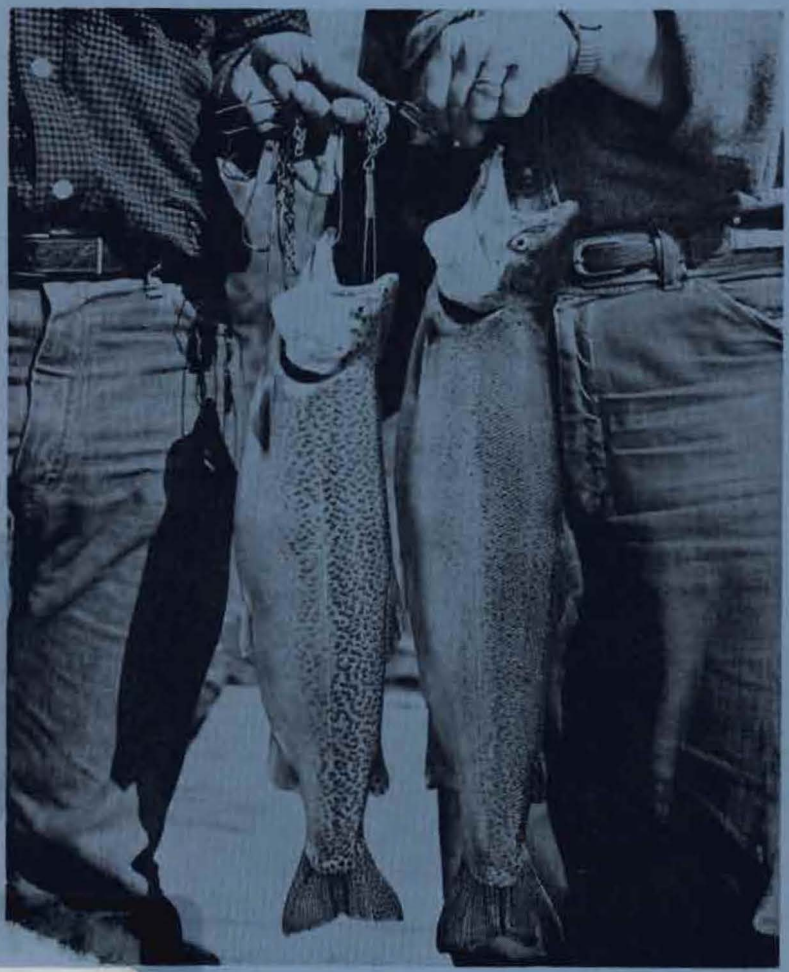
ALASKA DEPARTMENT OF FISHERIES

JUNEAU, ALASKA



Annual Report for 1956

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ERRATA SHEET

Page	Paragraph	Line	
15	2	1	Change "Chiknik" to "Chignik."
16	3	7	Change "1-3" to "1/3."
17	2	2	Insert the word "area" after "fishery."
42	1	3	Change "a typical" to "atypical."
42	3	11	Insert "that might affect the silvers adversely, or a lake from which such fish" after "other fish."
97	2	3 & 5	Change "42's" to "4_2s" and "53" to "5_3."

1956
ANNUAL REPORT

Alaska Fisheries Board

and

Alaska Department of Fisheries

B. Frank Heintzleman
Governor

Kenneth D. Bell
Chairman

C. L. Anderson
Director

REPORT NO. 8

JUNEAU, ALASKA

To:

THE GOVERNOR OF ALASKA
MEMBERS OF THE TERRITORIAL LEGISLATURE AND THE
CITIZENS OF ALASKA

Herewith is submitted the Eighth Annual Report of the Alaska Fisheries Board, created by the 19th Territorial Legislature and approved March 21, 1949.

This report covers the activities of the Board and the Alaska Department of Fisheries based on the calendar year January 1 to December 31, 1956.

C. L. ANDERSON, Director

KENNETH D. BELL, Chairman

J. HOWARD WAKEFIELD, Member

ROBERT C. KALLENBERG, Member

NELS E. NELSON, Member

ALBERT MUNSON, Member

FOREWORD

In presenting this Eighth Annual Report of the Alaska Department of Fisheries, a summary is given of the activities of the Alaska Fisheries Board and of the several divisions within the Department for the calendar year 1956. However, the financial statement is based on the Territorial biennium, April 1, 1955 to March 31, 1957. The statistical tables follow the usual procedure and cover the preceding ten-year period.

The work of the Biological Research Division was centered largely on a continuation of the Taku River salmon studies, the Kodiak king crab investigation and the Kitoi Bay red salmon research. In addition, a silver salmon research project was started during 1956 in Southeastern Alaska with funds provided by the 1955 Legislature. Silver salmon are important to the economy of the Territory and may well be the saving factor of the Southeastern troll fishery. Vast opportunity is present to increase the total production of this species by increasing the fresh water habitat. Tests and observations will be conducted on proposed silver salmon rearing lakes and streams, as well as age-growth analyses of scales taken from the commercial fishery. An effort will be made to establish an experimental lake to derive techniques for increasing the production of silver salmon by utilizing presently nonproductive waters.

With the modest appropriation for Education and Information, it became possible to produce an educational film of about one hour's length depicting many of the activities of the Department.

The Engineering Division handled a number of minor projects requested by the several divisions and, in addition, prepared complete plans and specifications for a proposed fishway on the outlet stream of Bakewell Lake near Ketchikan. Unfortunately, it was impossible to get a bid with the funds available. It is expected that additional funds will be available in 1957 for this installation.

The program of the Inspection Division was carried out on about the same scale as in 1955, with one stream inspector stationed at Pauls Bay, Afognak Island, one roving fishery inspector along the Kenai Peninsula and another along the Copper River in the Interior.

The continuing hair seal and beluga programs are reported upon herein as in the past. In addition, a first account is given on the sea lion and predaceous bird investigations. These were started in 1955 with Saltonstall-Kennedy funds, but have been continued in 1956 with Territorial funds.

During the past year the Sport Fish Division has continued its program of lake investigation, rehabilitation, and stocking. Lake Lucille (370 acres), which was treated with rotenone late in 1955, was stocked for the first time in the spring of 1956. Enlargement of the facilities at the Anchorage hatchery will be imperative in another year.

The Watershed Management Division was able to add one new district biologist, who was stationed at Dillingham in Bristol Bay. Other district men are located at Ketchikan, Wrangell and Kodiak. The Pauls Basin project on Afognak Island continues to show favorable results with about 500 adult red salmon returning to Gretchen Creek in 1956. Red salmon fry from the Deer Mountain Hatchery at Ketchikan were again planted in Bakewell Lake in an effort to have a run established in this system when the fishway is completed.

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FISHERIES BOARD

During the calendar year 1956, two regular meetings of the Alaska Fisheries Board were held at the office of the Alaska Department of Fisheries in Juneau. A summary of each meeting follows:

REGULAR SPRING MEETING, FEBRUARY 27-MARCH 2, 1956

After acceptance of the minutes of the fall meeting, November 7-12, 1955 and the financial report for the period April 1, 1955 to February 1, 1956, the work programs for the ensuing year were presented by the Director and members of the staff. In general, these followed along the lines of those pursued during the previous year. In brief these were as follows:

ADMINISTRATION: Operations of this division will continue on the same scale as the past year with no additions to personnel. Routine duties are provided for, as well as travel for the Director within the Territory and for attending meetings in the States.

BIOLOGICAL RESEARCH: The program for this division provides for the following four projects: (1) Taku River salmon studies; (2) Kitoi Bay red salmon research; (3) Kodiak king crab investigation; and (4) silver salmon research in Southeastern Alaska.

EDUCATION AND INFORMATION: The limited funds available will allow for only a part time man, working on an educational film for the Department.

ENGINEERING: Construction of the Bakewell fishway was authorized. However, if the funds available are insufficient to build this installation, the Director was authorized to select one or more smaller projects that could be contracted before the end of the biennium.

INSPECTION: With the funds available for the second half of the biennium, it will be possible to hire three temporary men for the summer. One stream inspector will be stationed at Pauls Bay on Afognak Island, one fishery inspector on th Kenai Peninsula, and the third man in the upper Copper River district.

MARINE PREDATOR CONTROL AND INVESTIGATION: Here again the following projects will be continued: (1) Stikine River hair seal control; (2) Taku River seal control; (3) Copper River hair seal control; (4) Bristol Bay beluga investigation and control; (5) Sea lion investigation; and (6) predaceous birds investigation. Part of this will be financed by Saltonstall-Kennedy funds and the balance from the Territorial appropriation.

SPORT FISH: Expansion of this program was authorized when it became evident the Kodiak Conservation Club would be willing to pay the salary of a biologist if one could be placed at Kodiak. The Director was instructed to draw up a satisfactory agreement with the Club and make arrangements for moving a biologist from Fairbanks to Kodiak. The usual program will be carried forward in the Fairbanks and Anchorage-Palmer areas.

WATERSHED MANAGEMENT: The addition of one district biologist will be possible with funds now available for the second half of the biennium. The new man will be assigned to the Bristol Bay area with head-

quarters at Dillingham. The work at Ketchikan, Wrangell and Kodiak will be continued by the district biologists on about the same scale as in the past.

The work programs as outlined above, were accepted by the Board. Details of the various projects will be found in the text of this report.

The proposed budget request for the 1957-59 biennium was presented to the Board for its consideration. After changing the Construction item from $150,000.00 to $250,000.00, the proposed budget was adopted as read. The total requested was $1,059,500.00.

The Board adopted the following resolution and instructed the Director to send copies to all interested parties:

"WHEREAS, it has been proposed by certain groups that the king and silver salmon fisheries of the Eastern Pacific Coast be placed under the control of an international commission; and

WHEREAS, the silver salmon fishery of Alaska is supported by stocks of fish originating in Alaska streams; and

WHEREAS, the runs of king salmon being harvested from the Yukon, Kuskokwim, Nushagak, Naknek, Susitna, Copper, Taku, Stikine and many other rivers in Alaska are obviously indigenous to Alaska; and

WHEREAS, Alaskans have suffered, since the creation of the Territory, from remote control of their fisheries; and

WHEREAS, the creation of a remote control commission for the regulatin of Alaska's fisheries, with the attendant bureaucratic, ineffecient and frustrating features of such control, is exactly what Alaskans have been protesting against for decades; and

WHEREAS, the problem of management of the stocks of king and silver salmon of the North Pacific are being effectively coordinated through the services of the Pacific Marine Fisheries Commission,

NOW THEREFORE, BE IT RESOLVED by the Alaska Fisheries Board, the official Territorial representative of the fishermen of Alaska, that the creation of an international commission for the king and silver salmon fisheries of the Eastern Pacific Coast would be superfluous and highly undesirable for the salmon fisheries of Alaska."

After a discussion of the proposed Fish and Game Department bill, that had been drawn up for consideration of the Board and the Tanana Valley Sportsmen's Association in 1954, the Director was instructed to draw up a revision incorporating certain changes that had been suggested and have it ready for the annual fall meeting.

Authorization was given the Director to allow certain members of the staff to attend outside universities for graduate studies and to receive up to one-half their regular salary while in school. Work to be submitted for advance degrees must be such that it will fit into the research programs and to be of future value to the Department.

After adoption of several changes in personnel classification and salary schedule, the meeting was adjourned.

REGULAR FALL MEETING, OCTOBER 29-NOVEMBER 3, 1956

The minutes of the meeting of February 27-March 2, 1956 were read and approved, also the financial report. Detailed reports on the past season's activities and projects of the several divisions were presented to the Board for their information. Much of this material is covered in other sections of this report.

The Director gave the Board a resume of the meeting called by Mr. Herrington of the U. S. State Department at San Francisco to discuss the stand to be taken by the the U. S. Government on the recommendations of the International Law Commission. Without the principle of abstention being included in the proposals, those present felt the United States should oppose the International Law Commission recommendations in their entirety. In line with this thought, the Board passed the following resolution:

"WHEREAS, the salmon and halibut fisheries of the Northwest Coast of North America are not only two of the world's most important fisheries but have been the field for the most extensive fishery conservation research anywhere; and

WHEREAS, these fisheries have been exclusively fished by the fishermen of the United States and Canada for many decades, millions of dollars have been expended upon them by the Governments of the two countries whose fishermen have been subjected to severe regulation in the interest of their preservation and development, so that the fishermen of this region justly feel and believe that they have acquired a special right and title to these fisheries and have fully qualified for the application to these fisheries of the principle of international law known as "abstention"; and

WHEREAS, the fishery recommendations adopted by the International Law Commission of the United Nations at Geneva this last summer not only failed to include the principle of abstention, but would deny the very existence of abstention as a principle of international law;

NOW THEREFORE, BE IT RESOLVED by the Alaska Fisheries Board that the United States Government should oppose the fishery recommendations of the International Law Commission in their entirety unless the principle of abstention is incorporated therein and all statements inconsistent therewith eliminated."

With only $60,000 available for the Bakewell fishway it was impossible to get any contractor to bid. A number of other smaller projects were listed and discussed, whereupon the Director was instructed to have surveys made of the proposed smaller projects in the Kitoi Bay area and at Ketchikan, and then to select the most feasible projects that can be completed with the funds available.

The Director presented to the Board a revised proposed Fish and Game Department bill for their consideration. It was pointed out that much valuable help had been given by Mr. McKay of the Legislative Council and Mr. Merdes and Mr. Camarot of the Attorney General's office. After a few minor changes the bill was accepted and the following resolution on the subject adopted:

"WHEREAS, transfer of control of the fish and game resources from the Federal Government to the Territory appears imminent; and

WHEREAS, Statehood for Alaska, presently pending before Congress, transfers control of Alaska's fish and game resources to the State of Alaska; and

WHEREAS, the Territory has taken steps to safeguard its fisheries resources by creating the Alaska Department of Fisheries in 1949; and

WHEREAS, the Alaska Department of Fisheries has been functioning in sport and commercial fisheries in biological research, inspection, watershed management, stream improvement, and predator investigation and control; and

WHEREAS, the Territory of Alaska is currently capable of assuming control of all its fish resources; and

WHEREAS, no Territorial agency has been organized to safeguard the game resources of Alaska; and

WHEREAS, much study and careful deliberation has shown that Alaska's fish and game resources could be better utilized and conserved by the administration of these resources by a single commission and department, in addition to being the most economical type of fish and game administration for the Territory or for the State of Alaska;

NOW THEREFORE, BE IT RESOLVED by the Alaska Fisheries Board, that the 1957 Legislature of the Territory of Alaska consider the bill offered by the Board creating an Alaska Department of Fish and Game."

The Board then instructed the Director to draw up a brief in support of the bill. Also for him to mail copies of the bill, the brief, and the resolution to all members of the Territorial Legislature, Alaska Sportsmen's Council, and other interested parties.

Consideration of recommendations to the U. S. Fish and Wildlife Service for the 1957 fisheries regulations constituted the main business of the fall meeting. Letters dealing with this subject were received from various parts of the Territory and several local fishermen appeared in person to give their views. A round-table discussion was held with Juneau officials of the above Federal agency. Members of the departmental staff presented information on the particular areas with which they were familiar. The Board then adopted its recommendations and the Director was instructed to incorporate these in a brief as follows:

November 13, 1956

Mr. Arnie J. Suomela, Acting Director
Bureau of Commercial Fisheries
United States Fish and Wildlife Service
Washington 25, D. C.

Dear Mr. Suomela:

The Alaska Fisheries Board herewith offers for your consideration its recommendations pertaining to the 1957 regulations for the protection of the commercial fisheries of Alaska.

The latest available biological data as well as the years of practical experience of members of the Board, fishermen and other interested parties have been the basis for these recommendations. The Board is grateful

for the cooperation and help given by Mr. Donald McKernan, the Service's Administrator of Commercial Fisheries, and members of his staff in discussing their proposed regulation changes with the Board.

It was gratifying to the Board to note that over the past few years a number of the Board's proposals have been adopted by the Service. Adoptions have not always been made in the year offered nor in the exact form suggested; however, progress has been made in incorporating the Board's recommendations in Alaska's fisheries regulations.

The Board reiterates its stand that wherever more effective types of gear are legally fished, the less effective types should also be allowed. Without doubt, the gear would be listed in order of effectiveness as follow: traps, purse seines, gill nets, and hook and line. There may be minor exceptions to this order at selected times and places, but normally this order of effectiveness is correct. In the past there have been instances of removing less effective types of gear from various areas while more effective types were allowed to remain; the Board cannot subscribe to this type of management.

PART 101 - DEFINITIONS

The Board reaffirms its stand that definitions of all legal types of fishing gear should be incorporated in the regulations. Included with the definition should be a clear statement as to when each particular type of gear is considered to be fishing and when it is considered to have ceased fishing. Confusion exists among the fishermen on the above points; clarification is in order.

PART 102 - GENERAL PROVISIONS

The Board is in accord with the proposal to have a permanent registration for each fishing device in all fishing areas of Alaska. This should be of considerable benefit to both the management and statistical sections of the Service.

The Board again takes its stand in opposition to area licensing for salmon fishing. The Board is opposed to area licensing in principle and feels there are numerous other methods of regulating fisheries which should be ued before attempting this method. These include regulating the gear, fishing time and fishing area. The method of regulation inaugurated in Bristol Bay whereby the amount of gear determines the fishing time is a step in the right direction. Area licensing has been a stop-gap measure and is not the answer.

The adjustment of opening and closing dates, taking into account week ends and closed periods, seems to be a good move and the Board concurs with the proposal in this regard.

The Alaska Fisheries Board has repeatedly recommended, and wishes now to reaffirm, that salmon traps in Alaska be eliminated. This is in line with the progressive policy followed by the Pacific Coast States and British Columbia. The people of Alaska have expressed their overwhelming opposition to traps by referendum vote and numerous memorials from the Territorial Legislature.

Since salmon traps have not been eliminated, it has been recommended by the Board in the past that salmon trap leads be required to have an opening during closed fishing periods. Perhaps a law similar to the one in British Columbia for their four remaining traps which requires a twenty

foot opening in the lead extending at least ten feet below the surface at low water could be modified to fit the Alaska trap situation. In any event, the trap leads should be required to have openings during the closed periods.

The Board reiterates its past recommndation that the mesh of webbing used in trap spillers be set at not less than 3½ inches to help prevent the needless destruction of small salmon, herring and other small fish that are now entrapped and destroyed when the trap is brailed.

The Board recommends that a regulation be made prohibiting the practice of fishing multiple gear; for example, the practice of a boat delivering a gill net loaded with fish to a tender for picking while the boat picks up a new gill net and resumes fishing immediately. It is realized that this practice has recently developed; it should be stopped at once.

PART 103 - YUKON AREA

The Board is in accord with the proposal to hold the Yukon River chum salmon for personal use by the human population in the watershed, until such time as it is definitely shown that the salmon will support a more substantial fishery. The needs of the local people are of paramount importance.

PART 104 - BRISTOL BAY AREA

The Board wishes to compliment the Service for the many basic research programs initiated this year in Bristol Bay. The results of these should form a sound basis for good management. The tagging experiments will further define the fishing areas as first proposed by the Board in 1953 and adopted by the Service in 1954.

The establishment of a fish ticket system for reporting catches in Bristol Bay is endorsed by the Board. Surely, this step is necessary from a management standpoint, since it will provide usable statistics from the fishery.

The Board concurs with the proposal to regulate fishing time by the amount of fishing gear in the area. This seems to be a good method of regulating certain fisheries and was originally proposed by the Board in their 1952 Brief to the Service for the Taku River and again in 1954, along with the suggestion that the same type of formula would work in other fisheries.

Moving the Northeastern District of the Alaska Peninsula into the Ugashik District of the Bristol Bay area seems to be in order and good management procedure.

The Board noted with some concern the lack of adequate enforcement in Bristol Bay after the close of the red salmon season. This has resulted in a general disregard of the upper fishing limits and other regulations; some people believe that certain regulations in effect through the red salmon seasons are no longer in force after the season. This should be corrected. Education and information will help alleviate this problem; in addition, a skeletal enforcement staff would insure proper adherence to the regulations. If relaxations can be made in the regulations after the salmon season due to reduced fishing intensity, these changes should be made.

PART 105 - ALASKA PENINSULA AREA

In view of the extensive rehabilitation measures instituted in the Bristol Bay red salmon fishery, the unrestricted size of purse seines and purse seine vessels in certain districts of the Alaska Peninsula Area deserves the Service's serious study. Tagging has shown that a good share of the red

salmon taken in the Alaska Peninsula fishery are of Bristol Bay stock. If severe curtailment of the red salmon fishery is needed in Bristol Bay, it should certainly follow that curtailment should be the case wherever numbers of Bristol Bay red salmon are taken.

PART 107 - CHIKNIK AREA

The Board is in agreement with the following proposals for the Chignik Area:

(a) The change in the weekly closed periods for Chignik Lagoon; this should allow a more even distribution of red salmon escapement.

(b) The greater closed area near the mouth of the Chignik River should be instituted if it will allow a better distribution of escapement.

(c) The additional closures proposed in Mallard Duck Bay and the western arm of Kujulik Bay are agreeable to the Board.

PART 108 - KODIAK AREA

The Board supports the Service's proposal to have a continuous season with an additional twenty-four hours added to week end closure periods. This is in accord with the policy advanced by the Board on numerous occasions recommending longer continuous seasons accompanied by short weekly fishing periods, thus securing harvest and escapement from all segments of the run.

The specific mid-season closure from July 19 to July 29 between Cape Karluk and Cape Uyak has the Board's approval, if these dates will provide escapement from the middle portion of the Karluk red run. This escapement has been negligible for years. Every effort should be made to rehabilitate the Karluk red salmon.

The Board agrees that some changes are needed to rehabilitate the red salmon runs of Olga Bay and yet utilize the early pink salmon runs. The Board recommends that both traps at the entrance of Moser Bay be removed; this should be coupled with a complete closure in Olga Bay proper.

A seventy-five fathom seine lead is recommended for the Kodiak Area. In some of the localities, fishing with a longer lead than currently allowed would be desirable and would provide the Kodiak purse seiners with the length of lead used in most other areas.

The Board suggests that the king crab trawling closure during the soft shelled stage be made for four districts in the Kodiak Area by field announcement. This was originally proposed by the Board in 1954. The four districts are as follows:

1. **Afognak District:** All the waters of the north coast of Afognak Island between Tonki Cape and Black Cape, and the waters of Shuyak Island.
2. **Kodiak District:** All waters of Marmot and Chiniak Bays between Cape Kostromitinof and Cape Chiniak, including Kazakof and Afognak Bays, Afognak Straits, Whale Passage and Kizhuyak Bay.
3. **Alitak District:** All waters of the south end of Kodiak Island inside a line drawn from Low Cape to the southwest corner of Tugidak Island thence along the north shore of the Trinity Islands to Sitkinak Cape thence to Cape Kaguyak.
4. **Fourth District:** All remaining waters of the Kodiak area not in-

cluded in the first three districts.

The stocks of king crabs in the above areas seem to be separate from one another and are probably independent groups or races. They can and do have different times for molting and mating.

PART 109 - COOK INLET AREA

In general, the Board suggests that the fishing season and gear be maintained according to the 1956 Regulations for at least another season, with such additional closures or relaxations as conditions may justify. It seems more study is needed before the set net gear is disrupted and the amount-of-gear versus length-of-fishing-time type of regulation is initiated in this area. There is some basis for the belief that the set nets would be cut more than 1-3 in efficiency by changing the distance between gear to 900 feet as has been suggested.

It is agreed that Kamishak Bay be opened to salmon fishing. Regulations should be liberalized wherever possible; consistent, of course, with sound management principles.

A uniform opening date of June 25 should be set for all traps in Cook Inlet; and fishing by gill nets from May 25 to June 25 should be limited to not more than thirty-five fathoms of net, having a mesh size of less than 8½ inches stretched measure. These measures are recommended as a protection for the red run in the Kasilof River.

The fifteen pot limit for taking king crabs in Kamishak Bay should be eliminated; see Section 109.25(b) of the 1956 Regulations. There should be no limit on the number of pots in this Bay since it is not economically feasible to fish in this large unexploited bay with the present pot restrictions in effect. The Board compliments the Service for the removal of the regulation prohibiting dragging in Kamishak Bay as proposed by the Board in 1955.

It is recommended that the number of pots allowable in Kachemak Bay be increased from fifteen per boat to fifteen per man. This would permit the use of larger boats and more economical operations in the fishery.

The Cook Inlet Area king crab season should be regulated by field announcement, closures being called at such times when the crabs are in a moulting or soft shelled condition.

The proposed bag limit on immature salmon is approved by the Board; this is in line with the Board's 1955 recommendation to the Service. The Board is also pleased to note that the bag limit of two salmon per day was extended in the 1956 Regulations to include the west side of Cook Inlet as was proposed by the Board in 1955.

At present there is a closed season on razor clams from July 10 to August 31 inclusive. This is the time of main tourist travel on the Kenai Peninsula. The razor clam personal use fishery is a major tourist attraction during the open season. The Kenai Peninsula is developing a good tourist trade with the income advantages of such enterprise. Tourism should be encouraged whenever possible. Therefore, the Board recommends a personal use fishery, open year around, with a forty-eight razor clam bag limit.

PART 111 - PRINCE WILLIAM SOUND

A trial of gear versus seasons as proposed by the Service seems worthwhile, provided the following are also accomplished: (a) the traps in use

during 1956 are used as the basis for the 50% curtailment of trap effectiveness, (b) the increased stream closures are made, and (c) increased enforcement is provided in the Sound.

Further study should be made of the proposal to establish a set net fishery in Esther Island passage to fish the Coghill red salmon.

PART 112 - COPPER RIVER AREA

It is recommended that the salmon season open the first Monday in May in the Copper River Area.

The Board wishes to compliment the Service for removing the pot limit for taking Dungeness crabs in 1956 and as proposed by the Board in 1955. This should encourage the prospecting and harvesting of crabs in the ocean fishery.

PART 113 - BERING RIVER-YAKATAGA AREA

The Board is in agreement with the Service's proposals for this area.

PART 115-124 - SOUTHEASTERN ALASKA AREA

The Board reiterates its opposition to area licensing as stated in Part 102, General Provisions, and is against the inclusion of the Southeastern Alaska Area under the area licensing plan.

We are in agreement that the curtailment on trap and bay fishing, instituted three years ago, be continued during 1957.

As far as fishing seasons are concerned, the Board wishes to reiterate its recommendations made in 1954 and 1955—a long continuous season with short fishing periods each week so that catch and escapement are ensured for all segments of the runs. During the long season, it may be necessary to have several sustained closures to allow escapement to the spawning grounds of badly depleted runs. This may be especially needed for the early pinks in the districts around Ketchikan.

The following fishing dates are suggested: Monday, June 13 to Thursday, October 24. The weekly fishing period should be of short enough duration to allow for escapement each week, say from 12:00 noon on Monday to 6:00 p.m. on Thursday.

The Board is in agreement that a winter closure for trolling in outside waters from November 1 to April 15 should be instituted. This is in line with the Pacific Marine Fisheries Commission recommendations to conserve the badly depleted runs of fall king salmon in the Columbia River.

The Board recommends that no winter closure be placed on the inside troll fishery at this time. The Department has accumulated data since 1950 in its research on the troll fishery which indicates the proposed closure of inside trolling from November 1 to April 15 would not accomplish the purpose for which it is designed. The inside stocks are composed primarily of king salmon from Alaskan and Northern British Columbia rivers. Tagging indicates that less than five percent of the available immature stocks are of Columbia River origin and the same percentage applies for Fraser River stocks. For mature fish, the percentage is much less. Sampling aboard commercial trollers also indicates that actually a smaller percentage of illegal fish (less than twenty-six inches) is taken on the gear in the winter in inside waters than in the summer. In addition, the total take of king sal-

mon in Southeastern Alaska during 1955, from November 1 to April 15, was only 2½% of the total catch for the year. This data in its entirety is available to the Service's Juneau office. Mr. McKernan has said he and members of his staff would like to discuss the above data with various members of the Department's staff.

The Board suggests more study on the various salt water sports fishing regulations, including limits and closed areas proposed by the Service. At the present time there is a great variance of thought on the subject and actually no thorough study of the recreational and commercial strip fishing for king salmon has been made. The Board recognizes a problem does exist and will continue to increase, but believes further study is in order before any conclusions are made.

There is one step that should be taken by the sport fishermen to assure some measure of conservation on immature king salmon. A regulation providing for a twenty-six inch minimum size limit on immature kings would do this and is hereby recommended by the Board.

The proposal to eliminate bundling and lashing of excess gill net web meets with the approval of the Board. If this was allowed to continue there would be a constant temptation to fish the web in excess of the lawful amount allowed.

Due to favorable year classes in the herring stocks of Southeastern Alaska, the fishing outlook is fairly good. However, predictions have proven wrong before, especially with herring stocks. The Board would favor a quota of 17,500 tons (140,000 barrels), and if warranted, an increase in the quota to 22,500 tons (180,000 barrels) as the Service proposed.

The move to dispense with the summer closed season on crabs in the Stikine District seems in order, a relaxation of regulations whenever possible.

The additional closure of ½ mile on the Taku River is needed due to silting.

