

KODIAK-Plan for the Mgmt. of Kodiak Brown  
Bear 1953

1233

A PLAN FOR THE MANAGEMENT OF THE KODIAK BROWN BEAR

by  
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US FISH & WILDLIFE SERVICE--ALASKA

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Refuge Manager Troyer, BSFW, Kodiak, Alaska

December 22, 1960

Regional Refuge Supervisor, BSFW, Kenai, Alaska

Bear Trapping Manuscript

We have read your bear trapping manuscript with great interest. It should be a very successful paper.

Table 2 clarifies the data better than 3 and 4--believe I would leave it in since it also has sex and age.

Would suggest a liberal batch of photographs illustrating all phases of the business and probably references to these in the text. The Journal may restrict the number printed so you better indicate priority.

References to specific data to be obtained will reassure the reader of the necessity for this work. Perhaps a plug on the Refuge--Kodiak National Wildlife Refuge--intensively managed for maximum trophy harvest --in spite of maximum kill still produces world's largest bear--this life history data required to maintain maximum trophy harvest--etc.

David L. Spencer

Encl:

Regional Director, FWS, Juneau, Alaska

28 December, 1953

Refuge Manager, FWS, Kodiak, Alaska

Bear - Salmon Study      Karluk Lake 1953

Two (2) copies of the report "Bear - Salmon Study, Karluk Lake 1953" are enclosed.

The basic report as submitted by Frank Grogan, Biological Aid, was rewritten and compiled in it's present form by the Refuge Manager and Russell R. Hoffman, Wildlife Management Biologist.

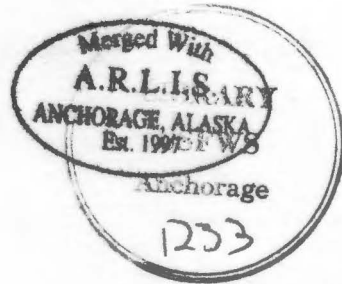
*Paul A. Chapados*  
PAUL A. CHAPADOS

cc: Spencer, Kenai with  
copy of Report

DOVE

Russ mentioned that you wanted  
some wire cable. Let me know  
the length - and we will try to  
pick it up - Paul

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A PLAN FOR THE MANAGEMENT OF  
THE KODIAK BROWN BEAR .

Prepared at Kodiak National  
Wildlife Refuge

Kodiak, Alaska  
March 12, 1953



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A. Preface

Kodiak Island contains natural resources of commercial, recreational and aesthetic values that must be conserved. The Kodiak National Wildlife Refuge was established in 1941 for the protection and conservation of wildlife on the island. The intention of this measure was not to restrict the utilization and wise use of this natural resource.

The ecological interrelationship between vertebrate species is a science not yet fully understood. When humanity forces itself into any natural biotic relationship, conflicts arise which produce ever-increasing problems. Various studies have been made in regards to these problems on Kodiak Island and are regarded here in an attempt to formulate a preliminary plan relative to the management of the Kodiak brown bear.

The following management plan discusses the work which has been accomplished to date in relation to the natural resources on Kodiak Island and suggests control and management practices relative to these problems.



## B. Summary

Kodiak Island lies in the Gulf of Alaska near the base of the Alaska Peninsula and has an area of 3,588 square miles. The climate is moderated by the warm Japan Current which flows past the island and the annual precipitation is approximately 65 inches. Kodiak Island is primarily mountainous with interspersed stream valleys; the extreme northeastern and southwestern ends of the island are less rugged than the central portion. The streams and rivers are all relatively short and no point on the island lies more than 15 miles from salt water. The melting snows and high precipitation maintain a flow in the streams and rivers which is considerable when considering the generally small drainage basins.

The majority of the soils belong to the Lithosol and Tundra groups and are poorly suited to agriculture excepting small isolated areas. Sedimentary rocks comprise the majority of the island while a wide belt of igneous rocks extends along the main axis of the island and forms the basis for the belt of rugged mountains.

Coniferous trees are found only along the northeastern end of the island and black Cottonwoods occur in the stream valleys throughout most of the island. The most typical vegetation is an association of Bluejoint grass, sedges, elderberry, willow, and alder. A tundra association is common on the southwestern portions of the island.

The native land mammals include the Kodiak brown bear, weasels, meadow mice, ground squirrels, red fox, and the Pacific land otter. Deer, muskrats, elk, beaver, hares, tree squirrels, mountain goats, mink, and marten have been released on the island group. Red salmon ascend the streams and enter the lakes for spawning. Pinks, chum, silver, and king salmon migrate into the river systems to spawn.

A total of about 60 miles of roads are found on the island and these are all located on the Chiniak Peninsula off the Kodiak National Wildlife Refuge. At the last census (1950), approximately 11,300 persons, white and native, live on the Kodiak Island Group and this figure includes and estimated 7,000 personnel at the Kodiak Naval Operating Base.

### Industry

Agricultural practices are limited almost entirely to cattle ranching. A small herd of dairy cows, supplying the town of Kodiak with milk, is located on Crooked Island. Approximately 100 head of sheep are kept on Harvester Island, Uyak Bay, and these do well. Hog raising was attempted but was abandoned as a poor venture. In isolated areas small home gardens are maintained and these produce root crops and berries, but require a great amount of care.

Cattle raising on Kodiak Island was initiated by the Russian settlers and was in progress in 1867 when Alaska was purchased by the United States. In 1907 the Agricultural Experiment Station was moved from Kenai to Kodiak and Galloway cattle were transferred. Apparently, this station used stateside methods of handling, by sheltering and feeding the cattle throughout much of the year, rather than seeking methods to adapt the cattle to local conditions.

In about 1932, a local resident purchased the stock from the experiment station and this served as the beginning of the present industry. In 1939, 349 cattle were ranched in the area and by 1952 this number had increased to 735. Excepting the small islands which carry a minor number of cattle, ranching is at present limited to the area within the Chiniak Peninsula.

In this area, a total of 310,224 acres with an estimated carrying capacity of 3310 head of cattle are open to grazing leases and at present, 203,386 acres having an estimated carrying capacity of 2760 head are under lease. Currently, only 7 ranchers are actively engaged in running stock in this area although 8 persons hold grazing titles. The four small islands under lease at present to 6 persons total 86,474 acres and can carry an estimated 550 head of breeder stock.

In the past, the cattle ranchers have suffered severe losses. The recorded losses show that of known mortality, from 1927 through 1952, 161 or 33.5 per cent cattle were killed by bears and 279 or 58 per cent were attributed to natural causes; 41 are listed as missing. These represent considerable losses to the ranchers when the small herd sizes are considered; this is eloquently documented by the many men who abandoned their ranching ventures in disgust. The most severe losses were incurred from 1937 through 1941; in recent years the losses have totalled less than 5 per cent and bears have been responsible for less than 2 per cent.

Local ranches are primarily utilitarian and very modest. The buildings are small, fencing scanty, and the herds average about 125 animals. The men do the work along with occasional help from each other and visitors from town. Small amounts of hay are stored for winter feeding and the grain fed through the months of February, March, and April is shipped from the States, at a cost of from 15 to 20 dollars per head. The local winter feed consists of beach debris such as kelp, seaweed, sedges, elderberry and willow browse, and the palatable grasses. Throughout the spring and summer the profuse growths of Bluejoint grass provide the staple food item. Some horses range year-long without care on the Chiniak Peninsula and each rancher has a few which are maintained in good condition for riding.

The commercial fishing industry at Kodiak, as in the rest of the Territory, is the most important Alaskan industry. Salmon, herring, clams, crabs, and halibut are fished commercially in the Kodiak area. All five species of salmon, (red, pink, chum, silver, and king), are caught in this area and nearly one-tenth of the Alaska salmon industry is centered at Kodiak.

The pink salmon pack totals about 350,000 cases annually, red salmon about 90,000 cases, chums approximately 65,000 cases, and silver salmon about 8,000 cases. King salmon are of little importance here. Fourteen salmon canneries operate on the Island Group.

Herring reduction plants operating in the Kodiak area produced annually about 7,500 tons of fish meal and 1,500,000 gallons of fish oil. A marked decline in the herring fishery in recent years make further exploitation unprofitable. Razor clams have been of intermittent importance with an annual average pack of about 8,000 cases. The king crab fishery has been of increasing importance in recent years and in 1951 ran close to 200,000 pounds of live crabs. Halibut are of little importance here but one cold storage plant annually freezes from 1 to 1,500,000 pounds.

The establishment of the United States Navy Base near the town of Kodiak has afforded employment for a great number of civilians both by the Navy and by the various contractors. Contracting work has been of increasing importance in recent years due to the influx of people and the need for housing and other facilities.

The business of guiding non-resident hunters provides the major income of our local game guides and a substantial income to many others who either are part-time guides or who assist the guides. This guiding business is based, without exception, on the presence of the Kodiak brown bear.

Trapping is permitted throughout the area and the furbearers consist of land otter, red fox, weasels, beaver, and muskrats. Both marten and mink have recently been stocked and soon these are expected to become important fur species. Many residents trap either full or part-time and this provides additional local revenue.

Mining operations are not at present important. In the past, many small claims have been worked but none have produced appreciable amounts of gold or silver. Prospecting continues on a small scale, however, and may well eventually disclose valuable deposits.

The various commercial establishments necessary to any concentration of humans provide an income for many persons.

#### History of the Refuge

The Kodiak National Wildlife Refuge was established on August 19, 1941 by Executive Order, for the purpose of protecting the range to the Kodiak bear and other wildlife found on the island.

This refuge includes Uganik Island and Kodiak Island excepting the Chiniak Peninsula, the Karluk Indian Reservation, and a one-mile strip around the periphery of the islands.

The economic use of the refuge is limited to guiding, hunting, and fishing. Guiding is the most important and most valuable use. No mining is in progress on refuge lands and logging is not practical. The reindeer herd placed on the island by the Alaska Native Service and controlled by the Ahkiok native village grazes throughout the southeastern portions of the refuge.

The primary present purpose of the refuge is the protection and perpetuation of the range of the Kodiak brown bear but other wildlife indigenous to the island such as land otter and weasels are also protected. Olympic elk, snowshoe hares, Sitka deer, beaver, and muskrats have been stocked on the island group and all are flourishing. Recently mountain goats, marten, mink, and red squirrels have been released. This refuge, then, in conjunction with the Chugach National Forest Lands of Afognak and Shuyak Islands will become more important in the future as an area for the protection and perpetuation of many species. The brown bear will, in all likelihood, remain the most widely publicized member of the association.

#### Management Districts

The following management districts were devised to serve as a tool in the management of the brown bear. Hunting pressure can be concentrated or reduced in the various areas as need for control is indicated. In devising these districts, it attempted to group similar areas into self-contained units so that the artificial boundary lines would follow, as much as possible, natural boundaries. There will undoubtedly be much movement between the various districts because of the habits of the animals involved; this seeming disadvantage may be an advantage in setting certain districts aside as sanctuaries from which surplus animals will emigrate.

The districts are briefly described below:

District A: Chiniak Peninsula: All the area east of a line extending from the head of Kishuyak Bay to the head of Ugak Bay.

District B: Kishuyak-Ugak Bays: All the area between a line extending from the head of Kishuyak Bay to the head of Ugak Bay and a line extending from the head of Viekoda Bay to the South Arm of Ugak Bay.

District C; Uganik Bay: All the area between a line extending from the head of Viekoda Bay to the South Arm of Ugak Bay and a line extending from the head of the South Arm of Ugak Bay to the head of the South Arm of Uganik Bay.

District D; Little River Peninsula: All the area northwest of a line extending from the head of the South Arm of Uganik Bay to the head of the South Arm of Spiridon Bay.

District E; Kilinda Bay: All the area between a line extending from the head of the South Arm of Ugak Bay to the head of the South Arm of Uganik Bay and a line extending from the South Arm of Uganik Bay to the northern side of Three Saints Bay.

District F; Alitak Peninsula: All the area southwest of a line extending from the head of Three Saint's Bay to the point of land between the North Arm and Alpine Cove in Deadman Bay.

District G; Uyak Bay: All the area within a line extending from the head of Spiridon Bay to the head of the South Arm of Uganik Bay thence to the northern side of Three Saint's Bay, a line extending from the head of Three Saint's Bay to the point of land between the North Arm and Alpine Cove in Deadman Bay, and a line extending from the head of the North Arm in Deadman Bay to the point of land near Alf Island in Uyak Bay.

District H; Karluk Lake: All the area between a line extending from the point of land near Alf Island in Uyak Bay to the head of the North Arm of Deadman Bay and a line extending from the mouth of Sturgeon River to the mouth of Dog Salmon Creek in Olga Bay.

District I; Olga Bay: All the area southwest of a line extending from the mouth of Sturgeon River to the mouth of Dog Salmon Creek in Olga Bay.

A sanctuary area will be established in District G and include all that area south of a line drawn from the point of land near Alf Island on the western shore of Uyak Bay due east to intersect the line of 153° 30' longitude West. This line of longitude is identical with the line delineating the eastern boundary of District G. At any time when the bear population appears low, this area will be declared a sanctuary and no hunting will be permitted. This area is called the Uyak Mountain Area.

#### Natural History of the Kodiak Brown Bear

The Kodiak Bear is one of the largest and most desired of game trophies. The male often attains the size of 11 feet, squared hide measurement. At birth the bear weighs only 1 to 2 pounds but attains the approximate weight of 450 pounds at the fourth year of life. Females average approximately 2 cubs each litter.

Kodiak and Afognak Islands are considered good habitat for this brown bear. The animal is found thriving in the brush, grass and tundra associations and lives comfortably from sea level to the mountain tops.

Mating occurs in April, May and June, and parturition takes place in December, January, and February. Food consists of fish, herring spawn, kelp, seafoods, sedge, grass, bark, and roots. The bear is a habitual carrion feeder.

A total of 1669 bear have been estimated to make up the population of bear. The greatest concentration of bear is found in the Uyak Bay, Uganik Bay and Karluk River drainages on Kodiak Island.

Monetary values of individual Kodiak bear taken by nonresident hunters have been determined as follows: to Kodiak, \$1516.00; to Alaska, \$1618.00 and total value, \$2595.00.



The total value of all bear taken by non-resident hunters was \$73,752.63 for 1949, \$117,457.89 for 1950, \$174,821.05 for 1951, \$199,405.26 for 1952 and the total value for all years listed was \$565,436.83.

A total of 512 bear have been killed by hunters and recorded during the past 4 years. Another 71 bear has been estimated and recorded in the "unrecorded" column. Approximately, 170 bear are estimated to be the annual hunter take on the island group.

The commercial fishing industry on Kodiak is one of the important livelihoods in the area. The amount of salmon taken by bear was relatively unimportant in past years, due to the abundance of salmon, but at the present time, with the decline in the numbers of salmon, has become a factor worth consideration. Studies conducted have shown that .09% to 31.3% unspawned salmon are taken by bear and that the bear-take factor is important only with red salmon as the pink salmon runs are effected only to a small percentage.

Experiments with electrical fences as a barrier to bear on salmon streams were conducted resulting in the successful operation on two red salmon streams.

Other control measures were ruled out as unsuccessful.

Bear and livestock form an incompatible relationship within the ranching area on Kodiak Island. Since 1927 to the present time, the total mortality has been 481 cattle. Classifying, 161 or 33.5% were due to bear, 279 or 58% were due to causes other than bear and 41 or 8.5% were reported missing. The figures derived in 1952 shows a mortality of 2.5% of which 1.4% is attributed to natural causes, .53% to bear and .53% are reported missing.

Incompatible relationships do not exist with any other animals, domestic or wild, on the island. The only sheep raised in the area are on a bear-free island.

Proposed Management Policies

The management districts will be used as a tool to manage the population of bear on Kodiak Island.

Theoretically, a total of 204 bear may be taken off of the refuge annually without undue harm to the population.

Hunting will be allowed according to the current regulations of the Alaska Game Commission.

The electric fence should be used as an enclosure to bear on the small red salmon streams.

Any ranching expansion should be limited to the area on the Chiniak Peninsula and on the small islands outside of the refuge.

Cooperation will be extended in every phase of the bear-cattle problem within reason and policy.

The most desirable type of control in the ranching area is a control that requires only a small amount of attention. It is recommended that the road from Middle Bay to Saltery Cove be repaired and put into useable condition, to increase activity in the ranching area.

## 6. Description of the Kodiak Island Group

### 1. Geographical Location

Kodiak Island (Figure 1) is situated in the Gulf of Alaska near the base of the Alaska Peninsula and is bordered on its northwestern shore by Shelikof Strait and on the southeast by the Gulf of Alaska. Approximately 25 miles from the mainland, this island is close to 57 miles across at its greatest width and nearly 103 miles long. Because of the numerous bays, however, no spot on the island is more than 15 miles from salt water.

Kodiak Island is the largest island in a natural group composed of Kodiak, Afognak, and Shuyak Islands. Tugidak, Sitkinak, Sitkalidak, Uganik, and Raspberry Islands also belong to this group but are smaller and of lesser importance here. Afognak Island lies 3 miles northeast of Kodiak Island and extends about 37 miles northeastward and averages approximately 24 miles in width. Shuyak Island, the smallest in the group, lies less than a mile northeast of Afognak Island and is nearly 12 miles long and 5 miles wide. Afognak and Shuyak Islands, similar to Kodiak Island, are deeply indented by bays.

Capps (1937-B) gives the areas of the largest islands in the Kodiak group and these are presented below.

Table 1.

<u>Island</u>	<u>Area ( mile <sup>2</sup> )</u>
Kodiak	3,588
Afognak	700
Sitkalidak	117
Sitkinak	91
Raspberry	82
Tugidak	71
Shuyak	69
Uganik	57
Marmot	24

Spruce	17
Whale	14
Amook	13
Ben	11
Aisktalik	<u>7</u>
Total	4,861

## 2. Climate

Kodiak Island thrives in a relatively temperate climate which is affected principally by the Japan current. The climate (Table 2) is similar to that of the Gulf of Alaska and Southeastern Alaska rather than the climate of the Alaska Peninsula.

The range of the mean temperature is slight. January is usually the coldest month of the year, temperatures below 18° F. are uncommon in the town of Kodiak. The most disagreeable weather occurs in April, in the latter part of September, and in October. This is the period of the equinox storms and high winds behind driving rain and snow are not uncommon.

Wind gusts of 30 to 50 knots and wind which exceed 90 knots on occasion are common. The Navy Weather Central data shown in Table 2 shows the maximum recorded wind velocity to be 92 knots. Weather conditions and wind velocities are often more severe in areas other than the Navy Weather Central location. Fog occurs generally and in patches during the late spring and in the summer

The average annual precipitation is 65.11 inches. The yearly total average snowfall at sea level for Kodiak Island, as given by the Navy Weather Central is 30.4 inches for the years 1943 through 1948. In 1951, however, the total snowfall was 44.9 inches. The bulk of the snowfall occurs during the first three months of the year. The first snows on the mountains occur during the first part of October and remain until June of the following year.

