Annual Report FOR 1959

Department of
SH AND GAME

STATE OF ALASKA

1959
ANNUAL REPORT

STATE OF ALASKA
Alaska Board of Fish and Game
and
Alaska Department of Fish and Game

WILLIAM A. EGAN
Governor

RICHARD JANSON, JR.
Chairman

C. L. ANDERSON
Commissioner

REPORT NO. 11
JUNEAU, ALASKA

TO:
THE GOVERNOR OF ALASKA
MEMBERS OF THE STATE LEGISLATURE AND THE
CITIZENS OF ALASKA

Herewith is submitted the eleventh Annual Report of the Alaska Board of Fish and Game.

This report covers the activities of the Board and the Alaska Department of Fish and Game based on the calendar year January 1 to December 31, 1959.

C. L. ANDERSON, Commissioner
RICHARD JANSON, JR., Chairman
OSCAR DYSON, Member
ARTHUR H. HAYR, Member
ROBERT I. MARTIN, Member
DAN S. ROSS, Member
ERLING STRAND, Member
ROY R. SELFRIDGE, Member
ARNOLD BROWER, Member

The Alaska Fisheries Board and the Alaska Department of Fisheries were created by the 19th Territorial Legislature March 21, 1949. In 1957, these became the Alaska Fish and Game Commission and the Alaska Department of Fish and Game respectively. In 1959, by legislative action, the Alaska Fish and Game Commission became the Alaska Board of Fish and Game. For all practical purposes, these are a continuation of the Alaska Fisheries Board and the Alaska Department of Fisheries and accordingly these reports are numbered consecutively.

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ALASKA BOARD OF FISH AND GAME

Since Alaska will assume control of the fish and game resources on January 1, 1960, a synopsis of the means provided by the State to insure for the conservation and wise use of its fish and game resources is pertinent. The Constitution of the State of Alaska recognizes the importance of the fish and wildlife resources in the economy and well-being of the people. In the section on Natural Resources, provision is made that wherever occurring in their natural state, fish, wildlife and waters are reserved to the people for common use. This section also states that fish and other replenishable resources belonging to the State shall be utilized, developed, and maintained on the sustained yield principle.

Chapter 64, Session Laws of Alaska, 1959, known as the Organization Act of the State, names as one of the principal state departments the Department of Fish and Game. This insures that the Department and the fish and game resources are accorded cabinet status under the Governor. The Organization Act was implemented by the Fish and Game Code, Chapter 94, Session Laws of Alaska, 1959. The Code sets up the machinery for the protection, management, conservation and restoration of the fish and game resources of the State. It provides that the primary regulatory authority for fish and game is vested in the Alaska Board of Fish and Game.

The Board consists of eight persons who must have a general knowledge of the fish and game resources of the State. The Board Members are selected without regard to political affiliation or special interest; they must be United States citizens and residents of Alaska. Members of the Board are appointed by the Governor subject to confirmation by a majority of the members of the legislature in joint session. Each Board member serves a four-year term and the terms of the Board members are staggered.

The Board of Fish and Game has the power to set apart fish and game sanctuaries, reserve areas and refuges, establish open and closed seasons, means and methods employed in the pursuit, capture and transport of fish and game, it sets the quotas and bag limits of taking of fish and game, classifies the fish and game, etc. The Fish and Game Code provides that the Board of Fish and Game shall establish advisory committees throughout the State. Members of the advisory committees are in effect advisors to the Board of Fish and Game on fish and game matters.

The executive officer of the Department of Fish and Game, and the ex-officio secretary to the Board of Fish and Game, is the Commissioner. He is appointed by the Governor for a five year term from a list of names submitted by the Board of Fish and Game. His appointment is subject to confirmation by a joint session of the legislature. The Commissioner is vested with the administrative, budgetary and fiscal powers of the Department. He is charged with the duty of managing, protection maintaining, improving and extending the fish and game resources of the State in the interest and economy and general well being of the State.

Two types of regulations are promulgated by the Board of Fish and Game and the Commissioner—permanent and emergency. A permanent regulation remains in full force and effect until rescinded or amended by subsequent action. Permanent regulations are promulgated by the Board of Fish and Game, for the most part. In order for a regulation to be permanent, it must be proposed and wide publicity accorded the proposal. Comments are solicited from interested persons with regards to the proposal. At least 30 days must lapse after the proposal is made before it can be considered by the Board of Fish and Game for adoption. At the adoption meeting, a public hearing is held so that interested persons may comment to the Board of Fish and Game on the proposal. Upon adoption by the Board, the regulation is filed with the Secretary of State and becomes effective 30 days after filing. An emergency regulation, on the other hand becomes effective immediately after being filed and upon proper notice being given to the public. This regulation automatically terminates at the end of 90 days if not amended or revoked prior to that time.

The Commissioner of Fish and Game has been enpowered, when circumstances require, to summarily open or close seasons or areas or to change weekly closed periods on fish or game by means of emergency orders which have the force and effect of law after field announcement. The Commissioner may authorize staff members to act in his behalf in connection with the emergency openings and closures.

The Board of Fish and Game held its spring 1959 meeting in May at which time C. L. Anderson was reappointed Commissioner of the Department of Fish and Game by the Governor from unanimous recommendation by the Board.

The Fall meeting of the Board was held in Juneau on November 16, 1959 in order to adopt regulations for Alaska's fish and game. This was an historic meeting since it was the first time in Alaska's history that regulations for fish and game were made by an Alaskan territorial or state body. Regulations were adopted at this session for the conservation and wise use of Alaska's fish and game resources to be effective January 1, 1960, when the State of Alaska assumed control of its fish and game resources.

ADMINISTRATION

Commissioner
C. L. Anderson

C. L. Anderson, Alaska's first Commissioner, is an Alaskan of long standing who has an intimate and personal knowledge regarding Alaska's fish and game resources. A brief sketch of Mr. Anderson's background is presented at this time in order to acquaint new Alaskans and others with their Commissioner.

"Andy" as he is known in Alaska came from pioneer Alaskan stock for his father traveled up the Yukon River in 1887 to the Klondike where he went in business. From there the family moved to Fairbanks where Andy received his first schooling. Andy's advanced education was at the University of Washington from which he graduated in 1917 with a Bachelor of Science degree in zoology, with a major in fisheries.

During the years immediately following graduation, Andy worked for the Bureau of Fisheries in Alaska and on both coasts of the United States, and for five years he was an instructor at the College of Fisheries of the University of Washington. One summer he was employed as the chief inspector for the National Canners Association, covering all salmon canneries in Southeastern Alaska.

From 1921-22 Andy studied fisheries in Norway under Professor Helland-Hansen, a world recognized fisheries authority, and did research on the commercial fisheries of Norway. Andy earned his Master of Science degree from the University of Washington in 1924 after which he entered employment in the fishing industry as superintendent of the Franklin Packing Company in Prince William Sound, Cook Inlet and Kodiak areas, and in operating his own fishing business, the Perfection Smokery in Seattle. In 1943, Andy sold the smokery and accepted a position with the Washington Department of Fisheries where he worked as assistant director and finally acting director until he came to Alaska in 1949.

The 1949 Alaska Legislature passed an Act, creating an Alaska Department of Fisheries, Chapter 68, SLA 1949, in an effort to supplement and complement the programs of the Federal Government. Alaskans were seriously concerned with the decline in salmon abundance. C. L. Anderson was asked to take over the task of organizing the Territorial department as its first Director. Andy arrived in Juneau in the spring of 1949 and set up an "office" in a hotel room. From this meager beginning, as the years went by, Andy's efforts demonstrated to Alaskans his outstanding administrative, scientific and other abilities. One cannot outline his accomplishments for Alaska in this brief sketch; however, there are milestones in Andy's career which do bear enumeration.

Andy set up programs in biological research within a year after he took office. Investigations on black cod and the king and silver salmon troll fisheries were initiated. In 1951, a sport fish program was started in Interior Alaska to meet the increasing demands placed on the sport fish stocks by the heavy angling pressures adjacent to the highway systems. In addition, the commercial fisheries division had its inception with work started in the Kodiak area. Realizing the importance of reference material to research and management, a comprehensive

library on fish and game was set up in the Juneau headquarters of the department. Predator control investigations were initiated with a study of the depredations caused by the beluga whales in Bristol Bay. Hair seal control programs were carried on in the Copper River Flats, Taku and Stikine Rivers.

Research on fish and game department organizations had convinced Andy that it was in Alaska's best interest to have the fish and game resources under the jurisdiction of one department. This was his recommendation to the Constitutional Convention of 1956 and to the 1957 and 1959 legislatures. In 1957, the Department of Fisheries was reorganized by Chapter 63, SLA 1957 to the Alaska Department of Fish and Game. This was followed by Chapter 94, SLA 1959, the Fish and Game Code of Alaska, which is the Act creating the present Department of Fish and Game.

Throughout the years, C. L. Anderson provided the leadership which culminated in the very capable Alaska Department of Fish and Game. This department will assume the administrative and regulatory control of Alaska's fish and game on January 1, 1960. Alaska is most fortunate in having Andy assume the grave responsibilities attendant with the administration of its fish and game resources during this critical period.

C. L. Anderson justly deserves the title bestowed on him by his staff, "The Father of the Alaska Department of Fish and Game."

RICHARD JANSON, JR.,Chairman
Alaska Board of Fish and Game

EDUCATION AND INFORMATION SECTION

The Education and Information Section, among other duties, was concerned with the production of a 30-minute motion picture in color and sound on the king crab industry at Kodiak. Although it is to be released as a Department film, the Kodiak Chamber of Commerce, king crab industry and public-spirited citizens of the Kodiak area contributed the funds (exclusive of salary) that made the production of the film possible.

The Section's Education and Information Officer discharged his functions under the supervision of the Commissioner. One of the Section's limitations has been the lack of a stenographer to aid in putting out press releases and to assist in answering the constantly growing volume of mail which has increased since the advent of Statehood. All indications point to an avid interest in Alaska's fish and game resources.

Aside from the above duties a considerable amount of darkroom work was accomplished in the developing of negatives and printing of photographs for press releases, illustrating scientific reports and for other purposes.

The Department's motion pictures were in constant circulation. Many appearances were made by members of the staff showing films and speaking before various groups on fish and game subjects throughout the State.

BIOLOGICAL RESEARCH DIVISION

PERSONNEL

Dr. William A. Smoker continued as Chief of the Division.

Dan Gittings, Librarian, continued in charge of the research library. Part-time library aides during 1959 were Pat Myrick from Juneau High School during the winter, Judy Nelson during summer vacation from the University of Alaska, and Judy Ogden from high school during the fall.

Calvin J. Lensink transferred from predator control in the Game Division in July to the Biological Research Division and is in charge of the birds and mammals section with headquarters in Juneau. His staff consists at present of Paul Garceau who is back from a Massachusetts' vacation and is working on wolf-deer studies near Wrangell, and Kenneth Neiland who joined the Department in September as Parasitologist. During the summer, Archie Mossman returned after two years' absence and completed observations on gull predation.

Gary Finger took charge of the new Dingell-Johnson sport fish research study in July on S. E. Alaska king salmon.

Taku River investigations continued under the leadership of Dr. William R. Meehan, assisted by Douglas Blanchard. Richard Reynolds and Gary Finger operated the fish wheel for short periods of time and Dan Gittings assisted in the king salmon spawning ground studies on the Nakina tributary.

Dr. Ahron Gibor in charge of salmon lake productivity studies left the Department of Fish and Game in March, 1959, to conduct research in Washington, D. C. on the problem of converting salt water to fresh water by use of algae. Robert R. Parker completed his doctorate at U. B. C. and moved his headquarters to Kodiak where he took charge of the Kitoi Research Station and projects. Sherman Marble continued as resident in charge at Kitoi. Charles McLinn left the station in April and was replaced during the summer by Jack Shrock. Pete Deveau of Kodiak helped rewire the station in September. Gil Ziemer spent time at the station conducting field observations on the action of water flowing through his aluminum fish-pass. William Smoker assisted Kitoi operations during the smolt run.

Guy Powell continued in charge of king crab studies at Kodiak. He was assisted by Red Heitman in August and September.

The Biological Research Division grew considerably in 1959 in concert with the growth of the Department of Fish and Game as it prepared for assuming full control of the Fish and Game resources of Alaska. The Division will consist of a team of trained scientists representing a diversity of disciplines and while primarily working on individual problems in basic research will collaborate and consult on matters of mutual interest in fish and game studies. For purposes of accounting and other administrative expedients 7 activities are delineated:

A. Central Research (Research administration and liaison at Juneau)
B. Library
C. Birds and Mammals
D. Sport fish (Marine–king salmon)
E. River salmon studies (Taku)
F. Lake salmon and trout studies (Kitoi)
G. Shellfish (king crab–Kodiak)

CENTRAL RESEARCH

Balancing present and future Research Division budgets and planning new research projects has proved to be a full-time job for the Division Chief particularly since the Department is now on an annual instead of biannual budget.

Research meetings attended by various research staff members which were of general interest to Alaska Fish and Game included:

- –Water pollution seminar, Cincinnati, Ohio, which discussed such problems as radioactive wastes, watershed spraying by pesticides, siltation from logging, and pulp mill wastes. March 1959.
- –Committee meeting on establishment of Marine Sciences Institute as branch of University of Alaska. August 1959.
- –American Association for Advancement of Science (Alaska Chapter) in Juneau, August 1959.
- –Southeast Alaska tour with visiting Russian fisheries officials in October 1959.
- –Guy Powell attended a SCUBA diving class in Seattle and received a citation attesting to his ability to undergo very deep water diving activities in August 1959.

RESEARCH LIBRARY

by Dan Gittings

During 1959, the library collection of books and publications expanded greatly to include fur and game as well as fish. Assistance was given to most of the district offices in building up their own collections of essential technical books and journals. An overwhelming and constant volume of grade-school correspondence has been handled by the library from all over the country seeking information on fish and game in Alaska. Stack space is inadequate at the Juneau headquarters and the expanded facilities proposed for the near future will be most welcome. The library now has about 470 bound books and 12,000 papers and journals.

Research publications authored or co-authored by ADF&G personnel or collaborators during 1958 and 1959 and available in the library are:

(1) "A Concept of Growth in Fishes" by Robert R. Parker and Peter A. Larkin, *Journal Fisheries Research Board of Canada,* 16(5) 1959.

(2) "Critical Size and Maximum Yield for Chinook Salmon *(Oncorhynchus tshawytscha)*" by Robert R. Parker, *Journal Fisheries Research Board of Canada* 17(2) 1960.

(3) "Fatigue and Mortality in Troll-Caught Pacific Salmon *(Oncorhynchus)*" by R. R. Parker, E. C. Black and P. A. Larkin, *Journal Fisheries Research Board of Canada,* 16(4) 1959.

(4) "The Distribution of Some Small Mammals in Eastern Interior Alaska" by Wilbur L. Libby, *Journal of Mammalogy,* Vol. 40, No. 4, Nov. 20, 1959.

(5) "Status and Distribution of Sea Otters in Alaska" by Calvin J. Lensink. Presented to 1959 AAAS Conference in Juneau and for 1960 publication in the *Journal of Mammalogy.*

(6) "A Color Marking Technique" (for gulls) by Archie Mossman. Presented to 1959 AAAS Conference in Juneau and for 1960 publication in the *Journal of Mammalogy.*

(7) "Plastic Wading Pools Used as Portable Circular Rearing Tanks for Salmon Fry" by William A. Smoker and Sherman W. Marble. Presented to *USFWS Progressive Fish-Culturist* for publication in 1960.

(8) "Diurnal Variations in Chlorophyll A Content of Some Fresh-water Algae" by Ahron Gibor and William R. Meehan presented to *Ecology* for publication in 1960.

(9) "Observations of Red Fox Behavior" by Robert Vincent. *Ecology* October 1958, Vol. 39, No. 4, Pp. 755-757.

(10) "An Investigation of the Trophic Status of Certain Lakes in the Kitoi Area, Afognak Island, Alaska" by James T. Wallace presented as a thesis for Master of Science degree with the University of Kentucky.

(11) "Nitrogen Fixation in Lakes" by Richard Dugdale, Vera Dugdale, John Nees, and John Goering. Published in *Science,* October 2, 1959, Vol. 130, No. 3319, pages 859-860.

(12) "The Larger Plants of Little Kitoi Lake" by Robert E. Vincent published by *The American Midland Naturalist,* Vol. 60(1):217-218. 1958.

(13) "Preliminary List of Fish Collections in the Institute of Fisheries, from Alaska, Yukon River, and Gulf of Alaska Drainages" by I. D. McPhail and C. C. Lindsey, December 1958, revised January 1959.

BIRDS AND MAMMALS RESEARCH

by Calvin J. Lensink

On July 1, 1959, parts of the former Predator Investigations and Control were transferred to the Biological Research Division to form the new section on Birds and Mammals. Its purpose is to develop for management, in balance with the rest of the Research Division, not only necessary general life history data but also basic information establishing parameters of survival and abundance of the important birds and mammals in Alaska.

During the 1959 field season studies continued on Beluga whales, sea otter, sea lions, wolves, and sea gulls, and a new program of studies on parasites was started.

Calvin Lensink presented a paper to the AAAS Alaskan meeting on his sea otter studies the summary of which follows:

"One hundred and seventy years of exploitation exterminated the sea otter in most of its original range, but small groups survived in widely scattered areas.

Sea Otter

In the aggregate these survivors may have numbered at least 200 and 500 individuals. Since 1911 when protection was extended to the sea otter, they appear to have increased at a rate which may be near their maximum capacity for recruitment and may now number more than 30,000 animals. Regional estimates of numbers are:

Cape St. Elias to the Kenai Peninsula	800 – 1,100
Kodiak Archipelago	800 – 1,500
Alaska Peninsula	3,900 – 5,000
Fox Islands to Islands of Four Mts.	1,000 – 1,500
Andreanof Islands	7,000 – 10,800
Delarof Islands	3,000 – 4,000
Rat Islands	14,700 – 23,000
Total	31,300 – 46,900

The present status of the otter is such that we can expect a rapid expansion in numbers from the Andreanof Islands eastward. West of the Andreanof Islands the habitat is limited and the population may already be near the carrying capacity. Here, sea otters are perhaps as abundant as they were before exploitation by the Russians. On Amchitka Island the evidence indicates that a high population has resulted in increased mortality and a lowered reproductive rate.

Both the historical and the present distribution patterns appear to indicate that the primary factor in the sea otter's habitat is the amount of shallow water available in which the otter can obtain food. The evidence suggests that the coexistence of kelp and sea otters may be at least partially coincidental. However, reliable information on nearly all phases of sea otter ecology is lacking and present survey figures are not adequate. Population movements, seasonal and otherwise, are known to exist, but are not yet understood. Such movements could have an important bearing on population estimates.

Two field operations on Kvichak River Beluga Whale studies occurred in 1959. The first was from May 18 to June 20 and the second during September. The studies this year emphasized a tagging effort to determine extent of move-

Beluga Whales

ment of these whales to other coastal areas from Bristol Bay. A total of 44 belugas has been tagged and two tags have been subsequently recovered—both in Bristol Bay. Twelve animals were taken for specimens to provide information on food habits, reproduction, growth, etc.

Movements of beluga within Kvichak River and Bay this summer reflected the results of the considerable harassment of the herd during investigations of previous years and the tagging program this summer. Prior to the initiation of investigations, the belugas moved up river as much as 40 miles on each tide during smelt and red salmon smolt migrations. During this season's studies, beluga entered the river on only a few occasions and much of the time were not even to be found in the upper bay. It is assumed that belugas which do not enter the river do not prey extensively on salmon smolt because other foods are available in the bay. This presents the possibility that control of beluga predation on salmon may be achieved through harassment of the animals in restricted critical areas.

Paul Garceau and Calvin Lensink accompanied the U.S.F.W.S. charter vessel *Arctic Maid* May-July 1959 on its experimental Sea Lion Harvest study and the conclusions of their report follows:

The Arctic Maid experimental sea lion harvest showed conclusively that large numbers of sea lions could be obtained for processing with relative ease.

Sea Lion Harvest

Although the present expedition was far from profitable, it appears that a commercial harvest of sea lions is feasible. A total of approximately 194,450 pounds of bone-free meat, 18,300 pounds of liver and 3 dressed carcasses weighing 2,000 pounds were processed. These products sold for mink food at 12c/lb. for liver, 10c/lb. for meat, and 7c/lb. for whole carcasses. The total value of all products was approximately $22,000. The estimated cost of the expedition awaits final auditing of the Arctic Maid Fishery Company books by the Fish and Wildlife Service.

To understand our conclusion that commercial harvest of sea lions is feasible it is necessary to keep in mind the experimental nature of the present expedition. The 60 days of operation represents only 33 days of actual hunting or processing of sea lions. While some time for travel and other delays is unavoidable, the present expedition lost many potentially productive days in exploring various rookeries. Such time loss would not be normal to commercial harvests, and it seems fair to assume that at least 45 days of productive operation may be expected for 60 days at sea. If so, and 475 pounds of meat and liver can be produced from each animal as in the present experience, the estimated breaking point at an average price of 10c per pound would be reached with an average harvest of 23 animals per day.

The limiting factor appears to be the processing of animals. During the 33 days of actual operation the average number of animals handled was only 14 in spite of long hours of labor by an excellent and hard working crew. Part of the difficulty was in the inexperience of the crew as is shown in the fact that towards the end of the season 16 or more animals could be processed in far shorter time than fewer animals were earlier. More important, however, was the lack of space and proper equipment aboard ship. Many such problems, such as clearing of deck space, use of a more powerful grinder, etc., can be partially or wholly remedied. Additional crew members might improve efficiency and offset added costs. Any extension of the hunting season should probably result from an earlier starting date. Harems were disintegrating at the end of the present season, and by the first of August few males remain on the rookery after initial disturbance.

Shore based operations offer the possibility for use of additional products, and an overall increase in efficiency where large rookeries are nearby. Initial costs of shore facilities, however, will discourage development until acceptance of products is assured by a stable market.

It does not appear that commercial exploitations of sea lions will offer appreciable relief from depredations by sea lions on the halibut or salmon trolling fishery. Only harvest of males appears feasible, and for a highly polygamous animal as the sea lion, such harvests may probably not greatly reduce the population over an extended period.

We were much impressed by the sincerity and conduct of the Arctic Maid Fishery Company in fulfilling the obligations on the contract. The crew was well selected and capable, and in spite of the heavy, often objectionable type of labor involved, worked far longer than the normal 8-hour day. Perhaps the best answer to the question of whether or not a commercial harvest is feasible will be given when we have the decision by the Arctic Maid Fisheries Company

of whether or not they will proceed in harvest of sea lions without government assistance. Table 1 shows the ages of male sea lions sampled from the harvest and Table 2 shows that bacula weights might be used to show the ages of individual male sea lions.

Other sea lion research by C. J. Lensink included tagging of 312 sea lion pups with specially constructed monel metal tags. Tagging operations were conducted on Sugarloaf Island in the Barren Islands which is midway between important rookeries in the Kodiak and Prince William Sound areas. About 100 tags were put on sea lion pups in 1957 by James Brooks on Lewis Island, using a smaller tag. This brings the total of sea lions tagged by the Department in the Gulf of Alaska to over 400. Future recoveries should provide valuable age and growth information.

Studying sea lions on beach, Lewis Island, Gulf of Alaska.

TABLE 1

AGE DISTRIBUTION OF MALE SEA LIONS
TAKEN IN THE 1959 EXPERIMENTAL HARVEST

Age	Marmot Is. 5/27-6/9	Atkins Is. 6/12-6/23	Ugamak Is. 6/26-7/8	Jude Is. 7/10-7/11	Atkins Is. 7/14-7/15	Chowiet Is. 7/15	Other	Total
7		1	1	1			1	4
8	2		2		1			5
9	1	10	8	5	2	1	1	28
10	4	12	20	3	7	1	2	49
11	8	10	12	3	3	1	2	39
12	6	14	2	1	1		3	27
13	8	5	6					19
14	4	1						5
15		2						2
16		1						1
TOTALS	33	56	51	13	14	3	9	179

TABLE 2

BODY LENGTH AND BACULA WEIGHTS FOR BULLS OF AGES 7 TO 14 OR OLDER

Age	Body Length Mean	Body Length Range	Sample Size	Bacula Weight Mean	Bacula Weight Range	Sample Size
7	106.0	106-106	1	30.4	25-42	4
8	115.5	114-117	2	32.7	25-39	3
9	113.8	106-122	13	36.3	28-49	22
10	115.5	109-123	20	36.3	25-48	35
11	118.0	111-121	16	38.2	26-54	25
12	117.5	110-124	18	38.0	28-51	13
13	118.0	112-129	10	38.3	28-49	11
14	117.0	110-126	6	46.7	47-51	2

Sea Gull Predation

During the summer Dr. Archie Mossman returned to Alaska after two years absence to conclude field observations on sea gull predation on salmon smolts started for the Department in 1956-57. He is now on leave from the University of Wyoming to study lion-zebra predator-prey relationships in Southern Rhodesia, Africa, on a Fullbright Grant. His report was presented to the AAAS Alaskan conference in August 1959 and will appear in the 1959 Alaskan Science. It was concluded that significant gull and tern predation on Bristol Bay area salmon smolts did occur and may be extensive enough for real concern and control. (See Tables 3 and 4.) The annual loss in potential adult spawning fish from this predation may be as high as 12,000 fish on the Kvichak River alone according to this study.

Biologist and aid examining tag on sea lion pup.

TABLE 3

SMOLT EATEN BY GULLS AND TERNS ALONG THE KVICHAK DURING THE 1959 SMOLT MIGRATION

Species	Calculated No. Present	Ave. No. Smolt in Collected Birds	Max. No. Smolt in Collected Birds	No. Eaten per Day During 8 days Smot Migration (1 meal/day) Based on Ave.	Based on Max.
Glaucous-winged Gull ...	912	1.3	5	1185.6	4560
Short-billed Gull	1212	3.3	7	3999.6	8484
Bonaparte Gull	93	2.0	4	186.0	372
Arctic Tern	783	1.3	3	1017.9	2349
Total	3000			6389.1	15,765

TABLE 4

ESTIMATION OF POTENTIAL LOSSES OF SALMON RESULTING FROM GULL AND TERN PREDATION

BASED ON DATA FROM TABLE 3

	Smolt removal in 8 days	Potential adult spawners removed (5% of smolts)
Based on average stomach contents	6389.1 x 8 = 51,113 (if one meal/day)	2556 (if one meal/day)
	51,113 x 2 = 102,226 (if two meals/day)	5111 (if two meals/day)
Based on maximum stomach contents	15,765 x 8 = 126,120 (if one meal/day)	6306 (if one meal/day)
	126,120 x 8 = 252,240 (if two meals/day)	12,612 (if two meals/day)

A Bird Check-list for the Kvichak River, Bristol Bay area, for the spring of 1959 was compiled by Calvin J. Lensink based upon casual observations during the beluga whale investigations. Fifty-two birds were identified and discussed.

Bird Check-List

Common Loon	White-winged Scoter
Arctic Loon	American Scoter
Red-throated Loon	American Merganser
Horned Grebe	Red-breasted Merganser
Cormorant	Goshawk
Whistling Swan	Bald Eagle
Lesser Canada Goose	Marsh Hawk
Cackling Goose	Gyrfalcon
Black Brant	Peregrine Falcon
White-fronted Goose	Willow Ptarmigan
Mallard	Rock Ptarmigan
Baldpate	Black Twinstone
Pintail	Wilson's Snipe
Green-winged Teal	Aleutian Sandpiper
Greater Scaup	Long-billed Dowitcher
Old Squaw	Northern Phalarope
Western Harlequin	Parasitic Jaeger
Surf Scoter	Long-tailed Jaeger
Short-billed Gull	Glaucous-winged Gull
Bonaparte's Gull	Sabine's Gull
Arctic Tern	Short-eared Owl
Violet-green Swallow	Robin
Raven	Barn Swallow
Bohemian Waxwing	Northern Shrike
Yellow Warbler	Redpoll
White-crowned Sparrow	Alaska Longspur

Specimens collected and preserved as study skins include: Arctic loon (2), greater scaup (2), American scoter (1), parasitic jaeger (2), glaucous-winged gull (2), Bonaparte's gull (1), and Sabine's gull (1).

Hair seal control work on the Stikine and Copper River Deltas was supervised temporarily by the Research Division. A total of 1503 seals was killed in the Stikine area by Predator Hunter Stan Miller, and 975 in the Copper River has essentially been terminated, as only a fraction of the former number of seals is to be found there. During spring and fall hunts on the Copper River, Lensink accumulated specimen material which will be analyzed at a later date.

Hair Seals

Investigations on the relationship of wolves to deer in Southeastern Alaska were continued by Paul Garceau. Emphasis at present is on determining relative numbers of wolves and deer in various areas. Seven wolf pups taken from a den in May are being held at the Department of Agriculture Fur Farm at Petersburg for observation and study.

Wolves

Parasitologist Kenneth Neiland has prepared a concise summary of collecting techniques to be furnished to all field personnel to aid them in proper preservation of suspected material in birds, mammals and fish in which they are interested. A bibliography of all publications making reference to disease or parasites in Alaskan animals and fishes is being prepared.

Parasite Studies

This summary is from an article by Robert Vincent, made available in early 1959 and based upon material collected by him while in residence at the Kitoi Research Station (1954-1957). It is entitled "Observations of Red Fox Behavior" and was printed in ECOLOGY (Vol. 39, No. 4, pp. 755-757).

Fox Behavior

"Behavior of thirteen wild red foxes were observed for two winters under near natural conditions in Alaska. Three forms of intraspecific combat were observed: violent, physical fighting; vociferous, modicum combat; and passive whining.

Only when the highest animal of the social hierarchy was involved did the violent fighting occur. Most common was the noisy modicum combat in which the animals assumed the characteristic upright stance with their forepaws on the opponent's shoulders. Between foxes of opposite sex the passive whining was more frequent.

"A social hierarchical system was established biannually in November and February. Fighting is common during the first month of the formation of the social hierarchy. Time of arrival or presence for a second year appears to have little effect upon social order, while age, physical condition, temperament, and social rank of mate are important.

"The pairing behavior of two animals progressed from daily fights to tolerance for each other, to premating behavior by one individual, to premating antics by both, and finally to constant companionship."

KING SALMON SPORT FISH RESEARCH

By Gary Finger

I. Purpose of Study

A sport fish investigation was started on July 1, 1959 under a Federal Aid matching funds program (Dingell-Johnson Act) to ascertain the magnitude of the sport harvest of king salmon in Southeastern Alaska. An additional aim was to initiate a racial study for the purpose of separating stocks of fish as to place of origin.

II. Methodology

The first part of the study is to be largely concentrated in the Ketchikan and Juneau areas, which are the two chief sport fishing centers in Southeastern Alaska. The numbers of fish caught, length, weight, age, and sex are to be determined by sampling the fishery and boat landings. The sport-commercial catch (sport gear used but fish sold) will be obtained from commercial fisheries catch statistics, while the catch will be sampled at cold storages and in the fishery.

Additional sources of data will include personal interviews of fishermen and the records of the Ketchikan and Juneau salmon derbies.

A measure of fishing effort, such as number of boats, fishermen, man hours fished, etc., will also be collected.

The plans for the second half of the program to investigate the racial origin of the fish is still being formulated. Conferences were held in Seattle, Washington during September with different agencies who are also concerned with the problem. It has been recommended by these agencies (North Pacific Fisheries Commission, Fisheries Research Institute, and College of Fisheries personnel) that this study could probably best concern itself with some phase of a marking program (tagging or fin clipping) of downstream migrants and/or adults. Some measure of the overall spawning population of Alaska king salmon was also felt to be desirable.

The use of other racial determination techniques, such as serology, scale patterns and other morphological measurements, would appear to involve too great a scope in both time and money for this program.

The racial aspect of the study is still under consideration and plans, personnel and equipment necessary for the investigation are being formulated.

III. Results

The king sport fishery for the season was nearly finished at the time of instigation of this program and as a consequence very little data was collected in 1959. However, the Juneau salmon derby was sampled from July 24 through July 26.

A. 599 king salmon were submitted to the two official stations at Tee Harbor and Auke Bay during the three-day derby. Fishing time was from 8 a.m. to 5 p.m. Of this number, a total of 467 fish were sampled. An unknown number of smaller fish were not turned in, but were kept for food purposes. (See Table 1).

B. The fish averaged 75.72 cms. long and 15 lbs. 9 ozs. in weight. There was little difference between the two stations. The sex ratio, based on fish at Tee Harbor only, was 1.5 females for every male caught. (See Table 2.)

C. The number of boats was estimated at 1,438 for the three days of fishing with 3,511 fishermen participating. An average of 2.7 fishermen were recorded for the smaller inboards, while 4.4 fishermen on the average fished

from the larger inboards out of Auke Bay. A total of 0.42 king salmon were taken per fisherman for the three days fishing. (See Table 3.)

D. The largest king was turned in, as usual, at Tee Harbor and was 115 cms. in length and 54 lbs. in weight. It was seven years old having 2 freshwater and 4 saltwater annuli on its scales. An inspection of a few selected scales indicated that kings with 2 ocean annuli were about 68 cms. in length and 11 pounds in weight; 3 ocean annuli were about 91 cms. and 29 pounds; and 4 ocean annuli were about 109 cms. and 42 pounds.

Department biologist sampling Golden North Derby king salmon catch for biological data.

Table 1. Total number of King Salmon landed and total number sampled during Juneau Salmon Derby

	Tee Harbor	Auke Bay	Totals
Total Kings landed	261	338	599
Length sample	255	209	464
Weight sample	205	169	374
Sex sample	246	...	246
Total Kings sampled	256	211	467
Total Coho (few other species of salmon)	...	...	862*
Total fish			1461†

*derived by subtraction of total kings from total fish.
†based on number of fish submitted for door prize drawing plus number of fish turned in for fish prizes.

Table 2. King Salmon Length, Weight, and Sex Ratio

	TEE HARBOR			AUKE BAY			TOTALS		
Date July	Ave. Length (cms)	Ave. Weight (lbs-ozs)	No. female ea. male	Ave. Lgth.	Ave. Wt.	Sex Ratio	Ave. Lgth,	Ave. Wt.	No. ea. male female
24	77.3	16-1	1.5	75.0	14-11	..	76.2	15-6	1.5
25	77.1	16-0	1.2	75.1	15.9	..	76.1	15-12	1.2
26	74.4	16-15	1.7	75.4	16-2	..	74.9	16-8	1.7
Total	76.1	16-4	1.5	75.2	15-9	..	75.7	15-9	1.5

Saltwater sport fisherman coming into harbor after day's fishing.

Table. 3. Number of Boats and Fishermen in Juneau Salmon Derby*

		FRIDAY July 24		SATURDAY July 25		SUNDAY July 26		TOTAL TRIPS		
		Tee Harbor	Auke Bay	Tee Harbor	Auke Bay	Tee Harbor	Auke Bay	Tee Harbor	Auke Bay	Grand Total
Small Boats	Open Skiff	67	225	90	231	95	241	252	697	1308
	Small Cabin	105		128		126		359		
Large Boats	Medium Cabin	8	29	10	30	10	32	28	91	130
	Large Boat	4		3		4		11		
Total Number of Boats		184	254	231	261	235	273	650	788	1438
No. of Fishermen		335	574	508	740	564	850	1347	2164	3511
Ave. Person Per Boat	Small Boat		2.5		2.6		3.0		2.7	
	Large Boat				4.4		4.4		4.4	

*Numbers were derived by direct count and in some cases were estimated. Numbers are only approximations to actual count.