Montana Creek in the Juneau area should be restricted to fishing for personal use by hand rod, hook and line. This small creek is readily available to Juneau by road and receives a heavy fishing pressure.

Both the change in the Tebenkof boundary and seasons and the opening of Port Houghton to trolling are in order.

The extension of the seine season in the Western District as requested by Sitka fishermen seems in order. The season proposed by the Board would take care of this.

The boundary change for the Stikine District, establishing Hour Point as a boundary marker on the back channel, has the Board's approval; however, it is felt that it would be advisable to allow a modest extension of the present lower boundaries as proposed by the fishermen.

During the king salmon season, the Board approves a restriction to three days salmon fishing per week for all forms of fishing gear in the Stikine River gill net area.

The Board is in full accord with the Service's proposal to have a commercial season on the red salmon runs into Lake, Salmon, and Red Bays. These runs have remained unfished for a considerable period of years and the Board suggested this be looked into in the 1953 Brief to the Service. It is suggested that a fishing area for drift gill nets be made consisting of a reasonably wide strip of water from a point south of Lake Bay to a point just west of Red Bay and that a gear versus time table be made to ensure an adequate escapement. If the Service has some fears of harvesting pinks

in this new drift gill net area, which should not be utilized, a mesh size restriction can be made to ensure the capture of the red salmon and yet allow the majority of the pinks to pass through.

The Board approves the move to limit the personal use take from Ward Cove Lake and Ward Cove Creek and Ketchikan Creek to two fish per person per day. Any waters in the midst of a population center and exposed to the intense pressure these receive should certainly have catch limits imposed on their spawning stocks. In addition, the Board feels that Ketchikan Creek, in the heart of Ketchikan, should have fishing limited to rod and reel only, with snagging prohibited.

The Board endorses the proposed closure of the Burroughs Bay gill net area and the opening of Portland Canal to absorb these fishermen.

The Board concurs with the Service's proposal to close all salmon fishing from Rudyerd Bay to Anchor Pass. It is noted that in the proposed regulations it is stated, "closed to **all** fishing." This should be changed to "all salmon fishing."

The Board is in accord with the increased closure at Tombstone Bay.

It seems to the Board to be a proper move to give a larger fishing area in Moira Sound, Cholmondeley Sound and Kasaan Bay during the fall chum salmon season.

The Board is in accord with the Service's proposal to permit a gill net fishery in Portland Canal to harvest these salmon runs which have been previously exploited by only the Canadian drift-gill netters. However, the Board feels the outer limit before and after the seine season should be from Cape Fox Island to Lord Rock and thence to the International Boundary. The season should extend to October 31, instead of September 30, in order to sample the runs throughout the season. If there is no fishing from October 1 to 31 in this new area, how can it be determined whether or not, and what numbers, stocks of salmon are present?

The Board is in agreement with the Service's proposal to close Shinaku Inlet and approaches to Big Salt Lake north and east of Klawock Island and Peratrovich Island to provide for more satisfactory escapements.

As in the past, we assure you the above recommendations and suggestions are offered in a spirit of cooperation, with the future of Alaska's sustained fisheries utilization being the paramount consideration.

Respectfully submitted by,

/s/ C. L. ANDERSON

C. L. ANDERSON, Director for the
Alaska Fisheries Board:

KENNETH D. BELL, Fairbanks, Chairman

ROBERT C. KALLENBERG, Dillingham

J. H. WAKEFIELD, Port Wakefield

NELS E. NELSON, Ketchikan

ALBERT MUNSON, Kenai

ADMINISTRATION

The Director and members of the staff held the customary meetings with fishermen's groups throughout the Territory to acquaint them with the progress of the work programs of the Biological Research, Marine Predator Control and Investigation, Sport Fish, and Watershed Management Divisions of the Department. In December the Director, accompanied by one member of the biological staff, attended the annual meeting of the Pacific Marine Fisheries Commission at San Francisco. Reports were presented on the results of the departmental research on the king salmon and blackcod fisheries.

Other meetings attended by the Director were the annual meeting of the International North Pacific Fisheries Commission held at Seattle, November 12-16, 1956 and the conference called by Mr. Herrington of the State Department at San Francisco, California, August 2-3, 1956. At this meeting representatives of the fishing industry from all parts of the United States met to discuss and formulate plans for the position to be taken by the U.S. State Department on the recommendations of the International Law Commission pertaining to fishing on the high seas. On February 16 and 17, the Director appeared before the House Subcommittee on Territorial and Insular Affairs in Washington, D. C., to present, on behalf of the Alaska Fisheries Board, the case for transfer of control of fish and game from the Federal to the Territorial Government.

As customary in the past, field trips were made to inspect the work being carried on by the several divisions in various parts of the Territory. Routine duties consisted of the preparation of the minutes of the Board meetings; submission of the proposed budget for the 1957-1959 biennium; working up material for the annual report; writing of a brief for the Board to the Director of the Fish and Wildlife Service; compiling of information and data requested by various governmental and private agencies; and preparing a fish and game bill for the Board.

Seine boats massed at Anan Creek for pink salmon fishing.

BIOLOGICAL RESEARCH

The 1956 activities of the Biological Research Division continued the three field studies under way in 1955 on Taku River salmon, Kitoi Bay red salmon, and Kodiak king crab. A new research project was initiated on silver salmon in Southeast Alaska. The library and headquarters unit continued to provide information and coordination for these projects.

The Taku River studies were conducted by Clarence Weberg and Paul Garceau who continued to gather catch and escapement data on the five species of salmon using the Taku system. In addition, a special study was made to determine the accuracy of spawning ground counts by determining the rate of spawned-out carcass drift.

With William A. Smoker in charge, and assisted by Richard Dugdale, both of whom are new to the staff, and Robert Vincent who continued as resident biologist, the Kitoi Bay Research Station expanded its operations. In addition to studies on the adult and smolt runs of red and silver salmon in Kitoi Lake, two experimental lakes were planted to measure the effect of resident predator and competitor fishes on red salmon fry. Richard Dugdale joined the staff in June 1956 and left in November of the same year. H. Reed Stevens expanded the tagging program on king crab to determine growth and migration of this species in the Kodiak region and nearly completed a large aquarium facility for early growth studies.

William A. Smoker organized a new research project on silver salmon in Southeast Alaska, which involved a review of information acquired in the past on silver salmon, establishment of general effects of stream-flow on their abundance in this region, and field surveys for study lakes suitable for the introduction of this species. Richard Dugdale assisted in obtaining laboratory equipment for lake productivity studies.

The entire staff at the Department headquarters participated in writing letters and reports providing basic information on fisheries in Alaska. The research library, under the direction of Dan Gittings, was integral part of this activity and was of primary importance as a source of information in planning research projects. The library continued to expand rapidly during 1956 and ranks high as a scientific library.

Biographical Sketches

William A. Smoker was born near Ishpeming, Michigan, on July 28, 1915. He received his undergraduate training in California in Forestry at San Jose State College and the University of California at Berkeley. He worked in California on temporary summer jobs for the U. S. Bureau of Fisheries in 1939, 1940, and 1941 on trout survival studies at the Convict Creek Research Station, and on king salmon studies related to the Shasta Dam project on the Sacramento River. Employment in forestry and fisheries projects and graduate studies in fisheries at the University of Washington were interrupted by the second World War. The years 1941 to 1945 were spent in the United States Army where he saw duty in the Infantry and Corps of Engineers. After the war he continued his graduate studies at the University of Washington, obtaining his degree of Doctor of Philosophy in 1955. His thesis was on the relationship of stream flows to salmon abundance. From 1947 to 1956, during his graduate studies, he was employed full time by the Washington Department of Fisheries as a research biologist, and at times was in charge of salmon stream investigations, salmon

and herring marine studies, and effects of industrial pollution on salmon. He joined the Alaska Department of Fisheries as a Senior Biologist in March 1956.

TAKU RIVER INVESTIGATIONS*

by

C. A. Weberg and Paul Garceau

The Taku River Research Program was initiated in 1951, with emphasis on the study of king salmon, (**Oncorhynchus tshawytscha**), and expanded the following year to include preliminary studies on red salmon, (**O. nerka**); pink salmon, (**O. gorbuscha**); chum salmon, (**O. keta**); silver salmon, (**O. kisutch**).

A description of the study area may be found in the Alaska Department of Fisheries Annual Report for 1955.

Gill Net Fishery

History

A gill net fishery was operating in Taku Inlet as early as 1897 and probably at least a dozen years prior to this date. Moser (1898) states that "as soon as the ice breaks up in the river (usually about May 25) the fishing for king salmon commences, and all that are packed at Pyramid Harbor are taken in the Taku, except for a few stragglers that appear around the Chilkat very early in the season, which can hardly be called a run . . . These fish are all taken with drifting gill nets by white fishing crews."

As the cannery at Pyramid Harbor was built in 1883 by the Northwest Trading Company which depended on Taku River fish, it is likely that a commercial fishery was started shortly after completion of the cannery.

Catch Statistics

Catch statistics of the Taku River fishery are available from 1904 to 1927, although portions of the data are questionable. Rich and Ball (1933) report that, "In assembling the data for Taku Inlet, it was necessary to divide the catches reported from Taku Inlet and Icy Strait in 1910, from Taku Inlet and Port Snettisham in 1919, from Taku and Chilkoot Rivers in 1922, and the unallocated catches of Southeastern Alaska in 1906 and 1911. All salmon reported from Taku River from 1913 to 1919 were also included as Taku Inlet fish."

Catch statistics for the years 1928 to 1944 are apparently non-existent. Accurate records have been maintained by the U. S. Fish and Wildlife Service starting with the 1945 season.

A summary of the available catch statistics obtained from publications of the U. S. Bureau of Fisheries and U. S. Fish and Wildlife Service, is presented in Tables 1, 2, 3, 4, and 5.

*Portions of this report are based on incomplete data and may be revised in future publications. However, they are considered to be substantially correct, as regards the data available at the present time.

Table 1. Annual gill net catch* of Taku River king salmon for the years 1904-1927 and 1945-1956 inclusive.

Year	No. of king salmon	Year	No. of king salmon
1904	29,214	1923	12,900
1905	22,362	1924	17,088
1906[1]	2,696	1925	16,232
1907	10,701	1926	7,801
1908	10,757	1927	8,177
1909	7,384		
1910[2]	21,597	1928-1944	No Data
1911[3]	45,017	1945	4,263
1912	8,088	1946	6,935
1913	9,985	1947	3,932
1914	16,996	1948	6,035
1915	12,099	1949	6,473
1916	13,048	1950	8,443
1917	8,239	1951	9,792
1918	7,781	1952	12,941
1919[4]	9,713	1953	16,766
1920	21,977	1954	14,348
1921	10,049	1955	10,686
1922[5]	6,474	1956	11,253

*Statistics for the years 1904-1927 may include a portion of fish taken by other forms of gear.

(1) Figured from the unallocated catches of Southeastern Alaska for 1906.

(2) Catch was divided from reported catch of Taku Inlet and Icy Strait in 1910.

(3) Computed from the unallocated catch of Southeastern Alaska for 1911.

(4) Catch divided from reported catch from Taku Inlet and Port Snettisham in 1919.

(5) Catch divided from Taku and Chilkoot Rivers in 1922.

Table 2. Annual gill net catch* of Taku River chum salmon for the years 1904-1927 and 1945-1956 inclusive.

Year	No. of chum salmon	Year	No. of chum salmon
1904	7	1923	9,224
1905 (1)		1924	16,565
1906 (2)		1925	20,212
1907	44,770	1926	18,462
1908	8,286	1927	11,530
1909 (3)			
1910 (4)	16,425	1928-1944	No Data
1911 (5)	38,865	1945	11,920
1912	45,255	1946	13,481
1913	8,891	1947	5,780
1914	32,211	1948 (8)	7,579
1915	17,652	1949	10,271
1916	58,318	1950	20,731
1917	19,357	1951	7,582
1918	6,561	1952	23,945
1919 (6)	66,157	1953	18,504
1920	43,088	1954	63,018
1921	13,000	1955	15,352
1922 (7)	23,192	1956	38,785

*Statistics for the years 1904-1927 may include a portion of fish taken by other forms of gear.

(1), (2), (3) No data.

(4) Catch was divided from reported catch of Taku Inlet and Icy Strait in 1910.

(5) Computed from the unallocated catch of Southeastern Alaska for 1911.

(6) Catch divided from reported catch from Taku Inlet and Port Snettisham in 1919.

(7) Catch divided from Taku and Chilkoot Rivers in 1922.

(8) Incomplete data.

Table 3. Annual gill net catch* of Taku River red salmon for the years 1904-1927 and 1945-1956 inclusive.

Year	No. of red salmon	Year	No. of red salmon
1904	50,599	1923	8,791
1905	72,353	1924	22,314
1906[1]	48,724	1925	19,685
1907	23,937	1926	39,028
1908	38,862	1927	11,103
1909	69,000		
1910[2]	58,304	1928-1944	No Data
1911[3]	34,885	1945	13,300
1912	19,892	1946	12,233
1913	14,014	1947	24,875
1914	20,378	1948	22,969
1915	30,300	1949	33,565
1916	16,431	1950	38,565
1917	32,721	1951	63,687
1918	36,600	1952	45,233
1919[4]	35,060	1953	51,570
1920	30,134	1954	54,260
1921	24,044	1955	28,765
1922[5]	26,920	1956	36,601

*Statistics for the years 1904-1927 may include a portion of fish taken by other forms of gear.

(1) Figured from the unallocated catches of Southeastern Alaska for 1906.
(2) Catch was divided from reported catch of Taku Inlet and Icy Strait in 1910.
(3) Computed from the unallocated catch of Southeastern Alaska for 1911.
(4) Catch divided from reported catch from Taku Inlet and Port Snettisham in 1919.
(5) Catch divided from Taku and Chilkoot Rivers in 1922.

Table 4. Annual gill net catch* of Taku River silver salmon for the years 1904-1927 and 1945-1956 inclusive.

Year	No. of silver salmon	Year	No. of silver salmon
1904	13,568	1923	24,845
1905	20,630	1924	24,825
1906 (1)		1925	40,066
1907	41,981	1926	26,836
1908	32,352	1927	41,160
1909	36,889		
1910 (2)	46,397	1928-1944	No Data
1911 (3)	40,824	1945	25,710
1912	38,440	1946	17,395
1913	17,647	1947	19,393
1914	46,731	1948	35,384
1915	37,108	1949	21,014
1916	58,182	1950	38,301
1917	32,251	1951	27,540
1918	25,239	1952	29,865
1919 (4)	33,350	1953	20,502
1920	34,076	1954	42,545
1921	57,047	1955	40,470
1922 (5)	34,882	1956	27,767

*Statistics for the years 1904-1927 may include a portion of fish taken by other forms of gear.

(1) No data available.

(2) Catch was divided from reported catch of Taku Inlet and Icy Strait in 1910.

(3) Computed from the unallocated catch of Southeastern Alaska for 1911.

(4) Catch divided from reported catch from Taku Inlet and Port Snettisham in 1919.

(5) Catch divided from Taku and Chilkoot Rivers in 1922.

Table 5. Annual gill net catch* of Taku River pink salmon for the years 1904-1927 and 1945-1956 inclusive.

Year	No. of pink salmon	Year	No. of pink salmon
1904	128	1923	12,030
1905 (1)		1924	19,988
1906 (2)		1925	13,832
1907	15,908	1926	20,241
1908	1,842	1927	37,032
1909 (3)			
1910 (4)	500	1928-1944	No Data
1911 (5)	24,661	1945	3,699
1912	9,059	1946	1,538
1913	8,635	1947	14,609
1914	11,043	1948	12,327
1915	34,355	1949	17,622
1916	13,902	1950	6,487
1917	39,272	1951	75,027
1918 (6)		1952	39,293
1919 (7)	50,117	1953	6,914
1920	24,162	1954	24,282
1921	40,000	1955	16,129
1922 (8)	8,373	1956	11,592

*Statistics for the years 1904-1927 may include a portion of fish taken by other forms of gear.

(1), (2), (3) No data.

(4) Catch was divided from reported catch of Taku Inlet and Icy Strait in 1910.

(5) Computed from the unallocated catch of Southeastern Alaska for 1911.

(6) No data.

(7) Catch divided from reported catch from Taku Inlet and Port Snettisham in 1919.

(8) Catch divided from Taku and Chilkoot Rivers in 1922.

Season

The Taku River gill net season generally starts near the first of May and closes the end of September. At the present time, fishing is allowed from Monday noon until Thursday noon, or 72 hours fishing per week.

Gill Nets

Prior to 1949, gill nets of lengths between 50 and 250 fathoms, hung measure, were allowed. This regulation was changed in 1949 to restrict the lengths to between 50 and 150 fathoms. The gill nets are all of a single wall, floating type, and the size of the nets is changed throughout the season according to the species available and most desired. Nylon nets came into use in 1953 and have largely replaced the linen nets during the past few years.

King Salmon

The adult run of king salmon approach Taku Inlet as early as April and their entrance into fresh water is from late April to the first part of July. During their migration to fresh water the king salmon are available to the trolling fleet primarily in northern Chatham Strait, lower Lynn Canal, and Stephens Passage. After the run enters Taku Inlet, it is beyond the effective use of troll gear as the water becomes turbid from the discharge of the Taku River. It is at this point that the gill net fishery takes its share of the mature run of king salmon.

The king salmon proceed up-river, arriving at their spawning grounds during June, July, and the first part of August.

Troll Fishery

The first commercial troll fishery for salmon in Southeastern waters was started near Ketchikan shortly after the turn of the century. Kutchin (1905) reports that, "As the fish (king salmon) were in close to the reefs, nets could not be employed, so trolling lines were used. At first herring were used as bait, but it was soon discovered that a nickel trolling spoon would answer the purpose as well, and in a very short time they were employed exclusively. Light canoes and skiffs were employed in trolling, and while the fisherman was rowing the boat he would have the line tied to his arm or leg, so that he could instantly tell should he have a bite. Nearly all of the fishing was done by Indians."

Since this time, the trolling fleet has grown into a very mobile and efficient fishery with power gurdies, stabilizers and electronic aides.

Suitable statistics of the Taku River king salmon troll catch are not available; therefore it became necessary, starting in 1951, to sample the catches of a portion of the trollers and to obtain observations on the fishing intensity throughout the season. From these data it was possible to extrapolate the total estimated troll catch in the vicinity of Taku Inlet for the various years (Table 6). It is shown that the majority of the Taku River king salmon taken by the troll fishery are in Age Classes III, IV, and V.

Table 6. Estimated troll catches of mature Taku River king salmon by age classes for the years 1951-1956.

Year	AGE CLASSES II	III	IV	V	VI	Total
1951	50	470	1,390	3,740	100	5,750
percent	.89	8.17	24.17	65.04	1.73	100.00
1952	(Cold storage strike, no data.)					
1953	30	900	4.490	3,420	180	9,020
percent	.03	9.98	49.78	37.91	1.99	100.00
1954	190	1,260	2,060	3,860	125	7,500
percent	2.53	16.80	27.47	51.47	1.67	100.00
1955*	61	899	961	1,227	102	3,250
percent	1.89	27.67	29.56	37.74	3.14	100.00
1956	No sample					

*Scale analysis of king salmon sampled during 1955 was interpreted in a slightly different manner than in the previous years.

Gill Net Fishery

The Taku River gill net catch of king salmon has fluctuated from a low of 9,790 to a high of 16,780 during the past six years (Table 7). Each year since the inception of the Taku River King Salmon Research Program, a portion of the king salmon catch has been sampled to determine length frequencies, sex ratios, and age composition of the mature run.

The age composition (Table 7) of the mature Taku River king salmon has been calculated from scale analyses for the years 1951 through 1956. It has been found that the majority of the mature king salmon taken in the gill net fishery are in Age Classes IV and V, and that the majority of fish in Age Classes II and III are not harvested by the gill net or troll fisheries. As the sexually mature fish in Age Classes II and III are predominantly male, a surplus of males are consequently found on the spawning grounds.

Spawning Ground Surveys

The Nakina River was chosen as a study area for king salmon as it is the main producer of king salmon in the Taku River system. Each year since 1951 the spawning grounds have been surveyed during a period in July and August to determine the magnitude and composition of the escapements. Attempts were made by standard survey methods to estimate the numbers of spawning king salmon, and to obtain length frequencies,

Table 7. Estimated gill net catches of Taku River king salmon by age classes for the years 1951-1956.

Year	AGE CLASSES II	III	IV	V	VI	Total
1951		10	1,680	7,890	210	9,790
percent		.11	17.16	80.59	2.14	100.00
1952		1,160	5,010	6,440	330	12,940
percent		8.96	38.72	49.77	2.55	100.00
1953		480	8,280	7,590	430	16,780
percent		2.86	49.34	45.23	2.56	99.99
1954	109	1,435	3,191	9,306	295	14,335
percent	.76	10.01	22.26	64.91	2.06	100.00
1955*		811	4,336	5,203	336	10,685
percent		7.59	40.58	48.69	3.14	100.00
1956*	59	1,455	4,997	4,525	217	11,250
percent	.52	12.94	44.40	40.21	1.92	99.99

*Scale analysis of king salmon sampled during 1955 and 1956 was interpreted in a slightly different manner than in the previous years.

sex ratios, and the percent of egg deposition from the king salmon carcasses.

In order to evaluate the estimates of the numbers of king salmon utilizing the Nakina River, a carcass collecting weir was built about one-quarter of a mile above the confluence of the Nakina River and the Silver Salmon River prior to the 1956 spawning season. The area immediately above the weir, for a distance of two miles, was chosen as the study area. The same techniques used to estimate the numbers of king salmon during the previous years were employed. The study area was checked once a day for king salmon carcasses and the collecting weir was cleaned of salmon carcasses twice daily. Very few, probably less than 50 carcasses, were taken by the bears in the study area.

A total block, just past the upper end of the study area, is impassable to salmon. Observation of this area is impractical due to the difficulty of traversing it. While the number of fish utilizing the area between the upper end of the study area and the block is not known, it is thought that it would not exceed 100 fish.

On August 5, 1956, through a visual survey, the study area was estimated to contain 550 king salmon. The actual carcass count of king salmon in this section was 2,777. The carcass count was discontinued on August 22, 1956 at which time only a few live kings were observed. From these figures (550 estimated kings and 2,777 actual count fish) it is seen that the ratio is 550/2,777 or 1:5.05 of fish seen to fish present in this stretch of the river.

On closer examination of the figures (Table 8), it is shown that by re-

Table 8. 1956 Nakina River king salmon length frequencies, fork length by 2.5 cms. groups.

Fork length cms.*	Male	Female	Total
25.0	1		1
27.5	3		3
30.0	34		34
32.5	141		141
35.0	235		235
37.5	237		237
40.0	125		125
42.5	82		82
45.0	57	1	58
47.5	83		83
50.0	129		129
52.5	155		155
55.0	175	1	176
57.5	146		146
60.0	140	2	142
62.5	103	1	104
65.0	80	1	81
67.5	58		58
70.0	46	1	47
72.5	36	3	39
75.0	28	6	34
77.5	28	16	44
80.0	22	29	51
82.5	17	44	61
85.0	25	46	71
87.5	19	69	88
90.0	21	66	87
92.5	24	50	74
95.0	22	37	59
97.5	24	28	52
100.0	19	15	34
102.5	19	4	23
105.0	11	3	14
107.5	4		4
110.0	3	1	4
112.5	1		1
Total	2,353	424	2,777

*2.54 centimeters equal 1 inch.

moving the numbers of fish in Age Classes II and III (those below about 65 cms. or 25½ inches) from the actual number of fish, the estimated number becomes fairly accurate. That is, approximately 1,925 kings were in Age Classes II and III, and the remaining 850 fish were in the older age groups which contain the female component of the king salmon run. This ratio would then be 550/850 or 1:1.55. It would seem that the observers were unable to see the majority of the smaller fish (jack salmon) when making their visual estimates.

The sex ratio in the study section was 424 females to 2,353 males or 1:5.55. If we again eliminate the II and III Age Class fish from our computations we have a sex ratio of 424 females to 427 males or a 1:1.01 ratio. (Table 7).

Spawning ground observations show: (1) that the female assumes almost the entire duty of the preparation of the redd (nest); (2) more than one female may occupy the same redd; (3) males have been observed to move from one redd to another and back again; and (4) the function of the male seems to be limited to the fertilization of the eggs.

From these observations, it would seem likely that a 50/50 sex ratio, or an even higher female ratio, would furnish the most efficient spawning composition for king salmon.

The number or percentage of jack king salmon produced from any one brood year is not known. Very likely it varies from year to year. However, data gathered during the next few years should provide a more accurate estimate of jack production.

From the data on **estimated** numbers of king salmon on the Nakina River (Table 9), it would seem that there is a definite downward trend

Table 9. Estimated escapement of Taku River king salmon during the period 1951-1956*.

Year	Estimated numbers of spawners on the Nakina River	Estimated percentage of females
1951	5,000	
1952	9,000	25.8
1953	7,500	46.5
1954	6,000	56.4
1955	3,000	51.1
1956	1,380	53.7

*Figures given in this table are not actual counts and may be used only as an indication of the fluctuations in the numbers of spawners from year to year.

during the past five years, with the estimations ranging from a high of 9,000 in 1952 to 1,380 during the past year, 1956. This rather wide range of spawning intensity should furnish valuable information on optimum escapement on the Nakina River.

OTHER SPECIES

Escapement Indices

Southeastern Alaska displays rivers with qualities which impede the requisite research studies necessary for efficient fisheries management. These are the turbid, glacier-fed rivers that have their headwaters in Canada. The Unuk, Stikine, Chilkat, Alsek, and Taku are rivers of this type. Because of its close proximity to Juneau, the Taku was selected for research

with investigations aimed at means of effectively studying the escapement.

The physical characteristics of the Taku, its swift, turbid, debris-laden water and fluctuating levels preclude the use of weirs. The futility of locating some of the spawning grounds further complicates the problem of enumerating the spawning escapement of each species; besides, measurements of the escapement must be taken close to the fishery so that these apply to the specific segment of the run that is under fishing pressure. This makes immediate remedial action possible, should the escapement fall below or rise above optimum limits set for that segment of the run. Because direct enumeration is impossible, studies are based on an index of the escapement. At Canyon Island Research Station, 17 miles upriver from Taku Point, fish wheel catches (with the exception of king salmon) are used as indices.

The fish wheel has wings like a paddle wheel which turn in the river current; fish caught in the scoop-like wings are lifted from the river. Captured fish then fall into the live tanks located in each of the two pontoons that support the wings (Fig. 1). Prior to their release, the captured salmon

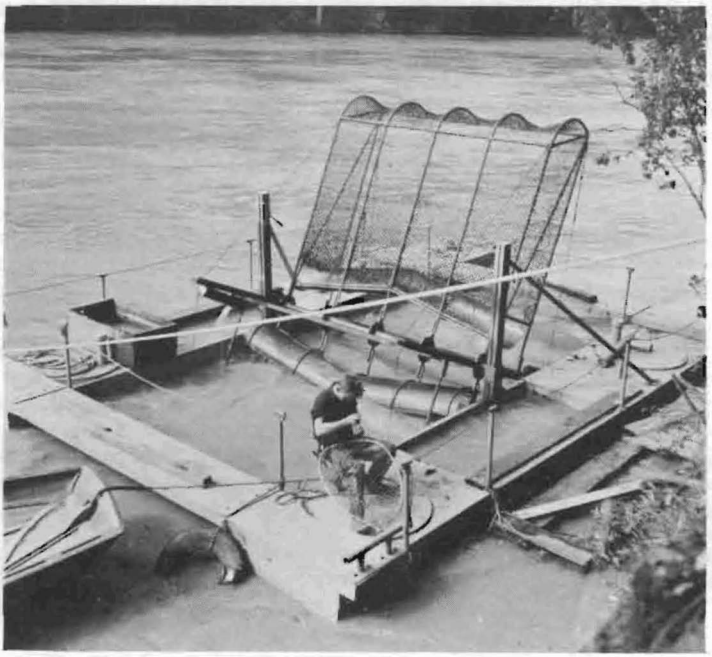

Figure 1. Experimental fish wheel on Taku River.

are measured and a scale is taken for age analysis and racial studies. All salmon taken by the wheel are counted and their numbers are recorded by species, sex, and date of capture.

The purpose for collecting these data and their value toward interpreting the escapement and its relation to the fishery are outlined below.

The reproductive capacity of salmon populations is largely dependent

upon the numbers of mature females. This makes the knowledge of sex ratios a "must" in determining the spawning potential of the escapement. The gender of captured fish at Canyon Island is determined by visual means, i.e., noting secondary sex characteristics. Although there is some chance of error, mistakes in identity are probably not significant.

Data on Sexes

The selectivity of gill nets in Taku Inlet depends upon the mesh sizes. Generally, large mesh nets catch big fish and small mesh nets catch small fish. Without length studies, the effect of gill nets on populations cannot be fully appreciated. At Canyou Island, lengths of the fish taken by the wheel are measured in centimeters. By arranging these measurements in 2.5 centimeter groups, (one inch equals 2.54 centimeters) we obtain the length-frequency of each species as it passes Canyon Island. Length frequencies are further divided into male and female components. Thus, we have a reference to changes in the sizes from year to year of males and females, of the populations as a whole, and after scale examination, of the various age components.

