## Alaska Department of Fisheries



Annual Report for 1954

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# 1954 <br> ANNUAL REPORT 

## Alaska Fisheries Board

and

# Alaska Department of Fisheries 

B. Frank Heintzleman<br>Governor

Ira H. Rothwell
Chairman
C. L. Anderson

Director

REPORT NO. 6
JUNEAU, ALASKA

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

Herewith is submitted the Sixth Annual Report of the Alaska Fisheries Board, created by the 19 th 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, 1954.
C. L. ANDERSON, Director

IRA H. ROTHWELL, Chairman
KENNETH BELL, Member
HENRY DENNY, Member
ROBERT C. KALLENBERG, Member
J. HOWARD WAKEFIELD, Member

## FOREWORD

The following report contains a summary or progress report on the activities of the Alaska Fisheries Board and the Alaska Department of Fisheries for the calendar year 1954. However, the financial statement is based on the Territorial biennium, April 1, 1953, to March 31, 1955. The statistical tables follow the usual procedure and cover the preceding ten year period.

The work of the Biological Research Division was centered on the investigations of the troll salmon fishery of Southeastern Alaska, the salmon runs of the Taku River, the blackcod fishery, the Kodiak king crab, and with continued construction and improvement of facilities at the Kitoi Bay Research Station. The king crab investigation has already paid dividends in pointing the way toward proper management of this new industry.

As mentioned in previous reports, the department has received wonderful cooperation from interested groups throughout the Territory. The year 1954 saw the establishment of a small modern salmon hatchery at Ketchikan, largely by the efforts of the people of that city through their support of the Ketchikan King Salmon Derby. The building itself was built with funds supplied by the derby committee with the engineering and planning by the staff of the Alaska Department of Fisheries. The water supply, hatchery troughs, drains, and other accessories were installed and supplied with Territorial funds. While primarily for king, silver and sockeye salmon, it is expected that some trout will also be handled. The facilities of the hatchery will assist immeasurably in the activities of the Watershed Management division in the Ketchikan district.

The Paul's Basin project on Afognak Island continued to show encouraging results. The count of downstream migrants from Laura Lake was 10,544 , of which 1,842 were from the 1951 plant of eyed red salmon eggs in Gretchen Creek, the remaining 8,702 were of the 1952 brood. Several hundred silver salmon passed through the fishways again this year to successfully spawn in the watershed above.

The predator control program on hair seals in the Stikine, Taku and Copper River areas continues to show tangible results. Their numbers have been reduced and depredations greatly diminished. As reported in considerable detail in another section of this report, the beluga whale investigation got off to a good start during the 1954 season. The numbers of young salmon taken by this marine predator were indeed surprising.

Good progress was demonstrated again by the staff of the Sport Fish division in their program of rehabilitating and stocking lakes and ponds in the Fairbanks and Anchorage-Palmer areas. Introduced rainbow trout have shown remarkable growth and several of the treated lakes will be opened to fishing during 1955.

## TABLE OF CONTENTS

Page
Foreword
Fisheries Board ..... 9
Administration ..... 21
Biological Research: ..... 22
Salmon Runs of the Taku River ..... 22
Kitoi Bay Research Station ..... 28
Blackcod Research ..... 32
King Crab ..... 34
Inspection ..... 44
Predator Control: ..... 45
Harbor Seal ..... 46
Beluga ..... 51
Sport Fish ..... 58
Watershed Management: ..... 71
Kodiak Area ..... 72
Ketchikan District ..... 76
Engineering ..... 82
Statistics:
Table 1 Comparative Value of Canned Salmon by ..... 85 Species, 1945-1954.
Table 2 Number of Canneries and the Salmon ..... 85
Pack, 1945-1954.
Table 3 Salmon Catch by Apparatus, Species and ..... 86 Districts, 1954.
Table 4 Poundage and Value of Alaska Fisheries ..... 87 Landings, 1945-1954.
Table 5 Poundage and Value of Alaska Fisheries ..... 88
Products Prepared for Market, 1945-1954.
Financial Statement, April 1, 1953 - March 31, 1955. ..... 89
Looking Forward ..... 91

## FISHERIES BOARD

During the calendar year 1954, 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, MARCH 16-20, 1954
The Board elected Ira H. Rothwell, Cordova fisherman, to serve as chairman for the ensuing year. The Director's report covering the general activities of the department since the November 1953 meeting was presented. This was followed by reports of the staff of the several divisions with an outline of the tentative work program for the coming year. In general, this followed quite closely, and was a continuation of, the proposals outlined in the spring of 1953, when funds for the new biennium became available.

In order to expedite the distribution and enforcement of the Territorial sport fish license, the Board held conferences with Acting Governor Hendrickson, Tax Commissioner Dewey, Assistant AttorneyGeneral Edward Merdes and Superintendent of Territorial Police A. P. Brandt. A satisfactory solution was worked out and it is believed conditions will be materially better in the future.

After a discussion of the changes in the 1954 fishing regulations as promulgated by the Fish and Wildlife Service, the following letter was dispatched:

March 23, 1954

Mr. John L. Farley, Director<br>U S. Fish and Wildlife Service<br>Department of the Interior<br>Washington 25, D. C.<br>Dear Mr. Farley:

The Alaska Fisheries Board has just concluded its annual spring meeting. One item of business was a review and discussion of the amendments that your Service has promulgated for the 1954 regulations governing the Alaska Commercial Fisheries.

On behalf of the Board I am pleased to state that substantial agreement was found on more points than at any time in the past. It was also noted that there was partial agreement on several items.

You will recall that the Board, in their brief of November 24, was in full agreement with your curtailment program for Southeast Alaska, whereby the numbers of traps were to be reduced and the closed areas enlarged. The Board was, and still is, of the opinion that both of these measures should be of a permanent nature. What value is there in a curtailment program if the fishery is to be thrown wide open again after a two year period?

In reading the regulations it is noted that the trap closures are effective only through December 31, 1955, but no termination date is mentioned for the area closures. Was this an oversight or is it to be assumed that the area closures are of a permanent nature? If the latter is true the good will created among Alaska fishermen by your original announcement last fall will be destroyed.

If you find that you cannot make both of the above changes of a permanent nature, the Board respectfully requests that a supplemental order be issued at the earliest opportunity stating that all added closed areas will also be effective only through December 31, 1955.

Sincerely yours,
C. L. Anderson, Director
for the Alaska Fisheries Board

The proposal of the Ketchikan King Salmon Derby Committee for the construction of a hatchery at some suitable location in or near Ketchikan was presented to the Board and discussed in detail. In brief, the Derby Committee offered to cooperate with the Alaska Department of Fisheries in this project by constructing the building with their funds, if the department would equip it with water supply, troughs, drains and accessory facilities. The department would be expected to operate the hatchery after its completion. The Board was in agreement that this would be a most worthwhile project. The Director was authorized to proceed with this cooperative venture and to utilize such funds as might be available for this purpose.

1955-57
The proposed budget request for the biennium was presented to the Board for their consideration. After some discussion and minor amendments, the budget was adopted with the provision that the Director be authorized to make such further changes as he deemed necessary before its final presentation to the legislature.

Several changes in the personnel classification and salary schedule were adopted. After reading and acceptance of the financial report for the period April 1, 1953, to February 28, 1954, the meeting was adjourned.

REGULAR FALL MEETING, NOVEMBER 1-6, 1954
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.

In order to discuss a proposed bill to create a Territorial Department of Fish and Game, a joint session was held with representatives of the Juneau Territorial Sportsmen's group. Several other sports groups in the Territory had been interested in such a bill. It was the opinion of the members of the Alaska Fisheries Board that they would take no official action at this time on a combined bill. However, if a bill could be drafted that would get the support of the majority of the commercial and sports groups, the Board would lend support in securing its passage at the coming session of the legislature. It was also
agreeable if the sportsmen's organization wanted a separate Department of Game, but the Board expressed opposition to separating commercial and sport fish, with sport fish being included in a Department of Game. The commercial and sport fisheries of Alaska are so closely interrelated from a management and enforcement basis that it would be rather impractical and inefficient to separate them.

Since it appeared likely that some relaxations would be implemented by the Alaska Game Commission to allow limited commercial fishing in certain lakes of the Bristol Bay area, the Director was authorized to inaugurate a program for exploratory and development work on whitefish, lake trout, and dolly varden trout.

The financial report for the period from April 1, 1953, to September 30,1954 , was read and accepted. It was reported that $\$ 3,000.00$ had now been accumulated in the Contingent Receipts Funds through payments from the Deep Sea Trawlers for research on the king crab. The Board authorized the Director to submit a request to Governor Heintzleman for the release of these funds.

The principal business of the fall meeting was the consideration of recommendations to be submitted to the Fish and Wildlife Service for the 1955 regulations for the protection of the commercial fisheries of Alaska. A public hearing was held for discussion of proposed changes in the regulations. A number of local fishermen appeared to present their ideas and numerous letters were received from residents of other areas. Officials of the Juneau office of the Federal Service were also in attendance to give their viewpoints. Many suggestions were accepted by the Board and included in the following brief, which was transmitted to the Fish and Wildlife Service, Washington, D. C.:

November 17, 1954
Mr. John L. Farley, Director
U. S. Fish and Wildlife Service

Department of the Interior
Washington, D. C.
Dear Mr. Farley:
In accordance with its established policy, the Alaska Fisheries Board herewith submits to you a brief pertaining to the regulation of the commercial fisheries of Alaska for the year 1955.

These recommendations are the result of careful study and incorporate the best and latest available biological information, along with the views of commercial fishermen, operators, the experience and knowledge of the members of the Alaska Fisheries Board and members of the staff of the Alaska Department of Fisheries.

The Board held a joint conference to discuss the proposed regulations with Mr. Clarence Olson, Mr. Frank Hynes and three management biologists of your Juneau office. We are pleased with the cooperative spirit now in evidence between the Service and the Alaska Department of Fisheries. It is our wholehearted wish that this spirit continue.

We wish to express satisfaction with many of the steps taken during 1954 to rebuild some of the badly depleted salmon runs of Alaska. How-
ever, we believe, and are sure you are in accord, that even more drastic changes in management procedure will be necessary in order to bring the salmon fisheries back to their former levels of abundance.

Our stand, as stated in previous briefs, that the Fish and Wildlife Service should place the welfare of the residents of Alaska in high priority when considering regulatory changes is here again reiterated. Consideration of sound biological principles must, of course, be given full consideration.

The following recommendations, suggestions, and comments are herewith offered for your consideration, and are offered in the belief that they are distinct contributions toward the successful rebuilding and management of a great but depleted resource.

## PART 101 - DEFINITIONS

The Board wishes to repeat its recommendation of 1953 relative to gear. Only one type of gear has been defined in the past, namely the trap, Sec. 101.14. It is suggested that definitions for all legal types of gear be incorporated in the 1955 regulations. Furthermore, there should be some clarification as to what time in the process of setting each gear it is considered to be legally fishing, likewise when it is considered to have ceased fishing. There seems to be some confusion and misunderstanding on these points not only amongst the fishermen but on the part of some of the enforcement officers as well.

Sec. 102.33 - The Board is in accord with the proposed rewording of this section as follows: "Fishing for herring by means of any trap is prohibited. This does not apply to pounds used primarily to retain herring alive over extended periods and which are filled by other gear or by infrequent opening of the pound itself.

This will clarify the situation at Auke Bay and Sitka where pounds are used for capturing as well as holding herring used for bait purposes.

Sec. 102.51 - The Board is also in accord with the proposed rewording of this section pertaining to personal use fishing. However, it might be more satisfactory to the general public to eliminate this section entirely from the general provisions. In lieu thereof a special section dealing with personal use fishing should be added under each area as proposed for the Kotzebue-Yukon-Kuskokwim, Bristol Bay and Cook Inlet areas. Conditions do vary considerably from area to area.

## PART 104 - BRISTOL BAY AREA

Sec. 104.2 - The Board was definitely pleased with the acceptance of its 1953 recommendation to move the outer limits of the several fishing districts closer to the river mouths. This gives protection to the salmon on the milling grounds in the bay and allows for a separation of the various races before being subjected to the fisheries. It is recognized that this separation of races is not perfect, but it is, certainly, a vast improvement over past conditions. As information becomes available from the biological investigations these boundaries could undoubtedly be improved. In the meantime some minor adjustments may become necessary to meet the convenience of the fishermen or the en-
forcement agency.
As a general policy the Board believes that wherever practical and wherever quality of the fish will permit, all salmon fisheries should be confined to relatively small districts near the mouths of the rivers. Management of the fisheries would thereby become much easier.

Sec. 104.3 - In consideration of the results of investigations being conducted in several localities along the Pacific Coast the Board has for some time been convinced that a basic policy of longer fishing seasons with properly regulated closed periods during the season is sound. These closed periods may be of two types: (1) longer weekly closures or (2) sustained closures at the peak of the runs. The particular type will depend upon the nature of the runs or races of salmon present in a district. In some cases a combination of the two types might be advisable.

As the underlying biological principals become known to the resident fishermen of Alaska the above management principle becomes more and more acceptable. Good examples are the gill net fisheries in the Stikine, Taku-Snettisham, Chilkat-Chilkoot, and Copper River districts. In view of this the Board is of the opinion that it is now time to give the above method a trial in the Bristol Bay area. It could be applied in all districts, but apparently only the fishermen of the Nushagak district are ready for a complete change in 1955.

However, so far as opening and closing dates are concerned, these could revert to the original dates of January 1 and December 31 throughout the entire area. The actual start and cessation of fishing will be taken care of by mother nature and the economics of the processing operations.

Sec. 104.5 - The weekly closed periods as proposed for the KvichakNaknek, Egegik, Ugashik and Togiak districts are acceptable. However, in the Nushagak district the Board recommends adoption of the weekly closed period schedule as proposed by the fishermen of that district as follows:

1. During the week in which the peak of the run occurs the statutory closed period to be increased to make a continuous closure of 84 hours. Past records will probably show that this occurs very close to July 4. This sustained closure should provide for escapement of the most valuable segment of the run.
2. During the weeks immediately preceding and following the above week the statutory closed period be increased to 60 hours.
3. During the rest of the year the weekly closure to be the regular statutory time of 36 hours.

In several of the fishing areas a proposal has been made to open the weekly fishing periods at 12:00 Noon instead of 6:00 A.M. The advantages of such a change to the enforcement agency is quite obvious. This suggestion is quite acceptable in any area or district where it does not create a hardship on the fishermen, because of weather or other conditions. It would appear that such a change would be satis-
factory to a majority of the resident fishermen of Bristol Bay.
Sec. 104.8 - This section requiring 48 hours notice before a boat can be shifted from one district to another should be retained. The rewording as suggested by the Service is satisfactory.

Sec. 104.9 - Your suggestion for rewording of this section meets with approval. The Board recommends that you go even further on this point by requiring that all drift gill nets be attended by the owner's boat at all times while the net is fishing.

Sec. 104.10 - There are serious doubts as to the advisability of setting minimum mesh sizes for Bristol Bay. However, if such is to remain in the regulations some uniform method of measuring same should be promulgated.

Sec. 104.15 - The clarification of this section by inserting the words "mean low water mark ' in place of "low water mark" is agreeable.

Sec. 104.18 - The question of minimum distance between set nets is discussed in Part 109 - Cook Inlet Area. The same line of reasoning applies in Bristol Bay.

Sec. 104.50 - In the matter of personal use fishing it is recommended that a small beach area adjacent to each village on the bay be set up strictly for that purpose. Illegal sale of salmon from these beaches can be readily controlled with the cooperation of the cannery superintendents and the enforcement officers.

## PART 105 - ALASKA PENINSULA AREAS

Sec. 105.1 \& 105.2 - If the new definitions as being proposed will be of assistance in the proper management of the fisheries there should be no objection.

Sec. 105.5 - Because of the depleted condition of the red salmon runs of Bristol Bay the Board has recommended on numerous occasions that additional weekly closures be promulgated while these runs are passing through this area. Your 1955 proposal for a continuous weekly closed period from 6:00 A.M. Friday to 6:00 A.M. Monday prior to July 5 meets with approval. Perhaps it should be of even greater duration.

Sec. 105.10 - The Board wishes to reiterate its recommendation of last year that the maximum lengths of seines and leads be set at 250 fathoms and 75 fathoms respectively which is the same as now in effect in S. E. Alaska.

## PART 107 - CHIGNIK AREA

Sec. 107.1 - Here again there should be no objection to a redefinition of the area if it will aid in management of the fisheries.

Sec. 107.3-The extension of the weekly closed period from 6:00 A.M. Thursday to 6:00 A.M. Monday making a total of 72 hours is in accord
with the Board's thinking. If additional restrictions are necessary, and it would appear that such is necessary in this case, it would be better to add to the weekly closures than to shorten the overall season.

Sec. 107.6 - So long as traps are legal gear in this area and so long as the escapement is regulated by weir count there seems to be no reason for this discrimination against the use of purse seines or drift gill nets.

Sec. 107.14 - The Board is certainly in accord with the Service's proposal to close four trap sites which have not been used for several years because of the depleted condition of the salmon runs in the Chignik area. Removal of the other four locations might aid materially in bringing these runs back to their former magnitude. If this were done the Board would be happy to withdraw its recommendation relative to section 107.6.

Sec. 107.15a - Your proposal to prohibit fishing inside the lagoon at the head of Aniakchak Bay is agreeable.

PART 108 - KODIAK AREA
Sec. 108.1 - The redefinition of this area ties in with that of the Chignik, area and meets with approval.

Sec. 108.3 - The Board is of the opinion that Kodiak is another area where a long continuous season could be put into effect. Actually no opening and closing dates are necessary, however, for all practical purposes June 1 to September 30 would be satisfactory.

It is further recommended that the weekly fishing period start at 12:00 Noon on Monday and close at 6:00 P.M. on Thursday. Should insufficient escapement develop it is further suggested that a sustained closure be made at the peaks of the runs in the several districts.

Sec. 108.10 \& 108.10a - The proposals to change the fishing areas in Olga Bay and to require fishing boats to report going in or out of the bay are agreeable.

Sec. 108.14 - It is recommended that the maximum length of seine leads be increased from 25 fathoms to 75 fathoms, making it in accord with the practice in S. E. Alaska. This would be an added incentive to keep away from the creek mouths and would result in better quality fish.

Sec. 108.24(d) - The Board is opposed to the proposal to close one mile of beach on each side of Karluk River. Since the fishing pressure is regulated by the weir counts on the river, there does not seem to be any argument from a conservation standpoint. The beach seine fishermen at the mouth of the river would be penalized for the benefit of other gear fishing some distance from the river. The economic repercussions of such a move would be serious in Karluk village.

Sec. $108.24(\mathrm{n})$ - The Board requests that the closed areas in Pauls

Bay and Kitoi Bay on Afognak Island be enlarged as a protection to the research and experimental work now being conducted by biologists of the Alaska Department of Fisheries in these bays. It is believed that a suitable relocation of these two lines could be agreed upon by a conference between employees of the two agencies in Kodiak.

Sec. 108.32 - Your proposal to prohibit all king crab fishing between January 1 and May 31 is strongly opposed. The Alaska Department of Fisheries has had a biologist working on the king crab for the past year. Attached is a preliminary report on this investigation, together with suggestions for regulations that would give protection where needed and still allow this new industry to survive.*

In brief these recommendations would allow pot fishing the year around and close otter trawl fishing during the height of the male and female molting periods in the three districts now being heavily fished.

## PART 109 - COOK INLET AREA

Sec. 109.2 - Until further knowledge of the migratory and schooling habits of the salmon become available the Board will go along with the seasons and weekly closed periods proposed for 1955 with two exceptions:

1. Should it develop that during the early part of the season a minimum amount of gear is fishing for king salmon, it might then become possible to add an extra day or two to the weekly fishing time.
2. Fishermen in the outer district have indicated an acceptance of the principle of protection for the peak of the run. They have suggested the season open on July 5 and run to July 20 , then close until August 1 and remain open again as long as anyone wishes to fish. The Board would be favorableto the adoption of this proposal for 1955.

Sec. 109.12 - The Board has given careful consideration to the dictum of Judge Folta whereby set nets were declared fixed gear and also to the opinion of your solicitor that following this, set nets must be spaced a minimum of 1,800 feet. Assuming that the judge was correct in his statement that a set net is fixed gear, the Board still cannot agree with the opinion of your solicitor that the White Act requires this 1,800 foot interval between set nets.

Your attention is directed to the wording of the act as follows: "to drive or construct any trap or any other fixed appliance within 600 yards laterally, etc." By no stretch of the imagination can it be said that an anchored gill net is driven or constructed. Nothing is driven; nothing is constructed. When a man throws an anchor from a boat to secure his position he certainly is not driving or constructing a boat.

It is realized that some of the set-netters do drive stakes to hold their nets, but it would be relatively easy for them to substitute anchors

[^0]for their stakes. Nothing whatsoever would then be driven.
Attention is again directed to the wording of the act just previous to the above quotation as follows: "to lay or set any seine or net of any kind within 100 yards, etc." It would appear that this is the part of the law that applies to an anchored gill net. The minimum distance would therefore be 100 yards unless the regulations state a greater distance, which in the case of Cook Inlet is 600 feet.

It is urged that you bring this question before your solicitor for reconsideration in view of the above statements. Should his opinion remain unchanged, the Board recommends that your Service support an amendment to the White Act which would allow a "status quo'" regulation for set nets in Cook Inlet and other areas where such gear is legal.

Sec. 109.25 - Since king crab fishing is now limited to pots, in the waters now being exploited, it is felt that no closure is necessary for the present. Very few, if any, soft-shell crabs are taken in pots. These, together with any lightweights, can be readily returned to the water without injury.

The Department expects that its biologist working on king crab will be able to devote some time this coming year to the Kachemak Bay region, but without a fishery it will be impossible to gather the necessary information required for proper management.

## PART 111 - PRINCE WILLIAM SOUND AREA

Sec. 111.1a - The redefinition of the Eshamy district is agreeable.
Sec. 111.2 - The Board wishes to renew its recommendation that a fall season starting about August 20 be promulgated covering a limited area in the vicinity of Valdez Arm and Fidalgo Bay. This would be of assistance to a small group of natives near Ellamar who seem unable to participate in the Copper River fishery.

DUNGENESS CRAB FISHERY - A suggestion has been made by some of the crab fishermen and operators that an escape hatch be required in all crab pots to allow female and small male crabs to leave the pot without handling. This is now being done on a voluntary basis by some of the fishermen. A regulation to that effect would be a good conservation move.

## PART 112 \& 113 - COPPER-BERING RIVER AREAS

Sec. 112.8 \& 113.8 - The Board is in accord with the rewording of these sections to clarify the size of gill nets that may be used.

Comments in Part 109 - Cook Inlet Area relative to set nets also apply to the Prince William Sound, Copper River and Bering River areas.