TAKU RIVER SALMON RESEARCH

by Dr. William R. Meehan and Doug Blanchard

The 1959 field season on the Taku River began with a trip during the last week of April to the Canyon Island Research Station maintained by the Alaska Department of Fish and Game's biological research division. During this brief trip, the station was prepared for the summer's activities, the fishwheel which had been left there over the winter was readied for use, and a survey was made of equipment needed for the forthcoming summer's program. On the fourth of May, biologists arrived at Canyon Island and initiated the summer program. The fishwheel was scraped and painted and began fishing for adults on May 15.

Taku Smolts

During this period (and until water conditions made it impossible) a floating downstream migrant trap, using the inclined screen "scoop" principle, was fished 24 hours a day as a means of evaluating the species composition and size composition of young salmon migrating to the sea. Also in this smolt and fry study, regular samples were taken throughout the season by means of a 100-foot nylon beach seine. This seine was fished by having one man act as a pivot on the beach or on a sandbar while a second man encircled an area by boat with the current and came back to the beach at a point either above or below the pivot man (depending upon along-short currents). The seine was then pulled into the beach, the sample if quite small was preserved for future study, or if the sample was a large one the bulk of the fish were counted and released while a few were preserved. At present, these downstream migrant samples are being analyzed to obtain size frequency, species composition and age of migration.

Taku Adult Salmon

On May 15, work had been completed on the fishwheel and water conditions were such that the wheel was put into operation. Immediately, it began to catch king salmon. Each fish was measured (fork length), sexed by visual observation of morphological characteristics, a scale sample was taken for future age and growth analysis, and then the fish was tagged (using Petersen disc tags) for future study on the spawning grounds and to follow movements of the fish following the tagging operation. The fish were transported by boat (using a small pump to provide ariation to a live box while en route) to a clear, quiet slough where they were able to recover from the tagging operation before re-entering the main river. The total number of fish of each of the five species of Pacific salmon captured in the wheel, the number of each species tagged, and the per cent recapture of tagged fish by the wheel are shown in Table 1. At present, the main difference in the sizes of fish taken by the fishwheel and also on the spawning grounds is being determined in order to determine whether or not the wheel was selective in size of fish captured in 1959. From cursory observations (Table 2) the proportions of adult king salmon males to females appears to be similar for both the wheel and the spawning ground samples, as does the proportion of adult (4- and 5-year-old) males to jacks (3-year-old males). However, as indicated in Table 3 the fishwheel in 1959 (as it was also in 1958) was selective to smaller king salmon, i.e., it did not catch as high a proportion of large kings as it did the smaller kings.

Due to weather and water conditions, the fishwheel was stopped on October 8. Freezing weather made it impossible for the wheel to turn due to the formation of ice on the axle. The station at Canyon Island was prepared for the winter and the fishwheel was towed to town for repairs on October 15.

The Taku Inlet gillnet fishery was sampled during the king salmon run in May and June to obtain length measurements, scale samples for age and growth determinations, and sex ratios to compare with fishwheels and spawning ground surveys. A total of 827 gillnet-caught kings were processed in this study.

As soon as all the material gathered during the summer is analyzed, recommendations will be made for the future study of the Taku River king salmon population, as well as the other species of salmon found there.

It appears that with the scope permitted by present budgets, adult salmon studies on the Taku River have reached a point of maximum production in research information. If it can be demonstrated that the wheel is consistent in its bias to size this summer, it may be assumed that it will at least provide a

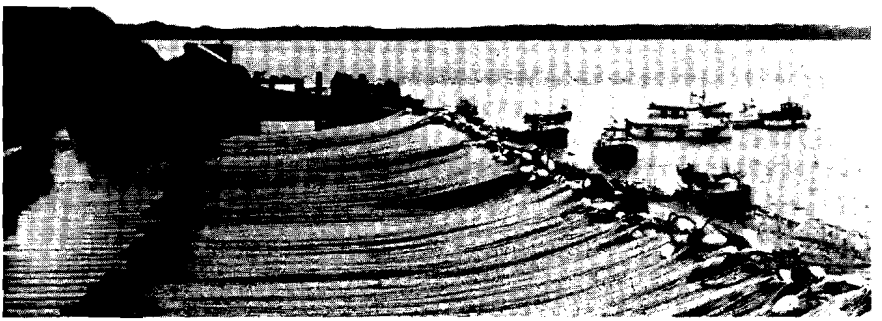
good index to escapement if not a means for calculating absolute numbers. The efforts of the staff might be more profitably turned to study of Taku River smolts in the future.

Table 1. Taku Fishwheel Captures—1959

Species	Kings	Reds	Pinks	Cohoes	Chums	Total
Number caught	2040	359	12,371	619	642	16,031
Number tagged*	1708	342	1,081	591	610	4,332
Number recaptured at wheel**	26	3	90	4	11	134
Percent recaptured at wheel	1.52	0.88	8.33	0.68	1.80	3.09
Number recaptured back downstream in gillnet fishery by November 1959	21	4	1	3	2	31

*Number tagged is actual number of fish capable of recapture in wheel—excluding tagged fish dead before release, etc.

**Number recaptured includes fish captured twice and this is considered in number tagged, i.e.—a fish captured twice is considered as two tagged fish.



Gill nets drying, Bristol Bay.

Table 2.

King salmon carcasses measured and sexed on Nakina River spawning grounds*—1959

*The survey is divided into two phases: (1) the carcasses floating down onto a screen weir and measured there, and (2) the non-floating carcasses or those which hang up on the banks of the river. The latter are measured over a 2-mile stretch of the river immediately above the carcass weir.

	Carcass Weir			Upriver Surveys			Weir and Upriver		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
No. of carcasses	2242	770	3012	648	432	1080	2890	1202	4092
% of carcasses	74.44	25.56	100.00	60.00	40.00	100.00	70.63	29.37	100.00

Ratio for the entire survey is 1 male: 2.4 females.

Table 3.

Average Fork Length in Centimeters—Taku King Salmon—1959

Sex	Fish Wheel Canyon Is.	Nakina R. (weir & spawning ground survey)	Difference (wheel & spawning ground)	Significance "t"	Significance "f"
Male	55.58	62.61	7.03	10.61 (0.01)	1.03 (0.01)
Female	89.08	90.17	1.09	3.27 (0.01)	1.28 (0.01)
Total Combined Sexes	64.32	70.69	6.37	10.38 (0.01)	1.14 (0.01)
Combined Sexes less than 66cm (26 inches)	44.30	48.55	4.25	10.68 (0.01)	1.11 (0.01)

LAKE SALMON STUDIES

by Gary Finger

PRINCESS BAY LAKE STUDY

I. Purpose of Study

One of the techniques that can be employed in providing more salmon is the rearing of salmon fry in rehabilitated lakes. The lakes are freed of all food-competing and predacious fish by poisoning before indoctrination of salmon fry. The fry, therefore, benefit by a decreased mortality and faster growth to time of migration to salt water.

The main purpose of this study was to determine the effects on survival and growth, which largely determines the age of migration, of a saturated plant of more than twice the usual number of fish planted into rehabilitated lakes.

Another aim of the study was to ascertain the effects of competition in space and food between different species of salmon that normally inhabit different ecological nitches. Red salmon are customarily found in the open lake feeding on plankton organisms while coho have been largely associated with shorelines, inlets and outlet streams and feeding chiefly on insect larva and other bottom organisms.

II. Physical Description of the Lake

Princess Lake is located on Behm Canal, Revillagigedo Island, about forty miles from Ketchikan. It is a small, typical Southeastern Alaska, bog colored lake of 22.2 surface acres with a volume of 734 acre feet. The average depth is 33.1 feet with a maximum of 65 feet. The pH when measured in May 1957 was 6.1 with 23 p.p.m. dissolved solids. The lake has two principal tributaries totaling several miles long and has one outlet, approximately one quarter mile long, emptying into Princess Bay. The outlet is believed to be impassable to fish.

The water shed was treated with rotenone at one part per million on May 18, 1957. The lake remained toxic until the fall overturn in October-November of that year. The kill of cutthroat trout, dolly varden char, stickleback, cottids and previously planted coho was believed total at the time of replanting.

A weir was constructed across the outlet in late summer preventing possible re-entry of fish back into the lake. A downstream inclined plane trap was added to the weir in March of 1959 so that the number of migrants could be determined and weight/length samples taken.

III. Fry Plant (see Table 1)

During the spring of 1958, 90 thousand red, 90 thousand coho and 15 thousand

king fry were planted into the lake. This plant represented a total of 4,055 fish per surface acre each for both the red and coho and 675 fish for the kings, for a total of all fish planted of 8,400 fish to the surface acre.

In the State of Washington, the Game Department, through trial and error plantings, have planted rainbow trout/fry at a rate of 500 to 1,000 fish per surface acre and expect growth up to 6 or 8 inches one year later. The Washington Department of Fisheries have customarily planted salmon fry in Western Washington lakes comparable to Princess Lake at approximately 3,500 fish (coho only) to the surface acre and obtained good growth to migrant size one year later.

The plant into Princess Lake at a rate of 8,400 fish per surface acre, therefore, is over twice again as heavy a plant into a rehabilitated lake that has been usually found to provide adequate growth and survival.

The lake was planted again with 45,000 each coho and red fry before the spring migration in the early spring of 1959. This plant of only 2,027 fish per surface acre for both red and coho, for a total of only 4,055 fish per surface acre is less than a half of the previous year's plant; but is still at the upper range of plants into Coastal lakes.

IV. Procedure

A weight, length and food analysis sample was obtained on the coho salmon in October of 1958. The sample was derived from the main inlet stream by angling with No. 12 hook and single salmon egg. The fish had been approximately six months in the system and the sampling procedure was probably selective to the larger fish. Attempts to obtain red and coho fry in the lake by gill netting was unsuccessful.

During the period of May 10 to June 18, 1959 the spring migration of yearling fish was recorded daily for numbers of migrants and sample of length, weight, scales and stomach contents were obtained. Lake hold-overs were also sampled by a variable, fine-meshed gill net after the downstream migration was nearly completed. Lengths and scales were obtained from both live and dead fish while weights and stomach contents were recorded only on freshly, formalin killed fish. A special measuring trough was used on the live fish while dead fish were measured by dividers. Weights were obtained by use of a Triple Beam Balance scale after excess water had been blotted from the fish.

Because of a wide size range in the coho, perhaps due to differences in stream and lake residence and the capture of some of the 1959 fry plant as well as the yearlings, the coho were also classified as to whether they resembled "true smolts" in appearance. The characters used were size, silvering (guanine deposited over scales), lack of parr marks and the omission of orange colored caudal and ventral fins.

V. Results and Discussion (See Table 2)

A. One 5 inch dolly varden was captured by gill net in October of 1958 and one dolly and 19 cutthroat trout (4 to 8 inches) were obtained during the spring of 1958. Therefore, the poisoning of Princess Lake was not a complete kill as had been expected. However, there was apparently a complete kill on sticklebacks and cottids and probably the trout and char populations were extremely reduced. The mortality resulting from predation and food competition from these two species will be an unknown uncontrolled factor in this experiment, but is probably very minor.

B. The coho fry sampled in October after 6 months' growth displayed good growth, averaging 6.36 cms. in length and a weight of 3.01 grams growth. The fry at the time of planting averaged 3.08 cms. long and weighed 0.30 grams. This sample obtained by angling in the inlet stream was very likely biased, as mentioned above (see procedure). The size of these fish were already larger than some of the migrant coho captured in the downstream trap six months later. There also could have been a differential growth ratio for stream and lake residence fish with the stream environment producing a better growth rate.

C. Very few fish left the lake during the normal spring migration. Only 839 red and 469 coho yearlings were trapped. None of the small number of king salmon planted were seen. This condition resulted in a very large hold-over (minus mortality) in the lake for another growing season of 99.48% for the coho and 99.07% for the reds.

D. Only 0.52% of the yearling coho and 0.93% of the red salmon left the lake.

This low migration figure is probably due to the slow growth resulting from increased competition for food by the heavy planting program. The survival to migration will not be known until the numbers of 2 year olds are ascertained for the spring of 1960.

E. A few (43 fish) of the 1959 "O" age plant of coho fry were trapped. They averaged 37mm fork length. These fish were probably not migrating, but were accidental captures from the fry who had established residence in the pool above the weir. No O age reds were captured.

F. Growth was slow as the length frequencies and weights indicate the reds averaged only 61.95 mm. in fork length, which is far below the length usually obtained from "normal" plants into rehabilitated lakes. The coho growth was extremely variable as the range of 46 to 173 mm. shows. Again the average length of 76.28 mm. is less than what one would expect under "normal" planting conditions.

G. The wide fluctuation in coho size resulted in the capture of many fish that did not have the "smolt" or migrant appearance. Consequently, they were classified visually into the two categories described above: smolt and non-smolt. A plot of this dicatomy for numbers of fish against length in mms. resulted in only a one fish overlap and that 76 mm. separated the two groups. Based on 76 mm. and above, only 48.10% of the coho captured were true smolts insofar as physiological appearance. All the red salmon were considered true migrants.

Gill netting in the lake from June 11-17 (after the migration had almost stopped) resulted in only a few fish being caught (1 trout, 4 coho and 4 red). In general the holdover fish were representative in size and appearance of the fish that had left the lake.

VI. Recommendations for 1960

The spring migration will have to be measured in the same manner as above to obtain the holdover of two-year-old fish. Some estimate of the total weight and survival can then be estimated. If some of the fish holdover for a third year, or landlock completely, the study will have to be carried out for additional years. The same procedures will have to be carried out on the 1959 plant.

Biologist in Copper River area measuring lake trout samples to determine lake productivity.

Table 1.

FRY PLANT INTO PRINCESS LAKE

Year	Red	No. per surface acre	Coho	No. per S. A.	King	No. per S. A.	Total Fish	No. per S. A.
1958	90,000	4,055	90,000	4,055	15,000	675	195,000	8,400
1959	45,000	2,027	45,000	2,027	–	–	90,000	4,055

Table No. 2

PRINCESS LAKE DOWNSTREAM WEIR CATCH

May 10 to June 18, 1959

	No. Fish	Average Length	Average Wt. (g)	% Migrated	% Holdover	% Smolts of Migrants	Total gr. Produced	Range (mm)
Coho	469	78.28	6.11	0.52	99.48	48.10	2,863.8	46-173
Red	839	61.95	1.79	0.93	99.07	100.0	1,501.8	47-73
Trout Char	20*	106.25**	13.3**					
Coho Fry	43	37.0	–	0.08	99.92			

*19 cutthroat–1 dolly varden char

**approximation on trout only

KITOI RESEARCH STATION

by Dr. William A. Smoker

The predator–competitor studies at Kitoi continued with emphasis on Ruth Lake in its more advanced research status and the Jennifer Lakes in their initial study phases.

The 1959 sockeye salmon smolt run from Ruth Lake was highly gratifying even reviewed from the objective standpoint of a scientific study. From the 110,000 fry planted in Ruth Lake in the spring of 1958 about 35,000 yearlings were counted down June 1959 in addition to about 6,000 fingerlings 2 and 3 years old from previous plants. This provides a yearling smolt production of about 31% of the fry planted, again showing a very high red salmon fry survival in a lake free of other species of fish which might be predatory or competitive.

This high survival was obtained in the presence of a substantial holdover of older sockeye fingerlings in Ruth Lake. The smolt run out of Ruth Lake again peaked during the second week in June just like the sister run in the home or donor lake (Little Kitoi). Due to a sustained period of sunshine, the outlet water temperatures during the smolt run frequently were over 65° F. Over 20% of the total smolt run left in one 24-hour period. The entire smolt run left the lake through a small 12-inch-wide notch dug in the beaver dam at the Ruth Lake outlet with a flow of about one cubic feet per second. Condition-factor data for the smolts remain to be analyzed but it was obvious that while in a healthy and lively condition they were not as fat as in the two previous years. It was noted that this spring (1959) that black fly emergence in the lake was far less than in 1958 and 1957. The smolts feed heavily on these insects before leaving the lake.

Biologist gathering management data on sport-caught fish.

Table 1.

Lake	Brood Year	Fry Planted	Smolts: One Annulus	Smolts: Two Annuli	Smolts: Three Annuli
Ruth (cleared of resident fish: 47 acres)	1955	90,000 (July 1956 Kitoi stock)	31,400 (35%) 1957 (100 mm)	8,600 (10%) 1958 (130 mm)	App. 1,000 (1%) 1959 (150 mm)
	1956	66,000 (June 1957 Kitoi stock)	9,300 (14%) 1958 (110 mm)	App. 5,000 (8%) 1959 (130 mm)	
	1957	60,000 (June 1958 Kitoi stock)	Approx. 35,000 (31%) 1959 (100 mm)		
	1957	50,000 (June 1958 Hugh Smith stock)			
	1958	50,000 (June 1959 Kitoi stock)			
Midarm (Resident fish undisturbed: 15 acres)	1955	80,000 (July 1956 Kitoi stock)	1,142 (1.4%) 1957 (72 mm)	1700 (2%) 1958 (90 mm)	10 1959 (90 mm)
Upper Jennifer (cleared by rotonone: 100 acres)	1958	194,000 (May 1959 Afognak-Pauls Lake stock)	---	---	---
Lower Jennifer (Resident fish undisturbed: 44 acres)	1958	82,000 (May 1959 Afognak-Pauls Lake stock)			

About 50,000 fry from the 1958 brood of Kitoi stock were released into Ruth Lake in early June 1959. They were flown by float-plane in five minutes from the hatchery to the lake and were released apparently in excellent condition. These fry have not been observed since then. (During the previous two years, 1958 and 1959, fry released in May were observed feeding in the shallows all summer. Fry planted in Ruth Lake in July 1957 were not seen until the following spring.)

A few 3-year-old smolt migrants were counted out of Midarm Lake. These were the same size as the 2-year-old smolts leaving in 1958.

Adult reds appeared at the Ruth Lake outlet stream mouth in July and remained schooled there until October. These were returns from the 31,000 yearling smolts counted down from Ruth Lake in 1957 from the first release of fry into the lake. Since there were no adequate trapping and holding facilities for the entire run and they could not swim up to the lake, a total count was not possible. A minimum estimate was 2,000 adults and probably the return was actually three or four thousand fish. Hence the marine survival of the Ruth Lake smolts was probably between 6 and 10 percent. This is probably not significantly different than the marine survival of the donor lake (Little Kitoi) smolts in spite of the larger size of the Ruth Lake smolts (100 mm compared with 70 mm).

Several hundred of the Ruth Lake adults were trapped and flown by float plane with a special tank to a holding net in lake Kitoi where they were ripened for hatchery eggs. The remainder of the adults were decimated by seals and sea lions since they could not enter Ruth Lake outlet. A trapping and holding facility capable of accommodating the Ruth Lake adult run is virtually complete and will be ready for the next brood year. Scales taken from fish entering Little Kitoi naturally showed upon microscopic examination that some of them were strays from the Ruth Lake run. In mid-October several ripe Kokanee males were taken at the beaver dam at the outlet of Ruth Lake.

At Midarm, a school of about 50 adults (or 5% of the 1957 smolts) stayed during the month of August off the mouth of the outlet stream. Since there were no ladder facilities these fish were unable to enter the lake and they disappeared. Because of location and the shallow nature of the salt water inlet they probably moved on to join the Little Kitoi run.

An excellent adult sockeye run of 3,500 (some of which were Ruth Lake strays) into the donor lake, Little Kitoi Lake, provided a hatchery egg-take in October of about 750,000 eggs which will provide fry for release during the spring of 1960 into the Jennifer and Ruth Lakes.

Considerable effort was made during the summer months to complete the hatchery facilities and apply the knowledge of last year's operations to correcting the installation of Roberson tray stacks and to avoid repeating the heavy incubation mortalities incurred in 1958-1959.

In spite of the heavy mortalities in the hatchery due to: warm initial incubation temperature, early hatch in November and the long period of rearing with a new dry pellet diet in the winter under near freezing temperatures and crowded fry conditions: about 194,000 red salmon fry were planted into Upper Jennifer Lake which had been treated with rotenone and 82,000 fry into Lower Jennifer which had been left alone. Observations during the summer showed that in Upper Jennifer where they had the lakes to themselves, the fry were feeding in the shallows while in Lower Jennifer none of the salmon were seen but myriads of stickleback were seen in the shore areas. The yearling smolt migrations from these lakes will be counted in the spring of 1960 as well as smolts from Ruth and Midarm lakes and Lake Kitoi.

To summarize the findings and accomplishments for the spring, summer, and fall: The third red salmon smolt season from Ruth Lake has demonstrated for the second time a high production from fry-to-yearling smolt numbers of about one-third; probably a consistent smolt biomass occurred for the three years of about 30 kilograms each year in spite of considerable variation in numbers; smolt departure from the lake was on a chronological basis rather than on a temperature regime basis in spite of very high temperatures at the peak of migration; return to Ruth Lake of the first adults after apparently a normal marine survival (in spite of a large smolt size) and a very low attraction flow from the lake; air transportation by float plane of Ruth Lake adults and successful ripening in a holding net in the ancestral lake (Little Kitoi Lake); releases of hatchery red salmon fry were made by float plane into the two Jennifer lakes

and were later seen feeding in shallow water in Upper Jennifer which apparently had a 100% kill of resident fish but were not seen in the control lake, Lower Jennifer, which showed myriads of small stickleback in the shallow areas.

It has been noted that among the adults returning to both Ruth and Little Kitoi there is no significant difference in lengths for either sex between the two lakes. This emphasizes again that the large size of the Ruth Lake smolts did not give them any advantage in survival of ultimate growth. The best management therefore would be to produce as many moderate sized smolts as possible with only one lake winter season.

KITOI LABORATORY STUDIES

To study further the conditions necessary for hatching eggs in a "non-continuous flow" system, an experiment was performed at the Kitoi hatchery during the fall of 1958. In this experiment by Dr. Ahron Gibor, a small volume of water was continuously agitated; however, no water change took place except for addition of water to compensate for evaporation.

Non-circulating Egg Trays

Several hundred green sockeye eggs were placed on the bottom of a shallow pyrex dish. Water was added to a depth of about 1 inch. A water wheel, operated under one of the faucets of the hatchery head trough, was used to revolve a pair of wooden paddles which kept striking and agitating the water in the dish. The eggs were separated from the spot where the paddle hit the surface of the water by a glass rod. Two such dishes were placed on a table top in the hatchery. By the use of a very dilute chemical compound, tris buffer (.05M), the pH in one dish was adjusted to about 7.5 and in the other 8.5. The less alkaline tray had a low mortality to hatching of about 6%. The tray with the higher alkalinity had a higher but undetermined mortality to hatching.

The partial success of this procedure indicates the possibility of a similar arrangement with the present Roberson trays, utilizing recirculating water. The incorporation of a pond with green plants in this recirculating system may or may not be necessary. It does seem, however, quite likely that even though plants could be incorporated in this system, continuous illumination would not be necessary as long as the plants were alive and growing.

(Compare, however, unsuccessful attempt of K. Wolf, Trans. Am. Fish. Cos., 86(1): 1956, to successfully rear rainbow trout in a similar arrangement to the one used in this experiment).

An experiment was concluded in April 1959 by Smoker and Gibor attempting to test the feasibility of incubating salmon eggs by suspending them below the surface of a lake. This general technique could permit fish cultural activities without the usual expensive physical plant and operating staff required by standard hatchery methods. It pre-supposes that if the eggs can be held sufficiently separated that there will be adequate supplies of oxygen and removal of metabolic waste products to and from each egg, and that any dead egg becoming enmeshed in fungus will not affect its neighbors. Thus the major effort would be in spawning the eggs and the usual attention to water flows and treatment for fungus and disease would be eliminated.

Immersed Egg-box

About 7,000 chum eggs were collected and spread on a screen tray held in a wooden screened box and suspended at a depth of about three meters in Auke Lake. After 70 days of submergence beneath the ice the box was raised and the dead eggs removed and then resubmerged. After 159 days of suspension beneath the ice the box was raised and it was noted that only 12 newly hatched embryos were found in good and healthy condition. It was felt that the severe mortality was due to inadequate design of the screen box which allowed the eggs to roll into a heap on the tray during the process of being lowered. In spite of this, some of the eggs did experience incubation conditions suitable for normal development and hatching at about ten feet below the surface in a lake covered with ice and snow for over 21 weeks. The study will be continued with improved experimental designs.

The search for improved techniques for measuring the basic productivity of lakes led to the experimental use of suspended glass rods in certain lakes in the Kitoi area to measure the growth of periphyton or attached algae. These were found to have certain advantage over various glass plates used in previous experiments. The techniques with glass rods need improvement but the results in 1959 confirmed previous findings that Ruth Lake was more productive than Little Kitoi, Midarm, or the Jennifer Lakes in the growth of periphyton. It was thought that the general procedure might be improved still further by using plastic rope instead of glass rods.

Periphyton

FLOATING PONDS

by Dr. Ahron Gibor

Several attempts have been made in various parts of the world to influence the productivity of a natural body of water by artificial fertilization. In an attempt to evaluate the limiting factors for productivity and the relative values of added fertilizers, we decided on using small isolated portions of lake surfaces instead of large scale operations undertaken by others. For this purpose small (about 1 cubic meter) polyethelene boxes were constructed, filled with surface water, and floated on the surface of the Kitoi area lakes. (Polyethelene can easily be sealed with a hot iron and attached to a wooden frame with staples). In the first attempts to float these open surface ponds, the necessity to protect them from wind was apparent. Strong wind and wave action caused water spillage and finally emptying of ponds. In subsequent attempts, the ponds were floated in a protected bay and protected from wave action by floating several logs, as wave breakers around them. This arrangement proved adequate to protect the ponds and minimize water exchange with the lake. Three ponds were suspended in Little Kitoi and three in Upper Jennifer. The ponds were enriched with 10 gm. KNO_3, 2 gm. KH_2PO_4, 10 gm. KNO_3 and 2 gm. KH_2PO_4. First enrichment was made on July 23. Water samples were collected at intervals after the enrichment and the concentrations of nitrate and phocsphate analyzed. Dark and light bottles were also suspended in the ponds to evaluate the effect of the added nutrients on productivity. The ponds were refertilized with the same amount of minerals of the 1st of August. The results of this experiment are given in tables 1, 2, and 3 and figures 1 and 2.

The theoretical shortcomings of the small ponds when attempting to infer from the experimental results obtained from them onto the total body of the lake should be borne in mind. The small ponds have a relatively large surface to volume ratio. Many important biological phenomena are greatly influenced by a large surface area. Thus, growth of attached algae, protozoa, and bacteria will be greatly increased in the ponds. The increased growth of the attached organisms will subsequently dominate the picture when the distribution of added mineral nutrients is analyzed. Productivity measurements by the light-dark bottle method does not include the productivity due to attached organisms. This should be borne in mind especially when the experimental period is long.

The floating ponds could have great value for culture of various planktonic organisms or fish on a large scale as well as other experimental manipulations of a small body of water. For example, studies of fish poisons and the rate of detoxification of the water could be studied in such ponds.

Table 1.

PHOSPHATE CONCENTRATION IN POND WATER
mg/per liter phosphate P

Hours	Upper Jennifer			Little Kitoi		
	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3
0		.61	.90		.62	.65
5					.33	.30
20		.33	.40			
24					.44	.38
44		.15	.12			
48					.24	.06
68		.08	.04			
72					.10	.06
92		.03	.02			
Re-enriched						
24		.54	.66		.60	.51
48		.37	.28		.33	.11
72		.33	.24		.21	.31
96		.19	.11		00	00
168		.02	.00			

It is probable that phosphate is taken up somewhat faster in Upper Jennifer than in Little Kitoi. Addition of nitrate simultaneously does not have an appreciable effect on the uptake in either lake.

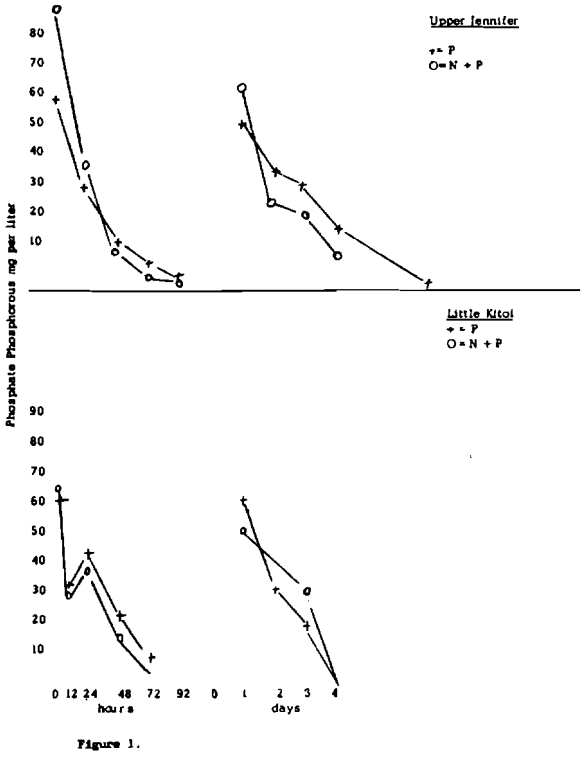


Figure 1.

Table 2.

Nitrate N in mg/liter in Pond Water

Hours	Upper Jennifer			Little Kitoi		
	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3
0	1.24		2.58	1.60		1.25
5				.92		.64
20	1.44		0.96			
24				.36		
44	.56		.34			
48				.01		
68	.36		.10			.46
72				.00		.25
92	.13		.04			
Re-enriched						
24	1.48		1.78	.92		1.64
48	.94		.72	.01		1.36
72	.86		.34	.00		.62
96	.68		.27			
168	.32		.00			

It is apparent that the rate of Nitrate disappearance is faster in Little Kitoi, and in this lake is is inhibited by simultaneous addition of phosphate. In Upper Jennifer, on the other hand, the rate of nitrate uptake is accelerated by phosphate.

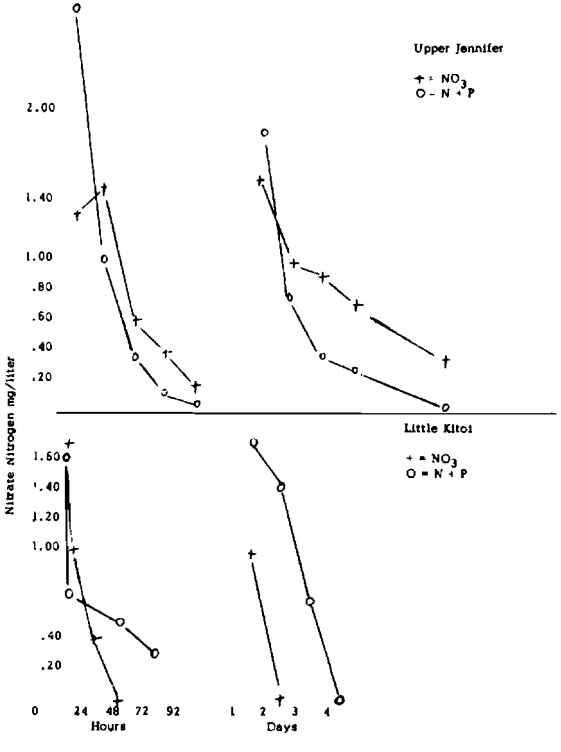


Figure 2.

Table 3.

OXYGEN PRODUCTION DURING TIME INTERVAL INDICATED

Values are in micrograms of Oxygen difference between the light and dark bottles in the experimental ponds and outside of the ponds (control).

	Upper Jennifer				Little Kitoi			
Interval	Control	No. 1	No. 2	No. 3	Control	No. 1	No. 2	No. 3
First enrichment on July 23								
July 23-25		56	88	56		32	77	20
July 27-28		−45	?	80		94	82	36
July 27-28								
July 29-31	62	104	49	121	52	64	87	205
Second enrichment on August 1								
August 2-4	−33	110	54	36	−20	53	75	180
August 5-7	62	192	71	125	−25	30	73	42
August 20-23	00	94	61	51	40	122	57	00

In both lakes the response to added nitrogen was more apparent than to the addition of phosphate. The simultaneous addition of phosphate seems to have increased. Note, however, the results on nitrate disappearance (Table 2). It seems as if the uptake of minerals does not necessarily parallel changes in photosynthetic productivity.

An experiment was conducted in the laboratory which eliminated the possibility of the minerals being absorbed to the polyethelene itself. In field conditions, however, uptake by periphyton might play a major role in the disappearance of added minerals.

WATERSHED NUTRIENT DYNAMICS

by Dr. Richard C. Dugdale

These studies, started by Dr. Richard C. Dugdale in 1956 with Alaska Department of Fish and Game and continued in 1958 on a National Science Foundation grant from the University of Kentucky at the Kitoi Research Station, are being presented for continuation by Dugdale from his present position with the University of Pittsburgh. A brief summary of progress in the Kitoi studies is presented here from his application for a new 1959 N.S.F. contract: This information is further developed in the Master's thesis by James Wallace for the University of Kentucky quoted under "publications (9)" in the above *Central Research* report.

Summary of Progress

1. We have shown that the postulated correlation between steepness of watershed and the PO_4–P concentrations of inlet stream water emptying into Little Kitoi and Upper Jennifer Lakes does exist.
2. A model has been constructed to explain the vertical distribution of phosphorous in cores taken from watersheds of both lakes. Qualitative interpretation indicates that the 1912 Katmai volcanic ash may very well be responsible for the differences in PO_4–P concentration described in (1).
3. A surprising nitrate-watershed relationship inverse to the phosphate-watershed correlation has been discovered. A likely explanation may be found in the distribution of nitrogen fixing alders which grow in dense thickets near steep rapidly flowing streams.
4. Measurements of nitrogen fixation with isotopic (stable) nitrogen were made in both lakes. Measure rates are low and final interpretation must await the determination of natural isotope ratio in a number of untreated biological samples from the lakes.
5. Upper Jennifer Lake has been shown to be limited in production by nitrogen deficiency. Little Kitoi Lake, with about the same phosphorous retention

but far more nitrate income, appears to be nearly twice as productive. There is the distinct possibility that lakes limited by nitrogen deficiencies due to the lack of alder (or some other factor) on their watersheds may be rather numerous at the present time.

6. An interesting situation in which a non-phytoplanktonic, particulate material shows a higher respiration rate in the light than in the dark negated our attempts to measure primary production with the light and dark bottle technique during the later part of the summer.

7. Routine temperature, oxygen, and light measurements have been made on a regular schedule throughout the summer and fall.

8. A limited number of chlorophyll A determinations were carried out with the result that the concentration of this material in Little Kitoi appears to be about twice that in Upper Jennifer. A restricted number of Clarke-Bumpus tows for phyto-plankton and zooplankton were made. Detailed results are not yet available.

Note:

Further treatment on the nitrogen fixation aspects is presented in a brief article in the October 2, 1959 edition of *Science* by Dugdale, Dugdale, Nees, and Goering. The abstract of this article is as follows:

"Incorporation of N^{15} into the fixed nitrogen fraction of natural lake water has been studied for the purpose of estimating rates of primary nitrogen fixation. Experiments in Pymatuning Reservoir, Pennsylvania, Lake Mendota, Wisconsin, and in two lakes in Alaska (Little Kitoi and Upper Jennifer) indicates that fixation occurs at measureable, sometimes high, rates."

The work of this team seems highly fruitful and any added information which they will gather in their future work on the lakes will be of utmost importance to this department. The information on nitrogen fixation alone is of extreme importance. If the study will clearly show nitrogen fixation in the waters, and the organisms responsible are identified, it is within the realm of possibility to accelerate this process at will.

Chlorophyll Production

In the winter of 1959 Dr. Gibor and Dr. Meehan collaborated on a laboratory study demonstrating that some freshwater algae show a dirunal fluctuation in chlorophyll "a" content. This is significant with reference to "lake productivity" tests which involve instantaneous sampling of lake waters and measurement of the immediate photo-synthetic activity or the chlorophyll present. The so called productivity ratings might be erroneous depending whether or not the samples happened to occur at a "high" or a "low" in daily chlorophyll "a" abundance. The details have been submitted for publication in a future issue of *Ecology*.

