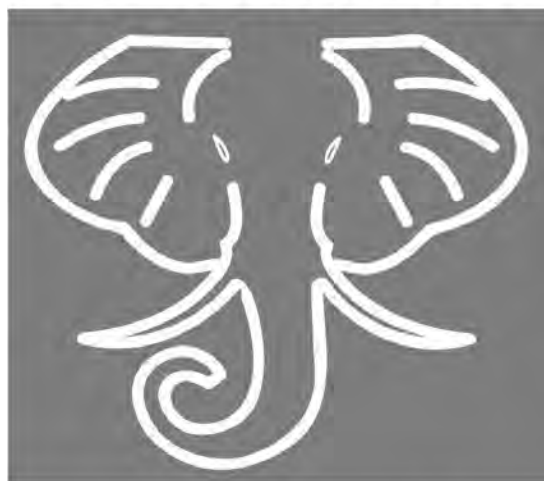


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STATE OF WASHINGTON
DEPARTMENT OF FISHERIES AND GAME

THIRTIETH AND THIRTY-FIRST
ANNUAL REPORTS

OF THE

State Fish Commissioner

TO THE

GOVERNOR OF THE STATE OF WASHINGTON

April 1, 1919, to March 31, 1921

L. H. DARWIN,
STATE FISH COMMISSIONER
Seattle, Wash.

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With the Compliments of
the COLLEGE OF FISHERIES,
UNIVERSITY OF WASHINGTON,
Seattle, Wash.

~~Please Exchange.~~

TO THE COMMISSIONERS OF THE
THE BOARD OF MINES
UNITED STATES DEPARTMENT OF
MINE, WASHINGTON, D.C.
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SEATTLE, WASHINGTON, April 1, 1921.

To His Excellency, Louis F. Hart, Governor of Washington.

SIR: In compliance with the provision of the law requiring the same, I have the honor to submit herewith the Thirtieth and Thirty-first Annual Reports of the Fish Commissioner of the State of Washington for the years ending March 31, 1920, and March 31, 1921, respectively.

Respectfully submitted,

L. H. DARWIN,

State Fish Commissioner.

THIRTIETH AND THIRTY-FIRST ANNUAL REPORTS

After thirty-one years, the office of the State Fish Commissioner, which has existed practically since statehood, passes out of existence today.

Under the terms of the new Civil Administrative Code, those duties heretofore performed by the State Fish Commissioner, in connection with the food and shell fish of the state, will be performed by the Supervisor of Fisheries, under the direction of the Director of Fisheries and Game.

With the passing out of existence of the office, it seems to me appropriate to briefly review its work during the past eight years that I have been its head.

The number of salmon hatcheries in the state during that time has been increased from seventeen to thirty-one, while the total hatching capacity is now nearly three times as great as it was eight years ago.

The last year of the work in this office is memorable, in that it witnessed the taking of the largest number of salmon eggs in the history of the department—186,906,525.

Today, there are twenty-eight acres of concrete dyked oyster lands on the oyster reserves of the State of Washington, whereas, eight years ago there was only one.

The number of fishing licenses issued during the past eight years has increased about 70 per cent, while the number of persons employed in the fishing industry has been considerably more than doubled, owing to the introduction of certain appliances which require from seven to eight men to operate.

Eight years ago, when taking charge of the department, I discovered there were practically no laws attempting to protect any of our vast food and shell fish resources, other than salmon. Since that time, with the aid of scientific research, we have ascertained the habits, spawning seasons and spawning places of our herring, smelt, clams, shrimp, etc. Five of the biggest herring spawning reservations have been located, set aside by myself under the terms of the law, and marked with monuments, and closed seasons prescribed, which permit the herring to spawn in these refuges undisturbed.

The legislature has passed bills, which we have sponsored, providing for closed seasons in which fishing is prohibited for smelt, clams, shrimp, etc.

Although the laws existing in 1913 provided for the designation of the mouths of all the rivers in the state, I was unable to find one where this law had been complied with.

Today, I believe that every river mouth in Washington, with the possible exception of a few of the upper tributaries of the Columbia River, has been designated by monuments, and plats are on file in this office, and also in the offices of the auditors of the respective counties, showing the location of these monuments.

The legislature having prescribed a number of fishing areas on Puget Sound, we have complied with the laws and designated their boundaries with monuments.

Boats suitable for patrolling the different waters of the state, for the enforcement of the fishery laws, have been provided at a minimum of expense, with the result that for the first time in the state's history we have annually

made numerous arrests of law violators, whose fines have each year amounted to many thousands of dollars.

So far as I am able to ascertain from the records, there has not been a single year during the last eight when we have not collected more fines than the sum total of fines collected during all the preceding years of statehood prior to 1913.

The laws which were in effect in 1913 were inadequate to place in possession of the State Fisheries Department those statistics which every one now admits are necessary in order for the state to be informed as to the conditions of its fishery. What laws were in effect had not been enforced.

Out of some 87,000 reports, which should have been made to the Fish Commissioner's office during the biennium of 1911-1912, just 140 were actually made. In 1918, out of some 22,000 reports due under the then existing laws, our records show that over 21,000 were actually made. And in the years 1913-1914, without any change whatsoever in the laws, but only enforcing them to the best of our ability, the revenues of the department were almost doubled, as compared with the highest preceding biennium.

The 1915 session of the legislature passed laws containing plans which we had formulated for proper statistical information on our fishery industry. These laws continue in force until this day, and as a result of them there is no other state in the Union that possesses anything like as accurate knowledge of the year to year cash value and disposition of its fishery resources as the State of Washington. Those who first opposed giving the state this information, now willingly do so, having come to realize its value.

When I first took charge of the Fish Commissioner's office, it was quartered in a couple of small, upstairs rooms on a side street in the city of Bellingham. More suitable quarters were at once obtained, and an exhibit of the fishery resources of this state installed that is not equalled even by the exhibit of the United States Bureau of Fisheries in Washington, D. C.

This exhibit has been viewed by many thousands every year, and has proven so interesting as to elicit favorable rental consideration for its housing, and a donation of a water supply by the city of Seattle, and free lights from the Puget Sound Traction, Light & Power Company, in Seattle, where the office was removed on February 13, 1914.

We have recently adopted a new style of hatchery trough, which will completely revolutionize hatchery operations in this state, tremendously lessening the cost of hatchery construction and operation, and permitting the work to be carried on by a less number of employes with comfort and ease as against prior conditions of more or less bodily discomfort.

NEW LAWS MAKE INDIVIDUAL FISH TAXING UNIT.

Commencing with the first Biennial Report I made to the Governor and continuing in each one since, I have earnestly recommended the taking of the individual fish as the taxing unit and doing away with the super or surtaxes, such as the tax on every case of salmon canned by the canner, and on each ton of salmon handled fresh, salted, or kippered by the wholesaler. Particularly in the case of the so-called tonnage tax was it impossible of equitable enforcement.

You recommended this plan of taxation to the 1921 session of the legislature. At your direction, I drew the bill providing therefor, which absolutely

equalized the tax on a certain per cent of the value of the food and shell fish product of our waters—approximately about 4 per cent.

The passage of this act, together with the one creating the Fisheries Board, places the state fishery authorities in a position to rehabilitate the salmon runs of this state, and provides them with revenues, which I feel are more than sufficient therefor.

When I assumed charge of the Department, there was not a hatchery in the state that had a permanent foundation, or a hatchery residence that contained a bath tub. Every hatchery we have constructed has a concrete foundation, and every new residence a bath room and toilet, while many of the old residences have been equipped with bath and toilet. The result of better living conditions has attracted a higher type of men to the Fisheries Department than ever before in its history.

The laws have been enforced impartially. The brazen violations by trap and purse seine owners, which occurred before 1913 and which had forced the fishery question into the forefront of political issues of the state, have been ended.

For the first time, scientific research has been carried on by the Department to ascertain the life habits of the salmon, with the result that the law-making body has had before it the evidence of scientists to guide it in the enacting of statutes to preserve our great fishery resources.

The diligence of the Department in enforcing the revenue laws has resulted in a large increase in the amount of moneys received. The previous lax enforcement of the revenue laws had lost to the State of Washington many thousands of dollars annually.

ECONOMIC CONDUCT REDUCES HATCHING COST.

The Department has been conducted so economically that the hatching cost of salmon, which in 1912 was \$1.64 per thousand, was in 1916 reduced to 34c per thousand. Even during the war areas of high prices, the cost of hatching salmon ranged from only 35c to 54c per thousand.

For the first time since statehood, the Department has issued complete statistical reports, which have enabled those interested to ascertain the number of fish taken annually, and the methods by which they were taken; the cost of hatching fish, and the output of the hatcheries; cost of operation of the Department, segregated into its various branches; and number of men and amount of capital employed in the fisheries of the state. No other state even attempts such complete statistical records.

Cash receipts of the Fisheries Department during the 1919-1921 biennium were \$208,395.85.

INSUFFICIENT FUNDS FOR NEEDED WORK.

During the 1919 session of the legislature, the code which I prepared provided for a substantial increase in the departmental revenues. At that time I pointed out, in view of the diminished salmon runs, the revenues would not be sufficient to maintain the Department.

It has always been my policy to curtail every other activity of the Department in order to operate the salmon hatcheries to the limit of their spawn taking capacity. This has seemed an especially desirable policy, in view of the

continued increase in the fishing operations and in the number of fishermen, and in view of the fact that it has been very plainly demonstrated that the fishermen's operations have resulted in the depletion of certain runs.

The reason there has been no evidence of the depletion of the runs of the Chinook and Chums on Puget Sound is, in my judgment, directly traceable in large part to the increased number of these varieties of salmon which have been liberated from the Puget Sound hatcheries. Many Chinook and Chum eggs have been brought annually for the last seven years from the Columbia River and Grays Harbor districts for hatching in Puget Sound hatcheries, and the fry liberated in Puget Sound waters.

CHINOOK AND CHUM SALMON RUNS INCREASED IN PUGET SOUND BY TRANSFERRING EGGS FROM OTHER DISTRICTS.

It is practically universally conceded, by those who have watched the catch of the Chinook or spring salmon on Puget Sound during the last four years, that a very large percentage of those taken during these years from Puget Sound waters are the Columbia River variety.

A number of Puget Sound streams, up which the spring (Chinook) salmon never ascended or ascended only in small numbers, have now come to have well established runs, as a result of the liberation of Columbia River Chinook fry into them. In the Nooksack, Skagit, Snohomish, Green, Tahuya and other rivers the results have been especially noticeable.

At the meeting of the Pacific Fisheries Society in Seattle in June, 1920, the ichthyologists, or fish scientists, announced that their experiments and investigations had demonstrated the truth of the salmon parent stream theory. In other words, they stated that they had conclusively demonstrated that a salmon egg hatched in a certain stream and the fry liberated in that stream would result in the return later on of the mature salmon, resulting from that fry, to that particular stream. This would happen even though the egg in the first instance might have been taken at another stream. The place of the return of the fish would be governed by where it was hatched and the waters into which the fry was liberated, rather than by the place of the original taking of the egg. Thus the scientists confirmed the announcement heretofore made by this Department of this same result.

Ever since I have been the head of the Department, the work has been carried on in the belief that such results would follow. It is, of course, highly pleasing to have the leading ichthyologists of the Pacific Coast announce that scientific research has shown that we have proceeded along the right lines. However, our own results had overwhelmingly demonstrated to us that we had.

Another important scientific announcement at this same meeting was made by Dr. W. H. Rich, of the United States Bureau of Fisheries, who has been making a study of the life, habits and maturing periods of the salmon of this state. He stated that eight marked salmon liberated in 1916 returned in 1920 and averaged a weight of twenty-five pound each. It is an undisputed fact that the average weight of the Chinook salmon of the Columbia River has been increased in the last four years. Several theories are advanced to account for this. As from two-thirds to three-fourths of the propagation work of Chinook salmon on the Columbia River is done by the State of Washington, I feel that the answer lies, in great part at least, in the hatchery methods

which we have followed. Commencing when I assumed charge of the Department, on the Columbia River we made use only of the largest males for fertilizing the Chinook salmon eggs, and it is to this that I attribute the increased size in the last four years of the Chinook salmon in the Columbia River.

ILL EFFECTS OF IMMATURE SALMON DESTRUCTION SHOWS IN THE COLUMBIA RIVER.

In my last Biennial Report to you of date April 1st, 1919, I said in discussing the catching of immature salmon in our coastal waters: "The ill effects of the taking of the young salmon will likely become more apparent during the next three years." Unfortunately, this prediction has been more than verified. 1920 showed a slight diminution in the pack, whereas, for four or five years preceding there had been a steady increase. And it is apparent, at the time this is written, that the year 1921 will show a tremendous decrease in the number of Chinook salmon taken from the Columbia River. Information which I have leads me to believe that the pack will be decreased from 25 to 30 per cent, and I am of the opinion that 1922 will at least show a proportionate decrease.

In my opinion, the result is wholly attributable to the taking of immature salmon in the Pacific Ocean off the mouth of that stream, and extending northward along the Washington coast. And while many of the men longest engaged in the fishery business on the Columbia River two years ago were inclined to doubt this, at the present time, I think everyone connected with the fishing business on that stream is ready to concede that the Department was correct when it announced that the immature salmon, which have been caught for several years by the purse seiners and trollers off the mouth of the Columbia River, were the young salmon native to that stream, which would have returned two or three years later as mature fish; and that in taking these fish a tremendous economic loss was being incurred, as they were being caught at a time when they weighed only from two to six or seven pounds, whereas, had they been permitted to have lived for from one to three years, they would have returned mature fish at an average weight of twenty-five pounds. As this report is being written, the men, who have for years engaged in the fishing business on the Columbia River and who have in past years encouraged the taking of these immature fish, are imploring the State Fisheries Board to stop completely all fishing for them by any appliance whatsoever.

A THANKLESS TASK.

At the end of eight years, I realize what a thankless task it is to try to preserve a great natural resource for a country. To him who tries to stand between the greed of those to whose private interest it is to destroy a great natural resource and the state which owns that resource, there is reserved a most unpleasant portion. In the Senate Chamber in 1919, at a public hearing on the fisheries code, which I prepared and which would have curtailed the fishing for both mature and immature salmon, one of the spokesmen for one of the fishermen's organizations declared that any person who would put forward a proposal for curtailing fishing should be beheaded.

Today there is but a small remnant of the organization which he represented. Through the unwise direction of their energies, its members have con-

tributed to the destruction of the very industry which should have for all time to come assured them of a livelihood. The persons interested in the taking of these immature salmon put forth every kind of a pretense to prevent any interference with their operations. One of the subterfuges resorted to was the calling of the immature salmon a "grayling." There were those who argued that the fish when caught was not a salmon at all, but immediately after it was put in the can, it became a salmon and was sold as such.

The efforts to prevent the destruction of these immature salmon resulted from a most careful study of the situation conducted by the Department, assisted by such eminent scientists as Prof. E. Victor Smith and Prof. Trevor Kincaid, of the University of Washington. In my last Biennial Report I published the preliminary reports of Prof. Smith. These were disputed by persons to whose interest it was to dispute them. During the past two years, Prof. Smith has continued his investigations, which have only served to demonstrate the correctness of his first statements. The result of Prof. Smith's scientific research work is to be found in this report.

Scientists employed by the United States Bureau of Fisheries, who have been investigating the same subject, have confirmed Prof. Smith's findings and conclusions.

The State of Oregon, which is jointly interested with the State of Washington in the Columbia River fishery, unhesitatingly accepted Prof. Smith's conclusions, and the 1921 session of the Oregon legislature passed laws to prevent future fishing for immature salmon.

There are none left to dispute that this Department was right in 1919, when it pointed out that the taking of immature salmon off the mouth of the Columbia River was bound to result in a depletion of the mature salmon supply of that stream, and if permitted to continue at the ratio then existing, that the Chinook run of salmon in the Columbia River would in a few years be terribly depleted. Forseeing the danger, I pointed it out at the earliest opportunity. Unfortunately, we were unable to secure legislative action to put a stop to this destructive work in time. The result is that the fishing industry on the Columbia River is today suffering financial loss, which should have been avoided, and unless the practice is stopped, it is my belief that in a few years the Chinook salmon fishery of the Columbia River will cease to exist as a great commercial industry.

The fishing carried on for immature salmon off Cape Flattery is as harmful, so far as it goes, as that carried on off the mouth of the Columbia River. However, the conditions at Cape Flattery are not so favorable to the fishermen as off the mouth of the Columbia. As a matter of fact, during the last two years this immature salmon fishing extended its way all up and down the Washington Coast.

CREATION OF FISHERIES BOARD IN LINE WITH FORMER RECOMMENDATIONS.

During the war, the demand for salmon was so great and such intensive fishing resulted that a sufficient number were not permitted to escape to the hatchery streams and the natural spawning grounds to anywhere nearly maintain the normal supply.

With a full knowledge of this condition, I prepared a fisheries code, which would have largely curtailed fishing and have regulated fishing operations, to the end that a larger escape of spawning fish would have occurred.

The passage of this code was bitterly opposed in the legislature by a majority of those interested in the taking of the fish. They succeeded in accomplishing its defeat.

In my last Biennial Report made to you, which was made within a few weeks following the defeat of my proposed code in the legislature, I pointed out to you that my experience led me to the conclusion that it would be impossible to preserve the fisheries of this state through legislative enactment. This for the reason that selfishly interested parties had always theretofore succeeded and would likely thereafter succeed in so confusing the legislature as to prevent the passage of any real conservation measures.

I, therefore, recommended to you the creation by the legislature of a State Fish Commission, which would be clothed with full authority to say how, when and where fishing operation might be carried on. I pointed out the necessity of the Commission being given these broad powers. It was recommended that the Commissioners serve for long terms, and be removed only by impeachment, as elective state officers are removed.

I also recommended that the Fisheries Department employes be placed under civil service and gave my reasons therefor.

The 1921 legislature passed the Civil Administrative Code, which created the State Fisheries Board, clothed with the powers which I suggested. The power for good of a Board so constituted, in the hands of honest, capable and impartial men, is almost unlimited. I recognize its equal possibilities for harm in improper hands. Unfortunately, the law does not provide the suggested safeguards as to tenure of office of the members of the Board, nor does it place the employes of the Department under civil service.

In June, 1920, the Canadian Fishery Society held its annual meeting in Vancouver, B. C., and I was invited to prepare a paper dealing with the international question arising out of the Fraser River sockeye fishery situation. Taking as my subject "International Treaty—or State Agreements," I pointed out the failure of sixteen years of efforts to bring about a consummation of an international treaty between Canada and the United States, which would contain provisions permitting the rehabilitation of the sockeye fishery, in which both countries are interested. I expressed the opinion that the question could quickest and best be solved by the creation by the State of Washington of a Fish Commission or Fisheries Board, which would have full authority to say how, when and where fishing operations could be carried on in this state. While such a Commission would have no authority to negotiate an international treaty, the paper pointed out that in Canada fishing operations can be regulated by Orders in Council. Therefore, it would be possible for the promulgation of identical joint regulations by an Order in Council by the Dominion of Canada and an order effective in Washington, passed by a State Fish Commission or State Fisheries Board. The almost universally expressed opinion in the discussion which followed the paper was to the effect that the method proposed offered the best solution which had been advanced.

Now that the State of Washington has created a State Fisheries Board, clothed with the powers suggested, I have small doubt that as soon as the pending treaty is out of the way, an amicable arrangement can be arrived at

with the officials of the Dominion of Canada, which will result in regulations which will effect a rehabilitation of the Fraser River sockeye salmon fishery, if such is the real desire of both parties in interest.

Dr. C. H. Gilbert, of Stanford University, who has given twenty years to the study of our Pacific Coast salmon, says that the State Fisheries Board of Washington offers the last and only hope for the rehabilitation of our sockeye salmon run.

GREAT FISHERY RESOURCES — OTHER THAN SALMON.

Washington's fishery resources, aside from its salmon, are very considerable. This despite the fact that many of our fish, which are valuable as food, have not been made use of to anything like the extent that they will be in the years to come. In 1920, the value of the clams, mussels and crabs taken from our waters, and of the other fish like smelt, shad, herring, sturgeon, etc., was \$286,686.21. Up to the present time our herring is principally made use of as bait. In the years to come, the value of these species of our fish will very largely increase.

Every year the world's fish supply grows scarcer. The diminution of the Atlantic Coast supply is more than marked with each passing year. This will undoubtedly result in the more extensive use and the more general taking of the species of our fish enumerated above.

VALUE OF CANNED SALMON, 1919-1920.

The value of the canned product of salmon in 1920 was \$4,531,119.85, and in 1919, \$12,956,477.67.

The difference in the value of our salmon, as they are taken from the waters and when finally canned, is almost 80 per cent.

INCREASE IN FISHING LICENSES.

The number of fishing licenses issued in 1919 was 6,638. The total number of licenses, including fishing licenses, dealers, etc., was 8,199. In 1920, 5,262 fishing licenses were issued, and the total of fishing licenses, dealers, etc., was 6,521.

During the biennium, the total number of salmon taken from the waters of the state was 13,140,576, and the amount of money paid to the fishermen for these salmon was \$9,131,760.63.

THE PURSE SEINES AND TRAPS TAKE GREATEST NUMBER OF FISH.

Since the inception of the fishing industry in this state, there has always been contention between users of the different kinds of gear or fishing appliances. This report contains very valuable statistical tabulations showing the salmon, segregated as to species, caught by the different classes of gear during the last eight years.

A reference to this will show that the appliances taking by far the greatest percentage are the purse seines and fish traps or pound nets.

During the eight year period from 1913 to 1920 the total number of salmon taken from the waters of the state was 109,696,626. Commencing with 1915, the statistics show that of the 12,608,503 salmon taken that year, there were taken with purse seines 6,612,354, and by fish traps or pound nets, 5,028,444.

During this year it will be seen that more than half of all of the fish caught in the state were taken by the purse seiners.

In 1916, out of a total of 5,273,548 salmon taken, there were taken by purse seines, 2,272,507, and by fish traps or pound nets, 2,128,468.

