastern purple sandpiper. It is unusually unsuspicious for a sandpiper. Two close relatives, the Commander Islands sandpiper and the Pribilof sandpiper, are of accidental or casual occurrence in the Aleutians.

Two small geese, the lesser Canada goose and the still smaller cackling goose, used to be locally abundant on the islands west of Unalaska, on some of which they bred by thousands. On the uninhabited and formerly foxless island of Agattu the lesser Canada goose used to be the most numerous bird and showed no fear of man. It was here and on Semichi that they bred in greatest abundance, though there were also vast colonies elsewhere. After the breeding season the birds wandered to other islands to feed on the ripening blueberries. These geese used to be domesticated by the natives on Attu and Atka. At the present time they are decidedly uncommon everywhere. The white-fronted goose occurs sparingly in the Aleutians during its migrations, and has been reported from Sanak, Unalaska, and Attu.

The whistling swan is occasionally seen in winter all along the chain of islands, as far west as Attu. This conspicuous and noisy bird is very wild and never remains long in the islands.

One of the most characteristic and interesting of Aleutian birds is the emperor goose—the tsiesarka of the natives. Tsiesarka is the Russian word for guinea hen, and it must be confessed that this gray-blue goose

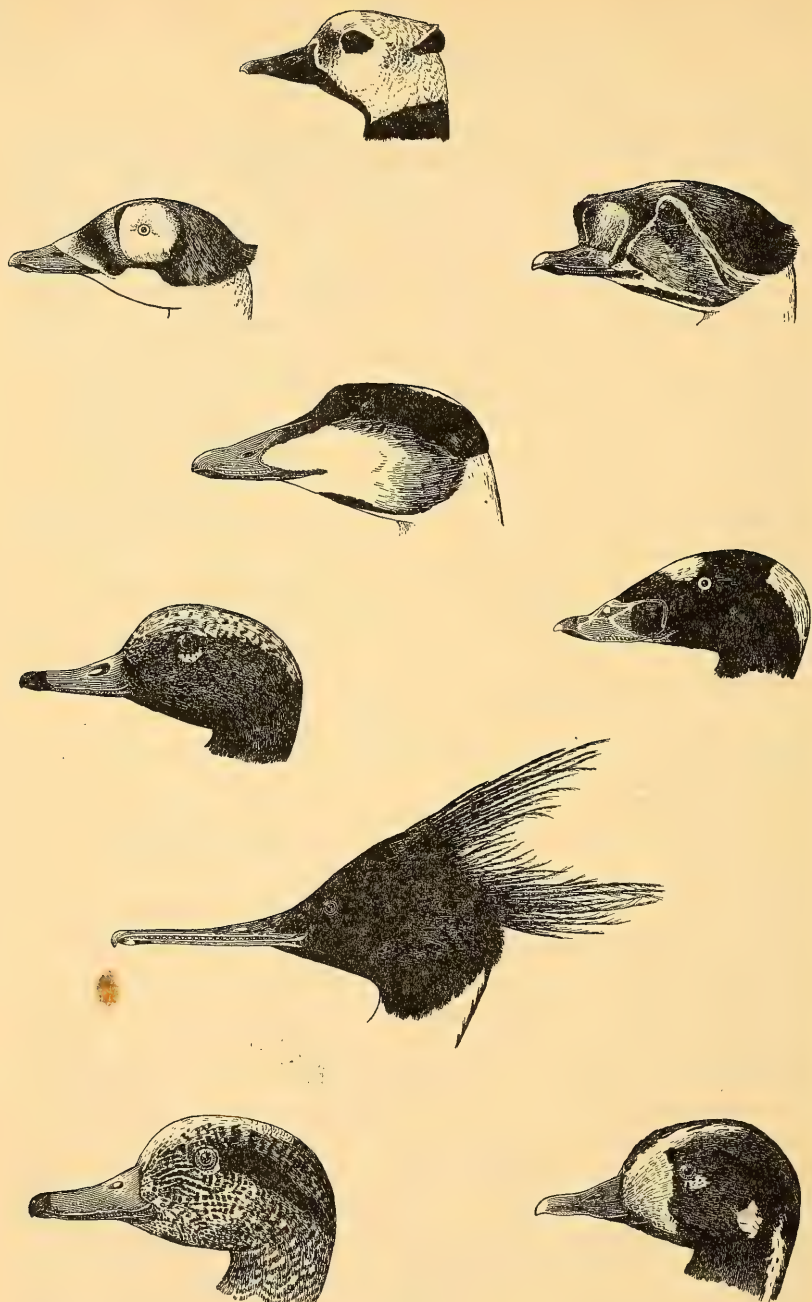
with its white head and neck does suggest a huge slow-flapping guinea hen when on the wing. The Americans in Alaska in the old days misunderstood the natives; they thought they were calling the bird *tsarskia*, which means imperial, so they dubbed the bird the emperor goose. This bird is a winter visitor to the Aleutians, arriving about the middle of November, sometimes even earlier, and remaining until March. Occasional individuals may be seen during the summer. It comes from the Alaskan coast and is more plentiful in the eastern and central islands than in the extreme west. Strictly a seacoast bird, it frequents only the most exposed rocks and reefs, where it is difficult to approach. Its flesh is coarse, with a disagreeable odor and fishy taste.

Among the more or less familiar birds of the Aleutians are the loons. Of these the commonest is the red-throated loon which breeds on nearly all the islands and is more common in summer than in winter. The natives consider its flesh good eating. The common loon, that familiar denizen of our northern lakes, has been reported from a number of islands. The Pacific loon, according to Mr. Murie, is very rare; I have seen it in the breeding season only on Agattu. The yellow-billed loon has not been recorded as a living bird from the Aleutians, but its bones have been found, according to Dr. Herbert Friedmann, in kitchen middens on Unalaska, Amaknak, and Little Kiska. It is probably a more or less frequent visitor.

Two grebes are known from the Aleutians, Holboell's grebe and the much smaller horned grebe.

In suitable localities throughout the islands lives the northern phalarope, an interesting little bird suggesting a very small duck or grebe. It is, however, most commonly seen at sea far from land, often in enormous flocks. Also seen in great flocks far out at sea is the red phalarope which, however, does not nest as far south as the Aleutians. This bird during the winter apparently keeps well away from the land, going south at least as far as Juan Fernandez and the Falkland Islands and probably farther. In the phalaropes the females are larger and more brightly colored than the males. They do the courting and lay the eggs, after which the males assume all domestic responsibilities.

Many fresh-water ducks have been recorded from the Aleutian Islands, and all but one of these are familiar to duck hunters in the United States. This unfamiliar one is the only one that is really common. It is the European teal, closely resembling our green-winged teal but in the male without the white crescent in front of the wings. Occurring on all the islands from Unalaska west, it is abundant on Atka, Amchitka, Kiska,



A.M.Awl.

FIG. 6.

Spectacled eider
European widgeon
Baldpate

Steller's eider
Pacific eider
Red-breasted merganser

King eider
Surf scoter
Pacific harlequin

Semichi, and Attu, and common elsewhere. At Attu it is more numerous on the southern side of the island than the northern. The green-winged teal occurs on Unalaska, and also on the more western islands, though in much smaller numbers than its Old World relative.

Almost everywhere throughout the Northern Hemisphere we find our old friend the mallard, the wild ancestor of the common barnyard duck. This duck is common throughout the islands in the winter, much less numerous in summer. It breeds (or bred) sparingly on Agattu and on Semichi, and probably on other islands. From our point of view, if not the Aleuts', this is the best eating of any of the local ducks. The American pintail occurs in small numbers on Unalaska during migrations, but does not winter in the islands. The baldpate (fig. 6) is a rare summer visitor, recorded from Atka and Attu, the European widgeon (fig. 6) has also been recorded, and the gadwall is of casual occurrence.

The red-breasted merganser (fig. 6) is a permanent, though not abundant, resident on nearly all the islands, breeding about the small ponds at the higher altitudes in the mountains. This is the duck most prized by the Aleuts. The American merganser is a winter visitor to Unalaska, and I once saw what I took to be one of these birds on Agattu.

The commonest of the sea ducks, and one of the most widely distributed, is the Pacific harlequin (fig. 6). It is abundant in small flocks everywhere—about rocky shores, exposed reefs, and gravelly banks—and individually or in pairs on inland streams. Its flesh is fairly good, though somewhat fishy. The greater scaup is rather common along the entire Aleutian chain. I noticed it in some numbers at Atka and Agattu, and Captain Ammann reports it as the most abundant duck at Kiska.

Most noticeable of the sea ducks among the Aleutians are the eiders. The Pacific eider (fig. 6), closely resembling the common North Atlantic eider, with the back, breast, and head white and the top of the head black, is fairly common about the islands west of Unalaska, though not nearly so abundant as are the eiders about the shores of Iceland and Greenland, or off the Massachusetts coast in winter. It is usually noticed about the rocky portions of the shores, and is more numerous in winter than in summer. The handsome king eider (fig. 6), with the back brown and the top of the head light blue-gray, occurs chiefly among the eastern islands, where it is more numerous in winter than in summer. Steller's eider (fig. 6), black above with the head white and with a broad black collar, and pale brownish below, is very common about Unalaska in the winter, and is found as far west as Attu. It stays well offshore, coming inshore only in stormy weather. It is seldom seen in summer, but has

been found at that season on Attu, and the natives say that it formerly bred sparingly on Agattu. The curious spectacled eider (fig. 6), with the neck and throat white and the head light greenish with a large white patch narrowly ringed with black about the eye, is found rarely in the Aleutians.

The American scoter, wholly black, the surf scoter (fig. 6), black with a square white mark on the top of the head and a triangular one on the nape, and the western white-winged scoter, black with a conspicuous white wing patch and a white spot beneath the eye, occur in the Aleutians in fall and winter, chiefly in the eastern islands. Captain Ammann says that at Kiska scoters were fairly common in early fall and later, toward late November, seemed to increase in numbers. At that time flocks of 40 or 50 were occasionally sighted in one of the lagoons or out at sea. The American scoter seemed to be the most numerous and formed the larger flocks. Scattered individuals and pairs of the western white-winged and a few surf scoters were noted. In the summer scoters are scarce. Many years ago I saw a pair of western white-winged scoters at the end of May in Unalga Pass, and in early June a few surf scoters at Attu and Agattu, but in recent years none have been reported west of Unalaska.

The familiar and very noisy old squaw or long-tailed duck winters along the entire Aleutian chain where it is extremely abundant, congregating in large flocks. As elsewhere, it is here essentially a sea duck. A few remain to breed on the fresh-water ponds. The American golden-eye and the bufflehead are found in winter about Unalaska, but only rarely about the western islands.

Of the gulls the commonest is the glaucous-winged, everywhere fairly numerous and becoming abundant in the more inaccessible regions in the west. Like all the larger gulls, this one commonly nests in or near colonies of smaller sea birds, with an eye to their eggs and young. As in the case of other gulls and the raven, the prickly sea urchins are by them considered a great delicacy. The birds often carry them far inland, then drop them on the rocks to break them open. The smaller short-billed gull is sometimes seen in the Aleutians, but according to Mr. Murie less frequently than on the Alaska Peninsula. The large glaucous gull, with the outer wing feathers wholly light, is said to be a permanent resident, but it is by no means common. The western herring or Vega gull is frequently seen among the eastern islands, and the large slaty-backed gull is occasionally noted. The rather small, active, elegant, and graceful Pacific kittiwake, which looks as if the ends of its wings had been dipped

in black ink, is common about Unalaska, becoming more abundant farther west. The red-legged kittiwake is far less numerous, perhaps only casual, and is seen chiefly in the west. Sabine's gull, a rather small gull with a dark head and distinctly forked tail, has been reported from Atka and Kiska, and Bonaparte's gull, of about the same size and also with a dark head, but with a rounded tail, occurs sparingly as far west as Kiska. Ross's gull, of the same size as the two preceding, with the head and pointed tail white, the back and wings light pearl gray, and the under parts a beautiful delicate pink, may occur in the Aleutians as a casual visitor, though it has not as yet been reported.

The usual tern in the Aleutians is the Arctic tern, which is not very common and occurs mainly in the western half of the chain. This bird, which is found in the North Atlantic as well as in the North Pacific, spends the winter in the Antarctic and sub-Antarctic regions, returning each spring to its far northern home. In this tern the entire top of the head down to the lower border of the eye, and the nape, are black, and the bill and feet are bright red. The so-called Aleutian tern, with the forehead and a broad stripe over the eye white and the bill and feet black, has not been found in the Aleutian Islands proper, though Mr. Murie has a record of its nesting on the eastern border of Unimak.

Three jaegers, known as *razboinik* or robbers to the natives, occur in the Aleutians. The only common one is the parasitic jaeger, which nests everywhere throughout the group. The long-tailed jaeger is of casual occurrence, and the pomarine jaeger is occasionally seen offshore.

I have mentioned the Arctic tern which, although a northern bird, visits the Antarctic regions in winter. Four other birds more or less common in the vicinity of the Aleutians reverse this process. At home in sub-Antarctic or at least far southern islands, they spend their winter (our summer) in the far north. The dark-colored slender-billed shearwater (fig. 7), often seen in immense numbers about the Aleutians, particularly in the eastern passes, breeds in the Southern Hemisphere, mainly on the islands in Bass Strait between Australia and Tasmania, on Lord Howe Island, and on New Zealand. The similarly colored but slightly larger sooty shearwater, also reported from the Aleutians, breeds on New Zealand and adjacent islands, and on the islands near Cape Horn. The scaled petrel, dark above but white beneath, of somewhat casual occurrence in the Aleutian region, breeds on the South Island of New Zealand and on Chatham and Bounty Islands. The sharp-tailed sandpiper, an occasional visitor to the Aleutians, is at home in the Australian region. As an indication of the extensive wanderings of these

sea birds, I may mention that a scaled petrel was once taken in western New York, while the sooty shearwater is found sparingly in summer from the Gulf of St. Lawrence to South Carolina, as well as in the Pacific.

Other great wanderers among the sea birds are the largest of them all, the majestic albatrosses. The albatrosses do not fly in the usually accepted sense—they glide. They are kept in the air not by their own exertions, but by the currents of air deflected upward from the slanting surfaces of waves. Because of this, they can live only in the windier portions of the oceans and are unable to cross the belt of prevailing flat calms, or to fly over land. So the kinds found in the stormy southern oceans are quite different from those of the North Pacific, and there are none at all in the Atlantic except in the extreme south. But all of them wander as widely as they can find winds to support them.

Two kinds of albatrosses occur in the Aleutian region, one very dark in color, like a gigantic sooty shearwater, the other mostly white. The dark-colored one, the black-footed albatross, is frequently seen about the islands, usually well offshore. About 20 miles south of Unalaska I once attracted 22 astern of the ship by trailing a piece of meat in the water. A day or two before about as many had gathered to inspect a boatswain's cap that had blown overboard. This bird nests in the western Hawaiian and nearby islands, and, after its family duties are over, wanders widely over the North Pacific. The mostly white short-tailed albatross is much less common, and does not follow ships. It breeds on Wake Island and on the Bonin Islands, and like the other kind wanders widely over the North Pacific after the nesting season. Like all the albatrosses, these two carefully tend their young until they are fully fledged and much heavier and fatter than the adults. They then glide away to sea, leaving the young to learn to fly and to find their food by a process of self-education.

Related to the shearwaters and albatrosses are the various kinds of petrels, which also have their nostril openings at the end of two short tubes. Of the petrels the most conspicuous is the Pacific fulmar, a medium-sized white or gray bird somewhat resembling a gull. In a number of places these birds may be seen in immense flocks which sometimes include hundreds of thousands of individuals. Such flocks have been noted in Akutan and Unimak Passes, and at various places farther west, especially near Semichi. In the Aleutians the majority of the birds are gray; farther south nearly all are gray; farther north all are white. Like all petrels, these birds when disturbed on their nests have the habit of squirting a nasty oily liquid out of their mouths.

Low down near the surface of the sea two kinds of small storm petrels flutter irregularly about more or less like swallows. One of these, the fork-tailed petrel, is light gray, the other, Leach's petrel, is blackish with a white rump. The fork-tailed petrel is common everywhere, but usually stays well offshore. It breeds in many places among the islands. On Agattu I found it nesting in holes along the sides of a deep ravine, mostly more than a quarter of a mile inland. The birds were frequently seen flying up and down the ravine and entering the burrows along its sides. Leach's petrel is not so common. Both kinds are attracted by the lights of a ship and can be heard chirping on all sides, like so many bats. They frequently come aboard, where they are easily caught.

Most characteristic of the sea birds in the Aleutian area are the myriads of puffins, murres, guillemots, murrelets, and auklets—no less than 15 different kinds ranging in size from the tufted puffin (fig. 7), as large as a good-sized duck, down to the least auklet (fig. 7), about the size of a robin. Diversified and interesting as these birds are, they scarcely call for individual mention here, except, perhaps, for the two puffins, easily distinguished from the others by their enormous and brightly colored bills.

The tufted puffin (fig. 7), dark brown with a white patch on the side of the head narrowing behind into a long yellowish tuft, is very common everywhere, and in some places incredibly abundant. It nests in large burrows which it digs in the soil, preferably along the edges of cliffs and bluffs. In many places the soil is honey-combed with a network of these burrows. The skin is very tough, and as the plumage is almost uniform in color these skins used to be in special demand by the natives for clothing. According to Turner, the skins were soaked in stale urine, the Aleut substitute for soap, until all the oil was removed, and then washed in a creek and hung up to dry. Then they were carefully scraped and the tougher parts chewed to make them pliable. An Aleut woman would go on a visit to a neighbor to have a "chai-peet" or tea sociable. In the intervals of drink and gossip a puffin skin would be drawn from beneath the folds of her garment and she would complacently chew it. A parka, or long overcoatlike robe, required 45 skins, which were sewed together with the feathers inside. A parka was expected to last for 2 years, but long before that time it would become a filthy mass of skin and feathers and the home of innumerable cooties, which found an ideal abiding place among the feathers.

Associated with the tufted puffin, and in its habits very similar to it, is the white-breasted horned puffin (fig. 7). This is much less numerous

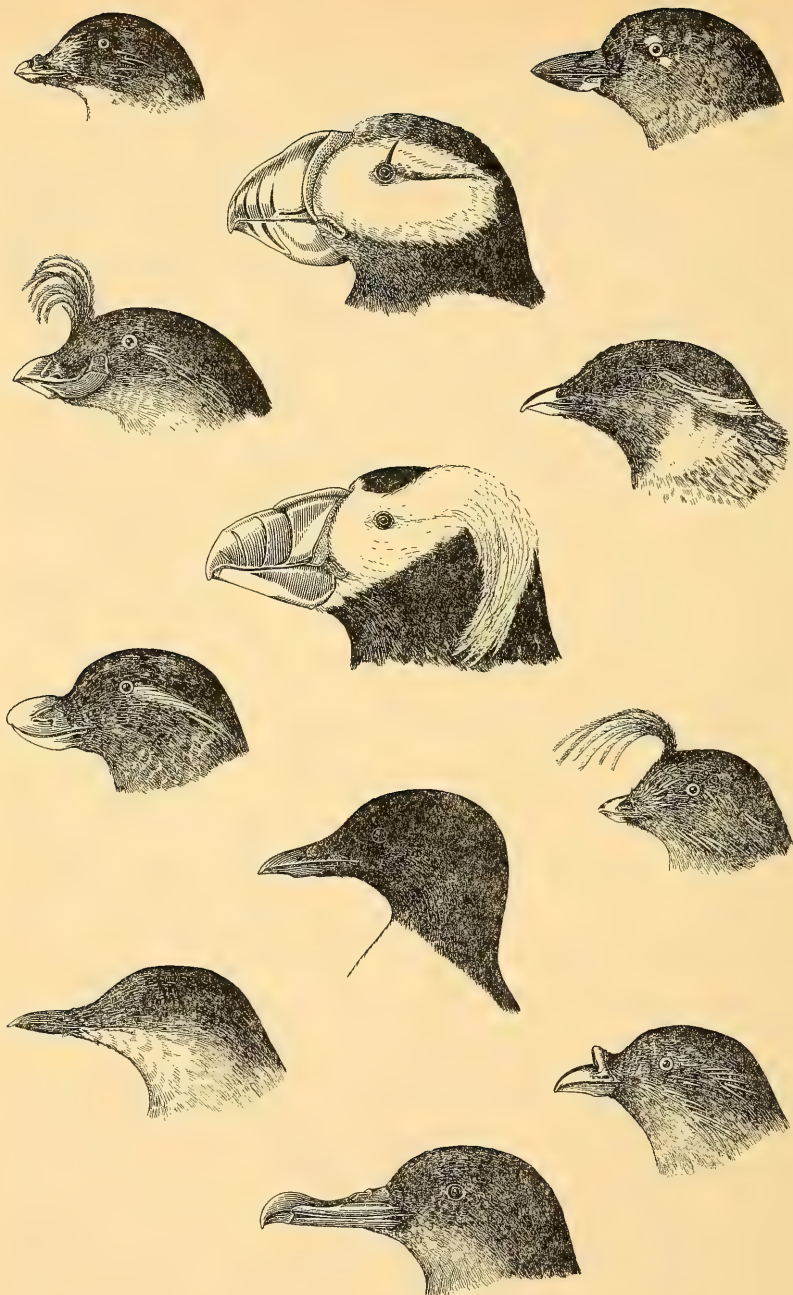


FIG. 7.

Least auklet
Crested auklet
Paroquet auklet
Marbled murrelet

Horned puffin
Tufted puffin
Pallas's murre
Slender-billed shearwater

Cassin's auklet
Ancient murrelet
Whiskered auklet
Rhinoceros auklet

than its larger brown relative. Formerly its skins were used extensively for articles of clothing among the western Aleuts.

About the cliffs, together with the puffins, murre, guillemots, murrelets, and gulls, are the cormorants. These are fairly numerous, though not abundant, and are commonly seen sitting in rows on the rocks near the water's edge, looking like rows of black bottles, or flying low over the sea. Frequently seen in the summer and common in the winter, especially among the western islands, are the pelagic and red-faced cormorants, the white plumes and neck feathers of which were in the past used by the Aleut women to adorn their small work bags. Less common is the white-crested cormorant, the most beautiful of all Aleutian birds. Turner said that the natives of Attu told him of another cormorant that formerly abounded there, but which had not been seen since about 1870. This was said to have been fully twice as large as the red-faced cormorant, and of different plumage. He suspected that this was the large and sluggish Steller's cormorant which formerly occurred about the Commander Islands. This bird was as large as a large goose, about 38 inches long and weighing from 12 to 14 pounds. If this bird did occur at Attu its bones should eventually be found in ancient kitchen middens.

The rocky shores and beaches of the Aleutians are frequented by nearly 20 kinds of shore birds or waders, and probably several more are at least occasional visitors. Nearly all of these are migrants, passing through the islands on their way from and to their breeding grounds. Two of them, however, are common breeding residents. The Aleutian sandpiper has already been mentioned as a bird of the upland bogs which, after the breeding season, changes its habits and becomes a bird of the rocky coasts. The other common resident is the black oyster-catcher, which nests just above the high-tide mark. You soon learn to appreciate the intense dislike of this bird on the part of Aleutian hunters. If while attempting to creep up on some desired creature along the shore you are detected by one of them, it at once sets up a most terrific racket that scares everything within hearing. The wandering tattler has the same obnoxious habit, but is far less numerous.

The Pacific golden plover, the black-bellied plover, and the Pacific godwit are occasional visitors to the islands, and single individuals of the turnstone are sometimes seen along the beaches. The other shore birds known from the Aleutians are the sharp-tailed sandpiper, already mentioned; the pectoral sandpiper; the least sandpiper, as far west as Umnak (Murie); the semipalmated plover (Murie); western sandpiper; and semipalmated

sandpiper (Eyerdam) as far west as Unalaska; and the red-backed sandpiper and Wilson's snipe on Unimak (Murie). The surf bird is known from Sanak, southeast of Unimak, and Mr. Murie tells me that the black turnstone has been found on the same island. There is a single record of the wood sandpiper.

Since at the present time there is no available list of Aleutian birds and no recent publication dealing specifically with them it has seemed advisable to include in an appendix a list of all the species and subspecies known from the islands (p. 77), and also keys by means of which they may be identified (p. 81). In the list and in the keys are given the English names adopted by the American Ornithologists' Union, and in the former also the scientific names in order to facilitate reference to ornithological works. This is advisable, because all conspicuous Aleutian birds are known by at least three different names. For instance, the black oyster-catcher or black sea-pie is commonly called morskoi pietukh (Russian for sea cock), on Unalaska hekli, and on Atka hegig; and the Pacific loon is called gagara shapka (Russian for loon cap, the skin of this bird being commonly used as a cap) and tueluk.

MAMMALS

The land mammals of the Aleutians are few and are mainly confined to the easternmost islands. The largest number is found on Unimak, which is separated from the Alaska Peninsula only by the narrow Isanotski or False Pass. Ice drifting down from the north sometimes becomes jammed in this pass, forming a temporary bridge between the mainland and the island.

Unimak is the western limit of the caribou, the brown bear, the wolverine, the Alaska Peninsula hare, which turns pure white in winter, the mink, and the weasel. Formerly wolves also occurred on Unimak. The Amak meadow mouse is found on Amak, northeast of Unimak, and the Unalaska lemming occurs on Unalaska, and in a slightly different form on Umnak. Unlike their relatives on the mainland, these lemmings do not turn white in winter. A distinctive saddle-back shrew lives on Unalaska.

Capt. George A. Ammann writes me that on Kiska Lt. Morlan W. Nelson and Sgt. Harold J. Dyer saw what was believed to be the little brown bat. Sergeant Dyer also saw it on Adak. This bat occurs as far northwest as the base of the Alaska Peninsula but has never previously been reported from the Aleutians where it is presumably accidental.

Most widely distributed of the land mammals in the Aleutian Islands are the foxes. The red fox, with its varieties the cross fox and the silver fox, which formerly lived on all the larger islands except those of the extreme western group, Mr. Murie tells me is now restricted in a wild state to the Fox Islands, though it is still tolerated on Amlia and on one or two other islands on which blue foxes have been placed commercially. The Arctic or blue fox, some individuals of which are white, ranged even more widely, being abundant on Attu, where it was the only land mammal, though absent from Agattu and Semichi. In recent years it has been placed on these two islands, and indeed on nearly all the islands that would support it, to the great detriment of the bird life.

The Norway rat and the house mouse have been introduced into all the larger settlements. The former in some localities lives along the rocky shores, but the latter does not stray from human habitations. The Aleutian ground squirrel, which lives in colonies, was introduced from the mainland and has become established on Unalaska, Umnak, and Kavalga.

Formerly the northern sea otter was everywhere abundant, but persistent hunting for the sake of its valuable fur brought it almost to the verge of extinction. Thanks to strict governmental protection its numbers are now increasing.