> PARTS 115-124 - SOUTHEASTERN ALASKA AREA
> Seine \& Trap Fishing Seasons

In its 1953 brief the Board voiced opposition to the system of stag-
gered seasons that were proposed and put into effect for the 1954 fishing season. These staggered seasons force concentration of mobile gear in the open districts. In effect it says to the fishermen 'this is the time the salmon should be here; come and get 'em'. What is needed is not staggered open sea sons but staggered closures during a long fishing season.

The Board has repeatedly made recommendations for a change in the seasonal setup in S. E. Alaska to bring it more in line with modern trends of fishery management. It believes that a majority of the fishermen in S. E. Alaska are now ready for such a change.

In accord with this line of thought a long continuous season for 1955 is being recommended as follows:

$$
\text { Monday, June } 13 \text { to Thursday, October } 27 .
$$

For all practical purposes no opening or closing dates are necessary. The runs of fish and the economics of the processing operation will dictate when the fishermen will start and when the canneries will open.

Because of the heavy concentration of gear in this area and the Service's prediction of poor salmon runs it is proposed that the weekly fishing period be from:

12:00 Noon on Monday to 6:00 P.M. on Thursday.
The 12:00 Noon on Monday is being suggested as a convenience to the enforcement agency. Many fishermen have also expressed a wish for a Noon opening as a convenience to them.

In case it appears that sufficient escapement is not being obtained with this shorter weekly fishing period it is further recommended that additional closed periods be promulgated by field order. These should be so timed as to protect the peaks of the runs. By staggering these closed periods from the outer to the inner districts a selected productive segment of the runs will be enabled to reach the sanctuary of the closed areas in the bays, of which many additional ones were created in 1954.

Sec. 115.3 - It is recommended that the regulations as to size of seines and leads be given more consideration this coming season. Violations were apparently more numerous in 1954 than previously.

Sec. 118.4 - It is again recommended that the gill net season in the Haines region be opened on Monday, May 2, instead of June 24. By having identical opening dates with other gill net districts there will be less tendency for the local fishermen to migrate to the other districts. It is also recommended that the closing date be changed from September 30 to Friday, October 28 to utilize late runs of chum salmon. Your suggested weekly closed period from 12:00 Noon Friday to 12:00 Noon Monday is agreeable. Here again the 12:00 Noon time is for convenience of the enforcement agency as well as the fishermen.

Sec. 119.3(a) - Investigations of the biological staff of the Alaska Department of Fisheries indicates that the long continuous season with shortened weekly fishing periods on the Taku River is working out very
satisfactorily. It is hoped that no changes will be made in this general policy. Since Monday falls on May 2 in 1955, it is suggested that this be the opening date. The fish wheel catches at our Canyon Island Research Station on the Taku River indicate that a substantial run of chum salmon frequently occurs after the closing date of September 30. A closing date of Friday, October 28 would permit the cropping of some of these fish. The Noon opening and closing time is again agreeable.

In lieu of the weekly closed period that you are proposing for 1955 the Board would like to renew its suggestion made in its 1952 brief:

1. The weekly closed period to be 72 hours based on an average of 40 boats fishing per week. This would be computed over the actual fishing days per week.
2. During any weekly fishing period that the average exceeds 40 boats per day, further closed time would be added starting at Noon on the following Monday. This additional time to be allotted on the basis of six hours for each five boats over the norm of 40 .

If this or some similar formula were printed in the regulations previous to the season the necessary changes during the season would become automatic and would obviate the necessity of continually changing field orders.

It is believed that formulas of this nature would work in other gill net districts, but the Board is not in position to offer concrete suggestions as yet.

Sec. 119.6 - Your proposal to limit the depth of gill nets meets with approval. However, instead of the 4 fathom limit, it might be more practical to adopt the fishermen's proposal as follows:

Nets $8^{\prime \prime}$ stretched measure or over - 40 meshes maximum.
Nets $6 \frac{1}{2}-8^{\prime \prime}$ stretched measure - 45 meshes maximum.
Nets under $6 \frac{1}{2}{ }^{\prime \prime}$ stretched measure - 50 meshes maximum.
There should be no restrictions as to the mesh size itself. This is up to the fishermen.

Sec. 119.10(p) - Your proposal to change the upper fishing limit in Taku Inlet is acceptable. Suitable markers should be installed on both sides of the inlet.

Sec. 120.2 - The gill netters of the Stikine area are again asking for a modest extension of the boundaries of this area to compensate for the loss of fishing waters due to the heavy silting at the river mouth. This request seems reasonable.

Sec. 120.3 - Your proposal of a weekly closed period of 72 hours from 12:00 Noon Friday to 12:00 Noon Monday meets approval.

Sec. 120.4 - The Board recommends that the season in the Stikine area be made uniform with the other gill net areas: May 2 to October 28.

Sec. 120.5a - For the convenience of the fishermen it is suggested that the proviso pertaining to use of six inch mesh for a limited period be made effective on a Monday instead of in the middle of a weekly fishing period.

Sec. 124.7(b) - Here again the Board is in accord that some restriction be made on the depth of gill nets. The suggestion made for the Taku district might also be used for Burroughs Bay.

In conclusion, we again assure you of our full cooperation as in the past.

Respectfully submitted by,
/s/ C. L. ANDERSON
C. L. ANDERSON, Director for the Alaska Fisheries Board:
IRA H. ROTHWELL, Cordova, Chairman ROBERT C. KALLENBERG, Dillingham J. H. WAKEFIELD, Port Wakefield KENNETH D. BELL, Fairbanks HENRY DENNY, Saxman


Fishing boats at Juneau

## ADMINISTRATION

The division of Administration handles all general routine business of the Department such as accounting, requisitions, vouchers, personnel records, general files and clerical work. The activities of the Director are likewise covered in this division.

During 1954, inspection and survey trips were made by the Director to all the important commercial fishing districts of the Territory, including coverage of the Alaska Peninsula as far as False Pass. In addition, some time was spent around Fairbanks, Anchorage and Palmer reviewing the sport fish programs in these areas. This work has been exceptionally well received and will be expanded to other parts of the Territory as fast as facilities and funds become available.

In February 1954, the Director attended the organizational meeting of the International North Pacific Fisheries Commission, which was held in Washington, D. C. This new commission was created during 1953 under a tripartite treaty with Canada, Japan and the United States to study the fisheries of the North Pacific and to make recommendations for their utilization, conservation and regulation to the respective governments.

The second meeting of this commission was held in Vancouver, B. C., on October 23-30, 1954, at which time the technical staff presented a review of the work accomplished during the past season. Alaska was represented officially by Governor B. Frank Heintzleman as a member of the Commission and by the following advisors to the American Section of the Commission: C. L. Anderson, Director, Alaska Department of Fisheries; Robert C. Kallenberg, fisherman, Dillingham, and member of the Alaska Fisheries Board; and Larry Fitzpatrick, fisherman, Juneau. Robert R. Parker, Senior Biologist, Alaska Department of Fisheries, was appointed as a technical advisor to the Committee on Biology and Research. The Commission is expected to hold its future annual meetings each fall with the place of meeting being rotated between Japan, the United States and Canada.

The Director and the Senior Biologist of the Department participated in the annual fall meeting of the Pacific Marine Fisheries Commission held at Portland, Oregon, on November 29 - December 1, 1954. The progress of the research programs on the troll salmon and blackcod fisheries came up for special consideration. The ultimate aim of this commission is the proper utilization of the coastal fisheries. Although official membership is limited to the three Pacific Coast States, representatives from Alaska, British Columbia and the U. S. Fish and Wildlife Service are invited to attend and participate in the discussions.

The customary meetings with fishermen's groups in the several major fishing districts were held to acquaint them with the progress of the work programs of the Department and to receive their comments on same. Among the routine duties were the preparation of the minutes of the Board meetings, the writing of a brief to the Fish and Wildlife Service on the proposed regulations for 1955, and preparation of material for the 1953 annual report.

## BIOLOGICAL RESEARCH

The research program of the Division of Biological Research was enlarged during 1954 to include studies of red salmon at the newly established Kitoi Bay Research Station, and studies of king crab in the Kodiak-Cook Inlet area. The studies of the Taku River salmon runs, king salmon, and blackcod were continued during the year.

## BIOGRAPHICAL SKETCH

Robert E. Vincent was born in Eugene, Oregon, on November 14, 1926. He attended grade and high school in Oregon and entered the U. S. Armed Forces in 1945. He served in the Pacific Theater and received an honorable discharge in 1947. In 1947 Vincent entered Oregon State College to study wildlife management and was graduated in 1954. During the course of his formal education, Vincent worked in lumber mills, as a farmer, and finally for the Oregon State Game Commission in Wildlife Habitat improvement. He joined the research staff of the Alaska Department of Fisheries in August, 1954, and is presently stationed at the Kitoi Bay Research Station.

The following report on the progress of biological investigations in 1954 represents the combined efforts of all members of the division staff:

Quentin Edson, Biologist<br>Ed Huizer, Junior Biologist<br>Walter Kirkness, Senior Biologist<br>Robert Parker, Senior Biologist<br>Ken Thorson, Junior Biologist<br>Robert Vincent, Junior Biologist

## SALMON RUNS OF THE TAKU RIVER

The study of the Taku River salmon resources began in 1951. The major amount of effort has been directed toward a study of the king salmon runs; and while field data have been gathered on the pinks, reds, silvers and chums, no detailed analysis has been prepared for these later species. It is the purpose of the investigation on the king salmon to determine the magnitude of the resource, and to evaluate the effects of the existing fisheries upon the spawning escapement. This has been a difficult task, as a direct enumeration of the run close to the fishery is not possible because of turbid glacial water in the main river. The only chance for direct enumeration of the escapement is at the spawning grounds on the clear water tributaries. Such counts are considered as only partial counts of the areas covered, with the likelihood that spawning also occurs in the turbid water tributaries.

The sizes of the yearly populations or runs have been statistically estimated, and while considered to be of proper magnitude are only "'best estimates'", based upon carefully collected data, but subject to future revision as methodology is improved.

Adult Taku River king salmon make their appearance as early as April in the waters adjacent to Taku Inlet and their entrance into fresh water is from late April to early July. While passing through the chan-
nels of Southeastern Alaska, they are subject to a troll fishery which operates up to the entrance of Taku Inlet, being barred at that point by muddy water. In Taku Inlet, gill nets are employed as far as the mouth of the river at Taku Point. (Figures 1 and 2).

The number of individuals comprising the entire adult run of kings has been estimated for the years 1951-1954. (Table 1). The individual fish are of several age groups, hence the product of several different spawning years. The males of the Taku stock exhibit variability in the age at which they will mature, some maturing in their second year, others in their third, fourth, fifth or sixth year of life. The females attain maturity in either the fourth or fifth years of life. Such variability in age at maturity causes the size of individuals to be also variable. While fish above 47.5 inches fork length are rare, individuals as small as 12 inches are quite abundant in some years, and must be sampled with specialized gear to determine their numbers.

Table 1. Estimated numbers of mature Taku River king salmon, by age groups 1951-1954.

|  | Age Groups |  |  |  |  |  |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: |
| Year | II | III | IV | V | VI | Total |
| 1951 | 1,430 | 2,430 | 4,980 | 14,220 | 330 | 23,390 |
| 1952 | 880 | 6,990 | 7,590 | 10,540 | 420 | 26,420 |
| 1953 | 970 | 3,920 | 18,460 | 14,030 | 730 | 38,110 |
| 1954 | 1,222 | 4,114 | 6,996 | 18,345 | 579 | 31,257 |

The catches of mature Taku River king salmon made by the trolling fleet have been estimated for the years 1951-1954. No data are on hand concerning a sizeable sport fishery which a1so exploits the stock. These estimated catches are presented in Table 2 and by reference to Table 1 it is seen that the troll fishery has annually withdrawn about 25 percent of the run.

Table 2. Estimated troll catches of mature Taku River king salmon, by age groups, 1951-1954.

|  | Age Groups |  |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Year | II | III | IV | V | VI | Total | Total Catch |
|  | Total Run* |  |  |  |  |  |  |
| 1951 | 50 | 470 | 1,390 | 3,740 | 100 | 5,750 | .25 |
| 1952 | (none, no fishery due to labor dispute) |  |  |  |  |  |  |
| 1953 | 30 | 900 | 4,490 | 3,420 | 180 | 9,020 | .24 |
| 1954 | 189 | 1,262 | 2,065 | 3,860 | 125 | 7,502 | .24 |

[^1]

Figure 1. A map of the water approaches to the Taku River, Alaska


Figure 2. A map of the Taku River watershed.

Troll gear is definitely selective in the size of individuals taken. Fish above 20.0 inches, fork length, are probably removed without selection, but individuals smaller than 20.0 inches fork length are not representatively sampled. The result, in terms of age classes, is a relatively greater escapement of the second year fish than of the other age groups.

The gill nets employed in the Taku Inlet fishery are all of the single wall, floating type and the mesh size used changes throughout the season according to the species available and most desired. In the years 1951 to 1953, king salmon fishing was done largely with linen nets of approximately nine inch stretch measure meshes. The entrance of the red salmon run in mid-June was the cause of a rapid change-over to mesh size of approximately six inches stretch measure. Thus the first segment of the king run was subjected to a mesh size highly selective to large individuals and the last segment subjected to a mesh size selective to the smaller individuals. Two events have contributed to a reduction of such selectivity in the 1954 catch: (1) A general changeover to nylon nets and (2) a general reduction in king salmon mesh size to approximately 81 inches stretch measure. The estimated removals of the gill net fishery for the years 1951-1954 are presented in Table 3.

Table 3. Estimated gill net catches of mature Taku River king salmon, by age groups, 1951-1954

|  |  |  | Age Groups |  |  |  |  |
| :---: | ---: | ---: | :---: | :---: | :---: | :---: | :---: |
| Year | II | III | IV | V | VI | Total | Total Catch |
| 1951 | 10 | 1,680 | 7,890 | 210 | 9,790 | 0.42 |  |
| 1952 |  | 1,160 | 5,010 | 6,440 | 330 | 12,940 | 0.49 |
| 1953 |  | 480 | 8,280 | 7,590 | 430 | 16,780 | 0.44 |
| 1954 | 109 | 1,435 | 3,191 | 9,306 | 295 | 14,336 | 0.46 |

A thorough comparison of king salmon gill net catch statistics is presented in Table 4. The pertinent features are (1) An increase in the units of gear employed in the fishery, (2) a seasonal value for catch per unit of effort of 7.8 which appears to reflect not only a decrease in available population but an increase in the amount of gear operated, (3) the reduction in total catch, effected through additional weekly closures which tended to offset the increase of gear efficiency due to the use of nylon. The weight of the catch was greater in 1954 than in 1953, being 355,000 pounds as against 335,000 . This higher poundage resulting from fewer fish was caused by the dominant 1949 brood-year class; these five year old fish formed the bulk of the run.

The estimated king salmon escapements for the years 1951-1954 are presented in Table 5. Here again the reduced selectivity of the gear is evident in the data.

Table 4. Catch statistics of the Taku River gill net fishery 1951-1954, king salmon only

| Period | Days of Fishing |  |  |  | Average units of gear |  |  |  | Catch, numbers of fish |  |  |  | Catch per unit effort ${ }^{(2)}$ |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 1951 | 1952 | 1953 | 1954 | 1951 | 1952 | 1953 | 1954 | 1951 | 1952 | 1953 | 1954 | 1951 | 1952 | 1953 | 1954 |
| May 1-7 | $\frac{1}{2}$ | 5 | $3 \frac{1}{2}$ | 4 | 22.0 | 11.1 | 22.0 | 28.0 | 183 | 403 | 681 | 1054 | 16.6 | 7.3 | 8.8 | 9.4 |
| 8-14 | $5 \frac{1}{2}$ | $5 \frac{1}{2}$ | 4 | 4 | 31.7 | 33.5 | 37.8 | 44.6 | 1422 | 2523 | 1642 | 2183 | 8.2 | 13.7 | 10.9 | 12.2 |
| 15-21 | $5 \frac{1}{2}$ | $5 \frac{1}{2}$ | 4 | 4 | 30.0 | 52.5 | 34.2 | 48.0 | 1402 | 3488 | 1818 | 1696 | 8.5 | 12.1 | 13.3 | 8.8 |
| 22-28 | $5 \frac{1}{2}$ | $3 \frac{1}{2}$ | 4 | $2 \frac{1}{2}$ | 40.3 | 57.8 | 48.2 | 65.0 | 4737 | 3210 | 4002 | 3239 | 21.4 | 15.9 | 20.8 | 19.9 |
| 29 - June 4 | $3{ }^{\frac{1}{9}}$ | 1 | 4 | 2 | 39.0 | 52.0 | 49.0 | 60.0 | 1315 | 537 | 5111 | 1775 | 10.4 | 10.3 | 26.1 | 14.8 |
| 5-11 | 0 | 0 | 4 | $2 \frac{1}{2}$ | 0 | 0 | 51.0 | 54.3 | 0 | 0 | 1938 | 1211 |  |  | 9.5 | 8.9 |
| 12-18 | 0 | $\frac{1}{2}$ | 2 | $2 \frac{1}{2}$ | 0 | 18.0 | 16.3 | 51.7 | 0 | 205 | 492 | 1605 |  | 5.7 | 15.1 | 12.4 |
| 19-25 | $\frac{1}{2}$ | 4 | 4 | $2 \frac{1}{2}$ | 31.0 | 40.6 | 42.4 | 74.0 | 60 | 1446 | 558 | 901 | 3.9 | 8.9 | 3.3 | 4.9 |
| $26-J u l y 2$ | $5 \frac{1}{2}$ | 4 | 4 | $2 \frac{1}{2}$ | 36.1 | 35.8 | 30.0 | 60.7 | 287 | 672 | 92 | 309 | 1.4 | 4.7 | 0.8 | 2.0 |
| 3-9 | 5 | $3 \frac{1}{2}$ | 4 | $2 \frac{1}{2}$ | 34.5 | 35.8 | 26.8 | 41.3 | 135 | 296 | 292 | 208 | 0.8 | 2.4 | 2.7 | 2.0 |
| 10-16 | 5 | $3 \frac{1}{2}$ | 4 | 4 | 44.8 | 44.8 | 15.4 | 24.8 | 131 | 71 | 46 | 81 | 0.6 | 0.5 | 0.7 | 0.8 |
| 17-23 | 5 | $3 \frac{1}{2}$ | 4 | 4 | 35.1 | 41.0 | 20.0 | 25.4 | 100 | 68 | 65 | 25 | 0.6 | 0.5 | 0.8 | 0.3 |
| 24-30 | 5 | $3 \frac{1}{2}$ | 4 | 4 | 36.5 | 39.5 | 18.4 | 42.0 | 13 | 11 | 14 | 29 | 0.1 | 0.1 | 0.2 | 0.2 |
| TOTAL | 46\% ${ }^{\frac{1}{4}}$ | 43 | 49 ${ }^{\frac{1}{2}}$ | 41 |  |  |  |  | 97851 | 29301 | 16751 | 4316 |  |  |  |  |
| AVERAGE |  |  |  |  | 34.8 | 38.5 | 31.7 | 44.8 |  |  |  |  | 6.1 | 7.8 | 10.7 | 7.8 |

${ }^{(2)}$ Catch per unit of effort is the average catch in numbers of fish of one gill net for a 24 hour period.

Table 5. Estimated escapement of Taku River king salmon, 1951-1954.

|  |  | Age Groups |  |  |  |  | V |
| :---: | ---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Year | II | III | IV | V | VI | Total | No. of <br> females |
| 1951 | 1,380 | 1,950 | 1,910 | 2,590 | 30 | 7,860 | no count <br> made |
| 1952 | 880 | 5,820 | 2,580 | 4,110 | 100 | 13,490 | 3,480 |
| 1953 | 950 | 2,540 | 5,680 | 3,020 | 120 | 12,310 | 5,720 |
| 1954 | 924 | 1,417 | 1,740 | 5,179 | 159 | 9,419 | 5,293 |

A better measure of effective escapement is through an estimate of the female component. Since optimum escapement is still an unsolved problem, the escapements cannot be termed as good, excellent, etc. Observations of the spawning habits of the Taku king salmon show: (1) That the female assumes almost the entire duty of the preparation of the nest, (2) more than one female may occupy the same nest, (3) males have been observed to move from one nest to another, and (4) the sole function of the male in the entire spawning act seems to be that of fertilization. It would seem a safe assumption then, that within reasonable bounds, the effective escapement is determined by the female component.

The king salmon escapement was not measured at the Canyon Island Research Station in 1954. The fish wheel was operated to measure the abundance of the other species and the adjusted catches for the years 1952-1954 are given in Table 6. The relationship between fish wheel catches and escapement of reds, pinks, silvers and chums is not known.

Table 6. 1952, 1953 and 1954 fish wheel catches of pink, red, silver and chum salmon. Data adjusted to standard unit of effort equal to 168 hours fishing per week.

|  |  | Reda |  |  | Pinks |  |  | Silvers |  |  | Chums |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 1952 | 1953 | 1954 | 1852 | 1953 | 1954 | 1952 | 1953 | 1954 | 1952 | 1953 | 1954 |
| June | 5-11 | 5 | 3 | (a) |  |  | (a) |  |  | (a) |  |  | (a) |
|  | 12-18 | 77 | 53 | 182 |  |  | 56 |  |  |  |  |  |  |
|  | 19-25 | 261 | 61 | 330 | 1 | 8 | 82 |  |  |  |  |  |  |
| 26 | July 2 | 208 | (a) | 338 | 113 | (a) | 10 |  |  |  |  |  |  |
|  | 3-9 | 151 | 55 | 185 | 815 | 102 | 500 |  |  | 2 |  |  |  |
|  | 10-16 | 125 | 24 | 66 | 286 | 56 | 3188 | 22 |  | 4 |  |  | 2 |
|  | 17-23 | 277 | 151 | 75 | 6290 | 1411 | 5119 | 75 | 23 | 49 | 7 | 2 | 0 |
|  | 24-30 | 318 | 260 | 66 | 2583 | 459 | 9320 | 77 | 57 | 76 | 4 | 0 | 10 |
| 31 | Aug. 6 | 255 | 180 | 442 | 2964 | 40 | 2823 | 117 | 52 | 105 | 4 | 19 | 1 |
|  | 7-13 | 47 | 142 | 350 | 149 | 7 | 638 | 67 | 46 | 158 | 10 | 17 | 41 |
|  | 14-20 | 36 | 85 | 59 | 33 | 2 | 76 | 118 | 47 | 63 | 23 | 5 | 32 |
|  | 21-27 | 10 | 39 | 14 | 7 | 3 | 11 | 169 | 122 | 84 | 46 | 47 | 38 |
| 28 | Sept. 3 | 4 | 20 | 6 | 4 | 5 | 6 | 268 | 226 | 127 | 80 | 75 | 133 |
|  | 4-10 | 2 | 2 | 0 | 0 | 2 | 3 | 83 | 62 | 87 | 139 | 56 | 347 |
|  | 11-17 | 0 |  | 1 | 0 |  | 1 | 32 | 60(b) | 61 | 38 | 155 (b) | 504 |
|  | 18-24 | 1 |  |  | 8 |  |  | 401 | 45 | 81 | 571 | 500 | 395 |
|  | Oct. 1 |  |  |  |  |  |  | 514 | 30 | 114 | 1165 | 805 | 1004 |
|  | 2-8 |  |  |  |  |  |  |  | 20 | 120 | (a) | 155 | 190 |
|  | 9-15 |  |  |  |  |  |  |  |  |  |  | 30 | (a) |
|  | 16-22 |  |  |  |  |  |  |  | 2 |  |  | 8 |  |
| TOTAL |  | 1777 | 1075 | 2114 | 13253 | 2095 | 21833 | 1943 | 799 | 1131 | 2087 | 1874 | 2697 |

(a) Wheel inoperative.
(b) Approximation after September 11, 1953.