	TEMPERATURE		PRECIPITATION		SNOWFALL		WIND	MAX. VELOCITY	
	<u>°F</u> <u>USWB*</u>	<u>°F</u> <u>USNWC**</u>	<u>Inches</u> <u>USWB</u>	<u>Inches</u> <u>USNWC</u>	<u>Inches</u> <u>USWB</u>	<u>Inches</u> <u>USNWC</u>	<u>Knots</u> <u>USNWC</u>	<u>WINDS (Knots)</u> <u>USNWC</u>	
JAN	29.5	29.0	4.69	5.38	9.7	5.8	11.4 NW	86	
FEB	31.3	32.0	4.64	6.26	11.2	6.6	10.9 NW	79	
MAR	33.4	30.0	3.93	2.57	9.2	5.9	10.2 NW	77	
APR	36.4	37.0	3.82	4.67	5.6	1.5	11.2 NW	73	
MAY	43.0	42.0	5.46	5.94	0.4	0.0	9.0 NW	54	
JUNE	50.0	49.0	4.85	4.72	2.2	0.0	7.8 E	61	
JULY	54.3	53.0	3.46	3.74	0.0	0.0	6.8 NW	65	
AUG	54.3	55.0	5.27	2.87	0.0	0.0	7.2 NW	46	
SEPT	49.8	49.0	5.16	7.44	0.1	0.0	8.0 NW	78	
OCT	42.0	42.0	7.32	7.25	0.8	1.8	11.3 NW	62	
NOV	35.0	35.0	5.63	7.03	3.3	3.3	9.0 NW	92	
DEC	30.7	31.0	6.08	7.26	8.0	5.5	10.9 NW	87	
YEARLY AVERAGE	40.8	40.0	60.61	65.11	48.3	30.4			
PERIOD OF RECORD	1896	1943	1890	1943	1905	1943	1943	1943	
	1934	1948	1934	1948	1934	1948	1950	1951	

\* United States Weather Bureau

\*\* United States Navy Weather Central

Table 2. Mean monthly weather tables

### 3. Relief

According to Capps ( 1937-B ), Kodiak and the adjacent islands are geologically a southwestward extension of the mountains found on the Kenai Peninsula. Capps remarks that some of the mountains around Uyak Bay reach a height of 4,200 feet while the Army Air Forces Aeronautical Chart ( 1945 ) shows the highest recorded point on the island to be 4,463 feet, a mountain along the north shore of Uyak Bay. When it is realized that these mountains rise directly from sea level, the rugged topography can more readily be appreciated.

The northern end of the island has a variety of land forms, ranging from wide, relatively smooth valleys to steep cliffs and jagged mountain peaks. The central portion of the island has mountains which extend to such a height that often snow remains on the peaks the year round. There are existing at least two valley glaciers on this part of the island and there are reports of two other slowly receding small glaciers. The mountains on the southern end of the island are less rugged than on the rest of the island and give more the impression of low rolling hills surmounted by a few mountain peaks.

The shoreline of the island is long; according to Hrdlicka (1944), it exceeds 1,000 miles. The numerous deep bays or glacial fjords cut into the island mass to such an extent that, for example, the head of Uyak Bay on the northern side of the island is only 7.4 miles from the head of Three Saint's Bay on the southern side.

### 4. Drainage

The majority of streams and rivers on Kodiak Island are small in relation to the size of the island because the run-off from the mountains and basin slopes usually has but a short distance to travel to reach salt water.

Spiridon, Zachar, Karluk, Sturgeon, and Red Rivers are the largest, and these all drain into Shelikof Strait. Spiridon and Zachar Rivers are fed by the run-off from the surrounding mountains as well as the melting valley glacier near their headwaters. Karluk, Sturgeon, and Red Rivers are geologically old, drain a wide area, and meander extensively through the glacial till on the southwestern end of the island. Even these larger streams can usually be forded on foot at favorable places. Snows that usually persist until late June and the rather heavy precipitation maintain a flow in even the smaller streams that is unusually large when the small size of the drainage basin is considered.

#### 5. Rocks and Soils

In the year 1912 the Katmai Volcano on the Alaska Peninsula to the north erupted and its ash was spread over a wide enough area to cover a good deal of Kodiak and the adjacent Islands. In some places on Kodiak, the ash built up a sterile layer exceeding 12 inches in depth. This ash forced almost the total human population to evacuate.

Now this volcanic ash and cinder is covered in most places by a root mat from the grasses, willow and alder which abound in the area.

According to Kellogg (1951), the following soil groups are represented on Kodiak Island.

Table 3

<u>Soil Group</u>	<u>Approximate Percentage</u>
Lithosol	40 - 50
Tundra	30 - 40
Alpine Meadow	5 - 10
Bog	5 - 10
Alluvial	5 - 10
Regosol	5 - 10

Lithosols are azonal soils, primarily made up of hard rock with or without thin and varying coverings of soil material.

The other main soil type, the Tundra, consists of a brown fibrous surface mat underlain by a few inches of dark humus-rich soil. This grades into a lighter colored soil beneath and overlays either permafrost or the parent rock material.

Permafrost is absent on Kodiak with the exception of the highest land and some northern slopes.

The Lithosols are found primarily on solid rock, generally above 1,000 feet altitude. Tundra and Bog soils are in the lower stabilized valleys and on smooth uplands. The Regosols consist primarily of volcanic ash and cinders on Kodiak Island.

On the Kodiak-Afognak group most of the exposed and near-surface rocks are Upper Cretaceous slate, graywacke, and argillite. Gapps (1937-A), writes, "The intrusive rocks on Kodiak Island are now known to be much more extensive than they were thought to be.....They are mainly of granitic character and are present in masses that with some interruptions extend along the central axis of the island..." Most of the stream valleys are covered with gravel, sand, and silt; rubble and larger rocks indicate the presence of alluvial fans and glacial morainal material. Numerous intrusive granitic dikes and sills occur throughout the island.

## 6. Flora

Kodiak Island is forested only on the extreme northeastern end. A few trees occur elsewhere in small areas, mainly along the coast and at the heads of various bays of the Northeastern one-third of the island. Sitka Spruce (Picea sitchensis) and Black Cottonwood [Populus trichocarpa hastata] are the only species which attain reasonable size and these are not found above elevation of 1,000 feet.



Sitka spruce does not occur naturally further south than Terror Bay on the northwestern and Ugak Bay on the southeastern shore of the island and the best stands occur only from Kishuyak Bay to Cape Chinik. Black Cottonwoods are associated with the spruce and extend further to the south but are found only in isolated areas, usually adjacent to streams or lakes. Alaska Alder (Alnus fruticosa) and various species of Willow (Salix sp.) are found throughout the island and are responsible for the widespread thickets common in the lowlands and along mountain slopes.

The ubiquitous Bluejoint (Calamagrostis canadensis), known locally as redtop grass, flourishes throughout the island up to an elevation of about 1500 feet. This grass reaches 4 to 6 feet in height and grows in clumps which form the hummock topography so discouraging to extensive travel by foot. Associated with bluejoint are the common Fireweed (Epilobium angustifolium), Wild Geranium (Geranium erianthrum), ferns, sedges, umbellifers such as Wild Celery (Angelica lucida), and the Cow Parsnip (Heracleum lanatum). Elderberry (Sambucus racemosa) and High-bush Cranberry (Viburnum edule).

Along the seashore are found the Danegrasses (Elymus mollis and arenarius), the extensive sedges (Carex lyngbyei, mertensii, and others), various seaweeds, umbellifers and legumes. The bluejoint association is often interspersed with the seashore flora.

Above timberline on the mountain slopes and on the extreme southern portions of the island are found the plants common to the alpine zone such as Crowberry (Empetrum nigrum), Early Blueberry (Vaccinium ovalifolium), Nootka Lupine (Lupinus nootkatensis), Alpine Azalea (Loiseleuria procumbens), Bearberry (Arctostaphylos uva-ursi), and Mountain Cranberry (Vaccinium vitis-idaea), mosses and lichens.

A number of composites such as the Daisy (Erigeron peregrinus), Dandelion (Taraxacum sp.), Goldenrod (Solidago lepidota), Aster (Aster subspicatus), Everlasting (Antennaria sp.), Senecio (Senecio sp.) and Yarrow (Achillea borealis), the birches such as the Kenai Birch (Betula kenaica), the crucifers, grasses and members of the Ranunculaceae, Caryophyllaceae, Ericaceae, Gentianaceae, Leguminosae, Rosaceae and other families are represented in the various areas; a complete listing is impractical here.

## 7. Fauna

The indigenous mammal fauna of Kodiak Island include the following:

Kodiak brown bear (Ursus middendorffi, Merriam)  
Kodiak meadow mouse (Microtus kadiacensis, Merriam)  
Kodiak Island weasel (Mustela kadiacensis, Merriam)  
Pacific otter (Lutra canadensis pacifica, Rhoades)  
Kodiak ground squirrel (Citellus parryi kadiacensis, Allen)  
Kodiak red fox (Vulpes harrimani, Merriam)

The three color phases of the red fox, i.e. red, cross, and silver, are common; the silver is seen least often. Rats occur on the island but the species is not known; it may or may not be native.

The various marine mammals found in the waters of the Kodiak area include the following:

Pacific right whale (Eubalaena sieboldii, Gray)  
Gray whale (Rhachianectes glaucus, Cope)  
Common finback whale (Balaenoptera physalus, Linnaeus)  
Sulphur-bottom whale (Sibbaldus musculus, Linnaeus)  
Humpback whale (Megaptera nodosa, Bonaterre)  
Sperm whale (Physeter catodon, Linnaeus)  
Sea otter (Erethra lutris lutris, Linnaeus)  
Common dolphin (Delphinus delphis, Linnaeus)  
Pacific killer (Orcinus rectipinna, Cope)  
North Pacific blackfish (Globicephala scammonei, Cope)  
Dall porpoise (Phocoenoides dalli, True)  
Baird whale (Berardius bairdii, Stejneger)  
Stejneger whale (Neomerodon stejnegeri, True)  
Harbor seal (Phoca r. richardii, Gray)  
Far seal (Callorhinus alascanus, Jordan and Clark)  
Steller sea lion (Eumetopias jubata, Schreber)

Hair seals, sea lions, porpoises, whales, and dolphins are frequently seen and are common in the area.

Many species of mammals have been planted on the Kodiak-Afognak Islands group from 1924 through 1952.

Deer: In 1924, 14 Sitkan deer (Odocoileus columbianus sittensis, Merriam) were liberated on Long Island in Chinik Bay. Two more were released in 1930. In 1934, 7 of these deer were transferred to Broad Point, Kodiak Island. The herd on Long Island spread to Woody Island and some swam to Kodiak Island proper. During World War II the Long Island herd was almost exterminated by military personnel and civilians. The herd on Kodiak has increased exceptionally well and has spread as far south as Uganik Bay on the northwestern shore and Old Harbor on the southeastern shore of the island. Deer have been reported as far south as Uyak Bay.

Fuskrats: Sixty muskrats (Ondatra ribethica zalepha, Hollister) were liberated in 1925 on Long Island. In 1929, 29 of these were transferred to Women's Bay on Kodiak Island and others were later placed on Afognak, Shuyak and Raspberry Islands. In 1948 they were reported as most plentiful on Shuyak Island but nowhere else have they shown any notable increase. Their distribution is spotty and they are apparently not well suited to the general area.

Elk: In 1928, 8 elk (Cervus canadensis occidentalis, Hamilton Smith) were planted at Kalsin Bay, Kodiak Island. Local objections to their presence caused their transferral to Afognak Island in 1929. They have shown a remarkable increase and the herd is now estimated at approximately 500 animals. These elk have spread over Afognak Island and recently some have been reported on Kodiak Island. These are the only elk in Alaska and are apparently well suited to the immediate area.

Beaver: In 1929, 21 beavers (Castor canadensis (belugae), Taylor) were liberated on Raspberry and on the northeast portion of Kodiak Islands. These beaver have shown a notable increase and have spread over most of Kodiak Island.

Hares: In 1934, 558 snowshoe hares (Lepus americanus macfarlandi, Merriam) were planted on Afognak, Kodiak, and Raspberry Islands. Some have been trapped and subsequently released on the smaller nearby islands by residents. In every instance the hares are apparently doing well and they have increased their range to include the whole of Kodiak, Afognak, and many smaller islands. These hares have proved to be a very successful introduction.

Squirrels: In 1948, 6 red squirrels (Sciurus hudsonicus petulans, Merriam) were released on Afognak Island. In 1952, 71 additional red squirrels were liberated on Afognak and Kodiak Islands. These have apparently become established but little is known about the population.

Mountain Goats: In 1952, 7-male and 1-female mountain goats (Oreamnos kennedyi, Elliott) were successfully released at the head of Ugak Bay, Kodiak Island, in an attempt to establish this species. This project is not yet completed.

Marten: Twenty marten, 8-males and 12-females, (Martes americana actonae, Osgood) were released on Afognak Island in 1952. Nothing is known about their survival but it is felt that they should do well.

Mink: Mink (species unknown) were planted on Kodiak Island in 1952. Twenty-four of these mammals, 8-males and 16-females, were released at Karluk Lake and are expected to flourish.

The birds which are believed either to nest or to reside on or near the Kodiak Island group for an extended period are listed in Table 4 A. The Bird species which have been noted on or near the islands but which are not known to reside in the area for any period are given in Table 4B.

The game fish found in the fresh waters of Kodiak Island consist of the abundant Dolly Varden (Salvelinus malma, Walbaum) and the Steelhead or Rainbow trout (Salmo g. gairdnerii, Richardson) Silver salmon are often caught as a sport fish.

The commercially-fished species include the five species of Pacific salmon: red (Oncorhynchus nerka, Walbaum), pink (Oncorhynchus gorbuscha, Walbaum), chum (Oncorhynchus keta, Walbaum), silver (Oncorhynchus kisutch, Walbaum), and the king (Oncorhynchus tshawytscha, Walbaum). Herring (Clupea pallasii, Valenciennes), halibut (Hippoglossus stenolepis, Schmidt), sole of various species, king crabs (Paralithodes camtschatica), and other shellfish are also commercially fished.

Clams, crabs, and various other salt water fish are regularly taken by natives and residents for food and sport.

Neither amphibians nor reptiles occur naturally on the island group.

### 8. Roads and Trails

On the northeastern end of Kodiak Island, i.e. that area outside the refuge boundary, there is a total of some 60 miles of roads and well over 100 miles of trails (Figure 2). Additional roads course through the Kodiak Naval Station in Women's Bay but data on these roads are restricted.

These 60 miles of roads extend from Spruce Cape and Fort Abercrombie north of the City of Kodiak, through Kodiak to the Naval Station; and at the station one road leads northwest to Anton Larsen Bay and another southeast to Pasagshak Bay. The Pasagshak road branches at Kalsin Bay and this branch leads to Cape Ghiniak.

There are no roads per se on the rest of the island; trails course through a good deal of the area but for the most part are obscured through little use.

Woody and Long Islands which lie in Ghiniak Bay just east of Kodiak have a total of about 13 miles of roads.

### 9. Human Population

A total of approximately 11,313 persons reside in the Kodiak Island group.

The city of Kodiak has a population of 1,632 residents (1950 census) living within the city limits. An additional estimated 1,500 (1950 estimate) reside close to the city. There are an estimated 7,000 persons at the Kodiak Naval Station in Women's Bay. The various native villages on Afognak and Kodiak Islands have the following populations: Afognak, 166; Alitak, 85; Kaguyak 26; Karluk, 140; Larsen Bay 50; Old Harbor, 166; Ouzinkie, 204 (1952 census). An estimated 200 persons live elsewhere on the island such cannery watchmen, homesteaders, trappers, and so on. Native residents on Woody Island and Civil Aeronautics Administration personnel stationed there number about 145.

The seasonal cannery workers and non-resident fishermen who flood into the Kodiak area during the summer fishing season are not included in this estimate.

In order to give an idea of the influx of persons during the past 30 years, the 1930 census showed a total of about 1,568 persons living in the island group. Of these 364 were whites and the remainder natives. The populations were broken down as follows: Kodiak, 442; Afognak, 298; Karluk, 192; Ouzinkie, 168; Wood Island, 116; Alitak, 86; Old Harbor, 84; Kaguyak, 52; Alaktalik, 30; and scattered, 100.

D. Industry on the Island

1. Ranching and other agricultural practices.

Agricultural practices are limited almost entirely to the raising of beef cattle. A small dairy herd is kept on Crooked Island which is the only source of fresh milk for the city of Kodiak. The large dairy that previously supplied milk to Kodiak and the Naval Base discontinued its operations in 1952. One small hog farm utilizes the local garbage wastes. Approximately 100 head of horses are kept on the island. These are sold locally and are used by the ranchers for their routine duties. Kellogg (1951) suggests that due to the nature of the soils found on Kodiak Island, livestock production is suitable in only small isolated areas.

Agricultural crops do not grow satisfactorily on most parts of the island. Small areas on steep southern slopes of several bays are utilized to raise root-type vegetables and berries for private use. The soil requires much fertilization and this is accomplished by the use of commercial fertilizers fish, and seaweed. Strawberries that are grown produce tremendously large plants with small berries which color only to a light pink. Very little gardening is done in the town of Kodiak and garden flowers never become vigorous.

Kellogg and Nygard (1951) states that, "At the upper end of the valley of the Baskin River north of Baskin Lake, a 12 acre garden plot on a gently south-facing slope was examined. When observed on August 13, the crops were judged a total failure." They further state "In an undisturbed area north of the garden, a set of soil samples were taken. The plants on the soil where sampled included Bluetop, Fireweed, and lupines. These plants appeared to be healthy, moderately dark green and of normal size; but their roots were well anchored in the old surface soil beneath the recent ash."

" The overlying volcanic ash has a very low content of exchangeable cations and is infertile despite the values for percentage base saturation and phosphorous." "Although additions of fresh volcanic ash are generally regarded as soil fertilizer, these examples show that they may have the opposite effect."

Neither legumes nor grains flourish on the island. Legumes have been grown in small, warm, well drained and ventilated areas, but by and large the plants cannot persist in this climate. Oats can be grown but they do not mature or become vigorous.

Cattle raising began here during the settlement of Alaska when the Russians imported cattle from Siberia. Cattle raising was in progress on Kodiak Island in 1867 when the United States purchased Alaska from Russia and the Russian cattle were still in existence in 1898. In 1906 the Agricultural Experiment Station at Kenai, Alaska, imported the Galloway breed and some were shipped to Kodiak.