Largest and most spectacular of the seals regularly occurring among the Aleutian Islands is Steller's sea lion, a huge yellowish-brown creature of which the males are 12 or 13 feet in length with somewhat elongated hair on their thick bulgy necks distantly suggesting a lion's mane. The females are much smaller. Once abundant, this animal is now greatly reduced in numbers, and it has disappeared from many of its former haunts. It is still numerous on Bogoslof Island.

A rare visitor to the Aleutians, coming from farther north, is the Pacific walrus of which the male is from 10 to 13 feet in length and weighs from 2,000 to 3,000 pounds. The famous Alaskan fur seal which breeds in immense rookeries on the Pribilofs is a visitor to the Aleutians but does not come ashore there.

The hind feet of the sea lion, the walrus, and the fur seal are mostly or wholly without fur and can be turned forward, assisting progress on land. The flippers are also without hair and can be used for locomotion on land. The sea lion and the fur seal have small external ears. The other seals living in Bering Sea have the hind feet directed backward and straightened so that the soles face each other, and covered with hair.

They are not used in progress on land. The flippers are also covered with hair and are of little use on land. There are no visible ears.

Most distinctive of the true seals of the Bering and Okhotsk Seas, and a rare visitor to the Aleutians, is the ribbon seal. This in the North Pacific takes the place of the Greenland seal, saddle-back, or harp seal of the North Atlantic, which does not range farther west than the mouth of the Mackenzie River. The male ribbon seal is from 5 to 6½ feet long, and is a strikingly handsome animal. It is black with a white band around the neck, another around each flipper, and still another around the body just in front of the hind flippers; from this last a branch runs forward on each side of the body to the shoulders, the two branches meeting in the midline below, but being widely separated above. The female is smaller and wholly different in color, pale grayish yellow or grayish brown, with an obscure transverse whitish band across the lower portion of the back; the limbs and back are darker, with a faint indication of the saddle mark of the male. When viewed from behind, the ribbon-like bands of the male, though faint, are clearly visible. The young of both sexes resemble the female. This seal has not been recorded from the Aleutians in recent years.

The largest of the true seals in Bering Sea is the bearded seal or square-flipper, which differs only slightly from the bearded seal of the North Atlantic. The male is about 10 feet long, and the female about 7 feet. It occurs as scattered individuals, not having the gregarious habit of most seals. Once plentiful in the Aleutians, it is now scarce, if, indeed, it is to be found there at all.

The only common seal in the Aleutian area is the northwest harbor seal, a small seal 5 or 6 feet long that occurs everywhere. It does not differ greatly from the common harbor seal of our northern Atlantic coast, which has been known to wander into Lake Champlain and Lake Ontario. It is quite possible that the Kamchatkan harbor seal may occasionally stray to the Aleutians.

Especially characteristic of the sea in the vicinity of the Aleutian Islands are the whales, dolphins, and porpoises. Most easily distinguished among these is the killer whale. The males of this formidable creature are about 30 feet in length with a very high dorsal fin standing up about 6 feet from the middle of the back. The females are much smaller, about 16 feet long, with a much lower dorsal fin. Killers usually travel in small packs, like wolves. Their offensive armament consists of 24 very large and stout recurved conical teeth in each jaw. They prey especially on young seals. The stomach of one killed near the Pribilofs contained

24 seal pups, and that of another 18. They also eat fully grown seals and do not hesitate to attack sea lions. Porpoises and large fish are also pursued and eaten. Even small fish like capelin when in large schools are gathered in. On occasion they will attack even the largest whales, exhibiting the greatest ferocity and often leaping clear of the water. In the case of the large whales they seem to content themselves with tearing out the throat. They are said to consider the whale's tongue a special delicacy. As in all other regions in which the killer occurs, the natives have a very wholesome dread of it. Once in Unalga Pass in a whaleboat I passed a pack of killers at rather close quarters, and I must confess I was very glad when we were safely by.

The other whales in the Aleutian area may conveniently be divided into two groups, those more than 50 feet in length, and the smaller ones, not more than about 40 feet long and usually much less.

Perhaps the easiest of the less common large whales to recognize is the sperm whale. This is now an infrequent casual visitor to the Aleutians, seen usually in the west. The sperm whale is from 55 to 60 feet long with a very large head which makes up about one-third the total length; the head in profile is straight on top with the snout truncated at right angles. The lower jaw is extremely narrow and has from 20 to 25 stout teeth on each side. There are no teeth in the upper jaw. This whale spouts diagonally upward and forward from the tip of the snout; all the other whales spout directly upward from the top of the head. The females are much smaller than the males, only about 30 feet long; they do not stray into northern seas.

In the old days beginning in 1848 when whaling was at its height the bowhead was common in the Okhotsk and Bering Seas and abundant in the Arctic Ocean north of Bering Strait. It is now rare, only one or two being taken in Bering Sea each year. This is a true ice whale, seldom found south of the southern limit of pack ice, except in the Okhotsk Sea where all the ice disappears during the summer. The bowhead is about 60 feet long. The head is strongly arched and is very large, about one-third the total length. There are no teeth, but instead there is a row of whalebone plates in the upper jaw, of which the longest are about 12 feet in length. The skin of the throat is smooth, and there is no dorsal fin.

Of the common large whales of Bering Sea the easiest to recognize is the humpback. This is a stout-bodied whale from 50 to 60 feet long with enormous, usually light-colored flippers about 13 feet in length and 3 feet across, having a scalloped border. The tail flukes are about 15 feet from tip to tip. There is a prominent hump on the back about one-

quarter of the distance from the tail to the snout, and the broad, flat head is studded with irregular rounded lumps that rise about an inch above the general surface. The lower jaw projects considerably beyond the upper. The color is black above, white or whitish below. In swimming, this whale pursues a characteristically irregular course as if it could not quite make up its mind just where it wants to go. It is the ugliest and most ungainly of all the large whales, but the easiest and safest to hunt. In former years it was captured in some numbers by the Aleuts.

The North Pacific right whale, found especially on the southern side of the Aleutian chain, resembles the bowhead, but the head is much smaller, only about one-fourth the total length, and the whalebone plates are much shorter. This whale, or a very close relative, played a most important role in early colonial days in New England, especially in Massachusetts.

The three other large whales of Bering Sea are known as rorquals or finbacks; they are distinguished by the presence of a fin on the hinder third of the back, by the longitudinal folds on the throat, and by their slender form. All have plates of short whalebone in the upper jaw, and no teeth. Largest of these is the blue or sulphur-bottom whale, 80 to 90 feet in length, occasionally over 100. This is the largest animal known, much larger than the largest of the ancient dinosaurs. The common fin-

PLATE 14

1. The Arctic tern is the champion migrant. It nests in the Aleutians and throughout Arctic North America, spends the winter in the Antarctic, the extreme summer and winter homes being 11,000 miles apart. The eastern Arctic tern has been estimated to make, in some cases, an annual round trip of 25,000 miles. (Photograph by O. J. Murie, Fish and Wildlife Service, U. S. Department of the Interior.)

2. Gull, showing characteristic flight. Atka. (Photograph by J. Malcolm Greany, Fish and Wildlife Service, U. S. Department of the Interior.)

3. Black-foot albatross and young. This particular photograph was taken in the Hawaiian Islands. (Photograph by A. M. Bailey.)

4. Tufted puffin. Amchitka Island. (Photograph by J. Malcolm Greany, Fish and Wildlife Service, U. S. Department of the Interior.)

5. Fulmar, dark phase. (Photograph by J. Malcolm Greany, Fish and Wildlife Service, U. S. Department of the Interior.)

6. Crested auklet. Kasatochi Island. (Photograph by J. Malcolm Greany, Fish and Wildlife Service, U. S. Department of the Interior.)

7. Wandering tattler. This particular photograph was taken in interior Alaska. (Photograph by O. J. Murie, Fish and Wildlife Service, U. S. Department of the Interior.)

8. Alaska longspur. Savage River, Alaska, July 6, 1923. (Photograph by O. J. Murie, Fish and Wildlife Service, U. S. Department of the Interior.)



PLATE 15

Left: Pelagic cormorants on a cliff in the Aleutian Islands.

Right: Pelagic cormorant and young. Note the crustose lichens on the rocks at the right.

(Photographs by J. Malcolm Greaney, Fish and Wildlife Service, U. S. Department of the Interior.)

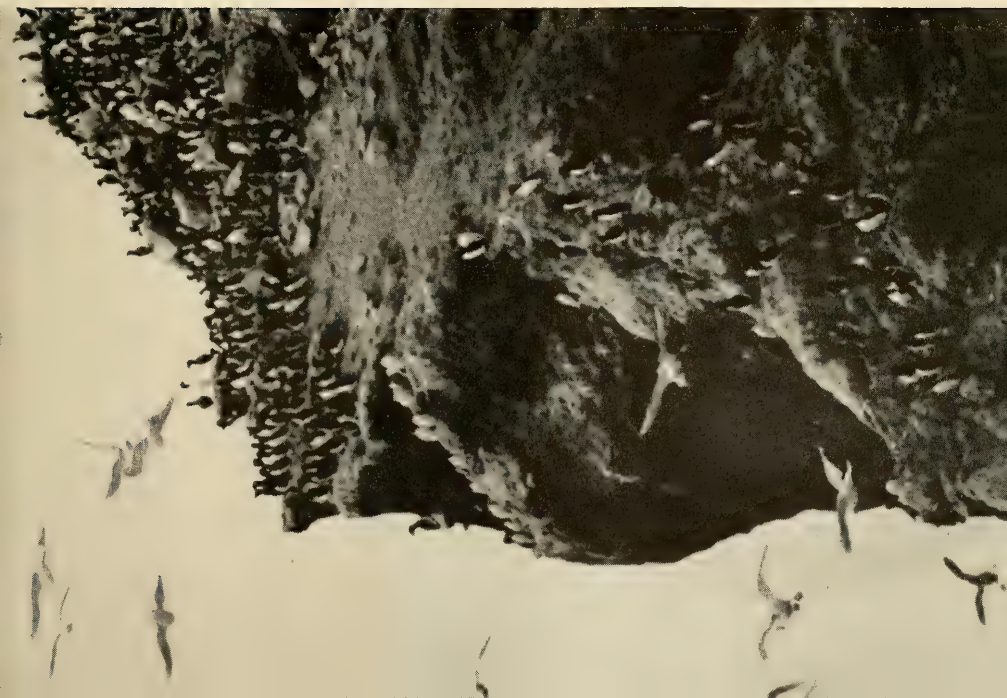


PLATE 16

Left: Murres on Bogoslof Island. Note the gulls waiting to prey on the eggs and baby murres.

Right: Kittiwakes flying up from a cliff on Whale Island, between Afognak and Kodiak Islands.

(Photographs by J. Malcolm Greany, Fish and Wildlife Service, U. S. Department of the Interior.)



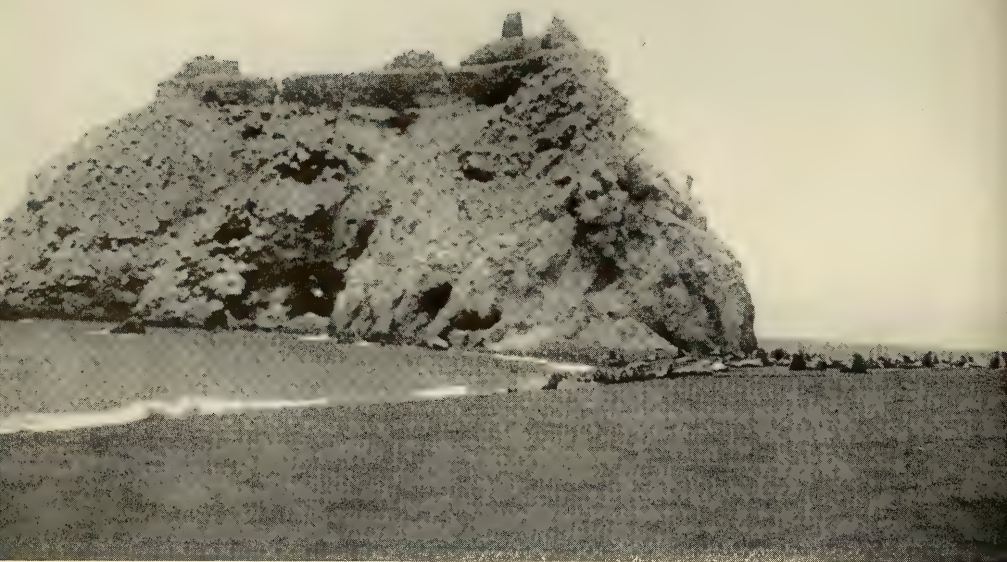


PLATE 17

Upper: Castle Rock and sea lion herd, Bogoslof Island. (Photograph by H. B. Collins, Jr., Smithsonian Institution.)

Lower: Sea lions on Bogoslof Island; an old bull in the foreground. (Photograph by O. J. Murie, Fish and Wildlife Service, U. S. Department of the Interior.)



back is smaller, 60 to 70 feet in length; the whalebone is slate color varied with yellow or brown. It feeds largely on small shoaling fish such as herring. The sei whale is still smaller, about 50 feet long; the flippers are very small, and the whalebone is black with fine curling white bristly ends. The color above is black with oblong light-colored spots, on the under side more or less white.

Much smaller than these, only 20 to 30 feet in length, and with a more pointed snout, is the sharp-headed finner or little piked whale. It is black above, white beneath, with a conspicuous white band across the flippers near the base.

Another whale of the whalebone group is the California gray whale. This whale, which is not very common in Bering Sea, is 40 to 44 feet long, mottled gray, very light in some individuals, dark in others. The profile of the head from the blowhole to the snout is convex instead of straight as in the finners. The whalebone is short and very coarse, and there is no dorsal fin. In its migrations to and from its breeding grounds in southern California it keeps close inshore instead of out at sea. It is a rather lively and active whale, but in calm weather it is sometimes seen lying motionless in the water, with gulls and cormorants resting on its back.

All the other smaller whales belong to the toothed-whale group, of which the killer and the sperm whale are also members. Of these the most easily recognized is the white whale or beluga, an inhabitant of the far north that wanders south as far as Cook Inlet, north of Kodiak Island and, being very erratic in its movements, is quite likely to turn up in the Aleutians. It is usually about 12 feet long, milky white in color as an adult, but dark when young. It has no dorsal fin. This whale often ascends rivers for long distances. It is occasionally taken far up the St. Lawrence, and has been reported from as far inland as Nulato on the Yukon.

Three types of the so-called beaked whales live in the North Pacific. In these the snout is produced into a more or less slender beak, and there is a conspicuous falcate dorsal fin placed well behind the middle of the back. They are from 25 to 30 feet long. Beaked whales are usually seen singly or in pairs, sometimes in small companies. Like nearly all other toothed whales, they feed on cuttlefish. In Cuvier's beaked whale there is a single conical tooth of moderate size directed forward and upward on each side of the lower jaw near the tip. In Stejneger's beaked whale there is a much compressed and pointed tooth on each side of the lower jaw some distance behind the apex. Baird's beaked whale

has two moderate-sized compressed and pointed teeth on each side of the lower jaw at the tip.

The other small whales of Bering Sea have the dorsal fin in the middle of the back, or are without one, and possess a complete set of numerous teeth, at least in the lower jaw. The pygmy sperm whale, about 10 feet long, has the teeth of the upper jaw absent or reduced to a single pair in front; in the lower jaw there are from 9 to 12 rather long, slender, pointed, and curved teeth on each side.

In addition to species already mentioned there are in Bering Sea the common dolphin, which resembles the dolphins so abundant in all warm seas; the familiar harbor porpoise; the blackfish, well known on the New England coast and elsewhere; the long-nosed dolphin; the rough-toothed dolphin; the bottle-nosed dolphin; the right whale porpoise; the striped porpoise; the grampus; the false killer whale; and Dall's porpoise.

No account of the mammals of southern Bering Sea would be complete without a mention of the strangest of them all, Steller's sea cow, a huge creature resembling a manatee but much larger, 20 to 25 feet long, and with a crescent-shaped tail. It was formerly abundant about the shores of Bering and Copper Islands, where it browsed in the great kelp beds, but it has not been seen since 1768.

FISHES

Quite likely to be mistaken for whales, especially when seen from the air, are two very large and lazy dark-colored fishes occasionally, though rarely, seen in the seas about the Aleutians. They may be distinguished from whales of the same size by the fact that their tails, as in all fishes, are vertical, whereas the tail flukes of all the whales and their relatives are horizontal. The larger of these is the basking or bone shark, a perfectly harmless creature usually from 20 to 30 feet long, though sometimes reaching 50. It is easily recognized by its pointed snout, which is more or less elongated. The other is the sleeper, Greenland, or Arctic shark, usually about 10 feet long and never exceeding 18 feet. This shark by preference feeds on seals. Another very large fish, the queer-looking sunfish, which seems to be all head and no body, is occasionally seen floating on the surface in the Aleutian region.

Perhaps the most interesting elements of the fish fauna of the Aleutians are the salmon, which occur in immense numbers at the proper season in all the streams and lakes. These North Pacific salmon cease feeding on entering fresh water. Their colors change, the jaws of the

males become elongated and curved inward, and after spawning they die, not returning to the sea like the Atlantic salmon.

Five kinds of salmon occur in the Aleutians. Most abundant and most generally distributed is the humpback or pink salmon—the gorbusha of the Russian-speaking natives. This is the smallest of the Pacific salmon, weighing usually from 3 to 6 pounds. It differs from the other salmon in its very small scales. When in the sea it is the lightest-colored salmon, light grayish above with silvery sides and a white belly; there are oblong black spots on the tail. In fresh water it becomes hump-backed and hook-jawed, the distortion of the body being carried to an extreme exceeding that in any other salmon. The flesh is soft and pale in color, with little of the characteristic salmon flavor. The humpback swarms everywhere, spawning in brooks, lakes, swamps, and even in brackish water.

The red salmon, sockeye, or *krasnaia ryba*, is the neatest and most symmetrical of the Aleutian salmon. It weighs from 6 to 10 pounds, usually about 7. In the sea it is clear sky-blue above, silvery below, and has no spots. After entering the streams the color soon changes to crimson, at first bright but soon blotched with darker and blood red, with the head bright olive green. The flesh is deep red and is firmer, drier, and less palatable than that of the king salmon. This fish always spawns in small streams that run into the head of a lake. The young fry live in the lake, leaving just before the arrival of the spawning adults the following year. This fish was formerly caught in large numbers by the Aleuts of Attu in the lake not far from Chichagof Harbor.

The silver salmon, *kisutch*, or *bielaia ryba*, is very similar in size and color to the red salmon, but the dorsal fin is always black at the tip, and there are only 23 gill rakers instead of 37. In the spawning season it becomes hook-nosed and the color changes to blotchy red. A peculiarity of this fish is that the scales fall off if it is handled, leaving only those along the lateral line. The flesh has a better flavor than that of the red salmon, but is paler in color and not so firm, having a tendency to disintegrate during cooking. This is the last of the common salmon to arrive in the Aleutians in the summer.

The dog salmon or *hayko* is rather larger than the silver salmon, averaging 10 pounds. When in the sea it is plump and silvery and is best distinguished from the red salmon by the tendency of the dark color of the back to form vertical bars on the sides. In the spawning season it becomes largely black, and the jaws are greatly elongated and distorted. The flesh is very pale, with little of the salmon flavor and none of

the color. It ascends the rivers in autumn and spawns near the sea. It is the least abundant of the Pacific salmon and is found irregularly and in small numbers in the Aleutians, though it occurs as far west as Attu.

Largest of the Pacific salmon is the king salmon or *tshavitscha*, with an average weight of 22 pounds, but occasionally reaching 60, 80, or even more than 100 pounds. The king salmon is easily distinguished by its large size and the circular black spots on the back and tail. As the spawning season approaches, it becomes blackish, the sides blotched with dull red. It usually runs in large rivers, especially those with glacial or snow-fed tributaries, appearing in May. It is of more or less casual occurrence in the Aleutians, becoming uncommon at Attu. Here I once saw several taken, together with an immense number of other species, in a seine at the head of Chichagof Harbor.

Abundant everywhere in streams and lakes is the Dolly Varden or salmon trout, the *golets* of the natives. This handsome trout is rich dark blue or olive green, with numerous cream-colored spots and the fins more or less marked with red, the pectorals and those of the under side often bordered in front with white. When in the sea they are steel gray with spots of paler gray. In the small streams some distance from the sea they may be only a few inches long and very intensely colored. They never grow very large in the Aleutians, though in continental Alaska they attain a weight of 25 pounds. This trout is extremely destructive to salmon eggs and young fry. It is an excellent game fish, eagerly taking a fly, especially a small red fly. Salmon spawn, however, make the most attractive bait.

The only other fishes found in fresh water in the Aleutians are bull-heads or fresh-water sculpins, up to about 4 inches long, and the common three-spined stickleback, the latter often very common in the streams and abundant in the shallower portions of the bays.

The sea fishes are exceptionally numerous and varied. One of the most important is the Pacific cod, which is abundant everywhere in the Aleutians, especially on the northern side of the islands, and reaches a large size. The average weight is about 12 pounds, but individuals of from 18 to 24 pounds are not uncommon, and not a few weigh more than 30 pounds. The larger ones are from deep water. At Attu cod were almost unknown until about 1873 when, after the disappearance of the sea lions, they became common.

The most characteristic, as well as the handsomest, of the Aleutian fishes is the Atka mackerel, which is not a true mackerel at all, though it has a similar flavor. This fish reaches a maximum of about 18 inches in

length and a weight of 3 or 4 pounds, but the average is about 2½ pounds. The color is a beautiful lustrous chrome yellow with six transverse black bands. It is most abundant in the passes about Atka and Attu, especially near the entrance to Chichagof Harbor, but it is also abundant about Kiska and between Unalaska and Unalga. This fish was not known at Attu before 1875, when it appeared quite unexpectedly. The natives asserted that it chased away the sea lions. The Atka mackerel appears about the middle of May and is found in the kelp beds. It takes the hook readily, but it is so extremely abundant that it is usually taken with gigs.

The halibut is common everywhere along the Aleutian chain, and here reaches a large size, up to at least 365 pounds. It is usually found in deep water, from about 100 to 600 feet below the surface, the larger ones at the greater depths. But in the spring when the Atka mackerel appear in the channels between the islands the halibut move up into the shallow water of these passages where many, some of great size, may be seen lying on the bottom like huge flagstones, taking their toll of the smaller fish.

Capelin, small fishes reaching a maximum length of about 10 inches, abound in incredible numbers throughout the Aleutians. These little fish spawn on sandy beaches about the third week in July, according to the natives every third year. When a high wave runs up the beach the fish dash in and cast their spawn which is immediately covered by the sand the wave washes back with it. When the fry are hatched, about a month later, the waves wash them back into the sea. Capelin are excellent eating and are dried in great numbers by the natives. Only the heads are removed, as it is not necessary to clean them. At spawning time thousands of gulls and terns gather for the feast, while offshore seals and killer whales take their share. The capelin are at all times one of the principal foods of the cod.

Another little fish, the sand lance, up to about 7 inches in length, is abundant in great schools off sandy shores. When disturbed this fish at once buries itself in the sand. It is excellent eating, and is also extensively used as bait for larger fish, many of which feed very largely on it.

Many kinds of sculpins are found about the Aleutians, one abundant species reaching more than 2 feet in length. These are eaten by the Aleuts, but not by Europeans as a rule. Various kinds of rockfish occur among the islands, and some are very common. Herring are also found. Large rays or skates are sometimes seen, and there are many kinds of flounders. Under stones between tide marks live slender blennies, up to

8 inches long, with a dorsal fin provided with numerous sharp spines running the whole length of the back. Various sorts of liparids or sea snails are quite common. These are soft gelatinous fishes with a large sucker on the under side of the throat by means of which they attach themselves to rocks. And in addition to all these, the sea about the Aleutian Islands abounds with numerous other kinds of fishes, many of which are of wholly unfamiliar and often bizarre types.

SEA INVERTEBRATES

Very many different kinds of sea invertebrates live along the shores of the Aleutian Islands and in the nearby sea, and some of these are almost unbelievably abundant. Although the number of different types is far less than on a tropical reef, the actual bulk of living things is vastly greater. This sea life includes immense numbers of minute creatures, largely crustaceans, that float about freely in the water feeding on the diatoms and other microscopic plants, other larger creatures that feed on them, and so on up to the largest fish, seals, sea birds, and whales; while on the bottom live numerous other kinds of animals, mainly crustaceans, worms, mollusks, and echinoderms, that feed on algae or seaweeds, or on the detritus from them, or on the detritus constantly falling down from the teeming life above, or on each other.

The Sitka periwinkle, in appearance much like the familiar brown periwinkle of the New England coast, is abundant on the rocks, while on the sandy beaches a large white natica or moon-snail, also much like the common New England one, burrows just beneath the surface. In crevices and under stones lives a rock snail or thais in a general way resembling the common New England one, but larger. This is, or used to be, gathered by the Aleut women and used for food. As an experiment, we tried them once and were all made very uncomfortable. The rock oyster, a moderate-sized rounded oyster, is extensively eaten by the natives, and its shells are a characteristic feature of their kitchen middens. The common black mussel is also eaten, but, like its Atlantic relatives, becomes very poisonous under certain conditions.

Perhaps the most important of the invertebrates along the shores of the Aleutians is the common green sea urchin, a globular bony creature from 2 to 4 inches in diameter covered with short green spines. It is the same one that is so characteristic of the rocky shores and tide pools of New England, but here it is vastly more abundant and grows to a larger size. In the past the Aleutian natives subsisted very largely on this creature, and incredible masses of its remains are found about their

dwelling places. The shell is broken open and the five yellow ovaries are eaten, either raw or cooked. They are very good, but it takes a large number of the animals to make a single meal. Wherever sea urchins occur in sufficient abundance they are always a favorite food. In the Mediterranean, the Caribbean, and the East Indies they are more or less of a luxury, but in the Aleutians and in Tierra del Fuego they were in the past of prime importance. Gulls and ravens feed extensively on the sea urchins, and they form the chief food of the sea otter.

The sea cucumbers in the Aleutians are also excellent eating, but they occur mostly in rather deep water and are not easily obtained. Other kinds of sea cucumbers, larger and tougher, living in the Southwest Pacific and on the Great Barrier Reef of Australia, are dried and cured and, as "trepang," find a ready market in China and even as far away as Tibet, where they are regarded as a great luxury.

Common everywhere among the islands is the octopus, living especially on the shallower parts of the flat-topped reefs and rocky shoals between the islands, and at the entrance to harbors. It sometimes lurks in crevices in the rocks when the tide ebbs, if disturbed scuttling with great speed into the water. It reaches an expanse of more than 10 feet from arm tip to arm tip, though the expanse is usually much less, seldom over 5 feet. It is easily killed by a slight squeeze just behind the head. The flesh may be eaten either raw or boiled, and by the natives is, or used to be, considered very good. It is the best of all baits for fish. The natives used to dry the ink sack, the contents of which they ground up and used for black paint.