Kitoi Aquatic Plants

In 1958 Robert Vincent, former Kitoi Resident Biologist (1954-1957), while working for his master's degree at Cornell University published a brief article based upon data collected while employed by ADF&G at Kitoi on aquatic plants which was published in the *American Midland Naturalist* (Vol. 60 (1):212-218, 1958) and became available to the Department in 1959. Vincent lists the following plants associated with Little Kitoi:

The common plant species inhabiting the beach habitats:

Rocky Open

Hordeum brachyantherum Nevski (barley)

Deschampsia beringensis Hylten (hair-grass)

Argrostis exaarata Linn. (bent-grass)

Rumex fenestratus Greene (dock)

Dodecatheon sp. (shooting star)

Rocky Shaded

Epilobium lactiflorum Hausskn. (willow-herb)

Arnica chamissonis Less. (arnica)

Aster foliaceous Lindl. ex DC. (aster)

Sand Humus Open

Calamagrostis canadensis (Michx.) *Beauv.* (blue-joint)
Phleum Alpinum Linn. (mountain timothy)
Potentilla anserina Linn. (cinquefoil)
Heracleum lanatum Michx. (cow parsnip)

Sand Humus Shaded

Geum macrophyllum Willd. (avens)
Sanguisorba sitchensis C. A. Mey. (burnet)
Angelica sp.
Artemisia Tilesii Ledeb.
Habenaria dilatata Hook. (bog orchid)

The aquatic plant species occupying the perimeter include:

Isoetes Braunii Durieu. (quillwort)
Potamogeton alpinus Balbis var. *tenuifolius* (Raf.) Fernald
P. epihydrus Raf. (Nuttall's pondweed)
P. Richardsonii (A. Benn.) Rydb. (Richardson's pondweed)
P. sp. (pondweed)
Ranunculus confervoides Fr.

Hydrophytes found on the deltas (listed from shallow to deeper water) are:

Galium trifidum Linn. (bedstraw)
Carex sp. (sedge)
Juncus filiformis Linn. (thread rush)
Hippuris vulgaris Linn. (marestail)
Equisetum limosum Linn. (swamp horsetail)
Utricularia macrorhiza LeConte (bladderwort)

The following hydrophytes, listed in order of occurrence from shallow to deeper water, are found in coves:

Caltha palustris L. (marsh marigold)
Galium trifidum Linn.
Carex sp. (sedge)
Juncus filiformis Linn.
Juncus sp.
Rorippa paulstris (Linn.) *Moench* (marsh cress)
Hippuris vulgaris Linn.
Equisetum limosum Linn.
Equisetum sp.
Sparganium angustifolium Michx. (narrow-leaved bur-reed)
Ranunculus sp.
Nuphar Polysepalum Engelm. (yellow pond-lily)

SHELLFISH—KING CRAB

by Guy Powell

The King Crab growth and life history studies continued at Kodiak with release and recapture of tagged crabs in Chiniak Bay. Almost 2,700 male crabs were tagged and released in 1958 and 4,000 in 1959.

All of the 1958 crabs were released in the inner part of Chiniak Bay (near Cliff Point) in May and June. Through the following fall and winter fishery 281 crabs with tags placed in 1958 were recaptured and while these had not progressed through a molt and could not show growth they demonstrated interesting migratory patterns within the bay (about 60 square miles), being largely grouped in the outer region in the fall and moving into the inner bays by spring. About 50% of the 100mm crabs and 25% of the 200mm crabs were recovered. Ten tags recovered in the winter of 1959 from taggings previous to 1958 had shown some growth and when combined with growth data from the small crabs held in a pen at Kodiak a straight line relationship was indicated of about 5mm growth in carapace length per molt for crabs 30mm in length and about 20mm growth in carapace length for crabs 130mm in length. This is an average increase in carapace length of about 16% per molt.

The current fall fishery has recovered about 40 more tags from the 1958 release and will provide additional growth data to be incorporated into the total recoveries for the 1959-1960 season.

Due to lack of available charter service the tagging of king crabs in 1959 was delayed until September. The same procedure used in 1958 was repeated

wherein the boat chartered fished its pots placed in Chiniak Bay (SE of Long Island) and brought the live crabs in the hold to the dock in Kodiak. A tagging crew then processed the crabs rapidly returning them to a separated portion of the hold. Sea water was pumped and circulated through the hold during the entire process. After tagging, the crabs were returned to desired points of release:

Sept. 11-13, 1959	Upper Chiniak Bay	1052 crabs released
Sept. 14	Inside Puffin Island, Chiniak Bay	1226 crabs released
Sept. 18	Inside Kalsin Bay, Chiniak Bay	1052 crabs released
Sept. 22	Inside Sharatin Bay, Marmot Bay	668 crabs released

Because the previous recoveries showed considerable local movement of crabs it was decided to release the last 668 tagged crabs into Sharatin Bay (part of Marmot Bay) to see if they would move back to the general area of initial capture. Since fishing has resumed in Marmot Bay the primary purpose of the study to obtain information will be satisfied if the crabs stay in the area of release.

The frequency of size classes represented in the September 1959 tagged releases are:

Carapace length	Number of crabs
60-90mm	1
70-79	70
80-89	146
90-99	472
100-109	630
110-119	675
120-129	707
130-139	517
140-149	354
150-159	287
160-169	114
170-179	21
180-	8

To date about 115 of these crabs have been recovered. They will not contribute to growth information. In fact, it will probably not be until the spring and fall of 1960 before growth after the first molt will become apparent. Meanwhile, most of the tags released in 1958 and recovered in the months ahead will provide good growth data.

During the summer of 1959 dart tags were tried experimentally on crabs held in captivity. While this tag looks extremely promising at first, it became apparent that the crab tended to form a callus around the barbed head and then to expel the whole tag. If a tag of this nature could be made to work satisfactorily on king crabs the rate of tag application could be speeded up greatly.

The dock site aquarium has been out of commission for the period of this report because the dock has been under extensive repairs and remodeling by the owner. It will be available for studies on molting by small crabs in the near future. Meanwhile several hundred crabs particularly of small sizes are being held in sunken pens or boxes at the Kodiak yacht harbor, fed various natural items and measured for changes in molting. A new set of bottomless holding boxes have been placed on the natural bay floor and king crabs held therein are being fed, observed, and measured by scuba diving. This may provide the most natural molting conditions possible under a captive situation.

In addition to studies and measurements on growth of the captive crabs at Kodiak and the tabulation and analysis of data from recaptured tags in the fishery, additional tagged crabs will be put out in suitable numbers in the months ahead if it becomes apparent that statistically significant recaptures are not coming in for certain size groups.

As a comparatively new king crab fishery develops and the primitive stocks with numerous large individuals is cropped off, more and more of the younger and faster growing crabs will provide the bulk of the fishery in the future. It becomes necessary to know the age, growth rate, and natural death rates of crabs in order to manage the fishery in a realistic manner. A major part of the Kodiak research is designed to determine the age and size of king crabs.

During 1959 over 4,000 crabs were tagged and released in Chiniak Bay and 179 of them were recaptured in the fishery. In addition 243 recoveries were made from previous releases of tagged crabs. Ninety of these crabs provided excellent growth data.

Over 130 small crabs (1 to 2½ inches carapace length) were studied by skin diving and holding in pens for growth data.

Apparently mature king crabs (older than four years) molt once a year. In his first year of life the male crab may molt 18 times.

Department biologist uses a scuba diving gear as an effective underwater research tool.

Kodiak-Chiniak Bay male king crab growth may be tentatively summarized as follows:

Age	Number of molts in time period	Total number of molts	Carapace length
adult form age 2½ months.....	5 molts	5 molts	0.08 inches
1 year old	8	13	0.51
2 years old	5	18	1.54
3 years old	3	21	2.48
4 years old	1	22	3.75
MATURE			
5 years old	1	23	4.29
6 years old	1	24	5.00
7 years old	1	25	5.63
COMMERCIALLY LEGAL (A certain percentage begin to skip the annual molt)			
8 years old	1	26	6.26
9 years old	1	27	6.89
10 years old	1	28	7.52
11 years old	1	29	7.91
12 years old	1	30	8.70

Therefore a male crab goes through 22 molts before he is mature (4-5 years of age) and 25 molts before he is of legal size (7-8 years of age).

A SURVEY OF THE RAZOR CLAMS (Siliqua patula, Dixon) SPORT FISHERY

by Jim D. Rearden and Clarence A. Weberg
Commercial Fisheries Biologists
August 1959

The above report is on file in the ADF&G Library and certain pertinent data on age and growth are listed here:

CLAMS SAMPLED COOK INLET AUGUST 1959

No. of "annula" checks on shells	No. clams in sample	Average shell length, inches	Range of shell lengths, inches
1	(1)	0.75	------
2	(1)	1.65	------
3	(5)	2.75	2.05-3.15
4	(19)	3.70	3.10-4.90
5	(15)	4.30	3.10-4.90
6	(8)	4.50	4.00-5.30
7	(14)	4.60	4.25-4.95
8	(10)	4.85	4.00-5.50
9	(10)	5.10	4.90-6.00
10	(7)	5.40	4.10-6.00
11	(2)	5.85	5.65-5.90
12	(1)	4.95	------
13	(2)	6.96	6.50-7.05

This is in general agreement with age and growth of razor clams sampled by Weymouth, et al, in 1925 at Swickshak and Cordova. An interesting comparison is the age-length distribution of clams at Copalis, Washington also sampled in 1925:

Length (inches):	0.7	3.4	4.25	4.75	5.0	5.25	5.5	5.5	5.6
Age:	0	1	2	3	4	5	6	7	8	9

Note that the Washington clams grow much faster at first and in three years accomplish the growth that the Alaskan clams achieve in their sixth year. However, at about nine years of age both Washington and Alaskan clams have the same length. In recent years it has been shown that some Washington clams may lay down two checks a year and clams estimated to be three years old may actually have been 1½ years which would indicate an even faster initial growth.

SPECIAL STUDIES

King Salmon—Growth and Mortality

During the spring of 1959 Robert Parker completed his doctorate at the University of British Columbia. His thesis entitled "Growth and Mortality in Relation to Maximum Yield in Pounds of Chinook Salmon" will be published as several papers in the Journal of the Fisheries Research Board of Canada. The references of the first of the publications is: Parker, R. R., E. C. Black, and P. A. Larkin, "Fatigue and mortality in troll-caught Pacific salmon," *Journal Fish. Res. Bd. Can.*, Vol. 16, No. 4, pp. 429-484, August 1959. A copy of the thesis abstract follows:

ABSTRACT

Life history events of chinook salmon preclude determination of a critical size for this species by established methods. The use of size, rather than age, as a basic correlate of growth rate is discussed and compared to analagous treatment of physiological rates described in literature. *Ecological* opportunity and *physiological opportunity* are visualized as the two interacting components that determine growth, both of which are related to size attained. Growth opportunity occurs in stanzas which are entered at "threshold" sizes.

The function $dw/t = kw^x$ is developed into a growth equation for linear dimensions, $l + 1 = a + 1$, and three methods of fitting this equation to growth data are demonstrated. Application is explored and discussed using steelhead trout and chinook salmon as examples. Significant differences in growth rate were found between life history types and sexes. The chinook data were then treated on a $l, + l, l,$ plot and it was shown how an apparent fit of the von Bertalanffy type growth equation can result from selectively fishing for the larger fish of any brood year. Accordingly, life history subgroups of a year class must either be treated separately or weighted according to relative abundance in determining critical size. The former alternative is followed in lieu of necessary weighting data.

Natural mortality of a chinook population is estimated from the pattern of tag recoveries, taking advantage of the fact that maturity occurs at different ages for individuals of a year class and that the fishery operated mainly on maturing individuals. Annual instantaneous natural mortality was estimated to lie in the range 0.36 to 0.51.

The growth equation was then transformed to a length-specific average annual instantaneous growth (weight) rate and critical size was observed to occur at maturity for each life history type. Since fishing is presently allowed on the immature stock, a size limit protecting the older life history type causes a loss in yield from the younger life history types. This loss might be offset, depending on the relative abundance of life history types in the stock, providing mortality due to hooking and releasing is negligible.

Capture by trolling was found to subject feeding coho and chinook salmon to hyperactivity which may lead to a distressed condition or death, and death cannot be predicted from examination of individual fish at time of capture. Mortality of coho was estimated to be in the 0.95 confidence interval of 34 percent and 52 percent; of chinook in the 0.95 confidence interval of 40 percent and 71 percent. Time of maximum death rate is shown to coincide with the period of maximum blood lactate response. Survival occurred either when blood lactate did not reach critical levels (above 125 mg%) or reached critical levels and subsequently subsided. Holding salmon in a live box for 8-14 hours before release did not improve tag recovery, suggesting additional indiscriminant stress was caused at release. Adult coho in freshwater did not appear capable of lethal hyperactivity. This led to the hypothesis that cessation of feeding during spawning migration has adaptive significance for survival of Pacific salmon.

The combination of natural mortality, mortality from hooking injury and delayed mortality from fatigue gave a total instantaneous first year mortality rate (exclusive of fishing) greater than 1.0 and possibly as high as 2.5. This mortality rate results in a critical size of not more than 22.5 inches and most likely about 15.0 inches fork length.

It is thus concluded that for maximum yield in pounds (1) fishing for chinook should be restricted to their ultimate year (maturity) and (2) the use of non-selective gear should be encouraged. These recommendations are opposite to present practices. If fishing is to be allowed on the immature stock, size limits should be abolished.

PLASTIC SALMON FRY REARING TANKS

by Dr. W. A. Smoker

In order to solve problems of limitations in both hatchery building space and in budget at the Kitoi Bay Research Station, circular tanks for winter rearing of salmon fry that could be easily erected and then demounted and stored away were devised from plastic wading pools by the Alaska Department of Fish and Game.

The plastic pools were obtained through a well-known mail order house catalog. They were eight feet in diameter and could hold a maximum of twenty inches of water. Each pool accommodated about 150,000 red salmon fry in water at 33-36° F. from November 1958 to May 1959. The hatchery building was insulated and the outside air temperatures at times dropped to 0° F. In order to obtain a convenient working height and to allow for drainage of discharging water, the pools were supported on wooden platforms standing eighteen inches off the concrete hatchery floor.

A standpipe hole four inches in diameter was cut in the center of the plastic pool bottom and also a hole to match in the supporting wood surface. The small red salmon fry were prevented from entering into the standpipe intake by placing a box screen around the entire center standpipe assembly.

The total cost of each rearing tank, completely assembled, was about forty dollars which is almost negligible compared to the cost in thousands of dollars of standard concrete rearing tanks. Further details were submitted for publication in the USFWS *Progressive Fish Culturist* 1960.

FISH COLLECTIONS

by U. B. C. Ichthyologists

The Department received during 1959 a check list of fish specimens collected by Dr. C. C. Lindsey and crew in 1958 in Alaska. This group were from the Institute of Fisheries, University of British Columbia, Vancouver, Canada and during their travels in Alaska were guests of the department at the Kitoi and Canyon Island Research Stations. From these areas the following fish were noted in their collections: (the numbers are from their published list: "Preliminary list of fish collections in the Institute of Fisheries, from Alaska, Yukon River, and Gulf of Alaska Drainages," I. D. McPhail and C. C. Lindsey–December 1958, Revised January 1959).

1 *Osmerus dentex* Steindachner–rainbow smelt, Taku system: Boundary Cr.

2 *Acipenser medirostris* Ayres–green sturgeon, Taku Inlet.

3 *Prosopium cylindraceum* (Pallas)–round white fish, Taku system: Flannigan slough.

14 *Oncorhynchus kisutch* (Walbaum)–coho salmon, Taku system: Canyon Island, Boundary Cr,, MacDonald's Lagoon (Afognak Id. Kitoi area).

17 *Oncorhynchus nerka* (Walbaum)–sockeye salmon Kodiak Islands: Big Kitoi Lk. (Afognak Id.).

18 *Salmo clarki clarki* Richardson–coastal cutthroat trout, Twin Glacier Lake, Flannigan Slough.

19 *Salmo gairdneri* Richardson–rainbow trout, Taku system, Canyon Id. Kodiak; Big Kitoi Ck., Fern Lake, Fraser Lk.

20 *Salvalinus alpinus* (Linnaeans)–arctic char, Kodiak Is., Fraser Lk., Karluk Lk.

21 *Salvalinus malma* (Walbaum)—Dolly varden, Taku system: Canyon Is., Twin Glacier Lk., Boundary Cr., Flannigan's Slough. Kodiak Islands: Fraser Lk., Karluk Lk., Big Kitoi Ck., Silver Lk., Fern Lk., Big Kitoi Lk., Midarm pond, Little Kitoi outlet, McDonald's Slough.

28 *Gasterosteus oculeatus* Linnaeus—threespine stickleback, Taku: Twin Glacier Lk., Taku R. below Canyon Is. Kodiak Islands. Fraser Lk., Kitoi Bay Cove, Siher Lk., Big Kitoi Lk., Little Kitoi Lk., Outlet, MacDonald's Bay.

31 *Cottus cognatus* Richardson—slimy sculpin, Taku system: Twin Glacier Lk., Taku R. below Canyon Is.

32 *Cottus aleuticus* (Gilbert)—Aleutian sculpin, Taku system: Boundary Ck., Grindstone Cr. Kodiak Islands: Fraser Lk., Karluk R., Karluk Lk., Red R., Big Kitoi Ck., MacDonald's Bay (Kitoi).

59 *Clinocottus embryum* (Jordan and Starks)—mossy sculpin, Grindstone Ck., near Bishop Pt., near Juneau.

MARINE FISHES FOUND IN KITOI BAY:

33 *Clupea harengus pallasi* Valenciennes—Pacific Herring.
36 *Psettichthys melanosticus* Girard—sand flounder.
37 *Lepidopsetta bilineata* (Ayres)—rock flounder.
38 *Limanda aspera* (Pallas)—mud dab.
40 *Platichthys stellatus* (Pallas)—starry flounder.
46 *Sebastodes mystinus* (Jordan & Gilbert)—priest fish.
47 *Hexagrammis stelleri* Tilesius—Whitespotted greenling.
48 *Hexagrammus superciliosus* Pallas—rock greenling.
50 *Blepsias cirrhosus* (Pallas)—silverspot.
52 *Enophrys bison* (Girard)—buffalo sculpin.
53 *Leptocottus armatus* Girard—cabezon.
54 *Hemilepidotus hemilepidotus* (Tilesius)—red Irish lord.
55 *Icelinus borealis* Gilbert—northern sculpin.
56 *Myoxocephalus polyacanthocephalus* (Pallas)—great sculpin.
58 *Oligocottus maculosus* Girard—Tidepool sculpin.
60 *Clinocottus acuticeps* (Gilbert)—sharpnosed sculpin, Big.
61 *Podothecus acipenserinus* (Telesium)—sturgeon sea poacher.
68 *Pholis laetus* (Cope)—bracketed blenny.
70 *Ammodytes tobianus personatus* Girard—sand lance.

Gill net fishermen picking red salmon from gill net, Bristol Bay.

COMMERCIAL FISHERIES DIVISION

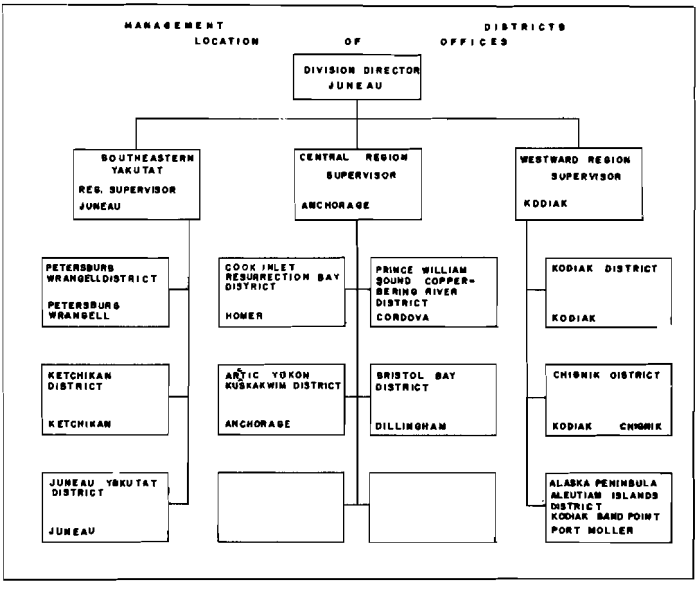
The advent of Statehood and the impending State control of fish and game on January 1, 1960 were by far the major factors in the activities of the Commercial Fisheries Division in 1959. This Division will be responsible for the management of Alaska's rich, varied and complex fisheries and, as such, must ensure the optimum use of this resource. By optimum use is meant managing on a maximum sustained yield basis—ensuring an optimum brood stock and harvesting all surplus. With such a responsibility, it was mandatory that a staff of management biologists be assembled in each management area or district.

Management Personnel

In 1958, the staff of the Division numbered seven individuals stationed in Ketchikan, Wrangell, Juneau, Homer, Kodiak and Dillingham. Personnel were sorely needed in 1959 for all other areas so as to become as well acquainted as possible in one short season with the commercial fisheries in their districts and thus be in a more advantageous position to manage these fisheries in 1960. During 1959, the Division was reorganized to some extent. Figure 1 gives the table of organization for the Division, illustrating the decentralization and staffing in all fishing districts in Alaska. By December, 1959, the Division consisted of seventeen scientific personnel, with several positions yet unfilled. New district offices were established at Juneau, Cordova, Anchorage, Chignik and Sand Point. Following is a list of the management personnel in the Division in 1959:

Walter Kirkness, Director, Juneau
Stanley Swanson, Southeastern Region Supervisor, Juneau
Charles Meacham, Central Region Supervisor, Anchorage
Roy Rickey, Western Region Supervisor, Kodiak
Stephen Smedley, District Biologist, Ketchikan District, Ketchikan
Norman Johnston, District Biologist, Wrangell-Petersburg District, Wrangell
E. J. Huizer, District Biologist, Juneau-Yakutat District, Juneau
Ralph Pirtle, District Biologist, Prince William Sound area, Cordova
Steven Pennoyer, District Biologist, Arctic area, Anchorage
C. A. Weberg, District Biologist, Cook Inlet area, Homer
Jim Rearden, Asst. District Biologist, Cook Inlet area, Homer
Dean Paddock, District Biologist, Bristol Bay area, Dillingham
Wilbur Church, Asst. District Biologist, Bristol Bay area, Dillingham
Robert Simon, District Biologist, Kodiak area, Kodiak
Thomas Richardson, District Biologist, Chignik area, Kodiak
Dexter Lall, District Biologist, Aleutian-Peninsula area Sand Point-Kodiak
Glenn Davenport, Asst. District Biologist, Aleutian-Peninsula area, Port Moller-Kodiak

Figure 1—Organization Table.



The responsibilities of the Division in actuality delve far deeper than just the management of the fisheries. Following is a synopsis of the varied responsibilities carried on.

The Commercial Fisheries Division is charged with the management of Alaska's complex and highly efficient commercial fisheries. Although the main fishery is for salmon there are a number of other important fisheries, some of which are rapidly rising in importance. Among these are king crab, shrimps, herring, razor clams, and blackcod. In the future we will see new fisheries rise, the main one of which will probably be for bottom fish—rockfish, flounders, cod and allied species. Some day these fish will surpass salmon in total poundage taken.

This Division's primary duty is, then, to see that these fisheries are managed on a maximum sustained yield basis, that all surplus will be harvested, and the needed brood stock will be maintained. To attain this purpose, an intimate knowledge of each District's fisheries stocks and the fishery itself is necessary. In order to accomplish this, trained personnel in Fisheries Biology are needed in each major fishing district where they can live with, observe and study the fisheries in their particular area. It is up to these men to make the recommendations for intelligent fisheries regulations, to make immediate changes during the fishing season when needed, and to advise the Protection Division when and where law enforcement is needed.

This means the Management Biologist and his staff must be on top of the fishery at all times. For instance, in the salmon fishery the Management Biologist must be aware of the number of units of gear fishing each day, the daily catch, and any shifting of fishing area. This will be mainly accomplished by: (1). A fish ticket system—data from which must be compiled as the tickets come in from the canneries; (2). Cannery pack reports; (3). Visual observation on the fishing grounds, and (4). Registrations.

The general magnitude of the run itself must be approximated so that a reasonable catch can be allowed and a sufficient brood stock be permitted to escape. Daily comparisons of catch to those of former years (whose escapements are already known) will help indicate the magnitude of the run. In addition, data on the downstream migration which produced the run in question will be important. Foot and aerial surveys of the bays and spawning streams will be needed throughout the season to check the progress of escapement. In some streams, weirs or counting towers will be maintained throughout the season to give an absolute count of escapement on these important or key streams.

The Division will conduct applied research on small or less-complex problems than those usually undertaken by the Research Division. When problems of a more complex nature arise, they will be referred to the Research Division.

As industrial expansion increases in Alaska, it will also increase the duties of the staff of the Commercial Fisheries Division. Such problems as deforestation, pollution, and hydro-electric projects should be investigated from the standpoint of their influence on our fisheries resources. Recommendations will be made as to the damage such projects would cause and means of circumventing such damage must be found. For instance, on hydro-electric projects the effects of building a dam must be assessed from the standpoint of possible damage to the salmon runs by: (1). Preventing adult salmon from ascending to the spawning grounds, (2). Loss of downstream migrants going back down over the dam and through the turbines, and (3). Loss of spawning and rearing area by the backing of water in the impoundment. The biologists will work in conjunction with the project engineers in planning facilities to prevent loss to fish life by such means as fish ways, downstream fish passes, etc.

Another phase of this Division's activities, and one in which it has been active in the past, is stream improvement. It has been demonstrated that more suitable fresh-water will raise more salmon, comparable to growing a crop in agriculture. Alaska has a great amount of water which is blocked to salmon by falls. By selecting the better watersheds which are so blocked and making them accessible by fishways and stocking salmon eggs or fry in these areas to form a brood stock, Alaska's salmon resources can be increased. Part of the Management Biologist's duties will then be to catalogue all watersheds in his district as to salmon rearing capabilities, nature and extent of blocks, and recommendations for future work. When blocked areas are selected for fishway projects, suitable stocks of salmon from similar waters must be selected for brood stock. Eggs or fry from the se-

lected brood stocks will be introduced for at least one cycle into the new watershed.

In the same vein of thought, introduction of new runs is the new tool of salmon management-rehabilitation. The predacious and competing fish are removed by chemical treatment from the watershed, either in presently low-producing salmon areas or in blocked lakes and streams not now producing salmon. These waters are then used as large salmon rearing areas where, free from predation and competition, the survival can be raised many times. Preliminary experiments have shown a survival rate as much as 30 times higher in treated waters as in natural waters. From the catalogue of watersheds in each district, suitable waters will be selected from time to time for rehabilitation. In natural salmon producing waters, the incoming runs will take care of production, while in blocked areas, eggs, fry or adults will be introduced each year.

These, then, are the primary duties of the Commercial Fisheries Division and its biologists. There will be many other important programs, such as public relations. Frequent meetings will be held with the public and fishermen groups to acquaint them with the Department's programs, the problems involved and conservation principles in general.

In order to accomplish the programs which have been mentioned, an adequate staff of permanent and temporary personnel is needed. These biologists are stationed in the area they will be working.

In addition to the active recruiting, shift of emphasis to management of existing runs, and reorganization, the Division during 1959 continued work on the various programs which had been started and carried on through the past nine years.

It would not be fitting to conclude this introductory section without paying our respects to the memory of Lee Larsen. Lee Larsen, fish culturist for the Division, was killed in the line of duty on July 3, 1959, in an Ellis Airlines Cessna 180 crash in Helm Bay, 26 miles north of Ketchikan. Lee had been participating in the planting of silver and red salmon fry from the Ketchikan hatchery into three experimental rehabilitated lakes in Ideal Cove in Dry Strait between Wrangell and Petersburg. On the return to Ketchikan, the plane crashed into the mountainside above Helm Bay. The cause of the crash is still unknown. Lee was an exemplary employee, giving uncomplainingly of his time and labor, no matter when or what the job. He will be sorely missed by the Department and all who knew him.

Lee Larsen

BIOGRAPHICAL SKETCHES

Stephen Clair Smedley was born on December 5, 1905 in Cul de Sac, Idaho. His family moved to California where he attended primary school and two years of high school at Sacramento.

Most of the interval from 1924 to 1954, Mr. Smedley was employed in various capacities in California State fish hatcheries.

In 1954, he enrolled at Humboldt State College and graduated in 1957 with a Bachelor of Science degree in Fisheries.

Upon graduation he was re-employed by the California Department of Fish and Game and assigned as management biologist to an area south of San Francisco with headquarters in Monterey. Mr. Smedley was promoted in 1959 and reassigned to a unit attached to the California Water Resources Board where duties consisted of evaluating fisheries problems created by various large water projects.

Mr. Smedley entered employment with the Alaska Department of Fish and Game in July of 1959 as the district biologist stationed at Ketchikan.

He is married and has four children.

Edgar J. Huizer was born September 15, 1923, in Newark, New Jersey, where he attended grade school and graduated from high school. After two years of schooling at the Middlebury College, Vermont, he entered the U. S. Navy. Upon his discharge two and one-half years later he had attained the grade of Ensign.

Coming to Alaska shortly thereafter, his education was continued at the University of Alaska. He graduated in 1948 having received a B.A. degree with a major in Geology and a minor in Biology. Graduate work in Fisheries and Wild-

life was also taken at the University of Alaska. His summer vacation periods were spent in commercial halibut fishing and salmon seining out of Petersburg, Alaska. He joined the staff of the Department on April 1, 1953, as a junior biologist being assigned to the Taku River king salmon investigation.

In the fall of 1953, he was assigned to the king crab study in the Kodiak Island area. In July of 1959 he became the district management biologist for the Juneau-Yakutat area.

Ted Bachman was born in Toledo, Ohio on October 5, 1916. Early schooling was brief and terminated at the 8th grade, but this lack was overcome in later years through I.C.S. courses in mechanical engineering, a C.T.I. course in diesel engineering, and General Motors Institute of Technology study in advanced diesel and electrical courses. He taught diesel engineering for two years in Chicago, Illinois.

Ted served 6 years in the U. S. Navy and 4 in the Coast Guard, leaving the service as a Warrant Officer. He has a son, Theodore Michael, age 6, who was born on his dad's birthday. Ted first came to Alaska in 1937 and has lived in Juneau and Ketchikan. Since August 4, 1959, Ted and his son have lived at Deer Mountain Hatchery where Ted is Fisheries Technician in charge of that installation.

Norman D. Johnston was born in Bakersfield, California on March 26, 1930. He attended high school in Milwaukie, Oregon where he graduated in 1948. His studies at Oregon State College were interrupted in 1951 when he entered the U. S. Air Force. After discharge in 1954, he resumed his studies at Oregon State where he majored in Fish and Game Management and graduated in 1956 with a Bachelor of Science degree.

Before Mr. Johnston started his career with the Alaska Department of Fish and Game in 1959, he gained experience with one summer with the Oregon State Game Commission, one year with the Fish & Wildlife Service branch of River Basins and two years work on the Lower Columbia River Fishery Program for the Bureau of Commercial Fisheries. Most of this time was spent in the upper Willamette drainage near Eugene, Oregon.

In July 1959 Mr. Johnston was stationed in Wrangell as the district biologist for that area for the Commercial Fisheries Division of the Alaska Department of Fish and Game. In January 1960 he moved to Petersburg where he now lives with his wife Laura and son Dale.

Steven Pennoyer was born in New York City on September 28, 1936. He received his Bachelor of Science degree in Wildlife Management from the University of California's Fisheries Research Station as a laboratory assistant. Thence, he joined the staff of the California Department of Fish and Game in Sacramento, California. From the fall of 1958 to the spring of 1959 he worked as an aid in the Water Pollution Control Section of California Fish and Game Department. In April of 1959, he transferred to the Research Division and worked on the striped bass population study in the Sacramento-San Joaquin Rivers until he joined the Commercial Fisheries Division staff as management biologist for the Arctic area on July 1, 1959.

Wilbur Church was born July 23, 1916 in Shirley, Maine. He moved to Alaska in 1938, residing there until entering the U. S. Army in December, 1941. After serving four years with the Alaska Scouts in the Aleutian theater, he was discharged in November, 1945.

Mr. Church spent eight years with the Fisheries Research Institute of the University of Washington. A major part of this time was spent in winter survival studies of red salmon eggs and larvae in the Wood River Lakes of Bristol Bay. This work was interspersed with lake environmental studies and observations of the migration of red salmon smolts and adults. He resigned in December, 1959 to join the Alaska Department of Fish and Game as assistant District biologist, Division of Commercial Fisheries, for Bristol Bay.

Jim D. Rearden was born April 22, 1925, in Petaluma, California, graduated from high school there, and in the fall of 1942 started his studies in fish and game management at Oregon State College. From March 1943 until August 1945 he served in the U. S. Navy, and saw a year and a half of combat duty in the South Pacific.

He returned to Oregon State College in the fall of 1945. During the summer of 1946, he worked for the Oregon State Game Commission as a temporary bio-

logical aide, and during the summer season of 1947 he worked for the U. S. Fish and Wildlife Service in Alaska as a Fisheries Patrol Agent. In 1948 he was awarded a Bachelor of Science degree in Fish and game management from Oregon State College.

In 1948 Mr. Rearden went to the University of Maine where he was accepted as a graduate assistant at the Maine Cooperative Wildlife Research Unit. In 1950 he was awarded a M.S. degree in wildlife conservation from the University of Maine.

In 1950 he joined the faculty of the University of Alaska where he organized the Department of Wildlife Management. He remained as head of this Department and as Assistant Leader of the Alaska Cooperative Wildlife Research Unit until May, 1954, when he resigned and ventured into the field of free-lance writing and photography.

From 1954 until February 1959 he was self employed as a free-lance writer, contributing nearly 100 major articles on Alaska to various national magazines. In February 1959 he joined the Commercial Fisheries Division staff at the Homer office as assistant district biologist.

Ralph B. Pirtle was born in Redlands, California, on July 24, 1924. He attended elementary and high schools in the State of California and was graduated from the Marysville High School. Schooling was interrupted when he joined the Navy in 1942, serving in the South Pacific theater until the end of World War II.

After discharge from the Navy, he entered school at Lassen Junior College in northern California, graduating in the spring of 1948 with an Associate of Arts degree. He re-entered college at the University of Montana where he majored in Wildlife Technology with his major emphasis on fishery science. His summers as a student were spent at the University's Biological station where studies were continued and valuable field experience was obtained. In 1951, Mr. Pirtle was graduated with a Bachelor of Science in Wildlife Technology.

After graduation, he continued his studies at Montana doing graduate work in fisheries science. After leaving the University of Montana in 1952, Mr. Pirtle was employed for six months with the U. S. Fish and Wildlife Service on the Celilo Indian fishery on the Columbia River. He resigned from the above position in 1952 to take a position with the Oregon Game Commission; his work included a biological and physical inventory and the investigation of sport fishing of the Sandy River drainage.

Mr. Pirtle resigned from the above position in 1953 and took a position with the Idaho Department of Fish and Game to head up the State's salmon and steelhead investigations. Coordinating the studies with the States of Washington and Oregon and the Corps of Army Engineers, he gained valuable information of fish problems and hydroelectric projects, fish passage facilities and other fishery problems related to dam building. In 1956, Mr. Pirtle was promoted to District Management Biologist where he remained until resigning to accept a position with the Alaska Department of Fish and Game as District Management Biologist in the Commercial Fisheries Division with headquarters at Cordova, Alaska.