The majority of the cattle in the early days were kept on the small islands near the town of Kodiak. Georgeson (1929) writes that probably Kalsin Bay on Kodiak Island was used by the Russians as a distribution center for their cattle in Alaska.

In 1907, the Agricultural Experiment Station was moved from Kenai to Kodiak because of transportation facilities lacking at Kenai. The cattle brought to Kodiak were the Galloway breed and these augmented the first shipment of these animals in 1906. This breed adapted itself to the Kodiak climate and the Galloway cross is found on Kodiak today. Four new Galloway bulls were shipped to Kodiak this year. Other breeds being raised include Shorthorn, Angus, and Hereford.



Palmer (1931) states that, " An agricultural Experimental Station was established on Kodiak Island in 1916 for the study of livestock raising. The station was abandoned in 1935. It is said that the Station accomplished nothing in that all handling was on a basis of Outside methods and not made to apply to local conditions. For instance, it is said cattle were sheltered in winter and fed on expensive feeds shipped in from Outside, rather than means found to range yearlong which is the important problem."

Cattle raising met with only partial success in the early days of settlement. Many of these who ventured into this business gave up in despair; others kept small herds in well protected places where grazing was best. Cows were satisfactorily maintained for personal use, i.e., milk products and meat.

The present ranching industry started in about 1932 when one of the ranchers purchased stock from the experiment station. In the year 1939, according to Sarber (1939) , 349 cattle were being ranched on Kodiak Island. In 1951, approximately 535 cattle including calves, bulls, and yearlings were being grazed and in 1952 the annual increment brought the total to 735. At the date of this writing, an approximate total of 550 breeder stock are run by the ranchers. With the exception of the small islands located around the periphery of Kodiak Island, grazing is limited to the Chiniak Peninsula or the area southeast of a line extending from the head of Kishuyak Bay to the head of Ugak Bay. This area is off the Kodiak National Wildlife Refuge (Figure 4). There is an area of 310,224 acres open to grazing leases. Of this amount, 167,507 acres are under lease to seven ranchers, includes one partnership, at a total rental of \$1,282.16. The estimated potential carrying capacity of this latter area is 2410 head, and 124,717 acres with a carrying capacity of 900 head have not been leased to date.

The past records show that ranching enterprise has been very slow to get a foothold. To date, the beef is marketed locally and is only a portion of the meat utilized within Kodiak. The potential of the ranching industry on Kodiak does not appear too great. A total estimated carrying capacity for the Chiniak Peninsula and the surrounding islands is 4,000 head and capable of producing 3000 yearling annually. The produce marketed would be a small percentage of the six million pounds of beef shipped annually to Alaska.

The ranching practice now in progress is the simplest type. One man with the minimum requirement of equipment can handle the herds satisfactorily. Whether the grazing lease and the winter range could hold the herd as estimated and whether the rancher could handle so large a herd in this rugged country is a moot point. Weather conditions and the type of terrain as occur on Kodiak Island has a natural culling effect on the herd at present. What degree this effect will increase percentagewise with the increase of herds is a point worth consideration.

An increase in production would require the construction of slaughter houses, cold storage plants, and transportation. Thus free enterprise and capital will be needed. This is not available at present.

The four small islands under lease to six ranchers total 56,474 acres and have an estimated potential carrying capacity of 550 head and total an annual rental of \$667.97. The total number of head run on these islands is not known at this writing but no significant operations are being expedited. Plans are being formulated now to develop Near Island, a small island across the channel from the town of Kodiak.

Sheep raising on Kodiak Island and the nearby islands is at present restricted to Harvester Island, Uyak Bay.

Approximately 100 head of sheep are grazed producing from 900 to 1,000 pounds of wool per year. This is sold on the Seattle market.

Over the past 20 years, the ranchers have brought cattle raising to its present status on Kodiak Island. The ranches do not exhibit the glamour of most places in the states with large buildings and fancy fences. Rather, the buildings are small and all other necessities are modest.

The ranchers, for the most part, handle their ranchwork alone; this can be done since the principle work is tending the small herds. Only a few miles of fence are used and maintained throughout the ranching area. These are mostly used to confine the cattle within the winter range. Hay is harvested during the summer in small quantities only. The major bulk of the work occurs in the spring and fall when the cattle must be rounded and put on the desired ranges. At these periods, too, the cattle must be watched so that they do not stray or move into the mountains. This is done as protection from bears and from the natural elements which cause mortality. Branding, butchering, and winter feeding requires the rest of the working time of the rancher. The ranchers on Kodiak Island are hard working men and usually put in long hours doing the necessary chores and tending the herds. The longest hours are required of the men in the spring when the herds need constant attention. The ranchers as a rule keep a constant vigilance over the cattle as they graze on the slopes during the early spring months. This is the time for calving and perhaps the odor from this process permeates the air and follows along the wind drafts up and through the mountain ranges attracting bear closer than they would normally travel. The facts that the cattle are farther from the central portion of the range, that the bear are normally moving about at this time, and the possibility that certain odors will attract them, make the bears a menace to the cattle within the immediate vicinity of the grazing herd.

Cattle are fed at the feed lots during the late winter and early spring. The usual feed has been about three pounds a head each day of rolled barley and oats fed in February, March, and April. It is not always necessary to feed the full three months depending upon the severity of the winter. The "hospital group", or the weaker cattle, however, must be sorted out and fed back to strength. The calves are fed all winter. The cost of feeding each cow for the winter, according to the ranchers, averages from \$15.00 to \$20.00 per head. The great majority of this feed is procured from the states.

A small amount of hay is put up for the winter and usually some of this spoils from exposure in the stack. Kodiak Island is not a good country for haying because of the persistent rains during the season when the grass must be cut and cured. Consequently, the haying operation must be hurried whenever the weather permits. Silage is not stored or used on any of the ranches. However, according to Georgeson (1929), silage in past years was successfully stored and used for the cattle on Kodiak Island.

The cattle in winter are kept near the ranches and salt water. The beaches provide a portion of the cow's food together with the sedge, wheat grass, and other grasses which are palatable during the winter. In spring, the cattle follow the vegetation on the slopes as it becomes green. The grassland vegetation grows very rapidly in the spring and the most abundant grass, blue-joint, soon becomes too coarse for cattle feed. The cattle in areas of precipitous cliffs work along the cliff edges for short growths and at times are killed upon falling. This is common in the spring and fall. The cattle are closely guarded at these periods and when the grass becomes short and the cattle are moving close to the cliff edges, the ranchers turn the herds into other grazing areas.

There are two distinct ranges used during the year; one, a summer range and the other, the winter range. The cattle are kept where the ranchers can maintain surveillance over the herd at most times.

With the exception of the sheep ranch on Harvester Island other sheep ranching ventures have met with failure. Sarber (1939) reports that sheep did remarkably well in the summer but that in winter most of the sheep perished from long and frequent intervals when the animals were obliged to be shut up tightly against the fury of winter laden with sleet, rain, and snow. This caused their wool to "sweat" and fall from the skin in large patches producing an emaciation and debility from which the animals seldom recover. A like experience has been reported to have occurred on Sitkalidak Island. One winter during the height of the gales the ranchers were obliged to wrap burlap sacks around the sheep where the animals had been exposed and had crowded together; the wool had slipped from their bodies leaving them naked. It is reported, however, that four sheep have lived successfully in a wild state for several years on the same island.

Approximately 100 head of horses are grazed on the Chinik Peninsula. These horses are allowed to live on the range the entire year and are not cared for. These horses survive and increase each year. Several of the horses have been broken and sold to residents of the town of Kodiak. The average sale price is from \$150.00 to \$300.00 each.

This is not particularly good country for horses. Any horse with light-colored hooves does not fare as well as animals with dark-colored hooves as the hooves will crack and impair its normal gait. A horse that is ridden much must be cared for continually.

One old horse named Kodiak has become famous through the years and has learned the Chinik Peninsula as well as its master.

## 2. Commercial fishing

Salmon The commercial fishery at Kodiak, as in the rest of the Territory, is the most important Alaskan industry. Salmon are the most important fish in this industry and all five species (red, pink, chum, silver, and king) are caught in Kodiak waters. Figures from the Pacific Fisherman (1951) show that of an average 5,365,481 cases of salmon packed in Alaska from 1933 through 1950, and 510,879 were packed in the Kodiak area alone. Thus, nearly one-tenth of the Alaska salmon industry is centered at the Kodiak district.

Table 19 shows the number of salmon canneries and traps operating as well as the salmon pack in the Kodiak district during the past 25 years. Table 20 shows the escapement and catch records for the Karluk District, Kodiak Island. Most of the canneries are located on the northwestern side of the island (Figure 3) where the greatest salmon runs occur. During the even years, the runs are much greater on the northwestern shore of the island; during the odd years, on the southeastern side. This is due to the alternating pink salmon runs.

Many persons living on Kodiak Island receive at least a portion of their annual income from the salmon fishery, either in the employ of canneries or from fishing. Most natives and established residents fish during the commercial open season and during the rest of the year work at the Naval Station, guide, trap, work in local establishments.

Herring During the previous years and the year 1950, herring reduction plants operating on Kodiak Island (Figure 3) produced annually about 7,500 tons of fish meal and approximately 1,500,000 gallons of fish oil. This was slightly over 25 percent of these products produced in Alaska.

In the past two years, however, a marked decline in the herring catches have reduced the fishery to the point where further herring exploitation may not be profitable.

Clams Throughout the past years, razor clams have been of intermittent importance. An average annual 3 to 10,000 cases were packed. During the present year no clams were packed commercially but the potential remains.

Crabs Commercial canning of king crabs began in this area in late 1949 and has since steadily increased. The trawl catch in 1951 ran close to 200,000 pounds of live crabs. It is felt that this industry will continue to increase throughout the island.

Halibut Halibut are of little importance in the Kodiak area. One cold storage plant operates and annually freezes from 1 to 1,500,000 pounds which were caught in Halibut area 3.

The gear used in the Kodiak area for commercial fishing consists of the following in order of decreasing importance: purse seines, beach seines, traps, drift nets, and set nets. Trolling is almost non-existent in the area.

### 3. Contracting Work

A large number of people are employed by local contractors working within the city of Kodiak and at the United States Naval Station. A large number of persons now living in and near Kodiak were drawn here by the great amount of obtainable employment. Increased activity in contracting work during the summer causes an influx of persons at that time.

The greatest impetus for the increase of the human population has been the establishment of the United States Navy Base, 17th Naval District Command, here at the city of Kodiak. This has brought with it a great deal of contracting work and the other usual businesses that form with an increase in population within an area.

All this has produced modern living conditions and has greatly improved the local conveniences.

#### 4. Guiding

Kodiak Island is ideally suited for the enterprise of guiding non-resident hunters who desire to hunt the Kodiak brown bear. Excellent airline service from the states is available. The waters around Kodiak Island permit travel by small boats because of the numerous anchorages in the many small bays. Air travel from the town of Kodiak in small amphibious planes to the various parts of the island is always available.

Kodiak Island is an ideal habitat for the brown bear. Abundant grasses, sedges, and berries, the anadromous fish and the varied flora and fauna of the littoral zone provide a great quantity and variety of food. The precipitous mountains, the thick brush cover and the wide stream valleys form an ideal habitat. This abundant food and the varied terrain together produce these record-sized game animals. The Kodiak brown bear is one of the most desired of all game trophies. These factors make the guiding business what it is today.

Alaska guides who hold valid guide licenses are required to pass an examination given by a representative of the Fish and Wildlife Service before the license is issued. Of the 140 registered guides licensed through June 30, 1953, 101 are authorized to hunt in the Kodiak district. Only 14 of these guides, however, actively participate in the guiding of non-resident hunters on Kodiak Island, and of this latter number, 4 guides derive their entire income from guiding.

#### 5. Commercial Establishments

Commercial establishments are found in the town of Kodiak and in all of the small outlying villages. The many canneries maintain store



operations throughout the year for the convenience of the persons living nearby.

The town of Kodiak has the largest number of enterprises on the island including the following: 5 restaurants, 13 taverns, 8 liquor stores, 2 stores that sell groceries, hardware and dry good, 2 grocery stores, 2 clothing stores, 2 bakeries, 1 beauty shop, 1 furniture store, 2 electrical repair shops, 2 drug stores, 1 fountain, 1 curio shop, 1 photography shop, 1 dry cleaning shop, 2 garages, 1 bottling works, 2 cold storage plants, 1 bank, 18 taxi cabs, 5 apartments, 1 hotel, 2 contracting companies, 2 ship repair companies, 1 carpenter shop, 3 seafood processing companies, and 4 airlines.

## 6. Trapping

Trapping is allowed throughout the entire islands of Kodiak, Afognak, and Shuyak. Land otter, weasel, red and silver fox, and beaver are the furbearers taken. Marten and mink have recently been introduced and it is hoped these will be a valuable addition to the furbearers present on the island.

Only a small percentage of the income of residents is derived from trapping. This is due primarily to the present low market prices paid for the pelts.

Kodiak Island harbors an abundance of red and silver fox which will be utilized when the market prices again make their trapping profitable. Blue fox (Alopex lagopus ssp.) were formerly ranched on these islands but these operations have been discontinued because of the low pelt values. Several small islands are still being used as silver fox ranches.

## 7. Mining

Mining operations have never produced a large quantity of minerals from Kodiak Island. Capps (1937-B) reports placer mining on the beaches at the southern end of the island during the early part of the 20th Century. Attempts to develop gold-lode mines on Kodiak Island have failed. Recently, one small mine was started in Terror Bay but this has not produced any significant amount of gold. One small mine was started on Sitkalidsak Island but has not produced any commercial quantity of minerals.

Prospecting is continuing to this date and some indications show that copper may be present in commercial quantities.

## B. History of the Kodiak National Wildlife Refuge

### 1. Establishment and purposes.

The Kodiak National Wildlife Refuge was established on August 19, 1941 by Executive Order for the purpose of protecting the natural feeding and breeding ranges of the brown bears and other wildlife on Uganik and Kodiak Islands, Alaska. The boundaries of this refuge are given below.

All of Uganik Island near the northern end of Kodiak Island in approximately latitude 57° 53' North, longitude 153° 21' West.

All of that part of Kodiak Island lying west of the following described boundary: Beginning at an initial point at a gap on the divide between the waters of Kizhuyak Bay and Ugak Bay located approximately one mile west of the summit of Crown Mountain in approximate latitude 57° 36' North, longitude 152° 56' 30" West, and from said initial point northeasterly with the main drainage course to the south end of Kizhuyak Bay, and also from said initial point with the main drainage course southerly to the western reaches of Ugak Bay, excepting from the above-described area the proposed Indian Reservation for the inhabitants of the native village of Karluk, Alaska, authorized by section 2 of the act of May 1, 1936, 49 Statute 1250, described as follows:

Beginning at the end of a point of land on the shore of Shelikof Strait on Kodiak Island, said point being about one and one-quarter miles east of Rocky Point and in approximate latitude 57° 39' 40" North, longitude 154° 12' 20" West. Thence south approximately twelve and one-half miles to the confluence of the north shore of Sturgeon River with the east shore of Shelikof Strait; thence northeasterly following the easterly shore of Shelikof Strait to the place of beginning, containing approximately 35,200 acres.

None of the above-described lands, except a strip one mile in width along the shore line, shall be subject to settlement, location, sale, or other disposition under any of the public-land laws applicable to Alaska, or to classification and lease under the provisions of the act of July 3, 1926, entitled, "An Act to provide for the leasing of public lands in Alaska for fur farming, and for other purposes."

### 2. Economic Use

Hunting and trapping are permitted on the Kodiak National Wildlife Refuge in accordance with the Alaska Game Commission Regulations. The guiding business is justifiably the most productive economic use.

Hunting cabins or recreational camp units are allowed on the refuge, but are subject to the limitations below. A maximum of 25 cabins or camp

units are allowed on the refuge, the number of cabins per individual, partnership, or corporation not to exceed one cabin per drainage and three cabins for the entire plan (Table 4). The hunting cabins must be one-story structures of wood-frame construction and the floor space must not exceed 175 square feet. One small cache is allowed each cabin. Annual rental fees are required in accordance with the Economic Use Plan of the Refuge.

Tent camps may be erected and used without any fee for a period of ninety days or less.

Cabins erected for use by Federal, Territorial or State, and Scientific Institutions are permitted without fees or restrictions. However, upon the completion of the initial useful purpose of the cabins, the property reverts to the ownership of the United States Department of the Interior, Fish and Wildlife Service, Branch of Wildlife Refuges.

Table 4

<u>Drainage</u>	<u>Cabins Permitted</u>
Red River Lake	3
Akalura Lake	2
Fraser Lake	3
Karluk Lake	5
Uganik Lake	3
Little River Lake	2
Un-named Drainages *	7

\* Not to exceed 2 cabins per any one drainage.

No logging is permitted on the refuge and all wood cutting is restricted to fallen timber. No prospecting or mining is permitted on the refuge.

Reindeer The grazing of all livestock but reindeer is not permitted on the refuge. A grazing lease is now held by the Akhiok native village which permits them to range reindeer on the southern end of the island. Approximately 600 reindeer make up this herd (1951 estimate).

These animals are butchered for food and are, at times, sold.

### 3. Future Outlook

The primary purpose for the establishment of the Kodiak National Wildlife Refuge was the intended protection and control of the brown bear and other wildlife, on the island. With the recent stocking of fur and game animals, that were previously absent from the area, the refuge has now assumed a more important role in the protection, control, and continuation of this wildlife.

The rugged terrain, the extensive shoreline, and the wilderness areas together, make Kodiak Island a suitable habitat for wildlife and conditions are such that the area will support substantial wildlife populations, which in turn will not harvestable returns to the many persons engaged in industries relating to this natural resource.

Few such areas are so ideally suited for a wildlife refuge as is Kodiak Island. Not only is there ideal habitat available to many forms of wildlife, but the area is isolated by the surrounding ocean, a natural barrier.

This, and the fact that this is the range of one of the most desirable big game species, produces an ideal situation found in few other areas. The interest in hunting, this form of wildlife is steadily increasing, and pressure upon this animal is becoming greater. The fact<sup>that</sup> this area is isolated and more suitable for wildlife than any other interest, will prove to be more important as a wildlife wilderness as time passes. The refuge will play the important role of caretaker for the perpetuation of this splendid and enormous beast.

## **F. Management Districts**

### **1. Purpose and intent.**

The objective of this plan for the management of the Kodiak Brown Bear is to perpetuate a desirable game species and to maintain the proper ratios and numbers of bear on a sustained yield basis.

Every attempt will be made to adjust the population of bear on the island according to the findings of the studies conducted, and according to the areas of conflicting interests.

Effort will also be made to determine a trend census method within the population in the Island.

Every effort will be made to learn more about the movement of bear on the island and to apply it properly to the management of the bear.