All along the Aleutians, chiefly in water between 30 and 300 feet in depth, lives the Kamchatkan spider crab, a very large, long-legged crab weighing up to 20 pounds or more. It is common, and excellent eating, though perhaps not quite so good as the blue crab of Chesapeake Bay and the sounds of North Carolina. This crab, which lives in the Bering and Okhotsk Seas and southward along the Kuriles to Japan, is the one furnishing the crab meat that in former years was imported into the United States in large quantities from Japan. Although the Japanese caught great numbers of this crab all along the Aleutian chain, it has never been utilized either by the Aleutian natives or by our fisheries industry.

Many other kinds of crabs, shrimps, sand fleas, and other types of crustaceans, large and small starfishes, sea worms, jellyfishes, and other marine animals are everywhere abundant among the Aleutians. The inshore seaweeds and the great beds of giant kelp are inhabited by hosts of interesting creatures of many different sorts, other kinds are found on the submerged reefs, and still others on sandy or muddy bottoms. Even

the exposed beaches are worthy of examination. The tide pools are especially rich. Besides the abundant seaweeds of various kinds they harbor multitudes of sea urchins, bright red sea anemones, and mussels, together with barnacles, limpets, chitons, snails, starfishes, hermit crabs, hydroids, bryozoans, and various other types of animal life.

LAND INVERTEBRATES

To an entomologist the insects of the Aleutian Islands are of great interest because of their varied responses to local conditions. These responses are of two types, responses to conditions affecting the whole region, such as frequent and violent gales, fog, and low temperatures, and responses to local conditions in limited areas, such as exposed or sheltered spots, the windward or lee sides of rocks, boggy or drier patches, or even the upper or lower portions of the same tuft of grass. In the Arctic, conditions in small adjacent areas may differ widely in temperature and in humidity, so that Arctic terrestrial insects are likely to be exceedingly variable, reflecting the differences in the conditions under which the early stages lived.

The insect fauna of the Aleutians is Arctic and sub-Arctic, modified by adaptation to foggy gale-swept islands—that is, without strong-flying types spending a large part of their time on the wing. It is composed of insects that keep on or close to the ground, many of which have no wings, or have atrophied wings and are thus incapable of flight. In the Aleutians there are no butterflies, true wasps, hornets, bees (except for a single bumblebee), ants, grasshoppers, dragonflies, or biting midges or “no-see-ums.” The only noticeable insects are a common and very pretty rather small moth, a handsome bumblebee, a metallic green, coppery, or bronzy ground beetle, and some flightless crane flies or daddy longlegs—plus the ever-present bluebottle fly. Mosquitoes and black flies or turkey gnats are scarce and very local.

Our knowledge of Aleutian insects is very incomplete, as little collecting has ever been done there, even on Unalaska, the most frequently visited and best-known island; the following account, therefore is drawn up partly from Aleutian records and partly from analogy with the Pribilof Islands, which have essentially the same fauna. Most numerous of the insects of the Pribilofs are small parasitic or vegetarian wasplike flies of which 100 kinds are known; probably as many, perhaps more, occur on the Aleutians. Next in number are the two-winged flies, commonly the predominant group in Arctic regions; there are about 80 kinds of these in the Pribilofs. There are probably at least 50 kinds of beetles,

many of which are flightless, about a dozen moths, mostly small and inconspicuous, a few aphids, a leaf hopper, and a scorpion fly. Spring-tails of a few kinds are very common, and a dark bluish one is often seen congregated in immense numbers on the rocks between tide marks, or in groups on the surface of tide pools, recalling one with similar habits and of the same color often seen along the rocky coast of New England. There are about 40 kinds of spiders, most of them very small, and a few small and harmless centipedes. The sea birds harbor various kinds of bird lice, the seals and sea lions have their own special lice, and head and body lice flourish on the Aleuts—or at least did in the past.

Wherever people of European origin have gone they have taken with them a larger or smaller assortment of insect pests affecting their persons (such as bedbugs), their clothing (such as clothes moths and dermestid beetles), or their stored foods (beetles, some moths, some flies, cockroaches, and others). Even the bright green Cuban cockroach has appeared on the Pribilofs. However, very few of these insects can maintain themselves under the severe conditions in the Aleutians.

PLANTS OF THE ALEUTIAN ISLANDS

BY EGBERT H. WALKER

U. S. National Museum

INTRODUCTION

The impression that most people have on first sighting the Aleutian Islands is one of barrenness and desolation. This is doubtless due to the almost complete absence of trees. However, the low woody and herbaceous vegetation has a lush green appearance, especially that in the more protected valleys. The tundra on the more exposed ridges and slopes has the appearance from a distance of a thick carpet, varying in color with the succession of flowers from season to season. Vast stretches of the higher parts, however, are absolutely devoid of plant growth.

In all the Aleutian Islands there are only two stands of trees—small groves of Sitka spruce (*Picea sitchensis*) on Amaknak and Expedition Islands in Unalaska Harbor. The trees were planted over a century ago and have as yet reached only a very modest size. In certain sheltered places throughout the islands one finds thickets of willow or alder, the stems of the former sometimes reaching a respectable size—large enough at least to furnish needed fuel—but the plants are scarcely worthy of being called trees. This lack of trees is surprising to one familiar with the dense forests not far away on the mainland of Alaska, forests which extend northward into much higher latitudes. Just why there should be this lack of forest growth is not entirely understood. The severe winds and storms and the low light intensity due to the abundance of fog have been considered as possible causes, but the arguments in their favor are not very satisfactory. There seems more evidence to support the belief that the forests which may have existed in the Aleutians before the glacial period and were completely destroyed by the ice caps that existed on each island have not as yet had time to reestablish themselves. The forest on the Alaskan mainland is advancing westward, its course not barred by an inhospitable climate. Various attempts have been made to establish forests in the Aleutians, but all have failed for one reason or another. The failure of young trees to survive under the small groves of Sitka spruce near Unalaska mentioned before may be due to the raids of domestic animals, especially sheep or goats.

In outward appearance, therefore, the Aleutians seem to be part of the great treeless wastes that surround the Bering Sea on all sides and extend eastward and westward along the shore of the Arctic Ocean. However, a comparison of the plants that grow in the Aleutians with those in the other treeless regions soon reveals that botanically the Aleutian flora is distinct. It has much in common with Kamchatka, except that that peninsula is well provided with trees and shrubs of various northern types. Thus the Aleutians stand as a treeless link between Alaska on the east and Kamchatka on the west. Although most of the more prominent plants range throughout these three regions, there are a number of less common ones which show the special relationships of the islands to the adjacent regions. There are certain distinctly Asiatic species on Attu at the western end of the chain and certain American plants on Unalaska and Unimak at the eastern end. Some special circumpolar species occur on the middle islands, but on the whole the true or high Arctic flora does not occur here and the vegetation is best considered as sub-Arctic or, better, may be called low Arctic.

About 480 species of seed plants and ferns are known from the Aleutian Islands. We have no very comprehensive knowledge of the numerous and conspicuous lichens, mosses, liverworts, and algae from these distant islands, although some have been collected and a few scientific papers have been published dealing with them. The ferns and seed plants are much better known and have been enumerated and discussed by Eric Hultén in his *Flora of the Aleutian Islands* (1937a). This is a technical work without the keys, illustrations, or descriptions so essential in identifying plants in the field. The botanical history and literature on the Aleutian flora is well reviewed in the introduction, along with a preliminary survey of the ecology and phytogeography. Many scientific specimens have been collected in the Aleutians over a long period of time, but Hultén's collections made in 1932 are probably the most extensive. However, much remains to be learned about the plants of the Islands, and many more scientific specimens of all kinds are needed. Hultén remarks that the ecology has been barely touched and the flora of the hot springs, which in Kamchatka is very distinctive, is as yet entirely unknown.

PRINCIPAL PLANT ASSOCIATIONS

The first plants that one meets on visiting the Aleutians are those of the beaches. The strand wheat or wild rye (*Elymus arenarius* subsp. *mollis*), reaching a height of 4 to 5 feet, is the most common and wide-

spread grass along northern shores. It occurs in great abundance on the upper beaches and was used by the skillful native women in making baskets and matting. Associated with the beach grass are the blue-gray sea bluebells (*Mertensia maritima*), a striking yellow ragwort (*Senecio pseudoarnica*), and various other plants, some of them being widely distributed and familiar sea-beach plants. The scurvygrass, so eagerly sought by the early explorers in this region as a cure for the dreaded nutritional disease, scurvy, was probably one of the beach plants, the sea-beach sandwort (*Honckenya peploides*), which is common on all sandy shores and can be eaten as greens. The sea bluebells and scurvyweed (*Cochlearia officinalis*) were also used in salads to cure or ward off scurvy.

Farther inland in the sheltered valleys on the eastern islands one may find prominent thickets of willows, occasionally reaching up to 12 feet in height. On Unalaska and Unimak Islands at the eastern end of the chain occur interesting alder thickets (*Alnus fruticosa*). They are of special significance because no other alders are known to occur westward for 1,500 miles—not, in fact, until one reaches eastern Asia, where they are again found in abundance. The bushes are low and the branches are pressed down like bows by the heavy winter snows; on hillsides all are directed down the slopes. Associated plants of willow thickets are the abundant reedgrass (*Calamagrostis canadensis*), various ferns, the cucumber plant (*Streptopus amplexifolius*), the delicate starflower (*Trientalis europaea* subsp. *arctica*), and others. The middle and western islands lack willow thickets or they are much reduced in size and extent.

One of the most striking features, as in all high mountains in temperate regions and in lowland Arctic regions, are the meadows aflame with color during the short growing season from July to early September. These meadows vary somewhat in composition from place to place, but the differences depend upon soil, drainage, exposure, and the accidents of seed distribution. Probably the most striking wildflower throughout most of the Aleutian meadows is the white-flowered narcissus anemone (*Anemone narcissiflora*). Other striking meadow plants interspersed among the dominant but less conspicuous grasses and sedges are white meadowrues (*Thalictrum kemense*), pearly everlastings (*Anaphalis margaritacea*), starflowers (*Trientalis europaea* subsp. *arctica*), Arctic sagebrushes (*Artemisia arctica*), and cloudberry (*Rubus chamaemorus*), yellow Indian painted-cups (*Castilleja unalaschensis*), pink fireweeds (*Epilobium angustifolium*) and willowherbs (*Epilobium* spp.), both familiar in the United States, purple wild geraniums (*Geranium erianthum*) and asters (*Aster peregrinus*), and blue monkshoods

(*Aconitum* spp.) and lupines (*Lupinus nootkatensis*). These meadows are common in the bottoms of the broad valleys, especially in the eastern islands, and also in somewhat protected hollows and depressions higher up on the mountains. The exposed slopes and ridges are largely covered with beds of heath and carpets of lichens and mosses. Most of the surface of these islands is exposed to the full force of the terrific storms, snow-laden during most of the year, but much of it is swept bare of snow even in winter. However, snow accumulates in the hollows and depressions and protection is afforded there to these meadow plants, so that they can burst forth quickly in spring into full bloom.

The Aleutian heath, which covers extensive areas, consists mainly of a dense low tangle of tough-stemmed shrubs. The principal plant is the crowberry (*Empetrum nigrum*), one of the commonest plants in the chain. It is a distinctive plant with juniperlike leaves and black berries which are gathered and eaten in great quantities by the natives. Its stems and leaves were formerly used as fuel, as they burn rapidly with a hot flame, even with little previous drying. The heaths also contain various members of the heath family (Ericaceae), as the blueberries (*Vaccinium* spp.), bearberries (*Arctostaphylos uva-ursi*), and others. Sometimes, too, one finds the delicious cloudberry (*Rubus chamaemorus*) growing in masses. Generally heaths are hard to walk through, but this difficulty is partly compensated for by the delicious berries in the proper season. Beneath the tangled mass of woody stems grows a thick bed of moss, usually accompanied by abundant grayish lichens. On the still more exposed mountains conditions may be too severe even for the heath plants, and there occur extensive thick carpets of mosses and lichens, with little else except certain grasses and sedges with roots that survive the winter, deep in the protecting mossy mat, or low creeping willows, which rise only an inch or two above the surface. In fact, most of the surface of the islands, except the higher mountain slopes, is covered with heath or lichen and moss carpets, all composing what is usually called the tundra. This term was originally applied to the Siberian Arctic plant formations where there was so little water that it was practically a desert. But in the Aleutians this thick lichen and moss cover is often as wet as a sponge, as one would expect in such a region of fog, rain, and high humidity. At present the name tundra is best applied to the whole plant formation beyond the northern tree line.

Higher up on the mountains and in the most exposed places one finds that the lichen carpet becomes thinner and is interspersed with bare gravel-strewn or rocky patches. Even here there occur some low woody

plants such as the Arctic willow and certain herbaceous plants. The crooked roots of the willows often lie exposed on the surface along with the short stems. Among the few herbaceous plants are several kinds of bellflowers (*Campanula*), and a primrose (*Primula cuneifolia*). These plants may also be found in various other habitats at lower altitudes. In fact, zones of vegetation due to differences in altitude do not occur in the Arctic regions as they do in lower latitudes. Plant associations seem to be much more mixed together, certain species occurring where they are not expected and others being absent where they would be expected.

From the wider point of view, there are some interesting problems of distribution of plants throughout the islands. Hultén's Flora contains maps showing the distribution of all the species which he records. Some species are found only at the western end of the chain, whereas others occur only in the eastern islands. Among the former are certain large high-growing herbaceous plants forming an association in protected places that is characteristic of the Kamchatka Peninsula and the Commander Islands to the westward. Especially noteworthy are the tall greenish-flowered false hellebore (*Veratrum album* subsp. *oxysepalum*), the Asiatic white-flowered goatsbeard (*Aruncus sylvester*), an Indian plantain (*Cacalia auriculata*), a groundsel with large leaves (*Senecio palmatus*), a distinctive thistle with nodding heads (*Cirsium kamtschaticum*), and a Siberian mountain ash (*Sorbus sambucifolia*). All these species are characteristic of the Asiatic shore and are not found on the American side of the Pacific, except on the far western island of Attu. Some New World plants are found among these Asiatics. On the Alaska Peninsula and farther south on the coast occurs a similar association of tall herbaceous plants, but of slightly different composition.

Many of the islands are well supplied with lakes, ponds, and streams in which occur many water plants, as is to be expected, although the number of species found here is considerably less than in the United States. The principal submerged aquatics are the northern pondweed (*Potamogeton alpinus*), the water milfoil (*Myriophyllum spicatum*), and the marestalk (*Hippuris vulgaris*), all familiar in temperate regions. A common plant growing up through the water on shallow bottoms and raising its burlike flower clusters above the surface is the northern burreed (*Sparganium hyperboreum*). There seems to be some uncertainty about the occurrence of the cowlily or yellow pondlily (*Nuphar* sp.), also familiar to most Americans, with its cuplike flowers and broad leaves raised usually a few inches above the water surface. Eelgrass (*Zostera marina*), common along most seacoasts where there are muddy

bottoms and quiet waters, occurs in the Aleutians, but its abundance and extent are not well known. It is one of the very few submerged salt-water seed-bearing plants of the world, and is an important duck food wherever it occurs. Most of the salt-water plant life consists of marine algae, to be discussed separately (see p. 70).

PLANTS OF SPECIAL INTEREST OR USEFULNESS

Besides the plants mentioned in the preceding general description of the vegetation there are a number of others of special interest because of their striking appearance or usefulness to man. Nearly every traveler is struck by the beauty of the large blue lupine (*Lupinus nootkatensis*) and its less common white form. It is found in association with various species and is conspicuous at almost every turn. It is worthy of note here that a new species of lupine was discovered in 1943 on Kiska Island by Pvt. E. D. McDonald of the United States Army, and it is likely that there are more species yet to be discovered in this and various other plant groups. Grasses and sedges, which often seem to form the background for the more showy flowers, grow luxuriantly, and the nutritious grasses are especially well liked by domestic animals. However, the high humidity and the short growing season combine to prevent the curing of hay for winter use, making it necessary to import this bulky commodity from outside the Aleutians. This fact, along with the distance from markets, has always thwarted attempts to develop stock raising here. Sheep, however, have been raised to some extent in the eastern islands, because they can survive on a more general diet. Because of the short growing season and high humidity, grains and cereals cannot be grown as the heads do not ripen, but rapidly developing garden plants are raised successfully.

Several plants are found closely associated with man. Of course there are the familiar weeds such as shepherd's-purse (*Capsella bursa-pastoris*), yellow watercress (*Nasturtium palustre*), and ox-eye daisy (*Chrysanthemum leucanthemum*) and plants which have escaped from cultivation or have come along with civilization uninvited. Besides these there are several plants commonly found around the abandoned sites of native villages. The Aleuts in the early days did not cultivate any plants, living entirely on meat and the abundant wild plants. However, their long-abandoned village sites may now often be easily recognized, especially from the air, by the presence of certain plants not abundant, or entirely absent, elsewhere and by the greener appearance of the vegetation occurring there. This condition is the result of the greater fertility of the soil which has been enriched by the discarded materials of habitation. Most



PLATE 18

Upper: Sea otter on the kelp beds on Ogliuga Island at low tide. (Photograph by J. Malcolm Greany, Fish and Wildlife Service, U. S. Department of the Interior.)

Lower: Blue whale drawn up on the dock at the Pacific American Whaling Company station on Akutan Island. (Photograph by William Paton Rauch, courtesy National Geographic Magazine.)





PLATE 19

Upper: Blue foxes in the Aleutians. These animals are released by the Aleuts on the islands and left there to multiply. At 2- or 3-year intervals the surplus is trapped and the furs sold at a good profit. (Photograph by O. J. Murie, Fish and Wildlife Service, U. S. Department of the Interior.)

Lower: An American soldier off duty at a trout stream on Kiska; cottongrass in the right foreground. This photograph shows the typical heath on the slopes above the stream. (Photograph by Capt. George A. Ammann.)





PLATE 20

Upper: A grove of Sitka spruces on Amaknak Island. This is one of the two groves of trees on the Aleutian Islands.

Lower: The abundant rich blue lupine near Unalaska Village on Unalaska Island.

(Photographs by Isobel Wiley Hutchison, courtesy National Geographic Magazine.)





PLATE 21

Left: Cottongrass.
(Photograph by O. J.
Murie, Fish and Wild-
life Service, U. S. De-
partment of the In-
terior.)

Right: Narcissus
anemone, one of the
most prominent flow-
ers of the Aleutian
Islands. (Photograph
from O. J. Murie,
Fish and Wildlife Ser-
vice, U. S. Depart-
ment of the Interior.)



prominent of these distinctive plants of village sites are the huge umbellifers of the carrot family, the cow-parsnip (*Heracleum lanatum*) and the wild celery or wild parsnip (*Coelopleurum gmelini*), which are the largest herbaceous plants found in the islands. Another plant common around the villages, at least at the eastern end of the chain, is the monkshood (*Aconitum maximum*). From its roots the natives extracted a poison used to increase the deadliness of their darts and spears.

A striking feature on certain exposed places along the shores of some of the islands, especially toward the west, are mounds of earth sometimes up to 3 or 4 feet in height, rarely higher, covered with verdant grasses and sedges. Their occurrence on special vantage points and their striking greenness in a sea of brownish heath suggests that they may have been the favorite resting places of various birds that fertilized the soil; the resultant more vigorous plant growth caused the mounds to increase in height through the years.

Before the coming of the white man with his refined flour, canned goods, and other easily purchased staples, the Aleuts supplemented their predominantly meat diet with various wild plants. The numerous berries, gathered mainly on the heath, have already been mentioned (see p. 66). Carbohydrates were largely furnished by the Eskimo potato or Indian riceroot (*Fritillaria camschatcensis*), a purplish- or brownish-green-flowered lily with an edible underground bulb rich in starch, which grows widely in the heaths and meadows. It was gathered in quantities by the women in late summer and autumn and either boiled for immediate use or stored for the winter. Another important food was the pith of the stem or leaf stalk of the cow-parsnip (*Heracleum lanatum*), already mentioned as common on abandoned village sites. This thick-stemmed member of the carrot family, which grows to 6 feet or more in height, bears large flat-topped clusters of white flowers and has leaves as large as palm-leaf fans. In May or June the tender stems were skillfully torn open and the delicate pith extracted and eaten raw. It is sometimes known by the adopted Russian name of "pootschky." The dried stalks left standing in the fall make usable fuel, and the pith of the old stems is a valuable emergency tinder as it is usually kept dry by the protective outer covering. The Aleuts used as greens the tender spring and summer growth of various plants such as the cowslip (*Caltha palustris*), the cow-parsnip just mentioned, and the anemone (*Anemone narcissiflora*). Among the roots eaten were those of the lupine (*Lupinus nootkatensis*) and of the anemone.

There are various other edible plants available in the Aleutians which, though not recorded as used by the natives, may have been, as they were used elsewhere in the Arctic either as staples or as emergency foods. Among the edible greens are the fiddleheads or young uncoiling fronds of various ferns, mountain sorrel (*Oxyria digyna*), cresses (species of *Barbarea*, *Nasturtium*, and *Cardamine*), scurvyweed (*Cochlearia officinalis*), Labrador tea (*Ledum palustre*), northern fireweeds (*Epilobium latifolium*), and dandelions (*Taraxacum*). Lichens of various kinds can also be cooked and eaten. Edible bulbs and roots are those of the onion (*Allium*) and bistort (*Polygonum viviparum*).

THE MARINE ALGAE OR SEAWEEDS

Very little is known about the marine algae of the Aleutian Islands. No extensive collections exist and no special studies of this form of life have been made. Botanists who collect land plants rarely give more than a passing thought to the seaweeds, rockweeds, and kelps, except to wonder at their extent and luxuriance. Some excellent technical publications have been issued on the marine algae of the Pacific Coast of North America, but aside from including the few specimens known from the Aleutians, these islands are ignored. Probably many species are the same as those of the Bering Sea, from which area there are many records.

Nevertheless the conditions favorable to the growth of marine algae exist here in almost ideal form. Clear, cold water, rocky bottoms, surging waves and strong currents are ideal for seaweeds, and they are found in great luxuriance, nearly equal to that of the aerial plants in tropical jungles. Still waters with muddy bottoms cannot furnish the needed firm support nor abundance of dissolved air so essential for their life. They cover the rocks from high-tide level down to 40-fathom depths and even beyond. On the rocks around lower tide level are found many rockweeds (*Fucus*), slippery mucilaginous plants with flat branches and thickened, pimply structures and smooth bladders that float them in the surging waves. They are brown in color, as are many of these marine forms.

From well above low tide down to a depth of many fathoms grow the kelps, usually large plants, each with a stem attached to the rocks by a holdfast and with fronds floating above supported by various types of bladders, bulbs, or other floaters. The most common kind in these waters seems to be *Alaria*, which consists of a flat or crinkled blade or streamer many feet long. Kelps often grow to great lengths, and some live only a few months, but others are perennial. They break loose in the winter storms and are washed ashore in sheltered places, sometimes piling up in

drifts many feet deep. Kelp beds are sometimes very extensive, one in Bering Sea being reported in 1875 to cover 25 square miles of shoal.

Besides the abundant brown algae, the kelps and rockweeds, there are a few green algae in the marine waters, the most prominent being the sea lettuce (*Ulva*). It is sometimes found washed up on shore and looks very much like a veinless lettuce leaf. It occurs in quiet waters and on less rocky or even muddy bottoms.

The Alaskan Indians and Aleuts used certain marine algae for food and also for ropes and fishing lines after preparation with fish oil and maceration to soften them. In Alaska they are sometimes used as fodder for domestic animals, and the "driftweed," or algae washed up on shore, has fertilizer value, as it releases much potash as it decays.

It is obvious that our knowledge of these plants in the Aleutians is in great need of expansion. Collecting marine algae requires procedures somewhat different from those used for land and fresh-water plants, but they have the advantage that dried specimens can be soaked in water again and made into better-arranged specimens if not adequately prepared in the first place. It is only by means of fully labeled specimens, supported by carefully recorded observations that can be studied by technically trained students in research laboratories, that scientific knowledge of this kind is accumulated. Almost anyone can make a valuable contribution to science by collecting marine algae from these waters, provided the specimens are properly labeled.

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APPENDIX A

LIST OF MAMMALS

SHREWS (Family Soricidae):

Unalaska saddle-back shrew (*Sorex hydrodromas*).

BATS (Family Vespertilionidae):

Little brown bat (?*Myotis lucifugus lucifugus*).

BEARS (Family Ursidae):

Brown bear (*Ursus gyas*).

OTTERS, WOLVERINE, MINK, AND WEASELS (Family Mustelidae):

Northern sea otter (*Enhydra lutris lutris*).

Wolverine (*Gulo luscus*).

Mink (*Mustela vison*, subsp.).

Weasel (*Mustela*, sp.).

FOXES AND WOLVES (Family Canidae):

Wolf (*Canis lupus*, subsp.).

Arctic or blue fox (*Alopex lagopus*, subsp.).

Red, cross, or silver fox (*Vulpes fulvus*, subsp.).

SEALS (Family Phocidae):

[Kamchatkan harbor seal (*Phoca vitulina largha*).]

Northwestern harbor seal (*Phoca vitulina richardii*).

Ribbon seal (*Phoca fasciata*).

Bearded seal (*Erignathus barbatus nauticus*).

WALRUS (Family Odobenidae):

Pacific walrus (*Odobenus divergens*).

SEA LIONS AND FUR SEALS (Family Otariidae):

Steller's sea lion (*Eumetopias jubata*).

Alaskan fur seal (*Callorhinus ursinus cynocephalus*).

GROUND SQUIRRELS (Family Sciuridae):

Aleutian ground squirrel (*Citellus parryii ablusus*).

LEMMINGS, MICE, AND RATS (Family Muridae):

Unalaska lemming (*Dicrostonyx unalascensis*).

Umnak lemming (*Dicrostonyx unalascensis stevensoni*).

Amak meadow mouse (*Microtus amakensis*).

Norway rat (*Rattus norvegicus*).

House mouse (*Mus musculus*).

HARES (Family Leporidae):

Alaska Peninsula hare (*Lepus othus podadromus*).

CARIBOU (Family Cervidae):

Caribou (*Rangifer arcticus granti*).

DOLPHINS, KILLERS, AND PORPOISES (Family Delphinidae):

Long-nosed dolphin (*Stenella longirostris*).

Rough-toothed dolphin (*Steno rostratus*).

Common dolphin (*Delphinus bairdii*).

Bottle-nosed dolphin (*Tursiops gillii*).
Right whale porpoise (*Lissodelphis borealis*).
Striped porpoise (*Lagenorhynchus obliquidens*).
Killer whale (*Grampus rectipinna*).
Grampus (*Grampidelphis griseus*).
False killer whale (*Pseudorca crassidens*).
Blackfish (*Globicephala scammoni*).
Harbor porpoise (*Phocoena vomerina*).
Dall's porpoise (*Phocoenoides dalli*).
White whale, or beluga (*Delphinapterus leucas*).