## KITOI BAY RESEARCH STATION

The Kitoi Bay Research Station, located on Afognak Island near Kodiak, was constructed as the result of an extensive search of Alaska's coastline for a suitable location to carry on a comprehensive research program aimed at studying all phases of the freshwater life of red salmon. This study seeks to determine the feasibility of utilizing lake systems now non-productive, due to barriers such as waterfalls and other obstructions, for rearing red salmon to seaward migratory size. Such an approach, if found biologically and economically feasible, would be a great stride toward enhancing the now diminished runs of red salmon.

Several factors were taken into consideration while various locations were studied for a suitable site. It was essential to find an area containing several lakes not now producing red salmon because of barriers, but capable of rearing salmon. The area also had to have a lake which had a natural run of red salmon so the experiment could have a reliable control. Such a situation was found to exist at Kitoi Bay. Kitoi

Lake, which has approximately ninety-five surface acres, and a maximum depth of ninety feet, now supports a salmon run consisting primarily of red salmon, but also supports a small silver salmon population. Patricia Lake, which is approximately 350 surface acres and located adjacent to Kitoi Lake, is not a salmon producing system due to a series of impassable falls located near the lake's outlet. The mouths of both lakes, however, flow into Kitoi Bay approximately onehalf mile apart. In addition to Patricia Late there are several other non-productive lakes of varying size within the immediate area which are blocked by waterfalls. Some of these lakes appear to have natural spawning areas while others do not, but all appear capable of rearing salmon. Since these lakes presented themselves as a natural laboratory and are reasonably accessible, plans to establish a research station at Kitoi Bay were formulated in the fall of 1953.

The approved plans for research at Kitoi Bay call for solutions of the following problems: (1) The most practical means of introducing the stock; should the lake systems be stocked with fry or should eyed or green eggs be used where practicable? (2) How many fry or eyed eggs should be planted in a given lake system to enhance the optimum production of returning adults? (3) When should the fry or eyed eggs be planted so that they will best utilize the lake as a rearing area? (4) What is the cost of producing salmon by this means; is it economically feasible to plant a non-productive lake devoid of spawning area, or should plants be made only in lakes where stream barriers can be removed with a moderate cost, thus allowing a natural run of salmon to establish themselves?

An experimental hatchery was planned for construction at Kitoi Bay to rear red salmon to the fry stage and to incubate additional eggs to the eyed stage. A site situated adjacent to the outlet of Patricia Lake was selected for constructing the hatchery. The water source could be obtained from Patricia Creek which does not freeze during the winter months and would allow the eggs to be held over safely until hatching the following spring. The site is also located on salt water frontage, which is advantageous in transporting the fry or eyed eggs to planting locations. When the fry are planted it is proposed to plant in small numbers at first and increase the plants until the optimum number of fry for a particular lake system is determined. This approach will call for a downstream weir at the outlet of the lake to check survival, growth rate and other pertinent facts concerning the seaward migrants. If eyed eggs are planted in lieu of fry, the same sampling procedure will be followed during their downstream migration. Other phases of study will also be pursued when eyed eggs are used. Temperatures in the gravel will be recorded, winter climatic conditions which affect the streams will be correlated with egg development, time of emergence from the gravel will be noted in relation to stream temperature and other physical and chemical characteristics

The time of planting fry is an extremely important part of the program. It must be determined what lake temperatures are optimum for introducing red salmon fry. If proper temperature demands are not complied with, an excessive mortality can be expected. These small salmon fry must have adequate food in the lake for maximum survival. Plants should be made when the plankton bloom is far enough advanced to supply food for the newly introduced salmon. The problem of cor-
relating temperature and plankton with the time of planting will be thoroughly investigated during the course of research.

Certain chemical features of the lakes must also be determined to know optimum conditions for rearing salmon. The dissolved oxygen content of the lake must be measured periodically throughout the year to determine if an adequate oxygen supply is available to fish at all times. The pH must also be measured to check the lake's suitability. These are but a few basic factors necessary in evaluating a lake system.

Another important phase of the program will be a cost analysis of the various approaches to the problem of rearing salmon for production purposes. It will be found if planting non-productive lakes, on an annual basis, is a sound financial practice. The possibilities of planting certain lakes, which have adequate natural spawning areas but are blocked to returning adults, with the idea of laddering or otherwise improving the barrier will also be examined from a financial aspect.

The first steps toward solving the problems just outlined were taken in the spring of 1954 . A downstream weir at the outlet of Kitoi Lake was constructed during the year to count and sample the migration from the control lake. An upstream fence was also constructed for purposes of counting and sampling the upstream migrants. A lake sampling procedure was established so the control lake and certain prospective nonproductive lakes could be sampled regularly throughout the year.

The downstream weir is a modification of the Wolf-type migrant trap. This device employs a series of inclined screens across the creek with a collection flume at the lower end for catching the migrants from the lake. The flume is extended to a holding box where the migrants can be counted and sampled. The weir was completed during the season and will be in operation prior to the downstream migration in 1955.


Plate 1. Looking down on the downstream weir at the outlet of Kitoi Lake.


Plate 2. Upstream view of the downstream weir at the outlet of Kitoi Lake.

The upstream red salmon migrants were trapped just below the weir site and sampled prior to liberation in Kitoi Lake. Measurements, a scale sample and an estimate of sex from external features were taken from each adult prior to release. A total of 2,185 adult red salmon were sampled into Kitoi Lake from July 9 to September 13 by this procedure. The range of sizes extends from 32 to 69 centimeters. The most striking feature of the distribution is the complete separation of jacks which extend from 32 to 41 centimeters in length. This group of precocious males comprise $10.4 \%$ of the total adult run. The total females constitute $51.6 \%$ of the run while the males, including the jacks, comprise the remaining $48.4 \%$.

The first spawning red salmon were observed in certain shoal areas of the lake on August 20. Spawning activity slowly increased after this date, with the peak of red salmon spawning occurring about October 10. Spawning took place in various measured depths from .2 to 14 feet.. It is very possible that spawning occurred at depths greater than 14 feet as this was the lower limit of accurate visibility along the shore line of Kitoi Lake during this time.

In addition to the 2,185 adult red salmon, there were 289 silver salmon migrants to Kitoi Lake. These fish also were observed spawning along the shoreline of Kitoi Lake, but confined themselves in areas adjacent to the outlet of the larger inlet stream. A few silvers and also a few reds were observed in the inlet stream but were soon removed by bears. The extent of this depredation is not yet known, but will receive a thorough study.

A sampling program was set up during the summer to test the temperature, dissolved oxygen and plankton of the various lakes in the area. Temperatures were taken from water bottle samples, but future
temperatures will be obtained with a bathythermograph which records both depth and temperature simultaneously.

Samples of the amount of dissolved oxygen were not started until December. During the latter part of this month, the amount of dissolved oxygen in Kitoi Lake ranged from 12.2 p.p.m. at the surface to 7.2 p.p.m. at a depth of 82 feet. This sampling will be continued through the winter and during the entire year. Samples of other lakes in the area yielded the same results as Kitoi Lake. Additional winter samples will show if the lakes are capable of adequately supporting a salmon population during the winter months.

The foregoing discussion has briefly stated the type of research which will be conducted at the Kitoi Bay Research Station and has presented some of the initial observations made during 1954. The research program will become more intensified during 1955 as further equipment and facilities become available. It is anticipated that the experimental hatchery will be near completion and red salmon eggs can be taken for initial fry planting in the spring of 1956. One complete year of lake sampling will be completed by 1955 and it will be possible at that time to further discuss the course of the research.

## BLACKCOD RESEARCH

Despite a relatively low price paid to the fishermen, the 1954 blackcod (Anoplopoma fimbria) landings exceeded the 1953 catch by over a million pounds. This increased fishery produced additional tag returns from both the 1951 and 1952 tagging programs. These returns serve to further substantiate the earlier findings on the migratory behavior of blackcod.

During 1951, a total of 992 blackcod were tagged in northern Chatham Strait. Including eight tag returns made during 1954, a total of 23 recoveries, or $2.3 \%$, have thus far been recorded. These 23 individuals were free from 299 to 1,078 days and showed an average migration of 1.3 miles, with distances ranging from 0 to 73 miles from the point of tagging. It is not anticipated that many additional tags from this experiment will be recovered due to the length of time elapsed since tagging.

A more intensive tagging program was carried on during 1952 with 5,333 tagged blackcod liberated in areas ranging from Middleton Island in the Gulf of Alaska to southern Chatham Strait. Table 1 summarizes this tagging experiment by area and includes all recoveries through 1954.

Table 1. Summary of blackcod tagging by area, 1952

| Area | No. <br> Tagged | No. <br> Recovered | $\%$ <br> Recovered | Average Miles <br> Traveled |
| :--- | :---: | :---: | :---: | :---: |
| Middleton I. | 969 | 2 | 0.2 | 805 |
| Cape Spencer | 1455 | 10 | 0.7 | 5 |
| Chatham Strait | 2909 | $\underline{45}$ | $\underline{1.5}$ | 12 |
| TOTAL | 5333 | 57 | 1.1 |  |

The results of the 1951 and 1952 Chatham Straight experiments clearly show the non-migratory behavior of these blackcod. There was no definite migration pattern in either experiment as all recoveries were made in random directions from the points of tagging. Only one or two fishing trips were reportedly made to the Middleton Island area during 1954 and no further tags from that area were received either within the area or in any other fishing areas.

Laboratory examination of ovaries from mature female blackcod was undertaken to determine if larger mature females produced more eggs than smaller mature females. Estimates of the numbers of eggs contained in ovaries of female blackcod ranging in size from 24 inches to 38.5 inches were made through a volumetric displacement method. The smallest female examined was found to contain approximately 82,000 mature eggs while the largest female contained an estimated $1,277,000$ eggs. A general regression of the number of eggs from larger to smaller sizes of females was also observed, thus substantiating the hypothesis.

During the course of the sampling program, scale samples were collected to determine the age composition of the population of blackcod encountered by the fishery. Blackcod scales taken from sampling the commercial fishery were found to be from 75 to 90 percent regenerated while scales collected from immature blackcod in Tongass Narrows were only 20 and 30 percent regenerated. All scales could be mounted dry and no special preparation was necessary prior to mounting. All scales were read twice and only those readings which were in agreement both times were used for further study. Readings from scales with three or less annuli were in agreement over 80 percent of the time, but scale readings from the older fish were only found to agree about 60 percent of the time. Due to the low level of agreement and the difficulty encountered in determining the limits of the annuli on the scales of older fish, no scale measurements were taken for a rate of growth study. The results obtained from the use of such scales would be of questionable value. The size groups of blackcod which compose each age class are listed in Table 2. True ages are the number of annuli actually observed on the scale plus one. A blackcod with five annuli, for example, would be in its sixth year but had not completed that year's growth. In some cases, a small check was observed near the center of the scale, but since this check was not consistent with the majority of the scales read, it was considered as an incidental or false check.

The fishing intensity still remains a function of market conditions and the cold storage carry-over. The 1954 Alaska blackcod fishery produced $4,721,750$ pounds as compared with $3,547,271$ pounds landed in 1953 . Despite a relatively high 1953 landing, the 1954 production rose indicating an improved market for blackcod. The blackcod fishery will continue to be carefully checked to insure the stocks of blackcod of remaining at a relatively high level of abundance.

Table 2. Age distribution of blackcod from three major fishing areas and Tongass Narrows

|  | No. of Annuli | Mean Length in Inches | Size Range | No. Scales Used |
| :---: | :---: | :---: | :---: | :---: |
| Middleton Island | 3 | 22.6 | 21.0-24.0 | 12 |
|  | 4 | 25.6 | 22.5-30.0 | 54 |
|  | 5 | 29.4 | 24.0-33.5 | 64 |
|  | 6 | 33.3 | 29.0-38.0 | 20 |
|  | 7 | 35.7 | 34.5-38.0 | 10 |
|  | 8 | - | - | 0 |
|  | 9 | 40.5 | 40.5 | 1 |
| Cape <br> Spencer | 2 | 18.7 | 18.0-19.5 | 2 |
|  | 3 | 21.6 | 21.0-22.0 | 4 |
|  | 4 | 24.0 | 21.5-27.0 | 40 |
|  | 5 | 28.0 | 24.0-32.5 | 55 |
|  | 6 | 31.0 | 27.0-34.5 | 33 |
|  | 7 | 33.9 | 30.5-37.0 | 11 |
|  | 8 | 39.0 | 39.0 | 1 |
| Chatham <br> Strait | 2 | 19.1 | 17.5-20.5 | 6 |
|  | 3 | 21.7 | 19.5-23.0 | 16 |
|  | 4 | 24.0 | 21.0-28.5 | 50 |
|  | 5 | 27.4 | 23.0-31.5 | 60 |
|  | 6 | 31.3 | 27.5-35.0 | 27 |
|  | 7 | 34.5 | 31.0-37.5 | 10 |
|  | 8 | 36.0 | 36.0 | 1 |
| Tongass <br> Narrows | 1 | 14.6 | 10.5-22.0 | 125 |
|  | 2 | 19.4 | 15.0-23.0 | 22 |
|  | 3 | 23.2 | 22.5-23.5 | 4 |

KING CRAB
The king crab, Paralithodes camtschatica, (Plate 1), has long been the chief source of the canned consumed by the American public.

Until recently, almost the entire

## INTRODUCTION

 canned king crab pack has been furnished by the Japanese. The low price of the generally excellent Japanese product has been an almost insurmountable barrier to American producers who have, until 1950, concentrated almost entirely on the Dungeness crab, Cancer magister. While canned Dungeness crab is an excellent product, it differs markedly from canned king crab in color, texture and flavor. These differences have made it difficult to sell large quantities of canned Dungeness crab, for the American consumers have become accustomed to the appearance and taste of the Japanese product. The presence of king crab in commercial quantities in the waters adjacent to Alaska has long been known, but the threat of Japanese competition has been a powerful deterrent to any large scale American operation.

Plate 1. Alaska King Crab
The first commercial king crab operation in Alaska was inaugurated in 1920 when a few cases of canned king crab meat were packed at Seldovia by the Arctic Packing Com-

## HISTORY OF THE FISHERY

 pany. In 1921 there were sixty cases canned at Seldovia by the Alaska Year Round Cannery. A small pack was again put up at Seldovia in 1922, but for the next two years production ceased as the fishing was described as "unsuccessful". In 1925, seventy-five cases were packed at Seldovia, but from 1926 to 1934 no commercial canning of king crab took place in the Territory.In 1935 a pack of forty cases of canned king crab was put up at Hoonah in Southeastern Alaska. From that time until 1947 a small pack was put up at Hoonah each year with the exception of 1945 . In addition, small packs were put up at Seldovia, Homer, and Kodiak.

The first determined effort to exploit this resource was made in 1938 when the floating cannery ship "Tondeleyo' of the Pacific Fisheries and Trading Company operated at Kodiak Island, the Shumagin Islands, and the eastern Bering Sea. The Tondeleyo, which was 113 feet in length, had fair fishing and put up an excellent pack, but the expense and uncertainty of exploratory fishing made the venture unprofitable.

The Japanese, on the other hand, started exporting canned king crab to the United States in 1906. Exact figures on the amounts of imported crab meat for the 1920 's are not available, but it is probable that at least 100,000 standard cases of forty-eight, half pound flats were received each year. A pre-war production high of 613,089 cases was reached in Japan in 1930, and annual production fluctuated at approximately the 400,000 case level until the outbreak of World War II. Table 1 presents the yearly Japanese catches of king crabs prior to World War II.

Table 1. Yearly Japanese catches of king crabs prior to World War II

|  | Eastern Bering Sea Catch |  |  | Total Japanese <br> Production |
| :--- | :---: | :---: | :---: | :---: |
|  | Number of <br> Factory Ships | Total No. <br> Crabs Caught | No. Standard <br> Cases | No. Standard <br> Cases |
| 1930 |  |  |  |  |
| 1931 | None | $1,330,022$ | 28,745 | 613,089 |
| 1932 | 1 | - | - | 416,721 |
| 1933 | 4 | $1,278,280$ | 34,359 | 310,152 |
| 1934 | 2 | $2,075,741$ | 49,829 | 330,877 |
| 1935 | 2 | $1,336,558$ | 30,622 | 471,772 |
| 1936 | 2 | 759,695 | 16,185 | 396,706 |
| 1937 | 2 | 291,794 | 7,864 | 397,225 |
| 1938 | 1 | 516,870 | 13,184 | 447,745 |
| 1939 | 1 | 411,030 | 13,385 | 525,858 |
| 1940 | 1 | 241,781 | 6,206 | 474,390 |
| 1941 | - | $8,607,970$ | 122,400 | 304,608 |
| 1942 | - | - | - | 17,361 |

Source: Cahn - Canned Crab Industry of Japan

Although the Japanese first canned crab in 1892, growth of the industry was slow until 1923 when the successful development of the floating cannery permitted expansion of the fishing operation away from Japan proper. By 1930 the floating canneries started working in the Bering Sea near the Pribilof Islands in Bristol Bay and along the north coast of the Alaska Peninsula. Floating canneries visited these waters every year from 1930 to 1940 , with the exception of 1931 . With the outbreak of war in 1941 , Japanese fishing operations in the eastern Bering Sea were suspended and were not resumed until 1953.

The total Japanese crab pack contains two other species of Paralithoides; the small brevipes, found only in the western North Pacific and platypus, found in limited quantity in isolated spots (Olga Bay) in Alaskan waters but common in the western North Pacific.

In the 1930's, the increasing activity of the Japanese floating canneries in the eastern Bering Sea aroused American interest in our heretofore neglected resource. In 1940, the President requested the Secretary of the Interior to investigate the practicability of establishing an American king crab industry in Alaskan waters and in the Bering

Sea. In the face of Japanese competition, private enterprise was unwilling to undertake the venture and Congress, in that same year, authorized the Fish and Wildlife Service to conduct research on the problems of king crab biology and technology, and on the abundance and distribution of the resource. Accordingly, in 1940 and 1941, the Service conducted exploratory fishing in the Bering Sea, along the Alaska Peninsula, Kodiak Island, Cook Inlet, Prince William Sound, Yakutat, Icy Straits, and Frederick Sound. Biological research and experiments in the technology of processing were also carried out. The results pointed the way toward prof itable commercial enterprises in Cook Inlet, around Kodiak Island, along the Alaskan Peninsula and in the Bering Sea.

In an effort to assist the domestic crab packers, the tariff on imported crab meat was raised from $15 \%$ to $22 \frac{1}{2} \%$ ad valorum in 1941. Later in that year the commencement of hostilities between Japan and the United States brought an unscheduled end to the research being done by the Fish and Wildlife Service, and effectively extinguished any hopes of a large scale American fishery for four more years.

With the end of the war in 1945, American operators began to show signs of interest in Alaska's king crabs. Exploratory fishing in the Bering Sea in 1946 was conducted by Wakefields with the trawler "Bering Sea" and by Libby, McNeill and Libby with the "Chirikof". Both companies put up experimental packs. The work continued in 1947, when the 'Deep Sea', the largest trawler yet built on the Pacific Coast, was put into operation by Wakefield's Deep Sea, Incorporated. The packs were put up in the form of frozen picked meat and frozen meat in the shell.

A new type of operation entered the field in 1948 when a large factory ship, the '"Pacific Explorer", with a fleet of trawlers was sent to Alaska by the Pacific Exploration Company, a firm subsidized by the Reconstruction Finance Corporation. The Pacific Explorer canned over 17,000 cases in 1948, but did not return to Alaska in subsequent years.

From 1948 to 1954, three American firms have processed king crab in the Bering Sea: Deep Sea, Incorporated, with the trawlers 'Deep Sea'", 'Foremost'", and 'Shelikof"' have frozen their entire production; Capt. Harry Guffey with his trawler "Chirikof" has also frozen his pack; Capt. J. E. Shields with the trawler "Nordic Maid" has canned his production.

The development of large scale crab fisheries at Kodiak and Cook Inlet lagged behind that in the Bering Sea. Once the harvesting of these stocks was started, the expansion has been nothing short of phenomenal. Starting with a catch of 3,119 pounds (round weight) in 1951 in Cook Inlet, the catch rose to a high of $1,710,880$ pounds (round weight) in 1953. The Kodiak catch of 64,882 pounds (round weight) in 1950, increased to over $3,000,000$ pounds (round weight) in 1954, making Kodiak the largest center of canned crab meat production on the Pacific Coast.

It is interesting to note that while the production of crab meat from the Bering Sea has largely been frozen, the production from Kodiak and Cook Inlet is mainly canned. Production data for Alaska are presented in Table 2.

Post-war imports from Japan began on a small scale in 1947 and increased yearly until by 1953 they had reached pre-war levels. These data are presented, and compared with American domestic production, in Table 3.