In 1917, out of 22,300,092 salmon taken, there were taken by purse seines, 11,866,442, and by fish traps or pound nets, 8,618,637.

In 1918, of a total of 5,446,203 salmon taken, there were taken by purse seines, 1,460,320, and by fish traps or pound nets, 2,189,404.

In 1919, out of a total of 10,082,627 salmon taken, 4,445,892 were caught by purse seines, and 4,165,172 by fish traps or pound nets.

In 1920, out of a total of 3,057,949 salmon taken, 941,096 were caught by purse seines, and 1,144,601 by fish traps or pound nets.

In this connection, it should be borne in mind that the purse seine did not come into general use in this state until 1913. In the years of 1915 to 1917 they caught more than half the salmon caught by all the combined appliances of the state.

Prior to the advent of the purse seine, the fish trap or pound net was the appliance which had caught by far the greater number of salmon. So rapidly has the use of the purse seine developed, that most people cannot bring themselves to believe that it has surpassed the fish trap in the number of fish taken annually.

It should also be borne in mind that the use of the purse seine is barred from the Columbia River proper, and the number of fish which are taken by purse seines is greater than shown by the statistical reports to this office. This for the reason that these purse seines operate in the Pacific Ocean outside the three-mile limit, and under the law do not report their catch or pay a tax on the fish taken, although practically all of the fish which they catch are the product of Washington streams.

Purse seines have never been used in Grays Harbor District nor in the Willapa Harbor District, except within the last two years. Therefore, when all these facts be considered, the tremendous effectiveness of this appliance as a catcher or taker of salmon cannot fail to impress a student of the fisheries question of the State of Washington.

THE SALMON PACK DECREASES IN 1920.

In 1920, the number of 48-pound cases of salmon packed in the State of Washington was 328,833½, with a value of \$4,118,200.15.

In 1919, the number of cases packed was 1,586,715 of a value of \$12,602,861.67.

One of the reasons for the great decrease of the number of cases packed in 1920 from the number packed in 1919 was the fact that by reason of the large accumulation of canned salmon during the preceding years, practically no attempt was made to can any except of the finer red grades.

FRESH FISH INDUSTRY GROWS.

The growth of the fresh fish industry during the last few years has continued. In 1920 there were 16,840,104 pounds of salmon and other food and shell fish taken from the waters of the state, which were handled fresh or preserved other than by canning, with a value of \$2,153,735.49.

In 1919, 16,260,364 pounds of salmon and other food and shell fish were taken from the waters of the state, which were handled fresh or preserved other than by canning, with a value of \$1,670,756.11.

The value of the fish by-products, consisting of oil, fertilizer and fish meal, in 1920 was \$37,742.25. The approximate price of oil was 35c per gallon, fertilizer \$83 per ton, and fish meal \$85.90 per ton.

OUR OFFSHORE FISHERY.

There is a great fishery business in this state which results from the handling of fish caught almost entirely outside our own waters, mostly Alaskan waters.

In 1920, there were handled 16,174,199 pounds of halibut valued at \$2,781,962.23, or an approximate valuation price of 17.2c per pound.

There were 6,122,488 pounds of cod-fish handled, valued at \$359,061.93. These cod-fish were handled fresh and cured. The approximate valuation price fresh was 3 $\frac{1}{2}$ c per pound; cured, 6c per pound; and cod-fish tongues cured, 5c per pound.

CONTINUED IMPROVEMENT OF STATE OYSTER RESERVES.

In my opinion, one of the great reserve sources of wealth in this state is its oyster industry.

The state has forever reserved from sale or lease 12,688 acres of oyster reserves. When I assumed charge of the Department in 1913, I found approximately one acre improved by concrete dykes. On April 1, 1921, there are more than twenty-eight acres under concrete dykes.

Contrary to the general rule, these lands have been dyked by the state at a seemingly considerable less cost per acre than private lands have been similarly improved. A large number of acres have been improved on the Clifton Oyster Reserve at the head of Hoods Canal. With proper handling, two years hence the state should be able to sell from this reserve several thousand sacks of merchantable oysters.

Improvements which we now have under way will during 1921 add between five and six more acres of dyked lands.

The largest new improved acreage will be on the North Bay Oyster Reserve. Here, again, will be an opportunity for the state to dispose of large quantities of merchantable oysters, if it so desires.

And, again, if the state desires, dyked areas on the Hammersly Inlet (Oakland Bay Reserve) can be made to supply thousands of sacks of merchantable oysters.

Up to this time, the reserves have principally been made use of to supply seed oysters to private owners of oyster lands. It must be admitted that private oyster growers are more fortunate than any other class of citizens of our state. To them the state annually furnishes, at a comparatively cheap price, all the seed for which there has been any demand.

Despite this paternalistic attitude on the part of the state, the price of oysters has advanced by leaps and bounds. If it be agreed that the reason for this is the limited area in private hands capable of producing oysters, then it would seem to be a proper policy on the part of the state to develop the large holdings, which yet remain in its hands, in the way of oyster reserves,

to the end that the oyster supply may be increased, and the price of this great article of food lowered so that a greater number of people may partake of it.

In 1919, a survey of our oyster reserve on Willapa Harbor led us to the conclusion that there were at least 30,000 sacks of seed oysters available for sale from that reserve. On my recommendation, the State Fish Commission decided to open the reserve for the sale of seed oysters therefrom, provided we could secure purchasers for 2,000 sacks, as it would not pay to go to the expense for a less number.

Notice was accordingly given, but despite our efforts and later offers to open the reserve if purchasers for 1,000 sacks could be found, we were unable to secure purchasers for even 1,000 sacks.

I then suggested to the Commission that we sell the merchantable oysters from the Willapa Harbor Reserve. We secured an offer from Mr. A. J. Nelson to take up the oysters, sort the merchantable ones therefrom, pay the state 75c a sack therefor, and return the non-merchantable or oysters of less than three years of age to the beds. In addition, he was to break up the clusters of oysters so as to permit them an opportunity to greater growth.

Mr. Nelson commenced operations and did take up a few sacks, but soon desisted, saying that he found himself without a market. The reason for his inability to market his oysters, he reported to us, was the threat made by the private oyster growers that if the dealers purchased from him, they would not furnish them after he was no longer able to supply them by reason of having completed his contract with the state.

Whether or not this be the true reason, the fact remains that with thousands of sacks of oysters to sell from the state reserve on Willapa Harbor in 1919, the state was able to dispose of only a very few.

It was particularly unfortunate in view of the fact that some kind of a disease seems to have broken out among the Willapa Harbor oysters in 1920, which has destroyed by far the larger portion of them. A survey of the beds in 1920 disclosed thousands of empty shells, with only a comparatively small number of live oysters.

I requested Prof. Kincaid, of the University of Washington, to make an investigation of the situation, and ascertain, if possible, the cause of the death of so many of these Willapa Harbor oysters. Other work, however, has so far prevented him from doing this, but he has promised to go over the situation at his earliest opportunity.

Of the 2,600 acres of oyster reserves on Puget Sound, I should say that one-half or 1,300 acres are susceptible of improvement without great cost.

From Mr. Henry Bucey, a well versed chemist, for many years in the employ of one of the largest cement companies of the state, came the suggestion that a quicker growth of oysters could be secured by placing on the state oyster reserves precipitate of lime. This gentleman advanced the idea that the reason for our small oysters was the fact that our Puget Sound waters contain such a small proportion of lime that they are unable to take it fast enough to produce a big shell like the Atlantic and Gulf coasts oysters.

Following his suggestion, we procured a quantity of this precipitate of lime from the quarries near McMillan, Washington, which he took to the oyster beds and placed on them, as I recall, without any charge for his services other than his expenses.

Later on, we requested him to go over this reserve to ascertain if any beneficial effects had accrued from the lime being placed thereon. He reported that in his judgment distinct benefits were to be observed in a larger growth in size.

Within a comparatively few years, the oyster reserves of Puget Sound alone could be improved and made to yield a revenue that would furnish no inconsiderable portion of the operating cost of our state government. At the same time, the food supply would be increased and the cost of this article of diet would be decreased to the consumer. With the number of acres already improved, a far greater seed supply has been offered during the last two years than has been purchased by the owners of private lands.

The question which now presents itself is whether these reserves are going to be permitted to continue lying idle and the state deprived of the revenue which can be derived from them, while the price of oysters remains beyond the reach of the ordinary individual, or whether they shall be improved, the state pay a portion of its operating expenses from the revenue which can be obtained from them, the supply of oysters increased, and the price reduced so that the ordinary individual may occasionally see them on his table.

USUAL RULES NOT FOLLOWED.

I have been advised by many so-called "practical politicians" that the easiest rule of politics is "to do nothing;" then there is nothing to criticize.

It has always seemed to me that the responsibility for being the head of the Fisheries Department of this state is a very great one. Millions of dollars are invested in our fisheries; thousands are dependent upon it for employment; the demand has yearly increased, and the efforts to take our fish have multiplied to the extent that some of the salmon runs have shown a great decrease.

The answer to this would seem to me to be increasing the number of salmon hatcheries; increasing the efforts at salmon propagation; giving nature a better chance by the establishment of longer closed seasons to assist in maintaining the supply by permitting a larger number of fish to escape to the spawning grounds; to annually continue to improve the oyster reserves of the state by dyking, and to ascertain the spawning seasons of those classes of fish which the state cannot propagate, and afford them that protection during the season which will permit nature to do the work in which man cannot assist.

It seems to me incredible that any man could be given the responsibility for this work and fail to give to it his very best efforts. It has been a matter of great surprise to me to find how many there are, who have large investments in the industry, who seem to give such little thought to its perpetuation.

Confronted with the plain facts that certain of the salmon runs were being annually diminished by too intensive fishing, efforts to better the situation have been fought by some of the very persons who stood to benefit by these attempts.

Unfortunately, the idea has been all too prevalent to let those engaged in the industry have the entire say concerning it.

The people of this state have an interest in perpetuating and maintaining our food and shell fishery, compared with which the right of any individual, no matter how great his investments therein, sinks into insignificance.

WASHINGTON LEADS ALL STATES IN FISHERY RESOURCES.

One effect of attending the meetings of the International Association of Fish, Game and Conservation Commissioners at Louisville, Ky., and Ottawa, Can., in 1919 and 1920, was to disclose to me how incomparably greater are the fishery resources of this state than those of any other state of the Union. In practically all other states, with the exception of Oregon, fishing is regarded only as a sport. None of the problems which confront this state in a commercial fishery way are shared by any other state. To be sure, they have some problems which have not yet bothered us to any great extent, the chief one being water pollution. Neither the Atlantic states nor the Gulf states have any great anadromous fishery such as the salmon fishery of this state; therefore, the greater reason for our preserving the great asset of our salmon fishery. Nowhere else in the United States does it exist; nowhere else in the United States will it ever exist, despite the efforts which have been made to transplant our salmon to the states of the North Atlantic Coast. It is, therefore, an asset which, if maintained, will each year grow more valuable as the demand is sure to increase. If the people of this state could only understand the situation as it really exists, they would never permit of its destruction by any selfish interest.

Many of those interested only in catching and canning fish lose sight of the fact that the state's interest in our fisheries is paramount to the interest of any individual who engages in their taking merely for profit.

Experience has taught us by this time about what percentage of the fish can be taken without diminishing the runs. And experience has also taught us the efficacy of properly conducted hatchery work as regards our salmon.

A CRIME TO DESTROY OUR FISHERY.

It seems to me to be a crime against mankind—against those who are here and the generations yet to follow—to let the great salmon runs of the State of Washington be destroyed at the selfish behest of a few individuals, who, in order to enrich themselves, would impoverish the state and destroy a food supply of the people.

Unfortunately, every pressure is exerted in behalf of those selfishly interested. These selfish interests have gone to an almost unbelievable extent in certain instances in order to silence any opposition to their course, and have slandered and villified those who opposed their plans and methods. These persons do not want the people of the state to know the truth of the matter, believing that if they do they will act to protect and conserve.

It is my belief that had the people understood the situation, they would have acted long ere this, and would have prevented the practical destruction of some of our greatest salmon runs.

SPAWNED FISH GIVEN AWAY AT HATCHERIES.

With the close of the war and the falling off of the demand for salmon, we found ourselves unable to dispose of the fish from which we had taken the spawn at the hatcheries, after 1919, except about \$1,000 worth sold in 1920.

During the war years, we received from spawned salmon and turned over to the state in round numbers some \$50,000. Had it not been for the moneys thus derived, it would have been impossible for us to have operated the Fish-

eries Department. Not only was the Department benefited financially, but the fish were sold under an agreement that insured their reaching the consumer at a much lower price than was being demanded at the time this plan was inaugurated. Scientific and chemical analysis demonstrated that they were entirely fit for food.

Finding ourselves without a sales market for this salmon in 1920, we announced that the people could come to the hatcheries and get the spawned fish without any charge. Thousands of persons availed themselves of this opportunity. Included, were organizations in certain cities, which were formed in some instances for the express purpose of securing these fish and distributing them to members at merely cost of transportation. Several thousand pounds were furnished to the United States army for the troops stationed at Camp Lewis.

For many years, the people stationed around the hatcheries have used these spawned fish for food, and the number annually is growing larger.

FISH GIVEN TO STATE INSTITUTIONS.

We continued the practice inaugurated several years previous of giving to the state penal, charitable and insane institutions all of the fish which they would make use of.

In Dr. Keller, the head of the Western Washington Hospital for the Insane at Fort Steilacoom, we always found an ardent co-worker in the attempts to lessen the cost of the state institutions by making use of our spawned salmon. Dr. Keller conducted his own research work and satisfied himself that the fish were entirely wholesome and stated that he made use of them on his own table. Both in 1919 and 1920 the greatest number of fish were made use of by this institution.

In return for this food, Dr. Keller, during several years when we were unable to secure help elsewhere, furnished us inmates from his institution, who assisted us in our hatchery operations. So great was the labor scarcity that had it not been for this assistance, we would have had to curtail our hatchery operations.

During some of the years, Dr. Keller not only preserved fish for his own institution, but also offered to preserve a supply for some of the other institutions, if they so desired.

INCREASED SALMON RUNS FROM TRANSPLANTED EGGS.

The most convincing results are apparent from the practice of transplanting surplus eggs from one hatchery to another. The statistics show a very decided increase in the take of spring or Chinook salmon on Puget Sound during the last two or three years. This seems to be the direct result of the transferring of the surplus Chinook salmon egg take of the Columbia River to the Puget Sound and other districts.

Puget Sound fishermen, who are acquainted with the Columbia River Chinook, almost without exception state that many of this specie which they catch now are of the Columbia River variety. The river fishermen state that the number of spring or Chinook salmon ascending the tributaries of Puget Sound has steadily increased during the last two or three years.

The fishermen in the Grays Harbor and Willapa Harbor districts also declare that the Chinook runs in their respective waters are increasing. And from all four fishing districts of the state come reports of the steadily increasing size of the Chinook salmon. In my opinion, the only reasonable explanation for this increase in size is the fact that during the last eight years we have adhered to the rule of using only the larger males in our spawning operations.

The 1920 run of spring Chinook salmon on Puget Sound was the largest in the history during the period for which records are available. In my judgment, the 1921 run in the Puget Sound district will prove to be still larger, for in 1917 we transferred the largest number of eggs ever taken in any one year from the Columbia River to that district.

The same is also true as regards the other districts, for in 1917 we took the largest number of eggs in the Columbia River district ever secured in the history of the state's operations on that stream.

NEW EYEING STATIONS.

During the biennium, the work of extending our hatchery operations in the way of establishing new eyeing stations for the taking of spawn went steadily forward. Lack of funds prevented the construction of any new hatcheries, with the exception of the new Chinook Hatchery, which was constructed from funds received from the Northwestern Electric Company in lieu of their maintaining a fishway over a dam which they have in the Big White Salmon River.

A number of trout eyeing stations were established, which are specifically mentioned in the report which I made for this same biennium as State Game Warden.

New eyeing stations established in connection with the salmon hatcheries were at the Elwha, where we inaugurated operations on the Lyre River and on Morse Creek; at the Skokomish, where spawn taking operations were inaugurated on two new tributaries; at the Nooksack and Middle Fork Nooksack hatcheries; at the Green River and Green River No. 2, and at the Nasel and Willapa hatcheries.

As pointed out in previous reports, the effectiveness of the hatcheries has been very greatly increased by the use of light automobile express trucks. These have enabled us to take spawn from streams, in some instances as high as twelve to fifteen miles distant from our established hatcheries. The fry resulting from these eggs were planted back into the streams from which the eggs were secured.

By following this plan, the salmon runs in these streams can be maintained and increased. It obviates the construction of new hatcheries, and of course the operating expenses are much less than if new hatcheries had to be constructed and maintained.

NEW HATCHERIES SHOULD BE CONSTRUCTED.

In my opinion, if the salmon runs of this state are to be maintained and increased, it is going to be necessary to constantly construct new hatcheries. The much greater effectiveness of hatchery operations, as compared with natural propagation, has in my judgment been so effectively proven as to no

longer permit of discussion among those who are acquainted with the situation.

On the Columbia River, with many of the tributaries formerly producing quite a portion of the salmon supply almost entirely eliminated from present day uses, because of the high dams, irrigation and electric projects, it was possible through means of intensive hatchery work on the lower tributaries to bring back the salmon supply of that stream to what it was before commercial fishing operations had so terribly reduced it.

The same is true of certain other salmon runs, notably the Chinook and chum or dogs, in the three other fishing districts of this state, while the silver-side salmon run has not shown the diminution that has been revealed in the sockeye and humpback runs because of our increased hatchery operations.

Prof. E. Victor Smith, of the University of Washington, who made a study of hatchery operations of the Fisheries Department of this state several years since, describes the greater advantage of hatchery or artificial propagation as compared with natural propagation, in a pamphlet issued by the Fisheries Department in 1919, entitled "Fish Culture Methods in the Hatcheries of the State of Washington," as follows:

Wastefulness of Natural Propagation.

The question naturally arises as to the advantage of the artificial method of propagation over the natural method. As the country becomes settled the natural spawning beds of the salmon and trout are rendered less and less productive, because of the increasingly unfavorable conditions incident to the commercial enterprises along the rivers and streams. It is imperative, therefore, that some means be adopted to counteract the depletions arising from this source; but the most important reason for the artificial propagation is the fact that the natural method is extremely wasteful, which is not true of the artificial method. The average number of eggs deposited by the females of the five species of salmon is about 4,000. Were it not for very great losses, the increase in the number of these fishes would be so enormous that in a few years there would not be food enough to keep them from starving by myriads. The greatest loss comes, without doubt, in the earliest stages of development. While there is much work to be done in determining the efficiency of natural propagation, yet enough has been done to show that the losses are very great during the first three or four months of development. In natural spawning Rutter estimates that at least 15 per cent of the eggs are not fertilized. This loss, he says, is small compared to the number destroyed before the hatching period. A considerable number of eggs is destroyed by the movement of the fish and gravel incident to spawning, a larger number is devoured by predatory fishes which abound in the spawning streams, and a still larger number is buried so deeply by the shifting gravel and sand, due to the winter's freshets, that they are smothered; or, if hatched, the young are not able to make their way to the surface. Again, many eggs are buried not more than three to four inches in the gravel, so when these hatch the young struggle to the surface long before the yolk sac is absorbed, and being of a bright attractive color and exceedingly helpless, they soon become the prey of voracious enemies. So it is probable that not 15 per cent of the eggs produce fry that reach the stage of complete yolk-sac absorption.

By the artificial method of propagation practically all the agencies so destructive to the salmon in their early stages of development under natural conditions are eliminated, and by the use of the most improved modern methods more than 90 per cent of the eggs may be hatched out and the young fish brought to the stage of complete yolk-sac absorption.

The proper policy seems to me to be to permit of the taking of all the fish that can be spared consistently with the maintenance of the supply. As heretofore pointed out, a very great number of men in this state secure their

livelihood by commercial fishing and many millions of dollars are invested in the commercial fisheries of this state.

The food resulting therefrom is made use of over almost all the civilized world. Therefore, the advisability of permitting operations on as large a scale as possible consistent with the maintenance of the supply. If this supply can be maintained and augmented by hatchery operations, and thus permit of the taking of a greater number of fish than can be taken if natural propagation is relied upon, it seems to me to be a question that does not permit of discussion.

Such is the view that has been taken by the legislature of this state in passing a revenue bill increasing the fish taxes to where the income of the Department, despite the diminished runs, will be doubled, if not trebled.

During the 1921 session of the legislature, as the head of the Fisheries Department, I was asked by many senators and representatives if the increased revenues were for the purpose of increasing hatchery operations. My reply was invariably to the effect that such was my understanding. In turn, these legislators replied that if such were the case, they were willing to vote for the increase.

Those engaged in the fishing business made no objection to the increase on the understanding that the increased revenues thus raised were to be used for increased and enlarged hatchery operations.

A reference to the 1921 revenue law will show that it will yield an increase of from 600 to 2,200 per cent on salmon catch taxes.

If there be any who doubt the efficacy of hatchery operations, I am sure that they would have these doubts removed by an understanding of the situation existing in Eastern states today. In these great centers of population, such as are to be found in the states from Pennsylvania north along the Atlantic seaboard, natural trout propagation is but a small factor. Whatever fishing there is results to a very great extent from hatchery propagation. Within the year, I have heard Mr. N. R. Buller, head of the Fisheries Department of the State of Pennsylvania, make the statement that the only reason for their rearing their trout to a six-inch fish was because practically all these fish were caught within a few months succeeding their liberation, and that the trout supply of the Pennsylvania streams were liberated into them each year just before the fishing season opened.

These conditions which exist in the East are, in my judgment, very largely responsible for the agitation which exists in Western states for the rearing of fish. However, the conditions which exist in the East do not exist in the State of Washington, particularly as regards our salmon.

The heads of the State Fisheries Departments, whom I have met and who have had the longest experience, are firmly of the opinion that better results, and certainly a much more economical system is the planting of the fry at the time of egg sac absorption, if conditions are such that they have an opportunity for natural growth.