BEAKED WHALES (Family Ziphiidae):

Baird's beaked whale (*Berardius bairdii*).
Stejneger's beaked whale (*Mesoplodon stejnegeri*).
Cuvier's beaked whale (*Ziphius cavirostris*).

SPERM WHALES (Family Physeteridae):

Sperm whale (*Physeter catodon*).
Pygmy sperm whale (*Kogia breviceps*).

GRAY WHALES (Family Rhachianectidae):

California gray whale (*Rhachianectes glaucus*).

FINBACK WHALES (Family Balaenopteridae):

Finback (*Balaenoptera physalus*).
Sei whale, or pollack whale (*Balaenoptera borealis*).
Little piked whale, or sharp-headed finner (*Balaenoptera acutorostrata*).
Blue, or sulphur-bottom whale (*Sibbaldus musculus*).
Humpback whale (*Megaptera versabilis*).

RIGHT WHALES (Family Balaenidae):

Pacific right whale (*Eubalaena sieboldii*).
Bowhead (*Balaena mysticetus*).

SEA COW (Family Halicoridae):

[Steller's sea cow (*Hydrodamalis gigas*).]

APPENDIX B

LIST OF BIRDS

LOONS (Family Gaviidae):

- Common loon (*Gavia immer immer*).
- Yellow-billed loon (*Gavia adamsi*).
- Pacific loon (*Gavia arctica pacifica*).
- Red-throated loon (*Gavia stellata*).

GREBES (Family Colymbidae):

- Holboell's grebe (*Colymbus grisegena bolböllii*).
- Horned grebe (*Colymbus auritus*).

ALBATROSSES (Family Diomedidae):

- Black-footed albatross (*Diomedea nigripes*).
- Short-tailed albatross (*Diomedea albatrus*).

SHEARWATERS, PETRELS, AND FULMARS (Family Procellariidae):

- Slender-billed shearwater (*Puffinus tenuirostris*) (fig. 7).
- Sooty shearwater (*Puffinus griseus*).
- Scaled petrel (*Pterodroma inexpectata*).
- Pacific fulmar (*Fulmarus glacialis rodgersi*).

STORM PETRELS (Family Hydrobatidae):

- Fork-tailed petrel (*Oceanodroma furcata*).
- Leach's petrel (*Oceanodroma leucorhoa leucorhoa*).

CORMORANTS (Family Phalacrocoracidae):

- White-crested cormorant (*Phalacrocorax auritus cinctatus*).
- [Steller's cormorant (*Phalacrocorax perspicillatus*).]
- Pelagic cormorant (*Phalacrocorax pelagicus pelagicus*).
- Red-faced cormorant (*Phalacrocorax urile*).

SWANS, GEESE, AND DUCKS (Family Anatidae):

- Whistling swan (*Cygnus columbianus*).
- White-fronted goose (*Anser albifrons gambeli*).
- Lesser Canada goose (*Branta canadensis leucopareia*).
- Cackling goose (*Branta minima*).
- Emperor goose (*Philacte canagica*).
- Mallard (*Anas platyrhynchos platyrhynchos*).
- American pintail (*Anas acuta tzitziboa*).
- European teal (*Anas crecca*).
- Green-winged teal (*Anas carolinensis*).
- Gadwall (*Chaulelasmus streperus*).
- European widgeon (*Mareca penelope*) (fig. 6).
- Baldpate (*Mareca americana*) (fig. 6).
- Greater scaup (*Nyroca marila nearctica*).
- American goldeneye (*Glaucionetta clangula americana*).
- Bufflehead (*Charitonetta albeola*).
- Oldsquaw (*Clangula hyemalis*).
- Pacific harlequin (*Histrionicus histrionicus pacificus*) (fig. 6).

- Steller's eider (*Polysticta stelleri*) (fig. 6).
- Pacific eider (*Somateria mollissima v-nigra*) (fig. 6).
- King eider (*Somateria spectabilis*) (fig. 6).
- Spectacled eider (*Arctonetta fischeri*) (fig. 6).
- White-winged scoter (*Melanitta fusca dixonii*).
- Surf scoter (*Melanitta perspicillata*) (fig. 6).
- American scoter (*Oidemia nigra americana*).
- American merganser (*Mergus merganser americanus*).
- Red-breasted merganser (*Mergus serrator*) (fig. 6).

HAWKS AND EAGLES (Family Accipitridae):

- American rough-legged hawk (*Buteo lagopus sancti-jobannis*).
- Golden eagle (*Aquila chrysaetos canadensis*).
- Gray sea eagle (*Haliaeetus albicilla brooksi*).
- Northern bald eagle (*Haliaeetus leucocephalus washingtoniensis*).
- Kamchatkan sea eagle (*Thalasoaeetus pelagicus*).
- Marsh hawk (*Circus cyaneus hudsonius*).

FALCONS (Family Falconidae):

- Asiatic gyrfalcon (*Falco rusticolus uralensis*).
- Duck hawk (*Falco peregrinus anatum*).
- Peale's falcon (*Falco peregrinus pealei*).
- Western pigeon hawk (*Falco columbarius bendirei*).

PTARMIGAN (Family Tetraonidae):

- Willow ptarmigan (*Lagopus lagopus alexandrae*).
- Nelson's ptarmigan (*Lagopus mutus nelsoni*).
- Turner's ptarmigan (*Lagopus mutus atkbensis*).
- Chamberlain's ptarmigan (*Lagopus mutus chamberlaini*).
- Sanford's ptarmigan (*Lagopus mutus sanfordi*).
- Gabrielson's ptarmigan (*Lagopus mutus gabrielsoni*).
- Townsend's ptarmigan (*Lagopus mutus townsendi*).
- Evermann's ptarmigan (*Lagopus mutus evermanni*).

CRANES (Family Gruidae):

- Little brown crane (*Grus canadensis canadensis*).

OYSTER-CATCHERS (Family Haematopodidae):

- Black oyster-catcher (*Haematopus bachmani*).

PLOVERS, TURNSTONES, AND SURF BIRDS (Family Charadriidae):

- Semipalmated plover (*Charadrius hiaticula semipalmatus*).
- Pacific golden plover (*Pluvialis dominica fulva*).
- Black-bellied plover (*Squatarola squatarola*).
- Surf bird (*Aphriza virgata*).
- Turnstone (*Arenaria interpres interpres*).
- Black turnstone (*Arenaria melanocephala*).

SNIPE AND SANDPIPERS (Family Scolopacidae):

- Wilson's snipe (*Capella delicata*).
- Wood sandpiper (*Rhyacophilus glareola*).
- Wandering tattler (*Heteroscelus incanus*).
- Aleutian sandpiper (*Glareola pilocnemis couesi*).
- Commander Islands sandpiper (*Glareola pilocnemis quarta*).

Pribilof sandpiper (*Glareola ptilocnemis ptilocnemis*).

Sharp-tailed sandpiper (*Erolia acuminata*).

Pectoral sandpiper (*Erolia melanotos*).

Least sandpiper (*Erolia minutilla*).

Red-backed sandpiper (*Erolia alpina sakhalina*).

Semipalmated sandpiper (*Ereunetes pusillus*).

Western sandpiper (*Ereunetes mauri*).

Pacific godwit (*Limosa lapponica baueri*).

PHALAROPES (Family Phalaropidae):

Red phalarope (*Phalaropus fulicarius*).

Northern phalarope (*Lobipes lobatus*).

JAEGER (Family Stercorariidae):

Pomarine jaeger (*Stercorarius pomarinus*).

Parasitic jaeger (*Stercorarius parasiticus*).

Long-tailed jaeger (*Stercorarius longicaudus*).

GULLS AND TERNS (Family Laridae):

Glaucous gull (*Larus hyperboreus hyperboreus*).

Point Barrow gull (*Larus hyperboreus barrovianus*).

Glaucous-winged gull (*Larus glaucescens*).

Slaty-backed gull (*Larus schistisagus*).

Western herring gull (*Larus argentatus vegae*).

Short-billed gull (*Larus canus brachyrhynchus*).

Bonaparte's gull (*Larus philadelphia*).

Pacific kittiwake (*Rissa tridactyla pollicaris*).

Red-legged kittiwake (*Rissa brevirostris*).

[Ross's rosy gull (*Rhodosthetia rosea*).]

Sabine's gull (*Xema sabini*).

Arctic tern (*Sterna paradisaea*).

Aleutian tern (*Sterna aleutica*).

MURRES, GUILLEMOTS, MURRELETS, AUKLETS, AND PUFFINS (Family Alcidae):

California murre (*Uria aadge californica*).

Pallas's murre (*Uria lomvia arra*) (fig. 7).

Pigeon guillemot (*Cepphus columba columba*).

Marbled murrelet (*Brachyrhamphus marmoratus marmoratus*) (fig. 7).

Kittlitz's murrelet (*Brachyrhamphus brevirostris*).

Ancient murrelet (*Synthliboramphus antiquus*) (fig. 7).

Cassin's auklet (*Ptychoramphus aleuticus aleuticus*) (fig. 7).

Paroquet auklet (*Cyclorhynchus psittacula*) (fig. 7).

Crested auklet (*Aethia cristatella*) (fig. 7).

Least auklet (*Aethia pusilla*) (fig. 7).

Whiskered auklet (*Aethia pygmaea*) (fig. 7).

Rhinoceros auklet (*Cerorhinca monocerata*) (fig. 7).

Horned puffin (*Fratercula corniculata*) (fig. 7).

Tufted puffin (*Lunda cirrhata*) (fig. 7).

OWLS (Family Strigidae):

Snowy owl (*Nyctea scandiaca*).

Short-eared owl (*Asio flammeus flammeus*).

SWALLOWS (Family Hirundinidae):

Barn swallow (*Hirundo rustica erythrogaster*).

RAVENS (Family Corvidae):

Northern raven (*Corvus corax principalis*).

DIPPERS (Family Cinclidae):

Dipper (*Cinclus mexicanus unicolor*).

WRENS (Family Troglodytidae):

Unalaska wren (*Troglodytes troglodytes petrophilus*).

Tanaga wren (*Troglodytes troglodytes tanagensis*).

Kiska wren (*Troglodytes troglodytes kiskensis*).

Attu wren (*Troglodytes troglodytes meligerus*).

THRUSHES (Family Turdidae):

Alaskan hermit thrush (*Hylocichla guttata guttata*).

Kamchatkan nightingale (*Calliope calliope camtschatkensis*).

WAGTAILS AND PIPITS (Family Motacillidae):

Swinhoe's wagtail (*Motacilla alba ocularis*).

Black-backed wagtail (*Motacilla alba lugens*).

Alaskan yellow wagtail (*Motacilla flava alasensis*).

Western pipit (*Anthus spinoletta pacificus*).

Red-throated pipit (*Anthus cervinus*).

SHRIKES (Family Laniidae):

Northwestern shrike (*Lanius excubitor invictus*).

FINCHES AND SPARROWS (Family Fringillidae):

Aleutian rosy finch (*Leucosticte tephrocotis griseonucha*).

Redpoll (*Acanthis flammea flammea*).

Aleutian Savannah sparrow (*Passerculus sandwichiensis sandwichiensis*).

Golden-crowned sparrow (*Zonotrichia coronata*).

Unalaska fox sparrow (*Passerella iliaca unalaschensis*).

Aleutian song sparrow (*Melospiza melodia sanaka*).

Alaskan longspur (*Calcarius lapponicus alasensis*).

Pribilof snow bunting (*Plectrophenax nivalis townsendi*).

Rustic bunting (*Emberiza rustica latifascia*).

I am deeply indebted to O. J. Murie, the leading authority on the birds of the Aleutian Islands, for his courtesy in revising the account of Aleutian birds. He was so very kind as to permit me to include in the list a number of his personal unpublished records.

Several species commonly given as occurring in the Aleutians, as the blue-winged teal, canvasback, ring-necked duck, and Mandt's guillemot, are omitted as there is no indubitable evidence of their occurrence in the region. The records are apparently based upon misidentifications.

The birds, the names of which are enclosed in brackets, are either extinct or presumably occur as casuals but have not as yet been reported.

APPENDIX C

KEYS TO THE BIRDS

The following keys will serve for the identification of all the birds known from the Aleutian Islands. In the first key are given the distinguishing features of the various types seen at sea; the various species within these types, and the land birds, are given in later keys.

In many Aleutian birds the sexes are more or less widely different, and in many there is considerable difference between the winter and summer plumages. These keys are drawn up for males in summer plumage, as it is quite impracticable to include the females and young, and the winter plumages. In most cases, however, the measurements are diagnostic regardless of the plumage.

A few unfamiliar terms occur in the keys. These are: *Culmen*, the midline of the upper half of the bill; *mandible*, the lower half of the bill; *secondary wing feathers*, the long feathers attached to the fore arm; the true flight feathers or *primaries* are the long and strong feathers attached to the wrist; *tarsus*, the portion of the foot, usually without feathers, between the toes and the heel—birds walk on their toes with the heel raised high above the ground; *wing* (length), the distance from the tip of the longest flight feathers to the fore border of the wrist.

The keys are based on various characters, each of which includes two contrasting elements. Each character is represented by a letter, the two contrasting elements being designated 1 and 2. Thus in key 1 the first character to be observed is the type of flight (A) which may be either gliding or skimming (A 1), or some other type (A 2). Under birds with a gliding flight (A 1) the next character is size (B). If they are very large (B 1) they are albatrosses; if they are of medium size (B 2) they are shearwaters. With a little practice it will be found to be a simple matter to identify any bird by means of these keys.

Not included in the keys are the little brown crane, which, the only large long-necked and long-legged bird in the Aleutians, cannot be confused with anything else; the medium-sized brown shorteared owl and the large white snowy owl; the familiar barn swallow; the local varieties of the winter wren, which may be identified from the localities where they are found; the local varieties of the rock ptarmigan, identifiable in the same way; and the willow ptarmigan, distinguishable from the rock ptarmigan by its larger bill.

KEY 1. *Field key to birds seen at sea.*

- A 1. Flight gliding, with little or no movement of the wings, which are held horizontal with the tips slightly downcurved, and always close to the water; dark brown, or white with the back grayish.
 - B 1. Very large, wings seldom moved.....Albatrosses (Key 2)
 - B 2. Size medium, wings occasionally flapped.....Shearwaters (Key 2)
- A 2. Flight not gliding.
 - B 1. Flight flapping and soaring, high or low, very buoyant; color white or more or less grayish.
 - C 1. Wings in flight with an obtuse angle beyond the middle.
 - D 1. Wings sharply pointed; tail long, conspicuously forked; bill pointed diagonally downward; top of head black; rather small (pl. 14, 1).
Terns (Key 5)
 - D 2. Wings less sharply pointed; tail shorter, rounded; bill held horizontally; head all white or all gray; larger (pl. 14, 1) . . Gulls (Key 4)
 - C 2. Wings in flight with the front border straight or nearly so; usually seen in large flocks.....Fulmars (Key 2)
 - B 2. Wings moved continuously in flight.
 - C 1. Flight very irregular, turning or twisting, close to the water; size small.
 - D 1. Flight angular, this way and that; birds solitary, or if in small groups each acts independently of the others; light gray, or black with a conspicuous white rump; tail conspicuously forked.
Storm petrels (Key 2)
 - D 2. Flight in broad curves; birds in large flocks, all the members of a flock acting in unison; usually brownish or grayish above, white or lighter below.....Sandpipers (Key 10)
 - C 2. Flight direct, higher.
 - D 1. Neck short, not evident in flight.
 - E 1. Wings moved very fast; flight swift.
 - F 1. Bill very large, parrotlike; size fairly large, as large as a duck; uniform brown, or blackish above, white below.
Puffins (Key 3)
 - F 2. Bill smaller; size smaller; uniformly dark, or dark above, white below.....Auklets and murrelets (Key 3)
 - E 2. Wings moved rather slowly; somewhat gull-like, but mostly dark brown with a pointed tail.....Jaegers (Key 6)
 - D 2. Neck evident in flight.
 - E 1. Neck short.
 - F 1. Head conspicuously larger than neck; usually in companies or flocks.....Ducks (Key 8)
 - F 2. Head not conspicuously larger than the thick neck.
 - G 1. Medium-sized; usually seen in great numbers; head, neck, and back plain black; beneath, black or white; float high on the water.....Murre and guillemots (Key 3)

- G 2. Large; seen singly or in pairs; head and neck not all black;
back spotted with white; float low in the water.

Loons (Key 9)

- E 2. Neck very long.

- F 1. White; very large.....Swans (Key 8)

- F 2. Color other than white; smaller.

- G 1. Legs extending for a considerable distance beyond tail;
uniform brown.....Cranes

- G 2. Legs not extending beyond tail; not uniform brown.

- H 1. Grayish brown, head and neck black, or blue gray, head
and neck white.....Geese (Key 8)

- H 2. Black; neck long and slender.....Cormorants (Key 7)

KEY 2. *Albatrosses, shearwaters, petrels, and fulmars.*

- A 1. Very large, expanse about 7 feet; wing more than 18½ inches.

- B 1. Uniform dark brown, base of tail white (in adults); legs and feet
black; expanse 80 inches, wing 18½-20½ inches, bill 4-4¼ inches;
length up to 32½ inches (pl. 14, 3).....Black-footed albatross

- B 2. White, tail and long wing feathers slaty brown; legs and feet grayish
dusky; expanse 84-88 inches, wing 22-23 inches, bill 5½ inches;
length 33 inches.....Short-tailed albatross

- A 2. Much smaller, length not more than 20 inches, wing not over 14 inches.

- B 1. Medium sized, wing 10-14 inches; tail short, not forked.

- C 1. White to slaty gray, uniformly colored, rarely checkered; bill short
and stout; length 18-20 inches; wing 11½-14 inches; flight rather
high; suggest gulls, but wings are moved almost continuously
(pl. 14, 5).....Pacific fulmar

- C 2. Not uniform white to slaty gray; flight skimming, always near the
water; bill longer and more slender.

- D 1. Brownish black, almost uniform but somewhat lighter and more
grayish below.

- E 1. Larger, wing about 11½ inches, bill about 1½ inches, about
½ inch deep at the base.....Sooty shearwater

- E 2. Smaller and darker, wing 10 inches, bill 1 1/5 inches, more
slender, less than ½ inch deep at base (fig. 7).

Slender-billed shearwater

- D 2. Above lead gray, below white; wing 10 1/5 inches, bill 1 inch

Scaled petrel

- B 1. Small, wing less than 7 inches, tail longer, deeply forked (storm petrels).

- C 2. Light gray; wing 6-6 2/5 inches, tail 3¾-4 inches. Fork-tailed petrel

- C 2. Dark sooty gray, a conspicuous white patch at base of tail; wing
6-6 1/3 inches, tail 3½-4 inches.....Leach's petrel

KEY 3. *Puffins, murres, auklets, etc.*

- A 1. Under parts of body white.

- B 1. Size that of a duck or larger; wing 6 2/3 - 9 inches.

- C 1. Bill very large, parrotlike; large white patch on side of head; wing
6¾-7½ inches (fig. 6).....Horned puffin

- C 2. Bill moderate, not at all parrotlike.
 - D 1. With a conspicuous hornlike knob at base of bill above; white plumes above and below eye; wing more than 6 $\frac{2}{3}$ inches; 16-18 tail feathers (fig. 7).....Rhinceros auklet
 - D 2. No hornlike knob at base of bill, and no white plumes on head; wing 8-9 inches.
 - E 1. Depth of bill at fork of mandible equal to less than one-third length of exposed culmen.....California murre
 - E 2. Bill stouter, depth at fork of mandible equal to more than one-third length of exposed culmen (fig. 7).....Pallas's murre
- B 2. Size less than that of a duck; wing 3 $\frac{1}{2}$ -6 inches.
 - C 1. Chin and throat dark.
 - D 1. No white plumes on head; wing about 4 $\frac{4}{5}$ inches (fig. 7).
Cassin's auklet
 - D 2. White plumes on head; larger, wing 5 $\frac{1}{5}$ -6 inches.
 - E 1. A long line of narrow white feathers extends backward and downward from the eye; bill swollen in the middle; wing 5 $\frac{2}{3}$ -6 inches (fig. 7).....Paroquet auklet
 - E 2. A broad band of white above and behind eye; bill not swollen; wing 5 $\frac{1}{5}$ -5 $\frac{3}{4}$ inches (fig. 7).....Ancient murrelet
 - C 2. Chin and throat whitish.
 - D 1. Larger, length 9 inches, wing 5-5 $\frac{2}{3}$ inches....Kittlitz's murrelet
 - D 2. Smaller, length 6 inches, wing 3 $\frac{1}{2}$ -4 inches; fore part of head with scattered narrow white feathers (fig. 7).....Least auklet
- A 2. Under parts of body dark.
 - B 1. Whole body very dark—blackish.
 - C 1. Bill very large and parrotlike; sides of face white; long yellowish tufts behind eye; wing 7 $\frac{1}{5}$ -8 $\frac{3}{4}$ inches (fig. 7)....Tufted puffin
 - C 2. Bill moderate; no white on head, and no yellow tufts; large white patch on wing; wing 6 $\frac{1}{2}$ -7 $\frac{1}{5}$ inches.....Pigeon guillemot
 - B 2. Whole body grayish or brownish.
 - C 1. Head without plumes; body mottled with whitish below and with rusty above; wing 4 $\frac{1}{2}$ -5 $\frac{1}{16}$ inches (fig. 7).....Marbled murrelet
 - C 2. Head with plumes; body plain gray below.
 - D 1. A tuft of long, recurved brown feathers on front of head; a narrow line of elongate narrow white feathers behind eye; wing 5-5 $\frac{3}{4}$ inches (fig. 7).....Crested auklet
 - D 2. A slender, long, recurved, black tuft above the bill; a large triangular patch of white plumes with the upper angle greatly lengthened just behind the bill; and a narrow line of white plumes running backward and downward from behind the eye; smaller, wing 4 $\frac{1}{6}$ -4 $\frac{2}{3}$ inches (fig. 7)....Whiskered auklet

KEY 4. *Gulls.*

- A 1. Head white.
 - B 1. Hind toe well developed; tarsus longer than middle toe without claw.
 - C 1. Tail evenly rounded; size large, wing more than 10 inches.
 - D 1. No black on outermost wing feathers.

- E 1. Gray of outer wing feathers fading gradually into white terminally; back and wings uniform pale gray; head, neck, under parts, rump, and tail white.....Glaucous gull
- E 2. Gray of outer wing feathers succeeded by abruptly darker subterminal portion and abruptly white tips; color otherwise as in preceding.....Glaucous-winged gull
- D 2. Subterminal portions of outer wing feathers black, at least in part.
 - E 1. Large, wing 15-19 inches; back and wings dark gray.
 - F 1. Second long wing feather from the edge with a distinct gray wedge on the inner web; wing 17-19 inches..Slaty-backed gull
 - F 2. Second long wing feather from the edge without a distinct gray wedge on the inner web; wing 15-18 inches.
 - Western herring gull
 - E 2. Smaller, wing 13-14½ inches; bill about 1½ inches; back and wings lighter.....Short-billed gull
- C 2. Tail pointed, the middle feathers the longest; head, neck, under parts, and tail white, the under parts more or less deeply suffused with clear delicate pink; back and wings light gray, the longer wing feathers tipped with white; wing 9½-10½ inches...Ross's rosy gull
- B 2. Hind toe rudimentary or absent; tarsus shorter than the middle toe without claw; head, under parts, rump, and tail white; back and wings plain bluish gray, the outer wing feathers tipped with black; wing 12 1/3 - 13 1/5 inches.
 - C 1. Legs and feet blackish; bill 1 3/5 inches long.....Pacific kittiwake
 - C 2. Legs and feet red (fading to yellow after death); bill shorter, 1 1/5 inchesRed-legged kittiwake
- A 2. Head dark slate color; back and wings pearl gray; under parts and tail pure white; length 14 inches, wing 10 1/3 - 10½ inches.
 - B 1. Tail evenly rounded; upper parts moderate pearl gray...Bonaparte's gull
 - B 2. Tail slightly forked, the outer tail feathers the longest; upper parts dark pearl gray; a narrow black collar bordering the dark head and neck belowSabine's gull

KEY 5. *Terns.*

- A 1. Entire top of head down to lower border of eye, and nape, black; bill and feet rich carmine red.....Arctic tern
- A 2. Forehead and a broad stripe extending back on each side over the eye white; upper half of head and nape and a broad stripe running forward through eye to base of bill black; bill and feet deep black..Aleutian tern

KEY 6. *Jaegers.*

- A 1. Larger and stouter; central tail feathers with rounded ends; wing 13½ inches, bill 1½ inches; total length 22 inches.....Pomarine jaeger
- A 2. Smaller and less stout; central tail feathers pointed; wing not over 13 inches; bill not over 1½ inches.
 - B 1. Scaly shield on bill longer than the distance from its end to tip of bill; central tail feathers extend about 3 inches beyond the others; wing 13 inches; bill 1½ inches; total length 17 inches.....Parasitic jaeger

- B 2. Scaly shield on bill shorter than the distance from its end to tip of bill; central tail feathers extend about 7 inches beyond the others; wing 12½ inches; bill 1 inch; total length 21 inches....Long-tailed jaeger

KEY 7. *Cormorants.*

- A 1. Of moderate size, length not more than 35 inches, bill not more than 2½ inches.
- B 1. A conspicuous tuft of pure white long curved feathers on each side of the head, springing from above and behind the eye; naked skin of throat and at base of bill deep orange; eyelids and interior of mouth bright cobalt blue; length 29-33 inches, wing 14 inches, bill 2½ inchesWhite-crested cormorant
- B 2. No pure white feathers on head.
- C 1. Feathers of forehead extend to base of bill; throat and naked skin at base of bill reddish brown or coral red; length about 30 inches, wing about 14 inches, bill 2½ inches (pl. 15)....Pelagic cormorant
- C 2. Feathers of forehead separated from base of bill by a band of naked skin; naked skin of throat and face light scarlet; length 33-35 inches, wing about 11 inches, bill 2 1/5 inches..Red-faced cormorant
- A 2. Very large, length about 38 inches, wing 13 - 13½ inches, bill 4 inches.
Steller's cormorant

KEY 8. *Swans, geese, and ducks.*

- A 1. Very large; length 55 inches, wing 22 inches; white with black feet and bill, the latter with a small yellow spot.....Whistling swan
- A 2. Smaller and not all white.
- B 1. Wing over 14 inches, neck long, wing beats slow (geese).
- C 1. Body gray brown, the feathers of the back more or less edged with lighter, lighter below; head and neck brown or black.
- D 1. Head and neck black, throat and a large cheek patch white; beneath grayish, fading to white on lower belly.
- E 1. Length 25-34 inches, wing 14¾-17¾ inches...Lesser Canada goose
- E 2. Smaller, wing 13¾-14½ inches.....Cackling goose
- D 2. Head and neck gray brown like the back, the region about the base of the bill white; breast with irregular black markings; length 27-30 inches, wing 14¼-17½ inches.....White-fronted goose
- C 2. Blue gray, the feathers edged with brown, head and neck white above and on sides.....Emperor goose
- B 2. Smaller, wing not over 11½ inches, neck much shorter, wing beats rapid (ducks).
- C 1. Bill broad and flat, without toothlike processes.
- D 1. Hind toe with a lobe or web; neck short and stout; head stout and rounded; body stout; wing beats very rapid (sea or diving ducks).
- E 1. Plumage sooty black, with or without a few white markings.
- F 1. Entirely black; length 19 inches, wing 9 inches; bill black, upper mandible orange or yellowish at base..American scoter

F 2. With white markings.