Table 2. Alaska king crab production 1950-1953

| Year | District $\begin{aligned} & \text { Pounds } \\ & \text { Round }\end{aligned}$ | Trawls | Pots | Tangle Nets | Fishermen |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1950 | Bering Sea 1,454,367 | 2 | - | - | 35 |
|  | Kodiak 64,882 | - | - | $\underline{2}$ | 5 |
|  | Total 1,519,249 | 2 | - | 2 | 40 |
| 1951 | Bering Sea 1,791,631 | 3 | - | - | 54 |
|  |  | 23 | - | 200 | 86 |
|  | Cook Inlet $\quad 3,119$ | - | $\underline{\square}$ | 6 | 10 |
|  | Total 1,993,912 | 26 | - | 206 | 150 |
| 1952 | Bering Sea 1,993,222 | 2 | - | - | 44 |
|  | Peninsula 240,053 | 3 | - | - | 14 |
|  | Kodiak 538,115 | 20 | - | 119 | 66 |
|  | Cook Inlet 87,968 | - | 25 | 106 | 60 |
|  | Total 2,859,358 | 25 | 25 | 225 | 184 |
|  | (excluding duplication) | 20 | 25 | 215 | 124 |
| 1953 | Bering Sea 1,998,932 | 3 |  | - | 34 |
|  | Peninsula 86,000 | 1 | - | - | 11 |
|  | Kodiak 817,397 | 33 | 160 | 43 | 129 |
|  | Cook Inlet 1,710,880 | 7 | 356 | 1 | 104 |
|  | Total 4,613,209 | 44 | 516 | 44 | 278 |
|  | (excluding duplication) | 37 | 516 | 44 | 248 |

Note: In 1952 various mobile gear units operated in both the Kodiak and Cook Inlet districts; in 1953, similar mobile units operated Bering Sea, Kodiak, and the Cook Inlet districts. Duplicated gear units have been subtracted from the districts as shown above.

Source: U. S. Fish and Wildlife Service

Table 3. Domestic production and imports of canned crab meat 1943-1953

|  | Domestic Production of Canned Crab |  | Imports of Canned Crab |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Year | Quantity in Pounds | Dollar Value | Total <br> Weight in Pounds | Japanese <br> Imports <br> in Pounds | Dollar Value of Japanese Imports |
| 1943 | 1,468,506 | 1,194,483 |  |  |  |
| 1944 | 1,695,369 | 1,361,458 |  |  |  |
| 1945 | 1,082,523 | 883,767 |  |  |  |
| 1946 | 3,882,021 | 4,720,119 | 16,000 |  |  |
| 1947 | 2,726,451 | 2,705,391 | 378,000 | 377,000 | 302,000 |
| 1948 | 4,305,639 | 4,846,494 | 1,336,600 | 480,000 | 396,100 |
| 1949 | 3,155,666 | 3,490,885 | 2,306,800 | 1,117,800 | 1,065,800 |
| 1950 | 2,681,055 | 3,121,269 | 4,070,600 | 1,761,000 | 1,361,091 |
| 1951 | 2,923,928 | 3,586,558 | 1,967,800 | 1,956,700 | 2,094,900 |
| 1952 | 1,678,131 | 2,087,019 | 2,080,300 | 2,033,100 | 2,203,800 |
| 1953 | 2,240,277 | 2,898,016 | 3,982,300 | 3,860,800 | 3,953,000 |

Source: U. S. Fish and Wildlife Service

Very little is known of the production capabilities of the king crab stocks of Alaska. It is wise then, to develop a basic pattern of fishing laws that will allow exploitation within the ability of the stock to survive at a maximum productive level. The problem has two facets: (1) prevention of excessive waste of the resource, and (2) restrictions on the catch, if necessary, to prevent over fishing. One way to accomplish these ends is to regulate the type, quantity, and time of use of the fishing gear.

Three types of fishing gear have been used in the king crab fishery. These are tangle nets, otter trawls, and pots. Tangle nets, which were regarded by the fishermen as destructive to females and soft crabs were prohibited after 1954. This restriction was brought about at the insistence of the industry. In the Kodiak area, otter trawls have been the predominate type of gear used, but the use of pots is increasing. Pots are the standard type of gear used in the Cook Inlet area. (Plate 2) Otter trawls are used in the Bering Sea. (Plate 3)


Plate 2. King Crab pot coming over the side.

With the increasing activity of the American king crab fishery, the need for basic research on the animals' biology was recognized by all concerned. Funds for research were not available in the Alaska Department of Fisheries budget for the 1953-55 biennium, but a research grant was donated by Wakefield's Deep Sea Trawlers, Inc., and a limited research program was initiated late in 1953. This program was expanded in 1954. The inclusion of $\$ 25,000$ for king crab research in the 1955-57
budget which, together with the Wakefield grant, insures continuation of the project through 1957. In 1953 the Fish and Wildlife Service resumed its biological studies on the king crab in the Bering Sea. The Alaska Department of Fisheries has expended its main efforts in the waters surrounding Kodiak Island, with the assumption that techniques and basic data can be adapted to other areas and their individual requirements.


Plate 3. King Crab otter trawl being dumped on deck.

Normally, only a very small percentage of crabs caught in an otter trawl are injured. After the male and female molt, however, the crabs do not have their tough protective

## NOTES ON THE FISHERY

 shell and are jelly soft and extremely susceptible to injury. Data collected from the Alitak Bay fishery show that, in 1954, the female molt took place from mid-March to early May. During this time, 120,000 male crabs were caught by otter trawlers, however, in sample counts 8.4 females were taken and discarded for each male caught. By actual count of two widely separated catches, 449 out of 1,000 and 800 out of 1,800 females were crushed or mortally damaged, indicating loss of approximately forty percent of the captured females during the season. Thus, out of $1,008,000$ females, 403,200 were killed outright or severely injured. With a male catch of 120,000 it can be readily seen that the population of females was being decimated at a rate nearly four times as great as the population of males, and for no useful purpose. In view of the rapid expansion of the Kodiak fishery,it seemed advisable that measures be taken to prevent otter trawling during the molting periods. This information was made available to the industry and to the Fish and Wildlife Service and appropriate steps were taken to prevent such wanton waste in future years.

The king crab, known scientifically as Paralithodes camtschatica, is not, strictly speaking, a true crab at all. It differs from true crabs such as the dungeness and tanner in

LIFE HISTORY NOTES several respects, for example: (1) The abdomen is unsymmetrical, (2) The fifth pair of legs is different from the fourth pair and is carried under the carapace or back, and (3) The relationship of eyes to antennae or feelers is different.

The baby king crab when it hatches from the egg in the spring of the year does not resemble an adult king crab in the slightest degree. The shrimp like young crab, called a larva, molts five times and assumes another form before it finally resembles an adult crab at an age of two to three months. Measuring only $1 / 8$ of an inch across the back it is at this time that the crab starts living on the bottom, the earlier forms being free swimming.

King crabs have a rigid outer covering known as an exoskeleton. The exoskeleton protects the soft parts of the crab and supports the organs and muscles much in the same manner as does a human's internal skeleton. There is one important difference: The internal skeleton grows with the rest of the body, while the exoskeleton is rigid and cannot grow or increase in size. As a result, when a crab increases in size it must get rid of its old shell, which it has outgrown. Prior to shedding, a new shell has formed under the old. After the old shell is shed the crab must increase its size rapidly before the soft shell hardens and it once again is encased in a rigid covering. This shedding process is called ecdysis.

The process of shedding may be a satisfactory one for growth, but it involves problems for biologists, fishermen, and the crab itself.

For the biologist shedding makes age determination very difficult. Most fish have ear bones and scales which remain with the fish for their lifetimes and upon which is recorded their life histories. All the hard parts of a crab, which might similarly be used, are shed with the shell during each molt. In addition, tagging or marking acrabs, a technique from which much valuable information can be gained, has been difficult because tags or marks attached to the shell are lost with the shell when it is molted.

For the fisherman, molting renders crabs unfit for sale until the shell hardens and the meat 'firms up'.

Young crabs molt several times a year while older male crabs may molt once every two years. Mature females molt once a year. Males and females mature at a carapace width of four to five inches.

When a female reaches maturity she mates each spring immediately following her molt. Directly after the mating act the eggs are laid under her own abdomen where they incubate until the following spring. Just before the female molts in March or April, the eggs hatch into the free swimming larvae described earlier. Each female carries from 150,000 to 400,000 eggs, depending on her size.

A mature male will mate with two or more females. When a male king crab encounters a female that is nearly ready to molt and mate,
he clasps the bases of her first walking legs with his claws. This hold is retained until the female molts, at which time the male must reestablish his hold on the newly emerged soft shelled female. After the molt of the female, mating is soon accomplished and the male then leaves her and goes in search of a new mate.

The life span of king crabs is difficult to determine but all researchers agree that the crab reaches a respectable age. Japanese biologists say thirty-two years, but this is regarded as high by Americans. A study of carapace lengths of Alitak Bay crabs between three and ten inches has established the presence of el even size or molting groups. This cannot be taken to mean eleven years because small crabs may molt several times a year while large crabs may molt once every few years. Much more work remains to be done regarding the frequency of molts and the age of crabs.

King crabs possess definite breaking points at the base of each leg by means of which a crab is able to rid itself of an injured leg. If a leg is lost the crab has the ability to regenerate a new one.

A major mile post in the development of technique for studying the life history and growth of the king crab was the development of a suitable tag that remains with the crab

## CRAB TAGGING METHOD

 through and after ecdysis. Japanese research workers also developed a method that is identical with that of the Alaska Department of Fisheries in regard to location, but use a fine wire instead of plastic tubing. The tag was conceived and developed as a result of studies made of the shedding process. These studies were carried out in live tanks located on floats in Kodiak Harbor. The tanks were supplied continuously with fresh sea water by motor driven pumps.Underneath the posterior portion of the crab carapace is a fleshy connecting isthmus between the median dorsal surface of the cephalothorax (head-body region) and the abdomen. This isthmus is covered with a thin transparent, parchment like membrane. Access to the isthmus is gained by placing the crab upside down and pushing the first abdominal somite upward and away from the carapace (shell of the cephalothorax).

During ecdysis, the old chitenous covering of the abdomen and the thin covering of the isthmus are the first to peel off. Next the old carapace is pushed upward and the crab backs out of the entire exoskeleton. With this type of molting procedure, the isthmus provides an excellent anchor for the tag; any tag through the carapace would either be shed with the old shell or prevent the molting process and kill the crab.

After trying several types of material a polyvinylchloride plastic tube, patterned after the California Type G tuna tag, was found to be the most satisfactory for a tag. The tube is passed through the isthmus by means of a needle and a knot is then tied to complete the ring. The completed tag is shown in Plate 4. This tag does not interfere with the shedding process and is retained by the crab through the molt under live box conditions.

During December 1954 and January and February 1955, 860 king crab were tagged and released using this method under field conditions aboard commercial fishing vessels. Results of this experiment will be reported in later reports of the Alaska Department of Fisheries.


Plate 4. King crab showing tag through isthmus.


Purse seiner underway

## INSPECTION

During the 1954 salmon fishing season the Alaska Department of Fisheries furnished the Fish and Wildlife Service with twelve temporary men to assist in the enforcement of Federal fishery regulations. These inspectors were distributed as follows:

7 in the Southeastern Alaska area at these locations: Kegan Cove, Naha Bay, Barnes Lake, Redfish Bay, Hugh Smith Bay, Hetta Inlet, and Taku River.
3 in the Kodiak area - 2 on Afognak Island and one on the mainland shore.
1 in the upper Copper River district.
1 on the Kenai Peninsula.
As in 1954, one full time district inspector was stationed at Ketchikan checking salmon runs and escapements and correlating the work of the Inspection and Watershed Management Divisions.

The two inspectors assigned to Afognak Island assisted in the eggtaking, hatchery, and egg planting operations of the Watershed Management Division, when not on active enforcement work. The inspector at Taku River worked with the Biological staff on the Taku River investigation.

The man on the Kenai Peninsula and the one in the upper Copper River district again operated with panel trucks furnished by the Department. Accessibility of the spawning streams to the roads makes highway inspection feasible in these two districts. Salmon protection, during their spawning migration, was the main duty of these two inspectors. In addition, these men provided valuable assistance to the sport fish biologists by checking for possession of the Territorial Sport Fish License; and assisting with lake surveys, trout stocking and general help around the hatcheries.


Fishing boats at the Juneau city float.

## PREDATOR CONTROL

The Department of Fisheries continued predator control activities in selected problem areas during 1954. Fishermen and cannery operators who have observed this program in action generally express gratification with the results. While justifying itself from a purely economic viewpoint, the program has provided much information about where, when, and how to apply predator control, and how then to evaluate the effects.

In spite of the beneficial outcome of the Department's recent work, predator control is a controversial matter. To be justifiably applied, it must compromise diverse interests of the public while being economically and biologically sound. Since the public is seldom introduced to the several considerations that properly guide the control of predators, these considerations will be briefly mentioned here.

While their depredations at times are costly, predators also afford mankind certain benefits. Appreciation of the eagle for its aesthetic and symbolic qualities is widespread; trout and bear provide cherished recreational opportunities for many; the subsistence and economic contributions of seals and belugas are of extreme importance to Eskimos of western and northern Alaska; and a little calculating in the field of garbage and refuse disposal would place some worth on the services rendered by gulls. Certain of these values that may seem of insignificant importance to one group of people are of paramount interest to another, and fair consideration of all such factors as they apply to specific problem situations is necessary in planning appropriate predator control action.

Because predator control is an active management measure that often lacks residual benefits, a quick favorable return of money spent is an obvious requirement. This means that the most efficient control methods must be employed, and effort concentrated where serious predator problems exist. A complicating factor here is the ability of many predators to move about. For example, seals cannot be kept away from a salmon fishing locality without removing them from adjacent areas - and adjacent areas have farther adjacent areas. Hence, the tendency for widespread control (witness the seal bounty system enacted by the Territorial Legislature) with the removal of predators from many regions where they cause no damage. Recent work by the Department has shown that intensive seal control restricted to fishing localities during the fishing season can vastly reduce seal depredations - a result seldom secured from widespread control despite the tremendous a mounts of money invested in it.

The risk that predator control will upset natural balances to the detriment of salmon is slight, but nevertheless present. Under good conditions, one female red salmon might easily produce several hundred young which survive to the fry stage, and if these are not decimated in number by natural mortality agencies including predators, they would likely exceed the capacity of their fresh water habitat to accommodate them. In other words, the great reproductive potential of fish allows for rather high mortality, which normally occurs during early life stages. Then too, any predator which we choose to control, undoubtedly acts as a check on other predators or competitors of the salmon, and the new living conditions which we create might become less favor-
able than the original. Such considerations need not prevent the use of predator control, but they should direct its application in ways to enhance the chances for success. Thus, if mortality of young salmon through char predation is known to be excessive, the selective removal of some of the larger, more predacious fish might be a better cure than enthusiastic removal of all char.

Seals, sea lions, and belugas sometimes give man keen competition on the fishing grounds, but their depredations are of greater economic than biologic importance. These marine mammals are abundant enough to make serious inroads in fish numbers only in a few widely scattered localities, and they are believed to feed on commercially worthless foods during most of the year. The nature of the depredation should guide the type and degree of control imposed. If minimal control or harassment will adequately reduce depredations by an animal, then large scale programs, costly in both money and animal life, are undesirable.

The Department of Fisheries has thus far confined its control activities to mammalian predators, chiefly harbor seals, in areas where their presence was known to be harmful to human interests. In the Stikine River, Taku River, and Copper River districts, the purpose has been primarily to reduce the loss of salmon to the fishery and secondarily to evaluate the effects of control measures, particularly the effects on the seal population. That is, will the removal of a certain number of seals in any one year affect the number present the next year? In Bristol Bay, a study of the beluga has been started, mainly to determine whether or not the animal's predation on salmon is of a serious nature. A summary of predator control and investigative activities is presented herewith.

## HARBOR SEAL

As recounted in previous Annual Reports, the Department of Fisheries undertook to control harbor seals in the Stikine River area in 1951 and has continued this activity in

## STIKINE RIVER

 subsequent years. For this program, skilled local hunters employing rifles were hired for the summer season. By thus concentrating the control effort where and when major seal depredations occur, maximum benefit is believed to result. Animals destroyed since the beginning of this predator reduction program are listed below:| Year | Hunters | Seals Killed | Sea Lions Killed |
| :---: | :---: | :---: | :---: |
| 1951 | 2 | 946 | 0 |
| 1952 | 2 | 768 | 18 |
| 1953 | 1 | 552 | 11 |
| 1954 | 1 | 491 | 35 |
|  |  | 2,757 | 64 |

Because most of the seals sank when shot, only a small a mount of food habit information was secured. It was noted, however, that seals entered the river to feed on eulachon during April and May. With the
arrival of the various salmon runs through the summer, these fish apparently became the dominant seal food. No quantitative data on seal feeding were obtained.

As seals were removed from day to day, there occurred an influx of animals from adjoining areas. It appears that only a portion of a large, widespread population is being removed and that striking inroads are not apt to be made at the present intensity of control. Nevertheless, testimonies from fishermen verify a good reduction in seal depredations as the result of this control program.

The significance of increased sea lion kills is unknown at this time.
The fishery inspector for the Taku River area, in addition to enforcement duties, has exercised local control of seals during the salmon fishing seasons of 1952,1953 ,

TAKU RIVER

| Year | No. of Seals Taken |
| :--- | ---: |
| 1952 | 123 |
| 1953 | 355 |
| 1954 | $\underline{186}$ |
|  | Total $\quad \underline{664}$ |

During the spring months, seals were found to feed predominantly on eulachon, though sole, salmon, and other fishes were taken occasionally. As the season progressed, salmon became an important food item.


Plate 1. This king salmon was mutilated by a harbor seal after being caught in a gill net.

There were never enough seals in the area to warrant their control on the basis of the free-swimming salmon destroyed. However, their net robbing was sometimes of serious magnitude. A careful check of fish scows and fishing boats showed a complete or partial loss to seals of 425 king salmon during May, 1952, in this locality. Undoubtedly many more fish were pulled from nets but escaped detection. The red, silver, and chum salmon fisheries also suffer seal depredations.

On the fishing grounds, the success of this control effort has been well demonstrated, and its continuation seems advisable. As in the Stikine River area, removal of a few seals from day to day was accompanied by an inflow of animals from surrounding areas.

An immense area of bars and low islands in the Copper River district is particularly attractive to seals, and concentrations numbering

## COPPER RIVER DISTRICT

 several hundred individuals are not unusual at any season of the year. Reports of costly seal depredations have been heard for many years from this district, which supports an important salmon fishery.The magnitude of this seal problem was so tremendous that ordinary control measures, i.e., hunting with rifles, proved ineffectual. To deal with this situation, a novel method of control employing dynamite "depth charges" was tried during the fall of 1951. The results were successful from the start, and an intensive use of this technique has been continued to the present time.

Two men, using an inboard powered fishing boat for a base and a large outboard powered skiff for actual control work, conducted this operation. Occasionally they were assisted in locating seal concentrations by an observer in an airplane.

When a seal herd was found hauled out on a bar or island, the skiff was loaded with depth charges and prepared for the bombing run. The best means of approaching the seals was decided upon, keeping in mind the characteristic behavior of the animals to quickly take fright and move into the water en masse as the boat advances toward them. The bombing run then started, with the skiff traveling as fast as possible. When over the seals, which ideally were in fairly deep water but still well concentrated, the explosive charges were tossed overboard, the skiff continuing to move at fair speed. The fuses, ignited by slip-on fuse lighters of the pull-wire type, were of such length that the charges sank for several seconds before detonating. Seals that were only injured by the blasts were promptly dispatched with shotgun fire. Most of the dead seals sank, but those which could be recovered were opened for stomach examination; their scalps were also removed and destroyed to avoid improper bounty claims.

During 1954, 60\% Hi-Velocity Gelatin Powder in 25 pound packages was used instead of the $50 \%$ Ditching Powder employed in previous years. This change precluded the need for tying numerous dynamite sticks together when preparing a charge and avoided the danger to hunters from sympathetic detonation of Ditching Powder when numerous charges were being tossed overboard.


Plate 2. These floating seal carcasses were the result of a single, well executed depth bombing run.


Plate 3. Following depth bombing, seal carcasses are recovered for stomach examination and scalp removal.


Because blasting operations were conducted during the spring, summer, and early fall seasons, the possibility of destroying salmon was obviously present. However, careful observations by the hunters and impartial observers revealed no loss of salmon fry or fingerlings and a total loss of only 23 adult salmon. The consensus among observers was that where fish were available in quantity, the seals were not inclined to haul out on bars in that immediate locality.

A tabulation of the seals destroyed to date is given below:

| Year | No. of Seals Killed (Approx.) |  |
| :---: | :---: | :---: |
| 1951 |  | 500 |
| 1952 |  | 6,790 |
| 1953 |  | 6,800 |
| 1954 |  | 4,910 |
|  | Total | 19,000 |

In the Taku River and Stikine River districts, it is not anticipated that the results of one year's control effort will carry over to the succeeding year because of seal reproduction and replenishment from surrounding areas. It is hoped, however, that enduring good effects may be realized from the very concerted control program in the Copper River area. After three seasons of control, seals are yet abundant enough to discourage a relaxation of pressure on them, though there are indications that progress is being made. In the event that seal numbers can be greatly reduced, then a minimal effort will serve to control them in the future. If, on the other hand, satisfactory reduction in seal numbers can be obtained only at prohibitive cost, then the future control program need be only intensive enough to substantially reduce seal depredations, a situation that might be achieved with considerably less effort than is now being expended.

There is general agreement among fishermen and packers of the Copper River district that this program has very greatly reduced losses of salmon and damage to gear caused by seals.

The cost of this work in the Copper River district is borne jointly by the Alaska Department of Fisheries and the Cordova Seal Committee, a group composed of fishermen and packers. To each $\$ 5.00$ allotted by the Department of Fisheries, the Seal Committee furnishes $\$ 1.00$.

## BELUGA

Commercial fishermen of the Kvichak-Nushagak area of Bristol Bay almost unanimously condemn the beluga as a destructive salmon predator, but adequate evidence for or against their views has never been collected. A notable scarcity of information concerning the biology of the beluga in Alaska heightens the difficulty of evaluating hearsay reports. In response to this situation, the Department has launched an investigation to learn the true role of the beluga in the ecology of the Bristol Bay region.


Figure 2. Beluga concentrations in Bristol Bay, as observed during the 1954 investigation, are indicated by shaded areas.

This investigation was inaugurated in May and pursued through August, 1954; work will be continued in 1955. One permanent and one temporary employee have thus far conducted the field work. Both the Alaska Packers Association and the Pacific American Fisheries gave fine cooperation and support in the furtherance of this program.

A total of 68 belugas were collected to obtain information on food habits, breeding biology and other elements that pertain to an ecological life history study. Local fishermen captured 16 of these animals, and the remaining 52 were caught by Department workers. A resume of findings bearing on beluga food habits and economic status is given below.

Surface observations, one aerial survey, and numerous interviews with fishermen lead to the conclusion that 1,000 to 1,500 belugas were present in the Kvichak-Nushagak district during the spring and summer of 1954. According to residents, belugas are absent from the region during the coldest winter months.

The ordinary means of catching belugas involves driving the animals into shallow water, if they are not already there, and harpooning them. After being struck with the harpoon, the beluga is dispatched with a rifle bullet aimed about a foot behind the blowhole. A rather fast boat is required for this hunting because belugas swim rapidly, probably in excess of 15 miles per hour for a short time. A 25 hp outboard motor on a 17 foot speedboat hull proved ideal; seas too rough for safety in this boat also made it nearly impossible to keep track of the belugas.