Mr. Pirtle is married and has twin boys 9 years and a girl 5 years of age.

Glenn H. Davenport was born on April 30, 1929 in Portland, Oregon. He attended Benson Polytechnic High School and after graduation worked for the Bureau of Public Roads until entering the U. S. Army in January of 1951.

After serving two years with the Army Engineers, he continued working for the Bureau of Public Roads and in 1955 commenced his education at the Oregon State College.

Periods of employment with the Fish and Wildlife Service consisting of salmon management and king crab research in Alaska and sport fish management and rehabilitation with the Montana Department of Fish and Game were interspersed with Mr. Davenport's years of college training.

Upon graduation with a Bachelor of Science degree in Wildlife Management in 1959 he began work with the Alaska Department of Fish and Game in the Alaska Peninsula-Aleutian Island area as an assistant district biologist in the Commercial Fisheries Division.

Dexter F. Lall was born August 26, 1932 in Everett, Washington. His family soon moved to Lake Stevens, Washington where he resided until entering the U. S. Navy in 1951.

After serving on active duty for two years, mostly in the Korean area, he was transferred to the inactive reserves and honorably discharged in 1955.

Upon completion of active duty Mr. Lall resumed his education by attending Everett Junior College and the University of Washington. He graduated from the University of Washington in December of 1958 with a Bachelor of Science degree in Fisheries.

Periods of employment with the Fish and Wildlife Service in Alaska were interspersed into his years of college training. He worked on a pilot scale commercial sea lion harvest for the Bureau of Commercial Fisheries just prior to joining the Alaska Department of Fish and Game. He took up duties as an area biologist for the Alaska Peninsula area in September of 1959.

Shortly after joining the Department he married Peggy Jane Lanphere and resides in Kodiak.

Thomas H. Richardson was born on February 25, 1937 in Oakland, California. He entered the University of California in 1955 and later transferred to Humboldt State College where he obtained a Bachelor of Science degree in Wildlife Management in January, 1959.

While attending college, Mr. Richardson worked as a season and part-time employee for the California Department of Fish and Game and for the U. S. Fish and Wildlife Service in Southeastern Alaska.

Upon graduation, he worked for the California Department of Fish and Game conducting salmon and trout studies until July of 1959 when Mr. Richardson joined the staff of the Commercial Fisheries Division as area biologist for the Chignik area.

MANAGEMENT AREAS

Following is a brief resume of the various management areas, their physical description and fisheries and a description of some of the programs which have previously been carried on in the Division.

SOUTHEASTERN ALASKA REGION

The Southeastern region of Alaska embraces the area from Cape Suckling on the northernmost point to the International Boundary between Canada and Alaska on the south. Some 1,000 salmon streams are found in this area which has in excess of 10,000 of the 34,000 miles of Alaskan coastline. This area is, for the most part, an interwoven network of waterways and has less than 10% of the total land mass of Alaska.

The salmon fishery is the most important fishery of this area, with pink (humpback) salmon being the most important species. In 1936, the most productive season for salmon canning in Alaska, of the 8,454,948 cases packed, nearly one-half of this pack—4,121,908 cases—was caught and processed in Southeastern Alaska. Nearly three-fourths of this Southeastern pack—2,959,774 cases—were pink salmon. An even more productive year for pink salmon in Southeastern Alaska occurred in 1941 when 3,631,491 cases were produced.

Since 1951, the once-productive pink salmon fishery has failed to yield a pack of 1,000,000 cases. Production of canned pink salmon has been consistently low since that time and escapements to the streams have suffered accordingly.

The salmon traps, long an object of noxious character to the fishermen of Alaska, were eliminated, with the exception of those owned by native villages, by order of the Secretary of the Interior in 1958. Eleven of these traps fished in 1959.

The reduction in number of traps fished in 1958—146 to 11 operating in 1959—was considered by many people to be a big step forward in the task of rebuilding the now badly depleted runs of salmon in Southeastern Alaskan waters.

The Constitution of the State of Alaska and state law both prohibit the use of fish traps in Alaska and, accordingly, the state attempted to shut down the native-owned traps when they commenced fishing in the summer of 1959. However, the trap owners obtained an injunction which permitted them to operate during the 1959 season. The fish trap litigation has since been under review by Federal and state courts.

Pink salmon have not been the only species of salmon to experience a decline

in abundance in Southeastern Alaska; other species as well have suffered—see Figure 2 and Table 1, Canned Salmon Pack, All Species, Southeastern Alaska.

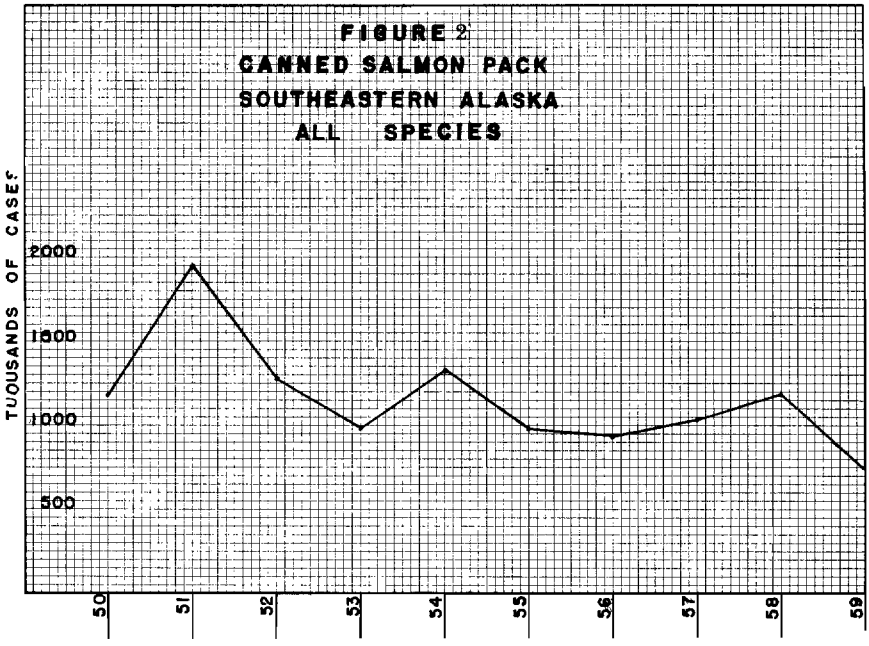


TABLE NUMBER 1

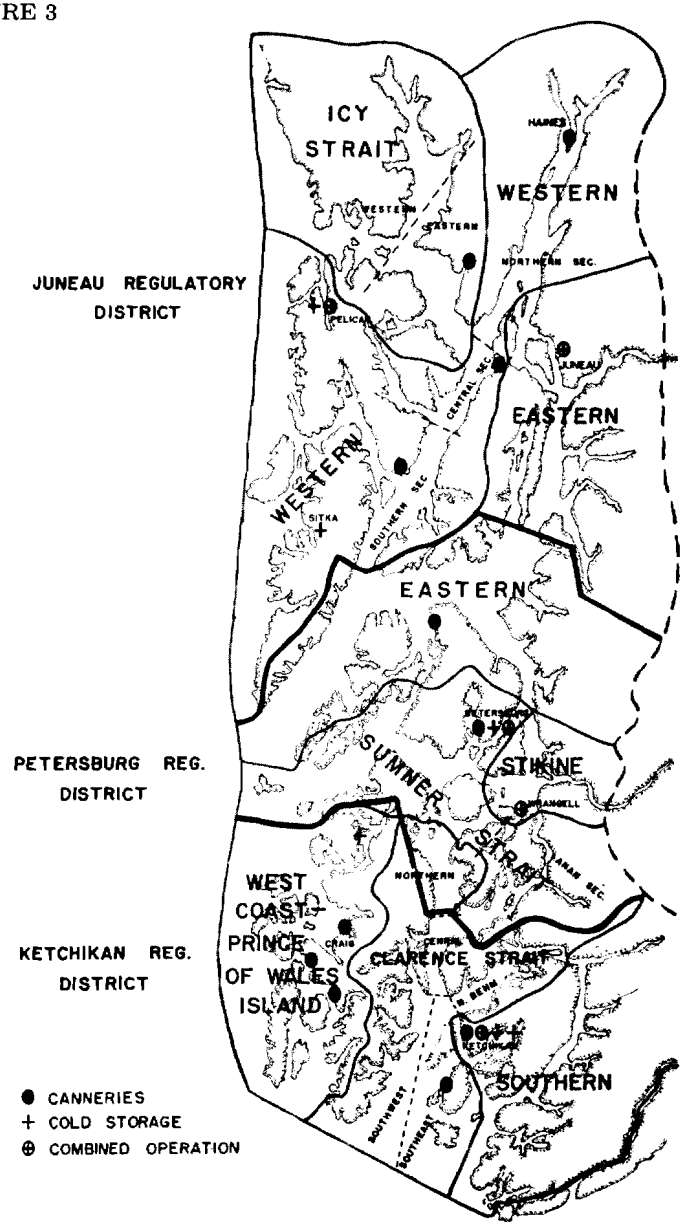
CANNED SALMON PACK FOR ALL S. E. ALASKA

	Kings	Reds	Cohos	Pinks	Chums	Total
1950	567	44,648	114,437	533,837	494,253	1,187,742
1951	738	72,227	258,350	1,164,029	468,870	1,964,214
1952	2,543	74,397	122,822	578,992	510,736	1,289,490
1953	1,414	125,958	86,479	353,247	410,384	977,482
1954	1,046	39,486	241,367	577,176	474,978	1,334,053
1955	314	41,753	103,709	353,247	468,164	967,187
1956	1,272	72,225	46,497	524,270	294,292	938,556
1957	1,358	74,397	53,373	544,666	362,715	1,036,509
1958	843	81,867	51,312	702,899	357,126	1,194,047
1959	1,209	61,393	57,990	471,896	160,354	752,842

In 1959, district offices were established in Juneau and Wrangell; one such office has been in existence in Ketchikan since 1952. District biologists were recruited to staff these offices and assumed their duties on July 1. Their duties for the remainder of the year consisted of becoming familiar with the area and the problems of fishery management.

For management purposes, Southeastern Alaska has been divided into three districts. See Figure 3. The northernmost district includes the Yakataga and Yakutat areas.

FIGURE 3



JUNEAU-YAKUTAT DISTRICT

The northernmost management district of Southeast Alaska extends approximately 450 miles northwestward along the Gulf of Alaska coast from Cape Ommaney at the south end of Baranof Island to Cape Suckling, which forms the eastern boundary of the Copper River-Bering River area. It includes all the inside waters of Southeast Alaska north of Pt. Gardiner in Chatham Strait and Pt. Hugh in Stephens Passage. This large management district is composed of one entire regulatory area: the Yakutat area, which extends westward from Cape Fairweather, plus the northern third of the Southeast Alaska regulatory area, which is called the Juneau district.

Juneau, the State capitol, lies within the district as do the communities of Douglas, Sitka, Haines, Hoonah, Skagway, Yakutat, Angoon Pelican, Elfin Cove, Tenakee, and Klukwan. In common with other parts of Southeast Alaska, the economy of most of these towns and villages is closely associated with the success or failure of commercial fisheries.

The most important fishery of the entire district is for the five species of Pacific salmon. In the Juneau portion of the district there are important salmon purse seine, drift gill net, and troll fisheries. The only remaining salmon set net fishery in Southeast Alaska is found in this district in Chilkat and Chilkoot Inlets. In the Yakutat portion of the district, on the other hand, the salmon fishery is conducted almost exclusively by set netting in the relatively few salmon streams.

Other fisheries include long lining for halibut and sablefish, herring, purse seining, pot fishing for Dungeness crab, and shrimp trawling.

As in the balance of Southeast Alaska, the pink salmon is the most important single commercial species, and the purse seine fishery is the most important fishery.

Handling the fishery products of the district during 1959 were eight salmon canneries plus eleven fresh fish or shellfish processing plants.

The Juneau-Yakutat management district, in common with the other two management districts in Southeastern Alaska, was staffed with a new district biologist during 1959. Unlike the other two districts, however, the Juneau-Yakutat biologist was hired as a deputy U. S. Fishery Management Agent under the terms of a cooperative agreement between the U. S. Fish and Wildlife Service and the Alaska Department of Fish and Game. He worked throughout the summer and fall of 1959 under the direct supervision of the Juneau-Yakutat management agent of the U. S. Fish and Wildlife Service and carried out routine management duties. Upon termination of the agreement on December 31, 1959, he assumed his duties as district management biologist for the Alaska Department of Fish and Game.

KETCHIKAN-CRAIG DISTRICT

The Ketchikan-Craig district extends from the International boundary between Canada and Alaska on the south to Myers Chuck in Clarence Strait and Warren Island, west of Prince of Wales Island, on the north. The area embraces approximately 10,000 square miles and has in excess of 400 salmon producing streams within its boundaries.

There are five communities within this area, Ketchikan, Klawak, Craig, Hydaburg and Metlakatla which in the main are supported by the salmon and halibut fisheries with salmon in the leading role.

There are 12 canneries in operational condition in this district, six of which operated during the 1959 season. There are also four cold storage plants within the district at which troll caught salmon, halibut and limited quantities of black cod are landed. Moderate amounts of herring are frozen and packaged at three of these plants for utilization by halibut fishermen, commercial and sport salmon fishermen.

A considerable part of the 1959 season was utilized by the district biologist in becoming acquainted with the geographical area; fisheries and problems existing in managing these fisheries.

In this connection, methods used in estimating salmon in the streams and

inlets, both from aircraft and from the ground were explained and demonstrated to the district biologist by Department of Fish and Game personnel familiar with survey methods and the area. Following the period of instruction, the biologist continued stream surveys in his area and recorded the data for future use.

Much of the winter period was occupied with indoctrination in routine office procedure, analysis of data and formulation of an operational plan for the coming season at which time management of the fisheries will become the responsibility of the state agency.

Some time was also spent in becoming familiar with the Deer Mountain Hatchery operation, and in the stocking of 590,570 salmon in various areas (Table 2.)

TABLE NUMBER 2

DEER MOUNTAIN HATCHERY FISH PLANTING--1959

Date	Species	# Per Lb.	# of Fish	Area Planted
May 4	Sockeye	2,900	45,000	Princess Lake
May 4	Silver	1,635	19,600	Arrowhead Lake
May 4	Silver	1,500	45,000	Princess Lake
May 25	Sockeye	2,650	79,500	TSA #1 Lake
May 25	Sockeye	2,650	23,800	TSA #1 Lake
May 25	Silver	1,050	21,000	TSA #1 Lake
May 25	Sockeye	2,650	39,750	TSA #2 Lake
May 25	Silver	1,050	12,600	TSA #1 Lake
May 25	Silver	1,500	45,000	TSA #3 Lake
June 17	Silver	1,151	36,800	Wrangell-June Lake
July 3	Sockeye	1,766	42,400	Wrangell-Crane Lake
July 20	Sockeye	1,426	34,200	Bakewell
July 21	Sockeye	1,426	33,000	Bakewell
July 27	Silver	500	14,000	Smugglers Cove
Aug. 4	Silver	640	25,600	Smugglers Cove
Aug. 4	Silver	475	7,100	Smugglers Cove Lake
Aug. 4	Silver	640	16,000	Smugglers Cove
Aug. 4	Silver	640	19,200	Whipple Creek
Aug. 4	Silver	640	6,400	Whipple Creek
Aug. 4	Sockeye		Est. 5,000	Hatchery Pond
Aug. 4	Silver	550	16,200	Ketchikan Creek
Aug. 4	Silver	645	2,500	Ketchikan Creek
Sept.	King		1,100	Ketchikan Creek

Several visits were made to observe the Bakewell fishway, which was completed on August 24, 1959, and to survey Bakewell Lake tributaries for spawning sockeye. The fishway proved successful in passing salmon to the lake, sockeye spawners being observed in the main inlet streams on the last two visits.

Table 3 lists the sockeye egg and fry plants which have been made in this system for the past six years.

TABLE NUMBER 3

BAKEWELL LAKE STOCKING

Year	Species	Green Eggs	Eyed Eggs	Fry
1954	Sockeye	100,000	200,000	
1955	Sockeye			49,700
1956	Sockeye			301,200
1957	Sockeye	525,000		
1958	Sockeye			11,500
1959	Sockeye			67,200

Prior work in this area, initiated in 1952, has consisted of collecting information on lake systems blocked to anadromous fishes by waterfalls, making salmon escapement counts in various streams of the area, tagging of king salmon and blackcod, lake rehabilitation (removing fish life by chemical application) and stocking of both rehabilitated and untreated lakes. See Figure 4, Lakes Stocked with Salmon.

1. BAKEWELL LAKE
2. PRINCESS LAKE
3. TSA COVE LAKES (3)
4. ARROWHEAD LAKE
5. KETCHIKAN CREEK
6. JUNE LAKE
7. CRANE LAKE
8. SMUGGLERS COVE
9. MANZANITA LAKE
10. ELLA LAKE
11. OLD FRANKS LAKE
12. WHIPPLE CREEK

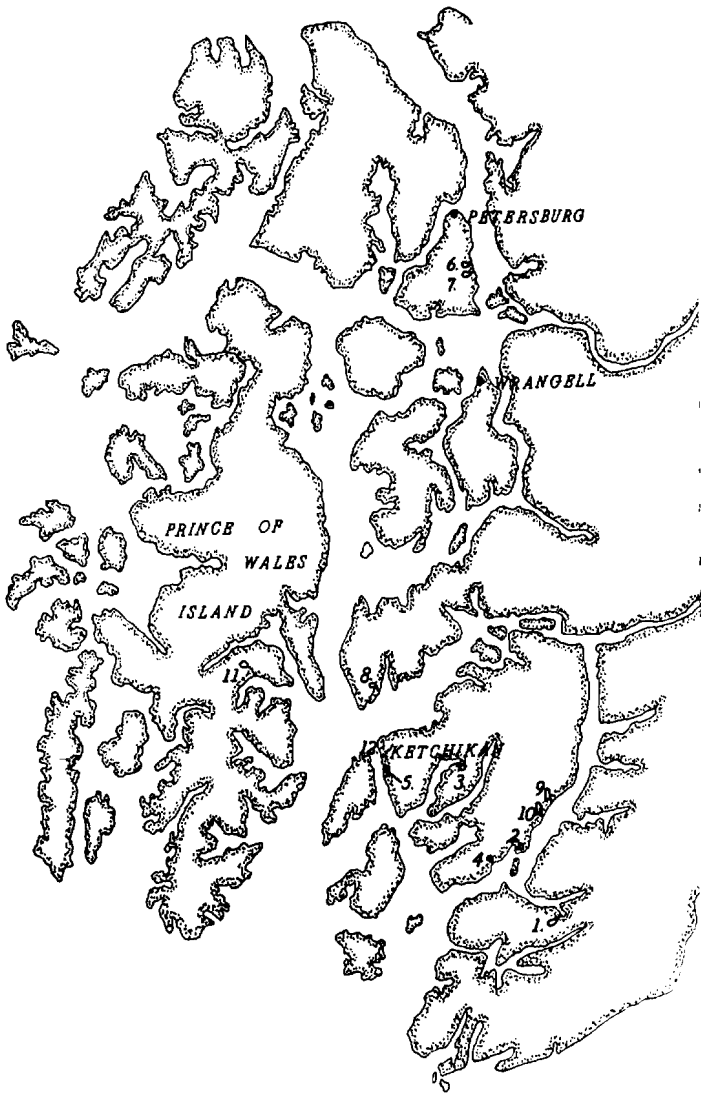


Figure 4--Lakes stocked with Salmon.

PETERSBURG-WRANGELL DISTRICT

Petersburg-Wrangell district, centrally located in Southeastern Alaska, extends from Myers Chuck on the south to Windham Bay on the north and from the western Canadian Border to the eastern shores of Baranof and Prince of Wales Islands. The area encompasses over 200 salmon streams including the famous Stikine River and Anan Creek.

The communities of Petersburg, Wrangell and Kake are supported by a diversified fishing industry in the district. Their fleets deliver five species of Pacific salmon to the five local canneries and three cold storage plants. The oldest shellfish industry in Alaska supports five plants packing shrimp and Dungeness crab in the communities. Also located in the district are the three remaining operative herring reduction plants in Alaska. Halibut and blackcod landings are a very important part of the local economy and provide at least part of the annual income of most of the boat crews of the district.

The 1959 season was spent largely in acquainting the new district biologist with the local area, the numerous streams, the commercial fishing fleet, and the problems inherent with managing an Alaskan fishery. Trips were made on U. S. Fish and Wildlife vessels during the summer and fall seining seasons and considerable time was spent observing the Stikine River gill net fishery. Aerial and foot surveys were made on many of the streams during the season.

Based on observations by Department biologist during the 1957-58 season an action program was instigated on Tahltan Lake, B. C. in 1959. During periods of low rainfall the water level at the outlet of the lake became very low and in 1958 the stream was observed to be completely dry in stretches resulting in the stranding and death of a large portion of the red salmon run before reaching the lake. The seriousness of this situation can best be realized when one considers that Tahltan Lake is estimated to possess over 75% of the known red salmon spawning area of the Stikine system. When alerted to the problem, Petersburg Vessel Owners Association and the Wrangell Gillnetters Association donated money for the construction of a log, flow maintenance dam to be built with the aid of Telegraph Creek, B. C. residents to specifications drawn by the Department engineer. The abutment resulted in a slight raising of the lake outlet level and allowed a continuous flow of water in the outlet stream during the critical summer months. The sockeye, 4,300 in number, were counted into the lake and scale samples taken for age analysis. This program is to continue as part of a plan to rebuild the badly diminished red salmon run in the Stikine River.

Silver and sockeye salmon fry were introduced into two small lakes on Mitkof Island which were treated in 1958 with toxaphene to remove all fish life. Removal of fish which prey upon or compete for food with the young salmon results in increased survival and growth of the planted fish.

36,000 silver salmon fry were planted in June Lake on the 17th of June and 42,000 sockeye fry were planted in Crane Lake on July 3rd. These two small lake systems drain into Ideal Cove which lies about midway between Petersburg and Wrangell.

At the end of the 1959 season the district office was moved from Wrangell to Petersburg to take advantage of a more central location. An office will be maintained in Wrangell and plans call for an assistant biologist for this station.

CENTRAL REGION

District Biologists have been in two of the areas in this region for three years, namely Bristol Bay and Cook Inlet. The staff in the Arctic and Prince William Sound areas are new on the job this year.

In anticipation of assuming the management responsibilities in January 1960 the staff has been searching past records and data as well as becoming familiar with the fisheries and the areas during 1959.

The Management Biologists and areas were assigned as follows:

Arctic Area Boundaries—Management Biologist, Steven Pennoyer: All waters of Alaska north of Bristol Bay between Demarcation Point and Cape Newenham.

Bristol Bay Area Boundaries—Management Biologists, Dean Paddock and Wilbur Church: All waters of Alaska from Cape Menshikof on the Alaska Peninsula to Cape Newenham.

Cook Inlet-Resurrection Bay Area Boundaries—Management Biologists, Clarence Weberg and Jim Rearden: All waters of Alaska in Cook Inlet and Resurrection Bay north of Cape Douglas and west of Cape Fairfield, including the Barren Islands.

Prince William Sound-Copper River-Bering River Area Boundaries—Management Biologist, Ralph Pirtle: All waters of Alaska between Cape Suckling and Cape Fairfield.

ARCTIC-YUKON-KUSKOKWIM AREA

The Arctic-Yukon-Kuskokwim district encompasses all the drainages in Alaska from Cape Newenham, just north of Bristol Bay, around to Demarcation Point at the Canadian border on the Arctic Ocean. This includes a land mass of nearly four hundred thousand (400,000) square miles and contains five major drainages of over one hundred fifty (150) miles in main river length. One of these, the Yukon, is twenty-three hundred (2,300) miles in length from its headwaters at Atlin Lake in the Yukon Territory of Canada to its mouth in the Bering Sea. Fourteen hundred (1,400) miles of its course lies within Alaska.

This area has been and is still largely a biological question mark. Even such basic information as species occurrence is missing in many drainages. The timing of salmon runs is but sketchily documented, and only the vaguest guesses are available concerning the magnitude of runs. The Arctic-Yukon-Kuskokwin district office of the Commercial Fisheries Division opened its doors on July 1, 1959 to answer the need for a permanent fisheries biological staff for this area.

The fisheries in this district consist of a small commercial fishery and a large subsistence fishery. The commercial fishery includes five canneries and nine salteries on the Yukon River and numerous small fresh and cured fish enterprises throughout the area. The canneries and salteries have been operating exclusively on king salmon, with the idea of reserving the other four species of salmon for the subsistence fishery. The commercial operators on the Yukon have been allowed a quota of 65,000 king salmon per year since 1954.

Subsistence fishing on salmon, whitefish, and other species in the Arctic-Yukon-Kuskokwin district is of major importance. Salmon is the mainstay in the diet and economy of most of the Eskimos and Indians who make up the majority of the population in this area. Many salmon are required to feed sled dogs which provide the only means of transportation available to many of these people through the long Arctic winter. Though it appears there has been a reduction in the subsistence fishery in recent years, there is not sufficient quantitative catch data from the past to evaluate the rate of decline. Nevertheless, the subsistence fishery is still a vital and important phase of fisheries management in this area of Alaska.

The State carried on no commercial fisheries research projects in the Arctic in 1959. A management program was set up for 1960 and the logistics of area administration were delved into.

BRISTOL BAY DISTRICT

With the attainment of Statehood at the onset of the calendar year and the accompanying iminency of responsibility for the management of the fishery, the activities in the district were of increased significance in the final season remaining prior to the assumption of the management function by this Department. Personnel of the Commercial Fisheries Division carried out observations within each fishery and closely followed the programs of the Fisheries Research Institute and the Bureau of Commercial Fisheries of the U. S. Fish and Wildlife Service.

RED SALMON

The 1959 Bristol Bay season was strongly influenced by the uncertainty regarding the scope of operations to be permitted by the Secretary of the Inte-

rior. At the time of initial publication of the 1959 commercial fishery regulations, those for Bristol Bay were delayed awaiting clarification of the high-seas fisheries situation.

Figure 5—Modern power fishing boats at cannery on Bristol Bay.

Regulations finally appeared in the Federal Register of April 28 prescribing a complete commercial closure on the taking of red salmon in the Kvichak-Naknek, Egegik, and Ugashik districts and limiting the commercial take on the Nushagak. Provisions comparable to those of the previous year were continued for the Togiak district and for species other than red salmon in the four main districts. This curtailment was imposed in the light of an expected small cyclic run and the prospect of an intense high-seas fishery on these same stocks of fish.

Later developments in regard to the high-seas situation were of such nature as to finally permit a limited commercial fishery in all Bristol Bay districts. The Federal Register of May 30 contained further amendments to this effect, including a gear-timetable providing for curtailment on fishing time from 2½ days to 1 day per week (2 days to 1 day in the Nushagak district) if the amount of gear exceeded the following limits: Naknek-Kvichak, 150; Nushagak, 324; Egegik, 60; Ugashik, 50.

In spite of the late disposition of the regulatory framework, packing and fishing operations were mounted in the routine fashion for years of anticipated low production. Subsequent participation of gear coincided with the upper limits of the timetable in all affected districts except Nushagak, where approximately 275 units were present. These levels represented a slight increase for the Nushagak and marked decreases for the remaining districts.

NUSHAGAK DISTRICT

The early portion of the Nushagak red salmon season was marked by a failure of the fishermen and packers to reach a price agreement. This resulted in a virtual cessation of fishing effort from June 22 through July 1. During this period the first of two strong peaks in the run appeared and the escapement into Wood River was already in excess of 800,000 red salmon when the price settlement was reached. The entire Nushagak fleet again joined in the effort with the commencement of the open period on July 2. Good catches were experienced

and extensions in fishing time beyond the provisions of the gear-timetable were granted upon occasion during the remainder of the season.

The return to Nushagak Bay approached 4,800,000 fish, for the largest total run since 1948. The catch of over 1,700,000 fish, though reduced by the lack of early effort, was likewise the largest since that year and the escapement of more than 3,000,000 was greater than any since 1946.

Apportionment of spawning stocks within the Nushagak Bay systems exhibited some noteworthy features. The 2,210,000 fish of the Wood River Lakes was the largest contribution to the total. The Igushik Lakes were also heavily seeded, with 643,808 fish counted past the towers. Numbers of spawners entering the Tikchik system were estimated this season by use of towers for the first time, with the rather low figure of 48,861 being tallied from the site at the mouth of Little King Salmon Creek on the Nuyakuk River. Aerial surveys indicated that approximately 15,000 red salmon also spawned in the main Nushagak and Mulchatna Rivers. No towers were maintained on the Snake River, but aerial surveys revealed a surprising concentration of approximately 140,000 fish in Lake Nunavaugaluk. It is hoped that production from a substantial escapement such as this may contribute toward re-establishment of a healthy run in this long-depressed area.

The aerial surveys of the Snake River system together with similar coverage of the Togiak spawning grounds, were conducted for the Department by Mr. Wilbur Church of the Fisheries Research Institute through special arrangement with that agency. Mr. Church later joined the Alaska Department of Fish and Game in December, 1959 as Assistant District Biologist for Bristol Bay. It is planned to continue these surveys after the establishment of counting towers on these systems to permit a retroactive check of their accuracy.

NAKNEK-KVICHAK DISTRICT

A low level of return to the Naknek-Kvichak District was expected for the 1959 season in keeping with the well-established cyclic pattern of the Kvichak River run, which usually dominates the production of this fishery. Though the Kvichak itself developed as calculated, the total return to this district was augmented by production from the Alagnak and, particularly, the Naknek systems which exceeded expectations. Management was successful in keeping the Kvichak escapement above that of the previous year (674,187 to 534,735) though the Naknek received 2,231,807 in the meantime. Escapement into the Alagnak also surpassed that of the Kvichak, with 825,431 fish being enumerated by tower observers.

Red salmon spawners in all systems numbered 3,731,425, which gave a return for the season of 5,420,850 fish when combined with the catch of 1,689,425 reds. Only the 1958 catch of less than a million fish has been smaller though total runs of lesser magnitude are recorded for 1954 and 1955, as well. In spite of the low total catch, individual fishermen fared well, due to the low numbers of units present.

EGEGIK DISTRICT

The anticipated return to the Egegik district was also exceeded by the run which materialized. A good catch of 662,391 fish was made from the total of 1,734,858. The escapement of 1,072,459 fish provided good utilization of this system's spawning areas and is considered entirely adequate.

UGASHIK DISTRICT

Though the 1959 catch of 423,414 red salmon in the Ugashik district compares favorably with those of many recent years, the number of spawners escaping to reproduce the run proved disappointing. This season marks the third consecutive year that the escapement has failed to reach 300,000 and the fifth in which total returns to this system have been disappointingly low. The escapement of 218,723 fish was well distributed within the productive spawning tributaries but was not of sufficient size to fully utilize available gravels.

TOGIAK DISTRICT

Effort in the Togiak district remained close to the level which has been maintained since serious exploitation commenced in 1955. The 1959 red salmon catch of 113,000 fish may be contrasted with that of 36,000 for the 1958 season as an indication of relative abundance. Aerial escapement surveys contribute similar evidence regarding the nature of this year's run, with an estimate of approximately 180,000 reds. An escapement of this magnitude is presently considered to be excellent.

Other species form a substantial supplement to the annual Togiak catch with chum salmon making by far the largest contribution. Approximately 50,000 salmon of other species were taken this season, 85% of which were chums.

KING SALMON

Though the fishing effort directed at king salmon in the Nushagak district was comparable to that of recent years, the overall catch was not large and daily catches reflected an inconsistent availability to the gear during king season. The catch by the 8½-inch mesh gear totaled 38,764, with the red season take raising the final figure to 50,695. This represents an approximate decline of over 40% from the previous season's catch of more than 85,000 fish and marks the first serious setback since 1953 in the recent upward catch trend.

Subsequent coverage of the spawning areas revealed the largest king escapement observed since surveys were first undertaken by the Department in 1956. This escapement appears to have been two to three times as large as those previously observed. This would suggest that some factors other than mere numbers of fish in the returning run have a major influence upon numerical size of the take.

Extension of aerial and float surveys brought to light the importance of the Koktuli and Old Stuyahok Rivers as contributors to the overall spawning areas utilized by this species.

Sampling of the commercial catch for size, age, and sex composition was continued.

COOK INLET AREA

Activities in the Cook Inlet Area for 1959 included observing and over-seeing a large scale offshore seismic exploration, supervising and checking on land seismic projects, accompanying U. S. Fish & Wildlife Service biologists during salmon season activities, a short term investigation of condition of the razor clam fishery on the east side of Cook Inlet, and a continual appraisal of the salmon, shrimp, and king crab fisheries of the district.

Observing Offshore[1] Seismographic Work

The presence of oil in apparent important commercial quantities on the Kenai Peninsula has added another problem to the management and perpetuation of Cook Inlet's fisheries. In late January, 1959, the first extensive offshore seismic exploration in Alaska was commenced in Cook Inlet. This work was done by Western Geophysical Company for Standard Oil Company of California, and ten other oil companies.[2]

1. "Observations on Offshore Seismographic Work in Alaska, January-June", by C. A. Weberg and J. D. Rearden, a report on the Cook Inlet Work, has been deposited in Alaska Department of Fish and Game library at Juneau.
2. Continental Oil, Ohio Oil, Pan American Petroleum Corp., Richfield Oil, Shell Oil, Sunray Mid-Continent Oil, Superior Oil, Texaco (Alaska) Inc., Union Oil of California, and Western Gulf Oil Company.

No established procedure existed for licensing or formally permitting offshore seismic operations in Alaskan waters. The Bureau of Commercial Fisheries, the Bureau of Sport Fisheries and Wildlife (the Federal agencies charged with administering Alaska's fish and game during 1959), the Alaska Department of Fish and Game, and the Alaska Land Board cooperatively agreed on the terms of a permit which was issued to Standard Oil and the other interested companies, granting permission for the work to proceed.

Under terms of the Permit the Alaska Department of Fish and Game supervised the operation and the oil companies furnished an observation vessel for

use by the Department. This vessel was equipped with fishing gear (otter trawl) for use in sampling fishing populations in the areas explored, as well as radio, radar, and other equipment believed necessary to properly oversee the operation. Also, a biologist experienced in supervising offshore seismic work was employed as a temporary advisor. All costs were borne by the oil companies.

Offshore seismic investigations require that explosives be detonated in water. This of course comprises a possible hazard to marine life, and justifies the need for a biologist observer during the work.

Various types of explosives are used in this work; some of these are extremely harmful to marine life, others are relatively safe. Black powder may be used; it is relatively harmless to fish life unless exploded very close (within 45 feet) to a fish. Fishes with air bladders are much more susceptible to damage from underwater explosions than those without; shellfish. including crab, are comparatively immune from effects of all but very close explosions.

Cook Inlet waters are fairly devoid of fish life during the winter months, with the exception of king crab and shrimp in Kachemak Bay and the lower Inlet. Therefore, during a part of the offshore seismic work, permission was granted the oil companies to utilize a much cheaper and safer (from the human hazard viewpoint) powder—Nitro-carbo-nitrate. Normally, however, when there was a possibility of downstream migrating smolts being within the area of explosion, or when the operation occurred where there was likelihood of an appreciable kill of any species, only black powder was permitted.

No commercially valuable or sports fish were known killed during the operation, late January until May 24, 1959. The total observed kill was composed entirely of tomcod *(Microgadus proximus)*. Only 272 of these were observed dead during operations, and none was longer than about a foot.