G 1. A square mark on crown and a triangular mark on nape white, rest of plumage black; length 20 inches, wing 9 $\frac{1}{3}$ inches; bill with white, red, and yellow, a black spot on its side at base (fig. 6).....Surf scoter

G 2. Large patch on wing and a spot below eye white, rest of plumage black; length 22 inches, wing 11 inches; bill orange, black at base.....White-winged scoter

E 2. Plumage not black or mostly black.

F 1. Feathers at sides or top of bill extending forward almost or quite to nostril; large, wing over 10 $\frac{1}{2}$ inches (eiders).

G 1. Top of head black, a greenish-white line on crown; rest of head, throat, neck, upper breast, back, and lesser wing coverts white; middle of rump, lower breast, and belly black; a broad black V on throat; length 23 inches, wing 11 $\frac{1}{3}$ inches (fig. 6).....Pacific eider

G 2. Top of head light-colored.

H 1. Top of head bluish gray, cheeks greenish, neck white; front and sides of breast creamy buff; upper back, sides of rump, and wing coverts white; rest of plumage black; length 23 inches, wing 10 $\frac{4}{5}$ inches (fig. 6)..

H 2. Top of head not bluish gray.

I 1. Head light olive green, a broad rounded white patch narrowly edged with black about the eye; above white, below black (fig. 6).....Spectacled eider

I 2. Head white, a green line across back of crown; a broad black collar; above black, below mostly pale buffy (fig. 6).....Steller's eider

F 2. Feathers at base of bill not reaching half an inch along its sides.

G 1. Larger, wing over 7 inches.

H 1. Feathers at base of wings on under side white; head and neck black, with greenish reflections; back with wavy black and white bars; speculum white; belly white, lower belly and sides faintly marked with wavy black bars; bill blue; length 18 $\frac{1}{2}$ inches, wing 8 $\frac{3}{4}$ inches.

Greater scaup

H 2. Feathers at base of wings on under side blackish.

I 1. Head and throat dark glossy green, a circular white patch at base of bill; neck all around, breast, belly, exposed part of wing coverts, and most of scapulars white; rest of plumage black; length 20 inches; wing 9 inches.....American goldeneye

I 2. Head not green.

J 1. Central tail feathers very long, narrow, and sharply pointed; sides of front of head white; rest of head, neck, throat, breast, upper belly, and back black,

- lower belly white; band across end of bill yellow orange; length 21 inches, wing 8 inches. **Old squaw**
- J 2. Tail evenly rounded; center of crown black, margined with white and rufous; front of sides of head, a spot on ear, a stripe back of it, and a collar around back and sides of neck white; rest of head and throat rich slaty brown; a band in front of wing white margined with black; back and breast bluish slate; belly brown; sides bright chestnut; length 17 inches, wing $7\frac{4}{5}$ inches (fig. 6) **Pacific harlequin**
- G 2. Smaller, wing $6\frac{1}{2}$ inches, length $14\frac{3}{4}$ inches; head, throat, and upper neck glossed with purple, greenish, and bluish; a broad band of white across back of head from eye to eye; back black; lower neck all around, breast, belly, wing coverts, speculum, and scapulars white. **Bufflehead**
- D 2. Hind toe without a lobe or web; neck longer; head narrow; body slender; almost always an iridescent patch (speculum) on the wing; wing beats less rapid (river and pond ducks).
- E 1. Larger, wing 10-11 inches.
- F 1. Whole head shining dark green; white ring about neck; breast rich chestnut; belly grayish white, finely marked with wavy black lines; upper back dark grayish brown; rump and upper tail coverts black; speculum rich purple; four middle tail feathers recurved; length 23 inches, wing 11 inches. **Mallard**
- F 2. Head not green.
- G 1. Central tail feathers much elongated (tail $7\frac{1}{2}$ inches long); head and throat olive brown; back of neck blackish, bordered with a white stripe that passes to breast; breast and belly white, the belly faintly and the sides strongly marked with wavy lines of black and white; back somewhat darker than sides; speculum green; long central tail feathers glossed with green; length 28 inches, wing 10 inches. **American pintail**
- G 2. Central tail feathers not elongated.
- H 1. Center of head above white or whitish; wing $10\frac{1}{2}$ inches.
- I 1. Middle of crown white or buffy; sides of crown from eye to nape glossy green (fig. 6) **Baldpate**
- I 2. Crown creamy buff; throat blackish; rest of head and neck rufous brown (fig. 6) **European widgeon**
- H 2. Top of head streaked with rufous brown and black; sides of head and neck pale buffy, thickly streaked or spotted with black; breast and neck all around black, each feather with a border and an internal ring of white, giving a scaled appearance; length $19\frac{1}{2}$ inches, wing $10\frac{2}{5}$ inches. **Gadwall**

- E 2. Smaller, wing 7 inches, length $14\frac{1}{2}$ inches; sides of head from eye to nape shining green; rest of head and neck rufous chestnut; chin black (teal).

F 1. A conspicuous white bar in front of the wing.

Green-winged teal

F 2. No white bar in front of the wing. **European teal**

C 2. Bill narrow and cylindrical, bordered with toothlike processes.

D 1. Larger, length 25 inches, wing $10\frac{1}{2}$ inches; head and upper neck glossy greenish black, breast and belly white, delicately flushed with salmon pink; back black. **American merganser**

D 2. Smaller, length 22 inches, wing 9 inches; head and throat black, glossy greenish above; a white ring around neck; a broad cinnamon-rufous band with black streaks on upper breast and sides of lower neck; lower breast and belly white (fig. 6).

Red-breasted merganser

KEY 9. *Loons.*

A 1. Top of head black; head, neck, and upper parts black, the head and neck faintly glossed with dull greenish; middle of fore neck and sides of lower crossed by a bar of longitudinal white streaks; back dotted with white; below, white; larger, wing more than 13 inches.

B 1. Bill black, $2\frac{3}{4}$ - $3\frac{1}{2}$ inches long, wing 13 - $15\frac{1}{4}$ inches long. **Common loon**

B 2. Bill yellow, $3\frac{1}{2}$ - $3\frac{3}{4}$ inches long, wing $14\frac{4}{5}$ - $15\frac{1}{2}$ inches long.

Yellow-billed loon

A 2. Top of head pale ashy; smaller, wing less than $12\frac{1}{2}$ inches.

B 1. Under side of head, with fore neck, velvety greenish or purplish black; upper part of head and nape pale ashy; back black marked with broad white bars; lower parts white; wing $11\frac{1}{5}$ - $12\frac{1}{4}$ inches, bill 2 - $2\frac{2}{5}$ inches. **Pacific loon**

B 2. Whole head and neck ashy, the crown and nape streaked with dusky and white; fore neck with a longitudinal wedge-shaped patch of rich chestnut; upper parts dusky slate speckled with white; under parts white; wing 10 - $11\frac{1}{2}$ inches, bill $2\frac{1}{4}$ inches. **Red-throated loon**

KEY 10. *Oyster-catchers, plover, turnstones, surf birds, sandpipers, snipe, and phalaropes.*

A 1. Toes bordered with fleshy lobes; swim and act like miniature ducks; often seen in great flocks at sea.

B 1. Above dark grayish, the back striped with buff; under parts chiefly white; length about 7 inches, wing 4 - $4\frac{1}{2}$ inches, bill $\frac{4}{5}$ inch.

Northern phalarope

B 2. Above buff, striped with black; sides of head white; under parts deep purplish cinnamon; larger, length about $7\frac{1}{2}$ inches, wing $5\frac{1}{4}$ - $5\frac{1}{2}$ inches, bill $\frac{4}{5}$ inch. **Red phalarope**

A 2. Toes not bordered with fleshy lobes; walkers, not swimmers.

B 1. Bill much longer than the head.

C 1. Size large, wing over 8 inches; found along the coasts.

- D 1. Black; bill stout, compressed, with a sharp chisel-like end, bright red; feet white; wing $9\frac{3}{5}$ - $10\frac{3}{4}$ inches, bill $2\frac{1}{2}$ - 3 inches.
Black oyster-catcher
- D 2. Upper parts heavily streaked and more or less spotted with black and light brown; tail light brown barred with black; wing $8\frac{1}{4}$ - $9\frac{1}{6}$ inches; bill very long and slender, brown, $3\frac{1}{6}$ - $3\frac{1}{2}$ inches **Pacific godwit**
- C 2. Size smaller, wing 5 inches; found in marshy areas; upper parts black, bordered and mottled with different shades of cream buff; wings fuscous; neck and breast buff, somewhat streaked; throat and belly white, the flanks barred with black; bill $2\frac{1}{2}$ inches.
Wilson's snipe
- B 2. Bill never much longer than the head, sometimes shorter.
- C 1. Medium sized, wing $6\frac{7}{8}$ inches.
- D 1. Under parts largely black.
- E 1. Whole lower back white, a black band across the rump; length about 9 inches.
- F 1. Upper parts, including wings, variegated with rufous, black, and white; head marked with white.....**Turnstone**
- F 2. Head, neck, breast, and upper parts uniform brownish black.
Black turnstone
- E 2. Upper parts black, streaked or spotted with white or yellow; lower back not white; larger, wing $7\frac{7}{8}$ inches.
- F 1. No hind toe; upper parts black, the feathers spotted and margined with golden yellow; tail brownish gray; forehead, sides of head, neck, and breast, white; rest of under parts and cheeks black; length $10\frac{1}{2}$ inches, wing 7 inches, bill a little less than 1 inch.....**Pacific golden plover**
- F 2. With a hind toe; upper parts black, the feathers bordered with white; tail white barred with black; entire under parts black, except white lower belly; length 11 inches, wing $7\frac{1}{2}$ inches, bill a little more than 1 inch....**Black-bellied plover**
- D 2. Under parts without solid black.
- E 1. Above uniform dark lead gray, below white; lining of wings white, spotted and barred with dark gray; wing $6\frac{1}{2}$ - $7\frac{1}{3}$ inches, bill $1\frac{1}{2}$ - $1\frac{3}{5}$ inches.....**Wandering tattler**
- E 2. Head, neck, breast, and upper parts streaked dusky and whitish, sides of the back with large irregular spots of rufous; upper tail coverts, basal half of tail, a broad band on wings, and under parts behind breast white; wing about 7 inches; bill, which has the tip strongly arched, about 1 inch....**Surf bird**
- C 2. Small, wing not over 5 inches.
- D 1. Under parts pure white, with a conspicuous black band around the lower neck; back of head and back brownish gray; front and sides of head black; patch on forehead and back of neck in front of black collar white; wing $4\frac{4}{5}$ inches....**Semipalmated plover**

D 2. Under parts not pure white with a black collar.

E 1. Tail feathers with conspicuous cross bars, the outer tail feathers white; above bronzy brown, below white; feathers above base of tail white; length $8\frac{1}{2}$ inches, wing $4\frac{3}{5}$ inches.

Wood sandpiper

E 2. Tail feathers not barred; outer tail feathers not white; under parts not pure white.

F 1. Larger, wing over $4\frac{1}{2}$ inches.

G 1. Middle of belly with a large black patch; feathers of back broadly margined with rufous, the centers black; wings brownish gray; breast whitish, lightly streaked with blackish; wing $4\frac{3}{4}$ inches.....Red-backed sandpiper

G 2. No black patch on belly; wing about 5 inches.

H 1. Compact and rather robust species with rather short and stout legs; legs feathered to the heel; tarsus shorter than bill, and shorter than middle toe with claw; tail moderately wedge-shaped, the middle feathers rounded at the tip and not elongated.

I 1. Edges of feathers above narrow, the dark centers conspicuous.

J 1. Feathers above bordered with rusty..Aleutian sandpiper

J 2. Feathers above bordered with tan..Pribilof sandpiper

I 2. Edges of feathers above very broad, bright rusty, so that back appears rust red with mostly concealed black centers to the feathers....Commander Islands sandpiper

H 2. More slender with longer and slimmer legs and sharply pointed wings; legs above heel bare for more than half the length of the tarsus; tarsus longer than middle toe with claw, as long as, or longer than, bill; tail sharply pointed, the two central feathers longer than the others and pointed.

I 1. Throat and breast light clay color conspicuously streaked with dusky; feathers under base of tail without dusky shaft streaks; bill slightly over 1 inch....Pectoral sandpiper

I 2. Throat and breast scarcely streaked; feathers under base of tail with shaft streaks of dusky; central tail feathers narrower and more sharply pointed; bill slightly less than 1 inch.....Sharp-tailed sandpiper

F 2. Smaller, wing less than 4 inches.

G 1. Toes partly webbed; wing about $3\frac{3}{4}$ inches.

H 1. Upper parts black or fuscous, the feathers margined with brownish gray and a small amount of rufous; bill about $\frac{3}{4}$ inch.....Semipalmated sandpiper

H 2. Feathers of back conspicuously margined with rufous; breast more heavily streaked; bill longer, about 1 inch.

Western sandpiper

G 2. Toes without a web; smaller, wing $3\frac{1}{2}$ inches....Least sandpiper

KEY 11. *Grebes.*

A 1. Large, total length 18-19½ inches, wing 7 1/3-8 inches.

Holboell's grebe

A 2. Smaller, total length about 14¾ inches, wing 5¾ inches.....Horned grebe

KEY 12. *Land birds.*

A 1. Bill short, stout, the upper mandible down-curved at the end, sharp-pointed, with a notch on the lower edge near the tip and with a conspicuous patch of bare skin at the base; claws long, curved, and sharp (eagles, hawks, and falcons).

B 1. Very large, wing over 19 inches (eagles).

C 1. Tail evenly rounded.

D 1. Feet feathered to the toes; head and tail dark, the tail basally with grayish bars, or whitish.....Golden eagle

D 2. Feet feathered only halfway to the toes; tail all white.

E 1. Head and tail white, body brown (young with head and tail dark, and bill black).....Northern bald eagle

E 2. Tail white, but head dark like the body; more grayish than the preceding; bill mostly yellow.....Gray sea eagle

C 2. Tail long and pointed; adults with head, tail, and shoulders white.

Kamchatkan sea eagle

B 2. Smaller, wing not over 16 inches (hawks and falcons).

C 1. Feet feathered to the toes; brown or blackish; wings rounded at the tip; large, wing 16 inches.....American rough-legged hawk

C 2. Feet not feathered to the toes.

D 1. Feathers at base of tail colored like those of back; wings pointed at tip (falcons; do not soar).

E 1. Large, length 20-22 inches, wing 15½-16 inches; color dark or whitish Asiatic gyrfalcon

E 2. Smaller, length not over 19 inches, wing not over 14 inches.

F 1. Length 16-19 inches; wing 12¼-14 inches.

G 1. Above dark bluish slate, the long wing feathers barred with ochraceous; tail indistinctly barred with blackish and tipped with white; under parts cream buff barred and spotted with black, except on the breast.....Duck hawk

G 2. Similar, but averaging darker.....Peale's falcon

F 1. Length 10-13 inches; wing 8 inches; similar to the duck hawk but smaller.....Western pigeon hawk

D 2. Feathers at base of tail white; wings rounded at tip; wing 13¾ inches.....Marsh hawk

A 2. Bill conical or slender, not notched, without a patch of bare skin at the base; claws moderate, not talonlike.

B 1. Plain brown or grayish brown; tail very short, directed more or less upward; size small.

C 1. Very small, about 4 inches long, bright brown; tail carried vertically; no down beneath the feathers; mostly in rocky regions near the sea; very active, impertinent, and noisy.....Winter wren

- C 2. Larger, about $7\frac{1}{2}$ inches long, grayish brown; a thick covering of down beneath the feathers; sides of clear and rapid streams, entering the water and walking along the bottom, or flying under water.

Dipper

- B 2. Not plain brown; tail longer and carried horizontally or directed more or less downward.

- C 1. Large, about 26 inches long, black with steel-blue reflections; crowlike.

Northern raven

- C 2. Much smaller, not over $10\frac{1}{2}$ inches long, and not entirely black.

- D 1. Bill long and slender, about $1\frac{1}{2}$ inches long; length about 9 inches, wing 5 inches (a sandpiper found in boggy areas, with the habits of an upland plover; see key 10). .Aleutian sandpiper

- D 2. Bill much shorter, not over $\frac{1}{2}$ inch in length, and stouter.

- E 1. Above light gray, below white usually finely barred with black, wings and tail black; length $10\frac{1}{3}$ inches, wing $4\frac{1}{2}$ inches.

Northwestern shrike

- E 2. Not light gray and white with black wings and tail; smaller, length not over 7 inches.

- F 1. Dark chocolate brown, feathers of the sides and lower back broadly tipped with bright pink; nape gray; length 7 inches.

Aleutian rosy finch

- F 2. Not chocolate brown and rose color.

- G 1. Back and top of head plain olive brown.

- H 1. Under parts light buffy, the feathers of the sides of the throat with wedge-shaped black spots at their tips, those of the breast with large rounded spots; middle of belly white; tail more reddish than the back; length about 7 inches, wing $3\frac{1}{2}$ inches.Alaskan hermit thrush

- H 2. Under parts plain olive brown, lighter than the back; a large bright red circular patch on throat and upper breast, and a white stripe over the eye; length 6 inches. wing 3 inches.Kamchatkan nightingale

- G 2. Back not plain olive brown.

- H 1. Black and white, conspicuously contrasted; length about 7 inches.

- I 1. Tail not wagged up and down when walking; head, neck, rump, secondary wing feathers, outer tail feathers, and under parts white, rest of plumage black; usually more or less tinged with rusty; tail $2\frac{3}{4}$ inches.

Pribilof snow bunting

- I 2. Tail wagged up and down when walking; wings black marked with white; smaller with a longer tail, which is $3\frac{2}{3}$ inches long.

- J 1. Back gray.Swinhoe's wagtail

- J 2. Back black.Black-backed wagtail

- H 2. Not conspicuously contrasted black and white.

- I 1. Tail long, wagged up and down while walking; bill slender; no bristles over the nostrils.
- J 1. Above streaked warm grayish brown; below buffy, breast and sides streaked with brownish; a whitish or buffy line over the eye; outer tail feathers largely white; length about 6 1/3 inches.
 - K 1. Throat buffy, like the breast.....**Western pipit**
 - K 2. Eyebrow, sides of neck, cheeks, throat, and breast red..... **Red-throated pipit**
- J 2. Above unstreaked dull olive yellow, head blue gray; below bright yellow, fading to white on belly; length 5 3/4 inches.....**Alaskan yellow wagtail**
- I 2. Tail shorter, not wagged up and down when on the ground; bristles over the nostrils.
- J 1. Head, neck, throat, and breast black; a buffy line behind the eye; rest of plumage streaked brownish, becoming white on belly; hind toenail as long as, or longer than, toe, nearly straight; length 6 1/4 inches**Alaskan longspur**
- J 2. Fore parts not black; hind toenail shorter than toe and strongly curved.
 - K 1. Grayish brown streaked with lighter, lighter below, becoming white on belly; crown bright red; rump and breast suffused with pink; length 5 1/3 inches.....**Redpoll**
 - K 2. Without red or pink.
- L 1. Breast conspicuously streaked.
 - M 1. Lower back and tail bright reddish brown, contrasting with the duller brown back; under parts heavily streaked and spotted with rufous brown and blackish; length 7 1/4 inches**Unalaska fox sparrow**
 - M 2. Rump and tail the same color as the back.
 - N 1. A pale yellow mark over or before the eye, and another on the bend of the wing; above brownish black streaked with lighter; tail with the end nearly straight; strictly a grassland bird.. **Aleutian Savannah sparrow**
 - N 2. No yellow; streaked grayish above; tail longer, with the end strongly rounded; inhabits rocky coasts and long grass near the sea.....**Aleutian song sparrow**
- L 2. Breast unmarked.
 - M 1. Central portion of head olive yellow, becoming gray behind the middle, this central portion bordered by a broad black stripe on each side; back streaked light and dark

brown; under parts light brownish gray;
length nearly 7 inches.

Golden-crowned sparrow

- M 2. Breast and throat pure white, separated by a
chestnut collar below throat; above chestnut
streaked with black; length $5\frac{1}{2}$ inches.

Rustic bunting

APPENDIX D

SYSTEMATIC LIST OF PLANTS

The following list is extracted from Hultén's Flora of the Aleutian Islands, except for the common names. Questionable records and hybrids are omitted. The commoner plants which have been included in the following keys are designated with as asterisk (*).

The common names used here are those that seem to the author to be the most appropriate, but they may not be accepted by all, and are not those that were used by the Aleuts, as only a few of these plant names have been recorded. The Latin names are those used by Hultén, with a few exceptions as noted. Only a few attempts have been made to record synonyms and to adjust the names to conform with those of other works, as this does not seem pertinent to the purposes of this work.

PTERIDOPHYTA—FERNS AND FERN ALLIES

Polypodiaceae.....	Fern family
<i>Cystopteris fragilis</i> (L.) Bernh.....	Brittlefern
* <i>Dryopteris austriaca</i> (Jacq.) Woynar ¹	Spreading woodfern
<i>fragrans</i> (L.) Schott.....	Fragrant shieldfern
* <i>linneana</i> C. Chr. ²	Oakfern
* <i>oreopteris</i> (Ehrh.) Maxon.....	Northern woodfern
<i>phegopteris</i> (L.) C. Chr.....	Long beechfern
<i>Polystichum aleuticum</i> C. Chr.....	Aleutian hollyfern
<i>braunii</i> (Spencer) Fée.....	Braun's hollyfern
* <i>lonchitis</i> (L.) Roth.....	Mountain hollyfern
* <i>Athyrium filix-femina</i> subsp. <i>cyclosorum</i> (Rupr.) C. Chr.....	Ladyfern
<i>Blechnum spicant</i> (L.) Roth.....	Deerfern
* <i>Cryptogramma acrostichoides</i> R. Br.....	American rockbrake
* <i>Adiantum pedatum</i> var. <i>aleuticum</i> Rupr.....	Aleutian maidenhair-fern
* <i>Polypodium vulgare</i> var. <i>occidentale</i> Hook.....	Western polypody
Ophioglossaceae.....	Adderstongue family
<i>Ophioglossum vulgatum</i> var. <i>alaskanum</i> (Britt.) C. Chr.....	Adderstongue
<i>Botrychium boreale</i> Milde	Northern grapefern
<i>lanceolatum</i> (Gmel.) Angstr.....	
* <i>lunaria</i> (L.) Swartz.....	Moonwort
<i>silaiifolium</i> Presl	
<i>virginianum</i> (L.) Swartz.....	Rattlesnake-fern

¹ See footnote 9, Appendix E, p. 128.

² See footnote 8, Appendix E, p. 128.

Equisetaceae.....	Horsetail family
* <i>Equisetum arvense</i> L.....	Common horsetail
<i>hiemale</i> var. <i>californicum</i> Milde.....	
<i>variegatum</i> Schlecht.	
Lycopodiaceae.....	Clubmoss family
* <i>Lycopodium alpinum</i> L.	Alpine clubmoss
* <i>annotinum</i> L.	Stiff clubmoss
* <i>clavatum</i> L.	Runningpine
* <i>obscurum</i> L.	Groundpine
* <i>sabinaefolium</i> var. <i>sitchense</i> (Rupr.) Fernald	Alaskan clubmoss
* <i>selago</i> L.	Fir clubmoss
Selaginellaceae.....	Selaginella family
<i>Selaginella selaginoides</i> (L.) Link.....	Low selaginella
<i>sibirica</i> (Milde) Hieron.....	Siberian selaginella
Isoëtaceae.....	Quillwort family
<i>Isoëtes braunii</i> var. <i>maritima</i> (Underw.) Pfeiff....	Quillwort

SPERMATOPHYTA—SEED PLANTS

CONIFERAE—CONE-BEARING PLANTS

Pinaceae.....	Pine family
* <i>Picea sitchensis</i> (Bong.) Carr.....	Sitka spruce

MONOCOTYLEDONEAE—MONOCOTYLEDONS

Sparganiaceae.....	Burreed family
<i>Sparganium affine</i> Schnizl.	
* <i>hyperboreum</i> Laestad	Northern burreed
Najadaceae.....	Eelgrass family
<i>Zostera marina</i> L.....	Eelgrass
Potamogetonaceae.....	Pondweed family
* <i>Potamogeton alpinus</i> subsp. <i>tenuifolius</i> (Raf.) Hult.....	Northern pondweed
<i>filiformis</i> var. <i>borealis</i> (Raf.) St. John.....	
<i>perfoliatus</i> L.....	
<i>praelongus</i> Wulf.....	
<i>Ruppia spiralis</i> L.....	
Juncaginaceae	Arrowgrass family
* <i>Triglochin palustre</i> L.....	Marsh arrowgrass
Gramineae.....	Grass family
* <i>Hierochloë alpina</i> (Swartz) Roem. & Schult....	Alpine holygrass
* <i>odorata</i> (L.) Wahl.....	Holygrass; vanillagrass
* <i>Pbleum alpinum</i> var. <i>americanum</i> Fourn.....	Mountain timothy
* <i>pratense</i> L.	Common timothy
<i>Alopecurus aequalis</i> Sobol.	Shortawn foxtail
<i>alpinus</i> var. <i>stejnegeri</i> (Vasey) Hult.	Alpine foxtail

<i>Arctagrostis latifolia</i> var. <i>arundinacea</i> (Trin.) Griseb.	
* <i>Agrostis</i>	Bentgrasses
<i>alaskana</i> Hult.	
var. <i>breviflora</i> Hult.	
<i>borealis</i> Hartm.	
<i>exarata</i> Trin.	
var. <i>microphylla</i> (Steud.) Wats. . .	
var. <i>purpurascens</i> Hult.	
<i>hiemalis</i> var. <i>geminata</i> (Trin.) Hitchc. .	
<i>stolonifera</i> var. <i>compacta</i> Hartm.	
<i>Podagrostis aequivalvis</i> (Trin.) Scribn. & Merr.	
<i>thurberiana</i> (Hitchc.) Hult.	Thurber's redtop
<i>Cinna latifolia</i> (Trev.) Griseb.	Drooping woodreed
* <i>Calamagrostis</i>	Reedgrasses
<i>canadensis</i> (Michx.) Beauv. ³	
<i>inexpansa</i> A. Gray.	
<i>neglecta</i> (Ehrh.) Gaertn.	
<i>nutkaensis</i> (Presl) Steud.	
<i>purpurascens</i> R. Br.	Purple reedgrass
<i>scribneri</i> var. <i>imberbis</i> Stebbins.	
<i>vaseyi</i> Beal	
* <i>Deschampsia</i>	Hairgrasses
<i>beringensis</i> Hult.	
var. <i>atkinsii</i> Hult.	
<i>caespitosa</i> (L.) Beauv.	Tufted hairgrass
<i>flexuosa</i> (L.) Trin.	
<i>Vahlodea atropurpurea</i> subsp. <i>paramushirensis</i> (Kudo) Hult.	
* <i>Trisetum spicatum</i> (L.) Richt.	Downy oatgrass
<i>Melica subulata</i> (Griseb.) Scribn.	Alaskan oniongrass
* <i>Poa</i>	Bluegrass
<i>annua</i> L.	
<i>arctica</i> R. Br.	Arctic bluegrass
<i>brachyanthera</i> Hult.	
<i>eminens</i> Presl	
<i>hispidula</i> Vasey	
var. <i>aleutica</i> Hult.	
var. <i>vivipara</i> Hult.	
<i>komarovii</i> Roshev.	
<i>lanata</i> Scribn. & Merr.	
var. <i>vivipara</i> Hult.	
<i>macrocalyx</i> Trautv. & C. A. Meyer.	
<i>nemoralis</i> L.	Wood bluegrass
<i>palustris</i> L.	Fowl bluegrass

³ Hultén erroneously considers the Aleutian specimens as belonging to *C. langsдорffii* (Link.) Trin., which is a Siberian species.