Many of the streams of the East have not contained trout for many years. There, one of the great problems is water pollution. It practically does not exist in the State of Washington.

Again, while the propriety of trout rearing may not be questioned even for this state, the facts are that funds have never been made available to permit of it on a large scale.

ADDITIONAL REARING PONDS CONSTRUCTED.

To the extent of the funds available, we have reared both our trout and our salmon, but the policy which my experience has led me to adhere to is to permit of the salmon taking their departure whenever nature dictates the time. There are two things we do know about the salmon: First—that it is hatched in fresh water and soon thereafter, the time varying with the several species, descends to salt water, there to remain until sexually mature; second—then to return to the fresh water streams where hatched, where they deposit their eggs and die.

Prof. Rich, of the United States Bureau of Fisheries, who has carried on scientific research to ascertain at what age the young salmon go to salt water, reports that his observations are that they go down at varying ages. His work is not nearly complete enough to permit of the passing of final judgment.

It seems to me to be unwise to attempt to interfere with the processes of nature. Therefore, we have followed the plan of using the natural streams, wherever possible, as rearing ponds, feeding the young fry therein as long as they care to remain, but leaving the way open at all times to allow them to depart for salt water whenever nature tells them the moment has arrived.

This plan permits us to keep out the natural enemies of these young fish, and also permits nature to have its way. Every result which we have been able to observe seems to point to the correctness of this course.

It must not be presumed that I am against the use of rearing ponds. What I am against is the wasting of large amounts of money on the construction of great concrete rearing ponds, which are not nearly so efficacious as the less expensive ones, which as far as possible approximate natural conditions.

As funds permitted, we have constantly constructed these. Quite an extensive lot of ponds were constructed during 1919 at our Chinook hatchery. A reference to the statistical portion of this report will show that nearly all of our hatcheries have rearing ponds to a greater or less extent.

For years, we have planned an extensive system of ponds at our Chehalis hatchery. Eight acres of ground have been purchased for them, and only lack of funds has prevented their construction.

An extensive system has been planned for the Green River hatchery, near Auburn, which will be constructed during the ensuing year. Additional ponds were also constructed at the Samish hatchery during the last biennium, while improvements in natural pond conditions were made at Chambers Creek and at the Nooksack and Willapa hatcheries.

The early years of our incumbency of office showed us the wastefulness and undesirability of concrete ponds. The hot sun shining on these ponds heated the waters, making it less beneficial for the fish.

My conversations, during the last two years, with heads of the Fisheries Departments in the East, have revealed that these gentlemen have come to the same conclusion and are now constructing ponds which approximate as nearly as possible natural conditions. Everyone who has made a success of rearing fish and game birds is keenly alive to the fact that the best results are obtained by approximating as nearly as possible natural conditions. Hence the discard of the expensive concrete rearing ponds, and the substitution of those with the gravel bottoms.

On the Columbia River, it is only necessary to point to the results attained at our Kalama and other hatcheries. At Kalama, fifteen years ago, the egg take which resulted from securing all the fish that ascended that stream was 2,300,000. By 1917, as a result of our hatchery operations, the run had been steadily increased until we secured 44,082,500.

At the same Kalama hatchery we have introduced a run of chum or dog salmon of very considerable proportions. Mr. L. E. Mayhall, superintendent of hatcheries, who was with the Department twenty-three years ago, advises that at that time and in later years there was no run of dog or chum salmon in the Kalama River.

The fisheries authorities of the State of Oregon stress feeding of their young salmon. They admit that their ideas have considerably changed and they are now getting away from the use of artificial ponds, which were constructed at enormous expense, and are following our example of making use of natural streams, selecting those where the situation can be controlled. At our Kalama hatchery, we annually take from two to three times the number of eggs that are taken by all the hatcheries of the State of Oregon combined.

A few years ago the fisheries authorities of Oregon were proclaiming the merits of a central hatchery system, and announce that their efforts on the Columbia River were largely centered at the Bonneville hatchery, to which they transferred eggs from the other tributary streams.

The central hatchery of Oregon—the Bonneville hatchery—is located on Tanner Creek, which I am advised was not a natural salmon stream in the first instance.

After many years of operation, the Bonneville hatchery is unable to secure its egg supply from the stream on which it is located, but annually depends upon an egg supply being received from Oregon hatcheries situated on other streams, or from the United States Government hatcheries located either in Oregon, Idaho or Alaska.

The first requisite of a salmon hatchery is an egg supply. The Washington hatcheries on the Columbia River secure their own egg supply in increasing numbers every year, when fishing operations will permit of the escape of fish up the streams on which they are located, and where we annually liberated the resulting fry.

If the Bonneville hatchery in Oregon cannot secure its own egg supply, it seems to me that the situation is one which even the layman can understand, when he considers it.

WHAT EXPERIENCED FISH CULTURISTS SAY.

The dean of all fish culturists in the United States, Mr. James Nevin, who has been engaged in it for more than fifty years, some thirty-eight of which he has served at the head of the Fisheries Department of the State of Wisconsin, emphatically believes in the planting of the fry just at the age of the completion of the egg sac absorption.

The following letter received from Mr. Nevin discusses the situation, particularly as regards trout. No other state in the United States, aside from Washington, attempts fish propagation on the scale that is maintained by the State of Wisconsin. Mr. Nevin's letter follows:

Mr. L. H. Darwin,
Fourth and Seneca Streets,
Seattle, Washington.

Madison, Wis., December 20, 1920.

My Dear Sir: In thinking and talking over fish matters with you in the few times that I have had the pleasure to meet you, in regard to propagation of fish in your state, I have in the past few years admired the great work that your state has been doing in the propagation of salmon, which industry is of great commercial value to your state, and the pep that you have put into the execution under your administration. You have become noted throughout the country for action and deeds you have done in the accomplishment of fish affairs in your great state.

As I have been engaged in the propagation of fish for the past fifty years, and the reports from the various states from year to year come to our office, it is a part of my business to go through these reports carefully to see if I can get any useful information that will be beneficial for us to adopt in the way of betterment of the service in this state, and in this manner I have become familiar with your great work.

As my first fish cultural work was with the salmon on the Atlantic Coast, it was but natural that I would become much interested in watching the work of other states and especially interested in the salmon of the Pacific Coast. I have also become much interested in the views of many people as to when is the proper time to liberate the salmon fry in the rivers and streams. We have had this same matter up in the various states in the planting of fry and fingerlings in regard to brook and brown trout in the Eastern states. Personally, I believe in the planting of the fry just before the yolk-sac is absorbed and before the fry commence to feed. Fish are like animals; when kept in close confinement and fed regularly they become so tame that they will come up and feed from your hands. These fish at this time are losing their natural inclination to be on the alert for enemies that will destroy them, as it is a well known fact that the big fish eat the little ones. With us, in holding brook trout in ponds we have to sort our fish twice a year to keep the fish as near an equal size as possible, to keep them from devouring one another. As an illustration, some twenty years ago we planted some 500 lake trout, weighing a pound apiece, in Lake Mendota here at Madison, one afternoon. That same night a couple of men were out spearing pickerel and two of these same fish that we had planted the day before were taken from the mouths of pickerel that had been speared during the night. These fish had been fed in ponds for some two years and did not know what it was to have an enemy and were easy prey for other fish.

In the central part of Wisconsin brook trout were unknown in its many streams until planted as fry during the month of February. These same fry did not hatch until after the first of January, and we usually commenced to distribute about the 7th of February, before the food sac was absorbed and before they required any food. This was followed up for several years in planting during the winter months, and I can assure you that no state in the Union ever had any greater success in the stocking of the streams with fry when they were about a month old. The result has been that this state has had less agitation than any other as to when is the best time to plant fry or fingerlings.

Some springs, when we have a lot of snow and it goes off with high water in the spring of the year, if the country around about is hilly, there will be great floods in the valley, with much roily water, lasting several weeks at a time, and we have not as good results as with other streams that do not overflow their banks. These streams, we take every precaution to plant the fry in the head water springs and in small rivulet feeders to the main stream. In planting fish during the winter months, and planting them in small spring-fed streams, we have had our wardens, that are scattered over the state, watch certain streams for a few weeks after the fish were planted, and report from week to week on how the fish were doing, and in fact when it has been so that I could visit the streams on a Sunday in the vicinity of Madison, I have done so for my own satisfaction, to know how the little fellows were getting along. So far it has been a great pleasure to me to watch their progress and growth, with the small losses from planting. If great care and attention is taken at the time the fish

are liberated in clear water, with animal life in the water for sustenance, there is no question of what the harvest will be in the future.

Salmon fry are no different from other varieties of fish in planting. This building of ponds and placing millions of fish in ponds to feed for a few months, and then liberate them, I do not believe in, if the waters are in a condition to plant them at a time before the food sac is absorbed, as I know you must have great losses of the fry from the time they are placed in the ponds until they are liberated. I know that when we keep more fish in confinement than we ought to according to the size of the pond, we have great losses, and with the care and attention with the feeding I do not think that we receive enough benefit from them to warrant the expense.

This last spring we placed 1,000 fish in a pond with an abundance of vegetation and small fresh water shrimp, and they were not fed and after four months we took out 882. In another pond we placed 200 fish and after four months we took out 182 fish, so that you can see that the loss was very small, as no attention was given to the fish. In some streams and rivers fish of the same variety will do much better than in others, as there is as much difference in food and the quality of the water as there is in various soils for producing various kinds of crops. Then again, the season has much to do with the kind of crop you are going to harvest, as weather conditions have much to do with the hatching of the animal life for sustenance in supplying the infant fish with food.

I have often thought of how I would like to look over your vast water resources and salmon rivers. At the same time I think I have them well in mind from the pictures I have seen of them, and from reading of your great fish industry.

I would be much pleased to hear from you in regard to how you feel, personally, about keeping the salmon fry in confinement for a few months before liberating them.

With kind regards and wishing you the compliments of the season, I remain,

Very truly yours,
STATE CONSERVATION COMMISSION,
James Nevin, Commissioner.

SCIENTIFIC PUBLICATIONS ISSUED DURING BIENNIUM.

During the biennium, the department has issued three pamphlets dealing with fishery subjects of this state, which have attracted wide attention and enlisted inquiries from almost every state in the Union. These pamphlets are: "Fish Culture Methods in the Hatcheries of the State of Washington", by Prof. E. Victor Smith of the University of Washington; "The Taking of Immature Salmon in the Waters of the State of Washington", by Prof. E. Victor Smith; and "An Annotated List of Puget Sound Fishes", by Prof. Trevor Kincaid, of the University of Washington, all of which are reproduced elsewhere in this report.

In bidding adieu to the Fisheries Department as it has existed in this state for thirty-one years, I wish to take this occasion to extend my most sincere thanks to Prof. E. Victor Smith and Prof. Trevor Kincaid, of the University of Washington. Prof. Trevor Kincaid's ability in fish and shell fish work has been recognized by three of the leading governments of the world. During University vacation periods, he has worked with this Department, in seeking to find a solution to the questions which have perplexed us, particularly regarding our shell fishes.

I have never known a more thoroughly sincere and conscientious worker than Prof. E. Victor Smith. During the last eight years he and Prof. Trevor Kincaid, working at the request of this Department, have done more scientifically, in my estimation, to ascertain the facts as regards our Washington

salmon than has been done in all the years preceding, since statehood. Feeding grounds and feeding habits of our salmon, and the periods of their greatest development, for the first time, are pretty definitely known to us, and this definite knowledge is the result of their research work during the last eight years.

Prof. Kincaid's pamphlet contains illustrations of 114 of the possibly 200 forms of fish life known to exist in our waters. I feel that this report will be more valuable, by the use of these illustrations, than any others that occur to me.

CONSTRUCTION OF NEW CHINOOK HATCHERY.

One of the first hatcheries constructed by the State of Washington was at Chinook. The site was unattractive and the original construction poor. The result was that the hatchery was in a very bad state of repair and in addition was of a very limited capacity.

The Northwestern Electric Company a number of years ago built a fishway over a dam, which they maintained in the Big White Salmon River, of a height of about 160 feet. While it is generally supposed that no fish will ascend a fishway over a dam of even fifty feet in height, it is a surprising fact that we found at least one specie of salmon—the steelhead—in limited numbers, making its way over this fishway. The other varieties of salmon would not attempt it. After negotiations with this company, they decided to avail themselves of the privilege of the law which permits of the construction of a hatchery in lieu of a fishway where the dam is of a greater height than in the judgment of the Fish Commissioner will permit of a fishway being efficacious.

With your approval, I received \$5,000 from this company with which to construct a new hatchery at Chinook, Washington. This for the reason that it was unnecessary to construct a hatchery on the Big White Salmon River because the United States Bureau of Fisheries has for years maintained one near the mouth of that stream.

At the Chinook Hatchery we now have a fry capacity of 9,440,000 at a given time, as against 3,340,000 before the construction of the new hatchery.

It is built along the same modern lines that the other hatcheries have been constructed, with the improvement of a floor sloping to conform with the drop in the hatchery troughs.

The new hatchery is adjoining the site of the old one, but on higher and better drained ground. In addition to the construction of the new hatchery, we drained the grounds of the old one, constructed new rearing ponds, and placed the old hatchery in such condition that both of them will hereafter be made use of because of arrangements which we have made to increase the egg take here.

FORCED TO MOVE OFFICE ON ACCOUNT NEW CONSTRUCTION.

During the biennium, the State Fisheries Building, constructed at the corner of Fourth Avenue and Seneca Street by the Metropolitan Building Company in 1914, which housed the State Fish Commissioner and State Game Warden's offices, together with the exhibit which had been installed, was razed so that a more permanent structure for commercial uses might be erected on the site.

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New quarters were arranged for the State Fisheries Department on the back of the grounds. This necessitated a double removal of the offices—one to vacate when the old building was to be torn down, and another back to the new building.

The new location is nowhere nearly so advantageous from a show point of view as the old one. It is questionable if one person visits the exhibit now, where ten formerly visited it. The new building is much more comfortable and the business offices are larger and much better arranged than the old building, but the obscurity of the location prevents the exhibit attracting the crowds which formerly thronged it.

Also, the exhibit room is smaller than the old one, and it is impossible to show as large an exhibit in the new building as was shown in the old one. The rent for the new building is \$300 per month as against \$150 for the former one.

As the new code takes the bulk of the clerical work out of the Fish Commissioner's office and transfers it to the State Treasurer and to the Director of Licenses at the state capitol, it may be found advisable to make some disposition of the exhibit and remove the Fish Commissioner's office to Olympia, thus saving over \$5,000 annually.

When the license department was maintained in the office here, and the Game Department as well, the expense being divided between them, there was every reason for its retention in the City of Seattle, where it could be personally visited by a large per cent of those having business with the Department. But these visits very largely arise from matters connected with the securing of licenses, the payment of taxes, and inquiries concerning the commercial and game and game fish laws. Now that these are transferred to Olympia, under the terms of the Civil Administrative Code, there would seem to be no reason for the present large expense of maintaining the office in Seattle.

These two removals of the office and exhibit entailed an immense amount of extra work on the part of the employes and extra expense on the Department. The matter of taking down and setting up the aquarium is most expensive.

FLOOD DAMAGE CURTAILED CHINOOK EGG TAKE.

The unprecedented and unseasonable September, 1920, floods caused us to lose the racks at those salmon hatcheries which take in the neighborhood of 90 per cent of our Chinook eggs. In the Columbia River district, we lost the racks at our Kalama and Wind River hatcheries. At Wind River we were able to secure 632,400 eggs before they went out; but at the Kalama Hatchery, the largest Chinook egg taking hatchery in the state and where in previous years we have been able to secure as high as 44,082,500 eggs, we were unable to take a single one. In the Willapa Harbor District, we lost our racks at the Nasel River Hatchery and the Willapa Hatchery, both of them splendid Chinook hatcheries. On Puget Sound, we lost part of our racks at the Green River Hatchery, where more Chinook eggs are taken than at any other hatchery in this district. This catastrophe was absolutely unavoidable. In none of these streams is it possible to construct permanent racks. Very fortunately, these disasters in the Columbia River district are an infrequent occurrence. It is the first time in the nine years of my operation of the

Department that we lost our racks by reason of floods at any of our Columbia River hatcheries. At the Nasel, Willapa and Green River hatcheries it is not so unusual to lose the racks, but generally not until after a considerable number of eggs are secured.

LARGEST SALMON EGG TAKE IN STATE'S HISTORY DESPITE DISASTERS.

From these unfortunate occurrences we can turn to the more fortunate aspects of our 1920 hatchery operations, for it should be borne in mind that despite these misfortunes it was in this year that we took the largest number of salmon eggs of any year in the history of the operation of the Fisheries Department.

The greatest increase came in the chum or dog salmon and silverside salmon egg take at our Chehalis and Humptulips hatcheries. From the records which I have been able to observe, the Chehalis Hatchery in 1920 took the greatest number of salmon eggs ever taken by a single hatchery anywhere in the history of hatchery operations. That year it took 71,736,720, of which 17,118,340 were silverside and 51,076,000 chum or dog. In both of these species it far exceeded any previous take at this same hatchery.

The increase in the take of silverside eggs at the Chehalis Hatchery is particularly gratifying. It is fortunate that, for purposes of comparison and getting a line on the possibilities of hatchery operations, the Chehalis Hatchery has been in charge of one man for seventeen years. By reason of this long continued experience, Superintendent L. M. Rice, is able to speak very definitely concerning the success in increasing the salmon runs which has attended the operations of this hatchery. The increase has been very great. The exact ratio, of course, is impossible to determine. Many millions of salmon eggs were deposited naturally in the Satsop River, from which the Chehalis Hatchery secures its spawn supply. This was because of the low water conditions which prevented the fish from reaching up to our racks, where they are trapped and their eggs taken.

The egg take at the Humptulips Hatchery was also large beyond all expectations. In 1920 we succeeded in constructing a rack at the Humptulips Hatchery which withstood the floods. This was our third attempt there at permanent rack construction, as the raging torrents which sweep down Stevens Creek had heretofore been able to frustrate our efforts. That year we took at the Humptulips Hatchery 21,913,280 eggs, against 10,060,000 in 1917, the highest we had ever been able to secure before.

The Chehalis and Humptulips hatcheries produced the greatest increases in egg takes of any in the state during this year. Notwithstanding the losses in our Chinook egg take, our hatcheries everywhere, generally speaking, increased their takes in 1920 over the preceding two years.

The Nooksack Hatchery passed all former records in taking silverside eggs. An unfortunate temporary break in our racks deprived us of several millions of eggs, which could have been secured here.

The Middle Fork Nooksack Hatchery surpassed any of its previous records, and a number of the other Puget Sound hatcheries, in 1920, made the best record of years.

One of the potent reasons for the increase in our egg take in the Puget Sound, Grays Harbor and Willapa Harbor hatcheries was the fact that there was less commercial fishing carried on in 1920 than during any of the previous six or seven years. This permitted of the escape of a larger number of fish to the spawning streams than had been the case during previous years.

The reason for the small fishing operations lies in the fact that there was a large carry-over salmon pack from previous years, which the cannerymen were unable to dispose of. This resulted in a tremendous drop in the price. Canning costs had not decreased in proportion to the fall in the price, and the canneries found themselves unable to can fish at as low a cost as the then prevailing prices. Hence their refusal to operate.

LEGISLATURE GIVES INDIANS SPECIAL FISHING PRIVILEGES AT PROSSER.

The 1921 session of the legislature passed a bill, over your veto, giving to the Indians the right to fish in the Yakima River, in the vicinity of Prosser, at the dam which was constructed there a number of years ago, and which is maintained for the development of power for local flouring mill interests and hydro-electric companies.

In view of the state wide publicity which has been given this question, arising out of the attempts of the Fisheries Department to enforce the fishing laws obtaining on the Yakima River, I think we owe it to candor to relate the facts and instances which gave rise to this situation.

It is unquestionably true that the aboriginal Indian fished with his snags and snares along all those Eastern Washington streams up which salmon ascend for spawning purposes. With their crude appliances, they were unable to secure any great number of fish in the Yakima River, and their operations must have extended for some seventy miles up that stream from its mouth.

Some fifteen years ago, E. W. Benson, who since then has occupied the position of Commissioner of Agriculture in this state, organized an irrigation company, and it is my information constructed this dam in the Yakima River at Prosser. Its height is some twelve to sixteen feet, and at the low water stages was of sufficient height to stop the up-stream ascent of salmon, had not a fishway been provided to permit them to get over.

Within a year or two after I took charge of this office, we caused an efficient fishway to be constructed by the owners of the dam. The question of the right to fish there did not become acute until after the hatcheries on the Columbia River had succeeded in restoring the run on that stream in 1913 and 1914. Commencing with those years, the Chinook salmon commenced to reappear in the Yakima river in much greater numbers than in the preceding years.

Particularly the older Indians want to fish. As the Chinook salmon ascend the Yakima River generally at the low stage of water in May, the time of their arrival was known to the Indians of the Yakima Reservation, who left the confines of their reservation to catch them in defiance of the laws which the state had made to protect them on their way to their spawning grounds.

When, as Fish Commissioner, I was advised that the Indians were violating the state law off their reservation, we proceeded to arrest them. At that time the Indians were taking the fish, using some themselves and selling many to commercial dealers and local white residents.

It was not until the second year of our enforcement of the law that the Indians put forth the claim that this was one of their ancient fishing grounds and that the treaty, which Governor I. I. Stevens made with the Yakima Indians, reserved to the Indians the right to fish at this particular place at any time and in any manner.

I carefully examined the treaty and could find no such provision. The reading of it developed the fact that practically the identical language was used as regards the fishing rights of these Indians that had been used for the last eighty years, commencing with the time the treaty was executed with the Omahas. In actions instituted against them in court, they set up the treaty as their defense. The supreme court of the state decided that the Indians had no special rights under their treaty, and that off their reservation they are amenable to exactly the same law as the white citizens.

As I recall, on one pretext or another, the supreme court in the last five years has had to decide this question four times, and each time they have decided it the same way. Even after the court had several times decided the question, unfortunately, certain officers of the state, who associated with the Indians, still advised them to violations. In one case in the lower courts, the Indians summoned to testify in their behalf General Hazzard Stevens, son of Governor I. I. Stevens, who was one of the signatory witnesses of the various treaties which his father made with the Indians of this state.