At the conclusion of the Cook Inlet operation the four seismic vessels with the chartered observation vessel used by the overseeing biologist, went to the Icy Bay-Yakataga area where 12 days of similar work were concluded. In this operation the observer estimated that 3400 pounds of gray cod *(Gadus macrosephalus Tilesius)* were killed. Gray cod are not taken commercially in this area. About 500 pounds of these fish were recovered by the observation vessel, cleaned, filleted and distributed for food.

Land Seismic Problems

The proven presence of quantities of oil beneath the surface of the Kenai Peninsula has, since the Richfield Discovery well of 1957, caused much activity by oil interests. The most obvious form this activity has taken has been in seismographic (seismic) exploration both offshore (see above) and on land.

The problems that offshore seismic exploration pose for fisheries management are relatively simple compared with those of land work. It is customary in almost all states for a state official continually to observe offshore operations. Not all states require observers with land crews. Alaska does not.

Nevertheless, these operations do present a possible serious threat to Alaska's salmon fishery.

On the Kenai Peninsula seismologists have discovered that best results are obtained by operating in stream valleys, rather than on uplands around these valleys. Consequently the tracked vehicles used in land work are continually travelling trails cut along stream valleys. Many of these streams are, of course, important salmon spawning areas. Mechanical damage to spawning gravel at crossings and simple erosion from much-used trails is becoming a problem on the Kenai Peninsula.

It is also probable that in some cases, damage to salmon spawn could occur from land seismic blasts.

Normal procedure for this type of operation is for holes to be drilled, at regular intervals on a "shooting line." These holes normally, on the Kenai Peninsula, vary from perhaps 30 feet to 100 feet and occasionally even deeper. The explosive charge is lowered into these holes and detonated.

Salmon eggs, for a brief time after being deposited in gravel, pass through a so-called sensitive or "tender" stage, at which time they are extremely susceptible to damage from a sharp jolt. Concern is felt about possible damage that could occur to such eggs in spawning streams from seismic exploration explosives.

The Cook Inlet staff consulted with oil geologists, spent time in various land

seismic camps, and corresponded with other state biologists in an effort to determine what effects these explosions could be having on salmon spawn.

Observing Federal Fisheries Management

From late June and well into August both biologists of the Cook Inlet staff accompanied various members of the Cook Inlet commercial fisheries management branch of the U. S. Fish and Wildlife Service throughout the district. As many phases of their operation were studied as possible. This work headquartered at Anchorage, at the head of Cook Inlet, nearly 200 miles from the extreme reach of the district, Cape Douglas. Consequently much time was spent travelling to and from the outer boundaries of the district in a federal airplane. Those techniques that were believed most practical for use under state management were concentrated on.

Razor Clam Fishery[1] Kenai Peninsula

A ten day survey of the razor clam fishery on the east side of Cook Inlet showed that digging for razor clams has increased during the past 10 years due to better highways and a larger human population. There has been no restriction on personal or commercial use of razor clams except for a closed season each year between July 10 and August 31.

Interviews with 17 local residents familiar with the clam beaches brought out the fact that most of these individuals believed that razor clams were not as large or as plentiful as they were in the past.

Clams are still abundant enough to provide good digging for personal or sports use, but they are probably not abundant enough to support any commercial enterprise. Study of a sample of shells indicated that the growth rate of razor clams on the beaches of the east side of Cook Inlet is similar to that of clams on the commercially dug beaches of Cordova and Swickshack. Water temperatures are high enough for normal spawning (about 55.5° F. before spawning occurs), spawning activity corresponds roughly with the yearly closed season.

A die-off of razor clams on the east side of Cook Inlet occurred in May, 1959, but it was probably not important to the clam population as a whole. Reports from residents who were interviewed showed that die-offs have occurred during past springs. No reason is known for these die-offs.

A daily bag and possession limit of 30 razor clams was recommended for the east side of Cook Inlet from Kenai River to the Homer Spit (sports fishery), with no size limit. In addition, this area should be closed to commercial digging. The yearly closed season should be continued, using the present dates. Further study of the razor clam fishery on these beaches is needed.

1. A copy of the report resulting from this study "A Survey of the Razor Clam (**Siliqua patula** [Dixon]) Sports Fishery, Kenai Peninsula, Alaska," by Jim D. Rearden and Clarence A. Weberg has been deposited in the Alaska Department of Fish and Game Library at Juneau.

PRINCE WILLIAM SOUND AND COPPER-BERING RIVER AREA

The Prince William Sound and Copper-Bering River area comprises all of the drainages in Alaska from Cape Suckling to Cape Fairfield. This area encompasses the waters of Controller Bay, Prince William Sound, Copper River and several small rivers entering in the Copper River Delta and adjacent areas. In land area the district includes approximately 35,000 square miles most of which is drained by the Copper River entering the Gulf of Alaska east of Prince William Sound. The major river system, Copper River, has its headwaters in the Alaska Range and Wrangell Mountains and drains portions of the Talkeetna, Mentasta and Chugach Mountains. Copper River travels through broad valleys dotted with numerous lakes, and winds through precipitous canyons below Chitina, Alaska before reaching the Gulf approximately 250 to 300 miles from its headwaters.

The Cordova district has one of the most varied fisheries of any district in Alaska. The major fisheries harvest the five species of salmon, razor clams and

Dungeness crab. Minor fisheries consist of shrimp, herring, king crab, cockles and some bottom fish. Some commercial fishing is done during most months of the year. The commercial fishery of the Cordova district included, in 1959, ten salmon canneries, one salmon saltery, one salmon cold storage operation, four miscellaneous fish processors and fourteen shellfish processors. In addition, several small fresh and cured fish enterprises operate periodically. Salmon drift gill net fishing for king and red salmon starts in early May on the Copper River flats and in Controller Bay in June and continues throughout the season until the salmon runs are over. After a slack period in late July, the silver salmon fishery begins in early August and continues until about mid-September in these same areas. A small set gill net fishery in Prince William Sound at Eshamy harvests a late run of red salmon.

The Copper and Bering River average case pack for the last 20-year period is 51,240 reds, 4,073 kings and 29,725 cohos. Recent years have shown a decrease in case packs for all three species.

The major salmon fishery of the district is a purse seine fishery for pinks and chums in Prince William Sound which usually begins in early July and lasts for about four weeks.

Records show a sharp decline in the catch of pink salmon in Prince William Sound during the past 20 years. In the last 10 years of harvest the average season catch of pink salmon has been approximately 120,000 cases.

Chum salmon catches in Prince William Sound for the last 17 years have averaged about 41,000 cases. The harvest of chums has shown considerable variation during these years, however, the catches have been more stable than pink salmon and records of chum catches do not show the sharp decline which is shown by pink catches during recent years.

The razor clam fishery has been on a quota system for many years, however, the main season quota of 1,470,000 pounds (42,000 cases) in the Prince William Sound and Copper River area has not been reached in recent years. Records of clam digs during recent years show a general decline in the harvest. The ten-year average harvest is approximately 985,000 pounds, or 29,000 (48½ lb.) cases. The razor clam season is from January 1 to June 30 and from August 16 to December 31. The major processing occurs during the spring season and only small, local processors take advantage of the fall season.

The Dungeness crab season is open the entire year with the exception of a small area of Prince William Sound that is closed during the period June 1 to August 31. This fishery harvests on the average of about 1,500,000 pounds of crab each season and appears to be the only major fishery of the area that shows no immediate signs of decline.

In addition to the commercial fishery there is a considerable amount of fishing done for subsistence purposes in Prince William Sound and in the Copper River. Each year approximately 20 Indian fish wheels are operated in the Copper River between Chitina and Gakona.

The Department of Fish and Game carried on no commercial fisheries research projects in the Prince William Sound and Copper-Bering River areas in 1959. The management biologist set up the district office in Cordova and endeavored to become acquainted with the fisheries, the fishermen and communities and logistics of the area administration.

WESTWARD REGION

Area management biologists in the Westward Region spent the bulk of the 1959 season becoming acquainted with the areas which they are to assume management in January of 1960 as well as searching previous data and management techniques.

The Management Biologists and areas were assigned as follows:

Kodiak Area Boundaries—Management Biologist, Robert Simon.

All waters of Alaska from the southern entrance to Imuya Bay near Kolokak Rocks, to Cape Douglas, including Kodiak, Afognak and adjacent islands.

Chignik Area Boundaries—Management Biologist, Tom Richardson.

All waters of Alaska on the south side of the Alaska Peninsula between the southern entrance to Imuya Bay near Kilokak Rocks and the western point at the entrance to Kuiukta Bay, including adjacent islands.

Alaska Peninsula Area Boundaries

All waters of Alaska from a point three statute miles south of Cape Menshikof to Unimak Pass, thence easterly to the western point at the entrance to Kuiukta Bay.

Aleutian Islands Area Boundaries

Management Biologists, Dexter Lall and Glenn Davenport.

All waters of Alaska in the Aleutian Islands west of, and including, Unimak Pass.

PENINSULA

RED SALMON

Bear River, combined with the adjacent Sandy River, sustains a major portion of the Peninsula red salmon fishery. These two streams produced 52% of 1959's 66,917 case pack (80% of the north-side pack) of red salmon. The Bear River-Sandy River catches were very good in July, but escapement was dangerously low. It wasn't until the area had been closed for a week that the escapement began to pick up on July 30. A large run of Eulachon smelt choked Bear River the first two weeks of July and may have interfered considerably with the red escapement. By August 18th Bear River had a very good escapement of 192,000 reds. Sandy River had an estimated escapement of 40,000 reds; somewhat less than good.

The Cape Lutke fishery (Unimak Island) normally furnishes 50 to 75 percent of the south-side red salmon pack. However, it furnished only 27% of the 1959 pack of 23,425 cases, even though the 1959 pack was on a par with those of 1957 and 1958.

An additional 5,400 red salmon were processed by a freezer ship in Ivanof Bay.

KING SALMON

A mild-cure king salmon fishery operates at Port Moller from late May until mid-June. In this, its second year, the fishery took 19,069 kings. The catch fluctuated almost directly with the effort, both of which were doubled over the 1958 season. An additional 2,018 cases (1,790 north-side; 228 south-side) of kings were produced on the Peninsula, the largest king pack since 1936. However, this is still less than one percent of the total 1959 Peninsula pack.

SILVER SALMON

Silver salmon are a minor factor in the Peninsula fishery, primarily because the runs do not develop until September. By this time the north-side fishery has ceased operations, and the south-side fishery is turning its attention to king crabs. The total Peninsula silver salmon pack was only 1,295 cases.

A cold storage plant at Sand Point and one freezer ship each in Ivanof Bay, Nelson Lagoon, and Port Heiden processed a total of 50,000 silvers. Independent fishermen commercially salted an additional 12,000 silver salmon.

PINK SALMON

Pink salmon are primarily a south-side product. Compared to a 10-year average production of 75,000 cases, only 45,642 cases of pink salmon were produced in 1959. This reduction in catch has been attributed to the reduced runs and drought conditions in 1957. Surprisingly, 48% (22,308) cases of the south-side pink pack was taken the first week of the fall season in the Southwestern District. The fall season in this district is historically a chum salmon fishery. An additional 4,500 pinks were processed by a freezer ship in Ivanof Bay and the cold storage plant at Sand Point.

The Makushin Bay (Aleutian Islands) pink run did not develop in 1959. A total of only 11,000 pinks and 6,000 reds were taken in Aleutian Islands area.

CHUM SALMON

Of the 86,187 cases of chum salmon packed on the Alaska Peninsula area for 1959, 78,739 cases were packed in south peninsula canneries. This was 10,000 cases below the average for previous 10-years but constituted 62% of the total

south peninsula pack. This high percentage of the pack is in keeping with past data that indicate the chum pack has remained fairly steady for the last 10 years while the pink pack has dropped alarmingly. For the period 1950-1959 the chum pack averages 96,150 cases while the average pink production was 74,683 cases.

Catch of chum salmon were particularly good in the Izembek Bay, Pavlof, Volcano and Cold Bay areas, contributing well over half of the south-side catch. The remainder of the chum catch was distributed throughout the south peninsula area.

An additional 12,000 chum salmon were taken in Ivanof Bay by a freezer ship.

SALMON ESCAPEMENT

Stream surveys on the north-side of the Peninsula were practically non-existent. Hoodoo Lake had a fairly good escapement of 70,000 red salmon. The Sandy River system also had a fairly good escapement of 40,000 reds. Bear Lake was in very good shape with 192,000 reds.

Estimates of south-side escapement, for the most part, was limited to two aerial surveys. The first was made by Fisheries Research Institute on the 16th of August. Forty-five streams were surveyed between Kupreanof Point and False Pass. Estimates of the escapement indicated the streams were receiving a spotty seeding of salmon. The second survey was made on the 19th of August by the Fish and Wildlife Service. Although close in time the survey indicated an overall improvement but good escapements into individual streams remained spotty.

KING CRAB

Exploration of the king crab potential in the Alaska Peninsula-Chignik area began as early as 1940-1941 with an investigation carried out by the Fish and Wildlife Service, Division of Fishery Industries on funds provided by Congress in 1940.

The investigation indicated that extensive populations of king crab existed in portions of the Alaska Peninsula-Chignik area. But, it was not until 1952-1953 that a commercial fishery developed in the Peninsula-Chignik area. A small trawl fishery produced less than 500,000 pounds of king crab for those years. Since the 1952-1953 season the industry has rapidly developed into an intense pot, trawl fishery producing 7,000,000 pounds of crab for the period from July, 1958 to July, 1959. Two processors and approximately 38 vessels were involved in the fishery.

The 1958-1959 season, extending from July to July in order to more closely follow the fishing year, actually began in August, 1958, and extended through May, 1959. The fall portion of the fishery was an even pot, trawl fishery while the winter fishery was almost entirely a pot fishery. A slack developed in December and January mainly due to weather conditions. Toward spring the trawl fishery increased.

The catch for the 1958-1959 season is shown in the following table:

1958-1959	Pounds of King Crab
Trawl	2,432,938
Pot	4,813,009
Grand Total	7,245,947

Figure 6 shows the trawl catch compared to the pot catch by statistical week for the 1958-1959 season.

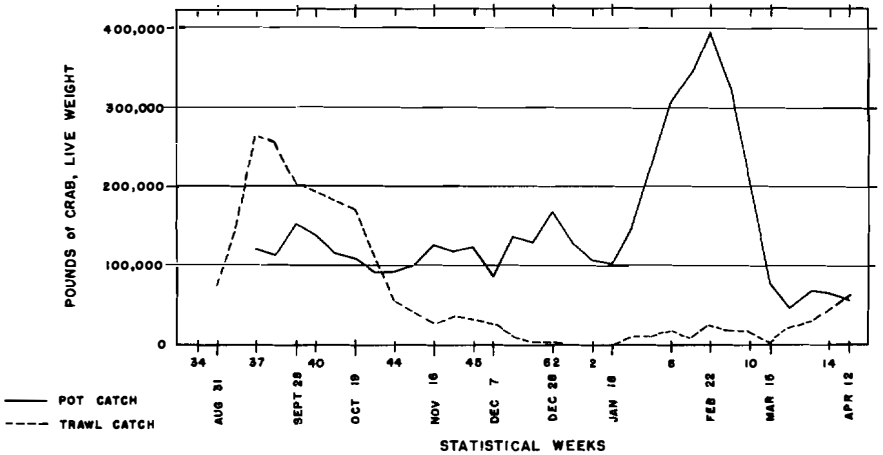


Figure 6—King Crab Catch—Peninsula-Chignik Area.

By far the areas of largest catch are centered in the Shumagin Island and Pavlof Bay regions. Belkofski Bay area follows closely with smaller catches being reported from nearly every section of the area between Kupreanof Point and Cold Bay. Weather conditions and unsuitable harbor conditions have nearly ruled out the Bering Sea to American processors.

With the outlook for the 1959-1960 season set at an increase in gear and the inclusion of another processing plant, several problems concerning management of fishery will become acute.

With no commercial fishing regulations other than licensing and crab area registration controlling the fishery, the protection of the female king crab during the spring, molt-spawning period from a destructive trawl fishery becomes necessary.

In addition, the problem of controlling the catch of harvestable male crab so as not to exceed yearly recruitment, indicates the need of a population study in the Alaska Peninsula-Chignik area.

KODIAK DISTRICT

The most distinctive feature of the 1959 salmon fishery in the Kodiak area was that it was the poorest in twenty-five years from the standpoint of the size of the pack and the average gross pay for the fishermen. The situation was aggravated by a relatively heavy effort: 444 seines and 104 set nets. This effort was due mainly to the closure in Prince William Sound, which forced the fishermen to move to Kodiak and other areas, rather than an expected good run in Kodiak.

The total run in the Kodiak area was not quite as bleak as the fishery indicates, however, since good runs did develop in some districts at the close of the season. The pink salmon runs, which are the mainstay of the salmon fishery, were unusual in their lateness. It is not known whether the late runs developed as a result of (1) the absence of traps for the first time, (2) fresh water conditions during spawning, or incubation, (3) a result of marine environmental conditions or, (4) several years of early closures.

The chances are quite remote that the absence of traps had any effect on the timing of the runs. If anything, one would expect an earlier and more orderly migration without the impedence of traps and their leads to cause milling and delay of the fish.

It is quite possible that fresh water conditions in 1957, had a strong influence on the 1959 pink salmon runs. In 1957, many streams in the Kodiak area were so dry that salmon were unable to ascend them until the early fall rains brought the streams up. Since the 1959 midseason runs seemed to be more or less confined to the larger more stable streams that are relatively unaffected by drouth, it would seem that stream conditions in 1957 were indeed an important factor.

Oceanographic data and the influence of marine conditions on the timing of salmon runs are, at present, not known in the Kodiak area, so no inference can be drawn at this time.

The commercial fishing season for salmon, in the Kodiak area, has been closed on or before August 15 each year since 1946. It is entirely possible that the late portion of the salmon runs have built up as a result of six cycles of complete protection.

Plates 1 and 2 are a graphic presentation of the pink salmon fishery and escapement for the year 1959.

Figures 7 and 8—Weekly Pink Catch and Escapement.

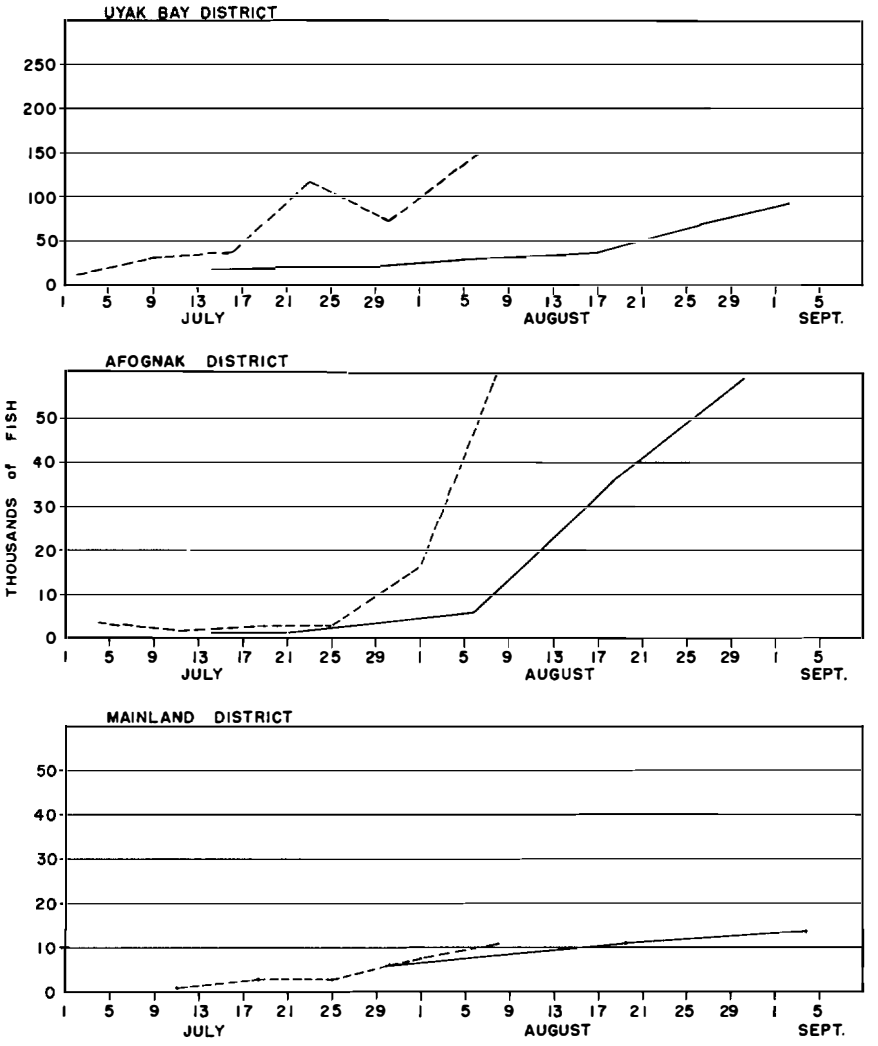
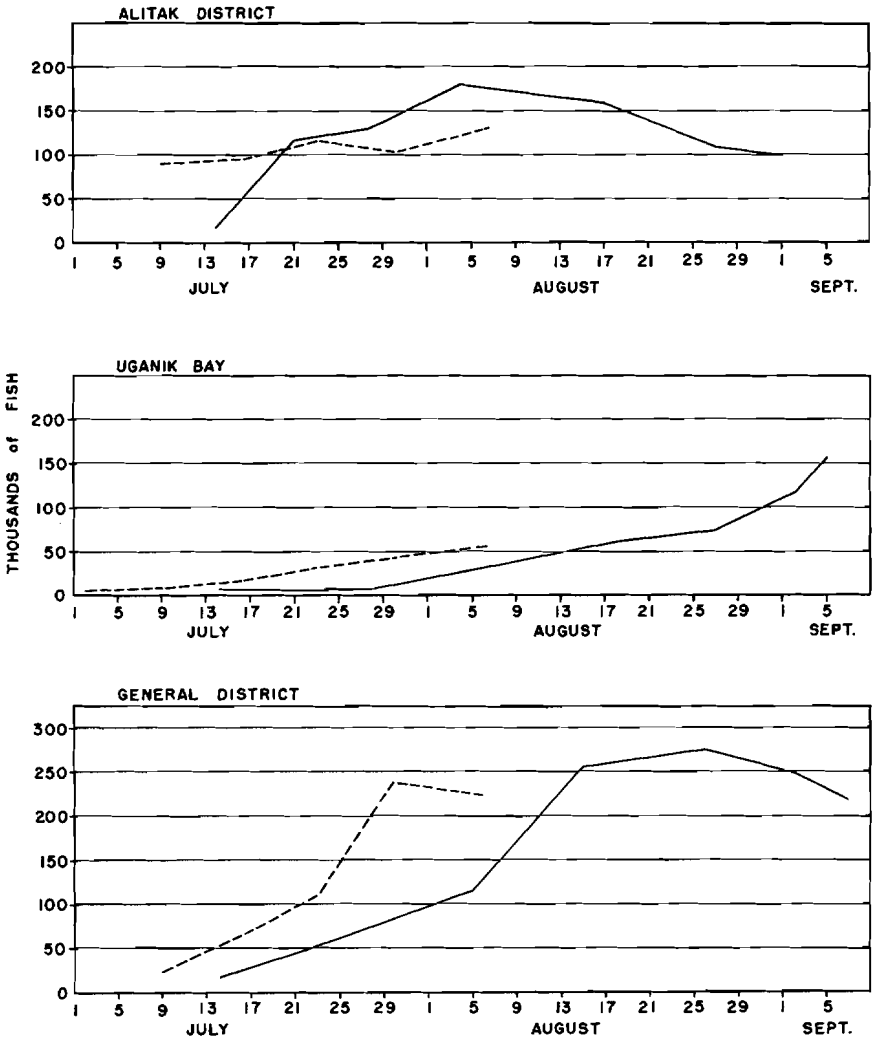


PLATE 2

WEEKLY PINK CATCH AND ESCAPEMENT

1959



With the exception of the Alitak district, the information suggests that a mid-season closure, with an extension of the season, might have been in order.

Red salmon runs in Kodiak continue to be poor. While no worse than average of the last five years, it's still but a fraction of the runs of thirty years ago. Red salmon runs have been of such low magnitude, that a complete escapement in late years would still be inadequate. To insure the desired escapement would, however, necessitate ignoring the pink salmon runs which have become the chief support of the salmon fishing industry.

Chum salmon runs remain fairly steady in the Kodiak area. In late years the chum have become more a significant portion of the total pack, partly be-

cause more chum are being taken, and partly because the contribution of the other species has dwindled. Escapement was generally less than optimum in 1959, which may indicate that chum are subjected to heavy fishing pressure on poor pink years.

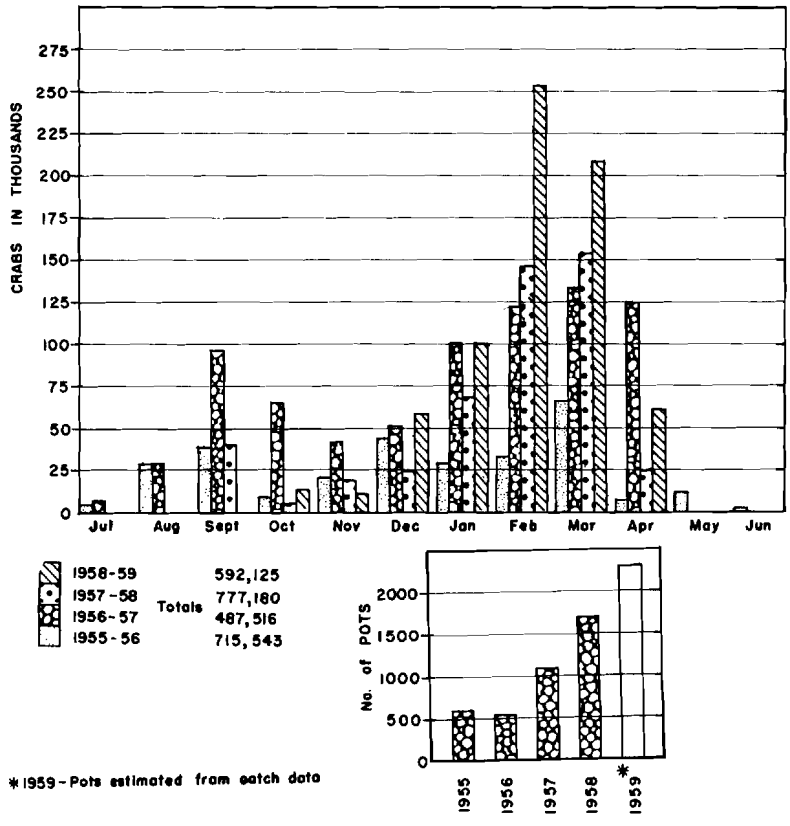
Total salmon catch in the Kodiak district for 1959 was 3,047,278.

Gear	Reds	Kings	Pinks	Chum	Coho	Total	% of Total
417 ps	213,279	1,302	1,768,741	593,163	11,337	2,587,822	84.9
27 bs	16,516	507	30,934	125,396	2,772	176,125	5.8
104 sn	100,292	28	167,383	15,225	403	283,331	9.3
Total	330,087	1,837	1,967,058	733,784	14,512	3,047,278	100.0

KING CRAB

The king crab fishery continued to build up through 1959, as it has during each preceding year. The crabbing season has historically peaked during the winter months, therefore the data has been adjusted to encompass a season, rather than a calendar year. Plate 3 indicates the nature of the crab fishery from July 1 through June 30, and its progression from 1955 through 1959. Also is depicted the effort as it is reflected in the total number of pots fished. Trawls are not included, since they are used intermittently, and generally when the crabs are schooling in the spring and not entering the pots.

Figure 9—King Crab Catch—Kodiak Area 1955-1959.



It can readily be seen that the king crab fishery is a winter operation in the Kodiak area. The timing of the fishery dovetails nicely with the salmon fishery so that both the fishermen and the industry can diversify their operation, so as to take advantage of both fisheries at the expense of neither. Also in late years, the crab fishery has served to bolster an economy suffering from poor salmon seasons.

RAZOR CLAMS

13,240½-24 pound cases of razor clams were canned in 1959. The clams were taken by 57 diggers. A series of minus tides uncovered clam beds that hadn't been dug for a number of years, as a result, the quota was raised 1,000 cases. However, the diggers failed to meet the original 12,500-case quota set in the Swikshak area.

HERRING

The herring fishery was quite poor due to a preponderance of young herring resulting in poor yields. A weak world market coupled with the poor yield rendered the herring operations unprofitable and the two plants closed down early. The catch was as follows:

Barrels	Lbs. Meal	Gallons Oil	Gallons Solubles
30,649	1,204,612	110,651	70,062

SHRIMP

A full scale shrimp operation was underway in Kodiak for the first time in 1959. Fishermen took 2,897,000 pounds of shrimp in local waters and no doubt would have taken much more, but technical problems were encountered that forced an early cessation of the fishery. All shrimp were canned.

CHIGNIK

The Chignik area in 1959 experienced its lowest total salmon pack since the World War II, and perhaps the lowest on record in terms of catch per unit effort. This was primarily due to the extreme poor pink salmon pack which dropped to 3,659 cases in 1959 compared to a ten-year average annual pack of 21,963 cases as represented in Figure 11. Economically, however, the fishery was sustained by a relatively good red salmon pack which was slightly higher than that of the previous two years. (Figure 12.) This was due, in part, to an extended season in the Chignik Bay district permitting a late freezer ship operation.

Figure 11—Annual Chignik Pink Salmon Pack.

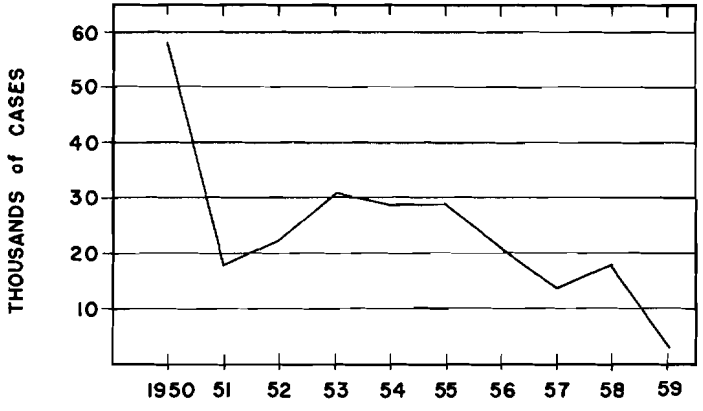
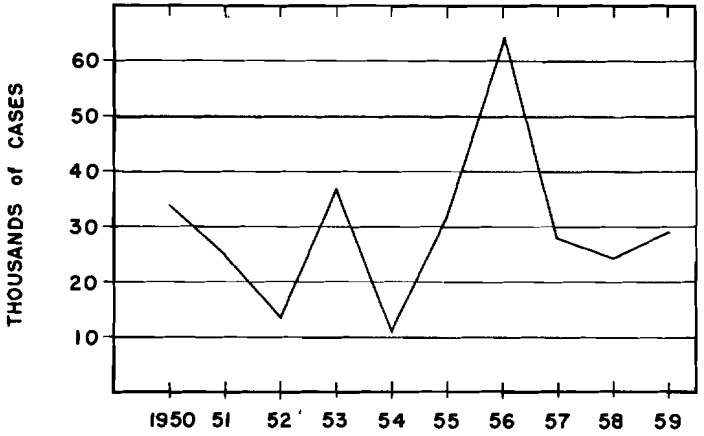
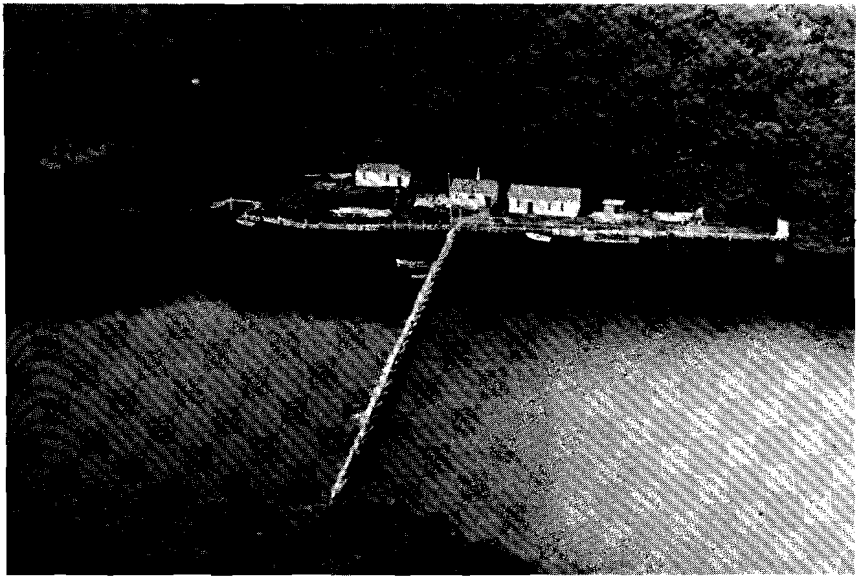


Figure 12—Annual Chignik Red Salmon Pack.



The Chignik River red salmon run peaked in mid July, somewhat later than usual. As in past years the catch exceeded the escapement during the early portion of the season due to the greater fishing effort at that time. Special closures in July and an extended run of red salmon in August brought the catch and escapement to a near equal ratio by the end of the season for a total estimated run of 831,000 reds. The weekly relation of catch and escapement is diagrammed in Figure 13. Although escapement data is lacking following the removal of the U. S. Fish and Wildlife Service Chignik weir on August 11, surveys indicated a continued escapement of red salmon throughout August corresponding closely to the magnitude of the catch.

Figure 10—Over 1500 Aluminum pipes were used in the construction of the Chignik Weir.



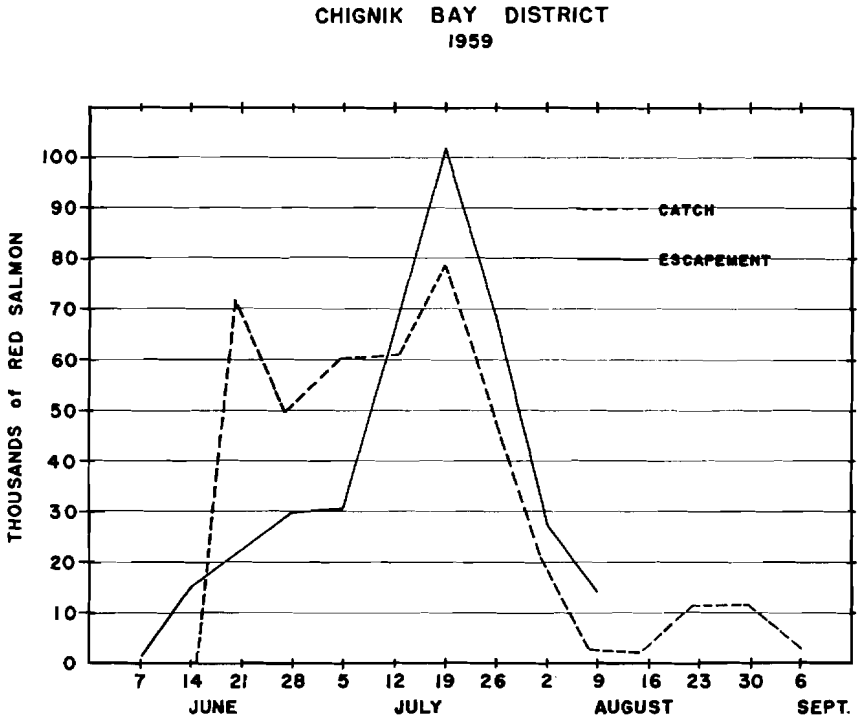


Figure 13—Weekly Relation of Catch and Escapement.