### **2. Description of Management Districts**

Kodiak Island has been divided into 9 management districts to be used as a tool in the management of the population of the Kodiak Brown Bear. This district system will be used directly in determining trends, population, concentrations, population dispersity, enumeration and spread of bear kills, and hunting pressure adjustment in relation to the population movements and concentrations. The districts are described separately below:

#### **DISTRICT A. CHINIYAK PENINSULA**

**Geography.** This portion of Kodiak Island lying east of the boundary described below is not part of the Kodiak National Wildlife Refuge and is excepted from the Refuge by Executive Order dated August 19, 1941. The boundary line is as follows: "Beginning at an initial point at a gap on the divide between the waters of Kishuyak Bay and Ugak Bay located approximately one mile west of the summit, of Crown Mountain in approximate latitude 57° 36' North, longitude 152° 56' 30" West, and from said initial point northeasterly with the main

drainage course southerly to the western reaches of Ugak Bay."

This portion of the island is composed primarily of rolling hills, steep slopes, wide stream valleys and rugged mountains extending above 2,000 feet elevation. In some places, primarily about the mouths of large streams, the beach is smooth and the intertidal zone extends gradually into the wide valleys. This describes twelve areas: Hidden Basin, Wild Creek, Saltery Cove, Portage Bay, Pasagshak Bay, and area midway between Narrow Cape and Cape Chiniak, Kalsin Bay, Middle Bay, Women's Bay, Anton Larsen Bay, Sheratin Bay and Kizhuyak Bay. The remainder of the shoreline is represented by rocky beaches and imposing cliffs.

Geologically, the district is mainly composed of Upper Cretaceous rocks (slate, argillite, graywacke, and conglomerate) overlain locally by Recent stream gravel, silt, morainal material and other glacial deposits. This latter unconsolidated material is located primarily in the twelve areas named above. A northeast-southwest fault at Narrow Cape exposed marine sandstones of either Pleistocene or Miocene age at the surface.

Flora The main Sitka spruce stands occur in this district and are found primarily along the northern and eastern shoreline. Scattered growths occur inland but these are not numerous. Black Cottonwoods are found in most of the stream valleys but further from the streams these are replaced by the omnipresent willow and alder thickets. Willow, alder and birch are scattered throughout the area below timberline.

Bluejoint and other grasses are found throughout the lowlands and on the mountain slopes but they are replaced by sedges and rushes in most of the intertidal zones. The twelve areas mentioned above are relatively open with little brush or trees.

Elderberry, Salmonberry, and Highbush Cranberry are scattered throughout the area. Fireweed, Goldenrod, and Wild Geranium are common in the valleys and lower slopes. Above this are found many legumes and composites while mosses and lichens and members of the Heath family such as Crowberry, Bearberry, Early Blueberry and Alpine Azalea extend further up the mountainsides. The mountain summits are sparsely covered by mosses and lichens.

### Fauna

Relatively few bear are, at present, found in this district; the majority of those venturing here are soon killed. There is, however, little doubt of their movement to and from the area, especially along the western boundary at Kishuyak and Ugak Bay.

Red fox are plentiful but a large percentage of these are of the cross variety and of little value as fur. Weasels and meadow mice are numerous. Beaver are common but muskrats are difficult to locate. Snowshoe hares are, at present, difficult to locate as shown by the poor hunters success this past year. Ground squirrels are not known to occur at any place on the island excepting a few local areas in this district.

A group of sea lions are found in Chinik Bay and at Long Island but seals are more plentiful and generally distributed.

The Sitka black-tailed deer are more numerous here than elsewhere on the island and the Olympic elk have been recently observed in Kishuyak Bay. Mountain goats have been liberated at Hidden Basin and at least some of these have travelled into this area. Red squirrels have also been released in this district during the past year.

During the winter the waters of this district support a concentration of ducks and other water birds such as gulls, murres and cormorants.



Song birds are abundant there during the warmer months.

The salmon runs are less impressive here than in other districts but some important spawning streams occur in Kizhuyak and Ugak Bay. Concentration of humans around Chiniak Bay results in excessive local sport-fishing pressure and many of the streams are depleted.

The cattle now being ranched on Kodiak Island are all located in this district and are found at Saltery Cove, Pasagshak Bay, the area between Narrow Cape and Cape Chiniak, Kalsin Bay, Middle Bay, and Anton Larsen Bay. A few horses are associated with each of the ranches and the greatest numbers are found at Kalsin Bay.

One small herd of domestic goats has gone wild in the region of Monashka Bay.

DISTRICT B. KIZHUYAK AND UGAK BAY.

Geography: This district is bordered on the east by the western boundary of District A and on the west by a line extending from the head of and west southern point of Viekoda Bay in approximate latitude  $57^{\circ}49'$  North, longitude  $153^{\circ}28'30''$  West to the head of the south arm of Ugak Bay in approximate latitude  $57^{\circ}25'40''$  North, longitude  $153^{\circ}3'12''$  West.

A good deal of this area is mountainous with several peaks extending above 3,000 feet elevation. The southern boundary is the western shore of Ugak Bay which is generally sloping with few cliffs. To the north, this district is bounded by Viekoda Bay on the western, Kupreanof Strait on the northern, and Kizhuyak Bay on the eastern side. This northern portion is composed of rolling hills, mountains not exceeding 2,500 feet in elevation and uneven valleys. The central and southern portions are mountainous and rugged with few spots below 500 feet elevation.

The largest stream in this district is found at the head of Kichuyak Bay, those at the head of Ugak Bay and at Barabara Cove are smaller and several other small streams drain the northern end of the district.

Geologically, the central and southern portions are formed of granular intrusive rocks such as diorite and gabbro and these give rise to the precipitous terrain. The northern part and extreme southern portions of this district are formed of primarily Upper Cretaceous rocks such as slate, graywacke, and argillite and these are overlain locally by Recent alluvial and morainal deposits. A fair-sized body of intrusive rock is found near the extreme northern part of this district and part of this encompasses Kupreanof Mountain.

#### Flora.

Sitka spruce growths are found along the northern shore of this district but it occurs here in patches; only a few scattered trees are found on the southern shoreline. Cottonwoods are scattered through the stream valleys. Willow and Alder are found in the valleys and on the lower mountain slopes, sometimes scattered, but in places form dense thickets. Grasses are in their usual abundance in the lowlands and altitudes below 1,000 feet elevation and are admixed with Cow Parsnip, Fireweed, Wild Celery, sedges, elderberries, salmonberry growths and brushy thickets.

Members of the Heath family, lichens, and mosses typical of alpine vegetation are found on the upper mountain slopes. The tops of the mountains are usually snow-covered with the exception of a few months during the summer.

#### Fauna.

Bear are more common here than in District A, but not so concentrated as on other parts of the island. Red fox are common, hares more plentiful in the lowlands than in District A, weasels and meadow mice

abundant.

Sea mammals live in the adjacent waters but not in exceptional numbers.

Sitka deer are common along the shores and up to an elevation of approximately 1,000 feet. Beaver are present and muskrats rare. Eight mountain goats were liberated on the southernmost shore of this district in 1952 and have moved back into the mountains.

Kupreanof Strait and Kishuyak Bay are important Kodiak Island winter concentration areas for migratory waterfowl; the other sea and land birds common in the area can be found in this district.

Salmon spawn in the several streams at the head of Ugak Bay, those entering Kishuyak Bay and others found on the northern portion of this district. This district does not support as many salmon as most others.

#### DISTRICT C. UGANIK BAY

Geography. This district includes all of Uganik Island and that area between the western boundary line of District B and a line which begins at the head of the South Arm of Ugak Bay in approximate latitude  $57^{\circ}25'40''$  North, longitude  $153^{\circ}3'12''$  West and extends to the head of the South Arm of Uganik Bay in approximate latitude  $57^{\circ}37'30''$  North, longitude  $153^{\circ}30'$  West. The western boundary of District B and the southwestern boundary of District C intersect at the above point in Ugak Bay.

This district includes drainages and watersheds of primarily the northwestern side of Kodiak Island and borders on Uganik Bay, Terror Bay, and Viskoda Bay. It reaches Ugak Bay at only one point and does not include any noteworthy streams here.

District C has an irregular topography characterized by the rugged mountains, many of which rise above 3,500 feet elevation. The only relatively flat bottomland is found in the valleys leading from the East and Northeast Arms of Uganik Bay, Terror Bay, and Viskoda Bay and on the peninsula at the extreme northeastern portion of the district.

The shoreline is mostly rocky with some cliffs and gravel beaches. Little of the southeastern portion is below 1,000 feet and much is above 2,000 feet elevation. A valley glacier is present here. This portion of the district lies in the chain of high mountains which extends from northeast to southwest along the island.

Geologically, the major and northwestern portion of this district is primarily Upper Cretaceous rocks (slate, argillite, graywacke, and conglomerate) with two areas of intrusive rocks; one near Dog Ear and Helmet Mountains and the other along Uganik Passage. Present alluvial and morainal deposits are found in the South and East Arms of Uganik Bay. A fault at the northwestern end of Uganik Island has brought sandstone, shale, and conglomerate of probable Eocene age to the surface. The southeastern part of the district is formed, with small exception, but igneous rock, primarily quartz diorite, diorite, and small amounts of gabbro.

#### Flora

Spruce are found only along the northern shore of this district and here only in scattered places in small groups or single trees. Willow and Alder are present in almost all lowlands and lower slopes while Cottonwoods are located primarily along the streams. The majority of the shoreline is bordered by brush thickets and grasses, notably Bluejoint.

The mountainsides are covered with grasses, legumes, heaths, composites, and mosses. Above an altitude of approximately 2,500 feet, mosses and lichens are common and other plants are rare. The exposed mountain tops have little vegetation save the hardy lichens.

#### Fauna

This district is a concentration area for the Kodiak brown bear and it is estimated that about 17 per cent of the bears on Kodiak Island reside in this area.

Red fox, weasels, and meadow mice, are common and some land otter live here. Beaver are present at least as far west as the Terror Bay and deer have extended their range to include this district. Hares and ptarmigan are common.

Various sea birds such as puffins, sea gulls, Guillemots, and Murres are common. There are fair numbers of Mallards, Green-winged Teal, goldeneyes, mergansers, and Harlequins nesting in the summer and wintering ducks are scattered throughout the bays.

The rivers and streams harbor good runs of red, pink, chum and silver salmon. The stream at the East Arm of Uganik Bay supports large numbers of red, pink and chum salmon and is the most important stream in the district. The streams at the Northeast Arm of Uganik Bay and Terror Bay also support sizable runs. The silver salmon usually enter the streams in the late fall. Steelhead trout are found in the larger streams and Dolly Varden trout are abundant here as elsewhere on Kodiak Island.

#### DISTRICT D. LITTLE RIVER PENINSULA

Geography This district includes all the area northwest of a line beginning at the head of the South Arm of Uganik Bay in approximate latitude  $57^{\circ}37'30''$ , longitude  $153^{\circ}30'$  West and extending to the head of Spiridon Bay in approximate latitude  $57^{\circ}35'50''$ , longitude  $153^{\circ}33'25''$ . The northeastern end of this boundary line meets the northwestern end of the District C boundary line in the South Arm of Uganik Bay.

This district is similar to District C in topography. The southern portion is more mountainous than the northern and one mountain rises to almost 4,000 feet elevation. The northern portion is characterized by sloping mountainsides, rolling valleys, and high mountains. Little River Lake, which is 7 miles long, is found in this district. There are three main drainages and Little River is the largest of these; all occur in the northeastern portion of the district.

The shoreline is generally sloping but in some places high cliffs drop directly into the sea.

Geologically, the southern two-thirds of this district is comprised of Upper Cretaceous rocks (slate argillite, and graywacke). The northern third boundary is marked by a northeast - southwest fault which brought sandstone, shale and conglomerate of probably Eocene age to the surface. The extreme northwestern end of the district is composed of granular intrusive rocks (quartz diorite and diorite) locally overlain by recent gravel.

#### Flora

Few scattered Sitka Spruce are present here but these were planted and have not reproduced. Some Black Cottonwoods grow in the stream valleys and in low areas along the shore. Most of the woody growth, however, is comprised of Alder and Willow, Elderberry, High-bush Cranberry, and Birch. This growth is found throughout the lower elevations and is thickest in the stream valleys.

Bluejoint grass is abundant below 1,000 feet elevation and is associated with the usual other grasses, umbellifers and composites. The mountainsides show grass, mosses and lichens and their summits often only support lichens. In places, volcanic ash deposits and slides are barren of any visible plant life.

#### Fauna

The brown bear are not concentrated in this district although some migrate here during the salmon runs. It is estimated that about 6% of the bears on the island live here. Land otter are seen here, weasels, fox, and mice are common. Beaver may be present, snowshoe hares are numerous and deer have been sighted on this area as far south as along the ~~North~~ northern shore of Spiridon Bay.

Salmon spawn in the streams of this district and in the even-numbered years Little River supports an enormous run of pink salmon. Red salmon use these waters and chum and silver salmon can usually be found in any of the streams but not in great numbers. Steelhead trout are common in Little River.

DISTRICT E. KILIUDA BAY

Geography This district includes all the area southeast of the southwestern boundary of District C and a line beginning at the head of the South Arm of Uganik Bay in approximate latitude  $57^{\circ}37'30''$  North, longitude  $153^{\circ}30'$  West and extending along this line of longitude to the shore of Three Saint's Bay at approximate latitude  $57^{\circ}11'5''$  North. Sitkalidak Island is not included in the Kodiak National Wildlife Refuge and is therefore not considered as part of this management district.

The greater part of this district is extremely mountainous and much of the land is above 2,000 feet elevation. The northwestern corner of this district is gently sloping and consists of the confluence of the valleys leading from the South Arm of Uganik Bay and from Spiridon Bay. The mountain chain which extends along the main axis of the island makes up the middle and main portion of this district. Many of these rugged mountains extend above 3,000 foot elevation and certain peaks rise above 5,000 feet. When considering that these mountains rise directly from sea level, their immense size is more readily appreciated.

Two valley glaciers are found in this district; the larger is about 7 miles inland from the native village of Old Harbor and it drains into both Spiridon and the South Arm of Uganik Bays. The smaller lies about 5 miles inland from the head of Kiliuda Bay and drains primarily into the East Arm of Uganik Bay.

There may be other small glaciers in this portion of the island but little of the interior of Kodiak Island has been surveyed. The southeastern portion of the district has a varied topography; rolling hills, steep cliffs, and wide stream valleys are scattered among the mountains. This latter portion of the district borders on Three Saint's Bay, Barling Bay, Sitkalidak Strait, Kiliuda Bay, Boulder Bay, and Ugak Bay. The coastline is generally rocky with areas of extensive tidal flats, gravel beaches, and precipitous cliffs. Because many of the mountains border directly on the ocean, rockslides and cliffs are common here.

Geologically, the northwestern and southeastern thirds of this district are underlain by Upper Cretaceous rocks such as graywacke while the middle region is composed of granular intrusive rocks. This middle expanse of igneous rocks are harder and more resistant to wear than the sedimentary rocks and thus constitute the basis for the mountain range. Several faults in the southeastern third of the district brought fresh-water sandstones, shale and conglomerate plus local areas of Triassic and Jurassic rocks of great diversity to the surface. Various valley areas are overlain with Recent gravel from stream and glacial deposits.

#### Flora

A few scattered individual Sitka Spruce occur on the southwestern shore of Ugak Bay. Black Cottonwoods occur in most of the stream valleys and are associated with the Willow and Alder which replace the Cottonwoods further from the streams.

Extensive growths of Bluejoint grass and the associated plants are found throughout the valleys and lower mountain slopes.



Mosses and lichens form expansive growths on the upper mountain slopes and because of the large amount of high elevations these cover much of the area. In the southern portions of the district mosses are found at elevations of 500 feet.

The mountain peaks are, to all intents, barren of plant life and are snow and ice-covered throughout most of the year. The glaciers fields support little or no plant life.

#### Fauna

Approximately 5 per cent of the bear on the island are believed to occur in this area. This low number might appear unusual when the size of the area alone is considered but it should be remembered that sizable salmon runs on this side of the island occur only in odd-numbered years and that salmon is a chief seasonal food of the bears. They would, therefore, not be so concentrated where in alternating years a chief food supply is scarce or absent.

Fox, weasel, meadow mice, and land otter are found in the area and all but the otter are common.

Beaver are known to have spread as far south as Barling Bay and may have spread further but not been reported. Muskrat are not known to be in this district. Snowshoe hares and Ptarmigan are common.

Various sea birds such as Glaucous-winged gulls, Short-billed Gulls, Kittiwakes, Tufted and Horned Puffins and Pigeon Guillemots are common and a minor concentration area for wintering ducks occurs in the vicinity of Sitkalidak Strait. Several species of ducks nest here during the summer.

Pink salmon ascend the streams in the odd-numbered years and occur in tremendous numbers. Other years, however, the salmon runs are limited to a minor red escapement, occasional good chum population and the usual fall runs of silver salmon.

DISTRICT F. ALITAK PENINSULA

Geography This district includes all the area southwest of a line beginning at the head of the northwestern arm in Three Saint's Bay in approximate latitude  $57^{\circ}11'25''$  North, longitude  $153^{\circ}32'35''$  West and extending to the point of land between Alpine Cove and the North Arm of Deadman Bay in approximate latitude  $57^{\circ}8'40''$  North, longitude  $153^{\circ}46'30''$  West.

The southernmost portions of Kodiak Island are included in this district. It includes both the Alitak and Hepburn Peninsulas and borders on Three Saints Bay, Kaingnak Bay, Kaiva Bay, Kaguyak Bay, Geese Channel, Russian Harbor, Portage and Sulua Bays, and Deadman Bay. One or more streams flow into each of these bays and areas. The northeastern end consists of sloping mountains with a few peaks extending above 3,000 feet elevation. The lower elevations are somewhat similar to those in District E: steep slopes, wide valleys and a generally undulating topography. The southwestern portion of the district is extremely flat with no elevations above 500 feet. The streams in this latter area meander extensively. The middle portion of the district has features intermediate between both end portions; rolling lowlands and gentle slopes and some mountain peaks extending above 2,000 feet elevation.

Geologically, the northeastern portion is primarily intrusive rock with some Upper Cretaceous rocks to the north and Triassic and older rocks of great diversity to the south. The southwestern portion of the district is primarily Recent and Pleistocene gravel (alluvial, glacial, and beach deposits); extending around the coast is a narrow belt of fresh-water sandstone, shale and conglomerate.

Flora

Alder are common on the mountain slopes and form thickets up to an elevation of approximately 1000 feet.