Length Data

It is necessary to evaluate levels of escapement in terms of success of the parent stock and this is impossible without knowing the ages of returning fish. Fish wheel catches of red salmon, when grouped by weekly periods, show that the run is of bimodal nature. Recent scale analysis shows that the two peaks of the run reflect the time of appearance and relative abundance of at least two separate stocks. Both races are dominated by fish of Age Classes III and IV. The fish of Age Class III live one winter in fresh water and two in salt water; fish of Age Class IV predominantly spend one winter in fresh water, then they migrate to the ocean where they spend three more winters before returning to spawn.

Scale Analysis

The casual observer might decide that one race is composed of inherently small fish. Studies based on age and length data taken at Canyon Islnd show that the two races are composed of fish of comparable sizes. The ratio of Age Class III to Age Class IV determines the overall sizes of each race and these ratios change from year to year.

Generally, the fish wheel catches fluctuate in rythm with the catches in the Taku Inlet gill net fishery. This indicates that wheel catches are in some semi-consistent proportion to the numbers of salmon available. But in many instances, water levels effect fish wheel catches and correction factors are necessary. As data is collected over a period of years, evaluation techniques are refined; now there is a possibility of actually calculating the numbers of fish in a specific run.

Fish Wheel Catches

It should be specified that the fish wheel is experimental gear; its function is to indicate the magnitude of the salmon runs. The reliability of the fish wheel, as a means for effectively studying the escapement so that scientific conviction will form the basis of future management measures, looks promising.

REFERENCES

KUTCHIN, HOWARD M., 1905. Salmon fisheries of Alaska. Dept. of Commerce and Labor.

MOSER, JEFFERSON F., 1898. The salmon and salmon fisheries of Alaska. United States Fish Commission. Vol. XVIII.

RICH, WILLIS H. and EDWARD M. BALL, 1928. Statistical review of the Alaska salmon fisheries. Part IV: Southeastern Alaska. U. S. Bureau of Fisheries. Bulletin 13.

KITOI BAY RESEARCH STATION

by

William A. Smoker

The purpose, location, early history, and findings of the Kitoi Research Station is presented in detail in the 1955 Annual Report. Briefly, its function is to conduct research on the lake production of red salmon (**Oncorhynchus nerka**) sufficiently to develop techniques for introducing this species into lakes that are not being fully utilized at the present.

In 1956, nearby Ruth and Midarm Lakes, with about 48 and 13 surface acres respectively, were selected for an intensive study of the effects of predation by resident fishes on red salmon fry. This work was assisted in large part through a research contract entered into in 1955 with the U. S. Fish and Wildlife Service, authorized and paid for by the Saltonstall-Kennedy Act. Both lakes are inaccessible to migratory fish because of precipitous outlet streams, and contained only resident populations of sticklebacks, sculpins and dolly varden trout.

Predation Studies

Ruth Lake was poisoned with rotenone in the fall of 1955 and it is believed that all of the resident fish were eliminated. Midarm Lake, the control lake, was left in its natural state. Red salmon fry from the 1955 parent stocks in Kitoi Lake were incubated in the Kitoi Hatchery. In mid-July 1956, Ruth Lake received 89,000 fry and Midarm 80,000 fry. The smolts will be trapped in the outlet streams where simple weir traps, with inclined screens, are installed. The survival and growth of fish from the two lakes will be compared. The first measurements of benefits to salmon production, by controlling predation and competition, will be made in the spring and summer of 1957 when the first smolt migrants are counted from the lakes.

The evaluation from the 1956 planting will not be complete until the second smolt migration leaving the lake in their third year, in the spring of 1958, are counted and the adult returns are counted from both of these smolt migrations in the summer and fall of 1958, 1959, and 1960. It is planned to repeat the releases of red fry into Ruth and Midarm Lakes for a number of years to simulate the natural overlapping of brood years in a lake. This may be necessary also to confirm the effects of elimination of predator and competitor fish since any unusually good survival of red salmon in Ruth Lake the first year may be due, in part, to a richer food supply as a result of temporary fertilization of the lake waters from the decomposed carcasses of fish killed at the time when rotenone was applied.

There is some evidence of this possibility from a periphyton study made

in Ruth, Midarm, and Kitoi Lakes in 1956, according to techniques developed on the California Convict Lake Watershed by Fish and Wildlife Service personnel. Glass slides, suspended below the water surface, accumulated growths of attached algae, which is a measure to a certain extent of the basic productivity of the lake. Figure 2 shows the relative amounts of such

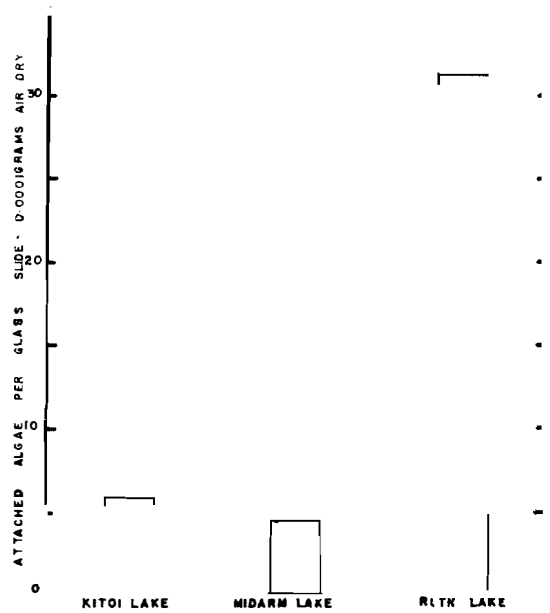

Figure 2. Growth of attached algae over a 60-day period in lakes in the Kitoi region.

growth. The exceptional growth of algae in Ruth Lake, in the summer of 1956, may be due to fertilizing effects of the dead sticklebacks and other fish caused by rotenone in the fall of 1955. It is expected that benefits from this fertilization will decline within a few years, at which time a more accurate comparison of the increased salmon productivity of Ruth Lake, due to elimination of resident fish, can be made.

Smolt Migration

The red salmon smolt migration from Lake Kitoi consisted of more fish in 1956, but was much different in timing and in composition than the smolt migration in 1955. The approximate number of smolts for 1955 and 1956 are listed in Table 10.

Table 10. Red salmon smolt migration from Lake Kitoi, 1955 and 1956.

Year	Number of Migrants (Average Fork Length)			
	One or less lake-growing season		Two lake-growing seasons	Total
	May migration	June migration	June migration	
1955	none	17,000 (73mm)	12,000 (81mm)	29,000 (76mm)
1956	41,000 (39mm)	9,000 (61mm)	1,000 (72mm)	51,000 (44mm)

It is apparent that, while more numerous, the 1956 smolts were much smaller in size. This was due to the surprise appearance, in May 1956, of a large number of fish that had hatched and emerged from the gravel late in the summer of 1955. They had acquired very little growth since they had only three to five circuli on their scales and had an average length of 39mm. The average length of emergent Kitoi red fry, before they start feeding, is about 28 mm. The appearance of these small red smolts was unprecedented (in the familiar literature at least) and were fish that had spent only part of one growing season in Lake Kitoi. They left in early May while the ice cover was still on the lake and the surface temperature was about 35° F. Most sockeye smolt migrations start after the spring overturn, and surface temperatures are in the high forties.

The bodies were thin, giving a large aspect to the head. These fish died easily with rough handling and any minor physical shock produced lethal brain hemorrhages. The early migration lasted about three weeks and terminated with the disappearance of the ice. Additional fish of this category appeared in June, about a centimeter longer and in a lively and healthy condition. The larger smolts that left Lake Kitoi, in 1956, during the "normal" June migration were a little smaller than those in 1955 and only a third as many, but were in a healthly condition.

The two outstanding characteristics of the 1956 red smolt migration, i.e., the smaller size of the migrants, and the "abortive" migration from under the ice, arouses considerable speculation and may not be explaind until more general data accumulates from Kitoi or at least until the 1956 smolts complete their life cycles. It is noted that the winter of 1955-1956 was very severe and the lake was covered with ice and snow for seven months. In spite of the long winter with the 1956 ice cover over three times as thick as in previous winters, the spring disappearance of ice occurred only ten days later.

Silver Smolts

The silver smolt migration for 1956 was about 3,450 fingerling fish, which is slightly less in number than the 3,500 for 1955. The 1956 smolts were also slightly smaller in average size. This is due in part to the appearance in late June and early July of silver migrants that had spent only one growing season in the lake and were only about 63 mm. in length. There were also, as in 1955, silver smolts of this age which were 110 mm. in length. But these smaller fish had not appeared in 1955. About 1,350 fry-of-the-year left the lake in 1956 compared with 1,000 in 1955.

Adult Migrations

In 1956 the adult red salmon entered Lake Kitoi in the same time-patterns that they did in 1955, with a small segment arriving in late June and early July, and a larger run in August. However, they were in much fewer number. The silver adults, on the other hand, finished their migration into the lake in early September which was about two weeks sooner than in 1955, but they were in larger number. Table 11 shows the arrival of adult fish at the Kitoi weir for previous years as well as 1956.

Table 11. Number of adult fish arriving at the Kitoi weir for 1954-1956.

	Red			Silver			Dolly Varden		
	1954	1955	1956	1954	1955	1956	1954	1955	1956
Males	864	806	158	——	189	——	——	——	——
Females	1,150	1,202	269	——	88	——	——	——	——
Not Sexed	——	——	19	289	——	338	80	589	410
Jacks	215	95	349	——	15	29	——	——	——
Total	2,229	2,103	795	289	292	367	80	589	410

Jack Salmon

The occurence of only a few jack red males (30-40 cm. fork length) in 1955 was a fair index of the small run of adults that did arrive in 1956. If numbers of jacks is an index of the abundance of adults to be expected the following year, then there should be a good run of adult red salmon in 1957. The number of silver jacks was considerably more in 1956 than in 1955, hence the 1957 run of adult silvers might be expected to exceed that of 1956.

Marine Survival

In 1956, for the first time at Kitoi an entire run of adults were counted into the lake that had been counted down as smolts. These were the adult silvers. It is of particular interest that in 1955 the three age groups of smolts were counted down in the ratio of 1,400: 1,700: 400 fish (110, 135, and 145 mm. average fork-length respectively) and these came back as adults after 15 months at sea in the ratio of 193: 152: 30 fish. The rates of marine survival to adult fish (excluding jacks) was about 9.9%, 8.9% and 7.5%. It appears that the advantage of a few extra centimeters of length obtained by juvenile silvers, remaining for more than one rearing season in the lake, does not add materially (if at all) to their survival in the ocean.

Spawning Ground

The adult reds and silvers, in 1956, appeared on their spawning grounds in October about the same time as in 1955. The early and late red salmon were tagged with distinctive Petersen disk tags as they were placed into the lake. Observations on the lake shore spawning sites did not reveal any separation of these groups. They appeared together on the same grounds at the same time and intermixed. This cannot be considered conclusive since the early segment in 1956 was comparatively small and it is not known if all of the salmon spawn within sight of a surface observer. About 132,000 red eggs were taken into the hatchery and 588,000 eggs were deposited in the gravel. The average fecundity for 1956 red females was about 2,800 eggs per female, which is higher than the 2,340 for 1955.

In the fall of 1956, thermographs were installed in the spawning gravel

at two different levels of the lake shore, and within ten feet a difference of 2° C was noticed. This could account for a considerable variation in time of emergence of fry from the gravel, and explain the occurrence of eyed eggs in the gravel as late as mid-June. Fry this late in development would acquire little size during the first growing season and would be forced to stay in the lake at least another year to grow to migrant size. Incubation temperatures for salmon is a major environmental limitation for survival in Alaska, and a barrier that will have to be overcome for effective introduction of new runs into barren lakes.

Incubation Temperatures

In the spring of 1956, after the installation of the weir screens, 232 adult dolly varden trout were counted downstream. 135 fish had the adipose missing, showing they had been placed up into the lake in 1954 or 1955. It also indicated they had spent the winter in the lake. They were in poor condition but, in spite of the presence of large numbers of salmon smolts—particularly the small weak red juveniles, the trout stomachs examined at the outlet weir were completely empty. Due to flood conditions and overtopping of the weir screens, some of the downstream adult dolly varden trout were not counted.

Dolly Varden Trout

Also in the spring of 1956, about 490 dolly varden smolts were counted out of the lake. In the late summer and fall of 1956, 410 adults were counted into the lake. 139 of these had adipose fin marks, showing that they had been in and out of the lake previously. This is fewer adult trout than the 589 counted up in 1955.

KODIAK KING CRAB STUDY

by

H. R. Stevens, Jr.

The value of the king crab industry on Kodiak Island has increased noticeably during the last three years. In terms of purchases and payrolls, the value of this industry was over $300,000 in 1955, over $500,000 in 1956, and in only the first three months of 1957 a high value of $500,000 was reached through the fishing and processing operations. The value of the king crab fishery was further emphasized during the past year because of a poor salmon season in the Kodiak area. The crab industry gives local business and wage earners a source of income that is an important factor in keeping a stable local economy. Those associated with crab fishing and processing are optimistic about the future of this fishery and have an interest in its expansion and protection.

Economic Value

The objective of the king crab study program is to determine what the maximum sustained yield of the fishery might be in order that sound management policy may operate. Some methods of approach to be used in the study of this problem are presented in the 1955 Annual Report. The crab program for the past year has been concerned mostly with obtaining and processing statistical data and with tagging operations. A regular commercial

Object of Study

crab pot containing marked and measured crabs has also been placed in a natural environment with the view to obtaining information about growth and molting frequencies. Small plates have been periodically suspended in the water in several locations in an attempt to get the growth rate of those barnacles (**Balanus hesperius** and **B. crenatus**) which are commonly found attached to the king crab. This is designed to obtain, indirectly, a measure of the frequency of molt of the crabs.

Satistical information is a necessary aid in the study and management of a fishery when such data is correctly interpreted. Sources of useful information are log books, the Fish and Wildlife Service fish tickets, cannery records, tag recoveries, and field observations.

For the calendar year of 1956, the number of crabs taken in the Kodiak Island area increased by 275,000 over the catch of 250,000 for the previous year. The 1956-1957 winter catch, when taken as a whole, will augment this number.

The two types of gear used in 1956 were pots and trawls with pot fishing predominating. During the 1956-1957 winter season, fishing was done almost entirely with pots, and dragging operations were generally for bait catching purposes only.

The fish ticket data obtained from the Fish and Wildlife Service Kodiak office has made it possible to compute the average weights of the catches for twenty bays and off-shore areas which have been, or are being, fished. There has been no decrease in the average weights in any of the major fishing areas but rather an increase is noted.

Average Weights

In the years prior to 1956, the average weight of crab in the catches was over eight pounds for Alitak Bay which is located at the southern end of the island. During the same period the average weight of the crab taken in Tonki Bay in the north was over ten pounds. The average weights of the crabs in the catches from bays between Alitak and Tonki fell between these two extremes and showed a trend of increase in weight from south to north.

The average weight of the catch for Alitak was about nine and a quarter pounds for the calendar year of 1956. However, during the winter season of 1956-1957 the size of the crabs showed another increase. During the first three months of 1957 a number of loads brought to the canneries averaged over ten pounds per crab. Although taking into consideration that more boats are using live tanks to carry their crab, and thus decreasing dehydration losses between fishing grounds and cannery, the marked increase in the average weights may indicate that new populations had moved into Alitak Bay. There is additional information which tends to show that this may be the case: (1) the catch per unit of effort has increased for this area; (2) only a few previously tagged crabs have been recovered in spite of heavy fishing; and (3) there has seemed to be a lack of the general male molting which in past years has normally occurred in January and February.

The Alitak Fishery

Data from fishing boat log books and field observations show that pot and trawl catch per unit of effort in Alitak at the height of the 1956-1957 winter season was over double that of the previous year. In early 1956 the catch per unit of effort for pots averaged 17 compared to 37 for early 1957. Trawl catch per unit of effort in early 1956 was 150 crabs per one hour drag as compared to 350 per one hour drag in 1957.

Tagging

During the past year 1,054 crabs were tagged. Some of the tags were put out to the west of the Shumagin Islands in the vicinity of Pavlof Bay which is located on the south side of the Alaska Peninsula about 320 miles from Kodiak. Since king crab studies have not been carried out here previously, very little is known at the present time of the crab migrations, but it is hoped that this, and future tagging operations in this region, will yield information as to the magnitude and direction of their movements. There is reason to believe that there is a migration of crabs northeast along the Peninsula into the Shelikof Straits and eastward into the waters at the southern end of Kodiak.

Most of the tagging for the past year was done in Alitak Bay and in Tonki Bay. However, the majority of the recovered tags have come from Marmot Bay and the surrounding bays since most of the tagging has been carried out in this area in previous years. Fishing intensity in the Marmot Bay region was greatly reduced (one-third to one-half varying with different bays) in the past year.

The ratio of recoveries of tagged females to tagged males is about 2:1. The percentage of recovery for both males and females, considered together during the past year for Kodiak Island, was 11.42% as compared to 7.29% for the previous year. The percentage of recovery for males was 8.63% and for females 15.02%. The number of females tagged during the past year was about two-thirds of the tagged males.

The percentage of recovered males yielding data that could be plotted to indicate growth was 4.01% of the total number of males which were tagged and the plotting percentages of females was 12.17%. Failure to return the crab tag with the tag or the return of a crab soon after tagging accounted for the low plotting rate.

The average weights of catches and present tag recoveries indicate that distinct populations exist in Marmot Bay and surrounding bays and that there is no indicated migration into or out of this region. The crabs move to the cooler deep waters of Marmot Bay during the summer months and the sexes tend to gather in separate groups. When the winter molting and mating times approach there is a migration to the shallower waters with a general mixing of the sexes. The continuance of the Marmot Bay fishery is probably dependent upon the stable (non-migratory) stocks. The Alitak fishery is not limited in such a manner and is capable of greater exploitation. The extent and magnitude of migrations into and out of Alitak Bay should be an important part of the future crab study program.

Barnacle Study

Barnacles on the crab carapace may offer a solution to the frequency of molt if the age of the barnacles can be determined. This is dependent on knowing the growth rate of each species. Square plates of plaster board, six inches on a side, were set out in four different locations at time intervals spanning a period of eight months. Only two plates were colonized by barnacles. Growth on these plates was very slow and the size too small to measure with the means at hand.

Biologists[1] who have made a study of barnacles have found that their growth is dependent upon the kind of food and the amount eaten. Their breeding season may be quite limited and rates of growth may vary in dif-

1. C. G. Bookhout and J. D. Costlow, Duke University

ferent areas. It is evident that a favorable environment to carry out the barnacle study in the Kodiak area remains to be found since the present locations produce a typical growth.

To find the frequency of molt per size and the amount of growth per molt is of primary importance in the study of the king crab fishery.

Growth

The solution to the interrelated problems of determining age, year classes, and recruitment will be dependent upon accurate growth data. The operation of a live tank, the use of crab pots, and especially the tagging of a wide size range of crabs on a large scale will be necessary in order to obtain this information.

The tagging and recovery of crabs should not have to rely completely upon the commercial fishing operations because tagging operations, which are strictly dependent upon the fishery, are limited as to the time and choice of stations for doing this work. An independent tagging program will also permit a wider size range in which to tag.

The average carapace growth per molt of the recovered tagged males was 27.27 mm. and that of the females was 6.54 mm.

SILVER SALMON RESEARCH

by

William A. Smoker

The Territorial Legislature in 1955 authorized funds to be spent on silver salmon studies in Southeast Alaska. The primary objective was to develop techniques for introducing productive runs of this species into lakes capable of producing silvers, but not being utilized for this purpose at the present. This might be due to outlet barriers shutting out spawning migrations or to depletion by man or other factors.

Because of problems in obtaining additional scientific personnel, activities in 1955 and part of 1956 were limited to general surveys of the region to find suitable study areas. In 1956, a review of present knowledge of silver salmon productivity was started both in general and in the Southeast Alaska region. Also, several study lakes were selected for research in the Ketchikan region. Certain basic criteria became evident in the proposed management of a lake for maximum silver production.

While silvers generally are "stream" fish, there are known runs of excellent quality, but limited in numbers, produced by lakes. A lake should be made to produce heavily in silvers, if either or both of two general conditions obtain: (1) the ecological niche to which silvers adjust in a lake is present in a maximum condition; and (2) the fish have exclusive use of this ecological niche. The first would require the selection of a lake with the proper physical and biological characteristics and also the control or manipulation of these qualities for the best effect. The second general condition can be met by utilizing either a lake that is barren of other fish have been removed or reduced.

Necessary Lake Condition

Silver fry and fingerling feed in streams by forming somewhat stationary

schools in shallow pools and eddies by a swimming action against the current. They often maintain individual feeding positions within the group from which they prey upon organisms swept before them by the current. Their diet consists largely of aquatic insects, of which the larval and pupal forms of various midge flies are major items. Although observations have not been made on the feeding habits of silver salmon in lakes, it may be safely assumed that they feed there also on available larval forms of aquatic insects, as well as zooplankton. They would not be expected to occupy stationary positions in a lake, except in special situations where currents of fair velocity occur. These would be along shore areas where winds might generate water currents or near outlet and inlet regions. Otherwise, the silver juveniles in a lake have to seek their food by actively swimming around. An example of successful lake rearing of an allied species, king salmon, has occurred in Capitol Lake at Olympia, Washington (Heg 1956). A shallow fresh water lake was created by damming an intertidal salt water lagoon. Excellent growth and survival of hatchery-reared chinook fry, released in the lake, has been obtained. A major food item of these fish is the larval and pupal form of the midge fly (**Chironomous tentans**). The occurrence of larval forms of such aquatic insects are limited by certain maximum depths, with favorable light and temperature, which would probably be about 25 feet.

Silver Ecological Niche

A lake selected for rearing maximum numbers of silver fry should be shallow or possess a large proportion of shoal area. Deep lakes with steep shore lines would probably present a minimum of good silver rearing area and much of the lake would be "wasted." Deep lakes might be capable of producing rich blooms of phytoplankton, which in turn could support good populations of zooplankton. These tiny plankters, while providing excellent forage for sockeye salmon juveniles, may not be as available to silver fry, due to difference in gill raker construction and feeding habits.

After a lake is selected, increasing its silver salmon productivity by artificial means should certainly be explored. These would include application of fertilizers, control of water level, control of the pattern of lake discharge, and introducing food for the fish. The feasibility of such means should actually be considered in advance and be instrumental in the choice of a lake for experimental rearing of silvers.

There are many unknown variables involved in the complex interrelationships among animals that constitute predation and competition. Actual predators on silver fry can range from large dolly varden trout to microscopic bacteria or viruses. Likewise, the types of animal life that, under various circumstances can deprive silvers of food that otherwise would be available to them, vary between microscopic and macroscopic sizes. If sufficient knowledge existed as to the details of these interrelationships, the more serious limitations in silver production could probably be controlled with a minimum disturbance to the "balance of nature." With our present lack of information, it is frequently expedient to cut the Gordian knot by eliminating as many as possible of the predators and competitors in a lake, previous to the introduction of the favored species. The use of rotenone has been most effective in clearing a lake of all fishes, thus eliminating the possible influences of these life forms on an introduced species of fish.

Predation and Competition

By furnishing exclusive use of a body of water, in this manner, excellent growth has been obtained for rainbow trout.

After preliminary surveys on numerous watersheds, several study lakes in the vicinity of Ketchikan have been selected to serve as testing sites to determine the practical limits of these criteria.

To properly manage a stock of silver salmon, the natural age and growth habits must be known. As a species, this information is generally at hand. However, there are local variations, and to determine the exact growth requirements of silvers in Southeast Alaska, a study of several thousand scales (largely taken from the commercial fisheries by Alaska Department of Fisheries since 1950) was started in 1956. Preliminary results indicate that, aside from small male jacks, almost all of the adults spend only one winter at sea. There is considerable variation in fresh water growth and about half of the silvers had spent one winter as fry in fresh water and the other half had spent two winters. This is of importance when considering the rearing of silvers in a lake. More production might be obtained from a lake if all of the juvenile salmon feed in the lake one season instead of two seasons. It may be possible to arrange this by early fry releases from a hatchery and planting an optimum number commensurate with the size of the lake.

Age and Growth Studies

The importance to salmon abundance of stream flows during the egg incubation period in some instances and during fry rearing periods in others, was discussed by Smoker in 1955 for the State of Washington and adjoining areas. For silver salmon in that region, the annual runoff, during the approximate one year of juvenile stream residence, directly determines the abundance of these fish as adults in the salt water fisheries. Available data on streamflows in Southeast Alaska from records by the U. S. Geological Survey was compared with silver landings recorded by the U. S. Fish and Wildlife Service for the years 1927 through 1954. The only streamflow measurements with fair continuity starting from that period was on Fish Creek in the Ketchikan region—hence, these data were used as indices of annual streamflow fluctuations in Southeast Alaska. Silver salmon landings before 1927 were of dubious significance in this comparison because they occurred in a period of rapidly increasing fishery. The trend of landings shows only a modest increase since that year.

Streamflows and Southeast Alaska Silver Abundance

The comparison of fluctuations in silver salmon landings, with the annual runoff two years previous to the year of catch is shown in Figure 3. The lower graph shows the harmony in fluctuations for the 27 year period. The years refer to the year of the salmon catch, hence, the streamflow graph has been "offset" two years. The same information is plotted in the upper graph as a scatter diagram emphasizing the significant grouping of points around the trend line.

This demonstrates that the abundance of silvers in Southeast Alaska is determined by annual runoff, as it is in the Washington region. However, almost all of the silvers in the south only spend one growing season in fresh water, but perhaps half of the silvers in Southeast Alaska spend two growing seasons in fresh water. This would indicate that where silvers do spend the extra year as juveniles in the streams, the streamflow during the last year has the most significance in survival to adulthood.

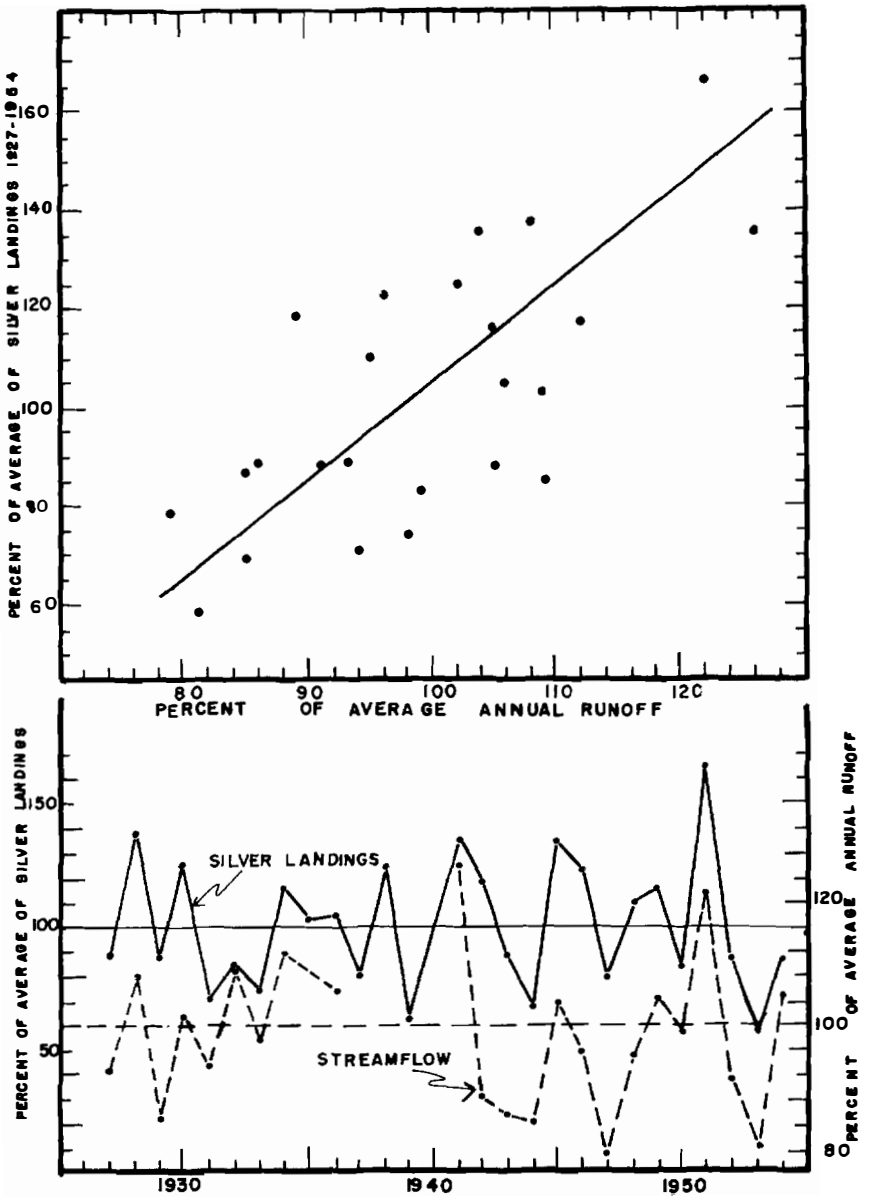

Figure 3. Correlation between annual runoff during juvenile residence and adult silver salmon landings in Southeast Alaska.