The extreme poor pink salmon runs in the Chignik area this year were generally attributed to poor parent escapements and low water conditions in 1957. Fishing effort in the pink and chum producing Eastern and Western districts has increased over the past years as a result of (1) regulations decreasing the weekly fishing periods of the Chignik Bay red salmon fishery, (2) decrease of the Chignik River red salmon stocks and, (3) the gradual change-over to gear equipped with power blocks. The need for intensified management by aerial survey and increased protection of the existing pink salmon stocks present are imperative to support a future pink fishery on an economical basis.

The chum and coho runs showed little change in the Chignik area in 1959, although the case pack of these species was slightly lower than 1958. Chum salmon escapements were relatively poor. Late coho runs in the past have provided a minor salting fishery following the termination of cannery operations in the Chignik Bay district. This fall, however, the presence of a freezer ship in the area limited salting operations to a minimum.

The 1959 salmon catch for the Chignik area is outlined in the following table:

	Kings	Reds	Cohos	Pinks	Chums	Total
Chignik Bay Dist.	502	425,277	4,654	21,228	17,613	469,274
Eastern District	20	1,634	43	14,134	108,830	124,667
Western District	148	1,111	117	31,680	60,636	93,692
Total	670	428,022	4,814	67,042	187,079	687,627

SPORT FISH

Forward

During 1959 the Sport Fish Division was in a position to commence several badly needed research projects in addition to the expansion of its management program. The increased undertaking of the division was made possible by the recruitment of six biologists to fill the positions created. A biographical sketch on each of the new biologists is provided.

BIOGRAPHICAL SKETCH

Rupert E. Andrews was born on September 18, 1929, at New Haven, Connecticut. From 1946 to 1951, Andrews served in the U. S. Coast Guard. He entered the University of Idaho in the fall of 1952 and received his Bachelor of Science Degree in Forestry, with a major in Fisheries Management in 1956. He completed his work for a Master of Science Degree in Fisheries at Oregon State College in 1959. Upon graduation Mr. Andrews joined the U. S. Fish and Wildlife Service, Gulf Fisheries Investigation, Mississippi, as a research biologist. Mr. Andrews joined the staff of the Alaska Department of Fish and Game in June, 1959 as a federal aid research biologist and is presently stationed in Palmer with his wife Genevieve and three sons, Brian 7, Scott 6 and Clyde 1.

Robert T. Baade was born on April 20, 1918 in Napa, California. He attended the University of Alaska from 1936 to 1939. Baade entered the U. S. Army Air Force in 1942 and was honorably discharged in 1945. After discharge he resumed his studies at the University of Washington where he received his Bachelor of Science Degree in Fisheries in 1947. During summer vacations he worked for the Fisheries Research Institute on Red Salmon Investigations in Bristol Bay. He transferred to the State of Washington, Department of Game, where he worked until 1951. He accepted a fishery biologist position with the U. S. Fish and Wildlife Service and returned to Alaska and was stationed in Ketchikan. Mr. Baade joined the staff of the Alaska Department of Fish and Game in April 1959 and is assigned to sport fish investigations in Southeast Alaska under the federal aid program. Mr. Baade and his wife, Dixie, make their home in Ketchikan.

Edward J. Cramer was born on July 20, 1930 in Appleton, Wisconsin. He attended grade school and high school in that state. He entered the University of Wisconsin in 1949 and after two years entered the Service. In 1953 he received an honorable discharge from the U. S. Army and accepted seasonal employment with the California Fish and Game Department. In the fall of 1954 Mr. Cramer returned to the University of Wisconsin. He completed his studies in 1958 and received his Bachelor of Science Degree with a major in Zoology. Mr. Cramer joined the staff of the Alaska Department of Fish and Game in July 1959 and is presently stationed in Anchorage as a research biologist under the state's public fishing access program.

Jean R. Dunn was born on June 27, 1934 at Coalinga, California .He attended grade and high schools in that state. He entered Oregon State College in 1953 and received his Bachelor of Science Degree in Fisheries in 1957. During the summer vacation periods, Mr. Dunn was employed by the Fish and Wildlife Service, Bristol Bay Research, and worked on salmon smolt studies in that area. Upon graduation he entered the military service and was honorably discharged in April 1959. He returned to work for the F. W. S. on the salmon studies until he joined the staff of the Alaska Department of Fish and Game in August 1959. Mr. Dunn is currently stationed in Seward, Alaska as a federal aid research biologist.

Henry J. McKirdy was born on December 3, 1925 at Gladstone, North Dakota. He attended grade and high schools in that state. From 1944 to 1946, Mr. McKirdy served in the U. S. Army. Upon separation from the service he entered North Dakota State School of Forestry, in Bottineau, North Dakota and received an AS degree in Forestry in 1948. He then entered Utah State University and received his Bachelor of Science Degree in Wildlife Manage-

ment in 1950. Upon graduation he accepted work with the North Dakota Game and Fish Department as a warden, later accepting a position as a fisheries biologist. Mr. McKirdy joined the staff of the Alaska Department of Fish and Game in June 1959 and is currently stationed at Fairbanks. Henry and Yvonne McKirdy have three children, Iris 10, Craig 8 and Brian 3.

Frank A. Stefanich was born August 16, 1916 at Roundup, Montana. He received his pre-college schooling in that state. Mr. Stefanich entered the service in 1942 and was separated in 1945 from the U. S. Army as a 1st Lieutenant. He entered Montana State College, Bozeman, Montana in 1946 and received his Bachelor of Science degree in 1950 and his Master of Science degree in 1951. Upon graduation he accepted a position as Fisheries Biologist with the Montana Fish and Game Department. Mr. Stefanich joined the staff of the Alaska Department of Fish and Game in June of 1959 and is currently stationed in Anchorage with his wife, Patricia and three children, Randall 11, Julia 8 and Susan 6.

The following report covers the activities and progress of the Sport Fish Division and represents the combined efforts of the following staff:

E. S. Marvich, Director, Sport Fish Division, Juneau

A. H. McRea, Federal Aid Coordinator, Juneau

R. E. Andrews, Research Biologist, Palmer

R. T. Baade, Research Biologist, Ketchikan

L. S. Bandirola, Ass't. Management Biologist, Anchorage

E. J. Cramer, Research Biologist, Anchorage

J. R. Dunn, Research Biologist, Seward

H. J. McKirdy, Management Biologist, Fairbanks

Dr. R. Reed, Research Biologist, Fairbanks

F. A. Stefanich, Management Biologist, Anchorage

SPORT FISH MANAGEMENT

The Sport Fish Division is charged with the supervision and management of Alaska's recreational fisheries. It formulates regulation proposals for consideration by the Alaska Board of Fish and Game for the conservation with maximum utilization, of the available resources. It provides technical council on the possible impact of industrial development, such as hydroelectric and water diversion dams and impoundments, nuclear experiments, road construction, logging, chemical pollution, etc., on the state's fishery resources. In addition the division participates in a conservation education program through lectures, radio programs and visual aids to various public organizations, sportsmen groups and educational institutions.

An investigational program, conducted under the Federal Aid in Fish Restoration program was instigated in July 1959 and is designed to provide the information required for sound management and regulatory practices. This program is discussed later in the report.

The management phase is augmented by a limited fish egg take, fish hatchery and fish rearing program.

The State's hatchery program has been guided by similar basic problems encountered in many of the 48 other states in past years. Waters readily accessible to the population centers are subjected to heavy angling pressure. Many of these lakes have shown an alarming depletion in sport fish stocks. A management program, based on maximum utilization of the available resource, was developed around the hatchery program to supplement the natural recruitment in areas of heavy angling pressure. In addition to replacement of fish stocks, virgin lakes have been made available to the angler by the introduction of desirable sport fish. Lakes that are unsuitable for angler use, due to populations of undesirable fish, are rehabilitated and then stocked with desirable fish from the Division's hatcheries.

The State hatcheries, one at Fairbanks, one at Anchorage and one operated under joint agreement with the Kodiak Conservation Club, produced approxi-

mately 992,000 rainbow trout, steelhead trout and silver salmon fry and 330,000 steelhead eyed eggs for distribution during the 1959 season. These stations raise only sub-catchable size fish (fry and fingerlings) for use in the State's management program. The actual rearing of the fish to catchable size is accomplished in the natural environment. This type of operation permits maximum production, for the facilities available, at minimal expense.

FIRE LAKE HATCHERY

The Fire Lake Hatchery, Anchorage, began its 1959 season in March with the arrival of one million rainbow trout eggs procured from Spokane, Washington. These eggs were hatched and the resulting fry were reared at this station until ready for stocking in the various lakes. Again this year the Anchorage station carried the quota of rainbow eggs for the Fairbanks station in addition to its own. In June, 280,000 feeding fry were transported to the Fairbanks station via Department tank trucks. An additional 150,000 steelhead eggs from Kodiak were received in the Fire Lake station at the end of June.

Water temperatures were again a problem at this station. During early spring, water temperatures below 32 degrees Fahrenheit were recorded in the rapidly flowing water supply. Sub-freezing air temperatures were an additional impairment to normal hatchery operation in the unheated building. During this period, about two weeks, two auxiliary type hot air heaters were put into operation to prevent the formation of skim ice in the hatchery troughs. It also proved necessary to install a portable steam generating plant at the water supply intake to overcome ice formation in the water supply line. This icing condition was in sharp contrast to the mid-summer operation when the hatchery water supply rose to high temperatures—a maximum of 70 degrees Fahrenheit—during the latter part of June and early July. Table I.

Table I. Water Temperatures at Fire Lake Hatchery 1959

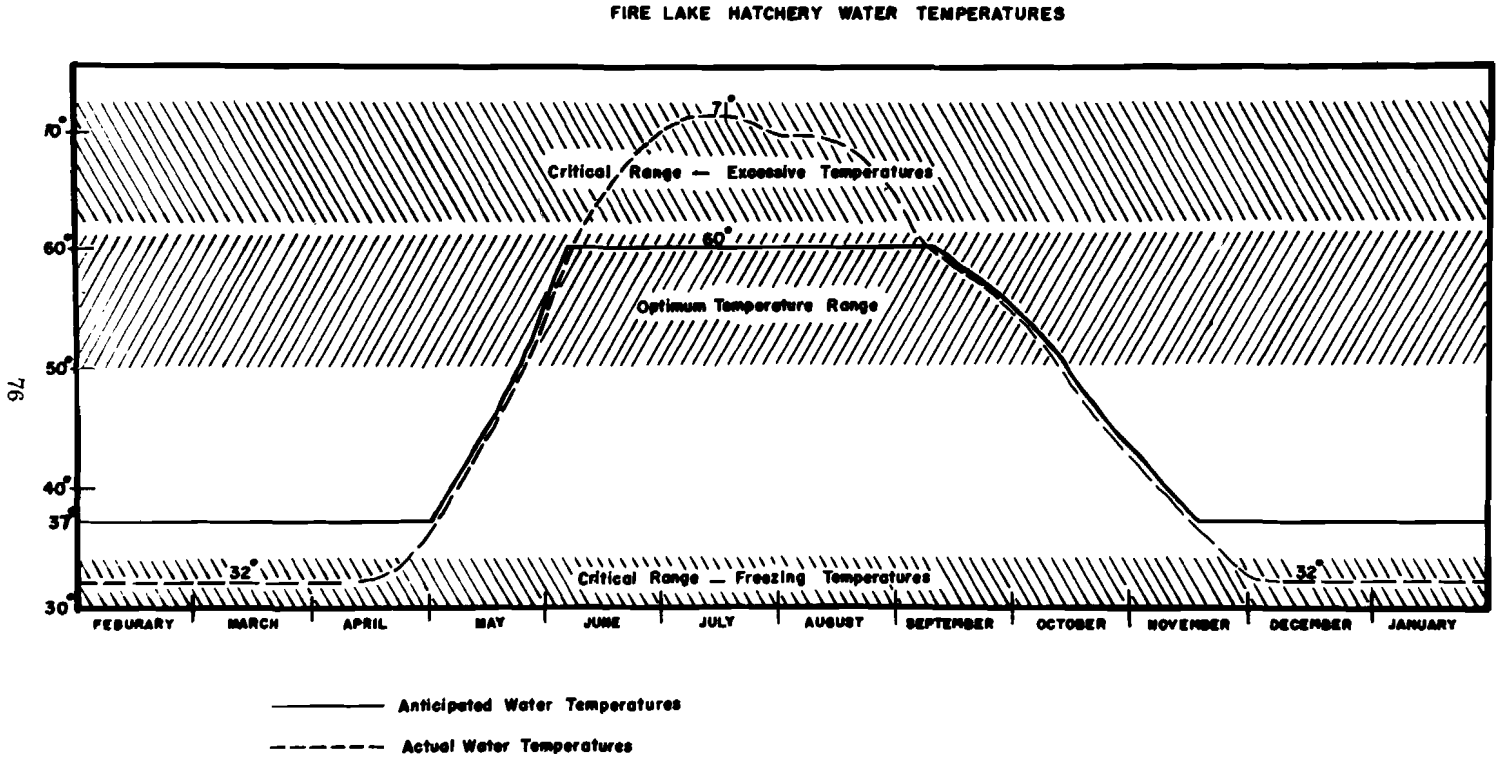
	Degrees Fahrenheit		
	High	**Low**	**Mean**
April	38	32	33
May	59	33	42
June	70	49	64
July	69	50	59
August	68	52	60

The high water temperatures put the hatchery fish off their feed. Consequently the lack of nutrition weakened the fish and increased their susceptibility to disease. As a result of the difficulties encountered and because of the contemplated year-round operation for this station, plans and preparations for a new water system were formulated. The hatchery was closed down at the end of August and a new eight-inch pipeline was installed. The pipeline intake was moved from the Fire Lake outlet stream to the lake itself and preparations were made for the construction of a tower out in the lake. The completion of this tower is expected by early 1960. The pipeline will be extended to the tower and a vertically adjustable intake installed. This new water system will accomplish the following:

1) Increase the water flow to the hatchery four times from its present flow, thus providing added hatching and rearing capacity.
2) Enable the regulation of water temperature by the adjustment of the intake depth.

This limited temperature control can be accomplished because of the physical characteristics of water. Water, as most liquids, expands as it is heated (becomes lighter). Conversely it contracts as it cools (becomes heavier). One peculiar property of water is that it will become heavier as it cools only up to a given point, approximately 39 degrees Fahrenheit. Below this temperature

FIGURE 1


FIRE LAKE HATCHERY WATER TEMPERATURES
70°
60°
50°
40°
37°
32°
30°
71°
60°
Critical Range — Excessive Temperatures
Optimum Temperature Range
Critical Range — Freezing Temperatures
32°
FEBURARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
JANUARY
Anticipated Water Temperatures
Actual Water Temperatures

water again expands, or becomes lighter, until it reaches the freezing point, 32°F., where continued expansion forms ice. Because the expansion resulting in ice formation increases a given volume of water 1/11 times, ice readily floats. It is this peculiar characteristic that enables fish to survive in our northern lakes. If water, contrary to its nature, increased in density, becoming heavier, as it cooled to the freezing point then ice formation would begin at the bottom of the lakes and Alaska, as most northern states, would have lakes of solid ice. Fortunately, this does not occur. As the water cools at the surface and gradually sinks it displaces the warmer water below it and forces this warmer water to the surface.

During the winter water reaches its maximum density at 39.2°F. below the surface of the lake with stratifications of lighter, cooler water above and with ice forming on the surface. Conversely during the summer the cooler water, again 39.2°F., is at the bottom of the lake and the lighter warmer water above it. It is this peculiar property of water that the Department will be utilizing in the new Fire Lake Hatchery water system. By adjusting the up and down placement of the intake pipe, hatchery personnel will be able to take water from the warmer, 39.2°F. water layer near the bottom of the lake for use in the hatchery during winter operation. The water, having high heat retention qualities, is capable of retaining its heat as it passes through the hatchery thus preventing ice formation in the troughs. During the summer, as the waters warm to an undesirable temperature near the surface of the lake, the hatchery men can lower the intake pipe to the cooler depths, taking water at the 55°F. level for hatchery use. See Figure 1. With this control of water temperature, the hatchery will be able to achieve (1) year-around operation (2) better growth of fish and (3) reduced susceptibility of the fish to disease and parasites.

During the 1959 season a total of 668,100 rainbow and steelhead trout and silver salmon were stocked in 31 lakes in the Cook Inlet-Matanuska Valley, Glenn Highway, Homer and Valdez areas from this station. A complete list of fish plantings made from the Fire Lake Station may be found at the end of this report. Table VII.

BIRCH LAKE HATCHERY

The Birch Lake Hatchery, Fairbanks, began its operation in June with the arrival of 280,000 feeding fry from the Anchorage station. The Fairbanks station normally begins its seasonal operation in June due to the late winter ice break-up in that area. By starting operations with feeding fish this station was able to go into full production at the beginning of the season, rather than experience a 5-6-week delay. In late June an additional 100,000 steelhead eyed eggs were received from the Kodiak Hatchery.

Water temperatures reached critical peaks for a short period in late June when a high of 77°F. was experienced. The average water temperature for a nine-day period during this time was 68.4°F. Cool weather, a result of heavy rainfall during July and August, lowered and maintained the water temperature in the low 60's.

This change in the weather prevented serious losses of the feeding fry and enabled this station to stock in the various Interior lakes approximately 70% of its fish. The Birch Lake Hatchery, operating only during the summer months, has water temperature problems similar to Anchorage (Table II) which limits its production.

Table II. Water Temperatures at Birch Lake Hatchery, 1959

	Degrees Fahrenheit		
	High	**Low**	**Mean**
June	77	55	66
July	64	44	59
August	70	44	59

A total of 268,800 rainbow and steelhead trout fry were planted in 10 lakes and gravel pits in Interior Alaska from the Fairbanks station. A list of the waters stocked from this station can be found at the end of this report. Table VIII.

KODIAK CONSERVATION CLUB HATCHERY

A full-time biologist is stationed at the Conservation Club Hatchery on the Kodiak Naval Station. This man cooperated with the Club in carrying out various sport fish projects and worked on sport fishing problems in the Kodiak, Alaska Peninsula, and Aleutian Islands areas. The Department has maintained a biologist in this area since 1956. Biological surveys have been conducted on some 27 lakes in the Kodiak area. In addition a comprehensive survey was completed on Adak in the Aleutian Islands this season. Table III. Ten accessible lakes and the majority of their tributaries were investigated. The fish species present were determined by test netting, using graduated mesh gill nets, hook and line fishing, and shore line observation. All specimens collected were measured, scale samples taken, sex determined, and stomach contents examined. Physical lake data consisting of pH tests, depth measurements and aquatic flora and fauna were collected and recorded. The following is a summary of the findings from ten lakes and some tributary streams on Adak and Kagalaska:

Table III. Fish Population Survey, Adak

			Fish Species Present				
Lake	Approx. Acres	Max. depth found	Rainbow	Dolly Varden		Stickleback	Sockeye Salmon
Andrews	2,300	86 ft.	X	X		X	
Haven Pond	5	6 ft.	X	X		X	
Leone	35	20 ft.	X	X		X	
Mitt	4	15 ft.		X			
Heart	25	25 ft.	X	X		X	
DeMarie	150	30 ft.	X	X		X	
Boy Scout Pond	2.5	18 ft.		X			
No-Luck Pond	3	6 ft.		X		X	
Bell's	7	7 ft.		X		X	
Kagalaska	125	8 ft.	X	X			X

Again this season the Department assisted the Kodiak Conservation Club in securing sufficient steelhead eggs to operate the Kodiak hatchery and provide eggs for various activities throughout Alaska. A portion of the Karluk River steelhead run was trapped by use of a weir and the eggs taken were flown to the Kodiak Naval Station hatchery. The Karluk River is isolated; therefore the steelhead are only lightly harvested. The egg take occurs in early May and lasts approximately two weeks. The weir is then disassembled to allow the natural spawning run of the remaining steelhead to take place.

During the 1959 egg take approximately 1,100,000 steelhead eggs were taken, of which 580,000 were shipped to other stations. The remainder were planted as fry from the Kodiak station. The 1959 egg shipments were as follows:

Agency	Location	Number
Alaska Department of Fish and Game	Anchorage	150,000
Alaska Department of Fish and Game	Fairbanks	100,000
Alaska Department of Fish and Game	Juneau	40,000
U. S. Navy	Adak	190,000
Washington State Department of Game	Olympia, Washington	100,000
	Total	580,000
Eggs held for Kodiak area		383,000
Total pick-off mortality		140,000
	Total egg-take	1,103,000

A total of 335,000 steelhead trout fry were planted in 27 lakes on Kodiak and adjacent areas from the Kodiak Conservation Club Hatchery. A list of the waters stocked from this station may be found at the end of this report. Table IX.

The hatchery program, in itself, is only one tool of management. Before this particular tool can be utilized an extensive lake survey must be completed. This survey determines, among other things, the suitability of a body of water to support fish life. Physical data are collected to determine oxygen levels, especially during the critical winter periods, in addition to the volumetric surveys. This data is augmented by biological findings collected throughout the year. Gill nets capable of catching fish from about 4½ inches to well over 25 inches in length are utilized for determining the existing populations of fish within the lake. Lake sampling has in some cases revealed lakes with past histories of excellent angling to be presently in a state of population unbalance. This unbalance can be caused by light angling pressure which fails to harvest sufficient numbers of fish. When this happens, the fish population exceeds its food supply and consequently "stunted" fish result, which are no longer attractive to the angler. Conversely, extensive angling pressure may reduce the desirable sport fish populations to a point where undesirable species become dominant.

Attempts have been made to restock trout fry in lakes with established dominant scrap fish populations. Except in rare instances this proved futile. The rough fish were utilizing the available food supply and living space within the lake. The trout fry introduced into this undesirable environment soon disappeared.

There is a remedial management tool which may be used in some instances to correct this condition. This tool is the complete eradication of the existing fish populations in lakes saturated with rough fish, and the subsequent re-introduction of a desirable sport fish species. This phase of the program is called lake rehabilitation.

A comprehensive discussion on the techniques used in the rehabilitation program can be found in the 1956 Annual Report. To summarize quickly; a fish eradicant, usually rotenone, is introduced into the lake. The quantity of the substance is determined by water volume, pH, and the species of fish to be eradicated. On introduction of the product, generally rotenone, into the lake, the fish become affected by an irritation causing the capillaries in the gills to constrict. This vasoconstriction prevents oxygen bearing red blood cells from passing through the gills. This in effect kills the fish by suffocation. The rapidity with which the fish succumb is largely dependent on the temperature and hardness of the water. The warmer and harder the water, the faster the rotenone affects the fish. The duration of the effectiveness is also dependent on the temperature and hardness of the water. The minimum duration occurs with high temperatures and hard water. Once the rotenone has dissipated (approximately six weeks in most Alaskan lakes) the lake is restocked with a desirable sport fish species from the Department's hatcheries.

In 1951 the Department inaugurated its lake rehabilitation program in Alaska. During the ensuing years, 23 lakes with 1,675 surface acres have been rehabilitated and restored to angler use by the introduction of desirable sport fish, Table IV.

TABLE IV
LAKES REHABILITATED IN ALASKA

Year	Surface Acres	Number of Lakes
1951	94	1
1952	–	–
1953	192	5
1954	493	4
1955	444	3
1956	227	4
1957	172	4
1958	–	–
1959	53	2
Total	1,675	23

THE FEDERAL AID PROGRAM

Statehood has enabled Alaska to participate in the Federal Aid in Wildlife Restoration Act. This Act is composed of two parts: (1) the Wildlife Restoration Act, commonly called the Pittman-Robertson (P-R) Bill, and (2) the Fish Restoration Act, commonly called the Dingell-Johnson (D-J) Bill. The Sport Fish Division is concerned with the latter.

The Federal Aid program is a contractual agreement between the Federal Government and the State which sets up a program whereby the State participates with the Federal Government in work on sport fish projects. These projects, upon approval, are a state responsibility.

Monies for the Federal Aid in Fish Restoration Act are obtained from a federal tax imposed on all sport fishing tackle, fishing rods, reels, lures, baits, supplies and creels. These monies are set aside in a special fund. Appropriations are made available to the various states from this fund during each fiscal year. The maximum apportionment to any state under the Act is 5% of the total amount of the fund. The actual amount of the fund received by any state is determined in the following manner: 40% of the state's share is determined by a ratio of the area of each state as compared to the total area of all the states, and 60% by a ratio of a state's paid fishing license holders as compared to all of the fishing license holders in all the states. No state may receive less than 1% of the total amount apportioned to all of the states. Alaska qualifies for the maximum annual apportionment because of its large land area—586,400 square miles.

Before a state may participate in the program established by the Fish Restoration Act it must comply with the following requirements:

(a) The State must have laws governing the conservation of its fish resources.

(b) All sport fishing license fees must be placed in a special fund earmarked for sport fish administration.

(c) The Secretary of the Interior and the State must agree on the sport fish restoration projects, and standards must be in accordance with the provisions set forth in the Act, and

(d) The State must provide 25% of the project funds.

This Act limits the type of projects pursued with these monies to fish restoration and management projects. These are construed to mean projects designed for the restoration and management of all species of fish which have material value in connection with sport or recreation in the marine and fresh waters of the state and include:

(a) Such research into problems of fish management and fish culture as may be necessary for the efficient management and conservation of the sport fish resources;

(b) The acquisition of such facts as are necessary to guide and direct regulation of fishing by law, including the extent of the fish population, the drain on the fish supply, from fishing and/or natural causes, the necessity of legal regulation of fishing and the effects of any measures or regulations that are applied;

(c) Formulation and adoption of plans for restocking waters with fishes according to natural areas or districts to which such plans are applicable together with the acquisition of such facts as are necessary to the formulation, execution, and testing the efficiency of such plans;

(d) The selection, restoration, rehabilitation and improvement of areas adaptable as hatching, feeding, resting, or breeding places for fish.

Money from the federal fund cannot be used for department administration, enforcement, hatchery construction or continued fish propagation, among other things. The intent of the act is to provide supplementary money for the improvement of sport fishing and not money simply for the operation of a sport fish department. Alaska, in its first year of participation, utilized 78 percent of the D-J funds available to the state (see Table V).

TABLE V

1959-1960 Dingell-Johnson Program

D-J funds available to Alaska	$263,500.00
State funds necessary to match	87,833.00
Maximum total program	$351,333.00
D-J funds actually matched	$204,927.00
State funds available for matching	68,309.00
Actual D-J program 1959-1960	$273,236.00

The available funds are presently being utilized on five Dingell-Johnson projects. They are:

1. The inventorying and cataloging of the sport fish and sport fish waters in Southeastern, Kenai Peninsula-Prince William Sound drainages and the Cook Inlet-Copper River drainages.
2. A creel census and population sampling of the sport fishes in Southeastern, Kenai Peninsula-Prince William Sound Drainages and the Cook Inlet-Copper River Drainages.
3. An investigation of the Arctic Grayling.
4. An investigation of the King Salmon Sport Fish harvest in Southeastern, and
5. An investigation of Alaska's Public Fishing Access Requirements.

The inventory and cataloging program is presently confined to the preceding described areas, but is scheduled for expansion to include Interior Alaska. This project includes an evaluation of the current and potential use of the waters readily available to the anglers. It will assist in the determination of the relative needs for further management investigations and will direct the course of future studies. The present goal of lake and stream survey activity is dircted toward:

a) Completing surveys on the waters presently under direct management measures.
b) Conducting surveys on other waters that are now, or soon will be, subjected to appreciable angling intensities.
c) Surveying the waters that appear to have a potential for providing recreational fishing.

To date 27 lakes in Southeastern, 35 lakes on the Kenai Peninsula and 42 lakes in Matanuska Valley areas have been investigated. The data collected from these surveys will be utilized for the determination of species distribution, estimation of population numbers, and age composition of the resident species in each body of water under study. In addition to the numeration data the physical, chemical and related biological characteristics of the waters involved were investigated.

The physical data collected encompassed lake surveys for area determination, depth configuration, water exchange, and temperature variations within the lake; in some instances volumetric surveys were completed. The chemical data collected included dissolved oxygen content, pH, and total alkalinities of the waters under study. In addition, the extent, type of vegetation and aquatic organisms present were recorded and evaluated for determinations as to the individual waters' productivity.

Streams were assessed, in addition to the indigenous species composition, for the quantity, quality and the potential of the existing spawning and rearing areas. Water flow and water fluctuation data were collected and recorded for evaluation in connection with the anticipated establishment of egg take sites for indigenous sport fish species. At the present time it is becoming apparent that certain waters must eventually be set aside as brood stock reservoirs to insure a constant supply of desirable sport fish eggs for utilization in the State's management program. The accumulated data will be utilized for evaluating to what extent, and to what potential, the existing waters may be best utilized to yield the greatest return to the angler.

The creel census and population sampling program of Alaska's sport fish will investigate and measure sport fish population trends and fishing success in the major recreational fishing waters which are readily available to the angler. This project will assist the Department in evaluating the effect of current management procedures and regulations. The waters under study have been divided

into the following three categories to facilitate the creel census and population sampling.

(a) Sport fishing waters currently under direct management; primarily rehabilitated and/or artificially stocked lakes.
(b) Sport fishing waters which are, or soon will be, subjected to appreciable fishing pressure.
(c) Waters which have a potential for supporting a population of desirable sport fish but are presently not utilized.

In most instances the intensity of the sampling on specific waters was determined by their relative importance from angler use as indicated by previous studies and other acquired background information. In Southeastern, 10 waters along the Juneau road system apparently receiving the highest angling intensity, were selected for a random creel census survey. In addition, 36 creel census collection stations were established in adjacent areas to provide an index of fishing intensities. These stations consisted of creel census drop boxes and limited personal interviews to substantiate the data collected from the voluntary creel census.

In the Southcentral area (Kenai Peninsula and Upper Cook Inlet) creel census studies were conducted on some of the heavily utilized streams and lakes. A census of the winter ice fishery was conducted on lakes located in the Matanuska Valley area and one lake on the Anchorage-Palmer Highway. Data from these lakes indicate a good catch ratio per fisherman considering the intensive utilization per capita for the area. Wasilla Lake, Big Lake and Mirror Lake bore an estimated sport fishing pressure of 1,406, 1,948, and 1,617 angler hours respectively. The rate of success for Wasilla Lake, Big Lake and Mirror Lake was 0.56, 0.44 and 0.76 fish caught for each hour of angling effort respectively. Table VI.

TABLE VI

Summary of creel census analysis, 1959-60 winter fishing season.

Location	Mirror Lake	Big Lake	Wasilla Lake
Average No. /FM/ day	6.87	4.24	3.89
Average No. fish/angler	1.9	1.6	1.7
Rate of success (F/hr.)	.76	.44	.56
Percent unsuccessful FM	56.9%	43.2%	45.5%
Average No. hours fished	2.5	3.65	3.05

Mirror Lake (85 surface acres) produced 1,236 fish for the anglers compared to 845 from Big Lake (3,200 surface acres) and 786 from Wasilla Lake (370 surface acres). It also provided the highest number of fish per angler. This is attributed to the rehabilitation and annual stocking of fry in Mirror Lake.

Big Lake is located on the western edge of the Matanuska Valley approximately 14 miles west of the town of Wasilla. It has a surface area of approximately 3,200 acres and one major outlet, Fish Creek, that empties into Knik Arm. The sought after fish species present in the lake are rainbow trout, silver salmon, dolly varden, and ling (Burbot). Other species present are red salmon, fine scale sucker, two species of whitefish and stickleback. During 1952, the U. S. Fish and Wildlife Service conducted pressure studies that indicated 10.9 percent of all the fishing on the mainland south of the Alaska Range occurred here.

Wasilla Lake is located approximately in the center of the Matanuska Valley foreplain one mile east of the town of Wasilla. This lake has an estimated surface area of 370 acres and one major outlet, Cottonwood Creek, that flows into Knik Arm. The sought after fish species in this lake are rainbow trout, silver salmon, and dolly varden. Other species present are red salmon, fine scaled sucker, and stickleback. Wasilla Lake is part of an important salmon rearing system and has large numbers of adult migrant silver and red salmon that enter the system each summer and fall.

Mirror Lake is located 24 miles from Anchorage on the Palmer Highway and has an area of 85 surface acres. This lake has been under intensive management by the Department since 1955 when it was rehabilitated with rotenone and successfully stocked with rainbow trout and silver salmon fry on an annual basis. Mirror Lake receives an intensive summer and winter sport fishery for the stocked rainbow trout and silver salmon. On the basis of the information gathered, recommendations will be made to improve existing management measures and direct future courses of study.

The investigation of the Arctic grayling was initiated in October of this year on the Tanana River drainage near Fairbanks. Orientation surveys were completed by air and road of the Tanana system which assisted in determining the population sampling and creel census patterns as related to the spring fishery. In addition, preliminary planning was instigated for a program to determine whether more than one racial stock of grayling was involved in Tanana fishery.

The tributary waters of the Tanana River were first classified into three ecological niches in the Department's annual report of 1951. This generalized classification recognized the glacier-fed, spring-fed and rapid run-off tributaries as possessing different environmental factors. In the present grayling investigation this ecological niche concept was enlarged upon to include those water areas that are bog-fed and lake tributaries.

Each ecological niche selected for this study has features which set them apart from all others. For example:

(1) glacier-fed streams are silt laden and freeze up during winter months.
(2) typical spring-fed streams in the Tanana River system are crystal clear, rich in aquatic plant and insect life and have limited fluctuations in their water level and water temperature. These streams normally remain open year round.
(3) rapid run-off streams can be recognized by their marked fluctuation in both water level and water temperatures. Insect life has a difficult time in maintaining itself in this particular niche. This type of stream is subjected to severe ice conditions during the winter months.
(4) bog-fed streams in the interior are slightly discolored and show fluctuations in their water temperatures and water level; these fluctuations are not as extreme as those encountered in rapid run-off areas. These streams vary in abundance of insect life and icing conditions during the winter.
(5) lake tributaries are utilized by grayling as spawning sites for the most part and may serve as sheltering and feeding areas for immature fish. Water level and water temperature fluctuations normally do not vary greatly.

The need for information about grayling migratory patterns was recognized by early investigators on the Tanana River watershed. Alaska Department of Fish and Game workers reported on the various ramifications of the Arctic grayling fishery in the Interior in the Department's Annual Report of 1951. The Fish and Wildlife Service tagging program on the Goodpaster River, Delta Clearwater and Fielding Lake tributaries established trends in the grayling migration behaviour. The most useful data from the studies resulted from the field workers experience on the benefits and practicability of the various tagging methods. Based on the experiences gained from this early work, a plastic subcutaneous tag was selected for the current grayling study.

The Chatanika River creel census is a joint program, established between the Branch of River Basin Studies, Fish and Wildlife Service, and the Department of Fish and Game, to study the migratory behaviour, fishing pressure and fishing success on the grayling. During the 1959 season the Branch of River Basin Studies tagged 1,500 grayling on the Chatanika River. To date, 40 tagged grayling have been reported caught by anglers fishing the Chatanika River and its tributaries and 25 were captured during sampling by the Department.

The grayling investigation will continue and specimens from the various ecological niches within the Tanana River drainages will be collected this coming spring. The meristic and morphometric data from the sampled niches will be evaluated in an attempt to determine if a positive racial breakdown of this species is possible. Expansion of the creel census program will continue in the Chatanika, Delta Clearwater and the Goodpaster rivers in an attempt to follow the grayling migratory patterns and to estimate their population size. An evaluation of the grayling fishery in the Tangle and Fielding Lakes area will be conducted this coming spring in an attempt to determine the actual status of this species in these heavily utilized waters.

The investigation of the king salmon sport fish harvest in Southeastern Alaska was begun on July 1, 1959 as a federal activity. This sport fish project is being conducted by the Biological Research Division and is explained in the Bio-Research section of this report.