A few scattered growths of Black Cottonwood occur in the extreme northern portion of this district; spruce are absent. In the stream valleys in the northern half of this district, Bluejoint and the associated herbs and grasses are abundant. Willows are found primarily in the lowlands adjacent to the streams. A typical tundra association (such as Crowberry, Alpine Azalea, Mountain Cranberry, mosses and lichens) is found throughout the district; this association covers the entire south end of the district, is the major ground cover in central portions, and is common from elevations of about 300 feet up in the northern areas. All along the shoreline are found sedges and these form extensive growths in the intertidal flats.

#### Fauna

An estimated less than 2 per cent of the Kodiak Island bear population resides in this area. More bear use this region at various times. Here, ptarmigan, weasel, meadow mice, and fox are abundant; land otter are present.

Some chums and silvers enter the streams here each year but the largest salmon runs, primarily pinks and chums, occur in this district during the odd-numbered years.

#### DISTRICT G. UYAK BAY

Geography This district borders on Uyak, Zachar, Spiridon, Three Saints, and Deadman Bays and includes all the area within the following boundary lines: beginning at the head of the South Arm of Uganik Bay in approximate latitude  $57^{\circ}37'30''$  North, longitude  $153^{\circ}30'$  West and extending along this line of longitude to the shore of Three Saints Bay at approximate latitude  $57^{\circ}11'5''$  North; beginning at the head of the northwestern Arm of Three Saints Bay in approximate latitude  $57^{\circ}11'25''$  North, longitude  $153^{\circ}32'35''$  West and extending to the point

of land between Alpine Cove and the North Arm of Deadman Bay in approximate latitude  $57^{\circ}8'40''$  North, longitude  $153^{\circ}46'30''$  West; beginning at the northwesternmost point at the head of the North Arm of Deadman Bay in approximate latitude  $57^{\circ}9'38''$  North, longitude  $153^{\circ}48'8''$  West and extending to the point of land in Uyak Bay lying west of the southernmost point of Alf Island in approximate latitude  $57^{\circ}24'50''$  North, longitude  $153^{\circ}52'15''$  West. The Little River Peninsula (District D) is separated from this district by its southern boundary line which extends from the head of the South Arm of Uganik Bay to the head of Spiridon Bay.

This district is extremely mountainous with very little of the land found below an elevation of 500 feet. The largest recorded mountain on the island occurs along the eastern shore of Uyak Bay and rises to 4,463 feet. The only ground between 0 and 500 feet elevation is found as a thin strip along the sea coast and extending into the main drainage valleys.

Large streams enter the North Arm of Deadman Bay, the heads of Uyak Bay, Brown's Lagoon, Lechar, and Spiridon Bays. Many smaller streams and rivulets drain into salt water throughout the area. No lakes of noteworthy size occur in the district.

The shoreline is varied with predominating rocky areas, talus slides, and cliffs; sandy beaches and wide tidal flats are found in isolated spots.

The northwestern and main portion of this district is underlain by Upper Cretaceous graywacke, argillite, and conglomerate. The southernmost portion is made up of intrusive igneous rocks which extend along the main axis of the island. An area of intrusive rocks is also found in the southwest corner of the district and local areas along the shore are overlain by Recent glacial and alluvial gravel deposits.

### Flora

Along the shoreline where talus slides and abrupt cliffs are not present, growths of Dunegrass and sedges can be found. Much of the shoreline, however, is rocky and abrupt and here the typical lowland association is present.

This latter association (primarily Bluejoint grass, willow and alder thickets, Fireweed and Cow Parsnip) is found throughout the lower elevations and is interspersed only near the streams with Cottonwoods and sedges. On the lower mountainsides growths of Wild Rose, Early Cranberry and Alder thickets are common. The mountain slopes above approximately 1,000 feet elevation consist primarily of a tundra association of scattered composites, mosses, lichens, and members of the heath family.

### Fauna

This district is estimated to harbor the greatest concentration of bears found on the island: approximately 35 per cent. Within its boundaries can be found the seasonal food and shelter necessary to sustain many of these animals year-round.

Land otter can be found on almost all the streams and weasel, ptarmigan, meadowlarks, snowshoe hares, and fox are abundant.

Many ducks nest along the streams, Bald eagles and other birds are common. During the winter many ducks are found in the region although this is not a local concentration area.

Impressive numbers of pink and silver salmon spawn in the many streams; red and chin salmon are caught in large numbers in the waters bordered by the district and some of these spawn in the local streams.

Sea lions and hair seals are common and sea birds (gulls, pigeon guillemots, puffins and murre) abound in that area.

DISTRICT H. KARLUK LAKE

Geography This district includes all the area between the following lines: beginning at the northwesternmost point at the head of the North Arm of Deadman Bay in approximate latitude  $57^{\circ}8'40''$  North, longitude  $153^{\circ}46'30''$  West and extending to the point of land in Uyak Bay lying West of the southernmost point of Alf Island in approximate latitude  $57^{\circ}24'50''$  North, longitude  $153^{\circ}48'8''$  West, beginning on the western bank at the mouth of Dog Salmon Creek in Olga Bay an approximate latitude  $57^{\circ}7'45''$  North, longitude  $154^{\circ}2'3''$  West and extending to the eastern bank, of the mouth of Sturgeon River, Sturgeon Lagoon in approximate latitude  $57^{\circ}30'50''$  North, longitude  $154^{\circ}30'48''$  West.

This district borders on Shelikof Strait, Larsen Bay, Olga Bay, and Deadman Bay and contains the two largest lakes found on Kodiak Island: Karluk and Frazer. Frazer Lake drains into Olga Bay via Dog Salmon Creek and an impassable falls below the lake prevents salmon from entering the lake and its tributaries. Karluk Lake drains into Shelikof Strait and has the distinction of supporting a greater salmon population than any other lake in the world of comparable size. The Karluk River meanders extensively through the glacial till and its tributary streams drain a wide area.

The majority of the land in this district is below 1,000 feet elevation. The northern third of the district is generally flat; the Karluk River is located here and much of the ground is pitted with tiny ponds. The hills are rolling but a few mountains rise above 2,000 feet. The central third contains both large lakes and is of varied topography. Some mountains here extend above 3,000 feet elevation and much of the ground is very hilly. The southern third is varied with topography similar to the central portion. In this latter area, the ground below 500 feet is found primarily along the shore of Boser Peninsula, and in the valleys of Horse Marine and Dog Salmon Creeks.

This area also has several mountains extending above 3,000 feet elevation.

The shoreline along Uyak Bay is generally abrupt with many cliffs and rocky areas. Along Shelikof Strait and the southern portion of the district, the shoreline is more sloping and gravel beaches are common.

#### Flora

Black Cottonwood trees are found in areas along the coastline of Uyak Bay, around the lakes, and in some places along the stream valleys in the central and southern parts of the district. Willow and alder thickets are common in most of the low areas and along the mountainsides. In the northern third of the district, a tundra-type growth with scattered areas of Blue-joint grass is common. On the mountain slopes this tundra association is more pronounced and the mosses and lichens are found here.

#### Fauna

An estimated 18 per cent of the Kodiak Island bear population is found in this district; these animals are concentrated in the vicinity of Karluk Lake primarily and Dog Salmon Creek secondarily. Land otter are common in the area and relatively concentrated at Karluk Lake; fox, hare, ptarmigan, weasels, and meadow mice are common to abundant. The Akhiok native-owned Reindeer herd occasionally ranges into the northwestern parts of this district.

Many species of birds nest in the area and a small colony of Whistling Swan are known to nest along Karluk River. Great numbers of red salmon spawn in Karluk Lake and its tributary streams while lesser numbers of pink and silver salmon spawn here. Pink and chum salmon are numerous in Dog Salmon Creek and most of the other streams in the district support some sort of a salmon run.

DISTRICT I. OLGA BAY

Geography This district includes all the area lying southwest of a line extending from the western bank at the mouth of Dog Salmon Creek in Olga Bay in approximate latitude  $57^{\circ}7'45''$  North, longitude  $154^{\circ}2'3''$  West to the eastern bank of the mouth of Sturgeon River, Sturgeon Lagoon in approximate latitude  $57^{\circ}30'50''$  North, longitude  $154^{\circ}30'45''$  West.

The district borders on Shelikof Strait, Alitak Bay, and Olga Bay. Along the northwestern shoreline, extensive slide areas form bluffs that drop directly to the water exposing, in places, 500 or more feet of gravel deposits. Local areas such as Grand Lagoon and Halibut Bay slope gently to the shoreline. The southwestern shore also consists of primarily gravel and rubble slide areas 100 to 150 feet high. These latter gravel bluffs are less steep in the extreme southern part of the district and low, very gently sloping land extends inland from the shore. The land bordering Alitak Bay and Olga Narrows is more varied and in some places mountains slope directly to the shoreline and in others, wide, flat areas approach the shore. Olga Bay is bordered on the eastern two-thirds by cliffs, mountain slopes, and stream valleys; the western third is bordered by gravel bluffs 30 to 50 feet high and a minor number of gently sloping beaches.

The northwestern and greater part of this district is below 500 feet elevation and consists of rolling ground pitted by numerous small ponds. Some peaks reach an elevation of 2,000 feet but these are few and are located along the northwestern boundary. The southeastern corner of the district has more rugged topography and here elevations of almost 2,500 feet are attained. The Alitak Peninsula in the southern part of the district has generally, very low and flat ground but some mountain peaks reaching above 2,000 feet elevation are located in the northeastern corner of the Peninsula.



Two unnamed lakes averaging 4 miles in length occur on this Peninsula and empty into Olga Bay

Red (Ayakulik) Lake and Akalura Lakes are found in this district and each is approximately 4½ miles long. Red River, draining Red Lake and flowing into Shelikof Strait courses through the greater part of this district and its many tributaries drain a wide area. Sturgeon River also meanders through the northwestern portion of the district. Akalura Lake empties into Olga Bay.

Geologically, this area is underlain by Upper Cretaceous rocks with local areas of granular intrusive rocks and Triassic and Jurassic rocks. Much of the region is overlain by Pleistocene and Recent glacial till and alluvial materials. The geology of this district is vague and has not been studied as thoroughly as other parts of Kodiak Island.

#### Flora

The southeastern portion of this district has a few scattered areas of Cottonwood trees, especially in the vicinity of Dog Salmon Creek, Red Lake, and Olga Narrows. Elsewhere, trees are scarce or absent. Brushy growths (alder and willow) occur on most mountainsides below 750 feet elevation.

The typical vegetation of this district is a tundra association and is found throughout the lowlands and on the mountainsides. In this association, Crowberry, Early Blueberry, Alpine Azalea, Alaska Heather, Wax Flower, Bog Blueberry, and Bearberry are common.

Local areas of Bluejoint grass and the associated members of the parsnip family, elderberry, and composites are found near the lakes, along some streams and usually in the northeastern portions of the district.

### Fauna

An estimated 6 - 7 per cent of the total Kodiak Island bear population resides in this area. The extreme southern parts of the district have few bear but many are found along the Red River and Sturgeon River drainages. Year-round food and shelter is available in the area.

Land otter are found on most of the waters in the district; weasel, voles, hares, fox, and ptarmigan are common to abundant.

A minor number of migratory waterfowl winter here but many ducks nest in the area throughout the summer. Seagulls, puffins, and other sea birds are abundant.

The Akhik native-owned Reindeer herd at present totalling an estimated 600 head, ranges throughout the western and southern parts of the district.

Many salmon spawn in the area; Red and Sturgeon Rivers are the major spawning systems for the red, chum, pink, and silver salmon. Other important spawning grounds are found in the Akaluta, Halibut Bay, Grant Lagoon, and Upper Station drainages.

These above mentioned districts will be used as an aid to manage the Kodiak bear. At such a time as is deemed necessary from the results of future studies and from records, these areas may be used as sanctuaries or closed areas for the express purpose of protecting a portion of the breeding stock of the bears which will be a nucleus of the population, or to concentrate hunting pressure where it may be deemed necessary to reduce the concentration of the bear.

### 3. Sanctuary Area

When the results of the field work entailing the population and trends of bear on Kodiak Island reveal that the number of bear is not sufficient to

maintain a proper population, the following described area is designed as a permanently closed area or sanctuary. The closed area to include: that part of District "G" southwest of a line  $57^{\circ}25'$  north. This area includes the head of Uyak Bay and is chosen as it provides the necessities for the year long livelihood of the bear. This area is approximately 294 square miles. (Figure 5) This sanctuary area will be called Uyak Mountain Area.

G. Natural History of the Kodiak Brown Bear.

1. Biology.

The Kodiak Bear is one of the largest big game animals that is hunted in North America and although it is definitely omnivorous, it is considered "the largest carnivorous animal in the world".

Physical characteristics The male bear often attains the size of 11 feet (squared hide measurements). The female is smaller and seldom exceeds 9 feet (squared hide measurements).

At birth in December, January and February the bear is very small, averaging approximately 1 or 2 pounds in weight. By May the young bear will weigh from 18 to 25 pounds and by July and August the weight will be about 50 to 60 pounds. One year later the weight has increased to 150 to 200 pounds and at the fourth year of life the bear has attained a weight of 400 to 450 pounds and is considered an 8 foot bear (squared hide measurements).

The conformation of the Kodiak bear is bulky and massive by proportion. The head is wide with small rounded ears and small eyes are placed forward on the head. The bears' legs are comparatively long, with pads that are large terminated with long curved claws.

Basically the bear is an attractive animal to watch and even though it's large in size, it is not clumsy.

Females with cubs average approximately 2.1 cubs per litter, after much of the cub mortality has occurred.

It is generally supposed that females have cubs every other year but this may not be true. It is entirely possible that three years elapse between births and if most females do have cubs each second year, others undoubtedly vary from this.

Year and one-half old cubs have been seen suckling on females. If females are lactating, breeding and fertilization would be unlikely until the following spring or second year. Such a female would then bear cubs three years after the previous litter.

Many females probably never have cubs; this might be due to faulty hormone balance or malformation of the genital system. Observations indicate that young females bearing their first litter usually have but one or two cubs.

Consequently, although there may be a large female population, the number of cubs per adult female may be quite low. Little is known concerning the sexual behavior of brown bears. Males may be monogamous or polygamous. If the males mate with but one female, a low male population caused by selective hunting would reduce the number of cubs by limiting the number of females fertilized. If males are polygamous, a lesser number of males would not injure the population.

Questions such as these must be answered in the continuing biological work even though a total population estimate is available. Justification of increased or decreased bear killing must be assumed until these unknown are solved.

Habitat The Kodiak Brown Bear is found and is limited to all of Kodiak, Uganik, Afognak and Shuyak Islands. This area is considered the ideal habitat for this species. Abundance is affected only by the human element as there are no indications of any other limiting factor present besides the bear itself. The bear is commonly found in association with spruce, Alaska alder, cottonwood, willow, birch, elderberry, cranberry, huckleberry, mossberry, devil's club, grasses, sedges, lichens and moss.

The bear is found from the relatively flat tundra-like area of the southern part of Kodiak Island to the spruce belt at the northern end and from sea level to the tops of mountains at 2000 to 4000 feet. The bear, therefore, is associated with all types of vegetation found on Kodiak Island from tundra to the coniferous belt.

Sexual activity      Mating occurs in April, May and June shortly after the period of hibernation. It is at this period that the male roams about from one drainage to another. By and large, the bear stay higher on slopes at this period of year as this is where the vegetation desired for food is located. Frequent trips to the lower altitudes to obtain sea foods or carrion on the beaches occurs at this time of year.

The mating activity may occur several times in a short period. The male during this period of sexual activity is more aggressive than usual. It is not known whether a male will service more than one female or that a female will accept more than one male during this period.

The usual number of cubs ranges up to four per female, but averages two cubs every two years. The cubs are born in December, January and February during the hibernation period. The females with their very small cubs stay close to the dens in the mountains until late spring or early summer, or until the cubs are large enough to follow the mother successfully. Nursing will continue, according to the reports from one guide, until the end of the second year. However, a six months old cub has been seen eating solid foods, but also the mammary gland of the female was still active as noted after the bear was killed.

Non-sexual activity and food habits.

The period of hibernation occurs from December to April and sometimes into May, on Kodiak Island.

Bears have been seen and bear tracks have been noted all winter, indicating that at least some of the bears stay out or are active intermittently during the winter months. The large male bear is the first to move about in the spring and this is the period when hunters take the largest of the animals.

The bears live mostly on the mountain slopes in the brush after hibernation but work to the lower valleys about the time the salmon are in the rivers at the end of June and the beginning of July. The bear remain then near the stream until the end of August and the first part of September when the streams are not as thickly populated with salmon and the berries are beginning to ripen. The elderberry is the favorite food and elderberry parts are found in the droppings as early as the first of August. Vegetation, usually sedge and grass, is taken in small quantities during all of the summer months. Cranberries are eaten in October and November in large quantities and during this period fish are not as available to the bear due to the comparative scarcity of the fish. High water deters the catching of salmon by the bear, and an abundance of the vegetative food is available. In September, bear are extremely hard to find as they live away from the streams, staying in the dense alder brush most of the time. By November the bear is in excellent shape and is ready for hibernation in December.

The abundance of spring food is scanty and during this period the bear must exert much effort for a meal. This is accomplished by traveling widely and eating anything that is palatable. Carrion is especially desired at any time of the year. Other spring foods are: herring spawn, a delicacy; kelp, seafood, sedge, grass, bark and roots.

## 2. Population Estimate

Various guesses as to the bear population on Kodiak Island range from 300 to 5,000 animals. Probably the local persons best qualified to hazard an educated guess are the professional guides. Three guides, Bill Poland, Alf Madsen and Charles Madsen estimate the population at 1,500, 1,800, and 2,300 respectively.

A minimum bear population has previously been estimated, by F.W.S. at only three points on the island: Red River Lake, Sulua Creek and Karluk Lake. These figures are, respectively, 31, 10 and 124, including cubs. An attempt at an aerial survey of the bear population was made in 1951 but this proved unsuccessful. Eight major drainages were observed from the air over a period of about two and one-half weeks. A total of approximately 16 hours of actual flight time was consumed. A total of 278 bear were observed and of these, 120 were felt to be the minimum number of individual bear.

The estimated minimum number of different bears seen from the air in the three areas where ground counts were made totalled 63. This figure is only 38 percent of the minimum estimated from ground counts. Assuming that this percentage of the bears in other surveyed drainages were seen, a total of 316 bears (minimum) are estimated to be in the eight drainages surveyed. These drainages in question harbor the bear concentrations on the Island. Thus, probably no more than 700 bears should be on the island if the past work and the interpretation of it is valid. It is felt that this figure of 700 is far from accurate as the following information indicates.

An annual bear kill of recorded and conservatively unrecorded animals during the past five years averages approximately 150. An additional 20 animals are probably killed but unrecorded. Thus, the annual kill is estimated at 170 animals. In order to produce this harvest of 170 animals, the absolute minimum total population would have to be 1388 bears.



The latter figure is obtained as follows.