References

HEG, R. T., 1956. Study of king salmon production in Capitol Lake. Washington State Dept. of Fisheries, unpublished manuscript.

SMOKER, W. A., 1955. Effects of streamflow on silver salmon production in Western Washington. Univ. Wash. Thesis (Available thru Univ. Microfilms, E. Lansing, Michigan)

Reeling in gill net, Taku Inlet.

EDUCATION AND INFORMATION

In line with the modest budget which provided for only a part-time employee, the Department decided to concentrate on a series of films designed to acquaint the general public and other agencies with the diversified field work of its biologists.

The six films made were:

1. Taku Gill Net Fishery
2. Taku River King Salmon Research
3. Kitoi Bay Research
4. Beluga Whale Investigation
5. King Crab Tagging
6. Sport Fish

The films are in color with a sound track combining commentary, sound effects, and music recorded with Western Electric sound. The total running time is 70 minutes. The films, which are of various lengths, can also be run separately or in combinations to meet any special topic and time requirements of noon luncheon meetings.

In addition, the films have also proved a valuable aid in giving new staff members an overall view of the Department's activities before they go into the field.

Wherever shown, the films have been favorably received and it is anticipated that these, and subsequent films, will provide an effective medium in acquainting Alaskans with their fish and game resources and the work being done by the Department to conserve and augment them for the fullest utilization.

Purchases of laboratory editing equipment and a portable RCA sound projector were also made. This will make the Education and Information Division more efficient, economical and flexible, both in the production of educational sound films, and the public showing of these films by various members of the staff.

Pewing red salmon aboard buyer's barge from gill net boat, Bristol Bay.

ENGINEERING

The vast areas of lakes and lengths of streams in Alaska, presently blocked to upstream migrating adult salmon by waterfalls and rapids, but otherwise suitable for their fresh water environment, indicate that the resource could be expanded were these waters made available to the fish. Most of these upstream migrant blocks are at locations difficult to reach with both construction equipment and materials, which results in very high onsite construction costs, and dictates development and utilization of fishpasses and ladders requiring only the barest minimum of activity at the sites of the blocks. Conventional fish ladder designs are generally too costly to be employed in the Territory except at selected locations. To meet this challenge, model studies were carried on to create a fishpass which would be functional under a variety of operating conditions and which, for greatest economy, could be shop fabricated of light weight, corrosion resistant, metal alloys. Great importance was placed on the factors of flexibility and versatility to enable utilization of prototypes at sites of varying topographical and hydrological characteristics.

Two 1/5-scale fishpass models, of sheet metal constructed along principles of the steep channel type, in tests showed promise of meeting the requirements set out. The fishpass designed for full scale development is functional, light in weight but sturdy, low in cost, admirably adapted to pre-fabrication in sectional panels and should be rather easily transported to, assembled and erected in the field with ordinary tools and, depending on the site, with a minimum of light equipment. Plans and specifications for shop fabrication of the fishpass were completed at the end of the year and pilot installations are contemplated during 1957.

The Division provided Engineering services including consultation and the preparation of plans, specifications, charts and maps for the several other divisions of the Department upon request.

Preliminary exploratory and reconnaissance work was accomplished at upstream migrant blocks located at: Gretchen Creek, and Little Kitoi, Big Kitoi, Midarm, Ruth and Jennifer Lakes on Afognak Island; Frazer Lake Falls on Kodiak Island; and at the Tuya, Little Tahltan, and Silver Salmon Rivers in British Columbia, Canada.

Design surveys and investigations were completed on the sites, covering both topographical and hydrographical aspects of projects contemplated or proposed, as follows: Bakewell Lake Fishway; Little Kitoi Lake Fishway and appurtenant facilities; Kitoi Research Station water supply; Ruth Lake Fishway; Midarm Lake Fishway; Jennifer Lake Fishway and Deer Mountain Fish Hatchery Fishway and Holding Tank.

Designs were completed for the Bakewell, Little Kitoi, and Deer Mountain Fish Hatchery fishways and appurtenant structures. Construction plans and specifications were completed for the Bakewell fishway project and, at year's end, were well along on the Little Kitoi and Deer Mountain projects.

No construction projects were carried out by the Division during the year. A bid-call for the Bakewell project in October resulted in about a dozen takeouts but no bids were received. It was felt the available funds were insufficient to cover the construction cost of the project.

INSPECTION

The Department continued its policy of assisting the U. S. Fish and Wildlife Service in the enforcement of Alaska's commercial fisheries regulations. Three men were temporarily employed as inspectors during the 1956 salmon season. The inspectors were stationed at Afognak Island, the Upper Copper River drainage and the Kenai Peninsula.

Thomas Juelson, the Afognak Island inspector, worked Pauls Bay and Perenosa Bay during the salmon fishing season. In addition to his duties on enforcement, he assisted the biologists from time to time and was particularly helpful during the installation of the downstream migrant trap at Laura Lake.

Wallace Fitzgerald patrolled the Kenai Peninsula. Enforcement in this area entailed coverage of the road systems paralleling the rivers by truck and hiking up other streams and rivers from the highway. Salmon protection during the spawning migration was the primary purpose of this enforcement.

John Degen patrolled the Upper Copper River watershed. This area was worked by truck patrol and on foot. Salmon protection during the spawning migration was of paramount importance.

The enforcement agents were stationed in the above areas with the purpose of acting as protectors to the salmon runs. Their presence in the areas acted as a strong deterrent to fishery violations, thus insuring public compliance with the fisheries regulations.

The inspectors, assisted by other personnel in the Department, continued to enforce the Sport Fishing License Act, Chapter 93, Session Laws of Alaska, 1951. Every effort was made to publicize this Act. When possible, anglers were checked prior to their going fishing. Thus, if they were not properly licensed they were advised to procure their license. The enforcement program in the Department stresses the prevention of violations rather than the apprehension of an offender after a violation has occurred.

Following is a table showing the collections to the Territory from its Sport Fishing License sales:

Calendar Year	Income from Sale of Territorial Sport Fish Licenses
1951	$ 9,967.00*
1952	14,021.00
1953	25,099.00
1954	32,373.00
1955	64,673.00
1956	63,081.88

*Includes only a six month period, since the Act did not go into effect until July 1, 1951.

The sharp upsurge in license sales evidenced during 1955 can be attributed to the Department's efforts in enforcement. Prior to 1955 there was no enforcement, so the collections could be called contributions. The slight decrease in sales during 1956 was also reflected in the Federal license sales in 1956, when compared with their 1955 sales.

MARINE PREDATOR CONTROL AND INVESTIGATION

The Division of Marine Predator Control and Investigation superseded the original Division of Predator Control in 1955. This action allows the use of funds and personnel for predator investigations to determine the need and best methods for control prior to its institution.

The permanent division staff is listed below; temporary employees are named in appropriate places in the following report.

James W. Brooks, Biologist

Archie S. Mossman, Associate Biologist

Harold Z. Hansen, Special Deputy Seal Hunter

The Department of Fisheries is especially pleased to acknowledge the continued excellent cooperation and assistance extended by the Cordova Seal Committee, the Alaska Packers Association and particularly Superintendent Fred Butler of the Kvichak and Clarks Point Canneries in Bristol Bay.

POLICY

A discussion of the principles which guide the Department of Fisheries predation investigation and control program has been presented in the 1954 Annual Report and briefly restated and explained in the 1955 Report. The general policy of the Department remains unchanged: Control of the predation by any species will be conducted only subsequent to establishment of the need for the control, and the methods employed will be those that are most efficient and at the same time, the least destructive of animal life having natural or other values. Under no circumstances will control be carried to the point where any species or subspecies is threatened with extinction.

SEAL CONTROL

In 1956, as in past years, control of predation by harbor seals was carried out in the Stikine and Taku Rivers and on the Copper River Flats. These three areas support gill net salmon fisheries which have been seriously troubled by the net-robbing activities of harbor seals. There are probably other gill net fisheries that would benefit from seal control, but lack of both funds and adequate knowledge concerning these other problem areas have prevented the inauguration of new seal control efforts in 1956.

Stikine River

The sixth season of seal control on the Stikine River was carried out by Clifford Kilkenny, the same expert rifleman who conducted the work in previous years. His kill this year was 426 seals and 14 sea lions. Measurements, sex, breeding condition and stomach contents were recorded for the seals that did not sink. It is anticipated that this program will be continued in 1957 because the cost is considered to be small in relation to the benefits returned.

During 1956, Clifford Tisdale carried out harbor seal control and data

collection on the Taku River. His shooting there resulted in a kill of 60 harbor seals and, in the general area, 10 sea lions. The numbers of seals dropped so low in the Taku River that he spent some time in Snettisham Bay and in the vicinity of Tracy Arm where he accounted for 165 seals. During the summer he collected data on 31 seals. It is felt that in the Taku vicinity both the seal population and their depredations have been reduced to the point where the fishermen can now readily protect themselves. Therefore, there will be no seal control by the Department on the Taku River or vicinity in 1957.

Taku River

Severe seal depredations on the Copper River gill net fishery result from the large number of seals present and also from the wide dispersion of the fishing effort. Prior to 1951, individuals or groups attempted to reduce the seal population, but their efforts were largely unsuccessful. In 1951, the Department of Fisheries assumed much of the responsibility for controlling the seals. The Cordova Seal Committee, a group of fishermen and packers, provides $1.00 for each $5.00 allotted by the Alaska Department of Fisheries for this work in the Copper River area.

Copper River

The following temporary employees conducted the control activities on the Copper River:

Dale Bosworth
Edwin L. Chester
Warren S. Choppell
Robert M. Elton
James W. Nichols
Charles S. Wells

During 1956, the depth bombing method of killing seals was again used. (See Alaska Department of Fisheries 1954 Annual Report for a description of this technique). In addition, a rifleman was also employed but circumstances prevented his having much success. The total kill was 2,100 seals, resulting largely from the bombing effort which was half as intense as that carried out in each of the years 1952-1955 inclusive. During the 1957 season, it is anticipated that the bombing effort will be somewhat less than in 1956, and no rifleman will be employed.

SEAL INVESTIGATIONS

During 1956, Departmental personnel gathered additional information relating to the harbor seal—its population size, local distribution, food habits, and general biology. For the past few years, this work has been carried forward as an incidental part of other projects, and has not yet provided a thoroughly adequate understanding of the harbor seal's life history and its relation to various fish species. This investigation is considered to be highly important, and it will be continued until conclusive results are obtained.

OTHER PREDATOR INVESTIGATIONS

The Alaska Department of Fisheries under a contract with the United States Fish and Wildlife Service (Saltonstall-Kennedy funds) instituted an investigational program in 1955 comprised of the following four study plans:

Study Plan I A study of the sea lion in Alaska with particular reference to commercial fisheries.

Study Plan II An Ecological life history study of the beluga with special emphasis on its relationship to salmon. This study was started in 1954 and carried through 1955 with Territorial funds.

Study Plan III A study of predation on salmon by gulls, terns, mergansers, and other predaceous birds.

Study Plan IV Basic predator-prey research employing controlled experiments in natural lakes.

Except in the case of Study Plan IV, these Saltonstall-Kennedy funds were withdrawn before a complete year of field research could be accomplished. As a result, the following summarization of the findings is very preliminary in nature. Some information obtained under Alaska Territorial financing, subsequent to the termination of Saltonstall-Kennedy funds, is included.

James W. Brooks was the principle investigator in the study of the northern sea lion, **Eumetopias jubata**, in eastern coastal Alaska. Because of the distances involved and the active program of sea lion study by the Fisheries Research Institute in the westward areas, this investigation was confined to the area east of 150° W

Study Plan I
Sea Lions

Aerial surveys in November 1955 and March, April and June 1956, (several obtained by flying in U. S. Fish and Wildlife Service aircraft) resulted in the best knowledge to date of sea lion distribution and abundance in central and eastern Alaska. These surveys indicate the presence of more than 13,000 sea lions in these waters, with the animals concentrated on fourteen or fifteen major sites during June. Interesting is the finding that all of the rookeries, or breeding grounds, are located on the outer coast, none on the "inside" waterways (Fig. 1).

Seasonal movements of sea lions do occur, though well defined migrations involving large numbers of animals together are only occasionally reported at sea or along the coasts. In general, there seems to be a southward population shift in the fall away from breeding areas and a reverse movement in spring. Thus, some sea lions breeding in Alaska probably winter in the coastal waters of British Columbia. In the inside waters of Southeastern Alaska, the animals are far more abundant in winter than in summer.

To cast light on this problem of movements, more than 50 pups were marked by attaching cattle ear tags to their foreflippers during June 1956, and additional marking will be done in 1957. It is hoped that some of these marked animals will be later recovered. Fishermen are especially urged to look for these tags on sea lions captured, and to report any tag recoveries to the Department of Fisheries.

Study of the breeding animals on Tanker Island in Prince William Sound revealed a low reproductive success; the 2,200 animals on this rookery produced fewer than 100 pups. It appeared that excessive crowding, on the flat rocks suitable for breeding and giving birth, might be a strong force tending to limit further population increase. Furthermore, there were relatively few places on this large rookery where newborn pups could survive in the event of a bad storm causing heavy seas to break on the rocks. Other rookeries will be studied in 1957 to determine whether or not over-

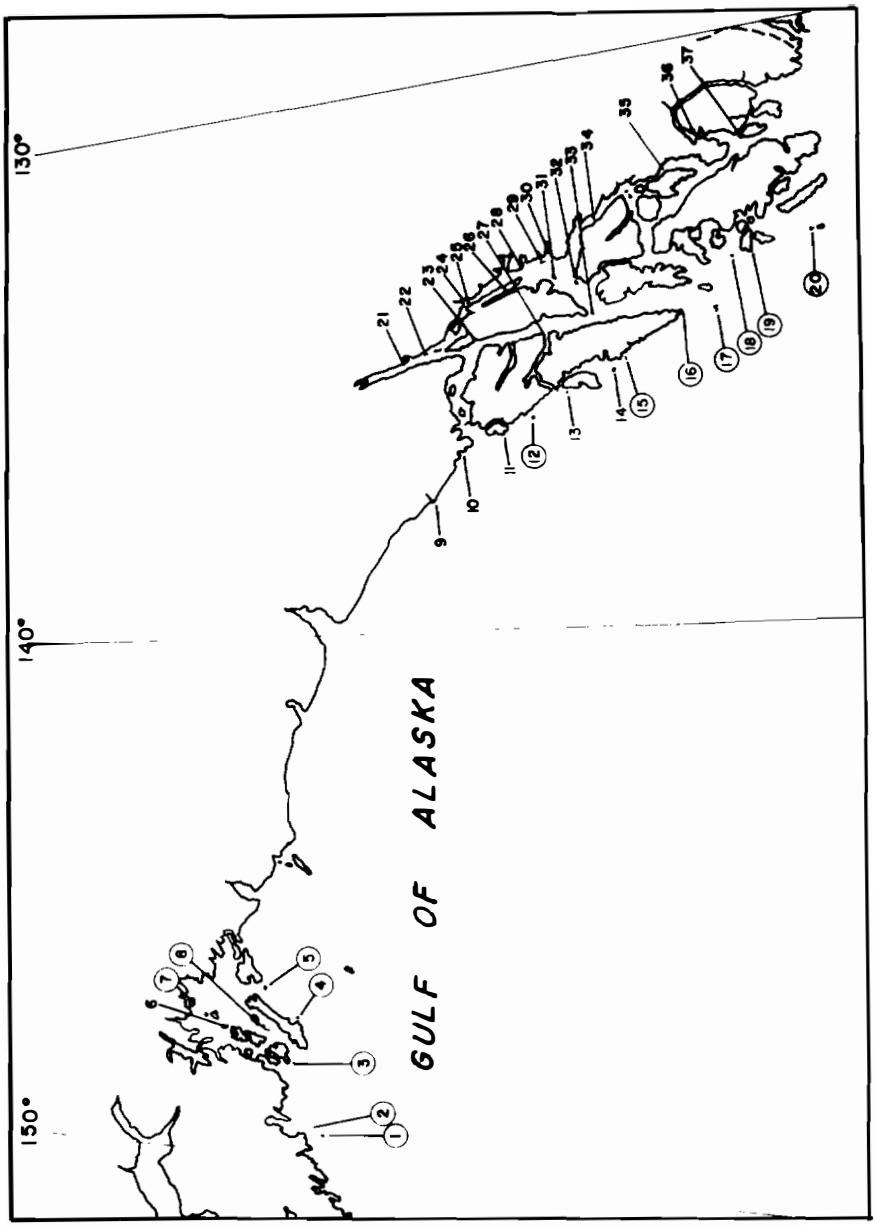

Figure 1. Location of occupied rookeries (No.) and hauling grounds (plain numbers).

crowding is of widespread importance as a factor limiting sea lion numbers.

The diet of sea lions includes a wide variety of fishes and other marine forms, some of commercial importance such as herring, salmon, sable fish, and halibut, and others of little or no value such as rockfish, pollack, and squid. With the exception of herring, it appears that free-swimming fishes of the commercial types are taken only in small numbers. However, the removal of salmon, sablefish, and halibut from fishing gear is sometimes a costly and serious matter to the fishermen involved, even though such depredations may have a negligible influence on the stocks of these fishes. Questionnaires were distributed to fishermen in an attempt to secure information concrning these depredations, but too few were returned to permit confident analysis. This information will be solicited from fishermen again in 1957.

The investigation of the sea lion in relation to the commerciel fisheries will be continued by the Territory until a conclusive point is reached.

While not commercially utilized now, the hides, flesh, and oil of the animals make them potentially valuable.

Study Plan II
Beluga

The work to date on the beluga has been carried out by James W. Brooks and his assistant, Charles Wilson. Prior to 1956, it was found, among other things, that in the Kvichak River the annual loss of red salmon downstream migrants appeared to approach 3,000,000, Fig. 2 (See 1955 Annual Report). Allowing the rule of thumb, five percent return of these fish to the fishery would mean that roughly 150,000 potential adults were removed by this predation (Fig. 3). As a result of these findings, investigations in 1956 concentrated on learning more about this problem and of ways to relieve it.

During this period in 1956 there were about 200 belugas in Kvichak Bay. This is fewer than observed in 1954 (250-400), but about the same as in 1955 (150-250).

The belugas are in Kvichak Bay ready to ascend the Kvichak and Naknek Rivers as soon as the ice goes out. This they do on each flood tide, returning to the bay on the ebb. During the past three springs, the ice in the Naknek River went out first and the beluga concentrated there prior to mid-May when the ice broke up in the Kvichak River. At that time, they forsook the Naknek for the Kvichak River. Since this shift to the Kvichak occurred before red salmon downstream migrants were present in the lower Naknek, no loss of red salmon smolt to beluga occurred there.

Smelt are the mainstay of the beluga prior to the arrival of the downstream migrant red salmon. In the Kvichak River, during 1954 and 1955, a very striking shift to the salmon smolts occurred as soon as they appeared in substantial numbers in the lower river. In 1956, however, relatively few salmon migrated down the Kvichak, and smelt continued to provide most of the food. In 1954 and 1955, for example, the number of salmon in each beluga stomach examined (sample of 30) was 685, while in 1956 (sample of 13) it was down to 148. Within the range of abundance seen, the more downstream migrants there are, the more of them the beluga eat. Even though the loss of salmon smolt was less in 1956 than in the two preceding years, its significance to the red salmon population may have been greater because of the smallness of the seaward migration.

Since most predation on salmon smolts occurs within the confines of

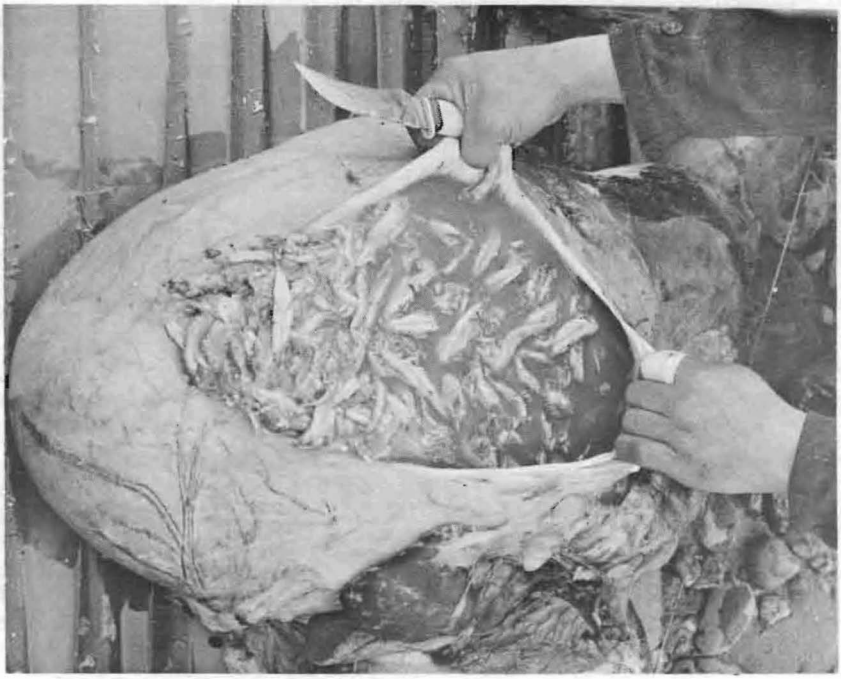

Figure 2. Beluga stomach containing 1,500 downstream migrants.

Figure 3. Adult red salmon taken from beluga's stomach.

the river where the fish are concentrated, the beluga were chased with a fast speed boat in an attempt to determine if this method would serve to keep them out of the river and thus reduce their predation. During daylight and with reasonably calm water, the method was successful. The use of two boats would help in turning the occasional animal that slipped by. Nevertheless, bad weather and the coincidence of flood tides with the hours of darkness severly limit the method. However, until we are able to devise something better, it will serve to prevent much predation and seems preferable to outright destruction of the animals.

Study Plan III
Predaceous Birds

Studies of bird predations upon salmon were carried out in the years 1955-1956, with Archie S. Mossman the principle investigator. Portions of coastal Alaska from Bristol Bay to Dixon Entrance were visited as an adjunct to intensive studies in order that an appreciation of the overall problem could be obtained.

Salmon eggs were found to be eaten by glaucous-winged herring, short billed and Bonaparte's gulls, and by American mergansers and water ouzels. Reliable reports mention, in addition, Canada geese and mallard ducks. Gulls obtain the eggs by: (1) removing them from salmon carcasses; (2) "tipping up" like a duck for them while swimming; (3) "treading" them up from silty stream bottoms; (4) picking up drifting eggs; and (5) by eating cannery refuse (Fig. 4). Mergansers swim right in among the spawning salmon to obtain eggs. The importance of egg predation by birds in terms of its effects on Alaska's salmon stocks is still unknown, and seems to be a very

Figure 4. Gulls feeding in Nushagak at Dillingham.

difficult thing to evaluate properly. Like most apparently important predations, it seems to be localized both in time and space. The scavenging in which eggs are eaten at canneries is, if anything, desirable from man's standpoint. Much of the other egg feeding is certainly of very minor importance. The problem is to determine what losses from egg eating are in excess of those losses that would occur anyhow. Utilizing stomach contents only, it seems to be impossible to tell whether or not an egg was alive, viable, fertilized one at the time it was eaten and it is even more difficult to known whether the egg was, or would be, properly buried in the salmon redd. Extensive experimentation probably will be required before a confident estimate of the importance of salmon egg feeding by birds can be made. The best that can be said is that information obtained to date does not warrant the institution of control operations as a management tool.

An attempt to study bird predation upon pink and chum salmon fry was completely thwarted by the near absence of fry at the study area in the spring of 1956.

Salmon smolt were found by observation and "stomach analysis" to be eaten by glaucous-winged gulls, short-billed gulls, Bonaparte's gulls and arctic terns. Red-breasted mergansers were observed fishing where they almost certainly were taking red salmon smolt since gulls and char at precisely the same spot and time contained nothing but red salmon smolt and a very few minute invertebrates.

In spite of a very small red salmon seaward migration in the spring of 1956, the gulls on the Kvichak River of Bristol Bay showed a shift from other foods to salmon smolt in the period June 6 to 19. In addition, calculations of gulls and terns seen per mile of outboard skiff travel on the Kvichak River indicated a heavy aggregation of these birds on the river during the four days within this period when by far the largest numbers of red salmon smolt passed through.

The data presently available are too sketchy to be able to confidently evaluate this predation and, as a consequence, do not warrant the establishment of control operations. In the event that future work does suggest that control of this predation should be undertaken, the emphasis, for many reasons, will probably be on frightening the birds from prey concentrations rather than on actively reducing their numbers.

Glaucous-winged gulls are known to prey upon spawning red, pink, chum and probably also silver salmon. These adult salmon, it has been found, are safe from gull attack until they get into water so shallow that one-third to one-half of their bodies are above the surface. Even under such circumstances, dense overhanging brush may protect them if it hangs closely enough to the water.

In two small streams and probably in a third, the glaucous-winged gulls apparently preyed selectively upon the as yet unspawned and partially spawned female red salmon, even though more male than female salmon were present in the streams. Only red salmon were present in the study streams at the time of this selective predation. Because of the limited observations, it should not be assumed that gull predation is always selective of the females. Where it occurs, however, this predation is bound to have a greater affect on the particular salmon stock than it would if the predation was non-selective or was selective for the males.

Considering salmon spawning in Alaska as a whole, there are relatively few areas in which gull predation upon spawners is of any importance,

Belugas, after examination, are turned over to the Eskimos.

simply because of the relative scarcity of places with the necessary physical attributes for this to occur. Therefore this predation is probably of minor importance to Alaska's salmon though it may, in scattered instances, affect the abundance of very local stocks.

In connection with studies of the kinds and amounts of food taken by the gulls, terns, and mergansers, considerable information concerning their life histories is also obtained. This knowledge is essential in evaluating their impact as predators and scavengers. Information about their reproductive processes such as the timing of the egg laying and incubation, the amount of reproduction by "immature" birds, hatching and fledging success, and renesting will especially be necessary to allow confident evaluations. We have already accumulated some data of this sort. This material will continue to be gathered and utilized as an essential adjunct to our studies of the food habits and behavioral relations of these birds as they impinge on Alaska's fisheries.

Study Plan IV
Lake Predation

Near the Kitoi Bay Research Station on Afognak Island, two small lakes, Ruth and Midarm, were selected for basic studies on the effects of predation or competition by resident fish on the production of sockeye salmon. Previous studies demonstrated that these lakes could produce salmon but both lakes were barren of these fish because of falls in their outlet streams. They contained, however, resident populations of dolly varden trout

and stickleback. Ruth Lake was treated with rotenone in the fall of 1955 resulting in a total elimination of resident fish, while Midarm Lake was left untouched as a control lake.

From the fall run of adult sockeye salmon in nearby Lake Kitoi, eggs were taken and incubated in the research station hatchery. In July 1956 about 90,000 fry were planted in each of the study lakes. During the fall of 1956, downstream counting weirs were installed in the two outlet streams, and the young salmon will be counted as they leave for the ocean. The difference in counts of downstream migrants will provide the first measure of difference in salmon production between Ruth and Midarm Lakes. The final measure of any benefits from eliminating competition and predation will be the comparative numbers of adult salmon that return to these lakes from the ocean.

During the summer of 1956, studies on the growth of attached algae were conducted in both lakes. It was found that in Ruth Lake about five times as much algae grew on test slides suspended in the water as grew in in Midarm Lake. This may be due to the fertilizing effect of the decomposed resident fish killed in Ruth Lake. If the initial production of sockeye salmon is greater in Ruth Lake it may be due to the release of essential elements to the basic food chain of the lake as well as to the removal of predation and competition. This will have to be evaluated by further study before the exact relation of predator to prey is defined in these lakes.

Belugas collected by research biologist in Bristol Bay.

SPORT FISH

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

E. S. Marvich, Senior Biologist
A. H. McRea, Senior Biologist
R. J. Simon, Junior Biologist

PROBLEM

The vast wilderness areas of Alaska provide anglers with some of the finest sport fishing to be found anywhere in the world. The waters in the remote areas abound in sport fish that seem to vie with one another in grabbing at the angler's lure. Excellent angling is available from any of Alaska's population centers by either bush plane jaunt or by a longer boat trip.

For the most part, however, relatively few anglers can take advantage of the excellent fishing to be found in the outlying regions. There are two primary reasons for this—time and money. It costs money to charter an aircraft to get to the out-of-the-way spots or it takes time to make the long boat trips necessary to get off the beaten path. Since Alaska's main working season corresponds with the time of year when sport fishing is at its best, people simply cannot afford to take the time off from work to make extended fishing trips. As a result, most of the angling is concentrated in the lakes and streams near the population centers and available by automobile (Fig. I).

Waters readily accessible to the population centers have been subjected to a heavy sport fishing pressure and show alarming depletion in many instances. Realizing that the maximum benefit would be derived from sport fish rehabilitation in lakes close to the population centers and available by automobile, the Alaska Fisheries Board established a policy whereby the sport fish biologists were to concentrate their efforts in these readily available waters.