The investigation of Alaska's public fishing access requirements was inaugurated on July 12, 1959. This program will investigate the possible recreational

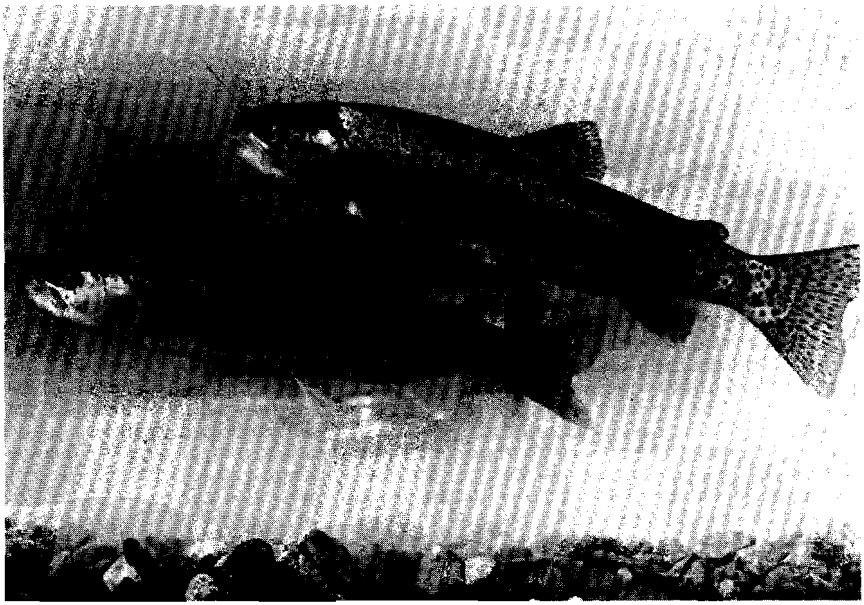
fishing areas in the public domain and will establish the necessity of, and make recommendations for, the selection or withdrawal of lands for public fishing access sites. Prior to Alaska's entrance into the Union (January 3, 1959) the responsibility of assuring sport angler access to the fishing waters of the Territory was a joint function of the Territorial Department of Fisheries, later known as the Alaska Department of Fish and Game, the Territorial Department of Lands, the U. S. Fish and Wildlife Service, the Bureau of Land Management, and the Bureau of Public Roads. The present program is a continuation and an expansion of the previous sport fish access projects. Most of the public fishing access site selections resulting from the investigation will be made by the Division of Lands, Alaska Department of Natural Resources.

Preliminary work consisted of an investigation and review of a number of waters throughout the state to ascertain (1) the biological potential of the water as a sport fishery area, (2) the possible future angler-use at the period of ultimate development, and (3) to determine what particular approach should be made in the site acquisition process. Public ingress to the lakes and streams of Alaska must be insured for today's angler as well as for the sports fisherman of the future. Alaska has a rare opportunity to set aside public recreation service sites to its lakes and streams since much of the state has not been subjected to industrial development and explosive population expansion.

It is not the intent of this Department to arbitrarily request the withdrawal of large tracts of land. In most instances less than five acres are required for public access sites; in others, larger parcels of land may be required to insure suitable access with adequate boat launching, parking and camping areas.

During the short 1959 season a total of 763 lakes and streams located throughout the state were reviewed with 163 of these waters visited. The majority of the waters visited are now, or are potential, roadside fishing areas. Under the various provisions of land acquisition methods, 123 use-site located on 92 lakes and 41 streams, were requested and/or acquired. As a result of this program, the angling public has had set aside for future use, access to 67,416 feet of stream frontage and 65,231 feet of prime lake frontage.

A complete report on the Federal Aid in Fish Restoration activities will be available in the 1959-60 Dingell-Johnson Project Report.



Alaskan rainbow trout, one of the most popular sport fish species. They are found in most coastal areas of Alaska.

Table VII

1959 ANCHORAGE TROUT PLANTS—FIRE LAKE HATCHERY

Lake	Area	Date Stocked	Numbers Stocked	No. Trout per Pound	Species
Beluga	Homer	6/26	10,000	2,300	Rainbow
Blueberry	Valdez Summit	7/29	5,000	1,950	Rainbow
Bonnie, Lower	Mile 84, Glenn Highway	6/19	40,000	2,200	Rainbow
		10/12	1,000	360	Rainbow*
Bradley	Matanuska Valley	8/28	6,500	450	Rainbow
		8/28	1,200	900	Steelhead
Cooling Pond	Fort Richardson	10/14	500	160	Rainbow
Clunie	Eagle River Flats	8/24	10,000	500	Rainbow
DeLong (Delaney)	Spenard	10/29	4,000	900	Steelhead
Falk	Matanuska Valley	9/24	4,000	500	Rainbow
Frank and Jerry	Mile 149, Glenn Highway	7/29	4,000	1,950	Rainbow
Green	Elmendorf Air Force Base	8/27	1,000	800	Steelhead
		8/27	4,000	444	Rainbow
Gregory	Elmendorf Air Force Base	6/24	24,000	2,300	Rainbow
Irene	Matanuska Valley	9/4	7,000	500	Rainbow
Keppler	Matanuska Valley	8/28	6,500	450	Rainbow
		8/28	1,200	900	Steelhead
Knik	Knik	8/13	10,000	476	Rainbow
Long	Mile 86, Glenn Highway	8/1	20,000	757	Rainbow
Long	Matanuska Valley	9/4	9,500	500	Rainbow
Lucille	Wasilla	7/2-8/10	10,000	115-445	Silver Salmon
		10/10	4,300	480	Rainbow

Table VII

1959 ANCHORAGE TROUT PLANTS—FIRE LAKE HATCHERY (Cont.)

Lake	Area	Date Stocked	Numbers Stocked	No. Trout per Pound	Species
Matanuska	Matanuska Valley	8/27	15,000	444	Rainbow
		8/27	5,000	800	Steelhead
Meier	Matanuska Valley	7/2-8/10	3,000	115-445	Silver Salmon
Middleton Island		7/8	1,000	2,300	Rainbow
Mirror	Chugiak	6/23-8/10	11,000	115-750	Silver Salmon
Otter	Fort Richardson	6/19-8/24	36,000	500-2,200	Rainbow
Ravine	Mile 84, Glenn Highway	6/19-8/1	6,000	757-2,200	Rainbow
Robe	Valdez	8/4	30,000	1,600	Steelhead
Rocky	Matanuska Valley	6/23-8/24	48,000	500-2,300	Rainbow
Sand	Spenard	7/26-8/29	6,000	400-2,000	Rainbow
Scout	Cordova	8/30	15,800	450	Rainbow
		8/30	2,700	900	Steelhead
Summit	Valdez Summit	7/29	5,000	1,950	Rainbow
Tex Smith	Mile 161, Glenn Highway	7/29	5,000	1,950	Rainbow
Thompson	Fort Richardson	8/26	1,000	450	Rainbow
Weiner	Mile 88, Glenn Highway	6/19-8/1	14,000	757-2,200	Rainbow
Fairbanks Hatchery	Richardson Highway	6/24-6/30	280,000		Rainbow
		Totals Planted	600,000		Rainbow
			45,100		Steelhead
			24,000		Silver Salmon
		Total	669,100		

*Trout marked with right ventral fin clip.

TABLE VIII

1959 FAIRBANKS TROUT PLANTS—BIRCH LAKE HATCHERY

Lake	Area	Date Stocked	Numbers Stocked	No. Trout per Pound	Species
Bolio	Big Delta	6/20-7/20	101,300	2,200-728	Rainbow
Gravel Pit	Eielson, AFB	7/1-8/15	27,600	1,600-544	Rainbow & Steelhead
Gravel Pit	Fairbanks, ARR yards	7/6	15,300	1,200	Rainbow
Gravel Pit	30 Mile	7/6	1,600	1,200	Rainbow
Gravel Pit	80 Mile	7/20	1,100	728	Rainbow
Gravel Pit	81 Mile	7/20	1,100	728	Rainbow
Gravel Pit	2 Mile	8/15	10,100	544	Steelhead
Harding	Fairbanks	8/4-8/27	46,100	1,090-450	Steelhead
Jan	Dot Lake	7/28	35,200	1,600	Rainbow
Lost	Fairbanks	8/4-8/17	29,400	616-332	Rainbow
		Total	268,800		

TABLE IX

1959 KODIAK STEELHEAD TROUT PLANTS— KODIAK CONSERVATION CLUB HATCHERY

Lake	Area	Date Stocked	Numbers Stocked	No. Trout per Pound
A. L. No. 3	Anton Larsen Bay	8/24	1,600	800
Base No. 18, Catherine	Naval Base	8/17	23,500	1,175
Base No. 19, Louise	Naval Base	8/18	22,600	1,100
Base No. 86, Lilly Pond	Naval Base	8/17	1,200	1,175
B. F. No. 21, Lee	Bells Flats	8/25	10,100	650
B. F. No. 23, Cicely	Bells Flats	8/29	2,500	560
B. F. No. 24, Aurel	Bells Flats	8/28	8,000	600
B. F. No. 25, Caroline	Bells Flats	8/25	4,000	650
B. F. No. 80	Bells Flats	8/19	5,000	1,100-1,070
B. P. No. 40	Broad Point	8/27	7,100	625
Buskin	Naval Base	8/24-9/1	138,700	870-500
C. C. No. 44	Cape Chiniak	9/7-9/8	10,000	490
C. C. No. 45	Cape Chiniak	9/9	6,000	480
C. C. No. 46	Cape Chiniak	9/9	5,000	480
C. P. No. 29	Cliff Point	8/19	3,900	1,100-1,070
C. P. No. 38	Cliff Point	8/27	1,000	700
C. P. No. 34-35	Cliff Point	8/26	3,800	625
Dark	Spruce Cape	8/26	7,000	685
L. I. No. 72	Long Island	9/2	7,000	500
N. C. No. 53	Narrow Cape	8/31	1,900	560
N. C. No. 54	Narrow Cape	8/31	1,900	560
S. C. No. 12	Spruce Cape	8/26	10,000	685
S. C. No. 13, Milnitsa	Spruce Cape	8/19	13,200	1,100-1,070
S. C. No. 15	Spruce Cape	8/27	6,000	700
W. I. No. 61, Tanignak	Woody Island	9/2	14,000	500
W. I. No. 62	Woody Island	9/3	12,000	500
W. I. No. 63, Elephant	Woody Island	9/2	8,000	520
		Total	335,000	

DIVISION OF PROTECTION

by Jack Rhien

Under statutory provisions of 1959, the Department of Fish and Game is "vested with the duties, powers, and responsibilities involved in the administration of the entire state program for the conservation and development of the State's commercial fisheries, sport fish, birds, game and furbearing animals." Among these duties and powers is the protection of fish and game through enforcement of appropriate statutes and regulations. The people issued their mandate for effective law enforcement by enactment of the Fish and Game Code (Chapter 94, SLA 1959). Commenting upon enforcement authority, the Code decreed, "It shall be the duty of any of the named persons specified law enforcement officers to arrest any person committing a violation of this Act, or any rule or regulation made under authority of this Act, in his presence or view, and to take such person immediately for examination or trial before an officer or court of competent jurisdiction."

The people further expressed their determination to safeguard their fish and game by enacting severe penalties for violations of protective laws and regulations. The maximum penalty upon conviction for commercial fishing violations was established as a fine of five thousand dollars and imprisonment for a period of one year; upon conviction for violations concerning sport fish, game, furbearers and activities related to these species, the maximum fine and imprisonment specified are one thousand dollars and six months. The Code further provides that, at their option, the courts of Alaska may order the forfeiture of hunting, sport fishing, trapping and related licenses following the first conviction for a violation of applicable laws. Upon a subsequent conviction, the courts are expressly required to order such forfeiture for not less than two or more than three years. In the case of commercial fishing violations, an order of license forfeiture by the courts for the first and second convictions is discretionary; Upon finding a third conviction, the courts are required to order license forfeiture for not more than three years. These deterrent penalties, judiciously assessed, should increase respect for the law among those to whom appeals for conservation in the public good are unheeded.

Reorganization of the department provided addition of a Division of Protection, the principal duties of which are the enforcement of provisions of the Fish and Game Code and regulations adopted by the Board of Fish and Game. Collateral duties include conduct of a predator control program and administration of bounty claims.

Following investigation of applicants during early months of 1959, the Commissioner appointed John O. Rhien, Jr., of California to serve as Chief of the Division of Protection.

Rhien was born in Santa Cruz, California, in December, 1922, and was graduated from high school in that city in 1940. He worked briefly on a forestry project in California following graduation; then, as a reservist, he volunteered for active duty in the Navy. Discharged in 1945, Rhien spent two years on a city police department. In 1948 he was appointed Fish and Game Warden by the California Division of Fish and Game. Assigned to Monterey Bay, he undertook enforcement of commercial fishing, sport fishing and hunting statutes and regulations. In 1954 he was promoted to the position of Fish and Game Patrol Captain and was assigned as assistant to the Chief of the Wildlife Protection Branch. His principal responsibility in that position was recruit training and advanced training of law enforcement personnel in California's fish and game agency. His appointment to the Alaska Department of Fish and Game became effective May 26, 1959.

Early in June it became apparent that an attempt would be made to operate a fish trap during the 1959 season. Although the people had expressed, at the polls, their strong opposition to the use of fish traps in Alaska, the Secretary of the Interior had published Federal regulations authorizing certain native groups to operate traps at eleven established sites. The natives themselves had voiced their disapproval of traps but, under sanction of the Secretary, prepared to fish with traps at the authorized locations.

On June 5 an aerial reconnoiter of the sites was made by the Commissioner of the Department of Fish and Game, Assistant Attorney General Douglas N.

Gregg, and the Chief of the Division of Protection. Signs declaring the illegality, under State law, of maintaining or operating a fish trap were posted at the sites. Discussions were held with councils of two of the native groups affected by the permissive Federal regulations. Discussions served the purpose of advising the groups of the will of the people respecting the ban on fish traps, and of asserting the intention of the State to prevent, by all lawful means, the use of traps.

Following conferences with the Office of Attorney General, the Chief of the Division of Protection, accompanied by a contingent of State Police headed by Lt. L. L. Mayfield, sailed on May 15 aboard a charter vessel for Pt. Pybus on Admiralty Island.

Fish traps in winter storage, West Coast, Admiralty Island.

On May 17, a trap was placed and rendered operational. Two men were arrested by the division chief for violating the provisions of Chapter 17, SLA 1959 (which prohibits the erection, mooring or maintenance of fish traps) and were escorted to Petersburg for arraignment. Subsequently the issue of State's rights respecting fish traps was argued before the U. S. Supreme Court. A restraining order was obtained by the plaintiffs, and the Pt. Pybus trap, which had been held in custody for more than two weeks, was released by the State. The trap was operated during the remainder of the season.

During July, the division chief undertoook familiarization flights to Wrangell, Petersburg, Ketchikan, Anchorage, Homer, Kodiak, Chignik, Sand Point, King Cove, Cold Bay, King Salmon and Cordova. In Petersburg, a talk outlining needs, philosophies and policies of fish and game law enforcement in Alaska was given to the local fishermen's union. An extended patrol flight of Kodiak Island waters was made in an unsuccessful attempt to locate drum seiners (prohibited by State law) rumored to be operating in the area.

On July 1, a State license for those who hunted, trapped or sport-fished became mandatory. Mr. Bruce Graham was appointed to a summer enforcement position in the Palmer-Wasilla area to insure that sport fishermen became acquainted with the license law.

Activities surrounding the Federal "Project Chariot," in which a harbor will be created near Cape Thompson by an atomic detonation, suggested the presence of an observer to safeguard wildlife values. Accordingly, Alan M. Courtright was appointed Conservation Officer and assigned to Nome in late July. Upon cessation of the project's activities for the year, Courtright was reassigned to the Division of Game in the Juneau Office of the Department.

August was primarily devoted to establishment of divisional administrative and operational procedures and to development of a divisional budget for fiscal 1961.

Recognizing the vital need for effective fish and game law enforcement in Alaska's well-being, the following policy guidelines were instituted:

1. Primary patrol effort will be directed toward safeguarding species of fish and game which are in greatest jeopardy because of over-exploitation by man.
2. Secondary effort will be aimed at the preservation of optimum populations of species which are currently present in satisfactory quantities.
3. All means afforded by law, and safeguarding the rights of the people, shall be exercised to detect violators of fish and game laws and regulations and insure their appearance in court to answer charges.
4. Believing that magistrates are accountable to the wishes of the people, officers will not make recommendations regarding specific amounts of fines or jail sentences to the courts.
5. Officers of the division will make themselves available to the public in order to hear complaints and to explain the need for departmental programs and policies.
6. A training program, designed to provide constantly increasing efficiency and stature within the division, will be commenced at the earliest feasible time.

The divisional budget was drawn. Under terms of the Statehood Act, the Fish and Wildlife Service was required to transfer to the State all equipment which had been used for the management of fish and game in Alaska. The proposed divisional budget, finally approved in the amount of $1,201,635 (including $150,000 for vessel repair) was predicated on the assumption that equipment received from the federal government would be sufficient in both quantity and quality.

Patrol districts were delineated. In recognition of the limited size of the inaugural Division of Protection force, a decision was made not to patrol the area north of Brooks Range unless special fish and game enforcement problems should dictate entry. Elsewhere, each officer would energetically enforce all of the provisions of the Fish and Game Code and regulations of the Board of Fish and Game.

Twenty initial positions maintained by the Division of Protection or shared with other divisions were authorized. "Protection Officers" are those whose principal duty is the enforcement of fish and game laws and regulations. "Conservation Officers" are headquartered in areas where a need exists for personnel to perform the functions of law enforcement and, in addition, to carry out work of a biological nature. While it would be preferable to station a Protection Officer and an appropriate biologist at such headquarters in order that all departmental activities might be suitably discharged, the considerations of budgetary economy dictate the discharge of concurrent duties by a Conservation Officer in areas where the need for a resident biologist is not demanding.

Headquarters of Protection Officers were established in Ketchikan, Petersburg, Sitka, Juneau, Cordova, Seward, Homer, Anchorage (2 officers), Kodiak, Dillingham, Fairbanks (2 officers) and Glenallen.

Headquarters of Conservation Officers were established as follows: Craig (Protection and Commercial Fisheries); Tok Junction and McGrath (Protection and Game); Yakutat and Sand Point (Protection, Commercial Fisheries and Game); and Nome (Protection, Game and Sport Fish).

During the spring and summer an undiminishing number of applications for work in the Division of Protection were received. By late autumn about 450

requests for employment had arrived in the Juneau headquarters of the Department and had been reviewed. While many of the applicants requested consideration for summer employment, a large percentage was interested in permanent fish and game law enforcement work.

An administration policy, laid down in early summer, required the employment of qualified resident Alaskans whenever possible. Accordingly, the field force of the Division of Protection was ultimately selected on the basis of prior fish and game law enforcement experience within Alaska, and residence within the State.

In late summer the Fish and Wildlife Service had begun retrenchment of its law enforcement activities in Alaska. A quonset hut and equipment in Yakutat became available for transfer on a temporary loan basis, as did residences and offices in Tok Junction and Glenallen. To take immediate advantage of the facilities offered, officers were appointed to the three locations. The officers, their effective dates of appointment and assigned headquarters are:

Conservation Officer William L. Burns, September 1, Yakutat;

Conservation Officer W. B. Stewart, October 1, Tok Junction;

Protection Officer William H. Sholes, November 13, Glenallen.

Following their appointments, the officers received valuable and appreciated assistance from the Bureau of Sport Fisheries and Wildlife, without whose help problems of fish and game law enforcement in transition would have been grossly magnified.

In November the division chief, cooperating with the State Police, delivered lectures on fish and game law enforcement to training conferences for police officers in Anchorage, Fairbanks and Juneau. The necessity for adequate law enforcement with limited personnel in an area as large as Alaska demands the utmost cooperation of all law enforcement agencies short of detriment to each agency's primary duty. Since Protection Officers and Conservation Officers are peace officers, a policy was formulated in which the officers are required to exercise their authority (in penal matters other than fish and game offenses) during emergency situations when no officer, whose principal responsibility would be control of the situation, is present.

Final selections of the field force were made and successful applicants were notified of their effective dates of appointments and assigned headquarters. In assigning the personnel, a conscious attempt was made to place each officer in a location where his prior experience would best benefit the State. Initial appointments and effective dates were:

KETCHIKAN: Protection Officer Maurice Field, January 1, 1960

PETERSBURG: Protection Officer Sid O. Morgan, January 1, 1960

SITKA: Protection Officer Robert B. LaGuire, January 1, 1960

JUNEAU: Protection Officer Douglas M. Blanchard, January 1, 1960

CORDOVA: Protection Officer Frederick J. Smith, January 1, 1960

HOMER: Protection Officer Edwin B. Martin, January 1, 1960

ANCHORAGE: Protection Officers R. C. Wilson (January 1, 1960) and Donald M. Roberts (January 5, 1960)

KODIAK: Protection Officer Ovid R. McKinley, January 1, 1960

FAIRBANKS: Protection Officer J. D. Lanni, January 1, 1960

The patrol vessel "Teal," headquartered in Juneau, had been received on temporary transfer from the Fish and Wildlife Service; accordingly, Henry Museth was appointed Protection Boat Officer in charge of the vessel and Philip C. Johnson was appointed Protection Boat Engineer. Both of the appointments were effective January 1, 1960.

Other district assignments were made at later dates.

At the close of 1959, an era of fish and game law enforcement under Federal control ended in Alaska. In accordance with terms of the Statehood Act, Alaska would assume full control of her fish and game resources on January 1, 1960. The Division of Protection, whose responsibility would be assistance in the rejuvenation and enhancement, through law enforcement, of depleted species and maintenance of optimum populations of species not endangered, had prepared itself as adequately as possible to fulfill that responsibility.

DIVISION OF GAME

Preparing for assumption of control over the state's game resources on January 1, 1961, the Division of Game staff was expanded considerably this year: personnel were placed in existing offices in Anchorage and Fairbanks, and in new offices in Petersburg, Yakutat, Cordova, Tok, Sand Point, and Nome. Other new offices will be staffed during 1960.

During 1959 the State became eligible to participate in the Federal Aid in Wildlife Restoration Program, which is financed by federal excise taxes on firearms and ammunition. This program provides matching funds, for approved investigations and development projects, in the amount of three dollars of federal money for each dollar of state money, thereby making possible the obtainment of much biological data of considerable value for management purposes.

A new position category—Research Biologist—was created with the inception of this Federal Aid program, and several new staff members were assigned to investigations of certain species of game animals. Responsibility for applying the results of these investigations by making recommendations to the Board of Fish and Game concerning seasons, bag limits, and other regulations affecting game harvests was delegated to the Management Biologists. These latter men are also charged with keeping the public informed concerning the Department's programs: they frequently assist the Research Biologists with their investigations and conduct some research of their own as well, thus keeping abreast of developments which could affect decisions concerning management.

Research Biologists were stationed during the year in Petersburg, Cordova, Anchorage, Nome, and Fairbanks, while management personnel were stationed at Fairbanks and Anchorage: it is anticipated that another management position will be filled in Ketchikan next year. In addition, men with joint responsibilities in investigations of interest to more than one division (e.g., Game and Sport Fish, or Game and Commercial Fish) and in protection work were stationed in Yakutat, Tok, Sand Point, and Nome: these men are termed Conservation Officers. The Division of Game staff at year's-end consisted of the Director, two Management Biologists, ten Research Biologists, three Conservation Officers, the Federal Aid Coordinator and clerical help.

A major division activity toward the end of the year was the preparation of the first State Game Regulations, which were ready for distribution by late December. All staff members met in Anchorage during the fall to formulate proposals, based upon the year's investigations and past experience. These proposals were then published for public comment, and the Board of Fish and Game acted upon the consolidated staff, Advisory Committee, and public proposals and comments at its meeting in Juneau November 16 to 25. The results were published as the Alaska Game Regulations, 1960 Edition (Game Regulatory Announcement No. 1), and became effective January 1, 1960.

BIOGRAPHICAL SKETCHES

James W. Brooks, Division Director, was introduced in a biographical sketch which appeared in the 1955 annual report. Under his direction, the Division expanded from two biologists at the close of 1958 to the seventeen men with varying responsibilities listed above.

Alan M. Courtright was born in Muskegon, Michigan, in 1930. He entered Michigan College of Mining and Technology in 1949 and after transferring in 1951, obtained a B.S. degree in Wildlife Management from Utah State University in 1954. He first came to Alaska in the summer of 1953 and following graduation from Utah State returned as an employee of the U. S. Fish and Wildlife Service in 1954. He entered the University of Alaska in 1956 and received his M.S. degree in 1959 after submitting a thesis on caribou and reindeer range problems. Entering on duty at Nome at the end of July as a Conservation Officer, he was given responsibilities in protection, game and sport fish investigations. He was also responsible for keeping the Department informed as to the progress of biological investigations in the vicinity of Cape Thompson instituted by the Atomic Energy Commission, which was investigating the feasibility of conducting a nuclear experiment in the area.

Jack C. Didrickson was born in Manistee, Michigan, in 1931. He entered Michigan State University in 1954 and obtained his B.S. degree in Wildlife Management in March of 1958. At that time he began work on his Master's degree, which he will receive upon completion of his thesis. He was previously employed by the Michigan Department of Conservation, and served with the Armed Forces in Korea. He commenced working for the Department in April and is stationed at Anchorage; his primary responsibilities concern research on moose and sheep in South Central Alaska.

Albert W. Erickson was introduced in a biographical sketch which appeared in the 1958 annual report. With a change of title to Management Biologist Erickson became responsible for the management of all game animals in South Central and Southwestern Alaska.

Samuel J. Harbo, Jr., was born in Hanska, Minnesota in 1929. He entered the University of Nebraska in 1947 and obtained a B.S. degree in 1951 in the field of soil conservation. After a stint in the Navy, he entered the University of California at Berkeley in 1954 where he studied vertebrate zoology with a minor in Wildlife Management. He transferred to the University of Alaska in January of 1956 and after writing a thesis on Alaskan mink he obtained his M.S. degree from that institution in May of 1958. Entering on duty in January, he is stationed in Nome as a Research Biologist. His primary responsibilities are in the field of marine mammal investigations, but he is also carrying out a reconnaissance of all other wildlife species in Northwestern Alaska.

Franklin F. Jones was born in Putnamville, Indiana, in 1917. He entered the University of Alaska in 1949 and after transferring to the University of Montana in 1952, obtained his B.S. degree there in Wildlife Management in 1953. Before entering on duty at the College station in May, he operated an aircraft charter service in Alaska, after spending seven years in the Air Force as a pilot. He is responsible for the conduct of research on caribou, beaver and sheep in Interior and Arctic Alaska.

Wilbur L. Libby was introduced in a biographical sketch in the 1958 annual report. Libby resigned from the Department in November to return to his home state of Maine.

Edward P. Keough, who was born in Waukegan, Illinois in 1932, attended Lake Forest College in Illinois in 1950 and 1951 before transferring to the University of Michigan in 1951, where he obtained his B.S. degree in Wildlife Management in 1954. He came to Alaska in 1954 and worked for the U. S. Fish and Wildlife Service for several months. After four years in the Navy he joined the Department in July and is stationed at Anchorage. His primary duties for the Department consist of caribou investigations in the Nelchina area and elsewhere in South Central and Southwestern Alaska.

David R. Klein was born in Fitchburg, Massachusetts, in 1927. He entered the University of Alaska in 1948 after Navy service and transferred to the University of Connecticut where he received a B.S. degree in Zoology in 1951. Returning to Alaska, Klein received an M.S. degree in Wildlife Management at the University of Alaska in 1953. After serving with the Army in Alaska he was employed for several years by the U. S. Fish and Wildlife Service in Western and Southeastern Alaska. He joined the Department in July, continuing out of Petersburg on black-tailed deer research.

Harry Merriam was born in Bellingham, Washington, in 1926. He attended the University of Washington from September 1947 through June of 1952, at which time he obtained his B.S. degree in Forestry. He was employed in the lumbering industry in Southeast Alaska until 1955 when he entered the University of Alaska, and in 1958 obtained a B.S. degree in Vertebrate Zoology. In the fall of 1958 he entered the University of British Columbia; he expects to obtain the M.S. degree upon completion of his thesis. He joined the Department in June and is stationed in Petersburg. His work is centered primarily on black-tail deer but he is also responsible for moose, goat, and furbearer investigations in Southeastern Alaska.

Elmer R. Norberg was born in Bald Bluff, Minnesota, in 1923, and attended school at Van Rapids, Minnesota. He entered Etoska Jr. College in Corvaine, Minnesota, in 1946 and entered North Dakota State College in October of 1948.

He transferred to Oregon State College in October of 1949 and obtained his B.S. degree in Wildlife Management there in 1950, after which he entered the University of Minnesota, obtaining his M.S. degree in Animal Ecology in 1953. He was formerly employed by the Minnesota Department of Fish and Game and the Idaho Fish and Game Department. Joining the Department in August, he was stationed in Fairbanks and is primarily responsible for moose investigations projects in Central and Arctic Alaska.

Sigurd T. Olson was born in Ely, Minnesota, in 1923. He attended Ely Junior College and the University of Minnesota, obtaining his B.S. degree in 1949. He continued on at the University of Minnesota and obtained his M.S. degree in 1951. He was employed for several years by the U. S. Fish and Wildlife Service in Alaska in Ketchikan, Petersburg, and Fairbanks. Olson joined the Department in July as Federal Aid (P-R) Coordinator, and is responsible for planning and supervision of investigation and research programs.

Robert A. Rausch was born in Sumner, Iowa in 1929. He entered Luther College in Decorah, Iowa in 1947 and obtained his Bachelor of Arts Degree in 1951. After serving two years with the Marine Corps Reserve, he entered Alabama Polytechnic Institute in 1953. Transferring to the University of Alaska in 1955, he was granted the M.S. degree in Wildlife Management in 1959. He was employed by the U. S. Fish and Wildlife Service as a Research Biologist from 1956 through 1959 except for the times when he was attending college. He joined the Department in July as a Game Management Biologist and is responsible for the management of all game and fur animals in Central and Arctic Alaska.

Arthur M. Sheets, Jr. was born in Washington, D.C. in 1930. His precollege education was obtained in a wide variety of places, from Pennsylvania to Texas to Oregon. He entered Oregon State College in 1949 and after a one-year stretch at Portland State College he returned to Oregon State and obtained his B.S. degree in 1955 in the field of Wildlife Management. Entering Utah State University part time while employed by the Utah Fish and Game Department, he expects to obtain his M.S. degree from Utah State after completion of his thesis. He joined the Department in August as a Research Biologist and is stationed at Cordova where his responsibilities cover deer, elk, moose, and goat investigations.

Ronald O. Skoog is from Chicago, where he was born in 1927. He attended the University of Montana in 1944 and 1945, and after a stint with the Marine Corps, entered the University of Alaska in 1949, obtaining his B.S. degree in Zoology in 1952. Switching to Wildlife Management, he continued at the same school and obtained his M.S. degree in 1954. Skoog was employed with the U. S. Fish and Wildlife Service at various times from 1954 to 1959: much of his work with that organization was concerned with caribou, and since his thesis was also written on that subject, he was well qualified to take over the Nelchina caribou investigations when he joined the Department in July. He is stationed in Anchorage.

W. B. Stewart, who joined the Department as a Conservation Officer in October, was born in Hormell, New York in 1930. He attended Houghton and Roberts Colleges in New York from 1948 through 1951, majoring in science and mathematics. He came to Alaska in 1952, and was employed at various times by the U. S. Fish and Wildlife Service in biology and enforcement and also served two years as a Conservation Agent in the U. S. Army. Stewart is stationed at Tok and is responsible for both protection and game work in the West Central area.

Robert B. Weeden was born in Bald River, Massachusetts in 1933. He entered the University of Massachusetts in 1949, obtaining his B.S. degree in Wildlife Management in 1953. He then entered the University of Maine as a graduate student in Wildlife Conservation, wrote a thesis on habitats used by breeding woodcock, and obtained his M.S. degree in 1955. From 1955 to 1958 he attended the University of British Columbia in Vancouver. His dissertation concerned the comparative ecology and distribution of ptarmigan (field work was done in Alaska); he was awarded a doctorate in zoology in October, 1959. He joined the Department in July and is responsible for game bird investigations throughout the state, with headquarters at College.

ACTIVITIES

The Division's investigational projects covered almost every species of big game animal in the state, as well as marine mammals, upland game birds, and fur animals. Some of these are major projects, while information on a few species is gathered by all personnel only incidental to other activities. Numerous factors influence the emphasis placed upon the various projects: the Division's program is sufficiently flexible to permit changes in emphasis as required by circumstances.

Some projects will yield information of immediate value for management programs, while others are longer-term investigations. Due to the foresight of the State legislature, which passed laws allowing considerable flexibility in the formulation of regulations, the state game regulations should always reflect the most current information obtained through investigation and observation.

Most of the projects initiated during 1959 are being conducted on a fiscal year basis and, having been initiated for the most part after mid-year, were not sufficiently developed by year's end to permit a comprehensive report of results. What follows is a summary of information obtained by year's end.

MARINE MAMMALS

Walrus

Research Biologist Sam Harbo, after opening a new office in Nome, instituted two walrus investigations projects. One of these was designed to determine the magnitude, utilization and value of the walrus harvest in Alaska, and the purpose of the second was to obtain information about the life history of the walrus with special attention to breeding biology and growth and to development of methods for estimating productivity, population size, and population trends. As a preliminary step in gaining the objectives of these two projects, Harbo spent two months on King Island in the Bering Sea this spring. He collected a considerable amount of information and specimens from walrus harvested by Eskimos.

Harbo's observations indicated that King Islanders took 256 adult and 18 newborn walruses during 1959. Data collected from other areas indicated that the total Alaskan harvest for 1959 was between 1,153 and 1,453 animals. This represents the number actually harvested; Harbo estimated that the actual kill was approximately 2,700 to 3,600 with the additional numbers representing animals which were killed but not retrieved because of sinking.

Walruses are often taken for their ivory alone: the harvest far exceeds the number of animals needed for food and skins. The Department hopes to foster sport hunting of walrus, which is one of the rarest trophies in North America: by doing so it is believed that the people who depend upon these animals for their living would be able to earn money through guiding and caring for trophies without killing large numbers of walrus solely for ivory.

Sport fishermen on opening day of fishing enjoying fishing on rehabilitated and stocked lake.

Bering Sea Eskimos cutting up walrus on ice after a successful hunt.

Seals

A project designed to determine the magnitude, characteristics, and value of the harvest of various species of hair seals in Alaska was instituted in the northwest coastal area. Other objectives of the project include determination of seasonal movements, abundance of seals, and determination of the food habits and other life history characteristics of these animals. A questionnaire was mailed to all villages in northwest Alaska by the Nome office, and it is expected that when these questionnaires are returned and analyzed, some of the objectives listed above will be obtained. The other objectives will be gained primarily through a study of specimens obtained by hunters.

It was found that ring seals accounted for nearly 90 per cent of the harvest during the period beginning in November when the project was instituted; harbor and bearded seals accounted for 5 per cent each. Virtually every part of a seal was found to be utilized by native hunters. A limited market exists in Nome for seal meat, blubber, skin and oil. Bounty records, plus estimates for areas where no bounty is paid, indicate that the total Alaskan seal harvest is in excess of 20,000 animals, but there is nothing to indicate that this is having a deleterious effect on seal populations.

BIG GAME ANIMALS

Moose

Moose investigations were instituted in all parts of Alaska and occupied a considerable proportion of the time of several investigators. These included Harry Merriam in Southeastern Alaska, Jack Didrickson in South Central Alaska, Elmer Norberg in the Interior-Arctic region and Sam Harbo on the Northwest Coastal area.