From data available at present, it is known that slightly over two-thirds of the bear killed are males. Further, data indicates that males of the following age groups attain the following total lengths; 5th year of life, 7 feet; 6th year, 8 feet; 7th year, 9 feet; 8th year plus, 9 plus feet. The hunting loss in the following table approximates the actual in relative numbers within each group.

TABLE 5  
Hypothetical Constant Bear Population

Year of life	Total Number	Males	Hunting Loss	Natural: Loss	Females: Loss	Hunting Loss	Natural Loss
9	35	0	2	0	35	10	0
8	47	2	6	0	45	18	0
7	71	8	16	0	63	12	0
6	99	24	48	0	75	8	0
5	155	72	34	0	83	2	0
4	191	106	14	0	85	0	5
3	210	120	0	10	90	0	20
2	240	130	0	40	110	0	60
1	340	170	0	0	170	0	0
Total	1388	632	120	50	756	50	85

\* 386 breeding females

This table was formulated by deriving the age composition of the bear population from the kill records as obtained during the previous two years. The total number, the estimate of unrecorded kills, the size of the bear killed in relation to numbers and the percentage of sexes killed was also derived from the kill records. The natural mortality is an estimate formulated from the obtained local knowledge and observations.

The above table 5 is made under the assumptions that no natural mortality occurs after the first three years, that no male bear lives longer than the ninth year of life, that at birth the male-female ratio is one to one, and that female cubs suffer a higher mortality than males. These assumptions are made to obtain the absolute minimum population necessary to sustain an annual kill of 170 animals. Undoubtedly, many of the assumptions cannot be made on wild populations.

In any wild population, infant mortality is high because of disease, insufficient food for all cubs due to malfunction of the mammary glands or the forcing away from the female of small or "runt" bears by their little-mates, exposure, suffocation, unintentional injury by the female's movements, loss of the mother because of hunting or natural mortality, and so forth. Female cubs, because of their relatively smaller size, probably suffer a higher mortality in their first year than do the males.

There appears to be a high degree of intraspecific competition and agitation within the population especially between large and small bear and between sexes. Observations indicate that this occurs to a great extent during the spring and summer. It would appear that the breeding attitude of the bear is accountable for part of this mortality as the male during this period attains a more aggressive attitude than its usual retiring nature as found later in the year.

Little mortality would be caused by competition with other species. Environmental factors causing mortality to all age classes are not to be overlooked. Cycles also influence the total population at a given time.

In table 5 the hypothetical population, the kill is 28.5 percent of the breeding stock of 598 animals. Any such situation would endanger the species on Kodiak Island for if any of the assumptions are incorrect, the mortality would increase and eventually the population would become extinct.

Any such situation as the above is extremely poor with respect to management practices for there are no surplus animals and should any disease or other unforeseen event occur, the population would be wiped out. Table 1 has but one purpose: to indicate the absolute minimum number of bears needed to sustain the present bear kill.

Observations this summer by Clark indicates 1.5 bear for each per square mile during the peak of the concentration of bear around the lake. Computing, this gives a population of 124 bear within the Karluk Lake area. Using this same method and figure per square mile, total number of bear were determined for all other concentration areas on the island. From this the total number of bear were determined for each management district as shown in Figure 5. Table 6 lists the districts, the relative number of bear in each, and the percentage of bear to the total number. A correction factor of 20% of the total was added to the number to derive the total population. This correction factor is used to account for the animals in areas other than the concentration areas and for those not counted within the concentration areas.

TABLE 6

District	Number of Bear	Percent of Bear	:
A	34	2.6%	:
B	117	8.7%	:
C	230	17.2%	:
D	81	6.	:
E	57	4.2%	:
F	18	1.5%	:
G	470	35.2%	:
H	241	18.1%	:
I	87	6.5%	:
Totals	1335	100.%	:

TABLE 7

District	Number of bear killed	Percent of bear
A	18	8.8%
B	15	7.4%
C	34	16.7%
D	3	1.5%
E	10	4.9%
F	7	3.4%
G	71	34.8%
H	38	18.6%
I	8	3.9%
Totals	204	100.%

The total number of Kodiak Brown Bear on Kodiak Island has been estimated to be 1669. The island has an area of 3,588 square miles; consequently there is 1 bear per 2.15 square miles.

Table 7 shows the number of bear killed and on record during the past two years and does not list the total number of bear killed on Kodiak Island for this period. The bear kills have been listed as to districts and the percentages of bear killed in each district to the total number had been computed.

A similar comparison is shown between the percentages listed in Table 6 and 7. The figures in table 7 were not used to derive the figures of Table 6.

A study to estimate the bear population of Admiralty Island in southeastern Alaska was conducted in 1932. The result of this study shows a population of 900 bear on the 1,664 square miles or 1 bear per 1 3/4 sq. Miles.

This compares favorably with the conclusions found from these calculations.

### 3. Concentrations and movement

The total Kodiak bear population on Kodiak Island has been estimated. Attempts have been made to determine the minimum number of bear during the summer by aerial survey within each drainage but these attempts were unsuccessful. Due to the type of brush cover and the habits of the bear to become secluded in the alder brush at the time of disturbance, aerial surveys have not been effective as a substantial system of censusing. Finding a suitable method of census is one of the problems that confronts the refuge workers.

Bears are found throughout the Islands of Kodiak, Uganik, Afognak and Shuyak. No area seems to be unsuitable for them, however reports and kill records indicate that the center of the population occurs around Uyak Bay. The two areas on either side of this bay, Uganik Bay and Karluk River Drainage contain nearly as many bear per area.

### 4. The Bear in Relation to Other Interests As an Individual Species.

The Kodiak Brown Bear as described by Merriam (1918) inhabits only the Kodiak, Afognak and Shuyak Islands group. Nowhere else in the world is this species found. It is, therefore, by reason of its limited distribution, an unusual animal and were it to be destroyed or materially decreased to the point where extinction might follow, the loss would be irreparable.

In some cases one species is differentiated from another by distribution alone, but this is not true here. Merriam found that the Kodiak bear possess skull characteristics which differ from those found on the mainland.

Further, the adult Kodiak bear usually averages larger than bear found in the Interior or southeastern Alaska. In recent times the trophy value of the Kodiak bear has been exploited to a much greater degree than bears in other areas. Consequently, at present there are indications of fewer large bears left on Kodiak Island. This is primarily due to the exerted hunting pressure.

The Kodiak bear has a value to mammalogists, taxonomists, ecologists, natural historians and students based primarily on its unique situation. It is felt that the bear population on Kodiak Island began after the last recession period of Pleistocene glaciation and thus the approximate length of time that the bear have inhabited the island is known. Further, the bear have little competition; they live on an island group with few other mammal species of comparative size and food is apparently abundant.

In the case of the Kodiak bear, any effective general control policy will jeopardize the continuation of the species because of the limited distribution. From a purely scientific and economic point of view, radical decimation of this species and the probable eventual extinction of the bear would be a heinous crime.

To the big game hunter, the name "Kodiak Brown Bear" means the largest carnivorous mammal on the North American continent, and one of the prized trophy animals. The Kodiak bear has been publicized to such an extent that other bears in Alaska have derived the name "Kodiak Bear" by the widespread use of the name.

The solitary mountain goat, the feeding bull moose, and the lumbering Kodiak bear all symbolize the Alaskan wilds to millions of Americans. To the average person, the Kodiak bear is probably better known than other mammals because of the numerous magazine articles portraying its attributes and the glamour attending the hunt.

The bear is one of the small and shrinking list of animals which are yet synonymous with the wilderness and "America's Last Frontier".

Few persons will probably ever have the opportunity to see a live wild brown bear, but to the fortunate few, this experience is never forgotten. There is a far greater thrill in seeing one animal in its natural wild state than can be gained in perusing the whole complement of a zoo. Others may find pleasure in moving pictures taken of the bears. This is an increasing possibility with the present popularity of wildlife films.

Wild animals represent a way of life that is denied to great numbers of persons now living in crowded cities and towns. More and more people are moving from the cities to the outlying suburbs and country. An ever increasing number of people are joining outdoor clubs and sportsmen's associations. The existing National Forests and State Parks are being utilized by more people today than ever before. It is at such a time as this that the trust given the Fish and Wildlife Service to protect what few natural areas as are left is more important than ever. The Kodiak brown bear represents just one of these trusts and with the increasing interest in and use of the natural areas by the American people, to permit any further encroachment on the existing wilderness would be a betrayal to this trust.

The city of Kodiak advertizes the bear as one of the island's main attractions. The bank of Kodiak shows a bear head on the official bank seal. Many of the local establishments show a bear head or whole animal on business stationery.

Although the Kodiak bears are despised by a small group of local fishermen and ranchers, to the vast majority of American citizens the bear represents not only a big game animal but a symbol of the last of America's once great wilderness.

The Kodiak Bear as a Game Animal

The Kodiak bear has become famous as one of the most desired of all big game species. The bear is known as the largest carnivorous animal in the world and because of this, the challenge to conquer this great beast is always present. For this reason, stories have been written and tales told many times over about the individual adventures to subdue this monarch of the wilderness.

The combination of an ideal hunting area, a prized trophy sought, and registered guides available for hunters produces a large income from a natural resource. Tables 8 and 9 show the total economic value of the bear and the value to Kodiak and Alaska as is known at this writing. This table was formulated after questioning several of the prominent guides in Kodiak. A total of 95% of the non-resident hunters are successful; therefore, the number of bear shown listed in table 8 indicates but 95% of the bears hunted by non-residents for the past four years.

Table 8

Values from Individual Kodiak Bear hunted by Non-resident Hunters

Initial guiding fee (two week period)	\$1250.00
Alaskan souvenirs, trinkets, etc.	144.00
Clothing, film, miscellaneous spending	52.00
Trips to packers	50.00
Room and board in Kodiak	<u>20.00</u>
VALUE TO KODIAK	<u>\$1516.00</u>
Room and board in Anchorage, Alaska	52.00
License fee (Non-resident)	<u>50.00</u>
VALUE TO ALASKA	<u>\$1618.00</u>



Preparations for trip	375.00
Taxidermy and preparation of hides	140.00
Travel from Seattle to Kodiak ( round trip )	250.00
Average round trip ticket airlines within U.S. to Seattle	<u>232.00</u>
TOTAL VALUE OF INDIVIDUAL KODIAK BEAR	\$2595.00

The number of bear taken by guided hunters represent 95% of the people who hunted on Kodiak during the past four years as 5% were unsuccessful but paid the guiding fee. Therefore, an additional sum, or 5% of the total, is included in the total values as given in the tables.

Table 9

<u>Year</u>	<u>Number of bear *</u>	<u>Value to Kodiak **</u>	<u>Value to Alaska **</u>	<u>Total Value **</u>
1949	27	\$ 43,086.31	\$ 45,985.26	\$ 73,752.63
1950	43	68,618.94	73,235.78	117,457.89
1951	64	102,130.52	109,002.10	174,821.05
1952	<u>73</u>	<u>116,492.63</u>	<u>124,330.52</u>	<u>199,405.26</u>
Totals	207	\$330,328.40	\$352,553.66	\$565,436.83

\* Non-resident hunters only

\*\* Figures represent 100% of bears hunted by guided hunters.

Aside from the non-resident hunters who took bear during the past four years, 11 persons went on hunts as non-hunters. The fee for this is usually \$500.00 per person. This represents a total value of \$5500.00, and in turn increases the value of the bear to Alaska by the same amount as is shown below:

\$330,328.40 plus \$5500.00 equals \$335,828.40 TOTAL VALUE OF THE  
BEAR TO KODIAK FOR THE PAST FOUR YEARS.

\$352,553.66 plus \$5500.00 equals \$358,053.66 TOTAL VALUE OF THE  
BEAR TO ALASKA FOR THE PAST FOUR YEARS.

\$565,436.83 plus \$5500.00 equals \$570,936. 83 TOTAL VALUE OF THE  
BEAR FOR FOUR YEARS.

This value considers only the non-resident hunters that hunt on Kodiak Island.

In table 8 the initial guiding fee was derived by finding the average of the fees charged by the registered guides. The sum listed as preparations for trip is an amount averaged from estimated by the guides. Travel from Seattle to Kodiak is an average taken of prices charged by the different airlines and steamship companies. The average round trip within the United States proper to Seattle was figured by taking the address of the 71 hunters of 1952 and sorting them as to states. Then choosing the main city in each state, the round trip ticket to Seattle on an airlines was figured. The average of that then was used in the table. The other figures are self-explanatory. The figures used in this table are considered conservative in all aspects and no attempt was made to produce a distorted viewpoint.

Table 10

Resident bear kills

1949	40
1950	98
1951	65
1952	<u>57</u>
TOTAL	260

Table 10 shows the total number of bear killed by resident hunters for the period 1949 - 1952. The economic value of the bear killed or hunted by the resident hunter has not been derived; however, it is safe to say that the value is not nearly as high as it is for the non-resident hunter.

Dates	Resident	Non- resident	Defense	Predator Agent	Scientific Permit	Unrecorded	Total
1948							
Total	42	33	16	0	0	25	116
1949							
Jan.-Apr.	8	6	1	0	0	0	15
May-Aug.	21	16	7	0	5	16	65
Sept.-Dec.	11	5	1	0	0	0	17
Total	40	27	9	0	5	16	97
1950							
Jan.-Apr.	4	7	0	0	0	0	11
May-Aug.	43	20	1	0	0	10	74
Sept.-Dec.	51	16	6	0	0	0	73
Total	98	43	7	0	0	10	158
1951							
Jan.-Apr.	5	10	0	0	0	0	15
May-Aug.	29	38	6	5	3	10	91
Sept.-Dec.	31	16	0	0	0	0	47
Total	65	64	6	5	3	10	153

Table 11. Bear-kill data from 1948 through 1952. (Cont. on next page)

Dates	Resident	Non-resident	Defense	Predator Agent	Scientific Permit	Unrecorded	Total
1952							
Jan.-Apr.	3	8	0	0	0	00	11
May-Aug.	30	35	7	0	3	20	95
Sept.-Dec.	24	30	0	0	0	15	69
Total	57	73	7	0	3	35	175

Table 11. Bear kill data from 1948 through 1952 (Continued)

Year	Male	Female	Unknown	Total
1948*	—	—	116	116
1949	38	13	46	97
1950	90	47	21	158
1951	87	50	16	153
1952	51	39	85	175

Grand

\* Data not available at date of writing. Total 602

Table 12. Bear-kill sex ratios from 1948 through 1952

Table II classifies the bear killed on Kodiak Island during the past five years. Table 12 classifies the bear killed as to sex, for 1949, 1950, and 1951. The latter table also shows that a total of 512 known bear were killed on Kodiak Island for the past four years, and estimate of approximately 20 bear are killed each year and not recorded, making up the remainder of the kill, 71.

Several bear are killed each year and utilized as food by the natives in the small villages on Kodiak Island. The number of bear used for food depends entirely upon the financial status of the villagers and upon the availability of the food source. Beside the bear, a great amount of reindeer and sealion is utilized.

#### Relation to the Commercial Fishing Industry

The commercial fishing industry on Kodiak Island is of relative importance to the commercial fishing industry in Alaska and especially important are the numbers of red salmon taken commercially in the Kodiak District. One area important biologically for the spawning grounds of red salmon, is the Karluk River drainage area. Biologists have studied this area and its biotics since the early 1920's and investigations are continuing to the present time. Men that have worked in this area noted that among the primary foods of the Kodiak Bear during the summer months, salmon ranked high. At the time of the earlier investigations and when the salmon abundance was comparatively large, the salmon taken by bear had little relative importance. In recent years, the salmon runs have been on a decline; consequently, any factor affecting the number of spawning salmon, rated primary concern.

The first study to determine the amount of salmon taken by bear was conducted in 1947 and subsequent studies were conducted in 1948, 1950, 1951 and 1952 on red and pink salmon streams. Results of these studies show that the amount of bear taken unspawned salmon, varies from .09 percent to 31.3 percent.

Table 13  
Bear-taken un-  
spawned salmon

<u>Investigator</u>	<u>Year</u>	<u>Bear-taken un- spawned salmon</u>	<u>Escapement</u>	<u>Species</u>	<u>Stream</u>
Shuman	1947	31.3	14,826	Red	Moraine
Shuman	1948	26.3	10,230	Red	Halfway
Lutz	1950	18.9	90,924	Red	Connecticut
Lutz	1950	26.4	24,000	Red	East
Clark	1950	9.4	?	Pink	Afognak R.
Clark	1951	1.02	10,895	Pink	Salma C.
Lutz	1952	0.09	136,390	Pink	Brown's R.
Clark	1952	19.0	1,396*	Red	Moraine

\* Fish above Moraine Creek electric fence only.

The results of the studies show that the amount of bear-taken salmon is not as great in the larger pink salmon spawning streams as occurs in the smaller and shallow red salmon streams. Also it is shown that the bear take in red salmon streams though high, is not representative of the entire Karluk River system for two reasons: (1) A considerable number of red salmon spawn along the shores of the lake proper and (2) a large percentage of the salmon spawn later in the fall.

The salmon that spawn along the lake shore are able to avoid the aggressions of the bear because escape into deep water is readily possible.

Spawning fish migrate to the small streams tributary to the lake during the early run in the spring, but these same streams are not utilized by salmon in the fall. The food preference of the bear in the fall of the year, changes to a diet of vegetation as berries ripen with the progression of the season. This variety of food acts as a buffer to the salmon and diverts the pressure of the bear on fish, to foods of no commercial value. The number of salmon taken by bear are important from a generalized standpoint, the knowledge of these factors reduce the importance of the bear as a limiting factor to the increase in the abundance of salmon on an over-all aspect.

The decline in the abundance of salmon and the resulting studies indicated the necessity for a control measure that would be applicable and would be practical, economical and effective.

Several experiments were conducted by personnel of the Branch of Wildlife Refugees, Kodiak National Wildlife Refuge, Fish and Wildlife Service, in an attempt to find such a control measure.

Noise Makers. The idea of using some type of noise maker has been suggested quite often but in no case has it proven effective. Dummy hand grenades were suggested; these were to be thrown near bears to frighten them from an area. Flights were made in an attempt to locate bear in the cattle ranching area, but no bear could be detected from the air. Bombs were dropped from a plane over a bear in the Karluk River area without conclusive results. A siren and automobile horn arrangement was attempted at Karluk Lake in 1952. This was set to function every 15 minutes. After one day of trail the 6 volt battery was so worn down that neither siren nor horn would sound. There is little in the past attempts which would encourage further trails along the same line.

Repellents Repellents have been tried at various places in the states but little success is reported. Glacier National Park Acting Superintendent , G.W. Miller (1951) writes that they have tried squirting bears with various liquid repellents along the highways, but none were found to be effective. Miller reports that Mr. Walter H. Kittams, biologist at Yellowstone National Park tested kerosene, purex and tannasol. Previously tear gas, chlorinated lime, ammonia, cresolis, creosote and carbon disulfide had been tested for effectiveness in repelling bears but none seemed to be effective.