<i>pratensis</i> L.	Common bluegrass
<i>rotundata</i> Trin.	
<i>stenantha</i> Trin.	
var. <i>vivipara</i> Trin.	
<i>trivialis</i> L.	Rough bluegrass
<i>turneri</i> Scribn. & Merr.	
<i>williamsii</i> Nash	
* <i>Puccinellia</i>	Alkali-grass
<i>nutkaensis</i> (Presl) Fernald & Weatherby	
<i>pumila</i> (Vasey) Hitchc.	
<i>Festuca</i>	Fescue
<i>altaica</i> Trin.	
<i>brachyphylla</i> Schult.	Alpine fescue
* <i>rubra</i> L.	Red fescue
subsp. <i>aucta</i> (Krecz. & Bobor.) Hult.	
var. <i>barbata</i> (Schrank) Hack var. <i>mutica</i> Hartm.	
* <i>Bromus aleutensis</i> Trin.	Aleutian bromegrass
* <i>Hordeum boreale</i> Scribn. & Smith.	Wild barley
<i>Anthoxanthum odoratum</i> L.	Sweet vernalgrass
<i>Elymus aleuticus</i> Hult.	
* <i>arenarius</i> subsp. <i>mollis</i> (Trin.) Hult.	Strand wheat; wild rye
<i>hirsutus</i> Presl.	
Cyperaceae	Sedge family
* <i>Eriophorum</i>	Cottongrasses
<i>angustifolium</i> Honck.	
<i>medium</i> Anderss.	
<i>russeolum</i> Fries	
<i>scheuchzeri</i> Hoppe	
* <i>Scirpus caespitosus</i> L.	Tufted club-rush
<i>kamtschaticus</i> C. A. Meyer.	
* <i>Carex</i>	Sedges
<i>anthoxanthea</i> Presl	
<i>aquaticus</i> Wahl.	
<i>bicolor</i> All.	
<i>canescens</i> L.	
<i>circinnata</i> C. A. Meyer.	
<i>glareosa</i> Wahl.	
<i>gmelini</i> Hook. & Arn.	
<i>gynocrates</i> Wormskjold	
<i>hindsii</i> C. B. Clarke.	
<i>lyngbyei</i> subsp. <i>cryptocarpa</i> (C. A. Meyer) Hult.	
var. <i>gigas</i> Hult.	

- macloviana* var. *pachystachya* (Cham.)
 Kükenth.
macrochaeta C. A. Meyer.
nesophila Holm
nigricans C. A. Meyer.
physocarpa Presl
pribylovensis J. M. Macoun.
pyrenaica Wahl.
ramenskii Komar.
rariflora subsp. *stygia* (Fries) N. J. Anders.
rigida var. *moncolor* (R. Br.) Kükenth.
stellulata Good.
stylosa C. A. Meyer.
 Juncaceae Rush family
 * *Juncus* Rushes
 balticus var. *haenkei* (C. A. Meyer)
 Buchen.
 castaneus var. *pallidus* Hook.
 drummondii E. Meyer.
 ensifolius Wikstr.
 falcatus var. *sitchensis* Buchen.
 mertensianus Bong.
 triglumis L.
 * *Luzula* Woodrushes
 arcuata Wahl.
 multiflora (Retz.) Lejeune
 var. *frigida* (Buchen.) Samuels.
 var. *kobayasii* (Satake) Samuels
 nivalis var. *latifolia* Kjellm.
 parviflora (Ehrh.) Desv.
 spicata (L.) DC.
 wahlenbergii Rupr.
 Liliaceae Lily family
 * *Tofieldia coccinea* Richards.
 * *Veratrum album* subsp. *oxysepalum* (Turcz.)
 Hult. False hellebore
 Allium victorialis subsp. *platyphyllum* Hult. Longroot onion
 * *Fritillaria camschatcensis* (L.) Ker-Gawl. Eskimo potato;
 Indian riceroor
 Common alp-lily
 Lloydia serotina (L.) Reichenb.
 * *Maianthemum dilatatum* (Howell) A. Nels.
 & Macbr. Wild lily-of-the-valley
 * *Streptopus amplexifolius* (L.) DC. Cucumber plant
 Iridaceae Iris family
 * *Iris setosa* Pall. Iris; flag
 var. *platyrhyncha* Hult.

Orchidaceae.....	Orchid family
<i>Cypripedium guttatum</i> Swartz.....	Ladyslipper
* <i>Orchis aristata</i> Fisch.....	
<i>Coeloglossum viride</i> var. <i>bracteatum</i> Richt.....	
* <i>Platanthera dilatata</i> (Pursh) Lindl.	Tall white bog orchid
var. <i>media</i> (Rydb.) Ames....	
* <i>hyperborea</i> (L.) Lindl.	Tall leafy green orchid
var. <i>dilatatoides</i> Hult....	
<i>stricta</i> Lindl.	
<i>tipuloides</i> (L. f.) Lindl.....	
<i>unalascensis</i> (Spreng.) Kurtz.....	
* <i>Spiranthes romanzoffianum</i> Cham. & Schlecht....	Ladies-tresses
* <i>Listera convallarioides</i> (Swartz) Torr.....	Broad-lipped twayblade
<i>cordata</i> (L.) R. Br.....	Heart-leaved twayblade
<i>Corallorrhiza trifida</i> Chatelin.....	Early coralroot
<i>Microstylis monophyllos</i> (L.) Lindl.....	White addermouth orchid

DICOTYLEDONEAE—DICOTYLEDONS

Salicaceae.....	Willow family
* <i>Salix alaxensis</i> (Anderss.) Coville.....	Felt-leaf willow
<i>arbutifolia</i> Pall. (<i>S. fuscescens</i> Anderss.)..	
* <i>arctica</i> Pall. ⁴	Arctic willow
* <i>barclayi</i> Anderss.	Barclay willow
* <i>ovalifolia</i> Trautv.	Oval-leaf willow
<i>phlebophylla</i> Anderss.	
<i>pseudopolaris</i> Flod. (<i>S. polaris</i> L.).....	
* <i>pulchra</i> Cham.	Beautiful willow
* <i>reticulata</i> L.	Net-vein willow
* <i>rotundifolia</i> Trautv.	Least willow
<i>stolonifera</i> Coville	Sprouting willow
Betulaceae.....	Birch family
<i>Betula exilis</i> Sukach.....	Birch
* <i>Alnus fruticosa</i> var. <i>sinuata</i> Regel.....	Alder
Polygonaceae.....	Buckwheat family
<i>Koenigia islandica</i> L.....	
<i>Rumex acetosa</i> L.	Garden sorrel
<i>acetosella</i> L.	Sheep sorrel
<i>domesticus</i> Hartm.	
* <i>fenestratus</i> Greene	
<i>graminifolius</i> Lambert	
<i>obtusifolius</i> subsp. <i>agrestis</i> (Fries)	
Danser	Bitter dock
<i>pallidus</i> Bigel.	
* <i>Oxyria digyna</i> (L.) Hill.....	Mountain sorrel
<i>Polygonum convolvulus</i> L.	Black bindweed
* <i>viviparum</i> L.	Bistort

⁴ Hultén considers this species as *S. crassijulis* Trautv.

Portulacaceae.....	Purslane family
<i>Claytonia arctica</i> Adams	
* <i>chamissoi</i> Eschsch.	Water springbeauty
<i>scammaniana</i> Hult.	
* <i>sibirica</i> L.	Siberian springbeauty
<i>Montia lamprosperma</i> Cham.....	Indian lettuce
Caryophyllaceae.....	Pink family
<i>Stellaria</i>	Starworts
* <i>calycantha</i> (Ledeb.) Bong.....	
<i>crispa</i> Cham. & Schlecht.....	
<i>longipes</i> Goldie	
* <i>media</i> (L.) Cyrillo.....	
* <i>sitchana</i> Steud.	
var. <i>bongardia</i> (Fernald) Hult..	
<i>Cerastium</i>	Chickweeds
<i>aleuticum</i> Hult.	
* <i>beeringianum</i> Cham. & Schlecht.....	Bering chickweed
* var. <i>grandiflorum</i>	
(Fenzl) Hult.	Large-flowered
Bering chickweed	
<i>caespitosum</i> Gilib.	
* <i>fischerianum</i> Seringe	Fischer's chickweed
* <i>Sagina crassicaulis</i> S. Wats.	Thick-stemmed pearlwort
* <i>intermedia</i> Fenzl	
<i>litoralis</i> Hult.	
<i>occidentalis</i> S. Wats.	
<i>procumbens</i> L.	
<i>Minuartia</i>	Sandworts
<i>arctica</i> (Steven) Aschers. & Graebn....	
<i>macrocarpa</i> (Pursh) Ostenf.....	
<i>verna</i> (L.) Hiern.....	
* <i>Honckenya peploides</i> (L.) Ehrh.....	Sea-beach sandwort
<i>Moebringia lateriflora</i> (L.) Fenzl.....	Blunt-leaved sandwort
<i>Silene acaulis</i> L.....	Moss silene
<i>Melandryum apetalum</i> (L.) Fenzl.....	Nodding campion
Nymphaeaceae.....	Waterlily family
* <i>Nuphar</i> sp.	Cowlily
Ranunculaceae.....	Buttercup family
* <i>Caltha palustris</i> var. <i>asarifolia</i> (DC.) Huth.....	Cowslip
<i>Trollius riederianus</i> Fisch. & Mey.....	Globeflower
* <i>Coptis trifolia</i> (L.) Salisb.....	Goldthread
* <i>Aconitum delphinifolium</i> DC.	Monkshood
* <i>maximum</i> Pall.	Monkshood
* <i>Anemone narcissiflora</i> var. <i>villosissima</i> DC.....	Narcissus anemone
<i>richardsoni</i> Hook.	
<i>Oxygraphis glacialis</i> (Fisch.) Bunge.....	

- **Ranunculus acer* L. Tall buttercup
 var. *frigidus* Regel.
 bongardi Greene
 * *eschscholtzii* Schlecht.
 hyperboreus Rottb.
 * *nelsonii* (DC.) A. Gray.
 subsp. *insularis* Hult.
 nivalis L. Snow buttercup
 * *reptans* L. Creeping spearwort
 sulphureus var. *intercedens* Hult.
 trichophyllus Chaix. White water crowfoot
 var. *hispidulus* (E.
 R. Drew) W. B. Drew
 **Thalictrum kemense* Fries. Meadowrue
 Papaveraceae Poppy family
 Papaver alaskanum Hult. Alaskan poppy
 Cruciferae Mustard family
 Subularia aquatica L. Water awlwort
 Aphragmus eschscholtzianus Andrzej.
 **Cochlearia officinalis* L. Scurvyweed
 Brassica campestris L. Turnip
 **Barbarea orthoceras* Ledeb. Erect-pod wintercress
 **Nasturtium palustre* (Leyss.) DC. Yellow watercress
 Cardamine bellidifolia L.
 pratensis L.
 regeliana Miquel
 * *umbellata* Greene Alpine cress
 **Capsella bursa-pastoris* L. Shepherds-purse
 Draba aleutica Ekman
 * *borealis* DC. Northern draba
 * *fladnizensis* Wulf. Arctic draba
 hyperborea (L.) Desv.
 lactea F. M. Adams. Milky draba
 nivalis Liljeb. Snow draba
 stenoloba Ledeb.
 Arabis Rockcresses
 * *lyrata* subsp. *kamtschatica* Fisch.
 * *rupestris* Nutt.
 Parrya nudicaulis (L.) Regel.
 Droseraceae Sundew family
 **Drosera rotundifolia* L. Round-leaved sundew
 Crassulaceae Orpine family
 Sedum roseum (L.) Scop.
 var. *aleuticum* Fröderst. Rose-root stonecrop
 Saxifragaceae Saxifrage family
 **Leptarrhena pyrolifolia* (D. Don) Seringe.
 Tellima grandiflora (Pursh) Dougl. Alaskan fringe-cup

<i>Saxifraga</i>	Saxifrage
<i>aleutica</i> Hult.	
* <i>bracteata</i> D. Don.....	
<i>bronchialis</i> subsp. <i>funstonii</i> (Small) Hult.....	
<i>caespitosa</i> subsp. <i>sileneflora</i> (Sternb.) Hult.....	
<i>foliolosa</i> R. Br.....	
* <i>hirculus</i> L.	
<i>nivalis</i> L.	Snowball saxifrage
<i>nudicaulis</i> D. Don.....	
<i>oppositifolia</i> L.	Twinleaf saxifrage
* <i>punctata</i> L.	Dotted saxifrage
subsp. <i>insularis</i> Hult.....	
<i>rivularis</i> L.	
<i>serpyllifolia</i> Pursh.	
<i>unalaschkensis</i> Sternb.	
<i>Heuchera glabra</i> Willd.....	Alumroot
<i>Chrysosplenium</i>	Golden saxifrage
<i>alternifolium</i> subsp. <i>tetrandrum</i> (T. Fries) Lund.....	
<i>beringianum</i> Rose	
* <i>Parnassia kotzebuei</i> Cham. & Schlecht.....	Grass-of-Parnassus
<i>palustris</i> L.	Marsh grass-of-Parnassus
Rosaceae.....	Rose family
* <i>Aruncus sylvester</i> Kosteletzky.....	Goatsbeard
* <i>Sorbus sambucifolia</i> (Cham. & Schlecht.) Roemer.	Siberian mountain ash
* <i>Rubus chamaemorus</i> L.	Cloudberry
* <i>spectabilis</i> Pursh	Salmonberry
* <i>stellatus</i> J. E. Smith.....	
<i>Potentilla nana</i> Willd.	Arctic cinquefoil
* <i>pacifica</i> Howell.	
* <i>palustris</i> (L.) Scop.....	Purple or marsh cinquefoil
* <i>villosa</i> Pall.	Hairy cinquefoil
* <i>Sibbaldia procumbens</i> L.....	Sibbaldia
* <i>Geum calthifolium</i> Menzies	Cowslip-leaved avens
* <i>macrophyllum</i> Willd.	Large-leaved avens
<i>pentapetalum</i> (L.) Makino.....	
* <i>rossii</i> (R. Br.) Seringe.....	
* <i>Dryas octopetala</i> L.....	White mountain avens
<i>Rosa aleutica</i> Crép.	Aleutian rose
* <i>Fragaria chiloensis</i> (L.) Duchesne.....	Wild strawberry
* <i>Sanguisorba sitchensis</i> C. A. Meyer.....	Burnet
Leguminosae	Pea family
* <i>Trifolium pratense</i> L.	Red clover
* <i>repens</i> L.	White clover
<i>Astragalus alpinus</i> L.	

* <i>Lupinus nootkatensis</i> Donn.....	Lupine
var. <i>unalaskensis</i> S. Wats...	
<i>Lupinus</i> n. sp. ⁵	
* <i>Lathyrus maritimus</i> (L.) Bigel.....	Beach pea
palustris subsp. <i>pilosus</i> (Cham.) Hult...	
Geraniaceae	Geranium family
* <i>Geranium erianthum</i> DC.....	Wild geranium
Callitricaceae	Water starwort family
<i>Callitriche verna</i> L.....	Water starwort
Empetraceae.....	Crowberry family
* <i>Empetrum nigrum</i> L.....	Crowberry
Violaceae.....	Violet family
<i>Viola epipsila</i> subsp. <i>repens</i> (Turcz.) Becker....	
* <i>langsдорffii</i> Fisch.	Blue violet
Onagraceae.....	Evening primrose family
<i>Epilobium</i>	Willowherbs
* <i>anagallidifolium</i> Lam.	
* <i>angustifolium</i> L.	Great fireweed
* <i>bebringanum</i> Hausskn.	
<i>bongardi</i> Hausskn.	
* <i>glandulosum</i> Lehm.	
<i>latifolium</i> L.	Northern fireweed; red willowherb
<i>luteum</i> Pursh	Yellow willowherb
* <i>sertulatum</i> Hausskn.	
<i>treleaseanum</i> H. Lév.....	
<i>Circaea alpina</i> L.....	Enchanters nightshade
Haloragidaceae	Water milfoil family
<i>Hippuris montana</i> Ledeb.....	
* <i>vulgaris</i> L.	Marestail
* <i>Myriophyllum spicatum</i> L.....	Water milfoil
Umbelliferae	Carrot family
<i>Osmorrhiza divaricata</i> Britt.....	Western sweet-cicily
* <i>Conioselinum gmelini</i> (Cham. & Schlecht.)	
Coult. & Rose.....	Hemlock parsley
var. <i>kamtschaticum</i>	
(Rupr.) Hult.	
* <i>Ligusticum hultenii</i> Fernald.....	Ligusticum
* <i>Coelopleurum gmelini</i> (DC.) Ledeb.....	Wild celery; wild parsnip
* <i>Heracleum lanatum</i> Michx.....	Cow-parsnip
Cornaceae.....	Dogwood family
<i>Cornus canadensis</i> L.....	Dwarf cornel; bunchberry
* <i>suecica</i> L.	Dwarf cornel; bunchberry
Ericaceae	Heath family
* <i>Pyrola asarifolia</i> var. <i>incarnata</i> (DC.) Fernald....	Wintergreen

⁵ This is a new species to be named for Kiska Island where it was found by Pvt. E. D. McDonald of the U. S. Army.

* <i>Pyrola minor</i> L.	Lesser wintergreen
<i>Ledum palustre</i> subsp. <i>decumbens</i> (Ait.) Hult..	Narrow-leaved Labrador tea
* <i>Rhododendron kamschatcicum</i> Pall.....	Kamchatka rhododendron
* <i>Loiseleuria procumbens</i> (L.) Desv.....	Alpine or trailing azalea
* <i>Phyllodoce aleutica</i> (Spreng.) Heller.....	Aleutian mountain heath
* <i>Cassiope lycopodioides</i> (Pall.) D. Don.....	Cassiope
<i>stelleriana</i> (Pall.) DC.....	
<i>Gaultheria miqueliana</i> Takeda.....	Wintergreen
* <i>Arctostaphylos alpina</i> (L.) Spreng.....	Alpine partridgeberry
* <i>uva-ursi</i> (L.) Spreng.....	Bearberry
<i>Vaccinium ovalifolium</i> J. E. Smith.....	Blueberry
* <i>uliginosum</i> var. <i>alpinum</i> Bigel.....	Mountain bog bilberry
var. <i>salicinum</i> (Cham.)	
Hult.....	
* <i>vitis-idaea</i> subsp. <i>minus</i> Lodd.....	Mountain cranberry
<i>Oxycoccus microcarpus</i> Turcz.....	Bog cranberry
Primulaceae.....	Primrose family
<i>Primula</i>	Primroses
* <i>cuneifolia</i> subsp. <i>dubyi</i> Pax.....	
subsp. <i>saxifragifolia</i> (Lehm.)	
Hult.....	
<i>egalikensis</i> Wormskjold	
<i>eximia</i> Greene	
<i>Androsace lehmanniana</i> Spreng.....	
* <i>Trientalis europaea</i> subsp. <i>arctica</i> (Fisch.) Hult..	Starflower
Plumbaginaceae.....	Plumbago family
<i>Armeria vulgaris</i> subsp. <i>arctica</i> (Cham.) Hult..	
Gentianaceae.....	Gentian family
<i>Gentiana acuta</i> Michx.....	Northern gentian
* var. <i>plebeja</i> (Cham.) Wettst.....	
<i>aleutica</i> Cham. & Schlecht.....	Aleutian gentian
<i>algida</i> Pall.	
<i>auriculata</i> Pall. ⁶	
<i>prostrata</i> Haenke	
<i>Menyanthes trifoliata</i> L.....	Buckbean
<i>Swertia perennis</i> Hult.....	
Polemoniaceae.....	Phlox family
<i>Polemonium acutiflorum</i> Willd.....	Polemonium
Boraginaceae	Borage family
* <i>Romanzoffia unalaschcensis</i> Cham.....	Unalaska mistmaiden
var. <i>glabruiscula</i>	
Hult.....	
* <i>Plagiobotrys orientalis</i> (L.) I. M. Johnston.....	Popcornflower

⁶ This gentian was collected by Lt. George B. VanSchaack, U. S. N., on Attu Island in 1944. It is an Asiatic species which has apparently never before been known east of the Commander Islands.

<i>Myosotis alpestris</i> Schmidt.....	Alpine forget-me-not
<i>Mertensia asiatica</i> (Takeda) Macbr.....	
* <i>mariitima</i> (L.) S. F. Gray.....	Sea bluebells
Labiatae	Mint family
<i>Prunella vulgaris</i> var. <i>aleutica</i> Fernald.....	Selfheal; healall
Scrophulariaceae	Figwort family
* <i>Mimulus guttatus</i> DC.....	Common monkeyflower
* <i>Veronica americana</i> Schwein.....	American brooklime
* <i>grandiflora</i> Gaertn.	Large-flowered speedwell
var. <i>minor</i> Hult.....	
* <i>humifusa</i> Dickson	Thyme-leaved speedwell
* <i>stelleri</i> Pall.	Steller's speedwell
var. <i>glabrescens</i> Hult.	
<i>wormskjoldii</i> Roem. & Schult.....	
* <i>Lagotis glauca</i> Gaertn.....	
<i>Castilleja pallida</i> (L.) Kunth.....	
* <i>unalaschensis</i> (Cham. & Schlecht.)	
Malte.....	Indian painted-cup
<i>Euphrasia mollis</i> (Ledeb.) Wettst.....	Eyebright
* <i>Rhinanthus groenlandicus</i> Chaubert.....	Rattleweed
<i>Pedicularis</i>	Louseworts; woodbetonies
* <i>capitata</i> M. F. Adams.....	
* <i>chamissonis</i> Steven	
<i>lanata</i> Cham. & Schlecht.....	Woolly lousewort
<i>langsдорffii</i> Fisch.	
<i>oederi</i> Vahl	
<i>sudetica</i> Willd.	
* <i>verticillata</i> L.	
Lentibulariaceae.....	Bladderwort family
* <i>Pinguicula vulgaris</i> L.	Common butterwort
Plantaginaceae.....	Plantain family
<i>Plantago juncooides</i> Lam.....	
* <i>macrocarpa</i> Cham. & Schlecht.	Big-pod plantain
<i>major</i> L.	Common plantain
Rubiaceae.....	Madder family
* <i>Galium aparine</i> L.....	Catchweed bedstraw
<i>kamtschaticum</i> Steller	Northern wild licorice
<i>trifidum</i> subsp. <i>columbianum</i> (Rydb.),	
Hult.....	Small bedstraw
<i>triflorum</i> Michx.	Sweet bedstraw
Caprifoliaceae	Honeysuckle family
* <i>Sambucus racemosa</i> subsp. <i>pubens</i> (Michx.) Hult.	Red-berried elder
* <i>Linnaea borealis</i> L.....	Twinflower
Valerianaceae.....	Valerian family
<i>Valeriana capitata</i> Pall.....	Valerian

Campanulaceae	Bellflower family
<i>Campanula</i>	Bellflowers
* <i>dasyantha</i> Bieb.	
* <i>lasiocarpa</i> Cham.	Bering bellflower
var. <i>latisejala</i> Hult.	
<i>rotundifolia</i> var. <i>alaskana</i> A. Gray.	Bluebell; harebell
<i>uniflora</i> L.	
Compositae	Composite family
<i>Solidago</i>	Goldenrods
<i>lepida</i> DC.	
<i>multiradiata</i> var. <i>arctica</i> (DC.) Fernald.	
<i>Aster</i>	Asters
* <i>foliaceus</i> Lindl.	
* <i>peregrinus</i> Pursh	
<i>sibiricus</i> L.	
<i>Erigeron unalaschensis</i> (DC.) Vierh.	Erigeron
<i>Antennaria</i>	Pussytoes
* <i>dioica</i> (L.) Gaertn.	
* <i>monocephala</i> DC.	
<i>pallida</i> E. Nels.	
* <i>Anaphalis margaritacea</i> var. <i>occidentalis</i> Greene.	Pearly everlasting
* <i>Achillea borealis</i> Bong.	Northern yarrow
<i>sibirica</i> Ledeb.	Siberian yarrow
<i>Matricaria suaveolens</i> (Pursh) Buchen.	
* <i>Chrysanthemum arcticum</i> L.	Arctic chrysanthemum
* <i>leucanthemum</i> L.	Ox-eye daisy
<i>Artemisia</i>	Sagebrush
<i>aleutica</i> Hult.	Aleutian sagebrush
* <i>arctica</i> Less.	Arctic sagebrush
var. <i>villosa</i> Hult.	
<i>globularia</i> Cham.	
<i>tiesii</i> subsp. <i>unalaschensis</i> (Besser)	
Hult.	
* <i>unalaschensis</i> Rydb.	
var. <i>aleutica</i> Hult.	
* <i>Petasites frigidus</i> (L.) Fries.	Butterbur
var. <i>hyperboreoides</i> Hult.	
<i>Arnica</i>	Arnica
* <i>chamissonis</i> Less.	
<i>lessingii</i> Greene	
* <i>unalaschensis</i> Less.	
* <i>Cacalia auriculata</i> DC.	Indian plantain
* <i>Senecio palmatus</i> (Pall.) Ledeb.	Groundsel
* <i>pseudoarnica</i> Less.	Ragwort
* <i>resedifolius</i> Less.	
<i>Saussurea subsinuata</i> Ledeb.	
* <i>Cirsium kamtschaticum</i> Ledeb.	Kamchatkan thistle

<i>Picris hieracioides</i> subsp. <i>kamtschatica</i> (Ledeb.)	
Hult.	Hawkweed; oxtongue
<i>Prenanthes lessingii</i> Hult.	Rattlesnake-root
* <i>Taraxacum</i>	Dandelions
<i>callorbinorum</i> Hagl.	
<i>chromocarpum</i> Hagl.	
<i>eyerdamii</i> Hagl.	
<i>kamtschaticum</i> Dahlst.	
<i>kjellmanii</i> Dahlst.	
<i>trigonolobum</i> Dahlst.	
<i>Hieracium</i>	Hawkweed
<i>gracile</i> var. <i>alaskanum</i> Zahn.	
* <i>triste</i> Willd.	
var. <i>tristiforme</i> Zahn.	