BIOLOGICAL DISCUSSION

A study of the fish population changes in the lakes has been undertaken. Since sound historical biological data was not available, the biologists contacted long time local residents who either fished the lakes for sport or personal use in order to arrive at some determination of the fish population of the lakes in the past.

The biologists used graduated mesh gill nets capable of taking fish from about 4½ inches in length to fish well over 25 inches in length in determining the existing fish populations in the lakes. Certain lakes with a past history of good angling for trout, on being sampled, showed negligible numbers of these sport fish. On the other hand, the lakes were teeming with trash fish such as stickleback and suckers. Natural spawning areas for the trout were very limited.

Lake Sampling

Logical assumptions could be made from the data available to the biologists in such cases. Years ago these lakes had well balanced trout-stickleback-cottid-sucker combinations. The large trout exerted a depressing in-

Figure 1. Angler's automobiles parked alongside a small lake near Anchorage.

fluence on the rough fish populations by their predaceous activity on the rough fish young. Since the trout managed to dominate the lakes, they were able to compete successfully with the sticklebacks, cottids and suckers for other food as well. The rough fish undoubtedly were predaceous, to some extent, on the trout eggs and fry. This complex interrelationship could be resolved into at least three components: (a) Predation by trout on rough fish, (b) competition between trout and rough fish for food and living space and (c) predation by rough fish on trout eggs and fry.

Competition and Predation

Man entered the picture. The anglers, using highly selective tackle, took the larger trout; they, of course, completely ignored the rough fish. The removal of the large trout had a far-reaching effect on the ecology in the lakes. The large trout had provided the spawn necessary for their replacement and had exerted control over the rough fish populations by their predaceous feeding and competition for food and living space. With the large trout removed, the rough fish multiplied by leaps and bounds. No longer were their young being preyed upon by the large trout. In addition, the removal of the trout eliminated a food competitor and provided more living space as well. As the angling pressure in the lakes increased and more and more large trout were removed, the rough fish populations had it better and better.

Attempts were made to stock trout fry in lakes saturated with stickleback and other rough fish. Except in rare instances, this proved futile. The

rough fish were in balance with the food supply in the lakes. The stocked trout fry would have had to displace the rough fish in competition for food and living space in order to survive. The small trout failed to make the grade; competing with the scrap fish was too tough on them and they succumbed.

Fortunately, a remedy is available to the biologists when lakes are saturated with rough fish—kill off all the fish in the lake and start anew with a desirable population of fish. This is basically the technique used and is called the lake rehabilitation program.

Lake Rehabilitation

Rotenone, a fish toxicant found in members of the plant family Leguminosae, is used to kill the trash fish. This toxicant has long been known to man. It was commonly used by Indians in the southeastern United States and near the Gulf of Mexico, by natives in Brazil and other South American countries and by the people in Sumatra, among other places. The natives generally picked the rotenone-bearing plants and pulverized them in a stream. The fish, affected by the drug, thrashed about in the stream, became stupefied and fell ready pry to the natives who picked them up for a fine fish fry.

Rotenone-bearing plants are grown commercially in South America and each year great quantities of the roots of these plants are imported for use as insecticides and as a fish toxicant (Fig. 2).

Figure 2. Cube powder containing rotenone to be used in eradicating scrap fish from a lake.

The fish are killed by suffocation when using rotenone. The rotenone causes the capillaries in the gills to constrict so tightly that the oxygen-bearing red blood cells are blocked in their passage. The rotenone does not remove the oxygen in the surrounding water. There can be a saturation of dissolved oxygen in the water, yet on treatment with rotenone the fish would be killed. The fish, due to vasoconstriction, cannot utilize the free oxygen in the water; hence the result is narcosis and ultimate suffocation.

The rapidity with which rotenone affects fish is largely dependent on two variables—the temperature and hardness of the water. The warmer and harder the water, the faster the rotenone attacks the fish. As the temperature and hardness of the water decreases, the rotenone effects the fish more slowly.

Every attempt is made by the biologists to insure a complete kill of fish in a lake. An engineering survey is made of the body of water and the volume and weight of water in the lake is carefully calculated. Since rotenone is expensive and the concentration of material required to insure a kill is known for the various species of fish, the biologists need an accurage de-determination of the weight of water in a lake so that a lethal dosage of rotenone will be applied without wasting any by adding unnecessary toxicant. Each pound of rotenone added beyond that required for a complete fish kill is wasted.

The duration of toxicity is dependent upon the temperature and hardness of the water. Harder water and higher water temperatures result in shorter toxicity duration. In Fairbanks and Anchorage areas, the toxicity dissipates in about six weeks. Toxicity is checked by suspending live-boxes containing fish at various depths in the lake; when the fish survive for a period of four days, the lake is considered to be free of toxicity. The lake is then ready for stocking.

Fish Stocking

Stocking the rehabilitated waters was accomplished from the Fairbanks hatchery, located 56 miles southeast of Fairbanks on the Richardson Highway; and from the Fire Lake Hatchery, located 17 miles from Anchorage on the Glenn Highway. These two Departmental stations produced a total of 884,971 rainbow and steelhead trout fry for stocking in rehabilitated, virgin and other lakes. In addition, 353,371 steelhead trout were stocked from the Kodiak Conservation Club Hatchery at Kodiak. Costs for 35,000 steelhead trout from the plant made by the hatchery at Kodiak were financed by the United States Fish and Wildlife Service. Details of the hatchery operations and fish stocking will be discussed later in the report.

A few general remarks about the hatcheries' use in sport fisheries might be pertinent at this time. The fish hatcheries are considered valuable tools for use in fish population manipulation. The hatcheries, in themselves, are not a cure for the sport fish problems. In cases where little or no spawning facilities are available for game fish, the fish hatcheries supply the necessary replacements resulting from angling, predation and other causes. The lake rehabilitation program necessitates a readily available source of game fish for stocking; the fish hatcheries meet this need. Hatcheries supply the fish for stocking virgin lakes. The hatcheries' value could be summed up by a simple statement of their objectives: To provide a source of fish of the desirable type, quality, and quantity, at the time requested. The hatcheries attempt to fill this need.

FAIRBANKS HATCHERY

The Fairbanks hatchery is located 56 miles southeast of Fairbanks on the Richardson Highway. This fourteen trough station utilizes the outlet of Birch Lake for its water supply. The hatchery, built as a pilot plant to provide trout fry for the Fairbanks and Anchorage areas in 1952, has been expanded during the ensuing years and modifications have been incorporated to add to its efficiency.

In order to ensure a constant supply of water to the hatchery, Birch Lake was dammed at its outlet and the lake level raised. The raised water level in Birch Lake acts as a reservoir, thus eliminating the possibility of the drying up of the outlet due to inadequate rainfall during the summer months. The amount of water flowing down the outlet was controlled by head boards at the dam, thus a steady flow of water was available at the hatchery intake pipe during the entire summer.

The Fairbanks hatchery commenced operations during 1956 with the receipt of the first eyed rainbow trout eggs on May 29 and planted out the last rainbow trout fry on October 1, after which the hatchery was secured for the season. Eyed rainbow trout eggs for the hatchery operations were purchased from a supplier in the States, and the steelhead trout eggs were obtained from the Kodiak Conservation Club at Kodiak. No attempt is made to rear fingerling for planting purposes at the trout hatcheries. Rearing large fish for stocking would present difficult mechanical problems during the long cold winters and would be prohibitively expensive. Trout fry are planted as "seed fish;" the fish are reared in the lakes in a natural environment.

The 1956 season was considered a successful one from the standpoint of hatchery operations. The Fairbanks hatchery received a total of 345,000 eyed rainbow and steelhead trout eggs; 297,000 trout fry were planted from these eggs. This resulted in an 86% survival from the eyed eggs through stocking. A complete list of the waters stocked from the Fairbanks hatchery can be found at the end of this report.

FIRE LAKE HATCHERY

The Fire Lake Hatchery, located 17 miles northeast of Anchorage on the Glenn Highway, was designed as a 40-trough station; however, only 24 troughs have thus far been installed. The output from this station, thus far, has been adequate to meet the biologists' requirements. As the need for more fry becomes apparent, the station will be equipped with an additional 16 troughs so it will have its full complement of 40. The hatchery's output is geared to the biologist's requirements for fish. It would be a waste of funds to hatch fish in excess of the number required for stocking.

Eyed trout eggs received at the Fire Lake Hatchery were obtained from the same sources as those discussed for the Fairbanks hatchery (Fig. 3). A total of 588,000 rainbow and steelhead trout fry were planted from the Fire Lake Hatchery. A complete list of the waters stocked from this hatchery can be found at the end of this report.

TROUT HAULING

Details concerning the transportation of trout fry from the hatcheries to the planting locations have been discussed in past annual reports. The

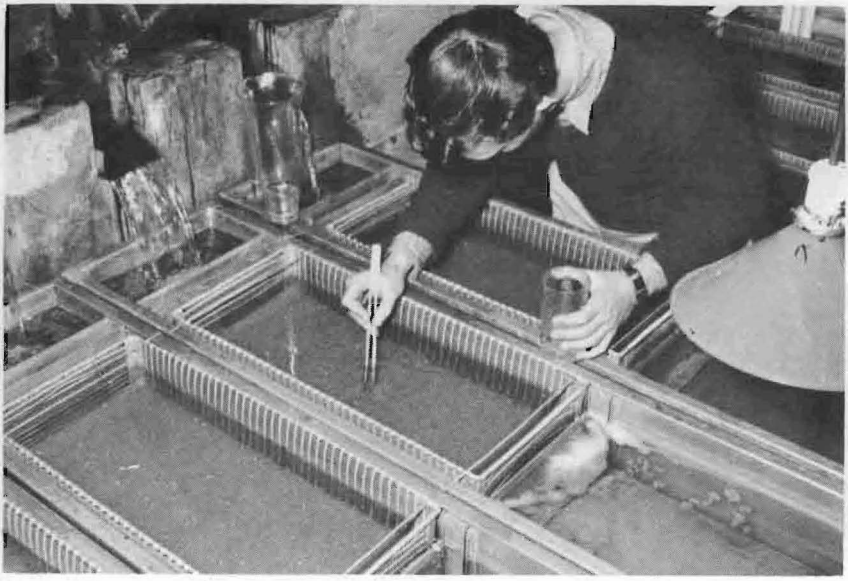

Figure 3. Rainbow trout eggs incubating at the Fire Lake Hatchery. Hatcheryman is removing dead (white) eggs.

methods used will be briefly mentioned here. Three types of hauling equipment are used. Trout are hauled with a pickup truck in a 250 gallon tank to lakes along the highways. The water in this tank is aerated by means of a positive displacement, piston type air pump run by a six-volt electric motor. Power is supplied to the pump motor by the truck battery. The air is pumped through rubber hoses and broken up under the surface of the water into thousands of small bubbles by ceramic diffusers. Portable fish planting tanks were used when trout fry were shipped by aircraft (Fig. 4). Each portable tank consists of four 5-gallon cans for carrying fish and water and an air pump powered by an electric motor run by a hot shot battery. This unit, loaded, weighs 206 pounds and has a capacity of about 8,000 trout fry which can be transported for a little over 2½ hours without changing the battery. Five-gallon back pack cans mounted on pack boards are used to transport the trout fry to hike-in lakes. About 2,000 trout fry can be carried in each can.

LAKE REHABILITATION

The following lakes were rehabilitated during 1956:

Lake	Surface Acreage	Location	Scrap Fish Killed
Clunie	103	Eagle River Flats	Stickleback
Long	105	Matanuska Valley	Stickleback
Jack	5	Kodiak	Stickleback
Lee	14	Kodiak	Stickleback

Figure 4. Fish tank carrying rainbow trout fry being loaded at the Anchorage airport for transportation to Cordova.

Clunie Lake was treated with rotenone on August 6, 1956. By August 29, 1956 the rotenone toxicity had dissipated and the lake was stocked with 13,000 rainbow and steelhead trout fry.

Long Lake was treated with rotenone on June 27, 1956, and was free of the toxic rotenone by July 20, 1956 when it was stocked with 25,000 rainbow and steelhead trout fry.

The treatment of Jack and Lee Lakes is discussed in the Kodiak section of this report.

INTERIOR ALASKA LAKES

Comprehensive biological surveys have been conducted on a number of lakes in Interior Alaska. Such surveys, among other things, have included a measurement of the area and depth of the lake, an analysis of the fish population and a determination of the amount of dissolved oxygen present during the winter months. Trout have been experimentally stocked in some of the lakes under investigation. Some of the trout stocking results have been significant and are reviewed at this time.

Boleo Lake, located about twelve miles south of Big Delta via the Richardson Highway, was initially stocked with 10,000 rainbow trout in 1953. Previous biological surveys had been made showing that the lake was populated

solely with cottids, a bottom-dwelling species of fish. The lake was restocked in 1954 but was not closed to fishing. By the fall of 1954, the rainbows in Boleo Lake were averaging 13 inches in length and showing at the surface. A few anglers observed them feeding and started to fish the lake. The angling pressure was light, however, since the lake froze over in October and very little ice fishing was done in the lake during the winter. In the spring of 1955, the angling in the lake was publicized and Boleo Lake was fished hard that season. Fish up to 18 inches in length, weighing three and one-quarter pounds, were taken. The lake had a good population of two plus and one plus year old rainbow trout in midsummer and had just been stocked with 101,000 rainbow trout fry when an unfortunate accident occurred.

Boleo Lake

Boleo Lake is utilized for picnicking and swimming, as well as for angling. In an effort to control the mosquitoes during the late summer of 1955 an aircraft attempted to spray an insecticide around the periphery of the lake. Unfortunately, due to the unpredictable wind currents in this area, the insecticide drifted into the lake. The mosquitoes were killed and so were the fish. Repeated attempts to take fish by angling and gillnetting in Boleo Lake during 1956 met with no results.

An agreement was reached regarding the prohibition of spraying of any insecticides in the vicinity of Boleo Lake and the lake was stocked with 70,000 rainbow and steelhead trout fry in 1956. By the first of October these fry were in evidence in the shallows of the lake and were from two to four inches in total length. It is expected that a sport fisheries can be re-established in Boleo Lake by the fall of 1957.

Deadman Lake, near Northway, was rehabilitated in the latter part of June 1954. This 341 acre lake has a maximum depth of 32 feet. The lake was closed and stocked with rainbow and steelhead trout fry in 1954 and again in 1955 and opened to angling on July 4, 1956. Opening day fishing was very poor. This can be attributed, in part, to the high surface temperature, 79° Fahrenheit, and the very dense algae bloom in the lake at the time.

Deadman Lake

By fall, when the water temperature had dropped, Deadman Lake supported a moderate sport fishery. The fish that were taken were large. The rainbows were running up to 19½ inchs in length, weighing up to four pounds. Up to August 5, a check of 13 anglers who had fished a total of 81 hours had taken 7 rainbows from 12 to 19 inches in total length for an average catch of 0.09 fish per hour. From August 5 to August 27, 11 anglers were checked; these anglers caught 26 rainbow in 63 hours' fishing time for an average catch of 0.41 rainbow per hour.

The sport fishery in Deadman Lake was disappointing. Two primary factors could be responsible, among others, for the lack of numbers of trout in this lake. One, a complete kill may not have been realized on the northern pike originally in the lake; and, two, the low dissolved oxygen concentrations in the lake during the winter months may have caused partial winter kills on the introduced trout. Biological surveys will continue to be conducted on this lake in an attempt to determine what limiting factors are responsible for the poor survival of the introduced trout.

The gravel pits along the Richardson Highway located at Mile 20, Mile 30, Mile 80 and Mile 81 continued to produce good fishing for the juvenile

anglers. These pits are closed to angling except by children under 16 years of age. The rainbows taken averaged 8 inches in length, with fish up to 12 inches in length taken from time to time. Oddly enough, one of the more effective baits used by the young anglers has been bread dough. The gravel pits have been consistent trout producers during the past several years, providing an annual crop for harvesting by the juvenile anglers.

Gravel Pits

At Mile 4 on the Richardson Highway a large gravel pit, comprising about 20 acres, was stocked for the first time in September 1956. This pit may not support trout during the winter due to marginal supply of dissolved oxygen; however, an experimental stocking was made in order to determine the possibilities of trout survival.

Several gravel pits, located at the Alaska Railroad yard in Fairbanks, were stocked with rainbow trout fry in July 1956. This series of pits had been rehabilitated in 1955; large numbers of suckers and chubs were killed in the pits during toxicant application. From all indications, a complete rough fish kill was accomplished. By September 1956 the introduced rainbow trout averaged three inches in length. It is expected that the pits can be opened to angling sometime during 1958.

Harding (Salchaket) Lake is located 45 miles southeast of Fairbanks via the Richardson Highway. This landlocked lake comprises approximately 7,000 surface acres and contains indigenous northern pike, freshwater ling cod and chubs. The lake is surrounded by summer cabins and is a favorite spot for picnic parties, swimming and water skiing. Harding Lake is too large to rehabilitate at the present time; the cost would be prohibitive.

Harding Lake

As an experiment, 37,000 rainbow and steelhead trout were stocked in Harding Lake during 1956. These fish were the largest and finest group of trout raised at the Fairbanks hatchery. It is very doubtful that they will be able to elude the predaceous pike. A careful check will be made on the introduced trout during the next several years to determine what percentage were able to survive.

Jan Lake, located about one mile off the Alcan Highway at Milepost 1353½ was surveyed in the spring of 1955. The biological survey indicated that the lake should be a good fish producer. The lake was stocked with rainbow trout in July 1955. This 46 foot deep "kettle" lake appears to have produced a fine crop of rainbows.

By the fall of 1956 the rainbow trout had reached sizes ranging from 9 to 13 inches in length. Jan Lake was not closed to fishing, nor was the location or stocking of this lake publicized. As a result, there was no sport fishery on the lake. The location of the lake and size of the rainbows will be divulged in 1957 so that the anglers will start harvesting the rainbow trout in the lake.

Jan Lake

Lost Lake, containing 94 surface acres, has been discussed in past annual reports of the Department. This lake has been closed to angling since 1952. Sampling the lake in 1956 disclosed a fair population of rainbow trout that could and should be harvested. As a result, the lake was

opened to angling on September 8. On opening day, 42 fishermen took 17 fish from 10½ to 15½ inches in total length. It is interesting to note that two fishermen of the 42 fishing the lake caught 12 rainbows out of the total of 17 taken.

Lost Lake

WESTERN ALASKA LAKES

Beach Lake, located one and one-half miles by trail off the Birchwood airstrip, was stocked with rainbow trout in 1955 and again in 1956 with steelhead trout. These experimental plantings are being made in the face of a heavy stickleback population. Thus far, it appears that the trout stocking did not take..

Beach Lake

Bradley and Keppler Lakes, located in the Matanuska Valley, are connected by a channel, so for the sake of this discussion will be treated as one lake. These lakes were rehabilitated in 1954 and stocked during the fall of the same year. The lakes were stocked again in 1955 and opened to angling in 1956. Angling has been good in the lakes, with a good survival on the stocked rainbow trout and a fair rate of growth (Fig. 5). The trout

Bradley and Keppler Lakes

Figure 5. Two limits of rainbow trout taken from Keppler lakes.

fry stocked in the fall of 1954 were running up to 12 inches in total length by June 1956.

DeLaney Lake

Delaney Lake was rehabilitated in October 1954; the toxic rotenone had not dissipated in time for stocking that same year. As a result, the lake was stocked during July and August 1955. The introduced trout were too small to open the lake to angling during 1956. Gill net sampling in the late fall of 1956, however, indicated that this lake should be opened to angling in the spring of 1957.

Echo Lake

Echo Lake, rehabilitated in 1953 and opened to angling in 1955, produced trout of large size (up to 18 inches in length and 2¾ pounds for two year olds) but not in goodly numbers. The lake was closed except to juvenile only fishing prior to July 1956, at which time this restriction was lifted. The lake has failed to produce anywhere near the maximum numbers of trout, largely because of a lack of a complete kill on the stickleback when the lake was originally treated with the fish toxicant.

Hidden Lake

Hidden Lake, a 7½ acre lake located near Spenard, has produced good fishing for children under the juvenile only fishing regulation in effect on the lake. This lake has been stocked each successive year since 1952 by the Department. During 1956 the public access agreement to the lake was lost. As a result, stocking was discontinued except for a few marked fish which were stocked to determine the relative rate of growth and survival between the Kodiak steelhead trout fry and rainbow trout fry. It should be possible to assess the comparative survival rates in 1957.

Jewel Lake

Jewel Lake, located near Spenard, was rehabilitated in 1953 and opened to angling in 1955. The lake has produced a good fishery during the past two years and has supported a moderately heavy fishing pressure. One and one-half year old rainbow trout ran up to 14 inches in length in this lake (Fig. 6).

Lower Bonnie Lake

Lower Bonnie Lake lies two and one-half miles off the Glenn Highway at Mile 84. This 120 acre lake has produced excellent catches of rainbow during the past two years. The lake was virgin when originally stocked by this Department in 1953. It has been stocked each successive year since that time. The rainbow grow to good size in the lake. Thus far, the largest rainbow taken has been a 6½ pounder.

Lower Fire Lake

Lower Fire Lake has produced excellent angling from the stocking done by the Department. Due to the short distance of this lake from Anchorage, 16 miles on the Palmer Highway, the lake supports a heavy fishing pressure. It is recognized that a sampling gill net has its limitation in assessing the number of fish in a lake; however, comparisons between the catches by gill net sampling from year to year does give some indication of the relative abundance of fish in a lake. Follow-

Figure 6. Happy angler with rainbow trout taken in Jewel lake.

ing is a table showing the catches by sampling gill nets in Lower Fire Lake:

Year	Average number of trout caught in one day by one net
1952 through 1954	4
1955	27
1956	30

In 1955, the trout fry stocked by the Department were large enough to be taken in the sampling net. Lower Fire Lake was first stocked in 1954 and has been stocked each successive year.

Lake Lucille

Lake Lucille, a 370 acre lake located in the Matanuska Valley, was rehabilitated in 1955 and stocked in 1956 with 157,000 rainbow and steelhead trout fry. A barrier was constructed in the outlet of this lake to prevent fish migration out of the lake. At the time of writing this report it was too early to determine the rate of growth and survival of the stocked fish. It is hoped that the fish will be large enough to open the lake to angling by the spring of 1958.

Rocky Lake has been a very successful example of the lake rehabilitation program. This 57 acre lake, located in the Matanuska Valley, had tre-

mendous numbers of stickleback when treated with the fish toxicant in 1953. The lake was stocked with 12,000 rainbow trout fry the same year and closed to fishing until the spring of 1955. The lake produced good angling during the 1955 and 1956 seasons. Trout up to five and one-half pounds have been taken in this small lake.

Rocky Lake

In addition to the lakes discussed, numerous others have been stocked by the Department and are producing trout for the anglers. These include Falk Lake, Matanuska Valley; Green Lake, Elmendorf Air Force Base; Gregory Lake, Elmendorf Air Force Base; Sharron Lake, Matanuska Valley; Tex Smith Lake, Genn Highway; and Upper Bonnie Lake, Glenn Highway.

KODIAK AREA

On April 1, 1956 the Department, in an agreement with the Kodiak Conservation Club, stationed a man at Kodiak, Alaska, to cooperate with the Club in carrying out sport fish projects and to work on sport fishing problems in the entire Kodiak area. Prior to 1956 steelhead trout fry had been planted in the area, but the results of the plants indicated that problems were being encountered that could best be solved by the stationing of a biologist in the area on a year around basis.

Aside from local trout planting, a large portion of the Conservation Club's hatchery output has been shipped to other stations in the Territory in the form of eyed eggs. Programs in Ketchikan, Juneau, Anchorage, Fairbanks and Adak are dependent either partly or entirely upon Kodiak steelhead for a source of eggs for experimental introductions.

The Kodiak Conservation Club's part in sport fish management will be better understood if a short history of the operation is presented. In 1953 a small group of sportsmen on the Kodiak Naval Station formed an organization, the purpose of which was to improve sport fishing in the local area and restore a former steelhead run in one of the local rivers. The idea was to nullify as much as possible the impact of a military establishment on the sport fish and other forms of wildlife, to replace that which has been taken and to improve conditions, if possible.

Kodiak Conservation Club

One of the Kodiak Conservation Club's first projects was to install a fish weir and base camp on the Karluk River, 60 miles south of Kodiak. All of the material and supplies for the camp and weir had to be hauled to Larsen Bay by boat and taken overland approximately three miles to the site on the river (Fig. 7). The club members donated a great deal of time and much hard work to complete this project.

A warehouse in Devil's Canyon on the Naval Station was completely remodeled for a fish hatchery. A dam was constructed on the stream above the warehouse and water piped into the building.

A portion of the steelhead run in the Karluk River is trapped each year by use of a weir, eggs taken and either shipped or flown to the Naval Station where they are incubated at the hatchery (Fig. 8). The Karluk steelhead run has been the source of eggs for management programs on other occasions. The run is fairly isolated; therefore is only lightly harvested by sport fishing.

Karluk River Steelhead

Figure 7. Karluk River steelhead weir and trap.

Figure 8. Sorting Karluk River steelhead during egg taking operations.

The life history of the Kodiak steelhead is similar to that of steelhead in other areas, with one notable exception: The runs are almost entirely limited to rivers with lakes in their systems. The adults come out of the sea in the fall and winter, migrate into the lakes where they lay until spring, then drop downstream to spawn and go back to sea. When trapped for egg taking, the fish are crowded downstream with a seine and into a trap. There is a possibility that portions of the run do not follow the above pattern but may migrate from the sea immediately prior to the spring spawning. This possibility is being investigated.

After a period of fresh water residence that may be from one to occasionally three years, the steelhead migrate to the sea where they feed and mature, then return to the parent system to spawn.

The egg take occurs in May, the time of the month depending upon icing conditions in the Karluk River. The take lasts approximately two weeks, whereupon the weir is disassembled to allow the downstream migration of sockeye salmon smolt and a spring run of adult chinook salmon to pass freely in the river without this man-made impediment.

During the 1956 egg take approximately 1,100,000 eggs were taken, of which 616,000 were shipped to other stations in the Territory. The remainder were hatched and planted as fry from Kodiak station less, of course, the pick off and fry mortalities.

Plantings of steelhead fry locally have been aimed at rebuilding the steelhead run in the Buskin River on the Kodiak Naval Base, which was depleted by fishing pressure from the thousands of men stationed there during World War II, and at creating a sport fishery in the numerous small lakes in the area by landlocking the trout. While it is too early to evaluate the Buskin River project, some generalizations can be made about the lake program.

Trout Migrate Out of Lakes

Among the problems encountered with the lake plantings in the area has been the tendency for the steelhead to migrate to sea from all of the lakes but those having natural barriers at the outlets. This is to be expected since this particular stock has been migrating to the sea for many thousands of years. It is as instinctive as the migrations of other forms of life, such as waterfowl and Pacific salmon.

The obvious thing to do, then, is to construct screens that prohibit the "drop out" or seaward migration of steelhead and to gear the trout planting to the producing potential of the lakes. This has been started (Fig. 9). Screen ways have been constructed on two lakes, is underway on another, and construction will be continued until all lakes with outlets feasible to screen will have the structures installed.

Two lakes on the Kodiak Naval Reserve, Jack Lake and Lake Lee, were treated with rotenone during the fall of 1956. The lakes had been planted in 1953 with 45,000 steelhead trout fry. No fishery developed from the lakes during the ensuing years. It was noted that both lakes contained very heavy populations of the three-spined stickleback, a small plankton feeding fish that rarely exceeds three inchs in length. It was felt that the presence of the heavy sticklback population was the reason for the failure of the trout to "take," especially when lakes free of stickleback and less

Figure 9. Building a screen structure in the outlet of a lake to prevent the stocked steelhead from migrating out of the lake.

than a mile away in the same watershed were producing trout. In short, the only discernable difference between the lakes producing trout and those not producing trout was the presence of stickleback. When the two lakes were treated with rotenone, it was estimated by shoreline and boat surveys that 120,000 stickleback were killed in Jack Lake (4.73 acres) and 523,000 from Lake Lee (14.25 acres). A total of 10 steelhead was recovered from both lakes, all that remained of 45,000 planted in the two lakes in 1953. Further clarification of the problem is being sought in an experiment designed to compare the growth and production of trout in rehabilitated lakes, as compared with several other lakes having various concentrations of stickleback.

Stickleback Study

The productivity of a lake, acre for acre, is much greater than that of a stream. The nutriment in a lake is continually recirculated and built up, while the nutriment in a stream is constantly being carried to sea. In general, the stream is no more fertile than the land surrounding it, and even then the fish therein depend to a large extent upon land produced food which is washed or has fallen into the stream. It would seem to follow, therefore, that lakes would more efficiently furnish downstream migrant size fish where it is desirable to build up or create a sea-run population of adults. The Buskin project is operated with this thought in mind. The Buskin River is about 3¼ miles in length draining Buskin Lake into

Chiniak Bay. Local reports indicate that the system once had a good run of steelhead. As previously mentioned, its location on the Naval Station led to overfishing by the large complement of men stationed in the area during World War II. The rehabilitation of the Buskin steelhead run was the primary objective of the Kodiak Conservation Club at the time of its formation. It was with this object in mind that the hatchery and Karluk Camp were constructed. Steelhead fry from the hatchery are planted in the 275 acre lake with the intent of introducing them into a rich environment that will rear them to migrant size, whereupon they will pass out to sea to mature and return to the system to spawn.