Plate 4. A newly caught male beluga which measured 15 feet, 5 inches. This was the largest of the 68 belugas examined.

In the Kvichak River, where the investigation began, about 250 belugas swam upstream for several miles on each incoming tide and retreated to the bay when the tide turned. This behavior was the rule from the first part of May until mid-June. Three belugas were captured prior to May 29; Table 1 lists their stomach contents.

Table 1. Stomach Analysis of Belugas from Kvichak River, Period May 26 to 28.

| Field | Date | Stomach Contents (No. of Individuals) |  |
| :---: | :---: | :---: | :---: |
| No. | 1954 | Smelt | Salmon (fingerlings) |
| 1 | $5 / 26$ | 503 |  |
| 2 | $5 / 27$ | 400 |  |
| 3 | $5 / 28$ | 600 | 1 |

Sampling in the river prior to May 30 with a small seine showed smelt to be very abundant and salmon fingerlings to be scarce. On May 30, downstream red salmon migrants appeared in a surge and immediately replaced smelt as the dominant species in the beluga' $s$ diet. This abrupt shift to salmon as food was probably intensified by the tendency of these fish to move along the edges of the river to a greater extent than smelt; hence, belugas feeding in the greatest salmon concentrations would pick up fewer smelt than one would expect in view of their substantial numbers. Salmon fingerlings remained abundant in the river through the first half of June; they were likewise common in stomachs of the nine belugas collected during this period (see Table 2).

Table 2. Stomach Analysis of Belugas from Kvichak River, Period May 31 to June 17.


This sample of nine belugas is too small to be considered more than indicative, but it suggests that the total loss of downstream migrant salmon may be large - possibly in excess of $2,000,000$ individuals per year.

150 belugas (min. no.) $\times 2$ meals $\times 390$ fish $\times 18$ days $=2,106,000$ fish.
There is a pressing need for additional information relating to predation on fingerlings. More data might show effects far more or far less detrimental than are here implied. An almost total lack of information from other major rivers of the region that are frequented by belugas may conceal problems such as encountered in the Kvichak.


Plate 5. The first chamber (there are five) of a beluga stomach has been opened, exposing a large quantity of red salmon fingerlings.

With the passing of the seaward migration and the arrival of mature salmon, the site of research moved from the Kvichak River to Nushagak Bay. Between June 23 and July 28, the stomachs of 32 belugas were examined (see Table 3).

In August, 24 belugas collected along the west side of Kvichak Bay provided additional information on food habits. At this time, the runs of salmon were tapering off, and the fair number of these fish present in the beluga stomachs suggest that the animals are quite proficient at catching active prey even in turbid water. Table 4 lists the contents of stomachs collected in August.

Table 3. Stomach Analysis of 32 Belugas from Nushagak Bay, Period June 23 to July 28.

| Food | Number of stomachs in which food items occurred | $\%$ of stomachs in which | Number of Individual Specimens |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | occurred | Max. | Min. | Avg. | Total |
| Salmon (red) | 17 | 53 | 9 | 1 | 4 | 75 |
| Salmon (chum) | 8 | 25 | 3 | 1 | 1 | 12 |
| Salmon (pink) | 6 | 19 | 14 | 3 | 8 | 45 |
| Salmon (silver) | 4 | 12 | 2 | 1 | 1 | 6 |
| Salmon (king) | 1 | 3 | 1 | 1 | 1 | 1 |
| Salmon (unid.) | 5 | 16 | 10 | 1 | 3 | 16 |
| Salmon (all spe combined) ${ }^{\text {a }}$ | ies 22 | 72 | 16 | 1 | 7 | 155 |
| Blenny | 5 | 16 | 65 | 1 | 25 | 125 |
| Sculpin | 2 | 6 | 1 | 1 | 1 | 2 |
| Fish, small (un identified) | 2 | 6 | 7 | 1 | 4 | 8 |
| Shrimp | 5 | 16 | 18 |  | 8 | 43 |
| Milk | 2 | 6 |  |  |  |  |
| Empty | 4 | 12 |  |  |  |  |

a/ All salmon listed were adults.
Table 4. Stomach Analysis of 24 Belugas from Kvichak Bay, Period August 5 to August 18.

| Food | Number of ${ }^{\text {a }}$ stomachs in which food items occurred | $\%$ of stomachs in which food items occurred | Number of individual specimens |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | Max. | Min. | Avg. | Total |
| Salmon (red) | 5 | 21 | 5 | 1 | 2 | 10 |
| Salmon (chum) | 7 | 29 | 5 | 1 | 2 | 12 |
| Salmon (pink) | 11 | 46 | 5 | 1 | 2 | 26 |
| Salmon (silver) | 6 | 25 | 4 | 1 | 3 | 16 |
| Salmon (unid.) | 2 | 8 | 1 | 1 | 1 | 2 |
| Salmon (all spec combined) | ies 17 | 71 | 11 | 1 | 4 | 67 |
| Blenny | 2 | 8 | 3 | 1 | 2 | 4 |
| Sculpin | 3 | 12 | 5 | 2 | 4 | 11 |
| Flounder | 2 | 8 | 3 | 1 | 2 | 4 |
| Fish (unid.) | 2 | 8 | 1 | 1 | 1 | 2 |
| Shrimp | 4 | 17 | 27 | 2 | 14 | 57 |
| Mollusk | 2 | 12 | 2 | 1 | 1 | 3 |
| Empty | 5 | 21 |  |  |  |  |

a/ Two calves were included in the sample; both had empty stomachs. Yearlings were not represented in the sample.

Tables 3 and 4 show that when salmon are available, they are the most common beluga food item. Other fish probably do not buffer the salmon, though they constitute alternative food sources when salmon are not to be had.


Plate 6. An adult female beluga with viscera removed revealing remains of six mature red and chum salmon.

Only the runs of red salmon in Nushagak and Kvichak Bays have shown marked depletion in the face of fishing, predation, and other mortality agencies, so it is on the basis of red salmon alone that the significance of beluga predation should be judged. By subjecting known information on beluga numbers and food habits to simple statistical treatment, it was found that this year's loss of adult red salmon in Nushagak Bay probably numbered between 28,000 and 57,000 individual fish. In Kvichak Bay, the loss has been calculated to total between 42,000 and 86,000 adult red salmon. Because the beluga sample was biased in favor of small easily caught animals, the loss of salmon in both bays probably approaches the higher figures.

In view of the depleted stocks of red salmon in the Nushagak-Kvichak areas, predation by belugas, particularly on seaward migrants, may seriously hinder efforts to restore the runs. The loss of adult red salmon to belugas is costly to this currently precarious fishery - if canned, these fish would have a wholesale value of from $\$ 148,000$ to $\$ 297,000$.

Conversely, belugas have considerable value as a usable resource. Along the west coast of Alaska, chiefly from Hooper Bay to Wainwright, Eskimos utilize at least 200,000 pounds of beluga flesh annually. While this contribution to native economies cannot be translated into dollar value, it probably has more immediate importance to many of the people involved than does increased salmon production in a distant locality.

The present investigation must advance farther before the potential hazards and benefits of beluga control in Bristol Bay can be properly evaluated.

## 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

In keeping with the policy set forth by the Alaska Fisheries Board, the sport fish biologists concentrated their efforts on work projects close to the population centers of the Territory and available to the sportsmen by automobile. The vast

## PROBLEM

 wilderness areas of Alaska provide anglers with an excellent opportunity to follow their recreational pursuits unmolested by other fishermen. Sport fish abound in these waters and eagerly await the angler's lure. For the most part, however, anglers are confined to the waters near their homes and close to the highway systems because of the expenses involved in air and water transportation to the outlying regions. In these waters, drastic reductions in sport fish populations have occurred. Research and rehabilitation has therefore been concentrated on these waters by the sport fish staff.To the layman, no type of fish rehabilitation work has the appeal of a fish hatchery. The reasons for this are obvious. A fish hatchery is a tangible structure; its output can

## FISH HATCHERY DISCUSSION

 be seen, weighed and counted. (Plate 1) A superficial examination of its purpose seems to completely justify its need. If a population of fish has been decimated, stocking from a fish hatchery is the first solution that comes to one's mind. All too frequently, nothing could be further from the answer to this dilemma.As an example, several lakes in the Anchorage area, years ago had well balanced populations of trout and stickleback. The trout grew to a nice size feeding on these small fish. With the recent increase in fishing effort in the Anchorage area, the trout were removed by the anglers. The removal of the predaceous trout had a profound effect on the stickleback population. First, the removal of the trout eliminated a serious stickleback predator; and, second, competition for food between trout and stickleback was greatly reduced. As a result, the stickleback population increased rapidly until the lakes became saturated with these trash fish.

Stickleback are small fish, the adults being about three inches in length. They have very sharp erectile spines on the back and spines preceding the belly fins. Stickleback feed on small organisms such as water-fleas, insect larvae and other animal forms - all good trout feed.

Stocking trout fry from a hatchery, in the heavily stickleback infested lakes, would have been wasteful because the stickleback had reached the point where they were in balance with the food supply. The available food was completely utilized. Introduced trout fry would be starved to death before they grew large enough to ingest any of the small stickleback.


Plate 1. Counting rainbow trout fry at the Fairbanks hatchery.
As an experiment, in 1952 the Department stocked 1,750 vigorous rainbow trout fry in sixty-seven acre Sand Lake, near Anchorage. Sand Lake met the conditions described thus far in the discussion. In 1953, Sand Lake was treated with a fish toxicant. Millions of stickleback were killed; not a single trout was found. Certainly the stocking of this lake with large numbers of trout, prior to toxicant application, would have been a waste of money. After eradicating all the fish in the lake, it was stocked with rainbow trout fry. These grew to fifteen inches in fourteen months.

Hatcheries do have a place in fisheries management. They provide the biologists with an extremely valuable tool to use in their work - a supply of fish. The condemnation of hatcheries has resulted from their misapplication in fisheries management. In the early days, hatcheries were considered a panacea for decimated fish populations. That was the big mistake, they are not.

Hatchery stocking success should be based on the number of fish harvested and not the number planted. The hatchery should be used as an effective tool and should not be considered an overall solution for fish production.

A demand for trout fry for rehabilitation, management and experimental planting has necessitated the installation of hatcheries by the Department. The rehabilitation program includes the complete eradication of andesirable fish population from a lake by the use of a fish toxicant. The killed fish may be suckers or stickleback; these are left in the lake to decompose, thus adding to the fertility of the water. The lake, completely cleaned of fish life, is clear of the toxicant within about
six weeks. A ready source of game fish for stocking must be available at this time. The fish hatchery meets this need.

Successful game fish introductions have been made in lakes containing a competing species of fish. Here again, the hatcheries provide a supply of game fish.

Certain lakes, due to watershed changes, have little or no spawning facilities for trout. With the clearing of land and the cultivation of the soil surrounding the lakes, their inlet gravel spawning beds become inundated with mud, thereby eliminating the possibility of natural reproduction. These same lakes provide excellent rearing areas for sport fish. Hatcheries provide the trout for stocking such waters, thus assuring a continuation of the sport fish stocks along with a fishery in the lakes.

The Department's fish hatcheries are used in sport fisheries to provide a supply of game fish fry for stocking purposes. No attempt is made to rear these fry to fingerling size. The Territory has no intention of initiating a "put and take" program where large hatchery fish are stocked. Hatchery fry are planted in the lakes of Alaska as "seed fish"; rearing is accomplished in the lakes.

The techniques used in egg procurement, shipment, incubation, hatching and feeding were discussed

## FAIRBANKS HATCHERY OPERATION

 in past Annual Reports. The same general procedures were used again in 1954. Refinements, however, were incorporated to make for more efficient operations during the year.The outlet of Birch Lake was used for the Fairbanks Hatchery water supply. A dam was constructed in this outlet during 1953 so water could be impounded in 850 acre Birch Lake. This excess water could be drawn off the lake during low creek flows to insure that an adequate supply of water was provided to the hatchery during an entire season.

Due to a dry fall season in 1953, coupled with an equally dry spring in 1954, the outlet flow from Birch Lake was insufficient for hatchery operations early in the season. A temporary wooden chute was run under the stringers at the Birch Lake control dam to increase the flow in the outlet. This allowed for the shipment of the first eyed rainbow trout eggs to the hatchery on June 4th. Rains occurring later in June permitted closure of the chute and the accumulation of fourteen inches of water reserve in Birch Lake. This reservoir of water was used to maintain a constant flow of water to the hatchery intake pipe.

The capacity of the Fairbanks Hatchery had to be increased again in 1954. Biological surveys conducted in this area had shown where additional fish plants would be successful. In addition, the lake rehabilitation program cleared a considerable water acreage which required game fish stocking.

The expansion of the hatchery building would have been relatively expensive. The hatchery had been increased in size from a capacity of five troughs to fourteen troughs in 1953 . Further expansion was accomplished in 1954 by using four holding and feeding live boxes placed in a backwater pool of the creek from which the hatchery obtained its water supply. The eggs were hatched in the hatchery and the fry were held in the troughs until they had absorbed their yolk sacs. When this absorption had been completed, a portion of the trout fry were placed in the liveboxes in the creek. This thinned out the fish held in the hatchery, resulting in a better than usual survival of fish.

Eyed rainbow trout eggs were obtained from a supplier in Montana and eyed cutthroat trout eggs were provided by the State of Washington. In addition, steelhead trout eggs were procured from Kodiak. The rainbow and cutthroat eggs were available early in the season. After these had hatched and a portion of the fry had been planted, the steelhead trout eggs were received from Kodiak. In this way, the hatchery could handle two lots of eggs. The rainbow and cutthroat were practically all stocked prior to the arrival of the steelhead eggs at the hatchery.

A list of the trout plantings made from the Fairbanks Hatchery can be found at the end of this report. This station increased its output from about 172,000 trout in 1953 to almost 266,000 trout during 1954. This increase was largely accomplished by more efficient operations, better quality of eggs received and the addition of holding liveboxes at the hatchery installation.

The Fire Lake Hatchery, built and donated to the Department by the Anchorage Sportsmen's Association, lies seventeen miles northeast of Anchorage on the Glenn Highway.

## FIRE LAKE HATCHERY OPERATION

 This station was built on a concrete floater-type slab and has a prefabricated steel frame with sheet metal siding and roof. The builcing is thirty-eight by forty-four feet and was designed to accommodate forty hatchery troughs. (Plate 2) At a capacity of 25,000 trout per trough, a total of $1,000,000$ trout is the hatchery potential. Bachelor living quarters and a work space were incorporated in the design of the building. The building was completed in the fall of 1953.

Plate 2. Fire Lake Hatchery.

Twelve troughs, a head trough, intake dam, and intake pipe were installed at the hatchery prior to the 1954 season. (Plate 3) In spite of the fact that there was a need for trout fry in excess of the number that could be produced in the twelve troughs provided at this station, the hatchery could not be equipped with its capacity of forty troughs due to budgetary limitations. Additional troughs will be purchased in future years, as funds become available.

The Fire Lake Hatchery was ready to handle trout eggs by the first part of May 1954, when eyed trout eggs were obtained for the hatchery from the same sources mentioned in the Fairbanks Hatchery section of this report.


Plate 3. Anchorage hatchery intake dam.
A total of 263,507 rainbow, steelhead and cutthroat trout were planted from the Fire Lake Hatchery during 1954, the first year of operation at this station. A new hatchery has "kinks" that must be ironed out; this has been done and there is every reason to assume that the efficiency will be greatly increased next year and in years to come. A complete list of the trout plantings made from the Fire Lake Hatchery can be found at the end of this report.

Small portable fish planting units were used for all fish hauling during 1952 and 1953. Each unit included four, five gallon cans for carrying fish and water. A recip-

## TROUT HAULING

 rocating air pump, powered by a six volt battery, provided aeration by pumping air into the cans of water carrying the trout. The unit loaded with trout weighed 206 pounds and had a capacity of 6,000 to 10,000 trout fry, depending on their size. These units were used at both the Fairbanks and Fire Lake Hatcheries again in 1954; however, since theircapacity was limited, their use was confined to fish stocking requiring either aircraft or railway transportation.

Large aluminum fish hauling tanks were built and used at the hatcheries during 1954. These tanks, mounted on $3 / 4$ ton pick-up trucks, carried about 250 gallons of water and fish. Aeration was again accomplished by using six volt air pumps run off the truck battery with air leads from the pumps to the bottom of the tanks. The rubber tube air leads were fitted with ceramic diffusers so the air was broken up into thousands of bubbles, thereby insuring a better exchange of gases between the introduced air and the water.

The pick-up truck hauling tanks were fitted with three inch diameter discharge couplings. When planting fish, the truck, with its load of fish and water, was backed as close to the lake as possible. A hose was fitted on the coupling and led out into the lake. The tank gate valve was opened and the water containing the fish was flushed out of the tank through the discharge hose and into the lake. (Plate 4) The tanks provided a simple yet efficient means of hauling trout from the hatcheries to the lakes. Twenty-five thousand rainbow trout fry were hauled in the tank on trips taking as long as seven hours, from the hatchery to the lake, with little or no hauling mortality.


Plate 4. Stocking rainbow trout.
The lake rehabilitation program of the Department includes the eradication of trash fish from a lake by the use of a rotenone bearing substance and the subsequent stockLAKE REHABILITATION ing of the lake with game fish. This program has been discussed in detail in past Annual Reports of the Department and was briefly explained in the Fish Hatchery discussion of this report.

The following lakes were rehabilitated during 1954:

Lake

Deadman
Kepler 1 and 2
De Laney
Matanuska

Surface Acres.
General Location
Northway
Palmer
Anchorage
Palmer

## TOTAL <br> 493

Deadman Lake, located 271 miles southeast of Fairbanks on the Alcan Highway, was treated with rotenone on June 26 and 27. A stunted population of northern pike was killed in this shallow lake. By July 25, one month later, the toxicity had dissipated from the lake. From July 31 to September 7, 99,000 rainbow and steelhead trout fry were stocked in the lake from the Fairbanks Hatchery. This 341 acre lake has a maximum depth of 32 feet and an average depth of 12 feet. Due to its shallowness the lake was economical to rehabilitate.

Deadman Lake, rehabilitated as an experiment, is characteristic of many of the lakes lying on the floor of the Tanana Valley. Dissolved oxygen determinations had shown that the lake had a maximum of 2.0 parts per million of dissolved oxygen during the late winter. This quantity of free oxygen in the water is considered marginal for carrytrout. The data from this rehabilitation experiment will be carefully evaluated in an effort to determine whether the rehabilitation program has possibilities in the management of this type of lake.

The two Kepler Lakes, located in the Matanuska Valley, were treated with rotenone and stocked during 1954. Prior to rehabilitation, these lakes were saturated with stickleback. The lakes were stocked with steelhead trout fry on September 21 st , after the toxic rotenone had dissipated.

Matanuska Lake was treated with rotenone on October 5th. Stickleback were the only fish killed in the lake. Due to the late date of toxicant application, the toxicity in the lake had not dissipated in time for trout stocking in 1954.

DeLaney Lake was treated with rotenone on October 6 th. Here again, stickleback were the only fish killed and the toxicity had not dissipated in time for trout stocking in 1954.

Boleo Lake, near Big Delta, was stocked with 10,000 rainbow trout, one aṇd one-half inches in length, on August 25, 1953. This lake was not rehabilitated. Biological surveys had shown a population of only cottoids in the lake. Minimum dis-

## RAINBOW TROUT <br> PLANTING RESULTS

 solved oxygen concentrations in excess of five parts per million had been recorded during the previous winter. Since cottoids are bottom-dwelling fish, it was logical to assume that rainbow trout fry could successfully vie with such competition. Results from the 1953 planting completely justified this assumption. By September 25, 1954, thirteen months after stocking, the rainbows averaged thirteen inches in length and better than a pound apiece. (Plate 5) Survival of these fish appeared to be good.

Plate 5. Boleo Lake rainbow trout.

The gravel pits in the Fairbanks area were opened to a juvenile only fishery that was limited to children under sixteen years of age. These pits had been stocked in both 1952 and 1953 and produced excellent angling for rainbow trout ranging from seven to sixteen inches in length.

Hidden Lake, near Anchorage, was also closed except for juvenile fishing. This lake, stocked in 1952 and 1953, produced an estimated 2,000 rainbow trout to the youthful anglers during 1954. The fish ran up to sixteen inches in length. Gill net sampling in the late fall of 1954 indicated a sizeable number of fish still in the lake. These rainbow trout, measuring ten to twelve inches in length, should sustain a juvenile sport fishery during the 1955 fishing season.

Green Lake, located on the Elmendorf Air Force Base near Anchorage, was stocked in both 1953 and 1954. The lake had been "bluestoned"' in the past (treated with copper sulphate to control the algae). Since this chemical treatment had an adverse effect on the food chain in the lake, the growth rate of the introduced rainbow trout fry was slower than in the other lakes similarly stocked. The trout did, however, grow to an average length of $10 \frac{1}{2}$ inches in fourteen months.

Following is a table giving the results obtained in the lakes that were rehabilitated in 1953:

| Lake | $\begin{gathered} \text { Size } \\ \text { in Acres } \\ \hline \end{gathered}$ | Date Stocked in 1953 | Number of Fish Planted | Length of Inches on Min. | Fish in 10-1-54 Max. |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Sand | 67 | August 28 | 13,307 | 8.0 | 15.0 |
| Jewel | 30 | July 31 | 5,046 | 11.0 | 14.0 |
| Rocky | 57 | Aug. 6, 26 \& 28 | 12,225 | 9.5 | 13.0 |
| Echo | 23 | August 26 | 8,858 | 9.7 | 17.5 |
| Tex Smith | 15 | August 1 | 2,174 | 10.5 | 14.0 |

The fish sampled from the rehabilitated lakes were all very deep bodied and heavy for their length. As an example, fourteen inch rainbows taken from Jewel Lake averaged one and three quarters pounds apiece.

The value of the lake rehabilitation program can be readily appreciated when one considers that, prior to rehabilitation, the lakes listed were saturated with cottoids, sticklebacks and suckers - trash fish. They are now producing rainbow trout for the benefit of the anglers of the Territory.

The results obtained in Lost Lake, near Fairbanks, have been discouraging. Although the rate of growth of the planted rainbows has been good, the trout survival has been poor. This rehabilitated lake has been recontaminated with suckers, a species that was not present prior to rehabilitation.

In the foregoing review, an attempt has been made to show how the hatchery fish were utilized to stock rehabilitated lakes, lakes with competing species of fish and virgin gravel pits. The results obtained from trout plants not specifically discussed have been similar.