APPENDIX E

KEYS TO THE MORE COMMON PLANTS

The following keys have been prepared to assist in the identification of the commoner plants of the Aleutian Islands. They do not include all the species known there but only those which are recorded by Hultén as common, or which have been specially mentioned by various naturalists of the United States Army and Navy with whom the writer has been in correspondence. The keys have been prepared with the hope that they can be used successfully by individuals untrained in botany and not provided with a hand lens. Except for the ferns and fern allies, the woody plants, those bearing edible berries, and a few others, one must have the flowers in order to use these keys. They will not be found satisfactory in identifying every flowering plant that may be encountered, because some of the less common or rare plants are not included here. Also, because of the inevitable limitations of Hultén's work, based as it is on only one season's field work and on scattered collections, some plants may be more common than he has recorded them to be, at least in restricted localities. Through necessity these keys were originally prepared from herbarium material. However, they have been adjusted in accordance with the findings of Lt. George B. VanSchaack of the U. S. Navy, who kindly checked them during the summer of 1944 in the field on the island where he was stationed and where he collected specimens to aid in the preparation of this account. Unfortunately the limitations of space have prevented the presentation of brief descriptions of the plants, which usually clarify doubts that arise in using any key for accurate identification.

The limitations of this work in identifying plants may be overcome by sending dried specimens for naming to the United States National Herbarium, Smithsonian Institution, Washington 25, D. C., or to any of the larger botanical centers in this country. The Institution is very desirous of increasing its now very meager reference collection of herbarium specimens from the Aleutians, so that it will have adequate representations of this interesting flora on which to base future scientific studies.

In gathering a specimen for identification the whole plant should be taken, not just the flower, for the characters of the leaves, especially of the basal leaves, and sometimes the roots are important in using the keys. If the plant is too large to gather entire, then a sample of the flowers

and leaves should be taken and other characters noted. Next, one must determine to which of the seven groups of plants it belongs. These groups are as follows:

- Group 1. Herbaceous flowering plants, exclusive of aquatic plants, grasses and grasslike plants, and composites.
- Group 2. Woody or semiwoody plants, including those with tough, wiry, creeping stems.
- Group 3. Plants of the composite family (Compositae), of which the dandelion and aster are well-known examples. The flowers are very small and gathered together in distinctive compact heads with a more or less flat base, the whole surrounded by one or more series of green bracts, these sometimes scalelike.
- Group 4. Plants with conspicuous edible berries. (These are mostly woody plants also included in group 2.)
- Group 5. Plants of special habitats: (1) Aquatic plants (exclusive of seaweeds and other marine plants); (2) seashore plants, especially those of sandy beaches, and (3) alpine or high mountain plants, mostly also included in groups 1 and 4).
- Group 6. Grasses and grasslike plants, mostly true grasses, sedges, and rushes.
- Group 7. Ferns and their relatives—that is, plants that never produce flowers or seeds, but that reproduce by spores.

(For explanation of principal terms used in the keys, see fig. 8, p. 131.)

GROUP 1. *Herbaceous flowering plants, exclusive of aquatic plants*
(see GROUP 5), *grasses and grasslike plants* (see GROUP 6),
and composites (see GROUP 3).

- A 1. Plants with distinctive basal leaves, these often forming a compact cluster, the flowering stems arising from the center.
- B 1. Basal leaves simple.
- C 1. Flowering stems bearing leaves.
- D 1. Leaves of flowering stems all alternate, except in geranium where there is usually a single pair of opposite leaves just below the flower cluster.
- E 1. Flowers white.
- F 1. Flowers in dense elongated racemes, each flower with a short stalk..... **Bistort** (*Polygonum viviparum*)
- F 2. Flowers not in dense elongated racemes, each flower with separate stalk.
- G 1. Petals 5.
- H 1. Flowers 1 or 2 on each stem; leaves narrow.
(*Saxifraga hirculus*)
- H 2. Flowers more than 2 on each stem; leaves broad, nearly round, deeply lobed..... (*Saxifraga bracteata*)
- G 2. Petals 4.
- H 1. Seed-bearing pods long and slender.
- I 1. Leaves on flowering stems long, narrowing at base; plants without hairs..... **Rockcress** (*Arabis lyrata*)
- I 2. Leaves on flowering stems elliptic or ovate, attached to stem by broad clasping base; plants hairy.
Rockcress (*Arabis rupestris*)
- H 2. Seed-bearing pods short, elliptic or triangular.
- I 1. Fruits triangular.
Shepherds-purse (*Capsella bursa-pastoris*)
- I 2. Fruits elliptical.
- J 1. Leaves about $\frac{1}{2}$ inch long, usually with a few marginal teeth..... **Northern draba** (*Draba borealis*)
- J 2. Leaves $\frac{3}{8}$ inch long or less, without teeth.
Arctic draba (*Draba fladnizensis*)
- E 2. Flowers yellow.
- F 1. Leaves not lobed.
- G 1. Leaves heart-shaped..... **Cowslip** (*Caltha palustris*)
- G 2. Leaves narrow, elongate..... (*Saxifraga hirculus*)
- F 2. Leaves deeply lobed..... **Buttercups** (*Ranunculus*)
- G 1. Lobes of leaves rounded or very blunt at tips; plants without hairs (*Ranunculus eschscholtzii*)
- G 2. Lobes of leaves sharply pointed at tips; plants hairy.
- H 1. Main lobes of leaves not again deeply divided, at least not below the middle..... (*Ranunculus nelsonii*)
- H 2. Main lobes of leaves again deeply divided, usually more than halfway to the base..... (*Ranunculus acer*)

- E 3. Flowers purple.....Wild geranium (*Geranium erianthum*)
- E 4. Flowers blue.
 - F 1. Flowers in dense thumblike clusters.....(*Lagotis glauca*)
 - F 2. Flowers solitary or few.
 - G 1. Petals 5, united in a bell-like cup....Bellflowers (*Campanula*)
 - H 1. Sepals slender, coarsely toothed, sharply pointed.
 - Bering bellflower (*Campanula lasiocarpa*)
 - H 2. Sepals oblong, not toothed, pointed but not sharply so.
 - (*Campanula dasyantha*)
 - G 2. Petals 3, not united.....Iris; flag (*Iris setosa*)
- E 5. Flowers green or greenish.
 - F 1. Leaves thick, leathery, shiny, toothed....(*Leptarrhena pyrolifolia*)
 - F 2. Leaves thin, not shiny, not toothed.
 - Western dock (*Rumex fenestratus*)
- D 2. Leaves of flowering stems opposite.
 - E 1. Flowers pink.....Siberian springbeauty (*Claytonia sibirica*)
 - E 2. Flowers blue.....(*Lagotis glauca*)
- C 2. Flowering stems without leaves, that is, all leaves basal, rarely with a single small leaf near base.
 - D 1. Flowers white.
 - E 1. Leaves round, covered with sticky glandular hairs which catch insects.....Round-leaved sundew (*Drosera rotundifolia*)
 - E 2. Leaves not covered with sticky glandular hairs.
 - F 1. Petals 4.....Arctic draba (*Draba fladnizensis*)
 - F 2. Petals 5 or more.
 - G 1. Leaves without teeth or lobes.
 - H 1. Flowers 1 on each flowering stem.
 - Grass-of-Parnassus (*Parnassia kotzebuei*)
 - H 2. Flowers several on each stem.
 - Lesser wintergreen (*Pyrola minor*)
 - G 2. Leaves toothed or lobed.
 - H 1. Leaves elliptic or oblong, white beneath.
 - White mountain avens (*Dryas octopetala*)
 - H 2. Leaves round.
 - I 1. Petals separate....Dotted saxifrage (*Saxifraga punctata*)
 - I 2. Petals united on lower part.
 - Unalaska mistmaiden (*Romanzoffia unalaschensis*)
 - D 2. Flowers red or pink, without spurs at back of flowers.
 - E 1. Leaves toothed on margin; flowers pink.
 - F 1. Petals separate; leaf blades nearly round, heart-shaped at base.
 - Dotted saxifrage (*Saxifraga punctata*)
 - F 2. Petals united; leaf blades oval, wedgeshaped at base.
 - Primrose (*Primula cuneifolia*)
 - E 2. Leaves not toothed; flowers red, several to many along stem or in dense cluster at end.
 - F 1. Leaves round or elliptic.
 - Wintergreen (*Pyrola asarifolia* var. *incarnata*)
 - F 2. Leaves narrow, grasslike.....(*Tofieldia coccinea*)

- D 3. Flowers purple, with a spur at back of flower
 - Common butterwort (*Pinguicula vulgaris*)
- D 4. Flowers blue....Unalaska mistmaiden (*Romanzoffia unalaschensis*)
- D 5. Flowers greenish or yellowish green.
 - E 1. Flowering stems branched; leaves round or oval.
 - F 1. Leaves without teeth, round..Mountain sorrel (*Oxyria digyna*)
 - F 2. Leaves toothed, round or oval.....(*Leptarrhena pyrolifolia*)
 - E 2. Flowering stems unbranched; leaves long and narrow.
 - Big-pod plantain (*Plantago macrocarpa*)
- B 2. Basal leaves compound.
 - C 1. Flowering stems bearing leaves.
 - D 1. Basal leaves pinnate.
 - E 1. Flowers white.
 - F 1. Flowers many in broad, flat-topped clusters; bases of leaf stalks enlarged.
 - G 1. Leaflets not deeply divided, toothed on margins but not deeply so.
 - Wild celery; wild parsnip (*Coelopleurum gmelini*)
 - G 2. Leaflets deeply divided or toothed on margins.
 - Hemlock parsley (*Conioselinum gmelini*)
 - F 2. Flowers not in broad flat-topped clusters; bases of leaf stalks not enlarged.
 - G 1. Flower clusters short; fruits long and slender.
 - (*Cardamine umbellata*)
 - G 2. Flower clusters elongate; fruits not long and slender.
 - H 1. Flowers small with numerous long protruding stamens.
 - Burnet (*Sanguisorba sitchensis*)
 - H 2. Flowers rather large, hooded, with few hidden or protruding stamens.
 - Lousewort; woodbetony (*Pedicularis capitata*)
 - E 2. Flowers yellow.....Avens (*Geum*)
 - F 1. All the leaflets about the same size.....(*Geum rossii*)
 - F 2. End leaflet much larger than the others.
 - G 1. Smaller leaflets more than 4.
 - Large-leaved avens (*Geum macrophyllum*)
 - G 2. Smaller leaflets 2 or 4.
 - Cowslip-leaved avens (*Geum calthifolium*)
 - D 2. Basal leaves palmate or with 3 radiating primary divisions, each again 3-lobed or divided into 3 leaflets or coarsely toothed.
 - E 1. Flowers blue.....Lupine (*Lupinus nootkatensis*)
 - E 2. Flowers yellow.
 - F 1. Leaflets very white, hairy beneath.
 - Hairy cinquefoil (*Potentilla villosa*)
 - F 2. Leaflets not white, hairy beneath.
 - Sibbaldia (*Sibbaldia procumbens*)
 - E 3. Flowers white.
 - F 1. Flowers small, numerous, in large flat-topped clusters; leaf stalks with bladdery or winglike expansions at base.

- G 1. Leaflets whitish and woolly beneath, the leaf stalks bearing leaflike or bladdery expansions at base.
Cow-parsnip (*Heracleum lanatum*)
- G 2. Leaflets green and not hairy beneath, the expansions at base of leaf stalks not bladdery. *Ligusticum* (*Ligusticum hultenii*)
- F 2. Flowers over 1/2 inch wide, solitary or few in a rounded cluster or many in an elongate cluster; leaf stalks not expanded at base.
 - G 1. Stem leaves alternate; flowers like sweet peas, the petals not all alike. *Lupine* (*Lupinus nootkatensis*)
 - G 2. Stem leaves forming a whorl below the solitary or few terminal flowers, the petals all alike.
Narcissus anemone (*Anemone narcissiflora*)
- C 2. Flowering stems without leaves.
 - D 1. Basal leaves pinnate.
 - E 1. Flowers 1 on each stem. (*Potentilla pacifica*)
 - E 2. Flowers several or many on each stem.
 - F 1. Flowers small with numerous long, protruding stamens.
Burnet (*Sanguisorba sitchensis*)
 - F 2. Flowers rather large, hooded, with few protruding or hidden stamens. *Lousewort*; woodbetony (*Pedicularis capitata*)
 - D 2. Basal leaves with 3 radiating leaflets; root golden yellow.
Goldthread (*Coptis trifolia*)
 - D 3. Basal leaves simple. *Blue violet* (*Viola langsdorfi*)
- A 2. Plants without distinctive basal leaves, the flowers or flower clusters borne on leafy stems.
 - B 1. Leaves simple.
 - C 1. Leaves alternate.
 - D 1. Flowers white.
 - E 1. Leaves without teeth or lobes.
 - F 1. Leaves broad, not more than 3 times as long as broad.
 - G 1. Leaves 1 or 2 on each plant; stems unbranched.
Wild lily-of-the-valley (*Maianthemum dilatatum*)
 - G 2. Leaves more than 2 on each plant; stems branched.
Cucumber plant (*Streptopus amplexifolius*)
 - F 2. Leaves long and narrow, more than 3 times as long as broad.
 - G 1. Flowers solitary on ends of upright stems. . . (*Saxifraga hirculus*)
 - G 2. Flowers few to many on upright or spreading stems.
 - H 1. Stems 2 or more, spreading or branched.
Popcornflower (*Plagiobotrys orientalis*)
 - H 2. Each plant with 1 upright unbranched stem.
 - I 1. Flowers spirally arranged, each twisted sideways.
Ladies-tresses (*Spiranthes romanzoffianum*)
 - I 2. Flowers not evidently spirally arranged, not twisted sideways. . . *Tall white bog orchid* (*Platanthera dilatata*)
 - E 2. Leaves, at least some of them, toothed or lobed.
 - F 1. Leaves nearly round.

- G 1. Petals 4.....Scurvyweed (*Cochlearia officinalis*)
- G 2. Petals 5.....Saxifrage (*Saxifraga bracteata*)
- F 2. Leaves ovate to oblong.
 - G 1. Lower leaf surfaces white, soft woolly.
 - White mountain avens (*Dryas octopetala*)
 - G 2. Lower leaf surfaces green, not woolly.
 - H 1. Fruits broad, notched at top.
 - Shepherds-purse (*Capsella bursa-pastoris*)
 - H 2. Fruits elliptical, pointed at top.
 - Northern draba (*Draba borealis*)
- D 2. Flowers yellow.
 - E 1. Leaves elongate, not roundish, without lobes, or pinnately lobed.
 - F 1. Flowers usually 1, occasionally 2 on each stem.
 - G 1. Plants of wet land; stems upright.
 - Saxifrage (*Saxifraga hirculus*)
 - G 2. Plants growing in ponds or on mud along stream margins; stems creeping, spreading by stolons.
 - Creeping spearwort (*Ranunculus reptans*)
 - F 2. Flowers several or many on each stem.
 - G 1. Stems usually several or branching, usually spreading; flowers small.
 - H 1. Petals 4, separate; leaves pinnately lobed.
 - Yellow watercress (*Nasturtium palustre*)
 - H 2. Petals 5, united; leaves not lobed.
 - Popcornflower (*Plagiobotrys orientalis*)
 - G 2. Stems usually 1, erect; flowers rather large.
 - Indian painted-cup (*Castilleja unalaschensis*)
 - E 2. Leaves nearly round, deeply lobed.....Buttercups (*Ranunculus*)
 - F 1. Lobes of leaves rounded or very blunt at tips; plants without hairs.....Buttercup (*Ranunculus eschscholtzii*)
 - F 2. Lobes of leaves sharply pointed at tips; plants hairy.
 - G. 1 Main lobes of leaves not again deeply divided, at least not below the middle.....Buttercup (*Ranunculus nelsonii*)
 - G 2. Main lobes of leaves again deeply divided, usually more than half way to the base..Tall buttercup (*Ranunculus acer*)
- D 3. Flowers blue.
 - E 1. Leaves lobed; flowers hooded.
 - F 1. Flowers in close clusters at ends of stems usually bearing more than 4 leaves.....Monkshood (*Aconitum maximum*)
 - F 2. Flowers fewer or more scattered along upper part of more slender stems, usually with 4 leaves or less.
 - Monkshood (*Aconitum delphinifolium*)
 - E 2. Leaves not lobed; flowers not suggesting a hood.
 - F 1. Flowers large, 1 inch broad or broader.
 - Great fireweed (*Epilobium angustifolium*)
 - F 2. Flowers smaller, less than 1 inch broad.

- G 1. Plants with 1 upright unbranched stem; flowers purple.
(*Orchis aristata*)
- G 2. Plants with several upright branched stems; flowers blue.
Sea bluebells (*Mertensia maritima*)
- D 4. Flowers green or greenish.
 - E 1. Leaves long and narrow.
Tall leafy green orchid (*Platanthera hyperborea*)
 - E 2. Leaves oval.
 - F 1. Flowers in cluster at end of unbranched stem.
False hellebore (*Veratrum album* subsp. *oxysepalum*)
 - F 2. Flowers single at bases of leaves on branched stems.
Cucumber plant (*Streptopus amplexifolius*)
- C 2. Leaves opposite or whorled.
 - D 1. Flowers white.
 - E 1. Leaves whorled.
 - F 1. Stems erect with one whorl of leaves.
Starflower (*Trientalis europaea*)
 - F 2. Stems erect or spreading with many whorls of leaves.
Catchweed bedstraw (*Galium aparine*)
 - E 2. Leaves opposite.
 - F 1. Flowers in a compact mass at end of upright stem surrounded by 4 petal-like bracts; the whole resembling a single flower.
Dwarf cornel; bunchberry (*Cornus suecica*)
 - F 2. Flowers not in a compact mass at ends of stems, without petal-like bracts.
 - G 1. Plants hairy; fruiting capsules elongate, opening at outer end.
 - H 1. Leaves $\frac{3}{4}$ inch long or less.
 - I 1. Petals less than twice as long as sepals.
Bering chickweed (*Cerastium beerianum*)
 - I 2. Petals twice as long as sepals or longer.
Large-flowered Bering chickweed
(*Cerastium beerianum* var. *grandiflorum*)
 - H 2. Leaves over $\frac{3}{4}$ inch long.
Fischer's chickweed (*Cerastium fischerianum*)
 - G 2. Plants not hairy.
 - H 1. Leaves thick and fleshy; plants of sandy seashores.
Sea-beach sandwort (*Honckenya peploides*)
 - H 2. Leaves not thick and fleshy; plants not confined to the seacoast.
 - I 1. Plants forming low dense tufts or mats, individual stems scarcely ever more than 4 inches long, single stems separated from the mass with considerable difficulty.
Pearlworts (*Sagina crassicaulis* and *S. intermedia*¹)

¹ These species can be separated only by rather technical characters.

- I 2. Plants with tangled stems but not usually forming low tufts or mats, the individual stems usually more than 4 inches long, easily separated.

Starworts (*Stellaria calycantha*, *S. media*, and
*S. sitchana*²)

D 2. Flowers yellow.

- E 1. Leaves 1 pair on each plant.

Broad-lipped twayblade (*Listera convallarioides*)

- E 2. Leaves more than one pair on each plant.

- F 1. Flowers large, conspicuous, on elongate stalks.

Common monkeyflower (*Mimulus guttatus*)

- F 2. Flowers rather small, more or less hidden among the end leaves, without stalks.....Rattleweed (*Rhinanthus groenlandicus*)

D 3. Flowers purple or pink.

- E 1. Leaves deeply divided on margins; flowers hooded, the petals not all alike.....Louseworts; woodbetonies (*Pedicularis*)

- F 1. Plants usually more than 1 foot high; flowers more than 1/2 inch long; stems stout.....(*Pedicularis chamissonis*)

- F 2. Plants usually less than 1 foot high; flowers 1/2 inch long; stems usually slender.....(*Pedicularis verticillata*)

- E 2. Leaves not deeply divided on margins, sometimes toothed; flowers not hooded, the petals all alike.

- F 1. Stamens 2 only.....American brooklime (*Veronica americana*)

- F 2. Stamens more than 2.

- G 1. Main stems long and trailing on the ground; flowers in 2's on upright branches; seeds not carried on white hairs by the wind.....Twinsflower (*Linnaea borealis*)

- G 2. Main stems upright, not trailing; flowers not in 2's; seeds carried on white hairs by the wind.

Willowherbs (*Epilobium anagallidifolium*,
E. bebringianum, *E. glandulosum*, *E. sertulatum*)

D 4. Flowers blue.

- E 1. Flowers long, tubular; stamens more than 2.

Northern gentian (*Gentiana acuta* var. *plebeja*)

- E 2. Flowers open, spreading, not tubular; stamens 2 only.

Speedwells (*Veronica*)

- F 1. Petals large, about 1/2 inch long.

Large-flowered speedwell (*Veronica grandiflora*)

- F 2. Petals small, scarcely over 1/4 inch long.

- G 1. Flowers in a single raceme on the upper end of the main unbranched stem.

- H 1. Flower clusters short; leaves distinctly toothed.

Steller's speedwell (*Veronica stelleri*)

- H 2. Flower clusters long and narrow, leaves obscurely toothed.

Thyme-leaved speedwell (*Veronica humifusa*)

² These species can be separated only by rather technical characters.

- G 2. Flowers in several racemes coming from bases of the upper leaves. American brooklime (*Veronica americana*)
- D 5. Flowers purplish green or brownish green.
 - E 1. Leaves in 2 or more whorls; flowers large, over 1 inch long, lilylike.
 - Eskimo potato; Indian riceroor (*Fritillaria camschatcensis*)
 - E 2. Leaves 2 only; flowers smaller.
 - Broad-lipped twayblade (*Listera convallarioides*)
- B 2. Leaves compound.
 - C 1. Leaves alternate.
 - D 1. Flowers white.
 - E 1. Leaves with 3 leaflets only.
 - F 1. Flowers in compact round clusters.
 - White clover (*Trifolium repens*)
 - F 2. Flowers in broad flat-topped clusters.
 - G 1. Leaflets whitish and woolly beneath, the leafstalks bearing prominent leaflike or bladdery expansions.
 - Cow-parsnip (*Heracleum lanatum*)
 - G 2. Leaflets green and not hairy beneath, expansions at base of leafstalks not bladdery. . . . Ligusticum (*Ligusticum bulbtenii*)
 - E 2. Leaves with more than 3 leaflets.
 - F 1. Leaves once compound.
 - G 1. Flowers small; petals 4, all alike, separate.
 - Alpine cress (*Cardamine umbellata*)
 - G 2. Flowers large, hooded; petals united, not all alike.
 - Lousewort; woodbetony (*Pedicularis capitata*)
 - F 2. Leaves twice or thrice compound.
 - G 1. Flowers in flat-topped clusters.
 - H 1. Leaflets deeply divided or toothed on margins.
 - Hemlock parsley (*Conioselinum gmelini*)
 - H 2. Leaflets broad, not deeply divided, toothed on margin but not deeply so.
 - Wild celery; wild parsnip (*Coelopleurum gmelini*)
 - G 2. Flowers not in flat-topped clusters.
 - H 1. Leaflets few-toothed or lobed, small, under 1 inch long; flowers on distinct stalks.
 - Meadowrue (*Thalictrum kemense*)
 - H 2. Leaflets many-toothed, over 1 inch long; flowers attached directly to branches of the flower cluster without stalks.
 - Goatsbeard (*Aruncus sylvestris*)
 - D 2. Flowers yellow. Erect-pod wintercress (*Barbarea orthoceras*)
 - D 3. Flowers red, pink or purple.
 - E 1. Leaflets more than 3.
 - F 1. Leaflets toothed; leaves not tendrill-bearing.
 - Purple or marsh cinquefoil (*Potentilla palustris*)
 - F 2. Leaflets not toothed; leaves bearing tendrils.
 - Beach pea (*Lathyrus maritimus*)

- E 2. Leaflets 3.....Red clover (*Trifolium pratense*)
- D 4. Flowers blue.
 - E 1. Flowers in close clusters at ends of stems usually bearing more than 4 leaves.....Monkshood (*Aconitum maximum*)
 - E 2. Flowers fewer or more scattered along upper part of more slender stems usually with 4 leaves or less.
 - Monkshood (*Aconitum delphinifolium*)
- C 2. Leaves opposite.....Lousewort; woodbetony (*Pedicularis verticillata*)

GROUP 2. *Woody or semiwoody plants.*

(Includes those with tough, wiry, creeping stems.)