Much to the surprise of the Indians, General Hazzard Stevens' testimony was to the effect that his father particularly explained to the Indians that off their reservation they would be subject to the same laws which would be made to govern the whites as regards fishing.

In the meantime, other Indian treaties, in which the same language as regards the rights of fishery was used as was used by Governor Stevens in the Yakima treaty, made their way to the supreme court of the United States. This court placed the same construction upon these treaties as was placed upon them by the supreme court of the State of Washington.

The public did not understand the situation. It could not realize that the only reason the Indians wanted to fish at this particular place was because the fish were stopped here by the dam, and the Indians were enabled to wade into the water and make a wholesale slaughter of them. The feeling was that they should be given the right to fish—and without a realization of the harmful effects which might result therefrom.

At the 1921 session of the legislature, a bill was introduced giving them these rights. A band of the Yakima Indians appeared before the legislature in tribal costume to plead for its passage.

In this connection, it should be remarked that only a very small percentage of the Yakima Indians were really asking this privilege. These were of the older and more improvident class. The Yakima Indian Agent made no attempt to aid them. He appreciated that a few miles further up stream within the confines of their reservation there were other places and even other dams which afforded the Indians all the opportunity they needed for fishing.

In my judgment, the whole proceeding will really amount to nothing. So far as the fishery equation of the Columbia River is concerned, I feel sure that the developments of the next ten years will demonstrate conclusively

that the Yakima River will largely have to be eliminated from consideration as a spawning tributary. It is said that even at this time 90 per cent of the water of that stream is made use of for irrigation purposes. Plans now on foot contemplate newer and higher dams and the use of even more of the waters of that stream for irrigation.

As the result of the construction of certain dams now planned, it is probable that this stream will be entirely dried up for several miles below Prosser. This being the case, it will, of course, be impossible for any salmon to ascend it during those times when the water is being used for irrigation.

Believing this condition is certain to ensue, I have sought to concentrate the propagation efforts of the state on other tributaries. In my judgment, the best opportunity lies further down the Columbia. I cannot conceive of a condition arising where the waters of the Yakima River are not going to be immensely more valuable for irrigation purposes than for spawning purposes. And while of course it would be desirable if both could proceed, in my opinion the developments of the next ten years are going to make this impossible.

The decision which this state is going to have to make is as between the value of the water of this stream for irrigation and fishery purposes. It is so tremendously more valuable for irrigation that I have no doubt as to what the final decision will be.

CRAB FISHING GROWS EACH YEAR.

Our native crab is the best to be found in any waters. For that reason, fishing for them has increased in volume with the passing years. In Puget Sound, some of the locations where this fishery has been carried on the longest have become depleted, but others have been discovered, so that more crabs are being taken now than in previous years. There is no evidence at hand to indicate a great depletion of our Puget Sound crab fishery.

The crab fishery of Willapa Harbor is unfortunately in much worse condition. The operations of the purse seiners in the Pacific Ocean off that district in their quest for salmon have seemingly proven very destructive to the crab industry.

The crab fishing operations carried on inside Willapa Harbor have undoubtedly resulted in a depletion of the supply there during the last few years, and have forced the fishermen to transfer their operations in large part to the Pacific Ocean waters adjoining.

The purse seiners in their operations drag their seines along the hard and sandy bottom of the ocean and the crabs become enmeshed in their web, with the result that great numbers of them, according to testimony of interested parties, have been destroyed. If the purse seiners are restricted from operating in these waters, it will be a great boon to the crab industry, to say nothing of the salmon industry.

On Puget Sound, the largest number of crabs today are being taken from Samish Bay—a fishery which has only been developed within the past few years.

The total value of our crab industry during the biennium of 1919-1920 was \$205,046.28.

CLAMS CONTINUE TO INCREASE ON PACIFIC OCEAN BEACH.

Each succeeding year only demonstrates the wisdom of the action taken in the matter of our Pacific Ocean beach razor clams. The 1917 session of the legislature passed a law providing for a closed season which we recommended. Each succeeding year since then has seen the supply increase until today it is as great as ever, if not greater, and these clams are now to be found on portions of our Pacific Ocean beaches which they had not heretofore inhabited.

Reversing the former plan of a nine months' open season and a three months' closed season, so that now there is only a three months' open season and a nine months' closed season, has not only increased the Pacific Ocean beach razor clam supply, but has brought prosperity to those engaged in the industry, as against poverty and failure under the old law.

In three months now the canners put up much larger packs than they used to put up in nine months. The wages of the diggers have been increased several hundred per cent. It does not take a financier to understand the great saving that can be made in doing more in three months than was formerly done in nine months. The operating expenses are tremendously reduced.

As usual, as the supply has increased, there are those seeking merely to profit, who would attempt to lengthen the season so that they may take a greater supply. It is to be earnestly hoped that the legislature will never accede to the wishes of those who would for their selfish interests destroy a great natural resource of the state. We have had a bitter experience and we certainly should profit by this.

Our greatest clam resources are to be found on our Pacific Ocean beaches. Not only are the clams found here in a much larger quantity than elsewhere, but they are also our most valuable variety.

Highly beneficial have been the results of the laws which have been enacted to protect the Puget Sound clams. A few years ago the statement was everywhere being made that the Puget Sound clam supply was being rapidly exhausted. I have not heard such a statement made by any person within the last four years. This despite the fact that our clam canning has gone forward as usual.

The Eastern states are trying to find a method for the artificial propagation of clams. In the State of Washington we rely entirely upon natural propagation. The sole effect of our laws has been to protect our clams during their spawning season. If the present laws are not disturbed, there is no reason to feel any danger of immediate depletion in our clam supply.

The total value of our clam industry during the past biennium was \$397,104.03.

SOCKEYE SALMON RETURN TO THE SAMISH RIVER.

In 1915, this Department undertook the experiment of attempting to propagate sockeye salmon at our Samish Hatchery. Detail of this is outlined in our previous report. Briefly, it was as follows: Arrangement was made with the Pacific American Fisheries whereby we were permitted to take salmon from their trap located on the west coast of Lummi Island, and some ten to fourteen miles distant from the mouth of the Samish River.

Live boxes were constructed, into which the fish were taken from the trap and towed through the water to the mouth of the river. A rack was constructed across the mouth and the fish, without ever being touched with hand or net, were liberated into the mouth of the river. They ascended up to our hatchery racks, where they matured, and their eggs were taken and hatched and the fry liberated in Caines Lake and Lake Samish.

Nineteen hundred and nineteen was the first year when mature fish should have returned from this experiment. As the Samish River is not a natural sockeye stream, we had small hopes of any sockeyes returning to that stream, but trusted to augment the general supply by our hatchery work. Therefore, we were not prepared to stop the fish in 1919, and cannot say positively that any returned that year. However, we continued placing sockeyes in the stream in 1916, 1917 and 1918. In 1920 we had our racks in the river, although they were open, and that year quite a large number of sockeyes returned to that stream, escaped up stream beyond our racks, spawned naturally and died, and their dead bodies floated back down stream. One hundred and sixty-five dead, spawned-out sockeyes were counted on the Samish racks in 1920, and several sockeyes were taken and their eggs hatched and fry liberated.

It is the general belief that sockeyes spawn only in those streams which are the outlets of lakes. The Friday Creek tributary of the Samish River is the outlet of Lake Samish. A general belief also is that these lakes must contain glacial waters in order for the sockeyes to inhabit them. Samish Lake does not comply with this condition.

It is my opinion the Samish Hatchery sockeye experiment is of tremendous importance to the fishing industry. In many quarters there has been a belief that the artificial or domestic propagation of sockeye salmon is not attended with that success which is known to attend the hatchery propagation of other species. The result of our Samish experiment seems to be proof positive that the sockeyes can be propagated successfully by the same hatchery methods which are employed in the propagation of other varieties of salmon.

It is probably true that the fry must be liberated into a lake, in which they can spend the first year of their existence, and make their way to salt water at the proper time.

If the Fisheries Department of the State of Washington can get definite results on the propagation of sockeye salmon, which have been obtained at the Samish Hatchery under the altogether abnormal conditions under which the experiment was undertaken, it would seem to be proof positive that with the employment of proper hatchery methods in the Fraser River water shed, and by the employment of them on sufficiently large scale, the sockeye salmon runs of the Fraser River can be rehabilitated, just as the Chinook salmon run of the Columbia River was rehabilitated.

It goes without saying, that the proper place to employ intensive hatchery operations of the sockeye species is in the Fraser River tributaries which they naturally ascend. It was for this reason that I suggested to you the advisability of having the legislature appropriate \$100,000 for the newly created State Fisheries Board of Washington, so that they might have this amount of money to spend in cooperation with the Canadian fishery authorities in increasing the sockeye hatchery operations in the Fraser River water shed.

The legislature appropriated this \$100,000, and I have no doubt that the State Fisheries Board of Washington and the Canadian authorities will within

the near future arrive at an agreement whereby all or a portion of this money will be available for hatchery operations in the Fraser River water shed.

DUWAMISH RIVER CLOSED TO FISHING.

At the beginning of February, 1920, all the tributaries of Puget Sound were closed to commercial salmon fishing, with the exception of the Duwamish, Skagit and Snohomish rivers.

In March, 1920, the State Fish Commission closed the Duwamish River to fishing until June, 1921. This action was taken in response to the request of the Port authorities of the City of Seattle, and a number of persons and organizations interested in shipping, who complained that the fishermen's nets were a serious obstruction to navigation in the waters of the harbor.

SAMISH HATCHERY RACKS UNLAWFULLY DESTROYED.

One of the problems with which the Fisheries Department has to contend, on many of the streams on which its operations are carried on, is the feeling held by the people, residing above the point where the fish are stopped for spawning purposes, that the fish should be allowed to proceed up stream so that they might have an opportunity to take them.

This feeling is very bitter in several communities, although the law prohibits these fish being taken, and the persons who desire them would have to violate the law if they did secure them. Nowhere has there been more animosity exhibited than at the Samish Hatchery. In 1919, our first permanent rack in that stream was constructed, only to be destroyed by a charge of dynamite at the very commencement of the fishing season.

In 1920, the racks were reconstructed during the low water season, only to have the attempt at their destruction by dynamite repeated at the very first high water stage. This second attempt was not so successful as the first and we were able to effect repairs, which permitted of our taking a very large quantity of eggs in 1920. Following this, we stationed a watchman at the racks day and night, and thus prevented any further attempts at their destruction.

Finding themselves foiled in their attempts to unlawfully destroy the racks, interested parties influenced the Commissioners of Skagit County to institute a suit against myself as Fish Commissioner in the City of Olympia to prevent our maintaining the racks there.

In the course of the trial of the suit, it was conclusively proven by engineers on the part of the state, and admitted by the engineer of Skagit County that the reason for the flooding of the lands was the constructing of the approaches of the new bridge erected just up stream from the racks and traps, and the racks were in no wise responsible, as was claimed by Skagit County.

The superior court promptly found in behalf of myself as defendant, and no appeal was taken from this decision.

PERMANENT RACK CONSTRUCTION.

Nothing has so contributed to the success of our hatchery operations as the construction of the so-called permanent racks. This permanent or new style of work is so far superior to the old style as to make comparison useless.

By their use, we have succeeded in stopping all the fish which ascend some of our hatchery streams—a thing which was never possible before. Also we were enabled to maintain them in streams where we were never able to maintain the old style. The greatest illustration of their efficaciousness is demonstrated at our Chehalis, Humptulips and Samish hatcheries. All three streams worked in connection with our Chehalis Hatchery operations were equipped with them in 1920, with the result that 71,736,720 eggs were taken there, which was not only the largest number of eggs ever secured at this hatchery, but so far as I am able to ascertain, the largest number of eggs ever secured at any salmon hatchery.

At our Humptulips Hatchery, every year prior to 1920 we suffered the loss of our racks. Some years favorable weather conditions prevented this until we had secured quite a few eggs. Other years, early freshets took them out before we had secured practically any eggs. The permanent rack constructed in 1920 withstood the tremendous floods of Stevens Creek, and enabled us during that year to get 21,913,280 eggs, or more than double the number secured there during any previous years.

At the Samish Hatchery we secured results almost as beneficial. A very large proportion of our 1920 expenditures was for the construction of these permanent racks at our Samish and other hatcheries.

BIOLOGICAL SURVEY OF FRESH WATERS.

In 1920 the Department arranged with the ichthyologists of the University of Washington for a biological survey of the fresh waters of this state—the expense to be borne by the Game Department. The matter is more fully covered in my report as State Game Warden for this same biennium.

ASSISTANCE FOR HATCHERY ENLARGEMENT EXTENDED BY GRAYS HARBOR CIVIC BODIES.

The unprecedented large take of eggs at the Chehalis and Humptulips hatcheries in 1920 taxed our hatching capacity in this district far beyond its limit. I felt a much greater number of eggs should be hatched at the Chehalis and Humptulips hatcheries than was possible with the then existing capacity. The financial condition of the Department was such that we were without funds to construct additional hatching troughs. Under these conditions, I appealed to the Aberdeen Chamber of Commerce and Hoquiam Commercial Club and the Rotary Clubs of those two cities to furnish us sufficient money to build enough hatching troughs to permit of the hatching of twelve million additional fry at the Chehalis hatchery and four million at the Humptulips Hatchery. The appeal met with a warm response and the money asked for was donated.

GREAT SAVINGS TO RESULT FROM USE OF NEW STYLE OF TROUGHs.

In commencing the use of the style of hatching trough made use of by the State of Wisconsin, the foundation has been laid for the greatest single economy ever introduced into the Fisheries Department of the State of Washington. This trough represents the result of fifty years of experience as a

fish culturist of Hon. James Nevin, of the Conservation Commission of the State of Wisconsin, elsewhere referred to in this report.

In 1920 I visited several of the hatcheries of the State of Wisconsin and witnessed the use of these troughs in the hatching of silver trout eggs furnished to Wisconsin by the State of Washington. In two single troughs we found that the same number of fish are hatched and brought to the period of egg sac absorption as were being hatched in the smaller hatcheries of this state.

Returning to this state, we immediately constructed one of these troughs and demonstrated the practicability of its use in our own operations. As soon as this was ascertained, we commenced the construction of forty additional troughs of this kind.

The adoption of this style of trough means an end to the construction of tremendously large hatchery buildings, like we have at such hatcheries as the Chehalis, Samish, Skykomish, Snohomish and others.

In the Wisconsin hatcheries, we saw ladies garbed as though for office work performing the same class of work as men clothed in rubber from shoulders to feet perform in the hatcheries of this state.

Warm, dry, comfortable rooms are the result of the use of these troughs in the Wisconsin hatcheries, while in our state the hatcheries are wet and cold and require the use of very heavy clothing if the workers are comfortable. The use of the Wisconsin style of troughs will hereafter permit of the construction of small, compact buildings, cheaply heated, and kept clean and comfortable at all times.

It means a tremendous initial saving in the cost of hatchery building, and the hatchery operations clear through will be much cheaper and much more comfortable for those engaged in them.

CARP SHIPPED TO EASTERN MARKETS.

In Washington, the carp is a most unwelcome fish in a number of the lakes situated in the Eastern portion of the state. They are a transplanted fish, having been brought here some thirty years ago, and in some of the lakes in which they have been planted have taken practically complete possession of them. This class of fish, however, is made use of by certain southeastern European peoples, and quite a market has developed in New York City.

Permission has been given fishermen to seine them from Moses and Colville lakes in Eastern Washington, in the hopes that they could be cleared out of these waters and better grades of fish planted therein. Although many carloads have been taken from these lakes, the supply has not been appreciably diminished. However, no harm is being done by these operations, as these are practically the only varieties of fish found in them, and as some people like them for food and as their taking gives employment to some people in this state, the result from every viewpoint seems beneficial.

LOBSTER TRANSPLANTING SEEMINGLY A FAILURE.

During the past biennium, the United States Bureau of Fisheries has desisted from its efforts to transplant the Atlantic Coast lobster to our Puget Sound waters.

For several consecutive years, carloads of these were brought here and this Department's assistance was extended in their planting. So far as

we are able to ascertain, none of these lobsters have ever been seen since they were planted, and the experiment seems to be definitely regarded as a failure.

One of the theories advanced for their disappearance is that they cannot survive the attacks of the Puget Sound crab, which, while smaller, seems much more pugnacious.

HAIR SEALS DESTROYED.

With each passing year, the fishermen seem more keenly alive to the toll taken from our salmon runs by the so-called hair seals. The result is that they have lent their efforts in increasing numbers to the hair seal's destruction. The appropriation made by the legislature has never been sufficient to pay these claims for bounty when presented. The result has been that these claims have been referred to the legislature and have by them been paid. The disadvantage of this, of course, is making the man wait in some instances almost two years for his money.

A bad feature of the law was offering a bounty of \$3 for the destruction of these seals in the Columbia River District and only \$1 in the Puget Sound, Grays and Willapa harbors. The last legislature corrected this inequality by providing that the bounty shall be \$3 in all the waters of the state.

The efforts of the employes of this Department have at all times been devoted to their destruction as opportunity offered.

THE DIVISION OF THE DEPARTMENT'S WORK A BIG MISTAKE.

The completion of this report has been delayed sufficiently to permit of observance of the work of the Department after it was divided and reconstructed under the Civil Administrative Code. When the code was being prepared by Director of Efficiency McArdle I pointed out to him that the proposed plan simply meant a repetition of the work to a greater or less extent in three departments, without the Fisheries Department, the real one in interest, having the control of the situation, which was necessary for the proper administration of its affairs, the enforcement of the fishery laws and for the economic operation of the Department.

I also presented my views to you in the matter and after the law was passed and in operation the division of the Department provided for was delayed in part for five months because of the apparent repetition of the work, and also of the very apparent fact that this Department could do it much more quickly and economically than under the new law.

In discussing the matter with me, you have frankly stated that you have arrived at the conclusion that a mistake has been made.

Under the present plan, the work which I alone performed for eight years at a salary never exceeding \$3,000 per year, is now being performed by three men at an aggregate salary of \$11,400 per year, with two different departments with separate office forces and with all the attendant expense to separately maintained offices.

Also, there has been set up two fishery organizations in the state. In each Biennial Report which under the law I have submitted to the Governor of this state, I have pointed out the desirability of a single department, under a single head, from the viewpoint of both economy and efficiency.

Prior to April 1, 1921, there was no department in the state where the work was concentrated like it was in the Fisheries Department. A man engaged in any branch of the fishing business transacted all his business with the Fisheries Department. He secured his license from the Department and paid his fees to the Department. This enabled the Department to know at any moment just who was qualified under the law to carry on fishing operations in the state.

Observe the difference under the new law. A man desires a fishing license. Under the law, he first applies to the Director of Fisheries and Game for a blank upon which to make application. This application, when filled out, is forwarded, together with the proper remittance, to the State Treasurer. The State Treasurer receives the remittance and issues a receipt in triplicate therefor, retains one copy, forwards one to the Director of Licenses along with the application, and the third to the Director of Fisheries and Game. The Director of Licenses issues the license and then returns the application to the Director of Fisheries and Game, from whence it was originally secured by the persons requesting the license. Thus, in order to issue a fishing license, three departments of the state are called upon to function, instead of one, as under the old law.

The same long, drawn out process applies to the payments to be made to the state by the licensee after he has caught fish from our waters. In order to make his report and payment to the state he first applies to the Director of Fisheries and Game for the blank. This being executed, he sends it, together with his remittance, to the State Treasurer. The State Treasurer keeps the money and forwards the report to the Director of Fisheries and Game.

From the reports which have been made to you by those charged with the responsibility of the various branches of the Fisheries Department, you are well aware of the duplication of expenses and annoyances which have resulted from the new law.

In order to get along with the work at all, the State Treasurer has been forced, since taking over the part of the work assigned to him by the new law, to assign one of his deputies to the office of the Supervisor of Fisheries. There can be no reasonable excuse for the waste of money which arises from the cost of the operation of the fishery business of the state under the new code.

If it is desirable to treble the tax burden of the fishing interests of the state, it is in my judgment far better to use the increased funds so received in assisting to pay the ordinary running expenses of the state, and thus lighten the burden of the general taxpayer, than it is to throw this money away in needless and unnecessary duplication of work, which results in lessened efficiency all around.

THE PROBLEMS WHICH LIE AHEAD.

In conclusion, permit me to again draw attention to the fact that in so far as Puget Sound be concerned, where by far the greater part of the fishing industry exists, the depleted runs are those over which the State of Washington has no control in a propagation way.

The sockeye run is the one which shows by far the greater depletion. Ninety-eight to ninety-nine per cent of this run only passes through our waters

to enter the Fraser River, in the Dominion of Canada. The only Puget Sound tributary up which any sockeye ascend is the Skagit River, and the United States Bureau of Fisheries operates the hatchery which takes every fish that ascends that stream.

In the case of the humpback salmon, which shows the next greatest depletion, about two-thirds of them also enter the Fraser River.

From these figures, it is to be seen how powerless is the State of Washington to act in the matter of rehabilitation and restoration of these runs, unless they act in conjunction with the Dominion of Canada authorities.

And it was to permit of the securing of such joint action that the creation of the State Fisheries Board was recommended to you two years ago by myself.

As to our Chinook run, as heretofore pointed out, we have increased this in Puget Sound, as shown by the catches of the last four years. This has been done in large part through the bringing of Chinook eggs from the Columbia River and hatching them in Puget Sound hatcheries and liberating the fry in Puget Sound tributaries.

The same is true of our chum or dog salmon run on Puget Sound. The only difference is that the surplus eggs of this variety have been distributed from the Grays Harbor to the Puget Sound and other districts. Had this policy not been pursued, in my judgment the spring and chum or dog salmon runs in Puget Sound would have shown depletion, not as great perhaps though as has been shown by the sockeye and humpback salmon runs.

The catch of Chinook and chum salmon on Puget Sound has been largely increased in the last four years and there has been nothing to indicate that this has been done at any expense to these runs.