Buskin River

Preliminary age determinations from the scales of fish handled during the annual Karluk River egg take indicate that the preponderance of the Karluk River steelhead are five year olds at maturity. If this is the case, adults from the 1953 plants can be expected to appear in the Buskin system during the fall and winter of 1957-1958.

Within limits, a lake will produce the same pounds of fish flesh each year. The productiveness can, as stated earlier, be realized in the form of many small fish or fewer large ones. In order to prevent a planting program from resulting in under or overstocking—in either case lakes are improperly utilized—an accurate survey is being made on each lake in order to ascertain its surface area. A planting schedule can then be made up so that an optimum growth rate can be realized from the planted trout. To date, 12 lakes in the Kodiak area have been surveyed. It is planned to eventually survey all lakes of any consequence in the area.

Lake Survey

Since almost all of the lakes and ponds near Kodiak have been planted at least once since the fish hatchery went into operation, the biologist's time during the first season was spent in evaluating the local waters. A planting program for 1956 was drawn up with caution. It was felt that only those waters which were either producing fish of acceptable size or had been fished out should be restocked. Those waters which had been planted but were producing nothing and those waters which were quite obviously overstocked were not again planted. Some of the larger less accessible lakes, such as Frazer and Spiridon, were not planted bcause it was felt that they were not utilized sufficiently to justify the tremendous numbers of fry necessary to produce a fishery. Also, some of these lakes have indigenous populations of rainbow trout. In addition, the millions of eggs required could seriously decimate the Karluk River steelhead run.

PUBLIC ACCESS

Past annual reports have discussed the problem of public ingress to lakes and streams of the Territory in detail. The acquisition of public service sites on the lakes and streams continues to be a pressing problem. The Alaska Fisheries Board has maintained that since the fish inhabiting the lakes and streams are public property, the water is public property and the land underneath the water is, in almost all cases, public property, it logically follows that pubic access must be provided so the people can utilize these resources. The Department, cooperating with the various Federal and Territorial agencies involved, continued to make efforts to insure public access to the lakes and streams of the Territory—a program proven to be in the best public interest.

1956 FAIRBANKS HATCHERY TROUT PLANTS

Date	Lake	Number Planted	Number of Trout per Pound	Species	Area
July 14-Sept. 15	Boleo	70,000	230-1430	Rainbow-Steelhead	Big Delta
July 3-Aug. 24	Deadman	124,000	630-2490	Rainbow-Steelhead	Northway
July 17	Gravel Pits	9,400	1350	Rainbow	Fairbanks, Alaska Railroad Yard
Sept. 25-30	Gravel Pit	12,500	175-420	Rainbow-Steelhead	4-Mile
August 31	Gravel Pit	1,700	600	Rainbow-Steelhead	20-Mile
August 31	Gravel Pit	600	600	Rainbow-Steelhead	31-Mile
Sept. 2	Gravel Pit	400	600	Rainbow	80-Mile
Sept. 2	Gravel Pit	2,400	600	Rainbow	81-Mile
Sept. 15-Oct. 1	Harding	37,000	170-430	Rainbow-Steelhead	Fairbanks
Sept. 1	Jan	11,000	1000	Steelhead	Dot Lake
July 21-Aug. 31	Lost	28,000	1200	Rainbow-Steelhead	Fairbanks
	TOTAL	297,000			

1956 FIRE LAKE HATCHERY TROUT PLANTS

Date	Lake	Number Planted	Number of Trout per Pound	Species	Area
October 2	Beach	3,775	650	Steelhead	Birchwood Area, Chugiak
July 17 & Aug. 20	Bradley	6,860	1840-3280	Rainbow-Steelhead	Matanuska Valley
August 29	Clunie	13,012	510-1300	Rainbow-Steelhead	Eagle River Area
Sept. 12 & 15	Cordova	8,216	1027	Steelhead	Cordova
July 20 & Aug. 21	DeLaney	10,930	1900-2440	Rainbow-Steelhead	Sand Lake Road, Anchorage
July 18 & Aug. 16	Echo	10,340	1840-3280	Rainbow-Steelhead	Matanuska Valley
July 18 & Aug. 22	Falk	8,920	1330-3280	Rainbow-Steelhead	Matanuska Valley
July 20 & Aug. 21	Green	6,400	2000	Rainbow-Steelhead	Elmendorf Air Force Base
July 19 & 20	Gregory	43,352	2060-3280	Rainbow	Elmendorf Air Force Base
October 10	Hidden	1,500	143-347	Rainbow-Steelhead	Anchorage
July 18, Aug. 16	Keppler	22,120	1840-3280	Rainbow-Steelhead	Matanuska Valley
July 16, Aug. 21	Jewel	12,094	1840-2620	Rainbow-Steelhead	Spenard
July 20, Aug. 23	Long	25,360	1330-2500	Rainbow-Steelhead	Matanuska Valley
July 18	Long	25,936	2620	Rainbow	Mile 86, Glenn Hwy.
July 6	Lower Bonnie	32,580	2800	Rainbow	Mile 84, Glenn Hwy.
July 15, Aug. 15	Lower Fire	20,000	2000	Rainbow-Steelhead	Anchorage

July 5, Aug. 21, Oct. 9	Lucille	157,248	505-2880	Rainbow-Steelhead	Wasilla
July 19, Aug. 22	Matanuska	20,360	1600	Rainbow-Steelhead	Matanuska Valley
July 16, Aug. 22	Mirror	15,743	1330-2440	Rainbow-Steelhead	Chugiak
September 5	Ravine	1,872	936	Steelhead	Mile 84, Glenn Hwy.
August 24	Robe	14,298	1330	Steelhead	Valdez
July 19, Aug. 20, Oct. 8	Rocky	23,150	180-2440	Rainbow-Steelhead	Matanuska Valley
July 16, Aug. 21, Sept. 7	Sand	33,866	209-2620	Rainbow-Steelhead	Spenard
August 16	Sharron	1,840	1840	Steelhead	Matanuska Valley
August 24	Summit No. 1	3,990	1330	Steelhead	Valdez Summit
August 24	Summit No. 2	6,650	1330	Steelhead	Valdez Summit
October 10	Sundi	3,000	286-347	Rainbow-Steelhead	Spenard
September 5	Tex Smith	6,080	936	Steelhead	Mi. 161, Glenn Hwy.
July 23, Aug. 23	Unnamed Lake	5,995	1330-2500	Rainbow-Steelhead	Matanuska Valley
July 5	Upper Bonnie	29,580	3280	Rainbow	Mile 84, Glenn Hwy.
Sept. 7, Oct. 2	Upper Fire	3,734	256-650	Rainbow-Steelhead	Anchorage
July 18	Wiener	9,170	2620	Rainbow	Mile 88, Glenn Hwy.
	TOTAL	587,971			

1956 KODIAK CONSERVATION CLUB HATCHERY

STEELHEAD TROUT PLANTS

Lake	Number of Fry
Anton Larsen No. 3	1,000
Bells Flats No. 23	6,000
Bells Flats No. 25	8,000
Buskin	274,371
Cape Chiniak No. 44	5,000
Cape Chiniak No. 45	5,000
Cape Chiniak No. 46	7,500
Catherine (Base 18)	10,000
Cliff Point No. 34-35	1,500
Louise (Base 19)	10,000
Spruce Cape No. 13	25,000
TOTAL	353,371

WATERSHED MANAGEMENT

The amount of water producing salmon in Alaska is great, but the amount that does not produce in most Alaskan areas is enormous. These waters are not producing salmon because of impassible falls in the watershed which block the ascent of the fish. Other than this, these blocked watersheds differ little from other habitats producing salmon.

One of the functions of the Watershed Management Division has been to explore and examine these non-salmon producing watersheds as to their capabilities of producing salmon, and to check the feasibility, wherever possible, of providing access to the fish by means of fishways.

In this regard, two systems which have been blocked by falls have begun to show their potential as silver and red salmon rearing areas. In the Pauls Basin area, laddered in 1952, the second return of red salmon planted as eyed eggs, and the fifth year return of silver salmon, ascended during 1956 to spawn in the newly opened watershed. At Frazer Lake approximately 500 adults returned from previous eyed egg plants to the base of the falls just below the lake.

The following reports on the progress of the Watershed Management Division represent the combined efforts of the staff:

Walter Kirkness, Senior Biologist
Stanley D. Swanson, District Biologist, Ketchikan
Roy A. Rickey, District Biologist, Kodiak
Charles H. Meachan, District Biologist, Wrangell
Dean Paddock, District Biologist, Wrangell
Robert W. Neal, Fish Culturist, Ketchikan

BIOGRAPHICAL SKETCH

Charles H. Meacham was born September 21, 1925 in Newman, California. He soon moved to the Inyo-Mono area of the Sierra Nevada mountains of California, residing there until enlisting in the U. S. Marine Corps in February 1943. After serving three years with the Corps, two in the South Pacific theater, he was honorably discharged. Resuming his education, he graduated from Utah State Agricultural College in June 1950 with a Bachelor of Science degree in Wildlife Management (Aquatic Option).

Mr. Meacham spent almost six years in biographical work with the California Department of Fish and Game; of this time, five years were devoted to fresh and salt water phases of salmon research. Mr. Meacham was project leader of "Ocean Salmon Study," Dingell-Johnson project, immediately prior to joining the Alaska Department of Fisheries in June of 1956 as District Biologist of the Wrangell-Petersburg District.

Dean Paddock was born June 15, 1927 in Nordland, Washington, and attended elementary and secondary school there and in Auburn, Washington. Following a year of training in a medical technician's school in southern California, he was drafted into the U. S. Army in October of 1945. After a period of Army training, he served in the Medical Corps as an instructor in X-ray technician's work until his release in December, 1946. He married Frances M. Nelson in 1950 and they now have three children. Periods of employment in a wide range of occupations, including commercial fishing, were interspersed into his years of college training. In 1954 the B. A. degree was received from Walla Walla College, where major studies were biology and education. After a period at the Walla Walla

College Biological Station near Anacortes, Washington, he worked briefly for the Fish and Wildlife Service before joining the staff of the Washington State Department of Fisheries in November, 1954. He served with the Fresh Water Environmental Studies group and the Statistics Section of that agency until resigning in May of 1956 to join the Alaska Department of Fisheries as District Biologist for Bristol Bay.

KETCHIKAN DISTRICT

Since 1952 numerous lake and stream systems blocked to anadromous fish by falls have been surveyed and catalogued in the Ketchikan District. The most promising have been selected for further study and test stocking with salmon. Two large lake systems, Old Frank's and Bakewell, were found to offer a good potential for salmon production and contain falls which are not too high to bypass with fishways.

Potential Salmon Rearing Areas

BAKEWELL LAKE PROGRAM

Bakewell Lake System, lying in Smeaton Bay 50 miles east of Ketchikan, has received the most attention in the Ketchikan area since 1954 due to its greater suitability for fishway construction and its considerable potential for salmon production. The Bakewell system consists of an outlet stream one-half mile long containing a 31-foot waterfall one quarter mile from the 740 acre lake, and three excellent tributary streams, the larger of which is approximately four miles in length. This system has been planted with red salmon eggs or fry each year since 1954. Engineering surveys of the Bakewell Falls were finished in 1956 and fishway plans have been completed. Fishway construction at this site will be accomplished when funds become available.

During 1956, 301,200 red salmon fry of the 1955 brood were introduced into Bakewell Lake (Table 1). These fish were planted between June 13 and October 1, and varied in size from 1,400 fish per pound in June to 150 fish per pound in October. The fry were transported by air, from the Ketchikan Deer Mountain Hatchery to Bakewell Lake through the courtesy of the Fish and Wildlife Service. The method used to transport the fish was the same as described in detail in previous Annual Reports—five gallon cans containing water and the fish were aeriated by six volt piston pumps. All fish plants away from the hatchery have been made in this manner.

1956 Plants in Bakewell Lake

The red salmon fry used to plant Bakewell Lake during 1956 had been derived from the natural run of fish in Hugh Smith Lake, Boca de Quadra. Eggs were taken here in the fall of 1955 and transported by air to the Deer Mountain Hatchery where the eggs were incubated and hatched, then the fry were fed until planting time.

Table 1. Salmon planted from the Ketchikan Hatchery during 1956.

Species	Area Planted	Egg Source	Dates	Number of fish	Number per lb.
Red Salmon	Bakewell Lake	Hugh Smith Lake	June 13-Oct. 1	301,200	150-1400
King Salmon	Ketchikan Creek	Soos Creek	July 17-Nov. 9	89,500	75-260
Silver Salmon	Ketchikan Creek	Soos Creek	January 9	53,000	143
			Total	443,700	

During the fall of 1956 red salmon eggs were again taken at Buschmann Creek, Hugh Smith Lake, for introduction into Bakewell Lake as fry in 1957. 814,000 eggs were taken, half in mid-September and half in mid-October. The adult fish were captured with the use of a small beach seine, hand dip nets, and an 80-foot long purse seine. The fish were held in live boxes until ripe and then stripped of eggs and milt. The fertilized eggs were immediately flown back to the Deer Mountain Hatchery.

OTHER FISH PLANTS AND EGG TAKES

Several bodies of water near Ketchikan have been selected as experimental sites for the rearing of silver salmon. These waters are all blocked by waterfalls too high for salmon to ascend, and include Princess Bay Lake, Smugglers Cove Lake, and Whipple Creek.

Silver Salmon Experiment

In addition, small numbers of silver salmon are being reared to migratory size (ready to go to sea) and released in Ketchikan Creek from the hatchery ponds to establish a brood stock which will return to the hatchery. During January of 1956, 53,000 silvers of the 1954 brood year (Table 1) left the hatchery ponds on their own accord to travel to salt water. These fish were of Soos Creek, Washington, stock. 2,200 were marked by removal of the adipose fin so they could be recognized when they return as adults. They had been released from the hatchery into the ponds in September 1955 and fed until they left in January.

12,700 silver salmon fingerling (Table 2), 1955 brood year, of Reflection Lake (Behm Canal) stock were on hand at the hatchery at the end of the year (Fig. 1). All of these will be marked by the removal of two fins prior to their release in Ketchikan Creek in the spring of 1957. The purpose of marking is to distinguish the hatchery-reared fish from those produced naturally in Ketchikan Creek. A sports fishery of considerable magnitude on silver salmon takes place in Ketchikan Creek. The marked fish catch can be calculated by inspection of catches and an approximation of survival can be arrived at by adding the number caught in the creek and the number returning to the hatchery ponds.

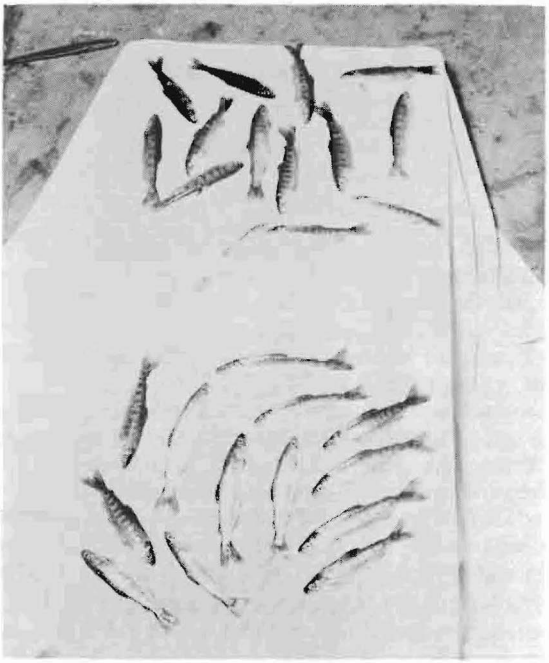

Figure 1. Salmon fingerlings reared at Deer Mountain Hatchery: Silver salmon—top; king salmon—bottom.

Table 2. Salmon (eggs, fry, fingerling) on hand at the Ketchikan hatchery as of December 31, 1956.

Species	Egg Source	Date Received	Status	Number
Red Salmon	Hugh Smith Lake	Sept.-Oct. 1956	eyed eggs & fry	531,000
King Salmon	Soos Creek	October 1956	eyed eggs	99,600
Silver Salmon	Reflection Lake	November 1955	fingerling	12,700
Silver Salmon	Ward Creek	Oct.-Dec. 1956	eyed eggs	396,000
			Total	1,039,300

1956 Silver Salmon Egg Take

In order to provide fry to carry on the silver salmon planting experiments, spawn was taken from fish purse-seined at the base of the Ward Creek Dam, 22 miles from the Ketchikan hatchery (Fig. 2). These fish had accumulated at the base of the dam trying to gain access to the area above. During the latter part of October 1956, 270 fish were seined from this location and transported to the hatchery to be held in live-boxes until ripe. This transportation was accomplished in a half-ton pickup in which the bed was lined with a polyethylene sheet between two tarpaulins.

Figure 2. Seining silver salmon for egg-take at foot of Ward Creek dam.

The truck box was filled half full of water and one-half grain of sodium amytal per gallon of water was used to lower the metabolism of the fish and thus reduce their oxygen demand. Up to 32 fish per load were hauled. No mortalities resulted from this procedure.

These fish ripened over a long period of time, eggs being taken from October into December. A total of 400,000 silver salmon eggs were obtained from this group of fish (Table 2.)

An experiment to test the feasibility of establishing a fall run of king salmon in Southeastern Alaska proceeded satisfactorily in its initial stages.

Fall King Salmon Migrants Reared

Eyed eggs had been secured from the Washington Department of Fisheries hatchery at Soos Creek, Auburn, Washington. These fish had been hatched and reared in the hatchery for about three months and then the 87,500 fingerlings were released in the hatchery pond to migrate out of the Ketchikan Creek and then to the salt water (Table 2). Feeding continued until all kings had left the pond.

The larger fish began leaving the pool in September and by early November there were approximately 30,000 remaining in the pool. On December 31, 1956, only about 2,000 were left (Fig. 1). Prior to migration the fingerlings developed a bright silvery sheen and the parr marks (black horizontal stripes on the sides of young salmon and trout) were no longer visible.

It is planned to continue rearing fall king salmon fingerlings to migrant

size for release in Ketchikan Creek for one cycle, four years, to test the feasibility of establishing a brood stock run which will supply eggs for expansion of the rearing and stocking program.

DEER MOUNTAIN HATCHERY

The Deer Mountain Hatchery, constructed by the Ketchikan King Salmon Derby Committee and maintained and operated by the Alaska Department of Fisheries, has greatly enhanced the program dealing with the stocking and testing of watersheds now blocked to anadromous fish. It places at the biologists disposal the time of the year, the size of fish, and the stages of development of the egg or fish he wishes to plant.

Water Temperature

The Ketchikan hatchery water is fairly cold but similar to temperatures found in many Alaska salmon streams. The average monthly water temperatures at the hatchery during 1956 are given in Table 3. This cold water, of course, causes a long incubation period for the eggs. For instance, the red salmon eggs taken on September 13, 15, and 16, 1955 started hatching on December 3 and were completely hatched on January 15, 1956. The silver salmon eggs taken on October 24 and 25, 1955 started hatching on February 10, 1956 and were completely hatched on March 24, 1956.

Table 3. Average monthly water temperatures in degrees Fahrenheit at the Deer Mountain Hatchery during 1956.

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
35.4	34.4	34.4	36.8	41.2	45.7	52.0	55.0	54.0	45.0	40.3	38.7

Diet

The diet first introduced to the fry consists of 50% beef liver and 50% hog liver. After all fish are eating well and some growth has taken place, the diet is changed to 33 1/3% beef liver, 33 1/3% hog liver, and 33 1/3% salmon viscera. Additional substances as distiller's solubles are added as a mineral and vitamin supplement. The livers are flukey, not suitable for human consumption, and are obtained at nominal prices. The salmon viscera is contributed by the Ketchikan Cold Storage and local commercial trollers. These diet ingredients are cold storaged free of charge through the courtesy of the New England Fish Company.

SPAWNING GROUND SURVEYS

Numerous spawning ground surveys, by air, skiff, and on foot were made in cooperation with the Fish and Wildlife Service. A marked upswing in pink salmon escapement over that of the parent year was noted for most of the streams in the Ketchikan area. In areas where the runs tend to occur late in the year, the pink salmon escapement was very heavy with some of the streams still receiving fish for more than three weeks after the season had closed. An outstanding feature of the pink salmon run in 1956 was the extremely small size of the fish during the early part of the season. On

opening day at Anan Creek, considerable time was lost by the fishermen in removing small pinks from the web of the seine.

KING SALMON TAGGING

King salmon tagging in the Clarence Straits area, north of Ketchikan was continued during the summer of 1956 and was similar to that carried out in the summers of 1954 and 1955. Fish were taken on sport gear and local sport fishermen assisted in the program. The purpose of this investigation is to find out what watersheds are furnishing these fish that support the sport and commercial fisheries in the local waters, and to learn about the migratory pattern of the immature fish.

During 1956, 56 tags were put out and 11 were recovered. To date, there have been 147 king salmon tagged and 34 recovered. Of these 34 recovered, only three were obtained from more than 50 miles away from the tagging location. These three were as follows:

1. Gardner Canal, B.C. 170 miles, 349 days elapsed from tagging to recapture.
2. Tahsis River, B. C., 600 miles from tagging point, 112 days elapsed between tagging and recapture.
3. Fraser River, B. C., 600 miles from tagging point, 38 days elapsed between tagging and recapture.

The other 31 recoveries were mainly retaken within the general tagging area, one of them 350 days after tagging. There was a trend to the south with six recoveries from the vicinity of Duke Island and Cape Chacon.

WRANGELL-PETERSBURG DISTRICT

Work in the Wrangell-Petrsburg District remained largely exploratory in nature though attention was given to the shrimp, halibut, herring, and sport fisheries during their respective peak periods. Recommendations providing for fish protection were made for the proposed hydro-electric project near Wrangell, Alaska, and for the proposed pulp mill at Sitka, Alaska. By combined use of foot travel, power boat, skiff, rubber boat, and airplane, surveys were made of several coastal streams and lakes, and of that portion of the Stikine River drainage lying below the block in the Grand Canyon of the Stikine, British Columbia.

The purpose of the coastal surveys was several fold, viz., to acquaint the District Biologist with the area, catalogue all salmon producing and non-producing waters within the district, locate barriers to salmon migration, and locate a source of brood stock for introduction into barren waters. Of the coastal streams surveyed during 1956, Kah Sheets Creek, Kupreanof Island appeared to have sufficient potential to warrant stream improvement work.

STIKINE RIVER

The Stikine River is the largest single producer of salmon within the district. Catch statistics of past years are poor; however it is evident from these records that the Stikine River gillnet fishery is declining (Table 4). Local fishermen confirm this. This present condition of the fishery warrants the immediate initiation of a thorough study.

The Stikine River has a colorful history, little of which has been recorded. During the Cassiar gold strike of 1873-1875, and again during the

Table 4. Stikine River gill net catch statistics.[a] Total reported or computed catch (in number of fish).

Year	Reds	Kings	Coho	Pinks	Chums	Remarks
1933	21,478					
1934						35 nets, 33 boats
1935	65,500		88,335			
1936						
1937						
1938	60,586	(30,062)	78,480	(2,714)	(10,040)	73 nets operated
1939	77,503		68,477	(41,712)	(8,575)	101 nets operated
1940	(64,177)		(18,426)	(25,497)	(4,960)	86 nets operated
1941	80,686		125,658	(263,081)	(5,627)	94 nets operated
1942	23,296	(5,077)	111,956	(76,908)	(21,211)	119 nets operated
1943	23,812		45,677			
1944	51,596		38,822			70 nets operated
1945	61,973	4,795	73,306	7,717	2,741	70 nets operated
1946	19,485	7,890[b]	68,386[c]	2,776	11,628	65 boats
1947		7,154				
1948	19,369	9,213	34,873	13,131	14,314	87 boats
1949	8,761	4,862[d]	29,295			49 boats
1950	13,000	4,716[e]	23,923			
1951	21,527	5,162	78,696	60,944	11,382	50 units
1952	20,308	5,184[f]	41,073			
1953[g]	22,957	984	51,582	7,215	31,996	58 boats
1954	26,834	17,031	66,605	17,461	35,141	71 boats
1955	8,803	12,171	48,949	14,115	9,067	73 boats
1956	12,171	9,646	34,775	4,734	29,620	160 nets registered

a. Data by courtesy of the United States Fish and Wildlife Service.
b. Total king salmon catch 157,806 pounds or approximately 7,890 kings.
c. Total coho salmon catch 547,088 pounds or approximately 68,368 coho.
d. May only. 97,238 pounds or 4,862 king salmon.
e. May only. Fifteen boats took 94,319 pounds or approximately 4,716 king salmon.
f. Total king salmon catch 103,685 pounds or approximately 5,184 kings.
g. Data includes only July 1 through September 27, 1953.

Parentheses ( ) indicate that the catch includes the Stikine River fishery and possibly other gill net catches from within the Wrangell-Petersburg District.

History

Klondike strike of 1896, the river was used as a main access route to the interior of British Columbia. The fourth salmon cannery constructed in Southeast Alaska was located at the mouth of the Stikine River in 1887; remnants still remain.

Physical Characteristics

The Stikine is an extensive river (Fig. 3). Heading in a plateau of northern British Columbia it drains an estimated 19,400 square miles, 90% of which lies within the Canadian boundary. In its 400 mile course, the river flows through semi-arid country, glacial fields, and wet coastal mountains before emptying into the ocean between Wrangell and Petersburg, Alaska. Due to waterfalls, rock slides, and velocity blocks, only a fraction of this huge drainage is available to spawning salmon. For example, a block exists in the Grand Canyon of the Stikine, short distance above Telegraph Creek, B.C., that prevents salmon entering 50% of the drainage. This area should be the most productive area of the river as it encompasses the clear headwater streams and lakes. The high summer temperatures and low rainfall which prevail in this section of British Columbia are usually associated with fertile waters.

The Stikine is navigable to boats of three foot draft from salt water to Telegraph Creek, B. C., a distance of approximately 150 miles. The average gradient is four feet per mile; from salt water to Great Glacier, a distance of 40 miles, the river is quite slow; for the next 60 miles to Little Canyon, the current averages five to six miles per hour; and above Little Canyon to Telegraph Creek, the Stikine becomes swifter and currents of eight miles per hour are common.

The main river is not subject to violent fluctuations, though changes in depth of up to 18 inches during a 24-hour period do occur frequently on the lower river. High water occurs in late June and continues until early August. During September or early November the river is quite low and in October or November it usually freezes all the way to salt water. This condition normally prevails until April.

Very little flow data is available for the Stikine River. The Canadian Government furnished the flow data in Table 5 from their gauging station at Telegraph Creek, B. C.

Table 5. Stikine River flow data from Telegraph Creek, B.C. gauging station.*

		Flow in cubic feet per second		
Year	**Month**	**Maximum**	**Minimum**	**Mean**
1954	September	10,800	8,700	9,420
1955	May	16,800	5,900e	9,300
	June	120,000	13,900	50,400
	July	88,700	31,100	54,400
	August	28,300	12,700	20,000
	September	14,500	9,280	11,100
	October	10,100	7,400	8,120
1956	May	42,400	3,100e	19,000
	June	50,200	20,800	32,600
	July	39,500	13,600	28,400
	August	15,600	11,200	13,100
	September	20,300	7,710	11,800
	October	9,910	6,890	8,180

*These data have been furnished by the Canadian Department of Northern Affairs and National Resources, Water Resources Branch, and are unpublished and subject to revision.
e Estimated.

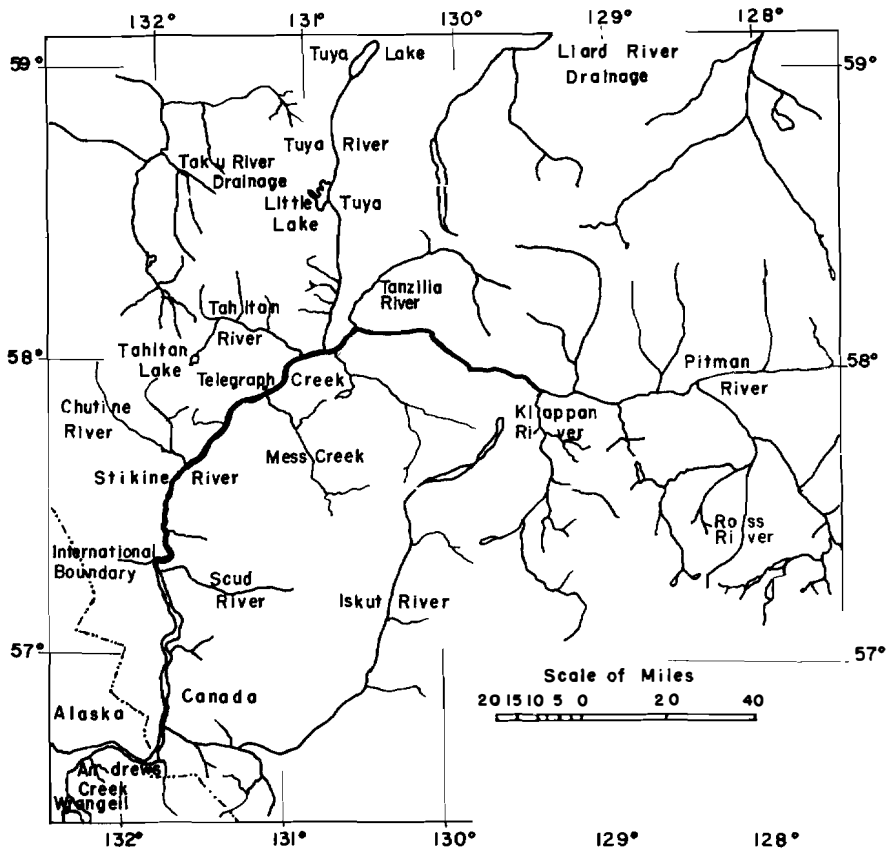

Figure 3. Map of Stikine River watershed.