- A 1. Cone-bearing, needle-leaved trees.....Sitka spruce (*Picea sitchensis*)
- A 2. Shrubs or low semiwoody plants, not cone bearing, leaves usually not needlelike.
 - B 1. Leaves small, under $\frac{1}{2}$ inch long, thick, leathery, never thin and never showing side veins, sometimes somewhat needlelike.
 - C 1. Leaves spreading sideways, not scalelike and not tightly appressed to the stems.
 - D 1. Flowers very small, without stalks, hidden among the leaves; fruits black edible berries.....Crowberry (*Empetrum nigrum*)
 - D 2. Flowers on definite stalks, in clusters at ends of leafy stems; fruits not fleshy and berrylike.
 - E 1. Leaves alternate, narrow, needlelike, the sides parallel.
 - Aleutian mountain heath (*Phyllodoce aleutica*)
 - E 2. Leaves opposite, elliptical, not needlelike, the sides curved.
 - Alpine or trailing azalea (*Loiseleuria procumbens*)
 - C 2. Leaves consisting of scales tightly appressed to the stems.
 - Cassiope (*Cassiope lycopodioides*)
 - B 2. Leaves more than $\frac{1}{2}$ inch long, or if less, then thin and showing side veins.
 - C 1. Leaves simple, with or without teeth on the margins, never deeply lobed.
 - D 1. Margin of leaves with many sharp teeth; flowers minute, greenish, in erect compact clusters (catkins).
 - Alder (*Alnus fruticosa* var. *sinuata*)
 - D 2. Margin of leaves with fine hairs; flowers purple, large and showy.
 - Kamchatka rhododendron (*Rhododendron kamtschaticum*)
 - D 3. Margin of leaves without teeth or with fine teeth with turned-in tips or teeth very few, blunt.
 - E 1. Low, dwarf, wiry-stemmed plants with leaves $\frac{1}{2}$ inch long or less.
 - F 1. Leaves nearly round, the tips rounded.
 - G 1. Plants with long slender horizontal above-ground stems; flowers 2 together, on ends of naked erect stems, pink.
 - Twinflower (*Linnaea borealis*)
 - G 2. Plants low but stems not long and slender; flowers inconspicuous, in clusters among the leaves.
 - Least willow (*Salix rotundifolia*)

- F 2. Leaves elliptical, the tips pointed.
 Mountain bog bilberry (*Vaccinium uliginosum*)
- E 2. Low and prostrate or upright shrubs with leaves over $\frac{1}{2}$ inch long.
 F 1. Leaf margins with fine teeth, the tips turned in.
 Alpine partridgeberry (*Arctostaphylos alpina*)
- F 2. Leaf margins without teeth.
 G 1. Flowers bell- or urn-shaped; fruits edible berries.
 H 1. Leaves thick and leathery, the side veins very obscure.
 I 1. Leaves broadest above the middle, long-tapering at the base.....**Bearberry** (*Arctostaphylos uva-ursi*)
 I 2. Leaves broadest about the middle, not long-tapering toward the base.
 Mountain cranberry (*Vaccinium vitis-idaea*)
- H 2. Leaves not distinctly leathery, the side veins clearly evident.
 Mountain bog bilberry (*Vaccinium uliginosum*)
- G 2. Flowers minute, in dense upright clusters, soft and hairy like "pussy willows"; fruits small pods splitting into two parts exposing white hairs within.....**Willows** (*Salix*³)
- H 1. Erect shrubs with leaves much longer than wide; leaves 2 to 4 inches long, $\frac{1}{2}$ to 1 inch wide, usually broadest above the middle, pointed, not especially net-veined.
 I 1. Leaf margin with shallow teeth; leaves white beneath.
 Barclay willow (*Salix barclayi*)
- I 2. Leaf margin without teeth.
 J 1. Lower surface of leaf with dense white felt.
 Felt-leaf willow (*Salix alaxensis*)
- J 2. Lower surface of leaf without hairs.
 Oval-leaf willow (*Salix pulchra*)
- H 2. Prostrate or low and spreading shrubs with leaves nearly as wide as long, mostly egg-shaped with the big end out; leaves $\frac{1}{2}$ to $1\frac{1}{2}$ inches long, from $\frac{2}{3}$ as wide to fully as wide (circular), plainly net-veined.
 I 1. Branchlets long, slender, prostrate, yellowish; leaves scattered, finely net-veined.
 Oval-leaf willow (*Salix ovalifolia*)
- I 2. Branchlets short, stiff, dark colored; leaves somewhat crowded toward the tips of the branchlets.
 J 1. Plants prostrate, the leaves white beneath; the stoutish net-veins sunken in upper surface, raised on lower surface.....**Net-vein willow** (*Salix reticulata*)
- J 2. Plants prostrate to somewhat ascending, the leaves pale to whitish beneath; the slender net-veins raised on both surfaces.....**Arctic willow** (*Salix arctica*)
- C 2. Leaves compound or deeply lobed.
 D 1. Stems with alternate leaves.
 E 1. Leaf blades pinnate..**Siberian mountain ash** (*Sorbus sambucifolia*)

³ The key to willows was prepared by C. R. Ball.

E 2. Leaf blades of 3 leaflets or with 3 lobes.

F 1. Flowers purple; stems upright, branching.

Salmonberry (*Rubus spectabilis*)

F 2. Flowers white; main stems low, mostly creeping, the upright flowering stems not branching.

G 1. Petals and sepals broadly ovate; leaves shallowly lobed.

Cloudberry (*Rubus chamaemorus*)

G 2. Petals and sepals narrowly ovate; leaves mostly lobed half way to the base.....(*Rubus stellatus*)

D 2. Stems with opposite leaves.

Red-berried elder (*Sambucus racemosa* subsp. *pubens*)

GROUP 3. *Plants of the composite family.*

A 1. Flower heads consisting of two kinds of flowers, (1) a circle of ray flowers around the edge with broad, flat blades (suggesting the petals of flowers of other families), and (2) disk or tubular flowers in the center without flat blades.

B 1. Ray flowers white.

C 1. Leaves simple, lobed or toothed.

D 1. Plants usually 6 to 12 inches high, the upright stems with 1 flower head; in low moist soil; common in western Aleutians.

Arctic chrysanthemum (*Chrysanthemum arcticum*)

D 2. Plants usually 12 inches high or higher, the upright stems often branched and bearing several flower heads; a weed escaped from cultivation, not common, in eastern Aleutians.

Ox-eye daisy (*Chrysanthemum leucanthemum*)

C 2. Leaves compound, very finely divided.

Northern yarrow (*Achillea borealis*)

B 2. Ray flowers yellow.

C 1. Leaves alternate.

D 1. Flower heads many; rays about $\frac{1}{2}$ inch long or less.

E 1. Leaves whitish and woolly beneath, nearly round or broadly triangular, lobed.....Butterbur (*Petasites frigidus*)

E 2. Leaves not whitish and woolly beneath, narrow or oval, lobed or merely toothed.

F 1. Flowers in compact round-topped clusters; leaves without lobes.

Goldenrod (*Solidago multiradiata* var. *arctica*)

F 2. Flowers in spreading branched clusters, often rather flat-topped; leaves deeply lobed.....Groundsel (*Senecio palmaris*)

D 2. Flower heads solitary or a few in a compact cluster; rays about $\frac{3}{4}$ inch long.

E 1. Flower head solitary on end of slender stem with few leaves, the upper ones very small.....(*Senecio resedifolius*)

E 2. Flower heads solitary or few in a dense cluster at end of leafy stem, the upper leaves about 2 inches long.

Ragwort (*Senecio pseudoarnica*)

C 2. Leaves opposite.

D 1. Flower heads solitary on each plant. .Arnica (*Arnica unalaschkensis*)

D 2. Flower heads usually several on each plant.

Arnica (*Arnica chamissonis*)

B 3. Ray flowers bluish, purplish, or pinkish.Asters

C 1. Rootstock long and slender, smooth, not scaly or rough; stems usually purplish.(*Aster foliaceus*)C 2. Rootstock shorter, thicker, rough and scaly or wrinkled; stems usually not purplish.(*Aster peregrinus*)

A 2. Flower heads with disk or tubular flowers only, never yellow. (Occasionally the bracts beneath the flower heads resemble ray flowers.)

B 1. Leaves without teeth or lobes.

C 1. Flower heads one on each plant. .Pussytoes (*Antennaria monocephala*)

C 2. Flower heads more than one on each plant.

D 1. Stem leaves small, narrow, the basal leaves broader; plants 6 inches tall or less.Pussytoes (*Antennaria dioica*)

D 2. Stem leaves at least 2 inches long, basal leaves none or scarcely different from the stem leaves; plants over 6 inches tall.

Pearly everlasting (*Anaphalis margaritacea* var. *occidentalis*)

B 2. Leaves toothed, lobed or deeply divided.

C 1. Plants with sharp spines; flowers purple or pink.

Kamchatkan thistle (*Cirsium kamtschaticum*)

C 2. Plants without spines; flowers not purple or pink.

D 1. Leaves deeply cut or divided.

E 1. Leaves whitish beneath; leaf segments coarse.

Sagebrush (*Artemisia unalaskensis*)

E 2. Leaves green beneath; leaf segments fine.

Arctic sagebrush (*Artemisia arctica*)

D 2. Leaves coarsely toothed or lobed but not more than half way.

E 1. Lower surfaces of leaves whitish and woolly.

Butterbur (*Petasites frigidus*)

E 2. Lower surfaces of leaves not woolly.

Indian plantain (*Cacalia auriculata*)

A 3. Flower heads with ray (strap-shaped) flowers only; flowers yellow.

B 1. Flowers solitary on leafless, hairless stems. .Dandelion (*Taraxacum* spp.⁴)

B 2. Flowers several on hairy stems bearing a few leaves.

Hawkweed (*Hieracium triste*)GROUP 4. *Plants with conspicuous edible berries.*A 1. Leaves less than 1/2 inch long, crowded, suggestive of juniper needles; berries black.Crowberry (*Empetrum nigrum*)

A 2. Leaves more than 1/2 inch long, not as above.

B 1. Leaves simple, deeply lobed.

C 1. Berries without separate stalks, in a compact cluster on end of a single stem above a whorl of leaves.

Dwarf cornel; bunchberry (*Cornus suecica*)⁴ The separation of the different species of dandelion is difficult and requires the use of obscure characters.

- C 2. Berries on distinct stalks, single or in small clusters at ends of branches or among the leaves.
 - D 1. Berries with sepals at base.
 - E 1. Fruits containing a single stone of 4 or 5 fused nutlets; leaves green.....**Bearberry** (*Arctostaphylos uva-ursi*)
 - E 2. Fruits with 4 or 5 separate nutlets; leaves usually reddish.
 - Alpine partridgeberry** (*Arctostaphylos alpina*)
 - D 2. Berries with sepals or their remnants at upper end.
 - E 1. Fruits red.....**Mountain cranberry** (*Vaccinium vitis-idaea*)
 - E 2. Fruits bluish....**Mountain bog bilberry** (*Vaccinium uliginosum*)
- B 2. Leaves compound or simple and deeply lobed.
 - C 1. Shrubs; leaves opposite; leaflets 5.
 - Red-berried elder** (*Sambucus racemosa* subsp. *pubens*)
 - C 2. Herbs or very low wiry-stemmed plants; leaves alternate or basal; leaflets 3, or simple leaves deeply 3-lobed.
 - D 1. Berries salmon colored, without green bracts beneath.
 - E 1. Flowers purple; stems upright, branching.
 - Salmonberry** (*Rubus spectabilis*)
 - E 2. Flowers white; main stems low, mostly creeping, the upright flowering stems not branching.
 - F 1. Petals and sepals broadly ovate; leaves shallowly lobed.
 - Cloudberry** (*Rubus chamaemorus*)
 - F 2. Petals and sepals narrowly ovate; leaves mostly lobed half way to the base.....(*Rubus stellatus*)
 - D 2. Berries red, with green bracts or "hull" beneath.
 - Wild strawberries** (*Fragaria chiloensis*)

GROUP 5. *Plants of special habitats*
(exclusive of ferns and their relatives, and composites).

- A 1. Plants growing normally in fresh-water lakes, ponds, or streams.
 - B 1. Leaves all basal, the flowering stem rising from their center.
 - C 1. Flowers large, yellow, one on each stem; leaves broad, raised above the water surface.....**Cowlily** (*Nuphar* sp.)
 - C 2. Flowers minute, in several burlike clusters; leaves narrow grasslike, often submerged.....**Burreed** (*Sparganium hyperboreum*)
 - B 2. Leaves borne on elongate stems.
 - C 1. Leaves alternate, about 4 inches long.
 - Northern pondweed** (*Potamogeton alpinus*)
 - C 2. Leaves opposite, finely divided, the divisions threadlike, the elongate leafy stems tail-like.....**Water milfoil** (*Myriophyllum spicatum*)
 - C 3. Leaves whorled, not divided.....**Marestail** (*Hippuris vulgaris*)
- A 2. Plants of seashores, especially of sandy beaches. (Although many plants can grow on sandy beaches, there are certain plants that occur only in such places, perhaps because of the salty nature of the sand. This key includes only the characteristic beach plants.)
 - B 1. Flowers yellow; leaves compound, covered, at least beneath, with silky hairs.

- C 1. Basal leaves mostly with three leaflets; plants without runners.
Hairy cinquefoil (*Potentilla villosa*)
- C 2. Basal leaves with more than three leaflets, pinnate; plants usually with spreading runners.....(*Potentilla pacifica*)
- B 2. Flowers white, blue, or pink.
- C 1. Leaves alternate; flowers blue.
- D 1. Leaves simple; petals all alike..Sea bluebells (*Mertensia maritima*)
- D 2. Leaves pinnately compound; flowers like sweet peas.
Beach pea (*Lathyrus maritimus*)
- C 2. Leaves opposite or all basal.
- D 1. Flowers very short stalked, in tips of stems or in angles of leaves.
Sea-beach sandwort (*Honckenya peploides*)
- D 2. Flowers on distinct stalks, mostly arising from ends of stems.
- E 1. Leaves short ($\frac{1}{2}$ inch long or less), awl-like; flowers white.
Thick-stemmed pearlwort (*Sagina crassicaulis*)
- E 2. Leaves longer, the blades more or less flattened; flowers white or pink.
- F 1. Leaf blades broad; at least the basal leaves with stalks.
Siberian springbeauty (*Claytonia sibirica*)
- F 2. Leaf blades $\frac{1}{3}$ or less as wide as long; basal leaves absent or without long stalks..Water springbeauty (*Claytonia chamissoi*)
- A 3. Plants found only in alpine regions or high mountains in the Aleutians.
- B 1. Plants woody, low, sometimes only 3 or 4 inches high; flowers without colored petals, gathered in compact cylindrical masses.....Willows
- C 1. Leaves under $\frac{1}{2}$ inch long.....Least willow (*Salix rotundifolia*)
- C 2. Leaves over $\frac{1}{2}$ inch long.
- D 1. Branchlets elongate, slender, prostrate, yellowish; leaves scattered, finely net-veined.....Oval-leaf willow (*Salix ovalifolia*)
- D 2. Branches short, stiff, dark colored; leaves somewhat crowded toward the tips of the branches, with stoutish net-veins sunken in upper surface, raised on lower surface.
Net-vein willow (*Salix reticulata*)
- B 2. Plants herbaceous, the lower parts sometimes tough; flowers with colored petals.
- C 1. Flowers blue or violet.
- D 1. Plants with a basal cluster of leaves, stem-leaves alternate or none; flowers more than $\frac{1}{4}$ inch long.
- E 1. Sepals very narrow, usually toothed on the margin.
Bering bellflower (*Campanula lasiocarpa*)
- E 2. Sepals about $\frac{1}{3}$ as wide as long, not toothed on the margin.
(*Campanula dasyantha*)
- D 2. Plants without a basal cluster of leaves; stem-leaves opposite; flowers $\frac{1}{4}$ inch long or less.
Steller's speedwell (*Veronica stelleri*)
- C 2. Flowers red or pink.
- D 1. Flowers about $\frac{1}{2}$ inch long; petals united into a tube; basal leaves broad, toothed.....Primrose (*Primula cuneifolia*)

- D 2. Flowers $\frac{1}{8}$ inch long, in dense clusters; petals separate; basal leaves grasslike.....(*Tofieldia coccinea*)
- C 3. Flowers yellow, one to several on upright stems rising from a basal cluster of leaves; petals more than 4.
 - D 1. Leaves with pinnate leaflets.....*Avens* (*Geum rossii*)
 - D 2. Leaves with three leaflets at end of stalk.
 - Sibbaldia* (*Sibbaldia procumbens*)
- C 4. Flowers white, several to many on stems rising from a compact basal cluster of very small leaves; petals 4.
 - Arctic draba* (*Draba fladnizensis*)

GROUP 6. *Grasses, sedges, rushes, and other grasslike plants.*

Many of the species belonging in this group can be fully identified only by the use of technical characters to be seen only with the aid of a hand lens. Hence the following key leads in many cases only to the genera. The grasses, along with the sedges and rushes, form the principal ground cover, at least at the lower altitudes, and in number of individual plants exceed all the others put together. All have small inconspicuously colored flowers. In the grasses the minute individual flowers, called florets, are aggregated into small groups called spikelets, which in turn are aggregated into various-shaped clusters called heads or inflorescences. There is very little difference between an inflorescence in flower and one in fruit. If these are long and narrow they are called spikes, if broader and more branching they are panicles. The spikelets are difficult to examine without a lens, hence few grasses are here identified beyond the genus.

- A 1. Stems round (rarely flattened), hollow; jointed..True grasses (*Gramineae*)
 - B 1. Plants fragrant; in low moist places.
 - C 1. Panicle loose; plants 1 to 2 feet tall; common.
 - Holygrass; vanillagrass* (*Hierochloë odorata*)
 - C 2. Panicle rather compact; plants less than 1 foot tall; less common.
 - Alpine holygrass* (*Hierochloë alpina*)
 - B 2. Plants without distinct odor.
 - C 1. Robust grasses of sandy beaches, common, up to 5 feet tall with dense soft hairy spikes mostly 4 to 10 inches long, $\frac{1}{2}$ to $\frac{3}{4}$ inch thick.
 - Strand wheat; wild rye* (*Elymus arenarius* subsp. *mollis*)
 - C 2. Slender grasses, the spikes smaller or the inflorescences broader and branching (panicles).
 - D 1. Tall grasses, commonly 2 to 3 feet tall or taller with rather large panicles; in moist meadows.
 - E 1. Spikelets 1 to $1\frac{1}{2}$ inches long, of several florets; common on Unalaska, scarce elsewhere.
 - Aleutian bromegrass* (*Bromus aleutensis*)
 - E 2. Spikelets less than $\frac{1}{4}$ inch long, V-shaped, in rather large panicles.
 - F 1. Panicle erect, open, the branches spreading; leaves very narrow, in a dense tuft at base; in boggy or moist soil.
 - Hairgrasses* (*Deschampsia*⁵)

⁵ This is one of the commonest grasses in the islands. Plants at higher altitudes are much dwarfed.

- F 2. Panicle nodding, rather dense, the branches ascending; leaves flat, not crowded at base; in meadows and moist ground.

Reedgrasses (*Calamagrostis*)

- D 2. Lower grasses, commonly less than 2 feet tall.

- E 1. Heads with long bristles (like barley but bristles much finer); common near villages.....Wild barley (*Hordeum boreale*)

- E 2. Heads without long bristles.

- F 1. Heads dense, narrow, cylindrical, spikelike.

- G 1. Heads soft, bronze colored; leaves narrow velvety; in mountain meadows and on slopes.

Downy oatgrass (*Trisetum spicatum*)

- G 2. Heads hard, with very short stiff bristles; leaves $\frac{1}{8}$ to $\frac{1}{4}$ inch wide; in meadows and on mountain slopes.

- H 1. Heads only twice as long as wide; common.

Mountain timothy (*Phleum alpinum*)

- H 2. Heads more than twice as long as wide; less common.

Common timothy (*Phleum pratense*)

- F 2. Heads a loose or rather dense panicle, not a cylindrical spike.

- G 1. Spikelets mostly about $\frac{1}{2}$ inch long, purplish; stems commonly reddish brown at base; in meadows and on mountain slopesFescue (*Festuca rubra*⁶)

- G 2. Spikelets mostly less than $\frac{1}{4}$ inch long.

- H 1. Leaves boat-shaped at the tips; panicles commonly purplish or bronze; in meadows and on mountain slopes.

Bluegrass (*Poa*)

- H 2. Leaves pointed only; panicles green or pale; in mud or on sand flats and brackish soil near the coast.

Alkali-grass (*Puccinellia*)

- A 2. Stems triangular or round, not jointed, usually pithy instead of hollow.

- B 1. Stems triangular (3-sided), pithy.

- C 1. Plants bearing white cottony tufts at ends of stems, the minute seeds enclosed in this tuft; in moist or boggy places.

Cottongrasses (*Eriophorum*)

- C 2. Plants with fruiting parts not consisting of cottony tufts. .Sedges (*Carex*)

- B 2. Stems round, mostly pithy.

- C 1. Flowers and fruits in a single small compact head at ends of slender green stems rising from a basal cluster of short leaves.

Tufted club-rush (*Scirpus caespitosus*)

- C 2. Flowers and fruits in branched clusters, each fruit (capsule) surrounded by 6 chaffy scales; stems leafy.

- D 1. Leaves narrow or bristlelike; capsule many-seeded...Rushes (*Juncus*)

- D 2. Leaves flat, grasslike; capsule 3-seeded.....Woodrush (*Luzula*)

- C 3. Flowers and fruits in a long narrow cylindrical spike with a single main stem, each flower on a short stalk; stem leafless, the fleshy leaves all from the base; in marshes and bogs.

Marsh arrowgrass (*Triglochin palustre*)

⁶ In fescues and bluegrasses small plantlets sometimes develop in the spikelets in place of seeds. These drop off and take root..

GROUP 7. *Ferns and their relatives.*

- A 1. Leaves large, few, simple or compound, lobed or divided. **True ferns**
- B 1. Spores borne in erect grapelike structures arising from a whorl of spreading leaflets at the top of a leafstalk, the whole being a single leaf arising from an underground stem. . . . **Moonwort** (*Botrychium lunaria*)
- B 2. Spores borne on the backs of leaves or leaflets, the edges sometimes turned or rolled under, covering the spores. (Not all leaves bear spores.)
- C 1. Spores covered by the folded or rolled-back leaf margins.
- D 1. Spore-bearing and non-spore-bearing leaves and leaflets appearing about the same, the edges sharply and narrowly turned back.
Maidenhair-fern (*Adiantum pedatum*)
- D 2. Spore-bearing leaves very unlike the others, the margins widely rolled back and appearing somewhat podlike.
American rockbrake (*Cryptogramma acrostichoides*)
- C 2. Spores not covered by leaf margins.
- D 1. Leaves simple but deeply pinnately divided nearly to the midrib.
Western polypody (*Polypodium vulgare* var. *occidentale*)
- D 2. Leaves compound.
- E 1. Leaves once pinnately compound.
- F 1. Leaflets sharply toothed.
Mountain hollyfern (*Polystichum lonchites*)
- F 2. Leaflets (pinnae⁷) lobed as far as the midrib.
- G 1. Lobes of the leaflets finely toothed.
Ladyfern (*Athyrium filix-femina* subsp. *cyclosorum*)
- G 2. Lobes of the leaflets not toothed.
Northern woodfern (*Dryopteris oreopteris*)
- E 2. Leaves twice pinnately compound.
- F 1. Leaf blades broadly triangular, nearly as broad as long, the stalks and underground stems slender.
Oakfern (*Dryopteris linneana*⁸)
- F 2. Leaf blades at least twice as long as broad.
- G 1. Lower pinnae nearly or quite as long as the middle pinnae; lobes finely and sharply toothed.
Spreading woodfern (*Dryopteris austriaca*⁹)
- G 2. Lower pinnae gradually shorter than the middle pinnae; lobes slightly toothed, sometimes wavy-margined.
Ladyfern (*Athyrium filix-femina* subsp. *cyclosorum*)
- A 2. Leaves very small, sometimes scalelike, numerous, never lobed or divided.
Horsetails and clubmosses

⁷ The pinnae are the first divisions of a compound leaf, which may themselves be simple or compound. If they are compound, then the leaf is called twice compound.

⁸ This is more often known as *Phegopteris dryopteris* (L.) Fée, *Dryopteris dryopteris* (L.) Britt., or *Dryopteris disjuncta* (Rupr.) Morton, the last preferred.

⁹ This is more often known as *Dryopteris dilatata* (Hoffm.) A. Gray, *Polystichum spinulosum* Ledeb., or *Aspidium spinulosum* Rothr., the first preferred.

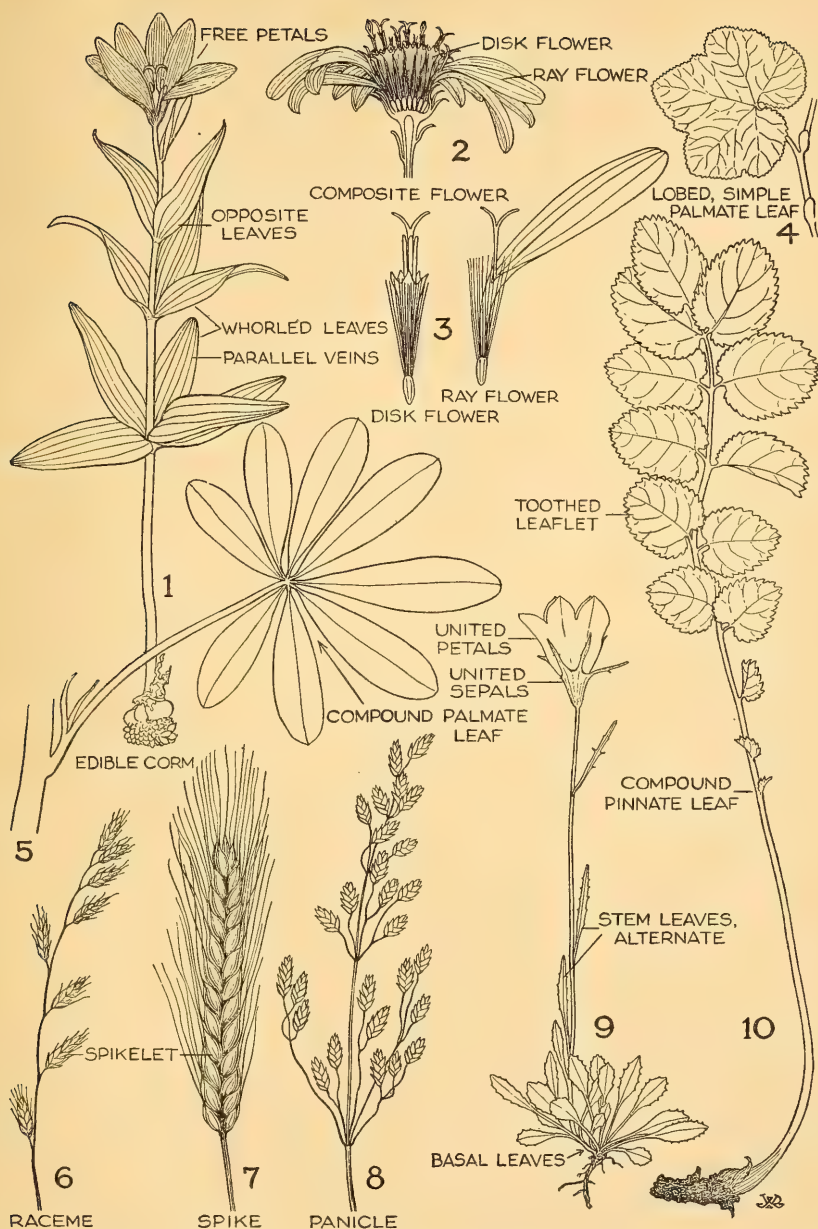


FIG. 8.—Explanation of principal terms used in the keys. The plants or plant parts shown here to illustrate these terms are: 1, Eskimo potato (*Fritillaria camschatcensis*); 2, section through an aster flower head; 3, single flowers from aster head; 4, cloudberry (*Rubus chamaemorus*) leaf; 5, lupine (*Lupinus*) leaf; 6-8, grass flower clusters; 9, Bering bellflower (*Campanula lasiocarpa*); 10, basal leaf of burnet (*Sanguisorba sitchensis*).