My years of experience in this Department only confirm me in the belief that the maintenance of our salmon runs lies in increased artificial propagation. This, of course, must be supplemented by regulations which will permit of the escape of a sufficient quantity of salmon to furnish the eggs for hatchery operations.

If the salmon runs are maintained, in my judgment, the time will come when every natural salmon stream in this state will have a hatchery thereon. Any other activity of the Department can well afford to be sacrificed in order to carry on the hatchery work.

Because it has fallen to my lot to serve the State of Washington for a longer time as Fish Commissioner than it has ever been served before by a single individual, I have made a fuller and more complete report this time than I have heretofore submitted.

The purpose of this is to provide those who may come after me with all the data gathered, and with a record of those things which I have experienced, that they may have this information before them, to use it or not, just as they see fit.

I am particularly moved to do this because of the paucity of information concerning the Fisheries Department of this state which was transmitted to me by my predecessors in office.

THE TAKING OF IMMATURE SALMON IN THE WATERS OF THE STATE OF WASHINGTON

By E. VICTOR SMITH, University of Washington.

Prepared at the Request of and Issued by

L. H. DARWIN,
State Fish Commissioner.

INTRODUCTION.

The conditions prevailing in the fisheries of the Pacific Northwest are causing grave concern to those who are most interested in seeing this important and lucrative industry conserved. So attractive is the industry that an ever-increasing number of men are seeking employment in it, until it is feared by many that it will be ruined as a commercial enterprise. Remedial measures are being very generally discussed by those vitally interested in the fisheries, but before wise and efficient measures can be adopted for the conservation of this industry, it is essential that a thorough and scientific investigation be made of the various phases of the problem, so that sufficient, well-established information may be supplied to those who will draft the conservation measures.

The State of Washington, through its Fish Commissioner, Leslie H. Darwin, is doing its share toward solving the problem. To gain satisfactory information on one phase of the problem, i. e., the taking of immature salmon in the waters of the state for commercial purposes, Mr. Darwin requested Professor Trevor Kincaid and the author to spend as much time as they had at their disposal during the fishing season of 1918 investigating this phase. Owing to other work it was impossible to devote very much time to this work, but enough was learned to make it seem worth while spending further time in making a more thorough study of it. Consequently, at the request of Mr. Darwin, the author spent the entire fishing season of 1919 following up the work begun in the previous year. "The Twenty-eighth and Twenty-ninth Annual Reports of the State Fish Commissioner to the Governor of the State of Washington" contain a short report of the work done during the fishing season of 1918.

THE SPECIES OF SALMON.

The salmon are by far the most important of the food fishes of the state and consequently of the highest commercial value. There are five species, all of which belong to the genus *Oncorhynchus*. The five species are: (1) *Oncorhynchus tshawytscha*, king, spring, quinnat, tyee or chinook salmon; (2) *Oncorhynchus nerka*, blue back, sockeye or red salmon; (3) *Oncorhynchus kisutch*, silversides, silver, or coho salmon; (4) *Oncorhynchus gorbuscha*, pink or humpback salmon; and (5) *Oncorhynchus keta*, chum or dog salmon. The steelhead, belonging to the genus *Salmo*, is for legal purposes included with the salmon by the laws of the State of Washington.

Since the only members of the genus *Oncorhynchus* taken in considerable numbers before maturity are the chinook and silver salmon, the observations recorded in this paper are concerning them. The chinook salmon is the largest and most valuable of the five species. Its average weight is about 22 pounds, but many are taken that weigh 40 to 60 pounds or even more. It reaches maturity in 4 to 7 years. The variation in the age at maturity has much to do with the great difference in the size of the adult fish. It descends to salt water in its first or second year and spends the ocean period of its existence in the inland arms of the ocean, or on the shallow banks along the coast. It is probable that the chinook salmon never goes far from the banks that lie closest to the mouth of the stream in which it began its existence. Observations made during the fishing seasons of 1918 and 1919 point to a confirmation of this belief. This fish takes the hook readily at any time during its sojourn in salt water until it is ready to start for the spawning beds, when it ceases to feed and consequently rarely takes the hook.

The silver salmon, while considered inferior to the chinook, has in recent years taken an important place in the canning industry and is valued highly as a food fish. It is quite similar to the chinook in its habitat and feeding habits. This fish is found in large numbers in the Puget Sound during the spring months and is very abundant upon the banks lying along the Washington coast during the summer and fall months. It matures in its third year. The average weight is given by the Pacific Fisherman, Year Book, 1920, as about 6 pounds. We found that the average weight of 82,621 silver salmon caught in the ocean at the mouth of the Columbia River and at Cape Flattery during the months of September, October and November was 10.45 pounds and that the largest weighed 20 pounds or more. This fish, like the chinook salmon, takes the hook readily up to the time it starts for the spawning bed.

The habitat of the three other species is not so well known. A few immature humpback and dog salmon are taken by gill nets in the Puget Sound during the spring months. Very few of the three species are taken on the coastal banks before they are practically mature and are soon to run for the spawning beds. As they rarely take the hook very few are caught by the trollers. The purse seiners catch a considerable number in the latter part of the season.

FISHING GEAR AND METHODS.

It is not the purpose of this paper to give at length a description of the apparatus used in taking salmon. We will, therefore, confine ourselves to a brief description of the equipment that is of interest to the problem in hand. For a more complete account of the apparatus and methods of the fisheries the reader is referred to "Pacific Salmon Fisheries" by John N. Cobb, published by the United States Bureau of Fisheries and recorded as Document No. 839.

PURSE SEINES.

The purse seine is probably the most highly efficient piece of apparatus used in the taking of salmon. The seines have an average length of 275 fathoms, a depth of 400 meshes of 3.75 inches 9 or 12 thread netting and 50 meshes of 5 inches 15 or 18 thread netting on the bottom. Along the

top is a cork line with enough cork floats to retain the upper edge of the net at the surface of the water; on the bottom is a heavily leaded line which serves to keep the net floating in an upright position; and along the bottom are galvanized rings 5 inches in diameter through which passes the pursuing rope.

The purse seine boats are 45 to 70 feet in length, and are propelled by 40 to 75 horse power gas engines. These boats, with their equipment, will average at the present time not less than \$8,000 to \$12,000 in value. Each



Plate 1— A typical purse seine boat



Plate 2— Columbia River trolling boats— common type

boat carries on an average 8 men who live on board during the fishing season. These boats are so staunchly constructed that they may be safely used to fish in the open ocean or go long distances from one fishing ground to another. The broad rounded stern carries a revolving platform on an elevated table, upon which the net is stowed with the cork line at one side and the lead line at the other side of the platform. At the rear of the platform is a long roller over which the net is paid out. The illustration (Plate 1) gives a good idea of the general appearance of these boats.

In operating on the ocean the usual custom of the purse seiners is to start from their base so early in the morning that they may arrive on the fishing banks by the time there is daylight enough to enable them to see clearly the field in which they hope to make a catch. It is usual for these boats to go out in fleets as they depend on one another for locating the schools of fish. The members of the fleet spread out over a considerable area, covering from 50 to 100 square miles, depending on the number of boats in the fleet. Each boat then cruises backward and forward over the fishing grounds until they see signs of a school of salmon. Frequently the fishermen are guided by the action of the birds. If large numbers of birds are collected in one place it indicates to the fishermen the probability that the desired salmon are feeding below the surface at that place, but they rarely lower their nets unless they see positive signs of the fish being present in considerable numbers. The indications they look for are to see the salmon finning, that is, swimming so close to the surface that their dorsal fins are exposed, or to see them jumping out of the water in considerable numbers. When the indications are sufficient, the large skiff with one man in it is lowered from the boat, and one end of the seine is made fast to the skiff. The purse seine boat then makes a circle, sweeping around to the skiff, and paying out the net as it goes. As quickly as possible the two ends of the net are brought together, and by means of a winch the pursing line is drawn in until the bottom of the net is closed. The net is then hauled aboard by hand and stowed on the revolving platform. Finally the fish are collected in a small pocket of the net and are then brailed into the hold of the boat. The brail is a strongly constructed dip net, and is handled by the aid of the winch. The remainder of the net is now hauled on board, placed in proper position on the platform and all is again ready for another sweep of the net. Fishing thus in fleets, when one boat lowers its net to make a catch, all the others, who have not only been watching for fish but also watching to see what their neighbors are doing, hasten to the vicinity of the boat that has lowered its net, and if a school of considerable size has been found, all the nets are soon out and as many as possible of the fish are taken. Since each net encloses an area of 4 to 5 acres, it may be readily seen how efficient a fleet of 25 to 30 boats can be in catching a school of fish.

It is very difficult to obtain accurate information on the results of the purse seiners' operations, largely because of their roving propensities. It may be said of them that wherever the fish are congregated together there are the purse seiners in their midst. They may spend part of the season at Neah Bay, or if they hear reports that fishing is good at the mouth of the Columbia River, they will be found there in a very short time. During the run in the Puget Sound they will be found in considerable numbers on the

salmon banks near the San Juan Islands. Still later in the season they may be found in the upper waters of the Puget Sound near the entrance to the rivers up which the salmon go to spawn.

TROLLING EQUIPMENT.

Commercial fishing in the open ocean by trolling was carried on in 1912 by a comparatively small number of boats. Since then the numbers have



Plate 3. Typical trolling boat - Neah Bay Fleet



Plate 4 - Trolling boat - better than average

increased until at the present time there are said to be upwards of 2,000 fishing off the mouth of the Columbia River, 600 or more in the ocean near Cape Flattery, and smaller fleets of 30 to 40 boats operating out from Willapa and Grays Harbors.

The Columbia River boats conform largely to the types shown in the illustration (Plate 2), while at Neah Bay boats of a great variety of types are engaged in this kind of fishing. Owing to the dangers incurred in fishing in the open ocean there is the necessity for having staunch, sea-going boats, consequently the smaller and less seaworthy boats are being discarded and larger and safer ones are being constructed to take their places, so that each year sees a number of the better types of boats added to the fleets.

The boats vary from 25 to 45 feet in length and are propelled by gas engines ranging from 4 to 25 horse power. As not only the success of their enterprise, but their very lives, is dependent on the reliability of their engines, the fishermen are discarding the inferior types of engines and using the most trustworthy ones they can get. The forward part of the boat is housed over to protect the engine and furnish rather cramped living and sleeping quarters for the men. Many of the boats have small pilot houses constructed over the engine which furnish protection and warmth to the steersmen while going to and from the fishing banks. While fishing, the course of the boat is directed by a helm attached to the rudder post. The after part of the boat is an open cockpit in which are constructed boxes for holding the fish.

The fishing equipment consists of two poles 15 to 20 feet in length hinged to or near the base of a short mast. When not fishing these poles stand upright by the side of the mast. When fishing, they are lowered by small ropes passing through pulleys at the top of the mast until they are at an angle of 25 to 30 degrees to the deck, in which position they are made fast. The poles are braced forward by guys to the bow of the boat. To each pole two or three fishing lines are fastened at regular distances. Another line is sometimes attached to a very short pole standing upright in the stern of the boat. These lines have metal, usually lead, sinkers varying in weight from 5 to 30 pounds, the longer lines having the heavier weights. The lines vary in length from about 50 to 200 feet. On the longer lines two lighter weights with 50 to 60 feet between them are sometimes used instead of one heavy weight. This arrangement reduces to a considerable degree the work of hauling in the lines. Baited hooks are rarely if ever used by the trollers fishing in the ocean, the spoon being used almost universally. The boats and their equipment range in value from \$1,000 to \$4,000. Boats under \$1,000 in value would not be considered of much account for outside fishing. The value of the average boat is about \$2,000. In trolling for chinook salmon the longer lines with the heavier weights are used as the chinook do not, as a rule, swim near the surface. The shorter lines and lighter weights are used for the silver salmon, as they swim much nearer the surface. On the longer lines No. 10 or 12 hooks are used, while on the shorter lines No. 6 or 8 hooks are used. The fishermen say that small salmon will not take the larger hook, the spoon or jigger representing prey too large for them to swallow.

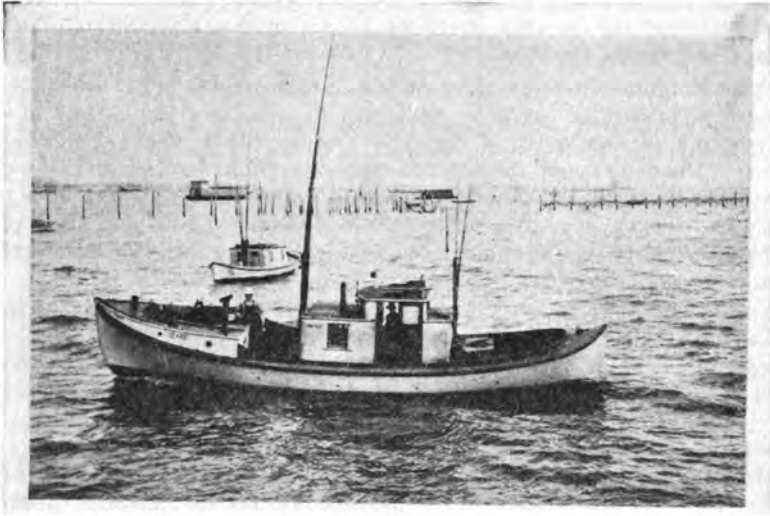


Plate 5. Columbia River trolling boat, latest type



Plate 6. Columbia River gillnet boats

Plate 2 shows the common type of trolling boat used at the mouth of the Columbia River. Plate 5 shows the newest and best of the Columbia fleet built for the season 1919. Plate 3 is a picture of the type in highest favor amongst the trollers of the Neah Bay fleet. It is 32 feet long by 8 feet beam, and is driven by a 6 horse power Atlas Imperial gas engine. The value of this boat is placed at \$2,000. Plate 4 is a picture of a more elaborate troller which will fish in Alaska this season, 1920. This boat is 40 feet long, 10 feet beam and is valued at \$3,000.

GILL NETS.

Hundreds of gill netters operate within the mouth of the Columbia River. They use open power boats (Plate 6) propelled by 4 to 6 horse power gas engines. The engine is protected from the rain and spray by a canvas covering stretched over the forward end of the boat. These boats usually carry two men. The nets vary in length and depth, depending on the channels in which they are used. In the Columbia River the average length is about 250 fathoms with meshes of 9 to 9½ inches stretched measurement for catching chinook salmon. When the water is clear the fishing is done at nighttime only, as during the daytime the fish see the net and avoid it. When the water is muddy fishing may be done during the daytime. In the Puget Sound the nets have an average length of about 300 fathoms with meshes adapted to the size of the fish to be caught. In the Columbia River and the Puget Sound these nets are fastened at one end to a floating buoy and paid out from the boat until they are stretched out in a straight line between the buoy and the boat. After a period of time varying in length according to conditions of tide and weather the nets are hauled into the boats, the fish killed by a blow on the head, removed from the net and thrown into the bottom of the boat.

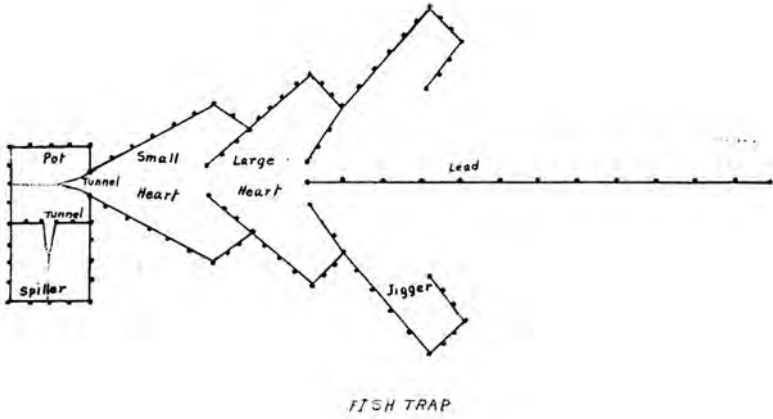
SHORE OR HAUL SEINES.

These nets are in common use on the Columbia River, being used on the sandy shallows in the river and along the shore where the bottom is free from snags. In several places along the river fish houses are built on piles driven into the sandy shallows in the river. In these houses are kept the fishing gear and several teams of horses used in hauling in the nets. Quarters are also provided in these houses for the men employed in handling the nets. The nets vary in length from 100 to 400 fathoms. They are much wider in the center than at the wings and the meshes vary with the size of the fish to be caught. The net is paid out from the stern of a large skiff, after one end has been made fast to the shore. The net is laid in a crescent shape, and the other end is brought to shore by ropes. The net is then hauled on shore by horses, two span being used at each end of the net.

TRAPS.

The traps are permanent fixtures consisting of a lead not more than 2,500 feet in length, a jigger, 2 hearts, a pot and a spiller. The webbing and netting of the trap are supported by piling driven firmly in the ground. The lead is made of wire netting firmly fixed to a straight row of piles. The netting extends from the bottom of the water to a little above high tide. It

Figure 1



35
Plate 9



forms a complete obstruction to the progress of the fish so that their course is turned along the netting in the direction of the main part of the trap which is at the end of the lead more remote from the shore. The jigger, found on many of the traps, is a hook-shaped structure which turns the fish that miss the entrance to the large heart back to the lead and headed toward the entrance to the heart. The hearts are structures so arranged that the movements of the fish are directed toward narrow openings at their apices. From the opening of the smaller heart a narrow tunnel leads into the pot. An apron is so arranged at the bottom of the heart that the fish are directed upward towards the tunnel, thus permitting the pot to be much shallower than it otherwise of necessity would be. The pot is a square compartment whose walls and bottom are made of heavy tarred netting. From the pot another tunnel leads to the spiller, a similar structure to the pot, from which the fish are taken. The method of removing the fish is to lower one side of the webbing and introduce a scow into the spiller. The webbing is then worked upward at one side of the scow until there is left but a small pocket out of which the fish are brailed into the scow.

Fig. 1 is a diagram showing the relation of the various parts of the Puget Sound trap. The Columbia River trap is a modified form of the Puget Sound trap, being as a rule smaller and having a much shorter lead.

LICENSES ISSUED.

That the fishing industry has proved very attractive and profitable is shown by the steady increase in the number of licenses issued to men wishing to engage in fishing. This steady increase in the number of men engaged in taking fish, together with the increasing efficiency of their equipment, can only hasten the depletion of the fisheries until before long they will cease to be of economic importance.

The following table of licenses issued for the taking of salmon by the State Fisheries Department indicates but too clearly how grave the situation has become, and how necessary it is that some effective measure be enacted which will speedily put a stop to the over-fishing.

TABLE 1—COMPARATIVE TABLE OF FISHING LICENSES ISSUED FOR THE TAKING OF SALMON.

YEAR	Pound Net	Fish Wheel	Set Net	Gill Net	Drag Seine	Purse Seine	Reef Net	Set Line	Hook and Line	Totals
1898.....	576	30	785	404	78	40	.....	.....	.....	1,913
1899.....	848	33	650	775	172	72	.....	.....	.....	2,550
1900.....	989	33	641	875	176	67	.....	.....	.....	2,781
1901.....	(No record)		.....	.....	.....	.....	.....	.....	.....	.....
1902.....	720	29	533	814	144	84	.....	.....	.....	2,324
1903.....	650	29	635	782	229	94	.....	.....	.....	2,445
1904.....	644	21	717	1,043	185	72	.....	.....	.....	2,682
1905.....	699	13	734	865	129	91	.....	.....	.....	2,501
1906.....	761	17	904	1,041	179	80	.....	.....	.....	2,982
1907.....	630	22	1,010	1,020	224	72	.....	.....	.....	2,978
1908.....	626	19	1,123	1,200	339	78	.....	.....	.....	3,445
1909.....	587	20	902	1,139	280	97	.....	.....	.....	3,105
1910.....	609	18	1,142	1,069	280	130	.....	.....	.....	3,238
1911.....	647	17	1,572	1,327	347	138	.....	.....	.....	4,048
1912.....	712	22	1,683	1,272	285	163	.....	.....	.....	4,137
1913.....	629	26	1,392	1,107	276	252	.....	.....	.....	3,682
1914.....	602	28	1,150	1,114	411	288	.....	.....	.....	3,303
1915.....	610	27	994	1,314	229	368	13	87	.....	3,642
1916.....	620	27	977	1,249	229	294	13	81	.....	3,490
1917.....	664	28	1,356	1,327	267	444	13	.....	965	5,064
1918.....	636	25	1,345	1,066	233	234	13	.....	1,248	4,830
1919.....	647	27	1,440	1,250	235	301	14	.....	1,450	5,364

The figures in this table for the last eight years do not represent the entire number engaged in fishing for salmon. Since 1912 an ever-increasing number of trollers have been employed in taking salmon in the ocean outside the jurisdiction of the state. The fish thus taken have been marketed within the state. Since these fishermen were fishing in waters outside of the state it was impossible to compel them to take out state fishing licenses; but, as they disposed of their fish within the state, they were required to take out retailers' licenses. Many of these fishermen took out retailers' licenses, but a considerable number avoided taking out any license. Were the number of trollers who took out retailers' licenses and those who did not take out licenses added to the table, the figures for the last seven or eight years would be very materially augmented.

REGIONS WHERE IMMATURE SALMON ARE TAKEN.

For the purpose of this report the waters of the State of Washington, from which large numbers of immature salmon are taken, are divided into three regions, each of which will be considered separately.

1. The banks lying along the coast just outside the mouth of the Columbia River, and extending six to eight miles out from the shore.
2. The banks lying off the Juan de Fuca Strait extending a considerable distance north and south of Cape Flattery.
3. The waters of the Puget Sound lying around the southern end of Whidby Island.

FISHING CONDITIONS AT THE MOUTH OF THE COLUMBIA RIVER.