During July, aerial surveys were made of the entire drainage below the block in the Grand Canyon of the Stikine. These reconnaissance trips revealed obstructions to salmon migration on all major tributaries except the Chutine, a glacial river. The largest of these tributaries, the Iskut River, is known to be a good producer of coho salmon and appears to possess tremendous potential as a producer of red salmon. Heading in a chain of lakes on the central plateau of British Columbia, it flows more than 100 miles before joining the Stikine River 35 miles above salt water. Flowing from a semi-arid plateau, the Iskut gathers most of its water from glacial fields and wet coastal mountains; for this reason it is unpredictable and subject to large fluctuations in water-level. To the writer's knowledge, no salmon have ever been taken upstream from a 12 mile long canyon that is located on the Iskut 40 miles above confluence with the Stikine. At the head of the Iskut River, about one half mile below the chain of lakes, there is a 40-foot cascade that certainly would be a total a barrier to all salmon (Fig. 4). It will be necessary to make an on-the-ground survey of the entire Iskut River system to determine the feasibility of attempting to get salmon past these blocks.

Stikine Survey

The aerial reconnaissance was followed by a skiff trip up the Stikine from salt water to the head of navigation at Telegraph Creek, B. C. Preliminery surveys were made of the following tributaries: Andrews Creek, Kahtate River, Tasakili River, Glacier Mountain Slough, Choquette River, Mud Glacier Slough, Andismith Creek, Porcupine River, Anuk River, Mount Alpha Stream, Flood River, Scud River, Patmore Creek, Oksa Creek, Jon-

Figure 4. Falls on the Iskut River, B.C., a total block to salmon.

quette Creek, Butterfly Creek, Dokdaon Creek, Chutine River, Helveker Creek, Yehiniko Creek, Shakes Creek, Bear Creek, and Mess Creek.

Between Telegraph Creek, B. C., the end of navigation, and the block in the Grand Canyon of the Stikine, four large rivers enter the Stikine. Three of these; Tahltan River, Tuya River, and Tanzila River, deserve further consideration. The Tahltan River and the Tuya River were surveyed in 1956.

TAHLTAN RIVER

The Tahltan River is believed to be one of the largest, if not the largest, contributor of king and red salmon to the Stikine River fishery. Due to its inaccessibility it was necessary to fly to Talhtan Lake and come down the Talhtan River in a rubber boat some 40 miles to its confluence with the Stikine River, 14 miles above Telegraph Creek, B. C. In this manner it was possible to survey the entire Tahltan system. Extensive spawning grounds, suitable to king salmon are present throughout the drainage. From the air, red almon were observed in Tahltan Lake. During the float-trip 400 red salmon and 150 king salmon were counted in approximately 12 miles of river immediately below Tahlton Lake; at this point, the Tahlton is joined by a silt-laden glacial river and visibility is impaired. A partial block was located on the Tahltan River approximtely 20 miles below Tahltan Lake. Although a small number of king and red salmon were able to surmount this obstruction earlier in the year during high water, none passed over during our observations of August 9 and 12, when reds were jumping at the rate of 200 per minute at the block, and finning the water for one half mile downstream. It is doubtful if any of these migrating salmon reached their spawning grounds as the high water period for the year had passed. Figure 5 is a

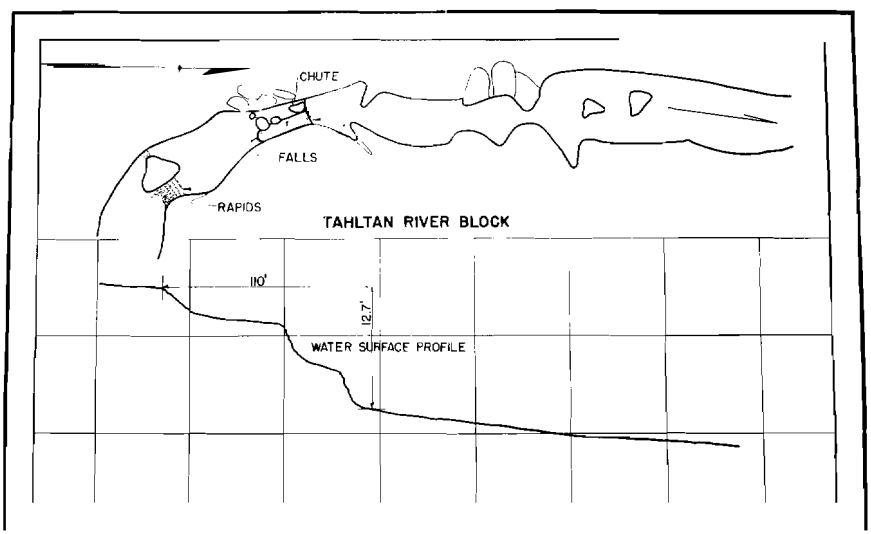

Figure 5. Profile of Tahltan River falls — a partial block to salmon.

photograph of this partial block in the Tahltan taken at a low water stage in late September. Figure 6, a profile of the block drawn by the Alaska Depart-

Figure 6. Partial block to salmon on the Tahltan River.

ment of Fisheries engineer from his survey, shows the four-foot falls, six-foot chute of high velocity, and three-foot falls, which constitute the block. None of these alone would be a block to migrating salmon, but in combination they form a complete block at most water stages. .

Action Taken

Removal of the Tahltan River block has been recommended to, and sanctioned by the Alaska Fisheries Board.

TUYA RIVER

The Tuya River drainage is one of the largest of the Stikine River system. Heading on the Pacific-Arctic divide, the Tuya River flows 100 miles from Tuya Lake, estimated at 10,000 surface acres, to join the Stikine River 20 miles above Telegraph Creek, B.C. Due to the large size and remoteness of the Tuya drainage, it was necessary to work by air. The results of an aerial reconnaissance were so encouraging, an on-the-ground survey was conceived. It was necessary to fly to Tuya Lake and to navigate the river in a rubber boat 100 miles to its confluence with the Stikine River. This survey revealed the Tuya Lake and Tuya River drainage to possess the largest known salmon spawning potential of any Southeastern Alaska drainage. Unfortunately, however, two complete blocks exist on the Tuya River about

2½ miles above its confluence with the Stikine River. Figure 7 is a photograph of the lower total block termed the "slide block." (Note the size of the boulders and how the entire river has been constricted) Approximately 150

Figure 7. Close-up view of the Tuya River slide block.

yards above the "slide block," the second total block or "chute falls" block is located (Figure 8).

During observations made in August of 1956, red salmon and another species, presumed to be king salmon, were observed jumping at the lower block. At a later date, gill netting in Tuya Lak with a variable mesh sampling net failed to yield salmon.

Action Taken

A survey of the Tuya River blocks, by the Alaska Department of Fisheries engineer, was made during the last week in September. Figure 9 is a profile of the Tuya River blocks drawn from this survey.

KODIAK DISTRICT

Frazer Lake

Adult Returns

The problem of evaluating the success or failure of several years red salmon egg plants in Frazer Lake tributaries was initiated in 1956 by attempting to determine the occurrence and age of any red salmon adults appearing below the barrier at Frazer Falls. In order to do this it was necessary to install a trapping device in the

Figure 8. Aerial view of the Tuya River "chute falls" block.

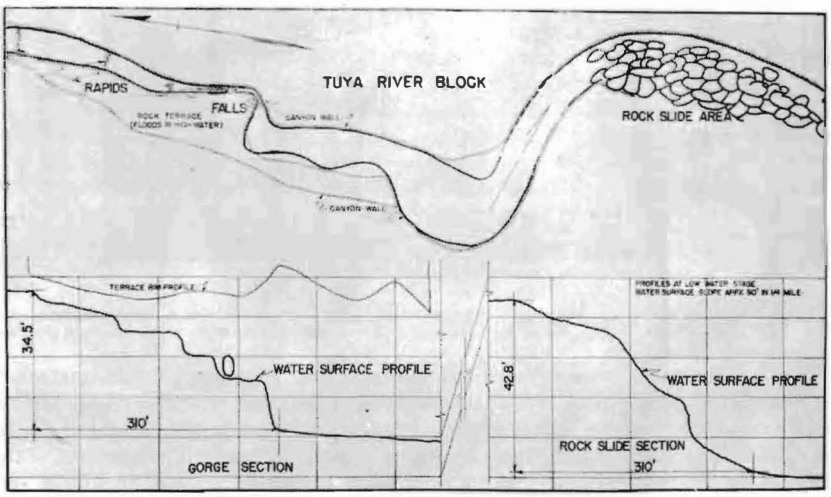

Figure 9. Profile of the Tuya River blocks.

river below the waterfalls. The conventional picket weir, commonly used on large streams, was too expensive. Some sort of device was required to lead the salmon to a trap where necessary data could be taken and the fish put upstream above the falls.

The barrier falls on Frazer River, which is the west fork of Dog Salmon River, is approximately one mile downstream from Frazer Lake. At this point the river is 130 feet wide and has an average depth of two feet, with an even bottom. The streambed is gravel with many football-sized rocks. Iron fence posts six feet long were driven into the river bed approximately two and one-half feet deep and spaced ten feet apart. The posts were driven in place, describing a straight line 180 feet long, diagonal to the flow of water. A roll of two inch by three inch mesh, 16 gauge fish trap wire, three feet wide, was attached to the posts to form the weir. An edge of the wire was turned upstream on the bottom and sufficient large rocks were laid along it to prevent any salmon from going under the weir. The installation was 200 yards below the fall (Fig. 10).

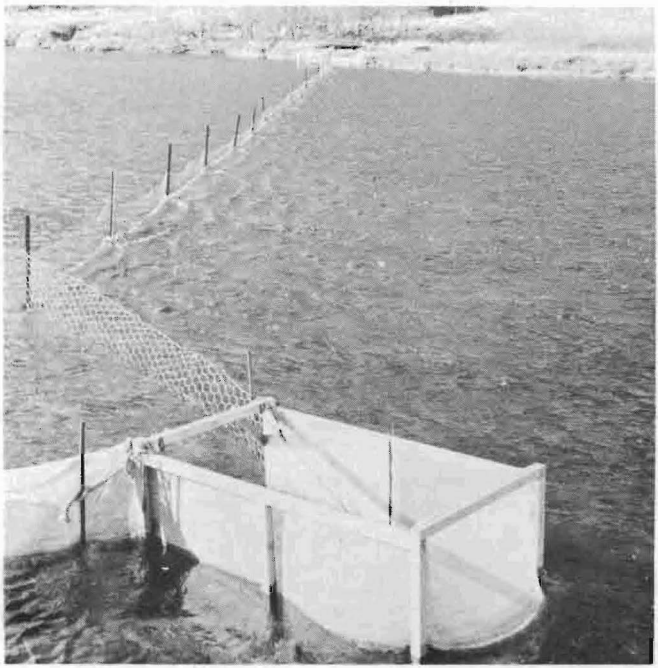

Figure 10. Trap wire weir at Frazer River; downstream trap in foreground.

A conventional wood-frame tunnel trap was installed at the upstream end of the diagonal weir. It was intended that the fish would lead along the wire and enter the trap where a scale sample and length measurement could be taken. The anticipated drop in water depth during mid-June and July did not occur. Instead heavy rains raised the water almost to the top of the weir. This was the condition when the red salmon adults appeared in the river below the weir.

Six salmon were taken in the trap. The balance of the fish went over the wire, continued upstream and began jumping at the barrier waterfalls. This was considered sufficent proof of the return from planting efforts in previous years as there is no record or knowledge of red salmon having been in this stream before. It has also been demonstrated, in other areas, that red salmon are not noted for extending their own range. In this case, there were about 500 salmon jumping at the falls. At any one time, over 200 could be counted.

The six fish that entered the trap were put above the falls to continue their migration to Frazer Lake. The scale samples from them showed that three of the females and two of the males were 42's, that is, returning to spawn in their fourth year having migrated to sea in their second year of life. The other male was a 53 returning to spawn in its fifth year having gone to sea during its third year.

When the weir was installed on the Frazer River, a smolt or downstream migrant trap of a modified wolf design was placed on the downstream end to determine if smolts would lead along the barrier of such relatively large meshes (2 inch by 3 inch hexagonal shape). Three silver smolts and one red smolt were caught in the trap plus several large trout. Either the migration of red smolts from Frazer Lake to the sea had occurred earlier than the installation of the weir or they had avoided the trap and passed downstream through the meshes of the wire. No schools of migrants were observed in the river at any time.

Downstream Migrants

An adequate weir of the same type, but altered to fit the stream conditions of maximum discharge, will be accomplished in 1957. A more valid sample of the adult reds will result in a better age analysis of the returning population. If sufficient numbers of adults can be trapped and put above the falls to ascend to the lake and spawn, stocking Frazer Lake from outside sources may be precluded in 1957.

In 1956 eyed eggs were again planted in the west shore tributary streams of Frazer Lake (Table 6). The source of the eggs was in East Creek, a tributary of Red Lake, a red salmon producing system adjacent to Frazer drainage. Because the source of red salmon eggs had to be shifted from Karluk Lake, fish of the Red Lake population were selected because their migration from salft water to their spawning grounds is of a comparable distance to that involved in the ascent of Frazer River from Olga Bay. Other considerations were that the two watersheds apparently have the same water quality and content, and the East Creek spawn taking site is but five minutes by air travel from the eyeing station at Olgo Bay (Fig. 11).

Eyed Egg Plant

Table 6. Egg take and subsequent eyed egg plant in Frazer Lake streams.

Eggs taken in East Creek, Red Lake	577,163 (from 268 females & 208 males)
Mortality to the eyed stage	76,719 (13.3%)
Eyed eggs planted	500,444
Temperature range in the eyeing station	45° to 50° F.

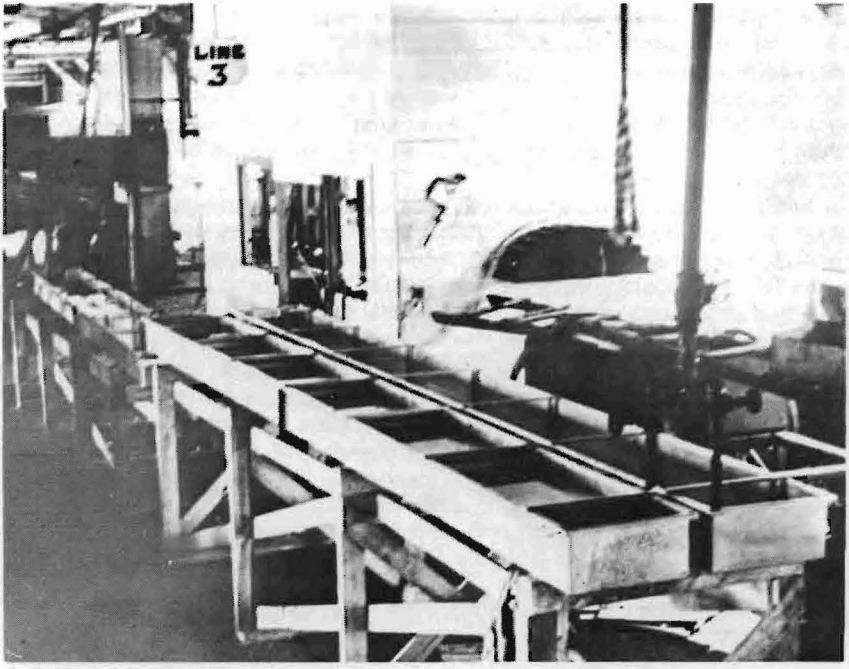

Figure 11. Olga Bay eyeing station.

LAURA LAKE

Red Salmon

Sampling of the returning adult red salmon and seaward-bound smolts of the Pauls Basin watershed was continued in 1956 but on a lesser scale than in previous years. From June 2 until July 13 measurements, scale samples, and numbers of adults were taken. Other work precluded further enumeration of this data. Data was taken from 87 of the 154 adult fish that were trapped at the outlet of Laura Lake. As in previous years, the reds seemed to have little difficulty ascending the fishways constructed in Laura Creek in 1952. This year, as in 1955, the fish were predominantly four year olds (Table 7).

Table 7. Age composition of adult red salmon returning to Laura Lake in 1956

Age Class	Number	Percent
3_2 (jacks)	2	2.3
4_2	68	78.2
4_3	1	1.1
5_2	4	4.6
5_3	12	13.8
Total	87	100.0

After pertinent data were taken, the fish were released into Laura Lake to continue their spawning migration up the lake and when fully matured to spawn in their parent stream, Gretchen Creek. A spawning ground survey was conducted at least three time a week during the month of August and the first week in September. There were between 40 and 60 spawning adults on the gravel in Gretchen Creek for a period of five weeks. This leads observers to believe that there were a minimum of 500 fish in the run. The ratio of males to females was one to one.

A small sample of the downstream migration of smolts was taken during the peak of the run in June. Age analysis of the sample revealed that the 1954 brood, those fish which had spent one summer and one winter in the lake, predominated as shown in Table 8.

Table 8. Age composition of downstream migrants from Laura Lake in 1956.

One check	86.1%	Migrating in their second year
Two check	3.0	Migrating in their third year
Three check	10.9	Migrating in their fourth year

Silvers continued to utilize the fishways and spawning facilities of this system. Several hundred adults were observed going in Laura Lake the first two days in September. Many more were in the stream below. Large numbers of silver smolts passed downstream during June, part of which were taken in the trap along with the red smolts. It appears that the silver salmon are well established in this watershed without artificial introduction by stocking of eggs or fry.

Silver Salmon

OTHER BLOCKED AREAS

In addition to the Frazer drainage and Pauls Basin, there are two more sizeable lakes now blocked to anadromous fishes by barrier waterfalls, that hold promise of being capable of red salmon production. One of these is Spiridon Lake, located on the peninsula between Spiridon Bay and Uganik Bay on the west side of Kodiak Island. This lake comprises approximately 2,200 surface acres and is the third largest lake on the island. The watershed is blocked by a waterfall half way down the mile and one-half outlet stream that empties into Spirdon Bay. Six tributary streams, with adequate spawning facilities for red salmon, feed the lake. The main tributary flows from a system of ponds and lakes three miles to the west of Spiridon Lake. Spiridon Lake now supports a population of rainbow and dolly varden trout.

The other potential producer mentioned above is Hidden Lake on Afognak Island. This lake is approximately 1,000 surface acres in area. Three barrier falls in the outlet stream, discharging into Foul Bay on Shelikof Strait, prevent ascent of salmon.

Preliminary surveys were made on the two lakes in 1956. Both of them present more of a problem than does Frazer Lake. The land surrounding the outlet stream in both cases is quite precipitous and difficult to work in. There may be an alternate access to Spiridon Lake rather than the outlet stream. This will be further explored in 1957.

CATCH STATISTICS

The relatively poor catch of salmon in the Kodiak area during the 1956 season was in direct contrast to 1955 when almost three times as many were taken. Table 9 presents the 1956 catch of salmon in the Kodiak area by the various forms of gear.

Table 9. 1956 salmon catch in numbers of fish for the Kodiak District.*

Gear	Reds	Kings	Pinks	Chums	Silvers	Total
22 traps	61,229	82	986,948	86,582	12,600	1,147,511
478 seines & gill nets	244,895	494	2,362,255	573,744	41,615	3,223,003
Totals	360,124	576	3,349,203	660,326	54,215	4,370,514

*Data courtesy United States Fish and Wildlife Service.

BRISTOL BAY DISTRICT

Permanent assignment of personnel to the Bristol Bay area took place during the spring of 1956 with the location of a biologist at Dillingham. The task of gaining an understanding of the conditions and problems in this extensive region was begun at once.

During the red salmon fishing season, from June 25 to July 25, observations were made in the Naknek-Kvichak and Nushagak fishing areas, with particular emphasis upon the latter. These observations were carried out in all phases of the fishery.

Following the fishing season, aerial surveys were made of the Togiak Lakes, the entire Nushagak system, the Kvichak system including the Alagnak (Branch) River, and the Naknek system. These surveys were timed to coincide, whenever possible, with the presence on the grounds of the spawning stocks. Estimates were made of the relative size of the escapement as conditions permitted.

Special emphasis was placed upon following closely the investigations being carried out in Bristol Bay by other groups. Good contact was maintained with projects of both the Fish and Wildlife Service and the Fisheries Research Institute. The cooperation of these agencies proved most helpful.

As in other districts, it is the intention of the Alaska Department of Fisheries to carry out a program of habitat improvement in Bristol Bay which will: (1) aid in opening for salmon production, lakes and streams which are presently inaccessible; and (2) improve production in localities where the yield is currently at a low level.

A number of blocked areas of undetermined potential for salmon production exist in the Bristol Bay watersheds. One of these is Kakhonak River and Lake. A number of waterfalls were known to exist in the river below Kakhonak Lake, but available information was sketchy and incomplete. Because of the promising numbers of red salmon which return to the first falls each year in an attempt to ascend the river, some work had been done at this site by the Fish and Wildlife Service in the early 1920's. The ladder which was erected at that time survived

Kakhonak Survey

only a short while but stocks have continued to maintain themselves within restricted limits. Knowledge was also vague concerning the potential of the lake for spawning or rearing. Accordingly, in August and September of this year, visits were made to the area for the purpose of gaining a more exact picture of existing conditions.

Four waterfalls, ranging between five and thirteen feet in height, were found to lie in the approximately seven miles of river below Kakhonak Lake. In this distance the river drops about 175 feet. Swift, rocky rapids alternate with wide, slower-flowing, gravelly stretches which are utilized for spawning by the fish that succeed in passing the first three falls. The fourth obstruction proved to be a total block (Fig. 12).

Figure 12. Fourth (upriver) falls in Kakhonak River.

As in other parts of the Kvichak system, this year's escapement to the Kakhonak River was relatively large in comparison with the generally diminished runs of recent years. Reliable observers estimate that 6,000 red salmon passed the first falls. Some of these continued on as far as the base of the fourth fall but most spawned successfully in the adequate area below the second obstruction. In this portion of the river there appears to be sufficient available space to accommodate a larger population than is now able to reach it readily because of the difficulty experienced in mounting the first falls.

Kakhonak Lake is roughly 7,500 acres in extent, and was surveyed late in September to determine the amount of suitable salmon spawning area and to secure an estimate of rearing potential. Explorations were made by

use of a rubber boat, on foot, and by air. Kakhonak Lke was found to actually be composed of an upper and a lower lake separated by riffles and rapids with a drop of several feet between the two levels. Both lakes are similar in character with very irregular shorelines, numerous islands, and large areas of relatively shallow water. Closely surrounded by steeply-rising mountains, the greater portion of the lake is of a rather oligotrophic nature, supporting only a sparse aquatic flora. Sampling with a gill net of graduated mesh size revealed the presence of numerous lake trout and rainbow trout, with lesser numbers of grayling, whitefish, and arctic char (dolly varden). Cottids and sticklebacks were abundant. Juvenile trout, in rather large numbers, were apparent to visual inspection along rocky shores. Small mollusks and aquatic insect forms were found to contribute a substantial portion of the diet of the fish collected. On the basis of the evidence collected during this investigation, it appears that Kakhonak Lake will furnish suitable rearing habitat for a considerable number of young salmon.

Streams, tributary to the lakes, are generally short, rapid, and rocky without extensive spawning area adaptable to red salmon. Suitable conditions for salmon spawning were apparently present, however, in portions of at least two of the several feeder creeks. It is not thought that beaches within the lake can be depended upon to provide an important amount of spawning area. Though definitely limited in this respect, the lakes and their tributaries may, according to this preliminary gross appraisal, be expected to provide enough area to accommodate a population of sufficient size to consititute worthwhile contribution to the fishery.

Future investigation by the Engineering Division of the Department will determine the advisability of providing, in the near future, such assistance as is necessary to : (1) ease the difficulty now encountered by salmon in securing access to the river; and (2) ultimately provide means of reaching the lake.

Other Blocked Areas

Several other extensive areas unavailable to salmon, because of waterfalls and rapids, are included in long-range plans for investigation. One of the most promising of these appears to be the continuation of the Copper River which lies above a waterfall some thirty feet in height located about fifteen miles up this tributary to Lake Illiamna (Fig. 13). The river below the falls is considered to be one of the most important spawning areas of the Kvichak system. The number of spawners returning to this area during this past year (1956) was thought to have approached nearly one million fish. Should the lake and river areas above this block prove promising, their eventual addition to the effective spawning and rearing resources of the system should prove of considerable value to the fishery.

Habitat Improvement

In working toward the second objective of the habitat improvement program, that of increasing production from present runs of fish, the District Biologist participated actively in assisting personnel of the Department's Predation Investigation and Control Section who were working in the Kvichak and Wood River Lake areas on problems concerned with beluga, bird, and trout population.

Although utilized in varying extent throughout the history of the

Figure 13. Aerial view of falls in Copper River.

Nushagak Bay salmon fishery, the taking of king salmon has been secondary to the taking of red salmon. This has been even more true in regard to the gathering of life history information concerning these species. Due to the likelihood that the king salmon fishery will assume increasing importance in the future, it has been thought advisable to initiate a program of investigation, coordinated with the other duties of the District Biologist, to supplement the meager knowledge now available. The first steps in this direction were undertaken this year.

King Salmon

King salmon fishing with 8½ inch mesh gill nets commences during the first or second week of June and continues until the arrival of the red salmon, when additional units of gear arrive and increase the effort that is immediately applied almost entirely to the red salmon. The mesh size used for red salmon is 5½ inch which causes a corresponding decrease in the average size of king salmon taken.

Though the freezer ship fleets were active during all of this period in 1956, resident fishermen and packers failed to reach price agreements until only a few days before the red salmon season and the change-over to 5½ inch mesh nets. This reduced effort resulted in a decrease in the king salmon catch below the volume usually anticipated, though the numbers of this species in the fishing area were considered to have been average or better. No sampling of the king salmon catch was begun until the red salmon season had commenced.

Sampling of the Nushagak Bay king salmon catch was carried on during the five weeks of the red salmon season when 5½ inch mesh nets were used. Length, weights, and scale samples for age analysis were taken. Although the sample was small (98 females and 276 males), it did reveal a typical length frequency for king almon as has been found in other river systems. The males in the sample ranged from 20 to 43 inches in fork length, with most fish being from 22 to 28 inches long. This peak at such a small size is, of course, due to selectivity of the 5½ inch mesh for small fish. The females, on the other hand, were more regular in thir length distribution—being from 28 to 42 inches in length with a peak at 36 inches. Scale readings indicated that most of the kings spend one year in fresh water, and that the males ranged from three to seven years of age, while the females were from four to seven.

King Salmon Spawning Areas

More precise location of the river and stream areas utilized for spawning was also begun during the past season. While the major components of the population are thought to reproduce in the main stream areas of the upper Nushagak and Mulchatna Rivers, investigation has revealed that a significant contribution may also be made by a number of the small tributaries throughout the system. Aerial surveys, though conducted on a limited scale, showed proportionally large numbers of spawners in comparison to the size of the stream in several cases. Expansion of this program, with observations facilitated through use of foot and boat surveys at the height of king spawning, is planned for the following seasons.

Biologist measuring King Salmon for length frequency data.

STATISTICS[1]

The commercial catch of fishery products in Alaska during 1956 amounted to 425 million pounds valued at over 40 billion dollars to the fishermen. This represented an increase of about 110 million pounds or 35 percent in volume and 14 million dollars or 53 percent in value compared with 1955. The number of persons engaged in the fishing industry decreased from 24,619 in 1955 to 23,598 in 1956. The number of wholesale and manufacturing establishments decreased from 179 in 1955 to 168 in 1956, while the value of products prepared for market increased over 23 million dollars in the same period.

In the following tables, the statistical presentation is grouped by fishing districts. The Southeastern district includes the area from the southern boundary of Alaska north to Yakutat. The Central district includes the entire area south of the Alaska Peninsula and north of Yakutat. The Western district includes that area north of the Peninsula including the Kuskokwim and Yukon Rivers.

(1) Fisheries statistics in Alaska are compiled by the U.S. Fish and Wildlife Service. The gross details are included in this Annual Report in order to acquaint the readers with the magnitude and the trend of this important industry. We have drawn our material from **Alaska Fisheries, 1956,** Annual Summary, published and obtainable from the U.S. Fish and Wildlife Service, and from unpublished data obtained from the U.S. Fish and Wildlife Service, Juneau, Alaska. The use of these data is hereby gratefully acknowledged.