Public information and education has been included in the sport fish program. The public is provided with the facts and reasoning behind the approaches used by the bi-

## PUBLIC RELATIONS

 ologists in sport fish management. Cooperation between the biologists and the public is mandatory if a progressive fisheries management program is to be realized.Public access to lakes and streams in the Territory is a pressing problem. Many lakes and streams have already been entirely or partially blocked to public entry by private

PUBLIC ACCESS property. In such cases, the biologists have worked on easements with land owners to provide for public access. No management, stocking or rehabilitation work has been done on any lake or stream without first insuring that public entry was provided.

The Territory has an excellent opportunity to set aside public access sites to lakes and streams, lying in remote areas, before these are surrounded by privately owned lands. Such land acquisition has
been and is being done; this will eliminate many ingress problems for the anglers of the future.

Excellent cooperation and assistance was received from the sportsmen in the prosecution of the sport fish work. Individuals donated time in fish planting (Plate 6), hatchery construction and maintenance, lake surveying and lake rehabilitation.

## ACKNOWLEDGEMENTS

 As an example, ten members of the Tanana Valley Sportsmen's Association drove 271 miles from Fairbanks to Deadman Lake on Friday night, June 25, worked on toxicant application for the rehabilitation of this lake all day Saturday, June 26, and almost all day Sunday, June 27. (Plate 7) They left Sunday in time to drive the 271 miles back to Fairbanks so they could report to their jobs Monday morning. Think of it, these men drove at least 542 miles on a week-end, and, in addition, worked like Trojans for two days to assist in this 341 acre rehabilitation job. The above is just one example of the help received. One could go on at great lengths listing the projects in which the United States Air Force, United States Army; and Anchorage, Palmer, Cordova and Fairbanks Sportsmen's Clubs participated. The help rendered by these groups and individuals has materially aided the sport fisheries program of the Territory.

Plate 6. Sportsmen loading fish planting tank at the Fire Lake Hatchery.


Plate 7. Sportsmen receiving instructions from biologist prior to the rehabilitation of Deadman Lake.


Tanana River Valley in interior Alaska.

1954 FAIRBANKS HATCHERY TROUT PLANTS

| Date | Lake | Number Planted | Number of Trout Per Pound | Species | Area |
| :---: | :---: | :---: | :---: | :---: | :---: |
| July 6 | Boleo | 90,000 | 3,800 | Rainbow | Big Delta |
| July 7 | Meier | 15,274 | 3,800 | " | Meier |
| July 7 | Gravel Pit | 3,820 | 3,800 | " | Richardson Highway, Mile 30 |
| July 18 | Otto's | 21,363 | 2,700 | " | Healey |
| $\begin{aligned} & \text { July } 31 \text {, } \\ & \text { Aug. 6, } 10 \text {, } \\ & 15,19, \\ & \text { Sept. } 7 \end{aligned}$ | Deadman | 98,993 | 1,700 | Rainbow, Steelhead | Northway |
| August 17, Sept. 7 | Lost | 32,953 | 1,400 | Steelhead | Fairbanks |
| Sept. 5 | Gravel Pit | 1,000 | 1,000 | Steelhead | Richardson Highway, Mile $80^{\circ}$ |
| Sept 5 | Gravel Pit | 1,000 | 1,000 | Steelhead | Richardson Highway, Mile 81 |
| Sept. 7 | Gravel Pit | 1,500 | 1,000 | Steelhead | Richardson Highway, Mile 55 |
|  | TOTAL | 265,903 |  |  |  |



## WATERSHED MANAGEMENT

The program in the Kodiak-Afognak area was intensified during 1954. A biologist was permanently stationed in the town of Kodiak. His main efforts are to be directed towards the work already started at Paul's Basin and Fraser Lake, and in addition to learn as much about the fisheries past and present as time allows.

The downstream migrants from Laura Lake were again sampled for size and numbers. The results were greatly encouraging. Silver salmon ascended the Paul's Basin fishways for the third successive year.

Further stream and lake surveys were carried on in the Ketchikan area. Two of the most promising blocked lake systems, Bakewell and Old Franks, were sampled as to indigenous fish and chemical properties. Bakewell Lake was picked as the most likely site in the Ketchikan area for a stream improvement project on the basis of potential rearing and spawning area and approximate cost of the project. Red salmon green and eyed egg plants were made at two tributary streams of Bakewell Lake. Further work was carried on assessing escapements of pink, red, chum, and coho salmon in the area.

The following report covers the mutual efforts of:

| Walter Kirkness, | Senior Biologist |
| :--- | :--- |
| Stanley Swanson, | District Biologist |
| Roy Rickey, | District Biologist |
| Leo M. Thompson, | Engineer |
| Paul Garceau, | Biological Aide |
| Lyle Simpson, | Fishery Inspector |

## BIOGRAPHICAL SKETCH

R. A. Rickey, Jr. was born in Seattle, Washington, on April 22, 1922. He attended elementary and high schools in the State of Washington and was graduated from the Skykomish high school. He entered the University of Washington in 1940; however, like so many others of his generation, he had his college career cut short by the outbreak of World War II. Mr. Rickey entered the U. S. Army in 1942 and served with the 10th Mountain Infantry Division for three years. He is a veteran of the 10th's Italian Campaign, in which he was decorated for aggressive action against the enemy forces.

After his discharge from the Army, Mr. Rickey re-entered the University of Washington and resumed his studies. During his summer vacations as a student, Mr. Rickey obtained valuable experience by working as a seasonal employee for the Fisheries Research Institute in Southeastern Alaska on pink salmon, the International Pacific Halibut Commission on the problems of age determination and catch indices of halibut, and as a deckhand on a purse seine tender in the Puget Sound and Neah Bay fishery. In 1949 he was graduated with a Bachelor of Science in Fisheries degree.

After graduation from the University, Mr. Rickey was employed for two years by the Washington State Department of Fisheries; his work included investigations of the salmon troll fishery, Puget Sound king salmon, Puget Sound bottom fish and razor clams in the Grays Harbor
area. Mr. Rickey resigned from the above position in 1951. During the 1951,1952 , and 1953 fishing seasons, he was a fisherman aboard purse seiners fishing in Puget Sound Washington, and in the Bering Sea, False Pass, Kodiak, and Southeastern areas of Alaska.

Mr. Rickey joined the Watershed Management Division of the Department in May, 1954, bringing with him an excellent educational background, skill in fisheries investigations, and practical experience in commercial fishing in Puget Sound as well as in Alaska.

## KODIAK AREA

The continuation of the Pauls Basin project was the primary consideration in the Kodiak area in 1954. As in previous years the two phases of this work were carried out:

## PAULS BASIN

the 1951 and 1952 plants of eyed eggs in Gretchen creek, the main tributary to Laura Lake.
2. Stocking Gretchen Creek with eyed eggs from the Perenosa (Portage Lake) system.

Again, the intent of this program is to establish a self sustaining run of red salmon in the Pauls Basin lake system, which (prior to 1951) had been barren of salmon because of the insurmountable falls in the stream between Laura and Pauls Lake.

The downstream fingerling enumeration indicated a good survival from the plant of 1951 and an excellent survival from the 1952 plant of eyed eggs. The migrants were trapped in the same manner as in 1953 (Alaska Department of Fisheries Annual Report for 1953, page 70). The trap was operated from June 6th until July 8th when the lack of migrants indicated the run was over. Water level and temperature data have been kept the past two years. No correlation between these two factors and downstream migration is yet apparent.


Plate 1. 1951 and 1952 brood year migrant red salmon fingerling from Laura Lake.

Fish from two brood years, 1951 and 1952, made up the migration and were easily identified because of the difference in size. This was verified by scale readings from a sample of the fingerlings as they passed through the trap. Plate 1 indicates the relative difference in size of the two year classes.


Plate 2. School of migrating red salmon fingerling off trap lead at Laura Lake.

One significant fact involved is that in 1953, 1,238 red salmon migrants of the 1951 brood year passed through the trap on their way to the sea, and in 1954 there were 1,842 of this same brood year counted through. This being the case, there was a holdover of over $50 \%$ of the 1951 brood year in Laura Lake for an additional year. If this can be projected to the 1952 brood, in which 8,702 red salmon migrants were counted downstream in 1954, the total number of downstream migrants will be more than doubled by 1955.

The fish not only survived well from the eyed stage, but were very robust and healthy appearing which would tend to make the outlook for sea survival optimistic.

One jack (precociously mature male) red salmon ascended the fishways and appeared below the downstream trap on June 29th. It measured fifteen inches from nose to tail fork. A scale sample showed it to be in its third year. Later, four jacks were seen in Gretchen Creek along with about 250 'lake jacks ', i.e., 1951 brood red salmon that had not gone to sea. All of the jacks displayed spawning coloration and morphological changes typical of red salmon on the spawning grounds. Plate 3 shows one of the lake jacks and one of the sea jacks. Both fish are the same age, but the larger one spent one year in the sea while the other one stayed in the lake. The difference in size illustrates the difference in abundance of food available to salmon in fresh water as compared to a salt water environment. Fortunately, all of the lake jacks were males, indicating the lack of a start of a kokanee or lake dwelling red salmon population that could perpetuate itself. Such a
population would be in competition for food and spawning grounds with its sea going relatives.


Plate 3. A 'ssea" jack and a "lake" jack of the same age - 1951 brood.
Eggs for stocking the Pauls Basin system were taken from Southeast Creek, a tributary to Perenosa (Portage) Lake as in previous years. The eggs were incubated to the eyed stage in the Perenosa (Discoverer) Bay station. A total of 488,000 were raised to the eyed stage and sustained a mortality of $2.5 \%$ from spawn taking to planting in Gretchen Creek. In the station the baskets of eggs were treated with malachite green hydrochloride approximately twice a week for a half hour interval then flushed clean of the solution. The treatment was a prophylactic measure against fungus infection of the eggs. No evidence of fungus was observed during or after the incubation period.

Blasting of the nests in the stream to be planted was unnecessary this year because the gravel was sufficiently loosened from previous years plants to permit excavation by shovels. All planting was accomplished by the tube method as described in previous publications by this Department.

The possibility of larger numbers of red fingerlings leaving Laura Lake after two years residence, as opposed to one, was advanced in the Annual Report for 1953 and borne out this year. Whether any fingerlings will stay for three years in the

## CONCLUSION

 lake remains to be seen in 1955. The overall picture of the Paul's Basin project seems to indicate that the red salmon fingerlings achieve good growth and survive from the eyed stage to migratory stage in better than normal numbers. The final proof of survival will, of course, be the return of adults to Gretchen Creek to spawn. The first returning adults are due back in 1955, but their numbers will be small due to the relatively small numbers of seaward bound migrants in 1953.In the extension of their own range, the silver salmon are utilizing Laura Lake and Creek for spawning. A minimum of 800 silvers ascended the ladders and went into Laura Lake. On one survey, 350 were counted at the outlet of Laura Lake and on the same day over 400 were ascending the stream below. The silvers had little difficulty in jumping the various steps of the ladders.

During the operation of the downstream trap for red migrants, numbers of silver salmon fry about one inch long would be found in the bunt of the trap. Apparently considerable numbers of silvers had spawned on this spot in the fall of 1953.

In July, a topographic survey was made of the most probable route for a fishway around Frazer falls. The falls represent the only obstacle to opening Frazer Lake sys-

FRAZER LAKE tem to red salmon production. The potential of this system is tremendous, to say the least. The lake is comparable in size to nearby Karluk Lake, whose production of red salmon in the past is well known.

Just after mid-July, another plant of green (fertilized) red salmon eggs was made in a tributary stream to Frazer Lake. Plans had been made to stock at least two tributaries, but due to the small numbers of mature red salmon available for egg taking purposes in Karluk Lake, there were only enough eggs taken for one stream. The Karluk drainage, in 1954, had the smallest numbers of reds escape to the spawning grounds in its recorded history.

Subsequent sampling of the fry as they emerge from the gravel will be done in the spring of 1955, as an indication of the success of survival. The first returning adult red salmon from the 1951 plant may appear below the falls as jacks in 1955.


Plate 4. Aerial photograph of Frazer falls.


Plate 5. Upstream view of right side of Frazer falls.

## KETCHIKAN DISTRICT

Surveying and cataloging of blocked lake systems suitable for salmon production and the stocking of selected areas was continued for the third season in the Ketchikan area. Work of this nature holds considerable promise for this district due to the large number of lakes and streams having falls which are impassable barriers to anadromous fishes. Some of these systems can be stocked with salmon eggs or fry and selfperpetuating runs created by surmounting the barrier falls with fishways. Experimental stocking and determination of the productive ability of lake systems having falls not feasible to bypass with fishways is being done to establish whether or not yearly planting will prove economically practical. If the production warrants, salmon fry can be planted on an annual basis with the adult salmon cropped, as they return, by the commercial fishery.

A promising large lake system, Bakewell, was surveyed in detail, water properties examined, sound-

## BAKEWELL SURVEY AND STOCKING

 ings made and the species of fish present determined by gillnetting with variable mesh size gillnets. Cutthroat trout, dolly varden, stickleback, kokanee (landlocked sockeye salmon) and cottids (bullheads) were taken in the nets.One hundred thousand fertilized and two hundred thousand eyed sockeye eggs were planted in the inlet streams to the lake during August and September. Examination of test cartridges filled with fertilized eggs revealed very low mortality after one month of development at which time the eggs were fully eyed.

Facilities for trapping the sockeye which furnished the eggs for the Bakewell plants were located at Buschmann Creek, tributary to Hugh Smith Lake (Plate 6). Red salmon were taken for spawn at this location on three occasions; August 18, 27 and November 16. The last lot of eggs, 68,000 , were placed in hatching troughs and the liberation of the fingerlings in the Bakewell system will be made in September of 1955.


Plate 6. Weir and holding pen at Buschmann Creek.
Most of the eggs were shipped after water hardening in sealed containers (one gallon capacity thermos jugs) from the eggtaking site to the eyeing station, with a three to four hour time lapse. One other method of shipping the eggs was employed, that of packing them in damp cheesecloth laid in trays. This method was used only during cool weather and when the time lapse from water hardening to arrival at the hatchery troughs was to be one hour or less.

The Bakewell Lake system offers good possibilities for establishing runs of sockeye and silver salmon which can be self-perpetuating. There is only one barrier in the half mile long outlet stream, a twentyfive foot falls, which can be bypassed with a fishway.

As it is a well recognized fact that salmon suffer their heaviest natural mortality while in the juvenile stage in fresh water, sampling in the marine environment directly

## SMALL FISH STUDY

 after this initial mortality has taken place should help achieve a clearer picture of survival and what may be expected to return as adults in the year of maturity. In addition, sampling in salt water (as in a large bay) should give an index to the production of a number of streams in the immediate area rather than one as in the case of sampling in the stream itself.A small floating trap was fished at two locations in the Ketchikan
area in an effort to determine whether or not fixed gear of this type could be successfully employed in taking small salmon in their marine environment, what gear modifications and refinements might be necessary, and whether or not the behaviour of the young salmon would readily permit their capture in the salt water. The trap was patterned closely after the conventional floating commercial salmon fishing trap. Dimensions of the trap were: Spiller $6^{\prime} \times 6^{\prime} \times 4^{\prime}$ wide with wings $12^{\prime}$ in length and $6^{\prime}$ deep. Mesh of the trap was $1 / 8^{\prime \prime}$ saran plastic screen. The lead used was $4 \frac{1}{2}{ }^{\prime}$ deep with mesh of two sizes, 50 of $1^{\prime \prime}$ stretch mesh fastened to the trap and attached to 100 of $3^{\prime \prime}$ stretch mesh. The trap was equipped with two tunnels and an apron. A shoreline was used to permit the lead to remain slack enough to follow the contour of the beach as the tide rose and fell. The trap was fished at distances of $25^{\prime}$ to $75^{\prime}$ from the beach with the best results obtained at about $50^{\prime}$. Plate 7 illustrates the small fish trap.


Plate 7. Small fish trap.
The trap was fished from May 17 to June 9 at Shoalwater Pass and took 810 pink fry, 543 chum fry, plus several thousand tubesnouts and herring. It was then moved to Mink Bay, Boca de Quadra, where it could be tended by one of the department's employees who was also serving as a streamguard. The catch at this location was 430 chum fingerlings, 22 coho and 2 sockeye fingerlings, plus hundreds of tubesnouts during the period June 18 to July 2.

As expected, considerable attention was required to prevent floating marine vegetation and debris from clogging the mesh of the trap and lead. Efficiency of the trap was found to be reduced immediately when such debris began to accumulate. Window cleaning brushes on four and a half foot handles proved satisfactory for cleaning the trap. Another factor found to affect the fishing efficiency of the trap on salmonoid fry
was the presence of other fishes in or near the trap. Herring and tubesnouts would enter the trap periodically and during these periods few or no fry would be found in the trap. In early June, tubesnouts were observed spawning on the mesh of the trap and were seen driving away approaching fry, a contributing factor to the low overall catch of salmon fry and fingerlings.

Observations made on fry approaching the lead of the trap disclosed that their migrating tendencies were greatly influenced by the velocity of the tidal current. When the tide was running strongly, the small fry would be seen swimming determinedly against the current up to the lead and into the trap. During periods of little tidal action, about $90 \%$ of the time at the first location fished, the fry would approach from either side of the lead and either enter the trap in a body or more often reverse direction and move away in an aimless manner.

Efforts were made to fish the trap in areas having prolonged strong tidal movements, but the light construction of the trap resulted in these efforts being unsuccessful. It was evident, upon conclusion of the experiment, that the use of heavier gear would produce more satisfactory results in sampling the small salmon in the marine environment. Definite possibilities exist in the use of a lead and counting plate, dispensing with the trap part of the structure. Sample counts could be made each day on the small salmon passing over the plate which could be located at the offshore end of the lead. Possibly mesh of one inch or more could be used successfully. It was found during the course of the experiment that fry would lead well along a half inch square wire mesh, through which they could have penetrated easily had they but tried.

King salmon were tagged in the Ketchikan area for the second year to gather information on stream origin of the fish and the extent of their migrations during the immature
KING SALMON TAGGING stages of their life. The fish were contributed for tagging by local sport fishermen as in the previous year. Twenty-five tags were put out with a return of four ( $16 \%$ ) to December 31. Three recoveries were local and one was made at the mouth of the Tahsis River, west coast of Vancouver Island. The tag recovery information is given in Table 1.

Table 1. Recoveries through December 1954 of king salmon tagged in the Ketchikan area during 1954.

| Area Tagged | Area Recovered | Days Out | Distance Traveled (1) |
| :--- | :--- | :---: | :---: |
| Grant Island | Grant Island | 3 | 0 |
| Island Point | Clover Pass | 12 | 15 |
| Chasina Point | Kah Shakes Cove | 16 | 45 |
| Grant Island | Tahsis River, <br> Vancouver Island | 112 | 600 |
| (1) Distance between tagging and recovery points in nautical miles. |  |  |  |

Six additional recoveries from the 1953 tagging of sixty-six fish were made during 1954. Eleven had been made during 1953, giving a total tag recovery of seventeen, or a recovery percentage of 26 . Table 2 gives the tag recovery information for all recoveries through December, 1954, from the 1953 tagging.

Table 2. Recoveries through December 1954 of king salmon tagged in 1953 in the Ketchikan area.

| Area Tagged | Area Recovered | Days Out | Distance Traveled (1) |
| :--- | :--- | :---: | :---: |
| Clover Pass | Grant Island | 32 | 5 |
| Clover Pass | Vallenar Bay | 123 | 5 |
| Mountain Point | Blank Island | 30 | 4 |
| Mountain Point | Vallenar Point | 146 | 14 |
| Bell Island | Bell Island | 39 | 0 |
| Skin Island | Mountain Point | 117 | 25 |
| Skin Island | Vallenar Point | 117 | 11 |
| Skin Island | Duke I. - West Rock | 70 | 35 |
| Skin Island | Cape Chacon | 15 | 40 |
| Island Point | Skin Island | 13 | 5 |
| Island Point | Twenty Fathom Bank | 95 | 3 |
| Skin Island | Gardner Canal, B.C. 349 | 170 |  |
| Clover Pass | Tolstoi Bay | 301 | 20 |
| Clover Pass | Hadley | 285 | 15 |
| Skin Island | Island Point | 325 | 5 |
| Skin Island | Behm Canal (2) | 238 | 20 |
| Skin Island | Walden Point, | 344 | 25 |
|  | Annette Island |  |  |

(1) Distance between tagging and recovery points in nautical miles.
(2) Exact location in Behm Canal unknown.

The tagged fish, with only two exceptions, were recovered within forty-five miles from the point of tagging, indicating that during the immature period of life, these fish remain for the most part within the limits of a relatively small area. Little evidence on stream origin of the tagged kings has resulted to date, only one recovery having been made which can be attributed to a particular spawning stream, the Tahsis River, Vancouver Island, British Columbia.

The following lake systems were surveyed during the silver salmon spawning season as possible sources for broodstock to be used in the stocking program; Reflection, Mac-

## STREAM SURVEYS

 Donald, Heckman, Ward, Hugh Smith, Nichols, Miller, Kegan, Dora, Salmon Bay and Big Swede. Scarcity or absence of fish, plus high water conditions, made estimation of numbers possible only in the following streams: Buschmann Creek, tributary to Hugh Smith Lake, 115 silvers counted on November 22; inlet to Heckman Lake, 250 silvers counted on November 12; and three to five thousand silvers were estimated to spawn at the inlet stream to Reflection Lake. When it became apparent that the silver runs under observation were not large enough to fulfillthe egg requirements for stocking purposes, a request was made to the Washington State Department of Fisheries who agreed to furnish this Department with 300,000 eyed silver eggs.

The Ketchikan King Salmon Derby Committee, under sponsorship of the Ketchikan Chamber of Commerce, constructed a $40^{\prime} \times 58^{\prime}$ cedar log hatchery building shell to be outfit-

DEAR MOUNTAIN HATCHERY ted and manned by the Alaska Department of Fisheries and used for the artificial propagation of salmon.


Plate 8. Deer Mountain Hatchery, Ketchikan.

Construction was completed in October and the building was ready for limited operation in early December. The Alaska Department of Fisheries provided for the installation of the water supply, wiring, plumbing, office and workroom equipment, plus twelve hatchery troughs. The Department also plans to construct a bachelor apartment over the workroom area of the building and install twelve more aluminum hatchery troughs early in 1955. The apartment will be occupied by the hatchery attendant, a full time employee of the Department. When equipped with the full complement of forty-eight troughs, the hatchery will have a rearing capacity of one and one quarter million salmon fry. These fry, kings, silvers, and sockeye, will be used in stocking areas not now having these species. Ponds in the city park adjacent to the hatchery will be used in rearing king and silver salmon fingerlings. It is planned to build a broodstock of both these species in Ketchikan Creek. The returning adults will be taken for eggs at the hatchery site.