The fishing area at the mouth of the Columbia River is divided into two parts; one, the lake-like expansion of the river's mouth, and the other the banks along the coast just outside the mouth of the river. The lake expansion at the mouth of the river is upwards of 20 miles long, and varies in width from three to nine miles. The mouth is not more than two miles wide where the river passes between the jetties which extend beyond the mouth into the ocean. The lake expansion consists of extensive shallow sand-flats, covered at high tide, but partially exposed at low tide. Among these flats channels of varying depths follow meandering courses, while quite deep holes exist at certain places. Some of these holes are from 70 to 80 feet deep. On the Washington side of the river the shifting sands have formed an island about four miles long, known as Sand Island. Along the southern shore of this island extensive fishing with drag seines is carried on. Between this island and Astoria lie the Desdemona Sands on either side of which is a deep channel. The one on the south side is the regular ship channel and, therefore, is not used so much for fishing as the one on the north side of the Sands. On the Desdemona Sands is constructed a fish house, which holds the fishing equipment used on the sands and which also furnishes quarters for the men and several teams of horses employed in working the haul seines. Along the Washington shore between Ilwaco and McGowan scores of fish traps are located. The deep channel between Sand Island and Desdemona Sands, which widens out west of the sands to nearly the full width of the river, furnishes the finest fishing area of the river for

gill net fishermen, who may be seen fishing there by the hundreds when the weather and the tides are favorable.

Just outside the mouth of the river are shallow banks extending north and south along the coast. In this region the shallow water extends out 5 or 6 miles from the shore line. Beyond this distance the waters deepen rapidly. Because these banks are exposed to the storms of the ocean no fixed appliances are used in taking salmon. Practically the only methods used are trolling and purse seining.

It is impossible to determine accurately the number of trolling boats engaged in fishing on these banks. As the waters are outside the jurisdiction of the states of Washington and Oregon neither of these states is able to keep anything like an accurate record of these boats, so that the investigator must depend largely upon the estimates made by the fishermen themselves. The fishermen affirm that the fleet has upwards of 2,000 boats, but for the purpose of this report the conservative estimate of 1,500 will be used. In addition to these, more than a score of purse seine boats are also employed in taking fish outside the mouth of the Columbia.

CHINOOK SALMON.

During the early part of the fishing season a large number of small salmon, called by the fishermen, graylings, is taken by the trollers and purse seiners. These graylings are young chinook salmon, averaging less than 4 pounds in weight. An examination of their scales showed that they were in their second year. Of those over 5 pounds, that are taken on the banks, many are in their third year and weigh not more than one-half of what they would if allowed to remain until fully matured. A considerable number of those taken in their fourth year are immature as is shown by the undeveloped condition of their sex organs, therefore would not return to the spawning beds for another year or more, and consequently would then be considerably larger in size.

In order to arrive at results of real and practical significance it was necessary to find records of a season's catch which would enable us to make a just comparison of those caught outside with those caught inside the mouth of the river. These records, of course, must be thoroughly reliable and kept in such a way as to furnish the material upon which fair comparative judgments could be based. Very few dealers in the whole region kept records that were of any value for this purpose. One firm was found which kept records that were practically perfect and admirably adapted for the purpose. The records of this firm showed the daily catches of 26 trollers who fished outside the mouth of the river, 18 gillnetters who fished just inside the river's mouth, and 22 traps located along the channel between Ilwaco and McGowan. These records showed the number of each species of salmon taken daily, with their weights and by whom taken. They also kept a separate record of the chinook salmon under 5 pounds that were taken by the trollers, giving their number and weight. This firm received no fish taken by the purse seiners.

The following tables are compiled from those records. For convenience the weekly totals are given rather than the daily. Tables 4, 5 and 6 are compiled from Tables 2 and 3 and give the totals for a period of four weeks each.

TABLE 2—SUMMARY OF CHINOOK SALMON TAKEN AT THE MOUTH OF THE COLUMBIA RIVER.
(Fish in the Round.)

TAKEN BY TROLLERS IN THE OCEAN OUTSIDE THE MOUTH OF THE RIVER									
Week Ending	Number Chinooks Under 5 Lbs.	Total Weight	Average Weight	Number Over 5 Lbs.	Total Weight	Average Weight	Total Number Chinooks	Total Weight	Average Weight
May 11....	686	1,985	2.89	1,069	9,326	8.72	1,755	11,311	6.45
18....	211	643	3.09	419	3,365	8.03	630	4,018	6.38
25....	138	452	3.28	68	567	8.34	206	1,019	4.95
June 1....	12	41	3.42	25	199	7.92	37	239	6.46
Totals..	1,047	3,131	2.99	1,581	13,456	8.51	2,628	18,587	6.31
June 8....	456	1,610	3.53	484	4,243	8.77	940	5,853	6.23
15....	701	2,385	3.40	756	8,400	11.11	1,457	10,785	7.40
22....	200	715	3.57	369	5,257	14.25	569	5,972	10.49
29....	190	631	3.32	418	5,899	14.11	608	6,530	10.74
Totals .	1,547	5,341	3.45	2,027	23,799	11.74	3,574	29,140	8.13
July 6....	278	955	3.43	739	10,420	14.10	1,017	11,375	11.18
13....	51	202	3.96	110	1,623	14.76	161	1,825	11.33
20....	.....	.....	.....	78	1,403	17.99	78	1,403	17.99
27....	8	37	4.62	160	3,523	22.02	168	3,580	21.19
Totals..	337	1,194	3.54	1,087	16,269	14.97	1,424	18,163	12.75
Aug. 3....	.....	.....	.....	564	11,014	19.53	.....	.....	.....
10....	.....	.....	.....	515	11,656	22.63	.....	.....	.....
17....	.....	.....	.....	448	10,627	23.72	.....	.....	.....
24....	.....	.....	.....	673	15,301	22.74	.....	.....	.....
Totals..	.....	.....	.....	2,200	48,598	22.09	.....	.....	.....
Aug. 31....	.....	.....	.....	570	12,288	21.55	.....	.....	.....
Sept. 7....	.....	.....	.....	179	3,155	17.63	.....	.....	.....
14....	.....	.....	.....	103	1,455	14.13	.....	.....	.....
21....	.....	.....	.....	65	1,042	16.03	.....	.....	.....
Totals..	.....	.....	.....	917	17,935	19.56	.....	.....	.....
Sept. 28....	.....	.....	.....	29	543	18.73	.....	.....	.....
Oct. 5....	.....	.....	.....	52	1,061	20.40	.....	.....	.....
12....	.....	.....	.....	21	506	24.10	.....	.....	.....
19....	.....	.....	.....	4	113	28.25	.....	.....	.....
Totals..	.....	.....	.....	106	2,223	20.97	.....	.....	.....
Oct. 26....	.....	.....	.....	51	802	15.73	.....	.....	.....
Nov. 2....	.....	.....	.....	13	247	19.00	.....	.....	.....
15....	.....	.....	.....	.....	.....	.....	.....	.....	.....
22....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals..	.....	.....	.....	64	1,049	16.39	.....	.....	.....
Grand Totals..	2,931	9,666	3.3	7,982	123,329	15.45	10,913	132,995	12.19

TABLE 3—SUMMARY OF CHINOOK SALMON TAKEN AT THE MOUTH OF THE COLUMBIA RIVER.
(Fish taken in the Round.)

TAKEN BY GILLNETTERS INSIDE MOUTH				BY TRAPS INSIDE MOUTH		
Week Ending	Number Chinooks	Total Weight	Average Weight	Number Chinooks	Total Weight	Average Weight
May 11.....	625	9,482	15.17	75	1,005	13.4
18.....	203	3,098	15.26	93	1,183	12.72
25.....	108	1,782	16.50	140	1,867	13.33
June 1.....	82	1,388	16.93	84	1,257	14.96
Totals.....	1,018	15,750	15.47	392	5,312	13.55
June 8.....	211	3,599	17.06	33	569	17.27
15.....	83	1,541	18.57	34	851	25.03
22.....	150	3,946	26.31	87	2,049	23.55
29.....	175	3,465	19.98	371	7,436	20.04
Totals.....	619	12,581	20.32	525	10,905	20.77
July 6.....	337	7,017	20.82	653	12,369	18.94
13.....	133	3,072	23.09	433	8,940	20.65
20.....	296	6,809	23.81	857	17,611	20.55
27.....	456	11,067	24.09	499	11,635	23.32
Totals.....	1,212	27,985	23.09	2,442	50,555	20.70
Aug. 3.....	728	18,885	25.94	805	18,690	23.22
10.....	669	16,753	25.04	652	15,135	23.21
17.....	1,569	40,590	25.87	1,288	27,919	21.67
24.....	3,152	68,110	21.61	2,692	61,096	22.69
Totals.....	6,118	144,338	23.50	5,437	122,840	22.59
Aug. 31.....						
Sept. 7.....						
14.....	261	6,856	26.26	222	5,403	24.34
21.....	7	187	26.71	104	2,125	20.44
Totals.....	268	7,043	26.28	326	7,528	23.09
Sept. 28.....				128	2,656	20.75
Oct. 5.....				72	1,542	21.42
12.....				55	1,276	23.20
19.....				33	757	22.94
Totals.....				288	6,231	21.64
Oct. 26.....				27	627	23.22
Nov. 2.....				10	226	22.60
15.....				5	121	24.20
22.....				2	46	23.00
Totals.....				44	1,020	23.18
Grand Totals.....	9,235	207,697	22.49	9,454	204,391	21.62

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TABLE 4—SHOWING LOSSES ON TROLLED CHINOOK SALMON UNDER 5 POUNDS EACH.

Four Weeks Ending	Average Weight of Chinooks Caught Inside Mouth of Columbia	Number of Graylings Trolled Outside Mouth of Columbia	Average Weight	Loss Per Fish	Total Loss in Pounds	Estimated Loss for Fleet of 1,500 Boats
June 1.....	Pounds 14.94	1,047	2.99—	11.95	12,512	721,942
June 29.....	20.53	1,547	3.45	17.08	26,423	1,524,607
June 27.....	21.49	337	3.54	17.95	6,049	349,027
Totals.....		2,931			44,984	2,595,576

TABLE 5—SHOWING LOSSES ON TROLLED CHINOOK SALMON OVER 5 POUNDS EACH.

Four Weeks Ending	Average Weight of Chinooks Caught Inside Mouth of Columbia	Number of Chinooks Over 5 Lbs. Trolled Outside Mouth of Columbia	Average Weight	Loss Per Fish	Total Loss in Pounds	Estimated Loss for Fleet of 1,500 Boats
June 1.....	Pounds 14.94	1,581	8.51	6.43	10,168	586,578
June 29.....	20.53	2,027	11.74	8.79	17,817	1,028,041
July 27.....	21.49	1,087	14.96	6.53	7,068	409,555
Aug. 24.....	23.12	2,200	22.09	1.03	2,296	130,748
Sept. 21.....	24.53	917	19.56	4.97	4,557	262,939
Oct. 19.....	21.63	106	20.97	.66	70	4,039
Nov. 22.....	23.18	64	16.39	6.79	435	25,100
Totals.....		7,982			42,409	2,447,000

TABLE 6—SUMMARY OF TABLES 4 AND 5.

Four Weeks Ending	Total Loss for 26 Trollers	Estimated Loss for Fleet of 1,500 Boats
June 1.....	22,678	1,308,520
June 29.....	44,240	2,552,648
July 27.....	13,147	759,582
Aug. 24.....	2,296	130,748
Sept. 21.....	4,557	262,939
Oct. 19.....	70	4,039
Nov. 22.....	435	25,100
Totals.....	87,393	5,042,576

CONCLUSIONS DRAWN FROM THESE TABLES.

In estimating the loss due to trolling on the feeding banks of the immature salmon, the comparison of weights is made with the fish taken inside the mouth of the river for the same period and not with the estimated weight of the chinook salmon at maturity. It will be noticed that the salmon taken within the mouth of the river during May averaged, at least, 7 pounds less

than the estimated weight of the mature fish. In fairness to the troller the estimates of losses due to his operations should be made on this basis provided the law permits fishing in the Columbia during the month of May.

During May 39.84 per cent of the entire number of chinook salmon taken by the 26 trollers consisted of fish under 5 pounds in weight and averaging 2.99 pounds. The average weight of those caught just inside the mouth of the river by the gill nets and traps for the same period was 14.94 pounds. These figures show a loss of 11.95 pounds per fish, which makes a loss of 12,512 pounds for the 1,047 small fish caught. Those taken by the trollers that were over 5 pounds in weight averaged 6.43 pounds less than those taken on the inside which indicates that many of those trolled fish must have been immature. The catch of 1,581 fish netted a loss of 10,166 pounds for the month. The estimated loss for the month of May for the entire fleet of 1,500 boats at the above rate, would be 1,308,520 pounds.

During the four weeks ending June 29, the number of chinook salmon under 5 pounds in weight taken by the trollers amounted to 43.34 per cent of the entire catch. The average loss for each of the 1,547 fish was 17.08 pounds, which makes a total loss of 26,423 pounds. The 2,027 fish weighing over 5 pounds taken by the trollers averaged 8.79 pounds less than those taken inside the mouth of the river for the same time. This gives an additional loss of 17,817 pounds to be charged against the trollers. On this basis the estimated loss for the four weeks chargeable to the entire fleet would be 2,552,648 pounds.

The results for July were slightly modified by the action of the packers who agreed to buy no more chinook salmon after July 19 that measured less than 20 inches from the tip of the snout to the end of the middle ray of the tail. But the effects of the enforcement of this agreement must have been slight, as the taking of these small salmon had nearly ceased by July 19. The entire catch for the two weeks preceding this date, by the 26 trollers, was only 65 chinooks under 5 pounds each in weight. Moreover, the majority of those small fish had grown until they were about 20 inches in length. To determine the size of these fish at this time ten were measured and weighed. The average length was 21.6 inches and the average weight 4.2 pounds. Fish 20 inches in length would weigh considerably less than those 21.6 in length, so it may be readily seen that this agreement on the part of the buyers amounted to practically nothing as a remedy for the evil. For the four weeks ending July 27 the catch of chinook salmon under 5 pounds in weight, taken by the 26 trollers, amounted to 23.66 per cent of the number caught. Of this 23.66 per cent 19.52 were taken before July 7. The average loss for each of these fish was 17.95 pounds, which gives a loss of 6,049 pounds for the 337 fish taken. During this same period the trollers took 1,087 fish, each of which weighed more than 5 pounds, but which fell 6.53 pounds below the average of those taken inside the mouth of the river for the same time. The loss on the 1,087 fish amounted to 7,098 pounds. The estimated loss for the fleet for this period would be 758,582 pounds.

During the remaining period of 17 weeks there was practically no chinook salmon under 5 pounds brought in by the trollers, so that any loss must be attributed to the taking of immature salmon over 5 pounds in weight. Table 6 shows that for this period the 26 trollers brought about a loss of 7,328 pounds. The estimated loss for the entire fleet for this period

was 422,826 pounds. The total loss chargeable to the 26 trollers for the season was 87,393 pounds, and the estimated loss caused by the fleet of 1,500 boats was 5,042,576 pounds. A further study of these tables shows that by far the greater part of the loss was due to the fishing done before June 29. The summary, Table 6, shows that the total loss brought about by the 26 trollers was 87,393 pounds, and that 66,918 pounds of this loss

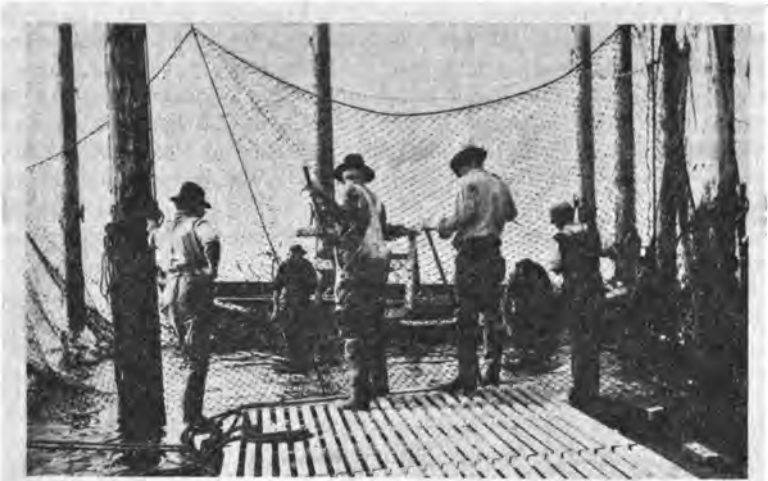


Plate 7 - Taking fish from trap for Chinook hatchery

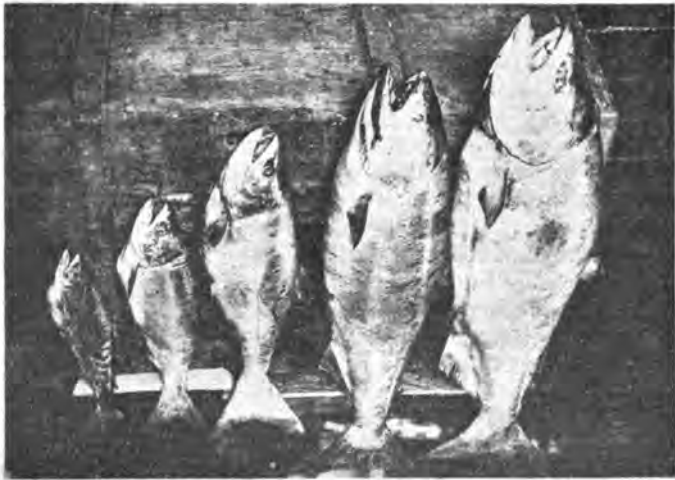


Plate 8 - Chinook salmon trolled at mouth of Columbia River; Smallest weighing 2 pounds, in its second year; largest weighing 23 pounds in its fourth year; all immature

were due to the trollers' operations prior to June 29. When reduced to a per cent basis these figures show that 76.57 per cent of the season's loss took place before June 29.

No records were available which would show the losses due to the taking of immature salmon by the purse seiners, but there is every reason to believe that they are responsible for the destruction of a larger per cent of small salmon than the trollers. Isolated observations of their catches of immature salmon have been reported. John Larson, the Oregon deputy, reported having seen one purse seine boat deliver to a cannery July 24, 250 chinook whose total weight was 720 pounds, the average being 2.88 pounds, and the next day another delivered 53 of these young salmon weighing 158 pounds and averaging 2.98 pounds. The average weight for 955 chinook salmon caught inside the river during the week ending July 27, as estimated from Table 3, was 23.78 pounds. Estimations from these figures show a total loss of 6,327 pounds on a day's catch for two purse seine boats. It is to be noted that these deliveries were made at a time after the trollers had practically ceased to take these small, immature salmon. With a score of these boats operating during the season the possibilities of this gear to destroy young salmon may readily be seen.

A few chinook salmon under 5 pounds were taken by the 16 gillnetters and the 22 traps within the mouth of the river. The following table gives the totals for the three months of the fishing season in which practically all of these fish were taken:

TABLE 7—SMALL CHINOOK SALMON TAKEN BY THE GILLNETTERS AND TRAPS.

TIME	GILLNETTERS			TRAPS		
	Number of Small Chinooks	Total Weight	Average Weight	Number of Small Chinooks	Total Weight	Average Weight
		Pounds	Pounds		Pounds	Pounds
For May.....	31	78	2.52	12	38	3.17
June.....	96	372	3.87	5	14	2.80
July.....	27	94	3.48	14	53	3.79
Totals.....	154	544	3.53	31	105	3.39

These very small salmon form but 2.9 per cent of the entire catch of gill nets and traps. It must be remembered that a number of male chinook salmon mature in their second year and run to the spawning beds with the larger fish. Without doubt some of the small fish taken within the mouth of the river belong to this group. It is clear that the gill nets and traps operating within the mouth of the river cannot be considered a menace to the industry by taking immature fish.

Reports have been verified that the haul seines on Sand Island catch, at times, considerable numbers of small chinook salmon. The numbers taken by this means were so large as to indicate an invasion of this fishing area by immature fish swept in by the tide from the feeding banks outside the mouth of the river.

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ANALYSES OF IMMATURE CHINOOK SALMON.

The salmon packers of the Columbia River divide their products into four grades according to quality. The first grade consists of prime chinook salmon which is in very great demand and brings the highest price in the market. The chinook salmon that are under 5 pounds in weight are put on the market as fourth grade salmon and given a trade name that does not indicate the species. This grade, in spite of the demand for fish, has been a drug on the market, and could not be disposed of advantageously. It is of a very pale color and quite insipid in taste. The intermediate grades are, of course, of intermediate quality, and are much more readily marketed than the fourth grade.

Careful analyses were made of the various grades and also of chums or tulas and spawned salmon by Miss Bella Kracower of the Pharmacy Department, University of Washington. Tula is the name given by Columbia River fishermen to the late run of chinook salmon. They are large fish with light-colored flesh and are considered inferior to the chinook salmon caught earlier in the season. They are put on the market under the trade name, Chum. The spawned-out salmon were taken in the Kalama River and canned at Rainier, Oregon. For these analyses three cans of each grade were picked at random, thoroughly ground together in a mortar and representative samples taken.

The following tabulations show the comparative food values of three of the grades, the tulas and the spawned-out salmon. The first is the analysis of first quality chinook salmon caught in the river. The second and third are of the third and fourth grades and are of fish taken by the trollers from outside waters, the fifth is of the tula, and the sixth is of the spawned-out salmon.

Analysis of first grade chinook salmon:

Water	60.615 per cent.
Protein	19.635 per cent.
Fat	17.56 per cent.
Ash	2.19 per cent.

Analysis of third grade chinook salmon:

Water	67.26 per cent.
Protein	20.386 per cent.
Fat	10.205 per cent.
Ash	2.149 per cent.

Analysis of fourth grade chinook salmon:

Water	70.43 per cent.
Protein	18.295 per cent.
Fat	9.19 per cent.
Ash	2.085 per cent.

Analysis of Columbia River Tulas:

Water	68.02 per cent.
Protein	18.37 per cent.
Fat	12.11 per cent.
Ash	1.50 per cent.

Analysis of spawned chinook salmon:

Water	70.765 per cent.
Protein	19.76 per cent.
Fat	7.03 per cent.
Ash	2.445 per cent.