Mount Ranier National Park Superintended P. R. Macey writes that he has tried no bear repellents; but it was reported to him that they were effective where garbage is involved, provided all the garbage is contacted by the repellent. "Otherwise", he writes, "bears will sort out untouched food".

Yosemite National Park Superintendent G. P. Russell (1951) informs that his personnel have tried several bear repellents without success.

It was felt that some repellent such as "Dogs Off" or "Cupid Chase" might be useful against bears, but reports indicate that these compounds are not effective in experiments conducted at Karluk Lake in 1952 by Clark (1952).

It is possible that some future work might prove repellents to be valuable in this type of work, if a repellent can be manufactured with a human odor as this odor has a repelling effect upon the bear.

Electric Fence Yosemite National Park Superintendent G. P. Russell (1951) writes that "An Electric fence was used successfully at the Yosemite Fish Hatchery for several years to keep bear away from the fish troughs and it is used periodically when bears become troublesome".

Storer (1938) writes that certain electric fence arrangements are quite effective in preventing raids on mountain apiaries by bear.



Yellowstone National Park Superintendent E. B. Rogers (1951) states electric fences placed along stream banks are unsuccessful, but that fences have been successful when the bears were standing in water. An electric fence was placed around mess hall but the black and grizzly bears apparently were effected very little by the electric shock.

Glacier National Park Acting Superintendent G.W. Miller (1951) writes that from his experience a well constructed fence, properly charged, is the most effective means of keeping bears from a particular area.

Mount Rainier National Park Superintendent F. R. Macey (1951) writes that in restricting black bear activity, electric fences have been found to be very effective.

Thus it is seen, that, with some exceptions, electric fences have been successfully used on black and grizzly bears and it seems reasonable that such fences would be effective against brown bears.

The main problems with the effectiveness of electric fences were proper grounding of the animals. In the arid regions of western and southwestern United States the bears seldom were well grounded and this problem was overcome by Storer in placing a well grounded length of chicken wire on the ground around the fence.

On Kodiak Island, there is little problem of proper grounding for the ground is usually moist even during the summer when less rain falls than at other times of the year. Further, the bear have large plantigrade feet which offer substantial contact with the ground. In most places where these fences were tested on Kodiak, dead and fresh grass along the fence line which might have acted as an insulator beneath the bears feet. There was some question that the heavy coat of the bears might insulate against the electric shock, but the following work tends to suppress this idea.

The first Kodiak experiments with electric fences were reported by Lutz (1951).

Two fences were tried in the summer of 1951. Both were placed on streams having red salmon runs, and neither fence was installed prior to the appearance of the salmon on the spawning grounds.

One fence was erected July 27, 1951 along Moraine Creek and enclosed an area approximately 675 feet by 15 to 20 feet during the peak of the salmon spawning. Insulators were wired to steel posts driven into the ground along the stream banks; a single strand of aluminum wire ran about three feet above the ground. The high grass had to be cut under most of the fence, but one cutting sufficed for the period the fence was in operation. This fence was dismantled 27 days after it was installed.

The battery-type charger was attached as soon as the fence was completed and was removed 3 days later for installation at another fence. The fence was not broken until August 16 or 19 days after the charge was removed. The fence was repaired and suffered no further damage through August 23. This indicated that the electric charge and not merely the fence was responsible for keeping the bears from the creek. The study below enforces this hypothesis.

Lutz (1951) writes, "When the salmon were abundant in Moraine Creek, they were fresher and perhaps more desirable to the bears in the lower portion of the stream. At that time, the fence does not prove its effectiveness as well as when the live salmon were scarce throughout most of the stream yet relatively concentrated within the fence section. At this latter time, the bear would be forced either to take salmon from within the fenced section or to move to another stream to obtain salmon. It is felt that the latter alternative was chosen here."

It should be noted that at the time the great majority of salmon were within the fenced area, the elderberry crop ripened, and therefore at least some pressure had been taken from the salmon.

The fact remains, however, that bears cleared the vast majority of dead salmon from the stream both above and below the fenced area, but left those salmon within the fenced area untouched.

One small electric fence was installed at Salmon Creek on August 3, 1951, enclosing an area of stream roughly 65 by 20 feet. This fence blocked a well-worn bear trail which ran across the creek at the place where the fence was erected, and enclosed a shallow area where salmon were extremely vulnerable. A double strand aluminum wire enclosed half the area, a single strand the remainder.

This fence was not charged until four days after it was installed and then only the top wire was charged. The fence was broken repeatedly, and arrangement similar to that at Moraine Creek. The three two year old bears which frequented the area then crawled under the fence to get inside. On August 16, 1951, the lower wire was replaced and charged. Thereafter the fence was not broken again, even though the great majority of the few fish in the stream were within the fenced area. The fence was removed August 25, 1951.

From the experimental work with the Salmon Creek fence it was found that two charged wires were necessary to prevent bear from going under the wire.

In 1952, four tributary streams at Kariak Lake were enclosed with an electrical fence similar to the type used in the 1951 studies.

The Moraine Creek (Clark 1952) was fenced with about two-fifths of a mile of electrical fence. Two strands of aluminum wire were used on angle steel posts. The wires were about one foot apart and the top wire was at a height of about three feet. The posts were set approximately 25 feet apart. Loops and short vertical wires were suspended from the fence above depressions in the ground. Clearing the strip of grass and brush was accomplished before the erection of the fence.

This fence operated and successfully excluded bear for the period of July and August, during the time that salmon were spawning in the stream.

The total cost of the fence, not including the cost of man hours, was \$228.55. Man hours spent in the erection were 272 and the time spent on maintenance amounted to 114 man hours. The cost of the man hours is not included as efficiency increased with experience and would increase more with better and more suitable equipment.

The fence was broken several times by bear. Only on serious entry was made and 100 fish were taken of which 33 had previously died naturally.

The fence protected 87.3% of the total run of red salmon in the stream. The original intention was to leave 1/3 of the run outside the fence and subject to bear depredation. Bear remained in the area as concluded by numerous trails and the bear-killed salmon above the fence. 19% of the fish above the catching weir at the upper fence were unspawned bear-taken salmon as determined by Clark, while the figure for fish inside the fence was 99.6%.

Halfway Creek (Clark 1952) was completely enclosed with an electrical fence. A single strand of aluminum wire was used about 2 1/2 feet above the ground. Few steel posts were used as the wire was attached mostly to brush along the stream bank.

A total of 1,000 feet of stream was enclosed at a cost of \$61.11, not including labor. Approximately 60 man hours were spent erecting the fence and 20 hours devoted to maintenance.

The fence was successful in all aspects. The wire was broken four times on both sides and three times on only one side. The stream remained full of swimming salmon during the time the fence operated, from July 13 to September 1 or 50 days.

Grassy Creek was fenced with a single fence constructed in the middle of the stream and not producing an enclosure to the bear.

The cost of this fence was \$48.00 with 30 man hours devoted to construction. The fence consisted of steel posts and one strand of aluminum wire. Operations started on July 26. Metal reflectors were used with little success for attracting the attention of the bear.

This fence was purely experimental, attempting to determine the minimum requirements needed to exclude the bear from a stream. The experiment was not successful and decided that a more elaborate type of fence is needed. Other investigations of this type were not justified.

The Canyon Creek-O'Malley River fence differed from the Moraine and Halfway Creek fences in that the fence was built along the sides of the stream and not on the bank.

The total cost of the fence was \$151.27 with 35 man hours used to erect the fence and 40 man hours to maintain it.

The fence was about  $\frac{1}{2}$  mile in length and consisted of a single strand of aluminum wire attached to steel angle posts on about one fourth of the stream and a double strand on the rest. The fence operated from August 19 to October 13 and was broken repeatedly since this was purely experimental as was the Grassy Creek fence in another attempt to determine the amount of fence necessary to exclude the bear.

The fence was only partially successful. One reason for this is that the power was turned off on several occasions experimentally and another reason is the fence was in the stream and not as noticeable to the bear. The stream is much larger than the other streams fenced, but a fence similar to the Moraine Creek fence should produce positive results.

Other costs entailed from the fence building experiment were costs of supplies and equipment that were used in the construction and maintenance of all of the fences. The items included machetes, sickles, scythes, saws, files and pliers which amounted to \$31.53. This cost can be carried over from one year to the next and these items are not expendable for the most part; however, replacement parts will be needed from time to time.

Each fence was powered with one pulsating-type battery fence charger and 12 gauge aluminum wire. The pulsating type of charger was selected since use of this type charger with domestic animals has been found more effective. Each pulse from the charge is surprisingly strong, but according to the manufacturers literature supplied, is safe for human handling. The aluminum wire was chosen because it has less resistance to the electrical charge, consequently the charge remains stronger, longer. The angle steel posts made especially for electrical fences were chosen for convenience in handling and because of the durability of the posts. The posts were about five feet long with a six inch square plate fastened at about one foot from the bottom. These posts were satisfactory but difficulty was found in driving them into the ground in several places due to large rocks and gravel predominant in some places. The insulators were the regular commercial stock supplied for this type of fence.

A total of \$521.16 was spent in the fencing experiments at Karluk Lake in 1952. The two successful fences which consisted of one and one-fifth mile of fence cost \$289.66. Therefore, it cost \$241.91 to build an electrical fence for one mile. It must be noted that once the articles are purchased they remain usable for a long period of time and it will be necessary to purchase only those articles each year thereafter that will be included in maintenance and repair. Aside from that figure there will be the cost of equipment for grass cutting or destroying, brush clearing and ground leveling. The costs of these items as can be seen from the listed costs of this year, is not excessive.

In Relation to the Livestock Industry

Cattle The Kodiak bear and the livestock on Kodiak Island form an incompatible relationship within the same area. While this relationship has always been the same the consequence was much more serious during the early days of the industry. This was due to several reasons: one, there were only a small number of cattle in comparison with today's herds; second, the natural mortality was higher probably because of the unfamiliarity of the ranchers in running cattle on Kodiak Island; and third, there were more bear within the ranching area. The natural mortality coupled with the bear mortality caused a serious drain on the herds of livestock.

The pressure then, as it is today, was put on the bear. Stories of bear killing cattle are publicized widely but little is said about the deaths of cattle due to natural causes. This is true in the reports turned in to this office in years past.

Table 14

Total Recorded Mortality of Cattle on Kodiak Island

<u>Year</u>	<u>Reference</u>	<u>Bear</u>	<u>Natural</u>	<u>Missing</u>	<u>Total</u>
1927	(13)		1		1
1928	(13)	1			1
1929	(13)	5			5
1930	(13) (26)	1	8		9
1931	(26)		20		20
1932	(13)	1		2	3
1933	(13)	1			1
1934					
1935	(13)	4			4
1936	(13)	5			5
1937	(13)	36	1		37
1938	(13)	12	20		32
1939	(13) (26)	29	108		137
1940	(13) (3)	5	17	17	39
1941	(3)	24	13	13	50
1942					
1943					
1944					
1945	(2)		15		15
1946	(2)	2	15		17
1947	(2)		12		12
1948	(2)		10	3	13
1949	(4)	2		2	4
1950	(4)	19	9		28
1951	(4)	10	19		29
1952	(10)	4	11	1	19
		<u>161</u>	<u>279</u>	<u>41</u>	<u>481</u>

Table 14 shows the cattle mortality as recorded for the corresponding years for the period 1927 through 1952. Biologists were assigned to Kodiak to study bear-cattle conditions during the years of 1938, 1939, 1951 and 1952. The other figures were taken from the report and field notes of A.C. Kinsley (1940), and from field notes of former Refuge Manager Frank Beale on file in the Kodiak Refuge office. This table shows the 66 2/3% of the total bear mortality to cattle from 1927 through 1952 occurred during the years of 1937, through 1941. This high point probably coincided with the peak of bear population on Kodiak Island, especially in the Chinik Peninsula area.



In 1941 a rancher put 28 head on Outlet Cape, a remote unsettled area, and lost at least 15 head. This rancher was, of course, forced out of business. After these disastrous years there was a decided decrease in the number of bear-killed cattle. There are several reasons for this. The most obvious one is that the Navy constructed a Base at Women's Bay in 1940, extending roads and building outposts throughout the Chiniak Peninsula. This permitted a heavier take of bears in the cattle area and at the same time, because of the vastly increased human activity, discouraged the movement of bears into the area. Alluding to this, Wildlife Agent Benson reported to the Executive Officer of the Alaska Game Commission in a memo dated May 22, 1941, that bear were becoming scarce in the Middle and Kalain Bay region. At the present time the number of bear within the area of ranching, or traversing the ranching area, is very low. Human activity, although slowing off in the Chiniak area immediately after the war, has increased again and therefore bears will continue to decrease.

Of the 481 head which is the total known mortality of cattle since 1927, 33.5% was due to bear kills, 58% due to natural causes, and 8.5% are listed in the missing class. For the period from 1945 through 1952 the mortality to cattle within the ranching area was 137. This total number reveals that 91 animals or 66 per cent represent the natural mortality. Bear have been responsible for the death of 37 cattle or 27 per cent of the total deaths, and 9 head or 7 per cent are considered missing. This period was chosen for this computation as it is representative of the latest years of the ranching operations.

The past two years show a mortality of lesser importance particularly since the herds have increased as compared to former years, and the number of bear on the Chiniak Peninsula have decreased. During 1951, 3.87% of the herd succumbed to all caused of mortality.

Bear mortality was the cause of 1.43% of the herd. The figures derived in 1952 show an increase in the total number of cattle but a decrease in the mortality to 2.5%. Of this percentage, 1.43% is attributed to natural causes, .53% to bear and .53% to the missing class.

Due to the fact that the figures given by the ranchers on the number of cattle harvested during the past two years are contradictory and not accurate, the following figures were taken from Burkholders report (1951) on herd composition of cattle; these figures are used as representative of the harvest of cattle on the range during the past two years. Cattle are not bred until the age of 22-24 months; therefore, more cattle are actually listed as breeder stock under the heading Agriculture than are used here. These figures show that 311 cattle have been bred and a birth success ratio of 80% was attained. This gives a total of 249 calves for the year. Considering a 54% male sex ratio, 135 calves were steers. This figure plus a 20% cull number, 105, equals 240 cattle harvested; this then is multiplied by \$300.00, the local value of a two year old steer, giving \$72,000.00. This is the total income for the year among all of the ranchers within the Chinik area.

The composition of the kills made by bear during the past three years is as follows: 8 adult cows, 4 calves, 6 yearlings, 5 steers (2 year olds) and 2 steers (3 year olds).

From these figures it does not appear that the bear are selective considering the size of the animal taken. Muris (1948) in Wyoming found that the grizzlies (Ursus horribilis) were selective in that the bear took a larger number of calves and yearling. The only reason to explain this is the generally larger size of the Kodiak Brown Bear.

After observing several of the cattle that were killed by bear, it does not appear that bears become "killer bears". Hoffman (1952) reported two adult cows killed at Pasagashak Bay by bear. These cows were killed in a brush growth in close proximity to the main herd of cattle. Hoffman (1952) reported two yearling calves as being killed by bear. These two yearlings were killed very close to the remainder of the calves. In both cases, it would seem apparent that the bear could have killed any number of the cattle that it choose. Evidence shows that one bear remained in the area for several days after the kill. A well used bed was found and trails from it were numerous that had not been visible one week previous. This evidence was found about 400 yards from where the yearlings were pastured. Had the bear been a "killer bear", it seems more yearlings would have been killed.

One point worth mentioning is that when bear or other animals are killed within the cattle area, the odors of decomposition become very strong and these permeate the air. This is one of the attracting influences that would draw bear into the area.

Horses There does not appear to be any incompatible relationship between horses and the Kodiak bear. Only one record is known of a bear killing a horse. This horse was a mare.

The horse has a fairly acute sense of odor and probably smells the bear, if one should be in the area, and escapes before an attack is made. Perhaps, too, the bear does not stalk animals, but rather finds them.

Sheep The only sheep that are being raised in the Kodiak Island vicinity are on Harvester Island, one of the small islands in Uyak Bay. This is a bear-free island and consequently no trouble has arisen. Rumors are that 22 sheep were killed by bear when an attempt was made to raise sheep on the western side of Kodiak Island and across from Sitkalidak Island. Whether this report is authentic or not is not known.

Swine Hogs have only been sparsely raised on Kodiak Island and in each case in close proximity to a village. Consequently, no trouble between bear and hogs is known. Because of the lack of grains and essential foods this is not considered a good country for hog propagation.

Goats In 1938, Palmer reports 21 goats on one of the ranches on the island. When the rancher sold out his ranch the goats were not cared for and drifted from the homestead; they are now living in a wild state in the vicinity of Anton Larsen's Bay and around Kizhuyak Bay. Six of the goats are found this spring washed up on the beach at Anton Larsen's Bay but death was apparently due to some natural cause. These animals have become very wary and deftly live in their chosen habitat.

In relation to other Animals

Fish Dolly Varden trout are sometimes eaten by bear but not in appreciable numbers. Since the trout average less than ten inches in the streams and because the larger trout habitually remain in deep pools or in lakes they are not easily caught by bears. The occasional Dolly Varden trout found on stream banks were probably caught as they swam over shallow riffles or possibly died naturally and were then eaten. Probably steelhead or rainbow trout are sometimes caught by bear but no evidence of this is known.

Salt water fish which die and are washed up on the beaches are eaten occasionally by bear whenever they are found. Herring spawn in the shore waters and deposit adhesive eggs in enormous quantities on kelp, logs, seaweed etc. The bears then eat large numbers of these eggs which are available at low tide, or when loose pieces of kelp or seaweed covered with eggs wash to shore.

Birds      Birds and bears normally affect each other only remotely; bears kill salmon and gulls feed on the parts left. Gulls often blind salmon by pecking at their eyes as they go through shallow water and these fish are subsequently easily caught by bears. Bears are known to raid gull rookeries when possible. Bears often walk past gulls along the streams and apparently pay little or no attention to them.

Feeding bears have been seen to bat at American Magpies hovering above them but they probably never hit one. Magpies often annoy bears feeding on salmon by trying to steal parts of the salmon. Eagles, magpies and other scavengers will feed on salmon which the bear have killed and not completely eaten.

Generally speaking, the interrelationships between birds and bear are little known and probably of small importance.

Mammals, Game and Non-game      Bears are large mammals and are preyed upon by no other animal except humans. Bears, fox and weasels often feed on the carcasses of bear.

Bear will dig ground squirrels from their burrows. They may go after weasels but it is not likely that a bear kill many. Voles are sometimes taken when available. Bear will attempt to dig out land otter dens and otter remains have been found in the stomach of one bear. Varying hares are probably eaten when found dead and it is reported that bear eat beaver.