The major project undertaken this year was the design and inspection of construction of the Ketchikan (Deer Mountain) Hatchery and its facilities. Other accomplishments include the survey and/or design for easements, weirs, and potential hatchery and fishway sites.

In January, the engineer was notified of the probability of the Department's participation in the construction of a hatchery in or near Ketchikan; a preliminary survey was made of the most likely site. The initial surveys were plotted, hy-

## KETCHIKAN HATCHERY

 draulic needs determined, and a rough cost estimate established. After notification in-late spring of a definite financial commitment from the Ketchikan King Salmon Derby Committee, (whereby they would pay for the building shell and the Department would contribute the rest on a matching basis of funds expended) work was immediately started on the design of a hatchery that could provide the necessary facilities and maximum capacity for the amount of money available. Further discussions brought agreement on attendant legal problems, final architectural design, and arrangements for water supply. Proposed chlorination of all Ketchikan City water for drinking purposes necessitated a separate water supply line for the living quarters to abide by possible future local ordinances.Ground was broken on August 2 by equipment and manpower contributed by the City of Ketchikan. A local building team, Johnson and Wells, contracted by the Ketchikan King Salmon Derby Committee to perform all the concrete work and erect the building shell, started work on August 30 and, except for weather reasons and material delays, worked steadily to completion of the hatchery in late November. Plans for the building, which were closely adhered to, called for outside dimensions of 40 feet by 58 feet with provisions for living quarters and storage area in the attic; the roof pitch was to be 8:12. A reinforced concrete footing, foundation wall, and 4 inch thick floor slab provided the base of a shell made of three-faced cedar log siding throughout. Cedar shingles were used as a roof covering. Interior partitions of vertical cedar planks separated the hatchery area ( 39 feet by 44 feet) from a workroom ( 13 feet by 25 feet) which included a small lavatory, and an office ( 13 feet by 14 feet). Drain gutters to transport water from the 48 aluminum troughs to the main drainage line at the building's edge were built into, and made a part of, the concrete floor; an 8 inch culvert pipe took the drainage from the hatchery to the Ketchikan Creek nearby. The head trough which feeds 24 series of 2 troughs each (end to end, thus making double use of water) is built of reinforced concrete and is 40 feet long, 2 feet deep, 2 feet wide, and has a sloped bottom draining towards a 6 inch (vertically adjustable) standpipe. An 8 inch gate valve controls the inlet flow (at the head trough) coming through an 8 inch welded steel pipe line which extends 425 feet underground and under City Park pools to the source of water - a municipal powerhouse tailrace.

The exterior (Plate 8) presents a pleasing rustic appearance which blends in well with the background provided by the City Park foliage and Deer Mountain. By the end of the year, the first group of aluminum troughs (twelve) was in place, and the hatchery was ready for operation.

A downstream-migrant weir, of the inclined-screen-principle type used successfully in Europe and the United States, was constructed at the outlet of Kitoi Lake near the

KITOI LAKE WEIR Kitoi Bay Research Station on Afognak Island this summer. Plans were drawn in the spring for a double-spillway (each about 5 feet wide) reinforced concrete weir. Each spillway consisted of a set of 3 inch by 12 inch stop logs, keyed into one another with eye bolts for removal ease.

The weir was built during the summer by a three man crew from the Biology Division. It required 14 cubic yards of concrete and over 1500 feet of $3 / 8$ inch reinforcing rod and was completed in mid-September.

A topographic survey was made of the hatchery site at Kitoi Bay for purposes of determining type of foundation needed and the hydraulic head available for water supply.

A further study of the Frazer River Falls area presented a possibility of a more economical route for a fishway; the engineer made a topographic survey of it and took some flow measurements of the stream above the falls for a basis of proper hydraulic design.

The Bakewell Lake system (in the Ketchikan area) which empties into Smeaton Bay on lower East Behm Canal, appears to be one of the most feasible sites for a fishway,

## FISHWAY SITES

 based on information thus far obtained. The falls consist of two drops: the upper falls is 13 feet high and is a sharply sloping short rapids, and the lower one (separated from the upper by a pool creating a 90 degree turn in the stream) is 25 feet high. The falls, pool and walls in the immediate vicinity were surveyed by the department engineer with the idea of building the ladder through part of the barrier.As in past years, the engineer complied with requests from the Biology and Sportsfish Divisions to perform certain tasks that more appropriately fell upon the engineer rather than the biologists, such as preparing specifications and drawings for bids on hatchery equipment, making mechanical drawings of weirs (proposed) adapted to certain sites, making and plotting surveys, writing easement descriptions for access roads, building sites and pipelines.


Troller with poles out fishing.

## STATISTICS

The year 1954 produced an increase of over 40 million pounds of fisheries products landed in Alaska as compared to 1953. The 1954 salmon catch exceeded the 1953 landings by over 25 million pounds, while the catch of nearly all other species of fish also increased. The landings of king crab rose sharply in 1954, exceeding the previous year's catch by over 4 million pounds. This comparatively new fishery has increased almost steadily over the past ten years and holds considerable promise of becoming an important year round fishery in Alaska.

In the following tables, the latest data are given for the ten year period 1945 to 1954 . As in the past, the districts of the Territory embrace the same area. The Southeastern district includes the area from the southern boundary of Alaska north to Yakutat; the Central district extends from Yakutat westward, including the entire area south of the Alaska Peninsula; the Western district includes that area north of the Peninsula and the Kuskokwim and Yukon Rivers.

The source of the material presented in this section is from the commercial fisheries branch of the United States Fish and Wildlife Service. The use of these data is hereby gratefully a cknowledged.


On the lookout for fish.

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 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1945 | \$ 12.12 | \$ 7.68 | \$ 8.04 | \$ 16.70 | \$ 15.51 | \$44,757,680 |
|  | 2,457,242 | 5,312,270 | 18,007,700 | 720,196 | 18,260,272 |  |
| 1946 | 17.30 | 10.53 | 10.67 | 21.25 | 19.55 | 53,157,194 |
|  | 3,250,249 | 6,421,647 | 21,895,235 | 805,199 | 20,784,864 |  |
| 1947 | 18.24 | 17.95 | 18.72 | 21.08 | 24.19 | 79,981,931 |
|  | 2,689,888 | 8,229,464 | 32,210,755 | 1,112,539 | 35,739,285 |  |
| 1948 | 25.96 | 21.10 | 24.24 | 26.70 | 27.51 | 98,660,291 |
|  | 5,732,253 | 15,082,926 | 31,445,485 | 1,435,578 | 44,964,049 |  |
| 1949 | 22.00 | 15.00 | 16.00 | 24.00 | 26.05 | 82,412,289 |
|  | 3,781,482 | 7,498,382 | 44,147,496 | 1,402,934 | 25,581,995 |  |
| 1950 | 22.00 | 21.10 | 24.00 | 23.00 | 29.00 | 84,252,325 |
|  | 5,556,430 | 15,539,056 | 26,753,868 | 1,590,996 | 34,811,975 |  |
| 1951 | 25.28 | 15.18 | 20.84 | 28.41 | 31.85 | 79,249,185 |
|  | 8,726,587 | 10,925,359 | 32,505,086 | 2,489,046 | 24,603,107 |  |
| 1952 | 21.34 | 15.66 | 18.52 | 26.76 | 28.60 | 76,362,304 |
|  | 4,206,757 | 15,140,209 | 21,705,200 | 1,526,532 | 33,783,606 |  |
| 1953 | 19.67 | 13.43 | 17.59 | 27.64 | 28.50 | 58,178,445 |
|  | 2,511,209 | 10,622,248 | 16,613,896 | 1,553,585 | 26,877,507 |  |
| 1954 | 22.87 | 14.66 | 19.55 | 26.76 | 28.89 |  |
|  | 3,826,839 | 14,766,146 | 22,230,115 | 1,374,656 | 21,158,968 | 63,356,724 |
|  |  | Total value all species, 1905-1954 |  |  |  | \$1,935, 164,372 |

Table 2. Total Salmon Pack in cases (48 one-pound cans) and number of Operating Salmon Canneries by district.

| Year | Pack <br> Southeastern | No. <br> Can. | Pack <br> Central | No. <br> Can. | Pack <br> Western | No. <br> Can. | Total <br> Pack | Total No. <br> Canneries |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1945 | $1,548,543$ | 41 | $2,091,739$ | 44 | 713,287 | 11 | $4,354,569$ | 96 |
| 1946 | $1,476,326$ | 45 | $1,772,318$ | 51 | 711,966 | 20 | $3,960,610$ | 116 |
| 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 |

Table 3. Number of Salmon taken in 1954, compiled by Fishing Gear, Species \& Districts.

| Gear and Species | Southeastern Alaska | Central <br> Alaska | Western Alaska | All Districts |
| :---: | :---: | :---: | :---: | :---: |
| SEINES: |  |  |  |  |
| Number of Units | 420 | 533 | 51 | 946(*) |
| \% of Total Catch | 47 | 41 | 18 | 39 |
| Silver | 110,016 | 50,647 | 857 | 161,520 |
| Chum | 3,161,329 | 2,255,863 | 376,767 | 5,793,959 |
| Pink | 4,034,288 | 4,565,536 | 584,059 | 9,183,883 |
| King | 9,449 | 1,452 | 368 | 11,269 |
| Red | 428,042 | 414,322 | 234,334 | 1,076,698 |
| Total | 7,743,124 | 7,287,820 | 1,196,385 | 16,227,329 |
| GILLNETS: |  |  |  |  |
| Number of Units. | 1,113 | 5,287 | 1,215 | 7,608(*) |
| \% of Total Catch | 8 | 27 | 82 | 28 |
| Silver | 417,591 | 503,715 | 58,503 | 979,809 |
| Chum | 292,434 | 535,076 | 443,444 | 1,270,954 |
| Pink | 150,208 | 1,456,789 | 103,859 | 1,710,856 |
| King | 42,613 | 70,060 | 127,754 | 240,427 |
| Red | 452,877 | 2,202,606 | 4,779,328 | 7,434,811 |
| Total | 1,355,723 | 4,768,246 | 5,512,888 | 11,636,857 |
| TRAPS: <br> Number of Units | 118 | 98 | - | 216 |
| \% of Total Catch | 36 | 32 | - | 29 |
| Silver | 193,735 | 124,518 | - | 318,253 |
| Chum | 781,069 | 532,080 | - | 1,313,149 |
| Pink | 4,620,918 | 4,554,050 | - | 9,174,968 |
| King | 1,450 | 13,129 | - | 14,579 |
| Red | 325,017 | 572,794 | - | 897,811 |
| Total | 5,922,189 | 5,796,571 | - | 11,718,760 |
| LINES: <br> \% of Total Catch | 9 | - | - | 4 |
| Silver | 1,049,445 | - | - | 1,049,445 |
| Chum | 7,487 | - | - | 7,487 |
| Pink | 103,217 | - | - | 103,217 |
| King | 344,108 | - | - | 344,108 |
| Red | 1,941 | - | - | 1,941 |
| Total | 1,506,198 | - | - | 1,506,198 |
| TOTAL: |  |  |  |  |
| Silver | 1,770,787 | 678,880 | 59,360 | 2,509,027 |
| Chum | 4,242,319 | 3,323,019 | 820,211 | 8,385,549 |
| Pink | 8,908,631 | 10,576,375 | 687,918 | 20,172,924 |
| King | 397,620 | 84,641 | 128,122 | 610,383 |
| Red | 1,207,877 | 3,189,722 | 5,013,662 | 9,411,261 |
| Grand Total | 16,527,234 | 17,855,637 | 6,709,273 | 41,089,144 |

(*) Exclusive of duplication

Table 4. Comparative annual landings of Fish and Shellfish by poundage and value.

| SPECIES | 1945 | 1946 | 1947 | 1948 | 1949 | 1950 | 1951 | 1952 | 1953 | 1954 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Salmon | $\begin{aligned} & 402,635,233 \\ & \$ 15,564,474 \end{aligned}$ | $\begin{aligned} & 391,689,076 \\ & \$ 17,088,935 \end{aligned}$ | 381,807,676 | 338,369,670 | 388,345,160 | 264,918,844 | 276,588,312 | 282,966,799 | 220,276,191 | 247,032,557 |
|  |  |  | \$19,570,408 | \$23,143,760 | \$32,662,497 | \$22,637,117 | \$32,368,160 | \$31,020,258 | \$21,497,532 | \$24,597,049 |
| Herring | $\begin{array}{r} 139,769,328 \\ \$ 1,355,738 \end{array}$ | $\begin{array}{r} 198,231,250 \\ \$ 1,982,312 \end{array}$ | $\begin{array}{r} 187,889,562 \\ \$ 2,077,314 \end{array}$ | $\begin{array}{r} 174,449,254 \\ \$ 1,852,972 \end{array}$ | $\begin{array}{r} 33,061,172 \\ \$ 414,072 \end{array}$ | $\begin{array}{r} 165,366,843 \\ \$ 2,067,085 \end{array}$ | 81,624,700 | 45,802,151 | 34,812,369 | 35,321,918 |
|  |  |  |  |  |  |  | \$1,003,292 | \$444,461 | \$452,811 | \$472,721 |
| Halibut | $\begin{aligned} & 33,398,004 \\ & \$ 4,020,358 \end{aligned}$ | $\begin{aligned} & 35,010,441 \\ & \$ 4,082,000 \end{aligned}$ | $\begin{aligned} & 34,016,781 \\ & \$ 5,676,630 \end{aligned}$ | $\begin{aligned} & 34,960,888 \\ & \$ 5,095,063 \end{aligned}$ | $\begin{aligned} & 35,196,343 \\ & \$ 5,157,902 \end{aligned}$ | $\begin{aligned} & 38,6.36,402 \\ & \$ 5,776,224 \end{aligned}$ | 32,045,000 | 33,390,807 | 26,749,543 | 36,075,542 |
|  |  |  |  |  |  |  | \$4,117,608 | \$4,533,808 | \$2,959,704 | \$4,352,759 |
| Sablefish | $\begin{array}{r} 8,351,129 \\ \$ 914,542 \end{array}$ | $\begin{array}{r} 9,019,257 \\ \$ 739,800 \end{array}$ | $\begin{array}{r} 1,228,431 \\ \$ 110,559 \end{array}$ | $\begin{array}{r} 6,512,346 \\ \$ 707,734 \end{array}$ | $\begin{array}{r} 5,753,724 \\ \$ 427,374 \end{array}$ | $\begin{aligned} & 954,901 \\ & \$ 35,791 \end{aligned}$ | $\begin{array}{r} 5,815,405 \\ \$ 529,368 \end{array}$ | $\begin{array}{r} 1,804,417 \\ \$ 141,364 \end{array}$ | $\begin{array}{r} 3,547,271 \\ \$ 250,792 \end{array}$ | $\begin{array}{r} 4,721,750 \\ \$ 336,200 \end{array}$ |
|  |  |  |  |  |  |  |  |  |  |  |
| Cod | $\begin{array}{r} 1,722,479 \\ \$ 34,013 \end{array}$ | $\begin{array}{r} 2,531,630 \\ \$ 126,820 \end{array}$ | $\begin{array}{r} 2,347,514 \\ \$ 81,405 \end{array}$ | 2,337,770 | 2,185,547 | $\mathbf{8 5 8 , 3 1 8}$$\$ 22,676$ | -- | -- | -- | - |
|  |  |  |  | \$73,860 | \$54,639 |  |  |  | -- | -- |
| Sharks and Skates | $\begin{array}{r} 2,744,224 \\ \quad 371.176 \end{array}$ | $\begin{array}{r} 6,445,025 \\ \$ 60,180 \end{array}$ | $\begin{array}{r} 1,975,664 \\ \$ 23,264 \end{array}$ | $\begin{array}{r} 2,250,474 \\ \$ 36,358 \end{array}$ | $\begin{array}{r} 1,507,325 \\ \$ 24,333 \end{array}$ | 18,883$\$ 105$ | 11,008$\$ 110$ | 3.550$\$ 53$ | 2,450$\$ 131$ | $\begin{array}{r} 2,783 \\ \$ 141 \end{array}$ |
|  |  |  |  |  |  |  |  |  |  |  |
| Miscellaneous Bottom Fish ${ }^{1}$ | $\begin{array}{r} 1,774,992 \\ \$ 105,317 \end{array}$ | $\begin{gathered} 1,500,545 \\ \$ 136,849 \end{gathered}$ | $\begin{array}{r} 82,800 \\ \$ 12,462 \end{array}$ | $\begin{aligned} & 408,989 \\ & \$ 17,387 \end{aligned}$ | $\begin{aligned} & 192,157 \\ & \$ 12,281 \end{aligned}$ | $\begin{array}{r} 20,604 \\ \$ 528 \end{array}$ | $\mathbf{2 5 , 2 6 4}$$\$ 1,620$ | $\mathbf{3 7 7 , 4 1 4}$$\$ 22,325$ | $\begin{array}{r} 14,146 \\ \$ 586 \end{array}$ | $\begin{aligned} & 46,914 \\ & \$ 2,217 \end{aligned}$ |
|  |  |  |  |  |  |  |  |  |  |  |
| Clams: |  |  |  |  |  |  |  |  |  |  |
| Butter | $\begin{aligned} & 713,035 \\ & \$ 14,925 \end{aligned}$ | $\begin{aligned} & 412,458 \\ & \$ 36,965 \end{aligned}$ | 11,176$\$ 838$ | 15,644 | 5,652 | -- | 80$\$ 8$ | 23,116 | 80,394 | 9,459 |
|  |  |  |  | \$939 | \$339 |  |  | \$1,828 | \$6,432 | \$643 |
| Razor | $\begin{array}{r} 1,705,847 \\ \$ 115,151 \end{array}$ | $\begin{array}{r} 1,804,679 \\ \$ 162,421 \end{array}$ | $\begin{aligned} & 606,540 \\ & \$ 57,621 \end{aligned}$ | $\begin{array}{r} 1,222,649 \\ \$ 128,378 \end{array}$ | $\begin{aligned} & 1,699,695 \\ & \$ 203,693 \end{aligned}$ | $\begin{array}{r} 2,201,717 \\ \$ 264,206 \end{array}$ | $\begin{array}{r} 2,355,681 \\ \$ 347,574 \end{array}$ | $\begin{array}{r} 1,272,454 \\ \$ 165,419 \end{array}$ | $\begin{array}{r} 1,486,222 \\ \$ 193,209 \end{array}$ | $\begin{array}{r} 1,229,135 \\ \$ 159,788 \end{array}$ |
|  |  |  |  |  |  |  |  |  |  |  |
| Crabs: |  |  |  |  |  |  |  |  |  |  |
| Dungeness | $\begin{array}{r} 1,857,720 \\ \$ 59,692 \end{array}$ | $2,438,600$$\$ 131,436$ | $1,392,611$$\$ 69,630$ | $1,222,326$$\$ 63,217$ | $1,428,401$$\$ 80,716$ | 4,119,425 | $5,482,416$$\$ 478,387$ | $3,749,412$$\$ 331,433$ | 3,471,806 | $\begin{array}{r} 2,739,383 \\ \$ 246,146 \end{array}$ |
|  |  |  |  |  |  | \$277,382 |  |  | \$312,463 |  |
| King | -- | $\begin{array}{r} 22,600 \\ \$ 960 \end{array}$ | $\begin{aligned} & 752,668 \\ & \$ 31,888 \end{aligned}$ | $\begin{array}{r} 2,133,354 \\ \$ 96,001 \end{array}$ | $\begin{array}{r} 1,206,945 \\ \$ 72,417 \end{array}$ | $\begin{array}{r} 1,519,249 \\ \$ 91,155 \end{array}$ | $\begin{array}{r} 1,993,912 \\ \$ 227,622 \end{array}$ | $\begin{gathered} 2,772,833 \\ \$ 388,197 \end{gathered}$ | $\begin{array}{r} 4,613,209 \\ \$ 547,431 \end{array}$ | $\begin{array}{r} 8,871,070 \\ \$ 880,465 \end{array}$ |
|  |  |  |  |  |  |  |  |  |  |  |
| Shrimp | $\begin{array}{r} 1,263,291 \\ \$ 23,757 \end{array}$ | $2,248,900$$\$ 56,222$ | $\begin{array}{r} 1,657,299 \\ \$ 215,449 \end{array}$ | $\begin{array}{r} 2,834,803 \\ \$ 226,784 \end{array}$ | $\begin{array}{r} 2,267,934 \\ \$ 181,434 \end{array}$ | $\begin{array}{r} 2,158,260 \\ \$ 172,661 \end{array}$ | $\begin{array}{r} 1,707,816 \\ \$ 179,301 \end{array}$ | $\begin{array}{r} 1,952,777 \\ \$ 181,609 \end{array}$ | $\begin{array}{r} 1,733,882 \\ \$ 225,405 \end{array}$ | $\begin{array}{r} 1,451,929 \\ \$ 188,751 \end{array}$ |
|  |  |  |  |  |  |  |  |  |  |  |
| $\begin{gathered} \text { Miscellaneous } \\ \text { Shellfish } \end{gathered}$ | $\begin{array}{r} 37,918 \\ \$ 2,100 \end{array}$ | $\begin{aligned} & 27,425 \\ & \$ 2,447 \end{aligned}$ | $\begin{aligned} & 23,917 \\ & \$ 2,078 \end{aligned}$ | $\begin{array}{r} 7,329 \\ \$ 733 \end{array}$ | $\begin{aligned} & 19,630 \\ & \$ 1,348 \end{aligned}$ | $\begin{aligned} & 73,200 \\ & \$ 4,392 \end{aligned}$ | $\begin{aligned} & 44,193 \\ & \$ 3,596 \end{aligned}$ | 23,021 | $\begin{aligned} & 91,956 \\ & \$ 8,074 \end{aligned}$ | $\begin{aligned} & 67,778 \\ & \$ 5,422 \end{aligned}$ |
|  |  |  |  |  |  |  |  | \$2,081 |  |  |
| $\begin{aligned} & \text { Miscellaneous } \\ & \text { Fish } \end{aligned}$ | $\begin{array}{r} 78,360 \\ \$ 5,793 \end{array}$ | $\begin{aligned} & 64,128 \\ & \$ 9.932 \end{aligned}$ | $\begin{aligned} & 16,855 \\ & \$ 1,953 \end{aligned}$ | $\begin{aligned} & 174,467 \\ & \$ 38,116 \end{aligned}$ | $\begin{aligned} & 19,596 \\ & \$ 1,564 \end{aligned}$ | $\begin{array}{r} 1,445,976 \\ \$ 22,304 \end{array}$ | $\begin{array}{r} 32,909 \\ \$ 3,594 \end{array}$ | $\begin{aligned} & \mathbf{4 5 , 4 2 4} \\ & \$ 5,548 \end{aligned}$ | $\begin{array}{r} 87,023 \\ \$ 12,265 \end{array}$ | $\begin{array}{r} 58,502 \\ \$ 8,739 \end{array}$ |
|  |  |  |  |  |  |  |  |  |  |  |
| Miscellaneous <br> Livers, Oil \& Viscera | \$1,112 | \$5,377 | \$50,589 | \$13,503 | \$4,396 | -- | -- | -- | -- | -- |
| TOTALS | $\begin{array}{\|l} 596,051,660 \\ \$ 22,288,148 \end{array}$ | $\begin{array}{r} 651,446,014 \\ \$ 24,622,456 \end{array}$ | $\begin{aligned} & 613,809,594 \\ & \$ 27,982,188 \end{aligned}$ | $\begin{array}{\|} 566,899,963 \\ \$ 31,494,805 \end{array}$ | $\begin{array}{\|l} 472,889,281 \\ \$ 39,299,005 \end{array}$ | $\begin{aligned} & 482,292,622 \\ & \$ 31,371,626 \end{aligned}$ | $\begin{array}{\|l} 407,726,696 \\ \$ 39,280,240 \end{array}$ | $\begin{array}{r} 374,184,175 \\ \$ 37,238,384 \end{array}$ | 296,966,462 | $\begin{array}{r} 337,628,720 \\ \$ 31,251,041 \end{array}$ |
|  |  |  |  |  |  |  |  |  |  |  |