Since the quality of salmon is largely dependent upon the amount of fat present the above tabulations show that the third and fourth grades packed from the immature fish taken by the trollers are decidedly inferior in fat content to the first grade of fish, somewhat inferior to the tula, and but little better than the spawned-out salmon.

The packers on the Columbia River have agreed recently that for the season 1920, they will purchase no chinook salmon under 8 pounds in weight. This measure will certainly protect the cannerymen from having on their hands a stock of inferior goods. Not only this, but it will have a decidedly corrective influence upon the wasteful practice of catching immature salmon, as it will make it impossible for the trollers to fish during the earlier weeks of the season and reap any profits on their catch. Table 2 shows that during the first six weeks of the fishing season the trollers' weekly catch averaged at best less than seven and one-half pounds, or if the estimate be made only on all they caught over 5 pounds in weight, the average weight for the catch was but 9.25 pounds. From these figures it is clear that it is better for the trollers to tie up their boats than to fish and face the loss that must consequently follow. The enforcement of this agreement of the canners means that there will be practically no trolling in the ocean at the mouth of the Columbia River before the middle of June. By that time the most serious menace to the salmon in their second year is past, as after the middle of June, a comparatively small number of chinook salmon under 5 pounds is caught. If this season of non-fishing could be extended three weeks longer, the loss by catching salmon under 5 pounds would be practically nothing. Still, the fact remains that all through the season those who catch fish on the feeding banks will surely take immature salmon and cause thereby a considerable waste.

THE SILVER SALMON AT THE MOUTH OF THE COLUMBIA RIVER.

All scientific observations up to the present are agreed that the silver salmon complete their life cycle in three years. The adults ascend the rivers to the spawning beds during the months of late fall and early winter. The eggs are deposited in the gravel and the young are hatched out in 10 to 12 weeks. The yolk sacs are absorbed in 6 to 8 weeks more and then the young fish seek food. About this time, according to Dr. Charles H. Gilbert, some of the fry find their way down to salt water, but his investigations indicate that very few of these survive to return to the spawning beds. Dr. C. McLean Fraser, Nanaimo, B. C., as the result of his observations, is of the opinion that very few silver salmon enter the salt water as fry, but remain in fresh water until the spring of their second year. So far then as the silver salmon of commerce are concerned, they may be considered as having spent their first year in fresh water. In the spring of their second year, when they go to salt water, they average between three and four inches in length. They grow quite rapidly during their first summer in salt water, so that by October they attain a length of 6 to 14 inches. Their growth through their second winter is not very great, as in April of their third year they are 10 to 18 inches in length and weigh from 8 ounces to one and one-half or two pounds. The average weight at the beginning of the fishing season, April 15, 1920, was not more than one and one-half pounds. Later

reference will be made to the size of these fish when considering the fishing around the southern end of Whidby Island. During their third summer the silver salmon make remarkable growth.

The following tables will show that those caught both at the mouth of the Columbia River and at Neah Bay during September, October and November averaged more than 10 pounds. Many were caught which weighed 20 pounds or more. Examination of the scales of a number of those larger ones confirms the belief that they complete their life cycle in three years.

A complete report for the season of 1919 was obtained of the daily catches of 26 trollers fishing outside the mouth of the Columbia River, and 18 gillnetters and 22 traps taking fish within the mouth of the river. This report shows some interesting facts in the growth rate of the silver salmon during its third summer. At the same time it shows the deplorable fact that large numbers of them are caught before they are much more than half grown, thus incurring great loss to the industry.

While the daily records of the catches of each of the groups are on file, for the sake of brevity, weekly and four-weekly totals will be given.

TABLE 8—SILVER SALMON TAKEN AT THE MOUTH OF THE COLUMBIA RIVER.

TAKEN BY TROLLERS				TAKEN BY GILL NETS			TAKEN BY TRAPS		
Week Ending	Number	Weight	Average Weight	Number	Weight	Average Weight	Number	Weight	Average Weight
May 11....	4	15	3.75						
15....	2	8	4.				12	65	5.42
25....	4	15	3.75				1	7	7.
June 1....									
Totals..	10	38	3.80				13	72	5.54
June 8....	2	11	5.50						
15....	34	184	5.41	2	13	6.50			
22....	66	302	5.49	2	11	5.50			
29....	1,363	8,433	6.19	33	182	5.51	4	15	3.75
Totals..	1,465	8,990	6.14	37	206	5.57	4	15	3.75
July 6....	453	2,776	6.13	16	85	5.31	2	7	3.50
13....	134	796	5.94						
20....	52	329	6.33	1	6	6.	1	5	5.
27....	69	486	7.04	1	7	7.			
Totals..	708	4,387	6.19	18	98	5.44	3	12	4.
Aug. 3....	170	1,292	7.60	6	37	6.17	15	91	6.07
10....	497	4,125	8.29	14	121	8.64	6	31	5.17
17....	314	2,764	8.80	30	226	7.53	390	3,080	7.80
24....	336	3,091	9.19	15	129	8.60	451	3,831	8.49
Totals..	1,317	11,272	8.56	65	513	7.89	862	7,033	8.16
Aug. 31....	184	1,787	9.71	1	13	13.	375	3,417	9.11
Sept. 7....	242	2,327	9.62						
14....	2,150	22,547	10.48	7	88	12.57	314	2,742	8.73
21....	3,000	41,895	11.64	20	256	12.80	71	603	8.49
Totals..	6,176	68,556	11.10	28	357	12.75	760	6,762	8.90
Sept. 28....	501	6,530	11.05	1	11	11.	856	7,784	9.08
Oct. 5....	611	6,730	11.01				486	4,510	9.40
12....	1,199	13,667	11.38				732	7,091	9.68
19....	709	8,190	11.55				628	6,214	9.89
Totals..	3,110	35,117	11.29	1	11	11.	2,702	25,659	9.47
Oct. 26....	215	2,505	11.65				674	7,266	10.17
Nov. 2....	439	5,325	12.13				393	3,751	9.54
9....							398	4,462	11.21
16....	476	6,225	13.09				107	1,062	9.93
Totals..	1,130	14,055	12.44				1,572	16,541	10.52
Nov. 23....							1,144	13,114	11.46
Grand Totals..	13,918	142,415	10.23	149	1,185	7.95	7,000	69,208	9.80

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CONCLUSIONS DRAWN FROM TABLE 8.

The numbers of the silver salmon taken by the gillnetters were so small that the figures are of little use for comparative purposes, the total catch for the entire season being 149 fish for 18 gillnetters. The smallness of the catch is probably due to the large-sized meshes used by these fishermen.

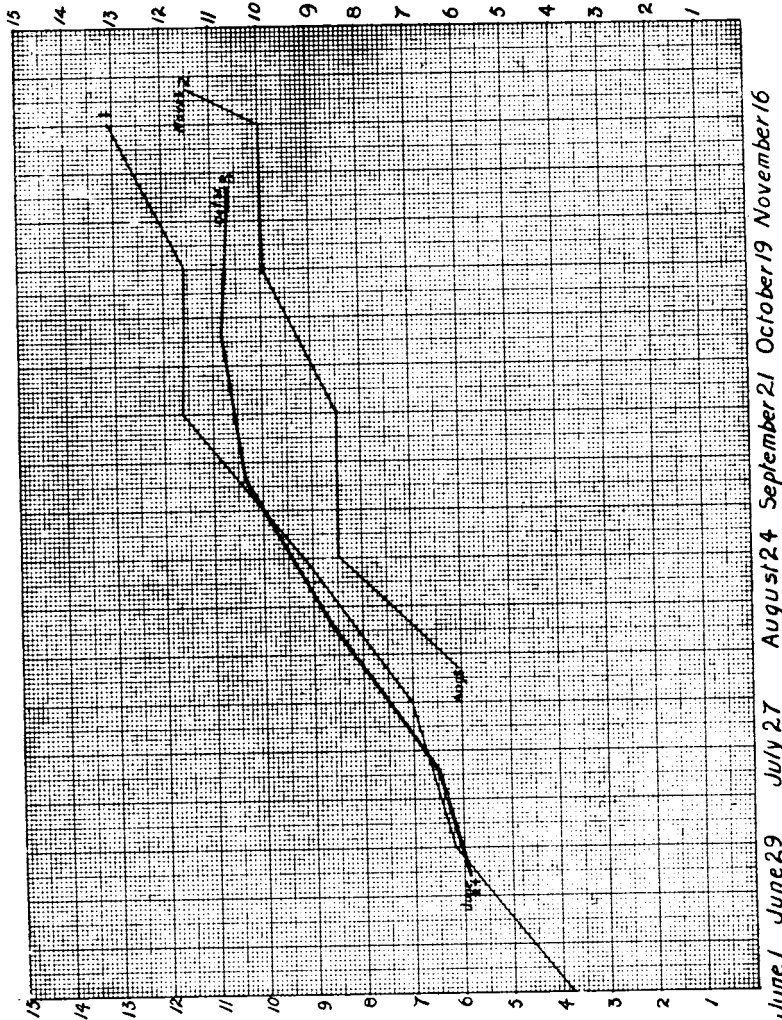
The table shows interesting comparisons between the silver salmon caught by the trollers outside the mouth of the river and those caught by the traps inside the mouth. The trollers began to take silver salmon as soon as the fishing season opened and continued to take them until the close of the season in November, but they did not take them in large numbers until about the middle of June. The traps took a few silver salmon throughout the earlier months of the fishing season but did not begin taking them in significant numbers before the middle of August. They continued their larger catches until the season closed in November. Estimates from this table show that the traps took 76.74 per cent of their silver salmon after September 22, and the trollers took 69.91 per cent of theirs prior to this date. Weather conditions during the fall months, without doubt, interfered with the operations of the trollers.

Table 9 is a brief summary of the losses chargeable to the trollers during the earlier part of the season.

TABLE 9—A SUMMARY SHOWING LOSSES IN SILVER SALMON TO THE TROLLERS.

FOUR WEEKS ENDING	Number Silvers	Average Weight	Average Loss	Total Loss to 26 Trollers	Estimated Loss for Fleet of 1,500 Boats
June 1.....	10	Pounds 3.80	Pounds 7.50	Pounds 75	4,827
June 29.....	1,465	6.14	5.16	7,559	436,154
July 27.....	708	6.19	5.11	3,618	208,750
Aug. 24.....	1,317	8.56	2.74	3,609	208,239
Totals.....	3,500	.....	.....	14,861	857,479

The average weight of all silver salmon taken by the trollers after August was 11.3 pounds. Using this as a basis to estimate the losses prior to this date the table shows that the total loss on the 3,500 silver salmon taken by the trollers was 14,861 pounds and by estimation, the loss for the entire fleet of 1,500 boats was 857,479 pounds. It is interesting to note that the fish taken by the trollers average right through the season heavier than those taken by the traps. Since these fish are all in their third year the increase in weight from month to month can be attributed only to growth. Table 8 shows the rapid rate at which the silver salmon grow. Silvers taken in May averaged 3.80 pounds, while those taken in the four weeks ending November 16 averaged 12.44 pounds, giving an increase of 227 per cent in weight for six months' growth. Figure 2 shows in graphic form this remarkable rate of growth. The average weight of the entire catch for each fourth week is used to show this growth. The figures along the ordinat represent pounds, while the absissa shows the time in four-week periods, three of the larger squares representing a period of four weeks. The upper, No. 1 graph, shows the growth rate for the fish taken by the trollers in the ocean. The



GRAPH—Showing the rate of growth of the silver salmon during its third summer.

lower one, No. 2, indicates the growth rate for those taken in the traps. A comparison of the two graphs shows that at no time did the fish taken in the traps equal in weight those taken by the trollers. The double line, No. 3, shows the rate of growth for the silver salmon caught at Neah Bay.

CONDITIONS WITHIN THE MOUTH OF THE COLUMBIA RIVER DUE TO TIDES.

Fishermen at Ilwaco reported that hundreds of immature chinook salmon were sometimes taken in the drag seines on the south shore of Sand Island. Further inquiry among the men operating the nets on the island confirmed the report that such catches had been made, but that they were not of frequent occurrence. Knowing that immature salmon do not, as a

rule, run into fresh water, it was deemed advisable to determine the extent to which the cold, salt water of the ocean invaded the mouth of the river. If such an invasion were extensive enough and the temperature of the water but little changed it would explain the presence of the schools of young salmon and other fish within the mouth of the river.

It is known that the tides affect the river for more than 100 miles above its mouth but the distance the sea water entered was not determined, so far as the author knew. To determine the extent of this invasion stations were chosen in the deeper channels at different distances from the mouth of the river, until a point was reached beyond which the sea water did not pass.

The equipment used consisted of a reversing water bottle of most recent type, mounted with a reversing thermometer graduated to tenths of a degree Centigrade, and delicate hydrometers that read to one part of salt in 10,000 parts of water. More accurate results could have been obtained by the silver titration method, but for the purpose of the problem in hand the hydrometers gave sufficiently accurate results.

The accompanying sketch of the mouth of the river, Plate 9, will give a fair idea of the situation. On the map are marked in Arabic numerals the stations at which samples of water were taken. At each station except 9 and 10 a series of samples was taken at regular distances between the bottom and the surface of the water. At stations 9 and 10 the water at the bottom was found to be fresh and practically of surface temperature, so that nothing would be gained by taking samples nearer the surface. The following table gives the results of the observations made at each station:

TABLE 10—SHOWING THE RELATION OF TIDES TO SALINITY OF THE WATER IN THE MOUTH OF THE COLUMBIA RIVER.

Position	Date	Hour Standard Time	TIDE	Depth	Temp.	Specific Gravity
1	July 25	6:45 A. M.	Low Tide	50 ft.	14.8°O.	1008
		6:52	5:50 A. M., -1.2 ft.	40	14.7	1008.7
		6:59		30	16.3	1006.7
		7:07	High Tide	20	16.2	1003.7
		7:13	11:56 A. M., 6.8 ft.	10	16.9	1002.2
		7:18		Surface	17.1	1000.9
2	July 25	8:00 A. M.	Low Tide	40 ft.	16.9°C.	1002
		8:10	5:50 A. M., 1.2 ft.	30	17.2	1002
		8:17		20	17.3	1001.4
		8:24	High Tide	10	17.9	1000.3
		8:30	11:56 A. M., 6.8 ft.	Surface	17.5	1000
2	July 24	10:20 A. M.	Low Tide	50 ft.	7.3°C.	1025.4
		10:27	4:56 A. M., -0.7 ft.	40	7.2	1025.1
		10:33		30	7.9	1025
		10:40	High Tide	20	8.2	1025
		10:46	11:04 A. M., 6.3 ft.	10	9.4	1023.5
		10:52		5	12.0	1015.5
10:59		Surface	14.0	1012.2		
3	July 23	1:10 P. M.	Low Tide	12.5 ft.	18° C.	1002.9
		1:17	3:31 P. M., 3.1 ft.	7	17	1002.9
		1:25	High Tide	Surface	16.8	1001.7
			10:30 A. M., 5.9 ft.			

Table 10—Showing the Relation of Tides to Salinity of the Water in the Mouth of the Columbia River—Concluded.

Position	Date	Hour Standard Time	TIDE	Depth	Temp.	Specific Gravity
4	July 24	2:10 P. M.	Low Tide	13 ft.	10.7°C.	1020.2
		2:17	4:42 P. M., 3.0 ft.	10	14.3	1010.8
		2:23	High Tide	5	16.9	1002.5
		2:29	11:04 A. M., 6.3 ft.	Surface	16.1	1002.5
4	July 26	6:10 P. M.	Low Tide	7 ft.	16.2°C.	1008.2
		6:18	6:37 P. M., 2.2 ft.	5	17.5	1002.6
		6:25	High Tide	Surface	16.8	1002.6
			12:41 P. M., 7.3 ft.			
5	July 24	1:35 P. M.	Low Tide	16 ft.	11.7°C.	1017.6
		1:42	4:42 P. M., 3.0 ft.	10	16.3	1004.2
		1:49	High Tide	5	16.9	1003
		1:55	11:04 A. M., 6.3 ft.	Surface	17.2	1002.9
5	July 26	7:00 P. M.	Low Tide	12 ft.	12.7°C.	1017.6
		7:07	6:37 P. M., 2.2 ft.	10	15.8	1007.3
		7:13	High Tide	5	17.3	1003.3
		7:20	12:41 P. M., 7.3 ft.	Surface	16.3	1003
6	July 24	9:33 A. M.	Low Tide	20 ft.	12.8°C.	1014.4
		9:40	4:56 A. M., -0.7 ft.	15	14.2	1011.2
		9:47	High Tide	10	15	1007.6
		9:55	11:04 A. M., 6.3 ft.	5	16.5	1004.4
		10:00		Surface	16.5	1001.8
6	July 25	8:45 A. M.	Low Tide	20 ft.	17.2°C.	1000.2
		8:52	5:50 A. M., -1.2 ft.	10	17.4	1000.2
		8:58	High Tide	Surface	17.5	999.8
			11:56 A. M., 6.8 ft.			
7	July 27	2:40 P. M.	Low Tide	65 ft.	9.3°C.	1020
		2:50	7:20 A. M., -1.4 ft.	50	10.7	1019.8
		2:59		40	10.5	1019.8
		3:07	High Tide	30	11.1	1017.1
		3:14	1:22 P. M., 7.5 ft.	20	14	1011.7
		3:20		10	18.5	1000.3
		3:25		Surface	19.7	999.5
8	July 27	1:50 P. M.	Low Tide	35 ft.	18.8°C.	999.6
		2:00	7:20 A. M., -1.4 ft.	20	18.6	999.5
		2:10	High Tide	10	17.6	999.5
		2:15	1:22 P. M., 7.5 ft.	Surface	18.4	999.5
9	July 28	11:30 P. M.	Low Tide	60 ft.	19.1°C.	999.4
		11:45	8:01 A. M., -1.2 ft.	50	19.1	999.4
		11:51	High Tide	Surface	18.6	999.4
			2:00 P. M., 7.8 ft.			
10	July 28	12:15 P. M.	Tides as above	80 ft.	19.0°C.	999.4

CONCLUSIONS DRAWN FROM TABLE 10.

Following a comparatively straight line from station 1 to station 7 the table shows that a large amount of salt water flows into the river where the most important fishing area is located, and that the flooding of this area with salt water is at periods of high tide only. At station 2, at

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high tide, the bottom of the river was covered to a depth of 30 feet with water having a specific gravity of 1025 or more and a temperature ranging from 7.3° C. at the bottom to 8.2° C. at 30 feet from the bottom. At station 7, with the same tide conditions the bottom of the river was covered to a depth of 25 feet with water having a specific gravity of 1020 at the bottom to 1019.8 at 25 feet from the bottom and a temperature that varied from 9.2° C. at the bottom to 10.5° C. at 25 feet from the bottom. Thus at station 2, just opposite the seining grounds on Sand Island, the inflowing water for a depth of 30 feet from the bottom was practically of the density and temperature of the ocean water, and that at station 7, which is 11 miles above the mouth of the river, the water for a depth of 25 feet from the bottom had a density and a temperature not differing very greatly from that of the ocean outside. The table further shows that Sand Island is surrounded at high tide by water of about the same density and temperature as the water at a corresponding depth at station 2. It is not surprising then that schools of immature salmon are sometimes swept in by the tide and that they may be caught in considerable numbers by the shore seines, or find their way in to the traps that lie between McGowan and Chinook.

The table further shows that at low tide the salt water is practically swept out of the river's mouth. At station 2, at low tide, the specific gravity of the water at a depth of 40 feet was only 1002, and the temperature but six-tenths of one degree lower than that of the surface. Since the difference between high and low tide was but 8 feet, it seems remarkable that the outflowing current of the river should remove the salt water to a depth of 40 feet. Since the salmon are very sensitive to changes in density and temperature of the water, it is highly probable that the salmon swept in by the flooding tide would be carried out by the ebbing tide.

At stations 9 and 10, although the water was very deep, the temperature at the bottom was nearly the same as at the top and the hydrometer showed that the water had practically the specific gravity of fresh water. This shows conclusively that salt water never reached those stations, the lower of which is about 16 miles from the mouth of the river, for, if salt water entered either of these deep places, even occasionally, it would probably remain there constantly, because these holes are much deeper than any channel leading from them to the sea, so that once filled with salt water the fresh water would not dislodge the heavier salt water from them.

FISHING AT CAPE FLATTERY.

The Neah Bay fishing fleet operates on the banks lying along the coasts of Washington and Vancouver Island. The area over which the fishing is done extends from Destruction Island fifty miles south of Cape Flattery, to Barclay Sound fifty miles north of the Cape, and seaward about thirty miles from the coast line. These are the extreme distances over which the fleet fishes but the major part of the fishing is done within 25 miles of the Cape. These banks extend about 12 miles from shore before the water covering them is 50 fathoms in depth, and 30 miles from shore the water is not more than 100 fathoms deep. The most favored region for fishing is the Swiftsure Bank, which has 20 to 50 fathoms of water covering it. The lightship located on this bank is about 15 miles northwest of Cape Flattery.

On the Washington side much fishing is done within the three-mile limit, while on the Canadian side, American boats are not supposed to fish within the three-mile zone. Some fishing is done within the Juan de Fuca Strait but this area is not nearly so inviting to the fishermen as the banks outside. At Neah Bay the Strait is 13 to 14 miles wide and varies from 100 to 155 fathoms in depth except for narrow strips along the northern and southern shores.

Since the banks are subject to the weather conditions of the open ocean, the fishing operations can be carried on only when the water is comparatively smooth, consequently considerable time is lost because of unfavorable conditions. Again, the work is so strenuous that very few of the fishermen can keep the work up day after day without periods of rest. As a result of these two factors there was rarely a day during the fishing season when there were less than 100 boats remaining at anchor in the bay. The daily movements of 110 trolling boats were kept for the entire season. The following table shows the daily average number of these 110 fishing boats that delivered fish at the Union Scow.

TABLE 11.

<i>Four Weeks Ending</i>	<i>Daily Average Number of Boats</i>
July 15	44.9
August 12	37.5
September 9	31.3
October 7	28.5
October 31	8.7
Average.....	30.18

These figures indicate that throughout the season less than one-third of the boats were engaged in fishing at one time; or, in other words, the entire fleet was fishing but one-third of the time.