Seiners and buyers anchored in Humpback Bay, S.E. Alaska

Table 1. Comparative values of canned salmon giving initial price per case, approximate total value per species, and total for all species.

Year	Silver	Chum	Pink	King	Red	Total Value
	$ 18.24	17.95	18.72	21.08	24.19	
1947	$2,689,888	8,229,464	32,210,755	1,112,539	35,739,285	$79,981,931
	25.96	21.10	24.24	26.70	27.51	
1948	5,732,253	15,082,926	31,445,485	1,435,578	44,964,049	98,660,291
	22.00	15.00	16.00	24.00	26.05	
1949	3,781,482	7,498,382	44,147,496	1,402,934	25,581,995	82,412,289
	22.00	21.10	24.00	23.00	29.00	
1950	5,556,430	15,539,056	26,753,868	1,590,996	34,811,975	84,252,325
	25.28	15.18	20.84	28.41	31.85	
1951	8,726,587	10,925,359	32,505,086	2,489,046	24,603,107	79,249,185
	21.34	15.66	18.52	26.76	28.60	
1952	4,206,757	15,140,209	21,705,200	1,526,532	33,783,606	76,362,304
	19.67	13.43	17.59	27.64	28.50	
1953	2,511,209	10,622,248	16,613,896	1,553,585	26,877,507	58,178,445
	22.87	14.66	19.55	26.76	28.89	
1954	3,826,839	14,766,146	22,230,115	1,374,656	21,158,968	63,356,724
	26.67	17.39	21.29	28.65	31.81	
1955	3,056,498	6,322,462	26,345,976	1,369,984	19,774,011	56,868,931
	28.82	18.75	22.31	31.10	34.55	
1956	2,763,122	12,873,940	26,601,559	1,426,590	34,912,246	78,577,457
				Total value for all species 1947-1956		$757,899,882

Table 2. Total salmon pack in cases (48 one pound cans) and number of operating salmon canneries by district.

Year	Southeastern Pack	Southeastern Canneries	Central Pack	Central Canneries	Western Pack	Western Canneries	Total Pack	Total Canneries
1947	1,056,878	32	1,786,629	43	1,414,895	15	4,260,394	90
1948	1,277,773	34	1,316,494	53	1,374,254	17	3,968,521	104
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	977,682	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*

*Adjusted to eliminate duplication.

Table 3. Number of salmon taken in 1956 compiled by gear, species and district.

Gear and Species	Southeastern Alaska	Central Alaska	Western Alaska	All Districts
SEINES:				
Number	441	907	72	1,420*
Percentage of total catch	53	52	11	43
Silver	125,624	61,052	30	186,706
Chum	1,978,809	2,440,623	368,128	4,787,560
Pink	7,313,627	6,716,295	32,672	14,062,594
King	4,702	2,804	931	8,437
Red	342,523	1,072,504	866,831	2,281,858
Total	9,765,285	10,293,278	1,268,592	21,327,155
GILLNETS:				
Number	1,142	5,920	1,010	8,072*
Percentage of total catch	4	20	89	30
Silver	237,153	316,353	52,185	605,691
Chum	179,724	748,188	423,119	1,351,031
Pink	61,767	981,995	92,436	1,136,198
King	31,220	66,339	135,762	233,321
Red	275,485	1,779,928	9,385,562	11,440,975
Total	785,349	3,892,803	10,089,064	14,767,216
TRAPS:				
Number	113	125	—	238
Percentage of total catch	39	28	—	25
Silver	148,941	117,832	—	266,773
Chum	571,276	485,325	—	1,056,601
Pink	6,018,690	4,242,115	—	10,260,805
King	5,775	13,048	—	18,823
Red	295,773	579,475	—	875,248
Total	7,040.455	5,437,795	—	12,478,250
LINES: (Hooks)				
Number	22,341	28	—	22,396
Percentage of total catch	4	—	—	2
Silver	423,743	—	—	423,743
Chum	5,933	—	—	5,933
Pink	78,203	—	—	78,203
King	197,451	—	—	197,451
Red	6,997	—	—	6,997
Total	712,327	—	—	712,327
TOTAL:				
Silver	935,461	495,237	52,215	1,482,913
Chum	2,735,742	3,674,136	791,247	7,201,125
Pink	13,472,287	11,940,405	125,108	25,537,800
King	239,148	82,191	136,693	458,032
Red	920,778	3,431,907	10,252,393	14,605,078
Grand Total	18,303,416	19,623,876	11,357,656	49,284,948

*Exclusive of duplication

Table 4. Comparative annual catches of fish and shellfish in pounds round and value.

Species	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956
Salmon	381,807,676	338,369,670	388,345,160	264,918,844	276,588,312	282,966,799	220,276,191	247,032,557	203,674,983	269,897,525
	$19,570,408	$23,143,760	$32,662,497	$22,637,117	$32,368,160	$31,020,258	$21,497,532	$24,597,049	$21,614,924	$32,930,179
Herring	187,889,562	174,449,254	33,061,172	165,366,843	81,624,700	45,802,151	34,812,369	35,321,918	64,216,435	103,758,710
	$2,077,314	$1,852,972	$414,072	$2,067,085	$1,003,292	$444,461	$452,811	$472,721	$793,752	$1,280,070
Halibut	34,016,781	34,960,888	35,196,343	38,636,402	32,045,000	33,390,807	26,749,543	36,075,542	26,504,787	33,075,770
	$5,676,630	$5,095,063	$5,157,902	$5,776,224	$4,117,608	$4,533,808	$2,959,704	$4,352,759	$2,371,623	$4,803,627
Sablefish	1,228,431	6,512,346	5,753,724	954,901	5,815,405	1,804,417	3,547,271	4,721,750	4,171,759	2,750,200
	$110,559	$707,734	$427,374	$35,791	$529,368	$141,364	$250,792	$336,200	$282,089	$185,913
Cod	2,347,514	2,337,770	2,185,547	858,318	———	———	———	———	119,001	6,170
	$81,405	$73,860	$54,639	$22,676	———	———	———	———	$2,082	$108
Sharks and Skates	1,975,664	2,250,474	1,507,325	18,883	11,008	3,550	2,450	2,783	———	———
	$23,264	$36,358	$24,333	$105	$110	$53	$131	$141	———	———
Miscellaneous bottom fish[1]	82,900	408,989	192,157	20,604	25,264	377,414	14,146	46,914	98,075	19,885
	$12,462	$17,387	$12,281	$528	$1,620	$22,325	$586	$2,217	$7,414	$625
Clams:										
Butter	11,176	15,644	5,652	———	80	23,116	80,394	9,459	158,558	———
	$838	$939	$339	———	$8	$1,828	$6,432	$643	$13,509	———
Razor	606,540	1,222,649	1,699,695	2,201,717	2,355,681	1,272,454	1,486,222	1,229,135	1,969,226	1,452,673
	$57,621	$128,378	$203,693	$264,206	$347,574	$165,419	$193,209	$159,788	$255,999	188,847
Crabs:										
Dungeness	1,392,611	1,222,326	1,428,401	4,119,425	5,482,416	3,749,412	3,471,806	2,739,383	4,384,043	2,446,122
	$69,630	$63,217	$80,716	$277,382	$478,387	$331,433	$312,463	$246,146	$374,567	$211,844
King	752,668	2,133,354	1,206,945	1,519,249	1,993,912	2,772,833	4,613,209	8,871,070	8,162,920	8,796,022
	$31,988	$96,001	$72,417	$91,155	$227,622	$388,197	$547,431	$880,465	$808,654	$864,065
Shrimp	1,657,299	2,834,803	2,267,934	2,158,260	1,707,816	1,952,777	1,733,882	1,451,929	1,828,127	3,043,598
	$215,449	$226,784	$181,434	$172,661	$179,301	$181,609	$225,405	$188,751	$237,657	$395,668
Miscellaneous shellfish[2]	23,917	7,329	19,630	73,200	44,193	23,021	91,956	67,778	672	85,460
	$2,078	$733	$1,348	$4,392	$3,596	$2,081	$8,074	$5,422	$61	$6,860
Miscellaneous fish[3]	16,855	174,467	19,596	1,445,976	32,909	45,424	87,023	58,502	34,312	21,106
	$1,953	$38,116	$1,564	$22,304	$3,594	$5,548	$12,265	$8,739	$5,241	$3,473
TOTALS	613,809,594	566,899,963	472,889,281	482,292,622	407,726,696	374,184,175	296,966,462	337,628,720	315,322,898	425,353,241
	$27,931,599	$31,481,302	$39,294,609	$31,371,626	$39,260,240	$37,238,384	$26,466,835	$31,251,041	$26,767,572	$40,871,280

1 Includes rockfishes, flounders, lingcod. 2 Includes cockles, oysters, tanner crabs. 3 Includes trout, smelt, albacore, sheefish.

Table 5. Comparative annual production of fishery products as prepared for market by poundage and value.

Species	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956
Salmon	224,862,543	210,608,877	232,616,358	174,765,212	189,100,990	194,611,255	156,657,320	174,484,964	131,280,885	160,569,980
	$93,145,456	$101,193,919	$86,112,666	$87,091,068	$85,887,641	$80,054,432	$62,067,161	$68,206,971	$60,617,136	$81,955,083
Herring	63,249,923	58,388,893	15,081,412	52,106,111	28,213,195	15,995,582	14,365,884	12,464,513	23,025,111	32,721,689
	$6,533,778	$5,694,889	$944,106	$3,819,994	$2,069,608	$944,667	$805,260	$793,790	$1,531,354	$2,262,660
Halibut	26,795,227	27,566,134	27,513,244	27,401,794	23,607,098	25,591,753	20,534,801	27,345,901	23,247,276	25,476,465
	$5,989,188	$6,615,876	$5,425,754	$6,081,896	$4,198,542	$4,730,643	$3,261,482	$4,477,799	$3,220,205	$5,203,496
Sablefish	934,435	4,943,507	4,281,771	680,301	4,170,292	1,297,365	2,455,115	3,277,673	3,042,343	1,923,217
	$143,250	$968,100	$529,935	$51,579	$548,426	$161,812	$271,366	$394,791	$369,866	$305,931
Cod	819,822	786,931	660,664	519,035	———	———	———	———	107,327	5,557
	$163,498	$85,389	$74,680	$65,347	———	———	———	———	$2,655	$167
Sharks and Skates	164,276	177,847	153,777	2,104	1,321	426	294	334	———	———
	$59,572	$82,016	$42,019	$125	$155	$170	$131	$141	———	———
Miscellaneous bottom fish[1]	63,261	240,463	140,167	14,804	20,298	372,809	6,938	24,777	88,308	16,142
	$19,404	$24,115	$14,938	$689	$2,170	$22,591	$832	$2,983	$10,231	$1,579
Clams:										
Butter	2,700	13,452	5,916	3,192	80	11,483	36,108	423,262[2]	82,068	———
	$1,985	$3,584	$1,219	$3,073	$40	$3,303	$12,745	$502,771	$41,358	———
Razor	259,690	428,551	613,140	754,684	670,398	390,956	471,222	———	551,333	411,488
	$247,801	$498,469	$680,171	$857,871	$812,791	$501,354	$607,326	———	$732,478	$545,210
Crabs:										
Dungeness	345,583	302,972	375,908	1,130,828	1,715,967	1,037,741	723,158	2,857,599[3]	1,110,859	496,979
	$326,958	$293,550	$349,693	$972,812	$1,125,419	$876,432	$921,893	$2,994,518	$881,686	444,025
King	195,433	572,107	499,121	626,871	812,690	618,408	1,272,524	———	2,086,565	1,628,603
	$168,507	$684,260	$272,905	$630,876	$754,208	$683,882	$1,171,554	———	$1,767,923	$1,566,750
Shrimp	350,375	493,271	521,703	500,566	427,096	507,857	503,168	481,225	567,919	715,808
	$326,467	$523,750	$473,790	$443,410	$434,201	$485,153	$476,469	$442,159	$495,557	$500,252
Miscellaneous shellfish[4]	4,899	1,026	4,356	47,400	2,174	3,561	8,398	———	150	530
	$2,949	$684	$3,504	$8,875	$1,609	$3,069	$7,734	———	$80	$413
Miscellaneous fish[5]	12,587	181,390	14,249	55,441	20,658	30,963	71,888	50,978	23,092	11,285
	$2,435	$50,827	$3,481	$16,508	$4,391	$9,941	$16,311	$10,482	$6,325	$1,952
Miscellaneous livers, oil & viscera	199,967	417,704	23,337	529,963	———	———	———	———	———	465,149
	$66,701	$149,906	$4,396	$39,149	———	———	———	———	———	$67,632
TOTALS	318,265,721	305,123,125	282,505,123	259,138,306	248,762,257	240,470,159	197,106,818	221,411,226	185,213,236	224,442,892
	$107,197,949	$116,869,334	$94,933,257	$100,083,272	$95,839,201	$88,477,449	$69,620,264	$77,826,405	$69,676,854	$92,855,150

1 Includes rockfishes, flounders, lingcod.
2 Includes both butter and razor clams.
3 Includes both dungeness and king crabs.
4 Includes cockles, oysters, tanner crabs.
5 Includes trout, smelt, albacore, sheefish.

FINANCIAL REPORT

ALASKA DEPARTMENT OF FISHERIES

Expenditures, April 1, 1956 - March 31, 1957

FUNDS ALLOTTED, BIENNIUM APRIL 1, 1955 - MARCH 31, 1957:

Administration	$ 61,500.00
Biology	167,910.00
Construction-Fishways	60,000.00
Expenses of Fisheries Board	9,000.00
Engineering	27,500.00
Education and Information	8,000.00
Inspection	25,000.00
Marine Predator Control & Investigations	60,000.00
Silver Salmon Research, S. E. Alaska	19,830.00
Sport Fish Propagation	95,000.00
Watershed Management	139,050.00
TOTAL	$672,790.00

ADMINISTRATION	Allotted biennium Apr 1, 1955-Mar 31, 1957	Mar 31, 1957 Balance
Salary of Director, Administration	$ 22,000.00	none
Salaries of Personnel, Administration	23,000.00	$ 25.00
General Expenses, Administrative & Travel	16,500.00	989.18
	$ 61,500.00	$1,014.18

	Expenditures		
Salaries & wages	$44,975.00		
Transportation	4,420.35		
Subsistence & lodging	1,950.00		
Office Expense	1,476.49		
Telephone & telepgraph	546.41		
Postage, freight & express	878.97		
Printing	3,406.17		
Industrial Insurance	145.03		
Other General Expense	971.13		
Operating Expense	1,422.82		
Office Equipment	293.45	$ 60,485.82	
		$ 1,014.18	Balance

BIOLOGY:		
Biology Salaries	$100,000.00	$4,365.42
General Expenses	67,910.00	530.99
	$167.910.00	$4,896.41

	Expenditures		
Salaries & wages	$95,634.58		
Transportation	7,038.69		
Subsistence & lodging	18,423.00		
Office Expense	333.81		
Telephone & Telegraph	593.61		
Postage, Freight & Express	1,679.86		
Printing	1,394.35		
Rent	424.02		
Industrial Insurance	613.42		
Other General Expense	2,117.62		
Operating Expense	28.298.82		
Office Equipment	698.09		
Floating Equipment	1,239.53		
Utility Equipment	407.35		
Structures	4,116.84	$163,013.59	
		$ 4,896.41	Balance

		Allotted biennium Apr 1, 1955-Mar 31, 1957	Mar 31, 1957 Balance
CONSTRUCTION — FISHWAYS		$ 60,000.00	$60,000.00
EXPENSES OF FISHERIES BOARD		9,000.00	2,263.93
	Expenditures		
Transportation	$ 2,306.40		
Subsistence & Lodging	3,159.00		
Telephone & Telegraph	104.33		
Office Expense	620.07		
Postage, Freight and Express	167.47		
Printing	228.80		
Other General Expense	50.00		
Office Equipment	100.00	$ 6,736.07	
		$ 2,263.93	Balance
ENGINEERING		$ 27,500.00	$1,356.67
	Expenditures		
Salaries & Wages	$17,103.89		
Transportation	1,860.41		
Subsistence & Lodging	2,931.00		
Office Expense	314.90		
Industrial Insurance	51.40		
Operating Expense	1,469.03		
Utility Equipment	817.41		
Postage, Freight & Express	60.24		
Other General Expense	318.84		
Telephone & Telegraph	49.71		
Office Equipment	481.00		
Printing	42.85		
Rent	642.65	$ 26,143.33	
		$ 1,356.67	Balance
EDUCATION and INFORMATION		$ 8,000.00	$ 33.63
	Expenditures		
Salaries & Wages	$ 4,466.66		
Transportation	648.15		
Telephone & Telegraph	6.16		
Postage, Freight & Express	99.52		
Printing	210.00		
Industrial Insurance	39.15		
Other General Expense	1,467.22		
Operating Expense	185.45		
Utility Equipment	844.06	$ 7,966.37	
		$ 33.63	Balance
INSPECTION:			
Salaries		$ 20,000.00	$1,624.18
General Expenses		5,000.00	113.37
		$ 25,000.00	$1,737.55
	Expenditures		
Salaries & Wages	$18,375.82		
Transportation	303.59		
Industrial Insurance	356.74		
Other General Expense	167.54		
Operating Expense	4,033.90		
Printing	12.30		
Utility Equipment	12.56	$ 23,262.45	
		$ 1,737.55	Balance

	Allotted biennium Apr 1, 1955-Mar 31, 1957	Mar 31, 1957 Balance
MARINE PREDATOR CONTROL & INVESTIGATIONS	$ 60,000.00	$ 646.67
	Expenditures	
Salaries & Wages	$36,181.45	
Transportation	1,749.80	
Subsistence & Lodging	2,853.00	
Office Expense	10.70	
Telephone & Telegraph	27.21	
Postage, Freight & Express	82.96	
Industrial Insurance	1,592.43	
Other General Expense	584.21	
Operating Expense	15,902.62	
Floating Equipment	242.00	
Utility Equipment	126.95	
	59,353.33	
	$ 646.67	Balance
SPORT FISH PROPAGATION	$ 95,000.00	$6,670.82
	Expenditures	
Salaries & Wages	$47,171.16	
Transportation	1,494.70	
Subsistence & Lodging	6,099.00	
Office Expense	152.65	
Telephone & Telegraph	391.02	
Postage, Freight & Express	1,026.36	
Rent	610.00	
Industrial Insurance	297.74	
Other General Expense	691.12	
Operating Expense & Dept. Car Expense	27,833.11	
Utility Equipment	2,485.67	
Printing	1.90	
Office Equipment	74.75	
	$ 88,329.18	
	$ 6,670.82	Balance
WATERSHED MANAGEMENT:		
Salaries	$ 85,000.00	$1,496.03
General Expenses	54,050.00	2,888.59
	$139,050.00	$4,384.62
	Expenditures	
Salaries & Wages	$83,503.97	
Transportation	5,688.51	
Subsistence & Lodging	11,430.00	
Office Expense	549.77	
Telephone & Telegraph	752.13	
Postage, Freight & Express	828.25	
Rent	1,121.74	
Industrial Insurance	408.63	
Other General Expense	1,072.39	
Operating Expense	23,488.82	
Floating Equipment	3,109.64	
Utility Equipment	1,387.19	
Printing	26.40	
Office Equipment	1,297.94	
	$134,665.38	
	$ 4,384.62	Balance

FISHERIES CONTINGENT RECEIPTS FUND (Chapter 64, S.L.A. 1953)

	Total Amount Received	March 31, 1957 Bal.
Monies received from Wakefield's Deep Sea Trawlers, Inc., Seattle, Washington, from October 13, 1953 - August 15, 1955	$ 5,000.00	$1,191.11
Expenditures		
Salaries & Wages	$ 2,299.50	
Subsistence & Lodging	552.00	
Miscellaneous Supplies	200.69	
Petty Cash (for use in tagging program)	150.07	
Matching FOA Money	63.00	
Rent	300.00	
Telephone & Telegraph	64.63	
Transportation	179.00	
	3,808.89	
	$ 1,191.11	Balance
Monies received from Fishermen and Cannery Workers Union No. 24365, Juneau, for use on destruction of Taku River seal, according to Chap. 64, S.L.A. 1953	$ 300.00 Balance	$ 300.00 Balance
Monies received from the Kodiak Conservation Club of the U.S. Naval Station, Kodiak, Alaska, for salary of Robert Simon, Alaska Department of Fisheries biologist, to manage the Kodiak Conservation Club Fish Hatchery at U.S. Naval Station, Kodiak—to supervise the development of sport fishing in the Kodiak area. Amount agreed to be paid from April 1. 1956 thru March 31, 1957	$ 6.000.00	$1,261.50
Expenditures		
Salaries & Wages	$ 4,738.50	4,738.50
	$ 1,261.50	Balance

CONTRACT NO. I — July 1, 1955 - June 30, 1956	Amount Provided	Unused Portion Mar 31, 1957
Monies received under the Saltonstall-Kennedy Act for Investigation of Predatory Animals and their Influences on Prey Species of Commercial Importance	$ 25,000.00	$5.961.19
Funds allotted for four study plans:		
STUDY PLAN I — A study of the sea lion in Alaska with particular reference to its influence on the Commercial Fisheries $11,690.00		
Amount expended 6,250.94	$ 5,439.06	

			Amount Provided	Unused Portion Mar 31, 1957
STUDY PLAN II — An ecological life history study of the beluga with special emphasis on its relationship to salmon	1,540.00			
Amount expended	1,329.80	210.20		
STUDY PLAN III—A study of predation on salmon by gulls, terns, mergansers, and other predaceous birds	8,575.00			
Amount expended	8,409.81	165.19		
STUDY PLAN IV — Basic predator — prey research employing controlled experiments in natural lakes	3,195.00			
Amount expended	3,048.26	146.74	5,961.19	

Total amount of money received from Saltonstall-Kennedy funds on March 31, 1957 $ 19,038.81

Note: Additional travel reimbursements totalling approximately $350.00 will be requested during April 1957.

CONTRACT NO. II — July 1, 1956 - June 30, 1957

Funds allotted for continuance of Study Plan IV. Basic Predator-prey research employing controlled experiments in natural lakes.

			Mar 31, 1957 Balance
Allotted for biologist and biological aides		$ 3,500.00	
Materials for weirs		500.00	
		$ 4,000.00	$1,832.24
	Expenditures		
Salaries and Wages	$ 2,167.76	2,167.76	
		$ 1,832.24	Balance

	Allotted biennium Apr 1, 1955-Mar 31, 1957	Mar 31, 1957 Balance
SILVER SALMON RESEARCH, SOUTHEAST ALASKA	$ 19,830.00	$4,078.60

	Expenditures		
Salaries and Wages	$ 9,701.00		
Transportation	314.78		
Subsistence and Lodging	639.00		
Office Expense	130.45		
Telephone and Telegraph	7.73		
Postage, Freight and Express	35.43		
Other General Expense	31.50		
Operating Expense	2,363.27		
Office Equipment	372.50		
Utility Equipment	2,155.74	15,751.40	
		$ 4,078.60	Balance

LOOKING FORWARD

This section of the 1956 Report was written after the 1957 Session of the Territorial Legislature had adjourned. Because of this, it is possible to look forward to a number of changes during the year 1957. First and foremost, the Alaska Department of Fisheries has now become the Alaska Department of Fish and Game. Under terms of Chapter 63, SLA 1957, the old Department was abolished and a new one created as of April 1, 1957. Likewise, the Alaska Fisheries Board has been replaced by the Alaska Fish and Game Commission. This legislative action will mean but little change in the staff and functions of the present departmental divisions. However, it will result in the formation of a new Division of Fur and Game and a change in the name of the Watershed Management Division to Commercial Fisheries.

The 1957 Legislative Session also passed Chapter 122, SLA 1957. This Act, which becomes effective on July 1, 1957, repeals the old Territorial sport fishing license law of 1951, which called for a license fee of $1.00 for residents and $3.00 for nonresidents. In its place, the new Act provides for both a sport fishing and hunting license. The resident sport fishing and hunting licenses will be $2.00 each and the nonresident $4.00 each. All license fees will be put in a revolving fish and game fund and must be used exclusively for the protection, propagation, investigation, and restoration of the sport fish and game resources of the Territory. This should result in an expansion of the future programs for the Sport Fish. and Fur and Game Divisions.

The operations of the several divisions for the coming year will continue along the lines outlined in the past with such additions as become possible with the increased funds appropriated by the 1957 Legislature.

ALASKA FISH AND GAME COMMISSION

This new Commission is composed of seven members. Chapter 63 provides for a continuation of the programs of the Alaska Department of Fisheries through a provision in the Act whereby four members of the Alaska Fisheries Board will continue in office as members of the new Alaska Fish and Game Commission. The three other members will be representative of the sport fishing, hunting and trapping interests. Provision is also made for the establishment of advisory committees at places in the Territory designated by the Commission. These committees, which will be composed of persons well informed on the fish and game resources of the locality, will make recommendations on regulations and other matters to the Commission.

ADMINISTRATION

The Director of the new Department will have general supervisory and administrative powers and control all activities and functions of the Department of Fish and Game, under the supervision and direction of the Commission and shall administer all the provisions of the applicable laws of the Territory relating to fish and game. He will continue to attend meetings and hearings, as a representative of Alaska, when it is felt his attendance would be of advantage to the Territory.

BIOLOGICAL RESEARCH

Taku River Salmon Investigations

The long term research project on the Taku River will be continued as in the past with such refinements in techniques as become necessary from time to time. While the main study is on the king salmon, additional emphasis will be placed on the other four species.

Kitoi Bay Research

Although the main laboratory and hatchery building has been completed, additional improvements will be made as the necessity arises. With the setting up of new experiments in the surrounding lakes, it will mean the construction of downstream migrant traps, fishways and upstream counting arrangements for the returning adults. This station is ideally located for conducting basic research on utilization of waters now nonproductive of salmon.

King Crab Studies

The commercial fishery for this species is continuing to expand and, unless something unforeseen occurs marketwise, gives promise of becoming one of the important fisheries of Alaska. Research will be centered on rate of growth studies and the migratory habits. Headquarters for this investigation will be at Kodiak, where suitable facilities have been installed.

Silver Salmon Research

This program will be aimed at working out the physical and other factors in the waters of Alaska that limit the production of this species. It is believed that much can be done to increase this production by utilizing methods now employed successfully in the States for other species. Under this heading can be listed the rehabilitation of certain waters to eliminate predators and competitors and by the judicious use of fertilizing materials.

COMMERCIAL FISHERIES

Under terms of Chapter 63, SLA 1957, a Division of Commercial Fisheries was created. By action of the new Fish and Game Commission at its first meeting in April 1957, the Division of Watershed Management was abolished and its functions transferred to the Commercial Fisheries Division. Work will continue along the same lines as in the past by the District Biologists at Ketchikan, Wrangell, Kodiak, and Dillingham. It is expected that one additional District Biologist will be hired during 1957 to be located in the Cook Inlet area, probably at Homer.

EDUCATION AND INFORMATION

With the funds made available by the 1957 Legislature, it will become possible to hire one man on a full time basis. His work will be featured by a visual aid program featuring both movies and stills depicting the work of the Department and carrying with it a conservation message that will appeal to children and adults.

ENGINEERING

Because of the insufficiency of the available funds, it was not possible to construct the Bakewell Fishway during 1956. A larger appropriation for this purpose was made by the 1957 Legislature, so it is hoped this worthwhile project can be built during the coming biennium. The engineer will also be called upon to draw up plans and specifications for several minor projects to be submitted by the several divisions.

INSPECTION

With the additional funds now made available, it is expected that operations in this division will be enlarged somewhat during 1957 by the employment of one extra seasonal employee. Added emphasis will be placed on enforcement of the new Territorial sport fishing and hunting license law which goes into effect on July 1. 1957.

MARINE PREDATOR CONTROL AND INVESTIGATION

The present hair seal control programs have been working out most satisfactorily and will therefore be continued in 1957. New types of control measures will be experimented with in Bristol Bay on belugas and predaceous birds. The sea lion investigation will be continued with a concentration of effort on the Wooded Islands off the coast of Montague Island in the Gulf of Alaska.

SPORT FISHERIES

The sport fish program will be continued along the same lines as during the past year, with some increase in the rehabilitation and stocking projects in the Anchorage-Palmer and Kodiak districts. The facilities at the Fire Lake (Anchorage) Hatchery are being taxed to the limit. It is planned to add a warehouse building to take care of needed storage, thus leaving more room in the hatchery for hatching and rearing of the fry.

LAND ANIMAL PREDATORY INVESTIGATION AND CONTROL

Formerly, the funds appropriated for this purpose were handled by the Territorial Treasurer, who in turn worked out an agreement with the Federal Fish and Wildilfe Service for a wolf control program in the Territory. Under the new Fish and Game Department set-up, these monies will be used by the new Department. It is planned to carry on both research and control projects on the wolves in Southeastern Alaska. The control part of the program will be conducted jointly by the Department and the Fish and Wildlife Service.

FUR AND GAME

At its first meeting the Commission decided to withhold any active programs for this division until the fall meeting, when sufficient time will have elapsed for a full study of the problems and finances involved, and for the lining up of personnel.

LITHO BY MINER