[^2]Table 5. Comparative annual production of Fishery Products as prepared for market by poundage and value.

| SPECIES | 1945 | 1946 | 1947 | 1948 | 1949 | 1950 | 1951 | 1952 | 1953 | 1954 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Salmon | $\begin{aligned} & 235,409,519 \\ & \$ 48,917,141 \end{aligned}$ | $\begin{aligned} & 218,653,709 \\ & \$ 59,090,973 \end{aligned}$ | 224,862,543 | 210,608,877 | 232,616,358 | 174,765,212 | 189, 100,990 | 194,611,255 | 156,657,320 | 174,484,964 |
|  |  |  | \$93, 145,456 | \$101,193,919 | \$86,112,666 | \$87,091,068 | \$85,887,641 | \$80,054,432 | \$62,067,161 | \$68,206,971 |
| Herring | $\begin{array}{r} 47,444,544 \\ \$ 2,973,500 \end{array}$ | $\begin{aligned} & 63,883,821 \\ & \$ 6,573,416 \end{aligned}$ | $\begin{gathered} 63,249,923 \\ \$ 6,533,778 \end{gathered}$ | $\begin{array}{r} 58,388,893 \\ \$ 5,694,889 \end{array}$ | $\begin{array}{r} 15,081,412 \\ \$ 944,106 \end{array}$ | $\begin{aligned} & 52,106,111 \\ & \$ 3,819,994 \end{aligned}$ | 28,213,195 | 15,995,582 | 14,365,884 | $\begin{array}{r} 12,464,513 \\ \$ 793,790 \end{array}$ |
|  |  |  |  |  |  |  | \$2,069,608 | \$944,667 | \$805,260 |  |
| Halibut | $\begin{aligned} & 26,757,711 \\ & \$ 4,390,183 \end{aligned}$ | $\begin{aligned} & 27,944 ; 512 \\ & \$ 5,460,111 \end{aligned}$ | 26,795,227 | 27,566,134 | 27,513,244 | 27,401,794 | 23,607,098 | 25,591,753 | 20,534,801 | 27,345,901 |
|  |  |  | \$5,989,188 | \$6,615,876 | \$5,425,754 | \$6,081,896 | \$4,198,542 | \$4,730,643 | \$3,261,482 | \$4,477,799 |
| Sablefish | $\begin{array}{r} 6,289,757 \\ \$ 1,239,929 \end{array}$ | $\begin{array}{r} 6,841,983 \\ \$ 1,153,025 \end{array}$ | $\begin{array}{r} 934,435 \\ \$ 143,250 \end{array}$ | $\begin{gathered} 4,943,507 \\ \$ 968,100 \end{gathered}$ | $\begin{array}{r} 4,281,771 \\ \$ 529,935 \end{array}$ | $\begin{aligned} & 680,301 \\ & \$ 51,579 \end{aligned}$ | $\begin{array}{r} 4,170,292 \\ \$ 548,426 \end{array}$ | $\begin{array}{r} 1,297,365 \\ \$ 161,812 \end{array}$ | 2,455,115 | $\begin{array}{r} 3,277,673 \\ \$ 394,791 \end{array}$ |
|  |  |  |  |  |  |  |  |  | \$271,366 |  |
| Cod | $\begin{aligned} & 543,680 \\ & \$ 80,255 \end{aligned}$ | $\begin{array}{r} 921,114 \\ \$ 152,660 \end{array}$ | $\begin{array}{r} 819,822 \\ \$ 163,498 \end{array}$ | $\begin{aligned} & 786,931 \\ & \$ 85,389 \end{aligned}$ | $\begin{aligned} & 660,664 \\ & \$ 74,680 \end{aligned}$ | $\begin{aligned} & 519,035 \\ & \$ 65,347 \end{aligned}$ | -- | -- | -- | -- |
|  |  |  |  |  |  |  | -- | -- | -- | -- |
| Sharks and Skates | $\begin{aligned} & 251,688 \\ & \$ 80,397 \end{aligned}$ | $\begin{array}{r} 277,038 \\ \$ 153,241 \end{array}$ | $\begin{aligned} & 164,276 \\ & \$ 59,572 \end{aligned}$ | 177,847$\$ 82,016$ | $\begin{aligned} & 153,777 \\ & \$ 42,019 \end{aligned}$ |  | 1,321$\$ 155$ | $\begin{array}{r} 426 \\ \$ 170 \end{array}$ | 294$\$ 131$ | 334 |
|  |  |  |  |  |  |  |  |  |  | \$141 |
| Miscellaneous Bottom Fish ${ }^{1}$ | $\begin{array}{r} 1,253,417 \\ \$ 110,733 \end{array}$ | 1,097,973 | $\begin{array}{r} 68,261 \\ \$ 19,404 \end{array}$ | 240,463$\$ 24,115$ | $\begin{aligned} & 140,167 \\ & \$ 14,938 \end{aligned}$ | 14,804$\$ 689$ | 20,298$\$ 2,170$ | 372,809$\$ 22,591$ | $\begin{array}{r} 6,938 \\ \$ 832 \end{array}$ | 24,777$\$ 2,983$ |
|  |  |  |  |  |  |  |  |  |  |  |
| Clams: Butter | 382,964$\$ 135,744$ | 261,681$\$ 171,947$ | 2,700$\$ 1,985$ | 13,452$\$ 3,584$ | $\begin{array}{r} 5,916 \\ \$ 1,219 \end{array}$ | $\begin{array}{r} 3,192 \\ \$ 3,073 \end{array}$ | 80$\$ 40$ | $\begin{aligned} & 11,483 \\ & \$ 3,303 \end{aligned}$ | 36,108 | $\begin{gathered} 423,262^{2} \\ \$ 502,771 \end{gathered}$ |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  | \$12,745 |  |
| Razor | $\begin{array}{r} 538,096 \\ \$ 403,688 \end{array}$ | $\begin{array}{r} 680,555 \\ \$ 752,783 \end{array}$ | $\begin{array}{r} 259,690 \\ \$ 247,801 \end{array}$ | $\begin{array}{r} 428,551 \\ \$ 498,469 \end{array}$ | $\begin{array}{r} 613,140 \\ \$ 680,171 \end{array}$ | $\begin{array}{r} 754,684 \\ \$ 857,871 \end{array}$ | $\begin{array}{r} 670,398 \\ \$ 812,791 \end{array}$ | $\begin{array}{r} 390,956 \\ \$ 501,354 \end{array}$ | $\begin{array}{r} 471,222 \\ \$ 607,326 \end{array}$ | -- |
|  |  |  |  |  |  |  |  |  |  | -- |
| Crabs: |  |  |  |  |  |  |  |  |  |  |
| Dungeness | $\begin{array}{r} 480,749 \\ \$ 352,222 \end{array}$ | 585,280$\$ 640$, | $\begin{array}{r} 345,583 \\ \$ 326,958 \end{array}$ | 302.972 | 375,908 | $\begin{array}{r} 1,130,828 \\ \$ 972,812 \end{array}$ | $\begin{array}{r} 1,715,967 \\ \$ 1,125,419 \end{array}$ | $\begin{array}{r} 1,037,741 \\ \$ 876,432 \end{array}$ | $\begin{array}{r} 723,158 \\ \$ 921,893 \end{array}$ | $\begin{gathered} 2,857,599^{3} \\ \$ 2,994,518 \end{gathered}$ |
|  |  |  |  | \$293,550 | \$349,693 |  |  |  |  |  |
| King | -- | $\begin{array}{r} 5,421 \\ \$ 8,172 \end{array}$ | $\begin{array}{r} 195,433 \\ \$ 168,507 \end{array}$ | $\begin{array}{r} 572,107 \\ \$ 684,260 \end{array}$ | $\begin{array}{r} 499,121 \\ \$ 272,905 \end{array}$ | $\begin{array}{r} 626,871 \\ \$ 630,876 \end{array}$ | $\begin{array}{r} 812,690 \\ \$ 754,208 \end{array}$ | $\begin{array}{r} 618,408 \\ \$ 683,882 \end{array}$ | $1,272,524$ | -- |
|  |  |  |  |  |  |  |  |  |  | -- |
| Shrimp | $\begin{array}{r} 214,806 \\ \$ 177,400 \end{array}$ | $\begin{array}{r} 346,811 \\ \$ 323,372 \end{array}$ | $\begin{array}{r} 350,375 \\ \$ 326,467 \end{array}$ | $\begin{array}{r} 493,271 \\ \$ 523,750 \end{array}$ | $\begin{array}{r} 521,703 \\ \$ 473,790 \end{array}$ | $\begin{array}{r} 500,566 \\ \$ 443,410 \end{array}$ | $\begin{array}{r} 427,096 \\ \$ 434,201 \end{array}$ | $\begin{array}{r} 507,857 \\ \$ 485,153 \end{array}$ | $\begin{array}{r} 503,168 \\ \$ 476,469 \end{array}$ | $\begin{array}{r} 481,225 \\ \$ 442,159 \end{array}$ |
|  |  |  |  |  |  |  |  |  |  |  |
| $\underset{\text { Shellfish }}{\text { Miscellaneous }}$ | $\begin{array}{r} 9,619 \\ \$ 6,113 \end{array}$ | $\begin{array}{r} 6,780 \\ \$ 5,800 \end{array}$ | $\begin{array}{r} 4,899 \\ \$ 2,949 \end{array}$ | $\begin{aligned} & 1,026 \\ & \$ 684 \end{aligned}$ | $\begin{array}{r} 4,356 \\ \$ 3,504 \end{array}$ | $\begin{aligned} & 47,400 \\ & \$ 8,875 \end{aligned}$ | $\begin{array}{r} 2,174 \\ \$ 1,609 \end{array}$ | $\begin{array}{r} 3,561 \\ \$ 3,069 \end{array}$ | $\begin{array}{r} 8,398 \\ \$ 7,734 \end{array}$ | -- |
|  |  |  |  |  |  |  |  |  |  | -- |
| $\begin{gathered} \text { Miscellaneous } \\ \text { Fish } \end{gathered}$ | $\begin{aligned} & 63,233 \\ & \$ 9,547 \end{aligned}$ | $\begin{aligned} & 41,504 \\ & \$ 8,558 \end{aligned}$ | $\begin{aligned} & 12,587 \\ & \$ 2,435 \end{aligned}$ | $\begin{aligned} & 181,390 \\ & \$ 50,827 \end{aligned}$ | $\begin{aligned} & 14,249 \\ & \$ 3,481 \end{aligned}$ | $\begin{array}{r} 55,441 \\ \$ 16,508 \end{array}$ | $\begin{aligned} & 20,658 \\ & \$ 4,391 \end{aligned}$ | $\begin{aligned} & 30,963 \\ & \$ 9,941 \end{aligned}$ | $\begin{array}{r} 71,888 \\ \$ 16,311 \end{array}$ | $\begin{array}{r} 50,978 \\ \$ 10,482 \end{array}$ |
|  |  |  |  |  |  |  |  |  |  |  |
| Miscellaneous <br> Livers, Oil \& Viscera | 9,633 | 74,275 | 199,967 | 417,704 | 23,337 | 529,963 | -- | -- | -- | -- |
|  | \$1,112 | \$433,575 | \$66,701 | \$149,906 | \$4,396 | \$39,149 | -- | -- | -- |  |
| TOTALS | $\begin{aligned} & 319,649,416 \\ & \$ 58,877,964 \end{aligned}$ | $\begin{array}{\|l\|} \hline 321,622,457 \\ \$ 75,019,883 \end{array}$ | $\begin{array}{r} 318,265,721 \\ \$ 107,197,949 \end{array}$ | $\begin{array}{r} 305,123,125 \\ \$ 116,869,334 \end{array}$ | $\begin{aligned} & 282,505,123 \\ & \$ 94,933,257 \end{aligned}$ | $\begin{array}{r} 259,138,306 \\ \$ 100,083,272 \end{array}$ | $\begin{aligned} & 248,762,257 \\ & \$ 95,839,201 \end{aligned}$ | $\begin{aligned} & 240,470,159 \\ & \$ 88,477,449 \end{aligned}$ | $\begin{aligned} & 197,106,818 \\ & \$ 69,620,264 \end{aligned}$ | $\begin{aligned} & 221,411,226 \\ & \$ 77,826,405 \end{aligned}$ |
|  |  |  |  |  |  |  |  |  |  |  |

[^3]
## ALASKA DEPARTMENT OF FISHERIES

## Expenditures April 1, 1953 - March 31, 1955

FUNDS ALLOTTED BIENNIUM APR1L 1, 1953 - MARCH 31, 1955

| Administration | $\$ 60,800.00$ |
| :--- | ---: |
| Expenses of Fisheries Board | $7,500.00$ |
| Biology | $145,700.00$ |
| Watershed Management | $45,000.00$ |
| Inspection | $110,430.00$ |
| Sport Fish Propagation | $90,000.00$ |
| Destruction of Hair Seals, etc. | $50,000.00$ |
| Federal O.A. Tax on Employees Wages | 972.00 |
|  | $\$ 510,402.00$ |



BIOLOGY

Salaries \& Wages
General Expenses, Biology

| $\$ 80,700.00$ | $\$ 11.50$ |
| ---: | ---: |
| $65,000.00$ | 877.28 |
| $\$ 145,700.00$ | $\$ 888.78$ |

Expenditures

Salaries \& Wages
Transportation
Subsistence \& Lodging
Office Expense
Telephone \& Telegraph
Postage, Freight \& Express
Printing
Rent
Industrial Insurance
Other General Expense
Operating Expense
Office Equipment
Floating Equipment
Utility Equipment
Structures
$\$ 80,688.50$
4,705.30
18,063.00
572.43
246.86
$1,122.83$

- 167.87
181.50
729.47

1,213.02
30,215.23
559.82

1,608.17
1,559.26
3,177.96

## WATERSHED MANAGEMENT

Salaries \& Wages
General Expenges - Watershed Management

| $\$ 25,000.00$ | $\$ 13.97$ |
| ---: | ---: |
| $20,000.00$ | $1,585.61$ |
| $\$ 45,000.00$ | $\$ 1,599.58$ |

Expenditures
\$24,986.03
2,291.67
Salaries \& Wages
Transportation
Subsistence \& Lodging
$6,112.50$
374.06
98.66
98.66
404.71
36.41
285.78
439.83

6,510.94
227.85
227.00

1,404.98

INSPECTION
Salaries \& Wages
General Expenses, Inspection

| $\$ 70,000.00$ | $\$$12.27 <br> $40,430.00$ <br> $\$ 110,430.00$ |
| ---: | ---: |

Expenditures

| Salaries \& Wages | $\$ 69,987.73$ |
| :--- | ---: |
| Transportarion | $2,904.34$ |
| Subsistence \& Lodging | $2,442.00$ |
| Office Expense | 504.80 |
| Telephone \& Telegraph | 382.12 |
| Postage, Freight \& Express | 571.02 |
| Printing | 41.94 |
| Rent | 4.70 |
| Industrial Insurance | 698.18 |
| Other General Expense | 164.52 |
| Operating Expense | $24,389.50$ |
| Office Equipment | 111.29 |
| Flating Equipment | $1,432.83$ |
| Utility Equipment | 963.56 |
| Structures | $2,995.00$ |
|  |  |

SPORT FISH PROPAGATION

|  | Expenditures |
| :--- | ---: |
| Salaries \& Wages | $\$ 47,049.17$ |
| Transportation | $2,796.02$ |
| Subsistence \& Lodging | $8,700.00$ |
| Office Expense | 128.78 |
| Telephone \& Telegraph | 365.96 |
| Postage, Freight \& Express | $1,393.56$ |
| Printing | 39.15 |
| Rent | 266.69 |
| Industrial Insurance | 221.77 |
| Other General Expense | 924.43 |
| Car Operation \& Operating Expense | 23.728 .56 |
| Office Equipment | 5.00 |
| Utility Equipment | $1,763.61$ |
| Structures | $1,018.78$ |
|  |  |
|  |  |
| DESTRUCTION OF HAIR SEAL, ETC. |  |
|  | Expenditures |
|  | $\$ 27,637.08$ |
| Salarles \& Wages | 476.12 |
| Transportation | $1,305.00$ |
| Subsistence \& Lodging | 25.00 |
| Office Expense | 249.55 |
| Postage, Freight \& Express | $1,143.76$ |
| Industrial Insurance | 111.59 |
| Other General Expense | $18,634.96$ |
| Operating Expense | 159.50 |
| Utility Equipment |  |
|  |  |

FEDERAL OLD AGE TAX ON EMPLOYEES WAGES

$\$ \quad 972.00$

None
$\qquad$
$\$ 9,157.51$

## LOOKING FORWARD

In looking forward to operations for the coming year, the several divisions of the Department will continue their work programs along the lines outlined in the past with such additions as may become possible within the funds appropriated by the 1955 session of the Legislature.

## BIOLOGICAL RESEARCH

The Taku River salmon studies will be continued during the 1955 season and should be carried on for several more years. Sufficient

## TAKU RIVER SALMON INVESTIGATIONS

 basic biological facts regarding the king salmon runs of the Taku River have already been accumulated so that these can be applied in a practical way in making recommendation for regulation of the fishery on this species. Future emphasis will be directed toward the four other species occurring in this river. Sampling of the escapement in the river by means of a fishwheel at the Canyon Island station has shown much promise. A new fishwheel with improved design is planned for 1955.Due to the insufficiency of available funds, it became impossible to complete, in 1954, the Kitoi Bay Research Station which was started late in 1953. However, it is antici-

## KITOI BAY RESEARCH

 pated that this station, including the proposed hatchery, will be completed early enough in the fall of 1955 so that a supply of red salmon eggs can be taken for use in experiments planned for the 1956 season. This station is ideally located for conducting basic research on utilization of waters now non-productive of salmon. The practical application of this work can be applied throughout all sections of the Territory.Unless some unfavorable economic conditions develop, it is becoming more evident that the king crab fishery will take its place as one of the important fisheries of

KING CRAB STUDIES Alaska Commercial operations are now being carried on in the Kodiak area, around Homer and Seldovia, and in the Shumagin Island group, all within Territorial waters or immediately adjacent thereto. These fisheries will become more and more important to the economy of these areas. Other unexplored areas will undoubtedly be utilized in the future. It therefore behooves the Department to continue its king crab investigations so that a determination can be made of the productive capability of the various stocks and fishing grounds to prevent over exploitation of the resource.

## INSPECTION

No significant changes in the operations of this division are expected in 1955. In addition to their enforcement duties, inspectors will again be called upon to assist in various phases of the work being conducted by the Biological Research, Sport Fish, and Watershed Management divisions. Special emphasis will be placed on checking for the Territorial Sport Fish License.

## PREDATOR CONTROL

If additional funds are provided by the legislature, it is planned to extend this program to set up a separate division of Predator Investigation and Control. In the past, the Department has confined its control efforts to particular areas where it was definitely known that damage was being done by the predator, such as the hair seal programs on the Stikine, Taku, and Copper River deltas. For the future, it would seem advisable that a study of a suspected predator and its relation to the commercial fisheries should be instigated before an all out control program is started. By learning the facts, it will become possible to exert control measures at such times and places where it will be most beneficial. Territory wide control measures or bounties may be unwise as well as exceedingly expensive.

## SPORT FISH

The Anchorage Hatchery will be provided with twelve additional troughs. There is a definite need for additional trout fry for stocking in this area. This will bring the hatchery up to twenty-four troughs; ultimately it is expected that the station will be equipped with its full capacity of forty troughs.

The lake rehabilitation program will be expanded. It is expected that Lake Lucille, a 371 acre lake near Wasilla, will be treated with rotenone to eliminate the scrap fish population of sticklebacks and suckers. Several large gravel pits located on Alaska Railroad property in Fairbanks are also scheduled for rehabilitation.

## WATERSHED MANAGEMENT

The egg planting programs carried out during the past few years will be carried forward at Frazer Lake on Kodiak Island and at Pauls Basin on Afognak Island. The 1955

## KODIAK AREA

 plant in Gretchen Creek (Pauls Basin) will complete one full cycle of five years. Since some of the se red salmon mature at four years, it is expected that first returns of mature spawning salmon in Gretchen Creek will be seen in 1955.The Deer Mountain Hatchery at Ketchikan, which is described in another section of this report, will prove to be of great value in accelèrating the Watershed Manage-

## KETCHIKAN DISTRICT

 ment program in this district. It is planned to rear some silver salmon in the adjacent ponds to migratory age for release in Ketchikan Creek. By continuing this for three or four years, it is expected that a run will return to the hatchery to serve as brood stock for the surrounding area.Other plans of the Watershed Management division call for the location of a permanent district man at either Wrangell or Petersburg.



[^0]:    * This report is covered in the Biological-Research section, Page 34.

[^1]:    * Total troll catch (Col. 7) divided by the estimated total run (Table 1).

[^2]:    ${ }^{1}$ Includes Rockfishes, Flounders, Lingcod.
    2 Includes Cockles, Oysters, Tanner Crabs.
    3 Incluces Trout, Smelt, Albacore, Sheefish.

[^3]:    ${ }^{1}$ Includes Rockfishes, Flounders, Lingcod.
    ${ }^{4}$ Includes Cockles, Oysters, Tanner Crabs.
    ${ }^{2}$ Includes both Butter and Razor Clams.
    ${ }^{5}$ Includes Trout, Smelt, Albacore, Sheefish.
    ${ }^{3}$ Includes both Dungeness and King Crabs.