In Southeast Alaska moose are becoming increasingly important as a big game species, although the total population is small compared to that in the interior. The animals occur near Yakutat and on the Chilkat, Taku and Stikine River systems. Smaller populations are located in Thomas Bay, Bradfield Canal and on the Unuk and Chickamin Rivers. The total known kill in Southeast Alaska during the 1959 hunting season was 156 animals: of these, 55 were taken in the Yakutat area, 39 on the Chilkat River, 19 on the Taku River and 43 on the Stikine River and vicinity.

The kill on the Stikine River was found to be composed primarily of young bulls; this indicated heavy cropping although the size of the kill has remained about the same during the past several years. Aerial surveys indicate that the bull-cow ratio on the Stikine is 31 bulls per hundred cows compared with the Yakutat area where counts showed 110 bulls per 100 cows. The Stikine area was found to be producing approximately 37 calves per 100 cows while the production at Yakutat was approximately 33 calves per 100 cows.

In the South Central area, the moose continues to be one of the most important big game animals. The minimum harvest in this area during 1959 was estimated to be 1,250 animals. Hunting emphasis appears to be shifting from the Palmer area to the Kashwitna-Willow area: roads are presently under construction in the latter area and it is expected to become increasingly important to moose hunters. Further to the east it was found that the Copper River Valley has a little-utilized population of moose: means will be sought to increase the hunting effort here in order to keep the herd in a healthy condition. In those areas where caribou occur, moose hunting efforts are often tied directly to caribou hunting efforts. For example, of 1,159 hunters interviewed at the Denali checking station during the fall of 1959, 613 were hunting moose and caribou, while 41 were hunting moose only and 505 were hunting caribou only.

In the South Central area there were 269 cases of moose mortality from sources other than legal hunting in 1959: of that number 115 were railroad mortalities; over one-third were killed between Willow and Talkeetna. Examination of carcasses from the Matanuska Valley area disclosed 38 cases of parasitism including 4 cases of *Dictyocaulus* (lungworm) which are believed to be the first reported in the Matanuska Valley. There were, however, no known cases in which parasitism was listed as a primary cause of death, nor do these parasites presently constitute a threat to humans: the information is of interest primarily in relation to the size of the moose population and the degree of range use. Over-stocked game ranges often lead to higher than normal incidence of parasites, and in view of the past history and present condition of the Matanuska herd it is recognized that moose parasite investigations should be instituted now.

In the interior of Alaska the large expanse of territory and the scattered distribution of the human population precludes obtaining a good estimate of the total moose harvest until new methods can be worked out and funds become available. It is known, however, that the harvest is small in relation to the harvestable surplus.

Investigations of Interior moose populations instituted during 1959 included determination of herd status, abundance and composition surveys, breeding biology and productivity studies, characteristics of the hunter harvest, mortality studies and range investigations. Although the data from these investigations had not been analyzed by the end of the year, the healthy condition of interior moose herds was obvious.

In Northwest Alaska, Harbo found that moose populations are limited to willow and poplar stands adjacent to rivers. The populations there are localized and of low density. Investigations pointed up the need for enforcement in this area, as it appears quite possible that illegal hunting of cows and calves may be limiting population buildup and spread, at least on Seward Peninsula.

Because methods for achieving an accurate tally of the statewide moose kill are still being developed, it is only possible to make an estimate from the projection of known kill figures. These data suggest the 1959 legal moose kill was from 5,000 to 5,500 animals.

Caribou

Caribou studies were primarily assigned to Ron Skoog, Ed Keough and Frank Jones. Projects included statewide distribution studies and a number of dupli-

cate projects on the two herds known as the Nelchina Herd in South Central Alaska and the Steese-Fortymile Herd in the Interior. These included assessment of herd status, movements, distribution and numbers, herd composition, breeding biology and productivity, mortality studies, characteristics of the hunter harvest and range analysis work.

The statewide caribou distribution project, which is a long term study, was initiated this year with some intensive aerial work on the Alaska Peninsula. In this area it was estimated that the caribou herd numbers about 6,000 animals: this year's excellent calf crop indicated the herd is in good condtion.

In the Nelchina area the herd continues to expand steadily and now numbers about 55,000 animals. This is the most intensively utilized caribou herd in the state. An estimated 60 per cent of the cows in the Nelchina herd had calves this year, giving an early increment of about 14,500 animals: calf survival through October was about 75 per cent. The annual increment or net gain to the herd, after all hunting, natural mortality and predation losses, was estimated at a minimum of 1,000 animals.

The continued increase in this herd had become a matter of considerable concern, as there appears to be some danger of losing the animals due to overpopulation in the not-too-distant future. Accessibility is the primary reason for the high (but inadequate) utilization in this area: any movement from the Nelchina area, an expected response to overpopulation, would make the herd much less accessible to hunters.

The need for concern is illustrated by the fact that although movements and distribution of the herd continue generally similar to past years, the animals are continuing to shift westward in their range. The herd is now splitting into three or four large concentrations in the winter, whereas in the past the animals remained grouped more or less together. One group of over 10,000 wintered in the Cantwell area along the extreme borders of the range, a considerable distance from their usual wintering area.

The range study in the Nelchina area, as in most other areas of the state, is a long term project. A number of permanent vegetation study stations and quadrats, as well as over two dozen fenced exclosures and matching check plots, have been established. These will allow, through the years, a continual assessment of the effect the animals are having upon the range.

The hunter harvest from the Nelchina herd during 1959 was estimated at 4,000 animals. Seventy per cent of the kill were males, 34 per cent were calves and yearlings; 56 per cent were less than four years old, and 88 per cent were less than six years old. The hunter success was about 35 per cent.

Guide and hunter display caribou trophy taken on north slope of Alaska Range.

The Steese-Fortymile caribou herd is much less accessible to hunters than the Nelchina group, and numbers about 40,000 animals at present; this northern group moves more or less erratically between Canada and Northeast Alaska. Unlike previous years, most of the herd remained in Canada during the calving season in 1959, and thus it was not possible to obtain much information on initial productivity. Calf-adult ratios were obtained later in the year, and it was found that these ratios of about 40 calves per 100 adults were approximately the same as in previous years. A brief reconnaissance of the caribou range in this area has indicated that, compared with the Nelchina, the Steese-Fortymile region has very poor lichen growth. Much of this area has suffered from fires in the past, and the lichen growth is still in the early stages of recovery. This condition has prevailed for some time in the past and perhaps in part explains the much more extensive movements of the Steese-Fortymile herd as compared with the Nelchina herd.

Deer

Deer studies in Southeast Alaska show that populations are continuing to increase: the total is now estimated to be in excess of 125,000 animals. The age composition of the hunter harvest—estimated at 11,000 animals in 1959—consisted of 52 per cent 2½ years of age and younger and 48 per cent 3½ years of age and older. The high proportion of older animals reflects low hunting pressure as has been the case for the past several years. The 1959 harvest was approximately 2,000 fewer than in 1958, and is far below the annual increment: hunter success was approximately 75 per cent. Ninety-one per cent of the harvest was found to occur between October 15 and November 30; 24 per cent of the animals taken were females.

Natural mortality during the winter of 1959 was very low, reflecting the extremely mild weather conditions of that season. Browse utilization on the winter ranges averaged 74 per cent during the winter of 1958-1959. This figure is relatively high, reflecting large deer populations for the amount of available winter forage.

In the Prince William Sound area approximately 775 deer were taken during the 1959 hunting season. The major portion of the hunting pressure in the Prince William Sound area emanates from Cordova; these hunters took an estimated 45 per cent of the Prince William Sound kill.

Inadequate snowfall precluded obtaining significant population figures, but observation from tracks in the little snow available made it possible to delineate future census areas. Browse utilization with local exceptions was found to be considerably less than in Southeastern Alaska, ranging from 30 to 50 per cent on blueberry and huckleberry in the Prince William Sound area.

Utilization of alder and willow on Cape Chiniak and Larsen Bay in the Kodiak area was excessive in creek bottom areas, but was moderate over the range as a whole. Investigations in these areas suggested a low winter mortality. An estimated 225 deer were taken in the Kodiak area during 1959.

Elk

Investigations of this species, which occurs only on Afognak and Raspberry Islands, were begun late in the year. Arrangements were made to erect browse enclosures in cooperation with the U. S. Forest Service and the U. S. Fish and Wildlife Service. It was found that browse analysis methods used in other areas were not sufficiently sensitive for use on the elk ranges, and therefore other methods will have to be developed. Preliminary examination of the ranges indicated that willows are being severely utilized in the Tonki Cape region.

The hunter harvest was estimated at 120 animals by the end of the 1959 hunting season.

Sheep

Aerial composition counts of sheep in the Talkeetna and Chugach Mountains and the Tanana Hills indicated good production of lambs in 1959. Insofar as could be determined, the hunted sheep populations are producing just as many lambs as those which are protected, such as on the Sheep Mountain Reserve. The average number of lambs per 100 ewes in all areas was approximately 30.

The numbers of legal (¾ curl) rams per 100 sheep observed varied considerably from one area to the next. In the Sheep Mountain Reserve 36 legal rams per 100 ewes were counted. In the Horn, Syncline and Fortress Mountains

area the ratio was 14 legal rams per 100 ewes, while the Eklutna Reserve yielded a figure of 22 rams per 100 ewes and the Tazlina-Klutina Lakes area 163 legal rams per 100 ewes: the count in the last named area was limited to 122 sheep of all age classes.

Goats

Limited mountain goat investigations were conducted in the South Central goat ranges, in Southeastern Alaska, and in the Prince William Sound area. These investigations were primarily confined to definining areas which would require more concentrated field effort in the future.

In Southeastern Alaska the mountain goat range includes all of the coastal mountain region from Portland Canal on the south, north along the entire mainland throughout the Coast Range and St. Elias Mountains. The animals do not occur naturally on the islands of the Alexander Archipelago, but introductions were made on Baranof Island in 1923 and on Chichagof Island between 1953 and 1956. The herd planted on Baranof Island has increased steadily, while the status of the Chichagof Island animals is uncertain at the present time.

In South Central Alaska goat range coincides with the coastal mountains, although in recent years there has been an extension northward into the interior regions. Populations are known to exist in the Eklutna River area near Anchorage, the Horn, Syncline, and Sheep Mountain areas of the eastern Talkeetnas and in the Tazlina-Klutina Lakes region of the Chugach Mountains.

In the Prince William Sound area, goats are distributed from Bering River Lake on the Southeastern end of the Copper River Delta to Columbia Glacier on the northern shore of Prince William Sound. None of these populations are heavily hunted at present.

Bears

Brown bear studies were confined this year to aerial surveys conducted in the Alaska Peninsula area. Although the results of these studies indicated a possibility of a much smaller recruitment than in 1958 resulting from increased mortality among young animals, the samples obtained were too small to provide any conclusive data. Conclusions regarding 1959 production should await further surveys in view of the obviously good condition of the population as a whole. This year's studies did indicate the desirability of placing a full time investigator on bear work by 1960.

No work was done by the Department during 1959 on polar bear except for the planning of a comprehensive survey of the harvest which will take place during the spring of 1960. Judging from previous investigations conducted by other agencies, it is anticipated that most of the trophy hunting for polar bear will take place in April, while the native hunters in places such as Barrow, Wainwright, and Point Hope will be more successful during December and January. It is anticipated that the kill will probably not exceed 200 animals.

FUR ANIMALS

Beaver

Aerial counts of winter food caches were combined with an analysis of beaver harvest affidavits to provide a sound basis for beaver management in the state. Data obtained by these methods indicate that beaver populations in most areas are being harvested in a satisfactory manner, although two Game Management Units appear to be somewhat over-trapped while two other Units may be undertrapped. Analysis of affidavits indicated that the total harvest of beaver for the state was 25,150 during 1959, which is about 700 pelts above the 1958 take and almost 10,000 more than were recorded taken in 1957. Special studies are being conducted in the Tanana Valley where analysis of trapper success has revealed below average conditions.

Wolves

After locating a denning area on Kupreanof Island during the fall of 1958, seven wolf pups were removed from the den in the spring of this year and taken

to Petersburg to be raised in captivity. These animals are currently providing interesting data on food consumption and growth.

In Central Alaska reports from guides indicate that the wolf is becoming increasingly important as a trophy animal. It is anticipated that increasing efforts will be made in the future to determine the status of wolf populations, their relationship to prey species, and their economic importance.

Other fur mammal investigations were primarily centered on pelt primeness studies to determine optimum open season dates, particularly for mink. These studies were well underway at the close of the year. The Division of Biological Research was conducting a comprehensive investigation of sea otter and a report of findings will be found in another part of this report.

SMALL GAME

A full scale project on Alaska game birds was initiated during the year, although it was confined to the planning stage. Field studies will commence in 1960. Another project with the same status, which will be conducted at the Alaska Cooperative Wildlife Research Unit with funds provided in part by the Department, is designed to provide information concerning snowshoe hares.

With the expanded number of personnel and projects this year, the Department will be able to obtain a considerable amount of information on small game incidental to surveys conducted in connection with primary investigations.

While not all of the Division of Game's present investigational work is expected to yield immediate results for practical management use, all of it is designed to ultimately provide a sound basis for the management of all important game species in the State.

Eskimo women supplementing winter food supply by fishing through the sea ice.

ENGINEERING DIVISION

FOREWORD

The Engineering Division continued the steeppass fishway research, provided technical and professional engineering services to the Department and supervised contract and force account project construction. Bakewell and Gretchen Creek fishways were completed and the Pauls Lake fishway was modified.

* * * * *

Research was continued during the year on our steeppass type fishways. A facility was constructed near saltwater on the Ruth Lake outlet stream in Izhut Bay providing close order accuracy of mensuration between one and ten cubic feet per second of water and having a range for slope adjustments of 14.15 feet rise in 40 feet of run. Hydrodynamically a steeppass of the model "A" design is a very effective energy dissipation device, controlling water velocities within the three to four feet per second range over slopes varying between 20 and 38 per cent grade. Flow patterns, explored by the Pitot tube technique, were studied for indicated desirable modifications in model design. Construction cost analysis was made of the Gretchen Creek fish ladder project and confirms the economics possible with installations of this type of fishpass.

Lower Steeppass unit in intertidal zone at Ruth Lake Research Facility passes migrants into holding tank. Upper steeppass in experimental position is for discharge tests. All water was shut off during taking of picture to expose the facility to view.

Steeppass unit under test at Ruth Lake Research facility showing weir box and migrant trap.

The Bakewell fishway project construction was completed and put into operation on August 24, 1959. Red salmon, held up in their migration by the falls, immediately entered the fishway and passed through it without delay. The final contract cost was $120,875. Supplemental work by Department personnel cost $895.00. A ten per cent allowance for Engineering and Inspection, in the amount of $12,180, brings the total project cost to $133,950. As the project spans a vertical rise of 40.9 feet at normal water levels, the unit cost of the completed project is $3,275 per foot of fishladder rise.

Bakewell Fishway entrance at base of lower falls, was built at difficult construction location where upstream migrant salmon were known to congregate.

Minor modifications were made in the Pauls Lake fishladder to afford a more easy ascent route for the salmon. Surveys were completed of this site for eventual replacement of the existing facility with a permanent fishway installation, now that the introduced run has become well established in this drainage system.

A permanent steeppass fishway, of our Model "A" design, was constructed at the Gretchen Creek block on the Pauls Lake drainage. Construction was accomplished under force account procedures at a total cost of $6,654. 30 lineal feet of steeppass was installed on a 26.2 per cent grade to span a vertical rise of 7.6 feet. Unit cost was $876 per foot of rise and indicates the inherent potention of this type of fishway at low head barriers. The first red salmon migrant arrived at the fishpass entrance on July 28, 1959, entered without pause, exited almost immediately and continued up the creek without stopping. Every salmon arriving at this block passed through successfully without delay.

Permanent Fishway at Gretchen Creek Falls demonstrates utility of the steeppass units. at remote locations.

Village of Angoon on Admiralty Island, Southeastern Alaska. Many communities from Ketchikan to Bristol Bay are dependent on salmon for their continued existence.

Trollers' haven, Southeastern Alaska.

FINANCIAL REPORT

ALASKA DEPARTMENT OF FISH AND GAME— Expenditures July 1, 1959 - June 30, 1960

		APPROPRIATIONS	EXPENDITURES	BALANCE
Fish and Game Comission Appr. Ch. 77, SLA 60	$ 7,000) $ 3,500) =	$ 10,500.00	$ 9,684.73	$ 815.27
Administration Appr. Tech. Lab. Ketchikan Lab.	$103,875) 15,000) 28,365) =	147,240.00	145,485.96	1,754.04
Biological Research		200,000.00	195,658.98	4,341.02
Commercial Fisheries		425,879.83	425,879.83	---
Engineering		36,370.00	34,940.91	1,429.09
Game		145,000.00	141,063.50	3,936.50
International North Pacific Comm.		1,800.00	1,779.50	20.50
Office Space Remodeling		125,000.00	125,000.00	---
Protection Appr. Contingency	$175,000) 326,055) =	501,055.00	397,800.74	103,254.26
Services (Licenses and Statistics)		47,000.00	46,975.75	24.25
Sport Fish		135,000.00	132,702.38	2,297.62
Bounties		125,000.00	86,451.25	38,548.75

	APPROPRIATIONS	EXPENDITURES	BALANCE
SPECIAL FUNDS			
Administration–From Contingency	$ 12,000.00	$ 12,000.00	$ ---
Services–From Contingency	90,090.00	90,090.00	---
Commercial Fisheries–From Contingency	70,000.00	70,000.00	---
Biological Research Saltonstall-Kennedy $23,280.00) Dingell-Johnson 25,995.32) = Pitman-Robertson 8,378.39)	57,653.71	49,060.29	8,593.49
Game License Receipts $ 65,595) Federal Aid in Wildlife 203.401) =	268,996.00	230,735.00	38,261.00
Sport Fish License Receipts $ 48,309) Fed. Aid in Fish Restoration 144,927) =	193,236.00	137,602.39	55,633.61
PRIVATE DONATIONS			
King Crab Investigation	$ 753.60	$ 525.86	$ 227.74
King Crab Film	2,132.68	2,132.68	---
King Crab–Saltonstall-Kennedy	4,883.33	4,883.33	---
Jennifer Lake	19,000.00	18,990.07	9.93
Standard Oil Special Research	2,034.07	2,034.07	---
Richfield Oil Special Research	1,127.00	1,127.00	---
Wide Bay Special Research	1,000.00	806.88	193.12
F. W. S. Cooperative Fund	10,000.00	9,962.50	37.50

STATISTICS

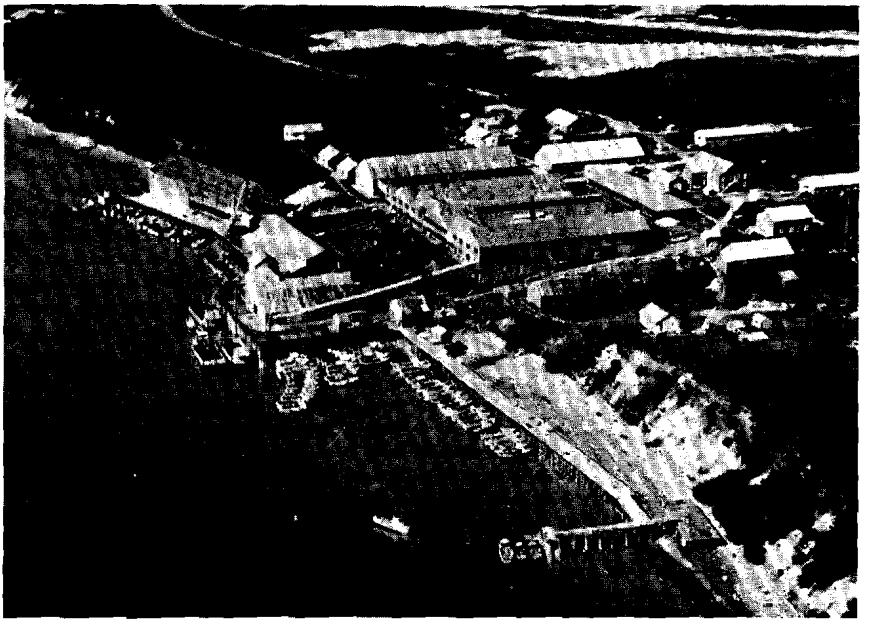
The Department's statistical staff began its work in July of 1959 with its office located in the Bureau of Commercial Fisheries Statistical Unit. Most of 1959 was spent working with the Bureau of Commercial Fisheries personnel, studying their procedures for collecting and processing Commercial Fisheries catch and production data. As the statistical staff became more and more familiar with the basic steps of collecting and processing these data, the Department's statistical program was designed for its Statistical Unit, which will be set up on January 1, 1960, when the State of Alaska assumes control of her Fish and Game resources.

A great amount of work was put into old records, bringing them up to date in order that they will be complete when transferred from Federal Government to the State.

Numerous requests by the Department's Commercial Fishery Biologists and other personnel for Commercial Fishery catch data were answered. The requests varied from inquiries for the current years' catches to inquiries for the catches for the past ten years. In many cases, the Biologists were interested in all species of fish that were of commercial value and interest.

The 1959 commercial catch of fishery products in Alaska amounted to over 324 million pounds, with a value of nearly 29 million dollars to the fishermen. This is 55 million pounds and over 4 million dollars below the volume and value of the 1958 catch. The number of persons engaged in the fishing industry decreased from 20,614 in 1958 to 18,674 in 1959. One hundred and sixty processing plants produced 170,575,957 pounds of fishery products in 1959, as compared to the production of 215,301,904 pounds by 157 plants in 1958.

The data in the following tables are from the ALASKA FISHERIES, 1959, which is an annual summary published by the Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service. The use of these data is hereby greatly acknowledged.



Salmon canneries on Bristol Bay are busy during the short red salmon fishing season which peaks in July. The rest of the year the canneries are inactive.

TABLE I.

COMPARATIVE VALUES OF CANNED SALMON GIVING PRICE PER CASE, APPROXIMATE TOTAL VALUE OF EACH SPECIES AND TOTAL OF ALL SPECIES

Year	Silver	Chum	Pink	King	Red	Total Value
$/Case	$22.00	$15.00	$16.00	$24.00	$26.05	
1949	$3,781,482 22.00	$7,498,382 21.10	$44,147,496 24.00	$1,402,934 23.00	$25,581,995 29.00	$82,412,289
1950	5,556,430 25.28	15,539,056 15.18	26,753,868 20.84	1,590,996 28.41	34,811,975 31.85	84,252,325
1951	8,726,587 21.34	10,925,359 15.66	32,505,086 18.52	2,489,046 26.76	24,603,107 28.60	79,249,185
1952	4,206,757 19.67	15,140,209 13.43	21,705,200 17.59	1,526,532 27.64	33,783,606 28.50	76,362,304
1953	2,511,209 22.87	10,622,248 14.66	16,613.896 19.55	1,553,585 26.76	26,877,507 28.89	58,178,445
1954	3,826,839 26.67	14,766,146 17.39	22,230,115 21.29	1,374,656 28.65	21,158,968 31.81	63,356,724
1955	3,056,498 28.82	6,322,462 18.75	26,345,976 22.31	1,369,984 31.10	19,774,011 34.55	56,868,931
1956	2,763,122 27.40	12,873,940 18.49	26,601,559 23.04	1,426,590 31.95	34,912,246 34.99	78,577,457
1957	2,391,960 26.34	15,344,031 16.31	16,945,404 20.76	1,533,286 29.76	26,694,705 33.77	62,909,383
1958	2,742,255 30.92	12,790,288 20.46	32,518,937 23.63	1,540,728 33.89	16,534,775 36.65	66,126,983
1959	3,038,291	8,498,434	15,002,039	1,534,259	21,419,766	49,492,789

TOTAL VALUE FOR ALL SPECIES 1949-1958, $810,294,026

TABLE II.

TOTAL SALMON PACK IN CASES (48 ONE-POUND CANS) AND NUMBER OF OPERATING SALMON CANNERIES, BY REGION

Year	Southeastern		Central		Western		Total	
	Pack	Canneries	Pack	Canneries	Pack	Canneries	Pack	Canneries
1949	2,493,709	37	1,281,212	51	588,550	19	4,363,471	107
1950	1,190,174	39	1,439.029	54	643,889	15	3,273,092	108
1951	2,028,262	39	1,067,687	59	388,519	24	3,484,468	122
1952	1,320,925	40	1,456,417	46	796,786	24	3,574,128	110
1953	997,682	37	1,350,589	43	533,996	20	2,862,267	100
1954	1,302,939	29	1,394,981	43	396,833	17	3,094,753	89
1955	839,694	30	1,162,541	39	382,910	15	2,385,145	83*
1956	1,032,487	26	1,349.116	37	641,303	14	3,022,906	77*
1957	904,970	27	1,001,792	36	556,910	18	2,463,672	80*
1958	1,181,245	24	1,363,525	38	436,758	17	2,971.537	78
1959	758,720	20	573.361	34	446,208	15	1,778,289	68*

*Total adjusted to eliminate duplication.

TABLE III.

SALMON TAKEN IN ALASKA BY GEAR AND SPECIES, 1959

	Southeastern	Central	Western	Total
Seines				
Number of:	482	413	35	904*
Percentage:	78.0	71.8	8.3	58.3
King or Chinook	4,549	2,945	1,341	8,835
Red or Sockeye	542,140	781,314	159,491	1,482,945
Coho or Silver	185,046	31,170	612	216,828
Pink or Humpback	7,208,811	2,855,233	20,213	10,084,257
Chum or Keta	891,609	1,558,828	353,053	2,803,490
Total	8,832,155	5,229,490	534,710	14,596,355
Gill Nets				
Number of:	759	1979	1738	4451*
Percentage:	9.9	28.1	91.6	36.2
King or Chinook	35,769	42,794	192,361	270,924
Red or Sockeye	216,676	1,155,481	5,089,642	6,461,799
Coho or Silver	333,484	299,312	75,838	708,634
Pink or Humpback	202,730	201,777	1,634	406,141
Chum or Keta	336,351	349,591	533,288	1,219,230
Total	1,125,010	2,048,955	5,892,763	9,066,728
Trap				
Number of:	11	.....	.....	11*
Percentage:	3.8	.....	.....	1.7
King or Chinook	17	.....	.....	17
Red or Sockeye	18,460	.....	.....	18,460
Coho or Silver	7,887	.....	.....	7,887
Pink or Humpback	384,404	.....	.....	384,404
Chum or Keta	17,576	.....	.....	17,576
Total	428,344			428,344
Fish Wheel				
Number of:			8	8
King or Chinook			1,409	1,409
Lines				
Number of:	6,118	32	.....	6,134*
Percentage	8.3	.05	.....	3.8
King or Chinook	318,488	1,505	.....	319,993
Red or Sockeye	161	.....	.....	161
Coho or Silver	567,166	1,920	.....	569,086
Pink or Humpback	55,314	229	.....	55,543
Chum or Keta	1,298	.....	.....	1,298
Total	942,427	3,654	.....	946,081
Total All Gears				
King or Chinook	358,823	47,244	195,111	601,178
Red or Sockeye	777,437	1,936,795	5,249,133	7,963,365
Coho or Silver	1,093,583	332,402	76,450	1,502,435
Pink or Humpback	7,851,259	3,057,239	21,847	10,930,345
Chum or Keta	1,246,834	1,908,419	886,341	4,041,594
Total	11,327,936	7,282,099	6,428,882	25,038,917

*Totals adjusted to eliminate duplication.

TABLE IV.

CATCHES OF FISH AND SHELLFISH IN POUNDS AND VALUE, 1959

Species	Pounds and Value
Salmon	147,277,979 $20,956,474
Herring	107,443,870 $ 1,293,624
Halibut	29,974,210 $ 3,899,108
Sablefish	2,312,379 $ 187,057
Cod	3,618 $ 181
Flounder	781 $ 62
Lingcod	4,186 $ 120
Rockfishes	6,517 $ 336
Smelt	8,400 $ 420
Dolly Varden	6,310 $ 1,199
Steelhead	8,644 $ 1,475
Razor Clams	1,126,051 $ 131,054
Dungeness Crab	3,999,344 $ 325,638
King Crab	18,839,470 $ 1,477,980
Shrimp	13,052,321 $ 505,537
Kelp, with herring eggs	107,900 $ 5,395
TOTAL	324,171,980 $28,785,660

TABLE V.

COMPARATIVE ANNUAL PRODUCTION OF FISHERY PRODUCTS AS PREPARED FOR MARKET BY POUNDAGE AND VALUE 1959

Species	Pounds and Value
Salmon	98,630,598
	$56,234,518
Herring	34,928,035
	$ 2,263,295
Halibut	26,051,202
	$ 6,056,909
Sablefish	1,817,707
	$ 344,782
Cod	3,618
	$ 434
Flounder	400
	$ 60
Lingcod	2,927
	$ 354
Rockfishes	6,517
	$ 781
Smelt	8,400
	$ 870
Dolly Varden	7,250
	$ 2,341
Steelhead	3,292
	$ 1,388
Razor Clams	315,015
	$ 445,691
Dungeness Crab	1,054,215
	$ 856,948
King Crab	4,317,663
	$ 3,850,022
Shrimp	2,143,048
	$ 2,041,110
Kelp, with eggs	107,900
	$ 36,100
Fur Seal	953,966
	$ 43,475
Sea Lion	222,625
	$ 24,017
TOTAL	170,574,378
	$72,203,095

TABLE VI.

ALASKA PACK OF CANNED SALMON, 1878-1959

Year	Standard Cases	Value	Year	Standard Cases	Value
1878.....	8,159	(1)	1919.....	4,583,688	$43,265,349
1879.....	12,530	(1)	1920.....	4,429,463	35,602,800
1880.....	6,539	(1)	1921.....	2,596,826	19,632,744
1881.....	8,977	(1)	1922.....	4,501,652	29,787,193
1882.....	21,745	(1)	1923.....	5,035,697	32,873,007
1883.....	48,337	(1)	1924.....	5,294,915	33,007,135
1884.....	64,886	(1)	1925.....	4,459,937	31,989,531
1885.....	83,415	(1)	1926.....	6,652,882	46,080,004
1886.....	142,065	(1)	1927.....	3,572,128	30,016,264
1887.....	206,677	(1)	1928.....	6,083,903	45,383,885
1888.....	412,115	(1)	1929.....	5,370,159	40,469,385
1889.....	719,196	(1)	1930.....	5,032,326	29,694,898
1890.....	688,591	(1)	1931.....	5,403,739	29,096,292
1891.....	801,400	(1)	1932.....	5,254,483	21,715,801
1892.....	474,717	(1)	1933.....	5,225,604	28,376,014
1893.....	643,654	(1)	1934.....	7,481,830	37,611,950
1894.....	686,440	(1)	1935.....	5,133,122	25,768,136
1895.....	686,530	(1)	1936.....	8,437,603	44,751,633
1896.....	966,707	(1)	1937.....	6,669,665	44,547,769
1897.....	909,078	(1)	1938.....	6,806,998	36,636,897
1898.....	965,097	(1)	1939.....	5,263,153	34,441,082
1899.....	1,078,146	(1)	1940.....	5,069,343	31,474,492
1900.....	1,548,139	(1)	1941.....	6,932,040	56,217,601
1901.....	2,016,804	(1)	1942.....	5,075,866	48,298,913
1902.....	2,536,824	(1)	1943.....	5,428,269	57,823,679
1903.....	2,246,210	(1)	1944.....	4,893,059	51,196,140
1904.....	1,953,756	(1)	1945.....	4,354,569	44,757,680
1905.....	1,887,801	$ 6,304,671	1946.....	3,949,878	53,157,194
1906.....	2,219,046	7,896,392	1947.....	4,312,455	88,672,661
1907.....	2,169,870	8,781,366	1948.....	4,014,572	96,522,290
1908.....	2,606,972	10,185,783	1949.....	4,391,871	81,273,153
1909.....	2,395,477	9,438,152	1950.....	3,307,717	82,346,644
1910.....	2,413,053	11,086,322	1951.....	3,484,468	79,249,185
1911.....	2,823,817	14,593,237	1952.....	3,574,128	76,362,304
1912.....	4,054,641	18,682,880	1953.....	2,862,267	58,178,445
1913.....	3,739,185	13,531,604	1954.....	3,094,753	63,356,724
1914.....	4,056,653	18,920,589	1955.....	2,385,145	56,868,931
1915.....	4,500,293	18,653,015	1956.....	3,022,906	78,577,457
1916.....	4,900,627	23,269,429	1957.....	2,463,672	62,909,386
1917.....	5,947,286	46,304,090	1958 (2)	2,971,537	66,126,983
1918.....	6,605,835	51,041,949	1959.....	1,778,289	49,492,789

(1) Data not available.

(2) Preliminary.

NOTE: Includes data on the pack of canned, smoked, and barbecued salmon. Does not include data on the pack of Alaskan salmon canned in the Pacific Coast states. "Standard Cases" represent the various size cases converted to the equivalent of forty-eight 1-pound cans, each containing 16 ounces.

TABLE VII.

NUMBER OF STANDARD CASES PACKED IN PUGET SOUND FROM ALASKA FISH IN 1959

	Kings	Reds	Cohos	Pinks	Chums	Total
Cases.....	110	2,628	17,621	6,239	5,813	32,411

TABLE VIII.

NUMBER OF SALMON CANNERIES BY AREA IN ALASKA 1959

Area	# of Canneries
Ketchikan	7
Petersburg	5
Juneau	8
Cordova	10
Cook Inlet	9
Kodiak	10
Bristol Bay	8
Peninsula, Aleutians, Chignik...	5
Yukon, Kuskokwin, Arctic	7

TABLE IX.

STIKINE RIVER DRIFT NET CATCH BY WEEK

Week Ending	No. of Boats Landing	Kings	Reds	Cohos	Pinks	Chums
May 9	16	261	.....	.....	.....	.....
May 16	22	378	.....	.....	.....	.....
May 23	41	1,327	.....	.....	.....	.....
May 30	44	2,129	.....	.....	.....	.....
June 6	53	1,433	3	.....	.....	1
June 13	50	2,882	8	.....	.....	1
June 20	64	674	356	.....	11	16
June 27	61	1,322	1,812	2	49	97
July 4	59	998	3,178	10	223	213
July 11	66	798	4,345	9	1,951	755
July 18	60	178	2,227	28	3,406	1,351
July 25	74	94	3,528	230	8,927	1,877
Aug. 1	64	36	2,695	726	12,592	806
Aug. 8	60	7	1,298	1,519	3,837	415
Aug. 15	64	25	349	5,086	2,854	313
Aug. 22	69	23	72	6,068	599	180
Aug. 29	66	15	21	7,254	354	223
Sept. 5	64	9	12	7,189	63	92
Sept. 12	76	5	2	10,442	68	115
Sept. 19	58	5	4	7,170	27	84
Sept. 26	34	.....	.....	2,178	1	15
Oct. 3	4	.....	.....	63	.....	1
Total		12,599	19,910	47,974	34,962	6,555

TABLE X.

KODIAK SALMON CATCH BY SPECIES, 1959

	Kings	Reds	Cohos	Pinks	Chums
904 Purse Seines	1,302	213,279	11,337	1,768,741	593,163
387 Beach Seines	507	16,516	2,772	30,934	125,396
1,521 Set Nets	28	100,292	403	167,383	15,225
Total	1,837	330,087	14,512	1,967,058	733,784

TABLE XI.

TAKU GILLNET CATCH, 1959

Kings	Reds	Cohos	Pinks	Chums	Total
18,512	13,431	32,702	50,463	25,738	140,846

Fish scows and boats silhouetted in sunset at mouth of Naknek, Bristol Bay.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