Bear will usually eat carrion found along the seashore. Reports of bear feeding on hair seals, sealions and whales have been received and it is likely that they also feed on fur seals, porpoises and dolphins.

Domesticated reindeer have been placed on Kodiak Island by the Alaska Native Service and it has been reported that bear both kill these and feed on carcasses found dead. On e case is reported in which a bear was attacking an elk on Afognak Island, but the bear was shot before it did any visible damage to the elk.

Bear are at various times adjudged to be a great danger to humans. True, an occasional bear will attack a human, but usually this situation results from (a) a wounded bear, (b) a female with cubs to protect or (c) a bear surprised in close quarters. Further, when a bear does attack a human the fact is widely publicized.

Whenever the bear is in close contact with humans, it is almost always the bear who suffers from the encounter. Man is the bear's only enemy on Kodiak Island.

## H. Proposed Management Policies

### 1. Management Districts

The management districts as herein described will be used as a means of managing the population of brown bear on Kodiak Island. Should the need arise, any of the districts could be closed to all hunting entirely as in the past. The number of cabins or cabin units will be limited within each district; thereby, somewhat distributing the hunting pressure. The Uyak mountain area will be used as a sanctuary whenever the need arises as a nucleus of the population of bear or a portion of the breeding stock that will feed the other areas.

The management districts will be used in determining the number of bear and the trends of the bear population on the island. The bear hunting pressure will be determined by the use of the basic plan used to find the bear population and as has been described. From this, the population of bear within each district and the safe limits of allowable harvest can be computed.

As an example of the management of the Kodiak brown bear within an area of Kodiak Island, district H has been chosen. This district was chosen because it lies in the center of the district, biological work was carried on there last season and of the conflicting interests that occur. Clerk found a minimum number of bear at Karluk Lake to be 124. This was obtained from daily observations. Computing this 20% of the total number of bear around Karluk Lake is added to the 124 bear estimated and a total of 154 bear are estimated to be within the lake area proper. Therefore, using the percentages as found in table 5 between the total number of bear and the number killed per year, it is found that 19 bear could be killed at Karluk Lake area only, each year and still maintain the numbers. Last year, 1951, 24 bear were killed within this area and 19 bear were killed there this year.

These figures show that a sufficient kill is being exerted upon the Karluk lake area and that the kill is such that it produces a control factor in the immediate area. The kill in 1952 would have been higher except for two things. First, the late spring forced hunters and guides into other areas prior to May 25 and consequently fewer spring bear were taken. Secondly, two guides with hunters stayed away from the lake part of the fall season because of the activity at the lake coupled with the scarcity of bear in September and the first part of October.

This type of management can be used and improved upon as the proper biological information is learned through a period of years.

Table 15

Minimum District H

Year of life	Total Number	Males	Hunting Loss	Natural Loss	Female	Hunting Loss	Natural Loss
9	6	0	0	0	6	2	0
8	8	0	2	0	8	3	0
7	13	2	2	0	11	2	0
6	17	4	8	0	13	1	0
5	26	12	6	0	14	1	0
4	33	18	3	0	15	0	1
3	37	21	0	2	16	0	3
2	42	23	0	7	19	0	10
1	59	30	0		29	0	0
Total	241	110	21	9	131	7	14



Table 16  
Maximum District H

Year of life	Total Number	Males	Hunting Loss	Natural Loss	Females	Hunting Loss	Natural Loss
9	8	0	1	0	8	1	0
8	10	1	1	0	9	4	0
7	15	2	3	0	13	3	0
6	22	5	10	0	17	1	0
5	33	15	8	0	18	0	0
4	41	23	3	0	18		1
3	45	26	0	2	19		6
2	53	28	0	9	25		11
1	<u>73</u>	<u>37</u>	<u>0</u>	<u>0</u>	<u>36</u>		<u>0</u>
Total	300	137	26	11	263	9	18

Table 15 shows a hypothetical constant of the minimum population of the bear within district H and table 16 shows the population as it has been computed. The figures from these tables show that a maximum of 35 bear can be taken per year from this district and still maintain the numbers of bear. However, any more than this will reduce the population until it reaches 241,,and then more than 28 bear taken per year would ultimately reduce the numbers seriously.

## 2. Bear harvest-Annual Limits

Table 7 shows that theoretically a total of 204 bear can be taken from Kodiak Island each year and still maintain the present population. This table also shows the percentage of bear killed allowed in each district. The bear kills on Kodiak Island have increased during the past three years. The estimated unrecorded and illegal kills vary between 20 and 50. Therefore,

according to the kill figures, the increase of numbers of bear killed per year is minimum.

### 3. Hunting regulations

The Alaska Game Commission was created by an Act of Congress dated January 13, 1925, which organized a group of five men empowered to institute laws relating to fur animals, game and non-game animals and birds, and sport fishing within the Territory. The Executive Officer of the Commission is a representative of the Fish and Wildlife Service and is appointed by the Director of the Fish and Wildlife Service. The other four members are appointed by the Secretary of the Interior, normally for a four year term. Each of these four members must be a resident citizen from the Judicial district from which he is appointed and must have been an Alaskan resident for at least five years before his appointment.

#### Hunting, Resident and Non-resident

Hunting will be allowed according to the current Regulations of the Alaska Game Commission. Every attempt will be exercised to adjust the hunting pressure according to the findings of the studies, to the areas where a limited amount of control is necessary.

According to the Alaska Game Commission 1952-1953 Regulatory Announcement, the following regulations pertain to the hunting of the Kodiak Brown Bear:

1. All bear hunters must be currently licensed with the exception of Alaska Indians and Eskimos (1/2 or more Indian or Eskimo blood) and Territorial residents under 16 years of age.

2. Non-resident hunters must, in addition to paying \$50.00 non-resident license fee, employ the services of a registered licensed guide.

3. Any person classed as an alien by the Alaska Game Commission must purchase an alien special license to hunt big game.

4. Export and export and return permits for trophies and meat must be purchased by residents; non-resident licensed hunters receive the permits free of charge.

5. Any bear may be taken for food in an emergency if other sufficient food is not available, but no part of any animal so taken may be transported or sold.

6. No bear may be used as food for dogs of fur-bearing animals except the waste parts, further, no part of a bear may be used as bait.

7. Bears may be taken only with a shotgun (capable of holding no more than 3 shells and not larger than 10 gauge), rifle or pistol using center-fire ammunition.

8. The direct aid or use of the following are prohibited: dog, machine or submachine gun, set gun, bow and arrow, spear, pit deadfall, fire, jacklight, searchlight or other artificial light, two-radio communication or artificial salt licks, aircraft, motor vehicle, motorboat, or any other boat except one propelled by paddle, oars, or pole. Animals in the water may not be taken.

9. Bears may be taken by hunters only from September 1 to June 20.

In the Kodiak-Afognak Islands group, there is a seasonal limit of 1 bear per hunter.

#### 4. Control Measures Regarding Fisheries.

The decline of the number of commercial fish has been a problem for many years in the Kodiak area. In consequence, any great loss of spawning salmon is serious at present.

The loss considered here is that of unspawned salmon which are taken by bear. Much has been said about these salmon concerning the percentages and the values of the loss. The most important fact remains that the investigator's on similar red salmon stream studies, have found that from 19% to 31% of the unspawned red salmon are taken by bear. This and the fact that within the Karluk Lake system the runs of red salmon are presently at the lowest numbers allowable according to fisheries management practices, indicate that a method of artificial and immediate control should be adopted. The electrical fence as was used successfully at Karluk Lake in 1951 and 1952, is the most logical solution from all standpoints.

The operation of the fence is economical; however, the initial expense would naturally be more excessive as it would be necessary to do a great amount of ground clearing for the primary construction of the fence. The same material could be used the following years.

One of the main advantages of this control method is that the effect will be immediate in the precise place where control is needed and would not entail a program of many years before the results could be shown. This would afford the lake system the additional number of spawners which is needed.

This area is primarily a refuge for the Kodiak bear and because of the depredations on salmon, a means was sought to decrease the seriousness of the situation. The refuge has found this means and offers it as a solution. If the Fisheries Management Biologists feel that the situation merits expenditures to protect these salmon, this method of control is suggested. It is felt that this type of operation should be conducted by the branch of Fisheries Management as this is a fisheries problem.

There seems little need for extensive fence erection throughout the island. Work on pink salmon streams has shown that bears do relatively little damage to these spawning salmon. The main fencing would be required on lake systems where the salmon enter the shallow and fairly narrow tributary streams to spawn. Here they are quite susceptible to depredations and here the fencing would be best utilized. The following lake systems are suggested as possible sites for fencing: Karluk, Red, Little River, Upper Station and Akalura. The greatest consideration should be given the Karluk and Red Lake systems as these are the most important areas in the perpetuation of the red salmon populations on Kodiak Island.

At present a continual removal of bear by big game hunters is occurring in the Karluk area. A type of control is being effected here which removes many of the surplus animals. At times when the bear become scarce, the guides will take the hunters to other areas.

In the future, should the bear become excessive in any one area and endanger the salmon population, refuge personnel could force greater hunting pressure in that area by limiting the kill elsewhere.

##### 5. Proposals in regard to livestock industry

Any ranching expansion should be limited to the area on Chiniak Peninsula by policy. The one mile strip of land around the periphery of Kodiak Island should not be utilized by ranches. On the basis of an average sized grazing lease on Chiniak Peninsula, 25,852 acres, 40.4 miles of this one mile beach line would be needed. This is an excessive distance to run cattle economically particularly, in the rough and rugged terrain that occurs on Kodiak Island.

The ranch would have to be a self-contained unit. Living conditions on an island in an isolated place would indeed be severe. Should a herd be started, there would be difficulty in getting the beef to Kodiak in first-class

condition.

There have been no range examinations on the southern part of Kodiak Island so far as is known. Studies to determine the range available and the carrying capacity of the acreage should be determined.

Bear are numerous on that part of the island and a great loss would be entailed by the rancher. Two ranchers in the past have put herds in remote areas and consequently suffered a great loss.

The small outlying islands around Kodiak could be utilized by ranching and they are bear free. There are greater possibilities that a self-contained unit could be maintained on the small islands than elsewhere. Most of these islands were once utilized and could be again. These islands would certainly be preferable to the one mile strip around Kodiak Island.

The general conformation of the southern end of Kodiak Island with muskeg and marshy flatlands and tundra-like vegetation appears to have greater possibilities for the production of reindeer. An industry utilizing the excess of the reindeer herds could be established with fewer difficulties than the production of cattle would entail. This domestic animal is suited to the elements and conditions as occurs on the range of the southern portion of Kodiak.

The Chiniak Peninsula is typically good bear habitat as it is mountainous and interspersed with river bottom valleys. Although this rugged terrain has made control somewhat difficult, records show that bears are decreasing steadily in the area. A classical answer made by one of the ranchers when questioned as to what he thought proper control measures should be was that, "Kodiak Island should be open to ranching and the ranchers would soon take care of the bear."

Cooperation will be extended to the ranchers in every phase of the bear-cattle problem within reason and policy. Thought and activities will be directed toward a closer liason between the opposing factors. Activities will be directed to find a workable control measure that will not lead to the extermination of the bear.

The conflict of game versus domestic animals is not an unusual one and it occurs in many places in the United States. This same type of conflict occurred in Wyoming (Murie, 1948) and the method of control exercised was trapping and hunting with dogs. Trapping was done at the cattle kills in hopes of catching the bear that did the killing. Trapping the Kodiak bear would present a problem because of its size but could be accomplished by the use of a large steel trap set at the carcass. This presents some disadvantages. First, trapping so large an animal would be considered inhumane by many people and much criticism would likely result. Secondly, the operation would be very costly as a considerable amount of time would necessarily have to be devoted to this activity by local personnel. It might take as long as ten days before the animal would return to the carcass if it returned at all. Thirdly, this control is not preventative. For these reasons trapping is not considered a satisfactory method of control.

A bounty system is not considered a feasible policy of control; this is, therefore, not discussed here.

The control of bear by a Government official could be accomplished by the addition of a control agent to the local office. It would be necessary to provide horses and equipment for satisfactory results. However, this is not considered a sound policy as the expenditure would be excessive. Then too, it would be an ever expanding program.

The above mentioned control systems have been suggested as possible measures to be used in the elimination of the bear on the cattle range and therefore they were mentioned.

The most desirable type of control would be a system that would require a very small amount of attention as a permanent measure. Along these lines there is one method worthy of mention and that is to encourage the opening of Chiniak Peninsula further with roads. The place under consideration is from Middle Bay to Saltery Cove, a distance of 12 and 1/2 miles. A road now exists for 9 and 1/2 miles of that distance south from Middle Bay. The condition of the road as it now stands is as follows: 5 miles from Middle Bay south, in need of minor repairs; 4 and 1/2 miles in need of major repairs and 3 miles of complete road building. This road was built for Military purposes but was abandoned several years ago. It would now be under the direction of the Alaska Public Works, Road Commission.

This road would provide the following:

1. Open more area to hunting of all kinds
2. Increase activity into the central part of the Chiniak Peninsula where it is needed.
3. Provide better access to the ranches on Ugak Bay side of the Chiniak Peninsula.
4. Open area for all recreational purposes.

Ranchers as a group could erect a substantial barbed or electric wire fence along this road as a barrier to the bear.

For the past 50 years, wilderness areas that have been opened by roads for settlement have undergone a marked decrease in wildlife abundance and variety. This, it is felt, would occur in this area.



Local personnel of the Fish and Wildlife Service will continue to direct hunters into areas of the Chiniak Peninsula, Kishuyak Bay, and Ugak Bay. Every year there are bear taken from these areas. Every attempt will be made to encourage licensed guides to hunt these areas as these men are considered as among the best bear hunters on the Island.

The Akhiok reindeer grazing lease on Kodiak Island issued to the Akhiok Native Village includes all of the land on Kodiak Island lying south-west of a line beginning at the mouth of Sturgeon River thence in a south-easterly direction of the Sturgeon River and along the westerly shore of Karluk Lake and continuing to the head of Kaliguak Bay. This lease will expire in February 1953 and should be issued again to expire in February 1973. A lease should also be issued for the area outside of the refuge for this same period.

Table 17  
Birds commonly seen in vicinity of Kodiak Island

Common Loon	Northern Phalarope
Pacific Loon	Parasitic Jaeger
Grebe(s) (sp.?)	Glaucous Gull
Brandt's Cormorant	Glaucous-winged Gull
Whistling Swan	Herring Gull
Mallard	Short-billed Gull
Gadwall	Bonaparte's Gull
European Widgeon	Kittiwake
Pintail	Arctic Tern
Green-winged Teal	California Murre
Scaup (sp.?)	Pigeon Guillemot
American Goldeneye	Marbled Murrelet
Harlequin Duck	Horned Puffin
King Eider	Tufted Puffin
Pacific Eider	Hawk Owl
Stellar's Eider	Belted Kingfisher
American Sooter	Three-toed Woodpecker
White-winged Sooter	American Magpie
Surf Sooter	Raven
American Merganser	Crow
Red-breasted Merganser	Black-capped Chickadee
Coopers Hawk	Water Ouzel
Bald Eagle	Winter Wren
Gyr Falcon	Varied Thrush
Sparrow Hawk	Hermit Thrush
Willow Ptarmigan	Golden-crowned Kinglet
Rock Ptarmigan	Alaska Yellow Warbler
Black Oyster Catcher	Pileolated Warbler
Wandering Tattler	Pine Grosbeak
Greater Yellowlegs	Redpoll
Wilson's Snipe	Savannah Sparrow
Spotted Sandpiper	Golden-crowned Sparrow
Saundersling	Fox Sparrow
	Snow Bunting

Table 18

Birds infrequently seen in vicinity of Kodiak Island

Sooty Shearwater	Buffle-head
Pink-footed Shearwater	Old Squaw
Slender-billed Shearwater	Snowy Owl
Beal's Petrel	Short-eared Owl
Canada Goose	Black Turnstone
Black Brant	Ruddy Turnstone
Emperor Goose	Golden Plover
White-fronted Goose	Semi-palmated Plover

<u>YEAR</u>	<u>CANNTRIES OPERATING</u>	<u>TRAPS OPERATING</u>	<u>TOTAL PACK IN CASES*</u>
1928	16	35	312,787
1929	19	42	542,009
1930	18	45	186,297
1931	13	25	577,620
1932	11	21	394,063
1933	10	21	498,426
1934	11	27	655,691
1935	13	27	703,036
1936	13	26	654,424
1937	14	26	933,618
1938	13	26	677,034
1939	13	26	791,374
1940	12	26	611,796
1941	13	23	710,891
1942	12	22	484,728
1943	10	20	732,070
1944	12	22	539,736
1945	12	23	716,977
1946	12	23	648,977
1947	13	22	609,928
1948	15	23	496,352
1949	17	22	347,530
1950	16	22	477,855
1951	14	20	278,112
1952	12	19	481,978

\* 48 1 lb. cans/case

Data from Lindsley (1952)

Table 19. Operating canneries and traps with total pack data for the Kodiak fishery.

<u>YEAR</u>	<u>ESCAPEMENT</u>	<u>CATCH</u>	<u>TOTAL RUN</u>
1921	1,500,000	1,643,000	3,143,000
1922	400,000	658,000	1,058,000
1923	694,000	731,000	1,425,000
1924	1,109,000	891,000	2,000,000
1925	1,621,000	1,323,000	2,944,000
1926	2,533,000	2,387,000	4,920,000
1927	873,000	714,000	1,587,000
1928	1,094,000	1,001,000	2,095,000
1929	901,000	227,000	1,128,000
1930	1,096,000	158,000	1,254,000
1931	874,000	751,000	1,625,000
1932	738,000	674,000	1,412,000
1933	987,000	826,000	1,813,000
1934	1,147,000	918,000	2,065,000
1935	877,000	654,000	1,531,000
1936	1,376,000	1,077,000	2,453,000
1937	1,265,000	1,071,000	2,336,000
1938	1,076,000	984,000	2,060,000
1939	706,000	510,000	1,216,000
1940	719,000	452,000	1,171,000
1941	867,000	698,000	1,565,000
1942	629,000	507,000	1,136,000
1943	985,000	807,000	1,792,000
1944	827,000	642,000	1,469,000
1945	659,000	675,000	1,334,000
1946	443,000	228,000	671,000
1947	484,000	111,000	595,000
1948	753,807	651,226	1,405,033
1949	690,390	432,943	1,123,333
1950	756,561	468,047	1,224,608
1951	672,922	149,413	822,335
1952	555,575	218,791	774,366

Table 20. Red salmon escapement and catch records for the Karluk district, Kodiak Island.

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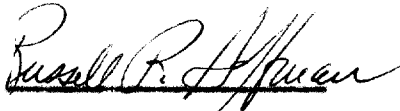
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