Practically all the fishing in this region is done by trollers and purse seiners. There are said to be about 600 fishing boats in the trolling fleet with headquarters at Neah Bay. Probably of these not more than 500 were doing anything like systematic fishing. The numbers of purse seine boats varied from time to time, as they were constantly on the move from one fishing region to another. There were probably not more than 30 to 35 of them fishing on the banks at any one time.

During the fishing season of 1919 three canneries were in operation at Neah Bay, one large one on shore owned by the Anacortes Packing Co., and two floating ones. The Fishermen's Union Co. had their butchering scow at the Bay, but the canning was done at Port Angeles. Besides these a number of buyers for Puget Sound firms had receiving scows.

The fishing season opens about the middle of May but the canneries do not begin operations until three or four weeks later. Fish caught prior to the opening of the canneries are shipped to the fresh fish markets of the Puget Sound cities.

The fishermen's day begins between 2 and 3 o'clock in the morning. At this hour they start for the fishing banks in order to be at their destination by the break of day. They fish until about the middle of the afternoon and then return to Neah Bay, where they dispose of their fish. Some



(1) Puget Sound fish trap off Lopez Island. (2) Small portion of purse seine fleet in Kanaka Bay. (3) Purse seine boats headed for the fishing grounds (4) Purse seine boat with seine "laid" out.

of the better constructed trolling boats, usually in the latter part of the season, go 40 or 50 miles from the Cape to fish in the less frequented waters. These trips cover two or more days. The fishermen usually run to the nearest shelter on the coast to anchor for the night, although sometimes in very favorable weather they anchor on the banks in the open ocean.

Here, as at the mouth of the Columbia River, the chinook caught ranged in age from fish in their second year to those maturing in their fourth to seventh year. Those in their second year, called black mouths by the fishermen, were mostly under 5 pounds each in weight, and averaged but little more than half that weight. As a separate account was not kept of these fish it was impossible to estimate the number taken, but judging by the average weight of the fish taken at Neah Bay compared with the average weight of those taken at the mouth of the Columbia River, the number must have been decidedly less in proportion to the total number of chinook caught. The average weight of all the chinook caught at the mouth of the Columbia River by 26 trollers for the four weeks ending July 13 was 4.9 pounds less than the average weight of those taken for the four weeks ending July 15 by the 110 trollers at Neah Bay. Still a very considerable number of black mouths were taken at Neah Bay. Besides these there were a large number of immature chinook salmon in their third and fourth years taken by the trollers. A comparison of the weights of those taken at Neah Bay with those taken in the traps in the Puget Sound or within the mouth of the Columbia River by traps and gill nets confirms this statement. The average weight for 14,082 red chinook salmon caught in the traps of the Puget Sound was 20.85, and for 18,689 caught within the mouth of the Columbia River was 22.05 pounds, while for 46,455 caught by the trollers at Cape Flattery the average weight was 15.83 pounds. It must be remembered that if the white chinook salmon had been included with the red in the Puget Sound, the average weight would not have been less than that of the Columbia River fish. Observations on a considerable number of chinook salmon at Neah Bay indicate the proportion of immature fish found among those taken by the trollers. The fish thus caught were divided into two groups. The first consisted of prime salmon for mild cure. These must be large, over 18 pounds each in weight, and without injury to the body such as bruises or wounds caused by gaff or pew. All the rest belonged to the second group and were canned. July 6, 50 of the mild cure, each over 18 pounds, were examined as to the developed condition of their sex organs with the following results: Twelve were mature, 2 males and 10 females; 23 were immature and would not seek the spawning beds that year, 6 of these were males and 17 females; the remaining 15 showed ovaries and testes in a half mature condition, that is, the organs were in size about one-half those of the mature fish. One hundred of the other group were picked at random from the cannery floor. They were measured, weighed and the development of their sex organs was noted. The measurements were made from the tip of the snout to the end of the middle ray of the tail. They varied in length from 21½ to 39½ inches and in weight from 4 to 31 pounds. Each of 44 of them weighed 10 pounds or less, each of 33 weighed between 11 and 16 pounds inclusive, each of 16 between 16 and 20 pounds inclusive and the remainder weighed over 20 pounds each. The average weight for the 100 was 11.89 pounds. There were 60 females in the group. only 6 of

which had eggs more than 2 mm. in diameter, and none of these had eggs more than 4 mm. in diameter, while the eggs at maturity are about 8 mm. in diameter. The remaining 54 had the eggs in every case less than 2 mm. in diameter and in most cases not more than 1 mm. Of the 40 males one had practically fully matured testes, 5 had them about half developed and the remainder had them practically undeveloped. These observations indicate that the majority of all chinook salmon taken by the trollers are immature and would have remained at least another season in the ocean if they had not been caught.

During 1918 a union was organized among the trollers. The owners of over 100 trolling boats became members and interested themselves in the building of an independent cannery. As a result of the efforts of commercial interests in Port Angeles the cannery was located at that place. The building was erected during the winter of 1918 and 1919 and was ready to begin canning about the middle of June, 1919. Practically all the fish delivered to this cannery were caught by 110 trollers, consequently almost the entire catch consisted of chinook and silver salmon. This cannery kept a complete record of the fish caught during the entire fishing season of 1919, showing the number of each species taken daily, their weights and the number of trollers who delivered fish each day. This record tells in the plainest terms the facts of importance about the trolling fleet fishing at Cape Flattery.

The following table compiled from the records of the daily catches made by these 110 trollers, shows the average number of boats fishing daily for each week, the total number of both chinook and silver salmon taken weekly with the total and average weights of each species for each week's catch.

TABLE 12—SUMMARY OF CATCH OF CHINOOK AND SILVER SALMON TAKEN AT NEAH BAY BY 110 TROLLERS.

Week Ending	Average Number of Trollers Daily	Total Number of Chinooks	Total Weight	Average Weight	Total Number of Silvers	Total Weight	Average Weight
June 24.....	44.4	6,320	87,969	13.92	4,250	25,106	5.91
July 1.....	38.1	4,386	65,442	14.92	3,169	18,374	5.79
8.....	44.3	6,890	100,686	14.68	4,395	28,642	6.51
15.....	52.7	6,556	105,370	16.07	7,090	46,853	6.61
Totals.....	44.9	24,152	359,467	14.9	18,904	118,975	6.29
July 22.....	20.1	1,660	21,032	13.21	1,261	8,279	6.57
29.....	46.1	3,062	48,929	15.98	2,791	19,287	6.91
Aug. 5.....	44	5,365	101,711	18.95	5,740	43,102	7.51
12.....	39.9	2,725	54,780	20.10	7,757	67,133	8.65
Totals.....	37.5	12,812	227,352	17.74	17,549	137,801	7.85
Aug. 19.....	19.9	1,344	30,594	22.76	3,414	28,625	8.38
26.....	29.9	2,813	45,151	16.05	12,038	126,869	10.53
Sept. 2.....	24.4	1,065	14,784	13.88	6,937	72,338	10.41
9.....	51	2,045	33,021	16.15	9,150	95,237	10.41
Totals.....	31.3	7,267	123,550	17.00	31,539	323,069	10.24
Sept. 16.....	40.6	563	7,869	13.96	7,822	79,637	10.18
23.....	22.1	571	5,805	10.17	4,739	49,251	10.39
30.....	17.4	70	975	13.93	1,932	19,093	9.88
Oct. 7.....	34.1	914	8,170	8.94	12,983	140,578	10.83
Totals.....	28.5	2,118	22,819	10.77	27,476	288,559	10.50
Oct. 14.....	15.3	95	1,350	14.21	5,117	56,381	11.02
21.....	13.9	39	740	18.97	4,940	54,994	11.13
28.....	5.1	2	35	17.5	1,784	19,471	10.91
31.....	4				349	3,733	10.69
Totals.....	8.7	136	2,125	15.63	12,190	134,579	11.04
Grand Totals.....		46,455	735,313	15.83	107,658	1,002,983	9.32

In order to have data with which to compare the Neah Bay catch, records were obtained of the daily catches of 6 traps in the Puget Sound. One trap was located at Tulalip near the mouth of the Snohomish River, another just inside Deception Pass, a third near Henry Island north of San Juan Island, and the remaining three on the west shore of Whidby Island north of Admiralty Head. The owner kept a record of the number of red chinook salmon, with their weights, taken at each lift of the traps. The number of silver, sockeye, dog and hump salmon were tabulated but none of them were weighed. Table 13 is a summary of the data collected from the records of those six traps. It gives the number of red chinook taken each week with their total weights and their average weight. Totals are also struck for each four weeks' period.

TABLE 13—FISH FROM SIX TRAPS ON PUGET SOUND.

Week Ending	Number of Red Chinooks	Weight	Average Weight	Number of Silvers	Number of Sockeye	Number of Dogs	Number of Humps
Apr. 29.....	12	456	38				
May 6.....	19	691	36.37				
13.....	24	721	30.04				
20.....	186	3,727	20.04				
Totals....	241	5,595	23.22				
May 27.....	241	5,190	21.53				
June 3.....	290	6,447	22.23				
10.....	449	10,789	24.03	1	4		
17.....	595	13,825	23.24	13	101		
Totals....	1,575	36,251	23.02	14	105		
June 24.....	987	24,445	24.77	3	330		
July 1.....	2,188	56,083	25.63	3	1,511		
8.....	1,689	37,918	22.45	9	87		3
15.....	1,441	31,730	22.02	6	446	2	2
Totals....	6,305	150,176	23.82	21	3,174	2	5
July 22.....	1,025	22,040	21.50	22	332	5	9
29.....	658	12,639	19.21	80	389	13	111
Aug. 5.....	849	14,332	16.88	144	1,066	98	1,935
12.....	937	15,877	23.21	326	1,157	156	1,414
Totals....	3,469	64,888	18.71	572	3,844	272	3,469
Aug. 19.....	684	10,743	15.71	735	645	123	5,906
26.....	700	11,569	16.53	932	839	136	15,069
Sept. 2.....	601	7,888	13.11	1,506	134	157	7,681
9.....	254	3,561	14.02	2,568		57	3,615
Totals....	2,239	33,754	15.08	5,801	1,618	475	32,271
Sept. 16.....	158	1,752	11.09	4,195		45	1,112
23.....	79	943	11.94	4,669		83	318
30.....	16	189	11.81	2,683		109	82
Oct. 7.....				3,886		1,058	7
Totals....	253	2,884	11.39	15,463		1,295	1,519
Oct. 14.....				3,278		1,602	2
21.....				3,536		4,014	
28.....				101		1,561	
Totals....				6,915		7,177	2
Grand Totals....	14,082	293,548	20.85	28,786	8,741	9,221	37,266

CONCLUSIONS DRAWN FROM TABLES 12 AND 13.

By comparing Tables 12 and 13 we are able to estimate the loss due to catching chinook salmon on the feeding banks outside the Juan de Fuca Strait. The six Puget Sound traps caught 14,082 red chinook salmon which had an average weight of 20.85 pounds. Had the white chinook salmon been weighed and included in the above, the average weight would not have been less than 22 pounds. The following table which is compiled from Tables 12 and 13 shows the number of chinook salmon, including both red and

white meated fish, caught by 110 trollers fishing on the banks off Cape Flattery, their average weight, the average loss per fish, the total loss to the 110 trollers and the estimated loss to the fleet of 500 boats. The losses are estimated on the average weight as given above, namely, 20.85 pounds. The totals are for the periods of four weeks.

TABLE 14—SHOWING LOSS ON CHINOOK SALMON TAKEN ON BANKS OFF CAPE FLATTERY BY 110 TROLLERS.

Week Ending	Number Chinooks Caught	Average Weight	Average Loss	Total Loss to 110 Trollers	Estimated Loss to Fleet of 500 Boats
July 15.....	24,122	14.9	5.95	123,526	561,480
Aug. 12.....	12,812	17.74	3.11	39,845	181,115
Sept. 9.....	7,267	17.00	3.85	28,055	127,525
Oct. 7.....	2,118	10.77	10.08	21,349	97,040
Oct. 31.....	136	15.63	5.22	710	3,225
Totals.....	46,455			213,485	970,385

These figures indicate that 57.9 per cent of the total loss may be charged to the first four weeks' fishing which represents but 20 per cent of the season's time.

The period of maximum catch and greatest average weight is the same for both trollers and traps, i. e., the four weeks ending July 15, the 110 trollers taking 24,122 chinook salmon, and the 6 traps, 6,305. The 110 trollers took during their entire season 3.79 times as many chinook salmon as the six traps did for the same period of time. After the middle of September neither the traps nor the trollers took very many chinook salmon.

In making an estimate of the loss due to taking silver salmon on the banks outside Cape Flattery it will be necessary to compare the catch of the trollers during the early part of the season with their catch in the latter part. As already stated the silver salmon that are caught in the ocean are all in their third and last year, and make the greatest part of their growth during the summer of this year.

Table 12 shows the total number of silver salmon taken each week during the season, and their total and average weights. The following table gives a summary of Table 12 and shows the number taken during the eight weeks that immature fish were caught, their average weight, the average loss when compared with the average weight of the mature fish taken in September and October, the total loss for the 110 trollers and the estimated loss for the entire fleet of 500 boats. The average weight of the silver salmon taken after September 1 was 10.62 pounds.

TABLE 15—SHOWING LOSS DUE TO TAKING IMMATURE SILVERS ON THE BANKS OUTSIDE CAPE FLATTERY.

Four Weeks Ending	Number Silvers Caught	Average Weight	Average Loss	Total Loss to 110 Trollers	Estimated Loss to Fleet of 500 Boats
July 15.....	18,904	6.29	4.33	81,844	372,018
Aug. 12.....	17,549	7.85	2.77	48,611	220,959
Totals.....	36,453			130,455	592,987

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(1) Purse seine boats unloading fish at Neah Bay cannery. (2) Section of trolling fleet anchored at Neah Bay. (3) Twenty-two thousand silver salmon on Neah Bay cannery floor—all immature.

A comparison of the figures in Tables 12 and 13 shows that the trollers took silver salmon in large numbers from the beginning of the season while the traps in the Puget Sound did not take them in significant numbers much before September 1. The trollers took 53.8 per cent of their entire catch of silver salmon before September 1, while the six traps of the Puget Sound took but 12.5 per cent of theirs. Unfortunately a more complete comparison with those taken in the traps of the Puget Sound is not possible as no cannery was found where the weights of the silver salmon caught in the Sound were kept. But it is known that the silver salmon taken at Cape Flattery average considerably more than those taken in the Puget Sound. Even including the small ones caught early in the season, the entire catch of the 110 trollers averaged 9.32 pounds which is more than that of the silvers taken in the Puget Sound during the height of the season.

The table shows that silver salmon were very abundant on the banks throughout the entire season. Had the average number of fishermen been fishing during the last weeks of October, as many silvers would have been caught as at any other period of similar length during the season.

It was difficult to get satisfactory records of the purse seiners' activities because of their migratory habits, and the fact that the dealers to whom they sold their fish did not keep a record of both their number and weight. However, some observations were made that show clearly the relation of the purse seiners to the taking of immature fish. All the species of salmon are taken in the purse seine nets while in operation on the banks in the ocean. During 9 days spent at Neah Bay beginning July 6, a careful study was made of the catches delivered by purse seiners to one cannery. A record of the number of each species, together with the estimated weights, was made.

The number of purse seine boats reporting catches to this cannery during the period of investigation varied between 5 and 12 a day for 7 out of the 9 days. The total catch was 46,102 silver salmon, 764 chinook salmon, 1,922 humpback salmon, 48 sockeye salmon and 2 dog salmon.

As it was impossible to weigh all the fish brought in by the purse seiners the approximate weight was estimated by weighing a considerable number taken on different days, striking an average and multiplying the average weight by the total number of the fish. For this purpose 352 silver salmon were taken at random, and the average weight was found to be 6.21 pounds. The average weight for the silver salmon caught at Neah Bay after September 1 was 10.62 pounds. Therefore, those caught by the purse seine nets during the period of investigation averaged 4.41 pounds less than that of the mature fish. On this basis then the 46,102 silvers taken by the purse seiners weighed 203,310 pounds less than the same number of silver salmon taken in September or October. The reader may readily understand the extent of the loss for a season when 25 or more purse seiners were engaged during the season in taking those immature salmon.

The purse seiner during the period of investigation did not take many chinook salmon, but the majority of those taken were small and immature. Out of 764 caught 591 were less than 6 pounds in weight. Therefore, while the number of chinook salmon taken by the purse seiners was much smaller than that taken by the trollers, the per cent of small ones was very much greater.

During the early part of the season the number of the other species taken by the purse seiners was insignificant. The humpback salmon taken were nearing maturity and averaged 5.96 pounds, this being considerably more than the average weight of those received at the canneries of Puget Sound, which is given as 4 pounds by the Pacific Fisherman Year Book, 1920. The sockeye and dog salmon taken during this period were too few in number to be of importance from the standpoint of our problem.

FISHING IN PUGET SOUND.

The most inexcusable slaughter of immature salmon takes place in Puget Sound during the 8 or 10 weeks that follow the opening of the fishing season, April 15. During this period large numbers of small silver salmon, called by the fishermen salmon trout, feed in the Sound. These silver salmon are in their third year, but at the time the fishing season opens they do not weigh more than one or two pounds and many of them weigh less than one pound. These fish mature in the fall of their third year, when they average 6 to 10 pounds in weight, depending on the region in which they are caught. To take these fish in the early part of the season when they average not more than one and one-half pounds means a loss of several hundred per cent. A smaller number of young chinook salmon is taken during this period. The majority of them are in their second or third year and weigh from 1 to 5 or 6 pounds. These fish if allowed to mature would average more than 20 pounds in weight. A few young humpback and dog salmon are also taken.

The region where the most of these young fish are taken is Possession Sound and the banks just south of Whidby Island. Possession Sound is a narrow strip of water lying between the southern end of Whidby Island and the mainland. In this fishing area most of the common types of fishing gear are used. During a visit to Possession Sound in April, 1918, traps, purse seines, trolls and gill nets were found in use for taking these small fish, and during a visit in April, 1919, between 25 and 30 trolling boats and between 50 and 60 gillnet boats were similarly engaged.

Each troller took on an average, 20 to 30 fish daily, while each gillnetter was reported to average not less than 200 daily. A maximum of over 2,000 fish was reported as a night's catch for one gillnetter. On the basis of these figures it is easily shown that many tons of these young fish are taken annually. For every ton taken the loss in food to the state is not less than 5 tons, for if the fish had been left until fall, when they would be mature, they would have weighed 5 to 7 times as much as they did when caught.

The laws of the State of Washington permit, during the spring season, the use of nets having a 3-inch stretched mesh. They also provide that it is a punishable offense to sell or have in possession salmon under 15 inches in length. These nets catch large numbers of fish under the legal size which, according to law, must be returned to the water. The majority of these fish, when taken from the nets, are either dead or so injured that they cannot live, so that they constitute a total loss. The other gears of whatever kind take their share of these undersized fish and so add to the loss.

There is no question whether but that fishing for these small salmon for commercial purposes should be stopped.

SUMMARY.

The taking of immature salmon in the Puget Sound and on the banks along the coast of Oregon, Washington and Vancouver Island is responsible for a great loss in one of the important food products of the region; not only is the loss great but much of the food is of inferior quality.

During the 1919 season 26 trollers fishing on the banks off the mouth of the Columbia River caught 2,931 chinook salmon weighing 9,666 pounds, and averaging 3.3 pounds, which, when compared with the adults caught inside the mouth of the river, represent a loss of 44,984 pounds. If the entire fleet, estimated at 1,500 boats, caught a proportionate number of these small salmon they would be responsible for a loss of 2,595,576 pounds. Besides these the 26 trollers caught 7,982 chinook salmon of larger size, weighing 123,326 pounds, and averaging 15.49, which when compared with those caught inside the river's mouth represent a loss of 42,409 pounds, and an estimated loss for the fleet of 2,447,000 pounds. This totals for the 26 trollers a loss of 87,393 pounds on the chinook salmon they caught and an estimated loss of 5,042,576 pounds for the fleet.

Added to this, these 26 trollers caught 3,500 silver salmon previous to August 24 which weighed 24,687 pounds and averaged 7.05; these, when compared with those caught after September 1, show a loss of 14,861 pounds. On this basis the estimated loss for the fleet was 857,479 pounds of silver salmon.

Some loss has been shown as a result of taking immature chinook salmon by the drag seines on the south shore of Sand Island. This is without doubt due to the flooding of the mouth of the river with large volumes of sea water at high tide, when numbers of salmon are swept in from the ocean.

At Neah Bay 110 trollers took during the season 46,455 chinook salmon weighing 735,313 pounds and averaging 15.83 pounds. When compared with the chinook salmon taken by 6 traps during the season they represent a loss of 213,485 pounds and an estimated loss of 970,385 pounds for the fleet of 500 boats. During the first eight weeks the 110 trollers took 36,453 silver salmon weighing 256,776 pounds and averaging 7.04. When compared with the average weight of silver salmon taken after September 1, the catch before August 12 represents a loss of 130,455 pounds and an estimated loss of 592,987 pounds for the fleet.

It was difficult to determine the extent of loss due to the purse seiners as isolated records for short periods were all that were available. However, the indications are that they caused a proportionately greater waste than did the trollers.

The most inexcusable waste is caused by the spring fishing in the Puget Sound near the south end of Whidby Island. Here many tons of young silver and spring salmon are taken whose weight average not more than one and one-half to two pounds. The silver salmon would mature in the fall of the same year and produce 5 to 7 tons of fish for every ton taken in the spring. The chinook salmon if left until maturity, which would be in two to three years, would yield even greater returns.

Analyses of the immature fish show that they are much poorer in fat content and therefore inferior in food qualities to the mature fish.

The figures in Tables 8 and 11 show the very rapid growth of silver salmon taken in the ocean during the summer of their third year. The average increase in weight for those taken at the mouth of the Columbia River was from 3.80 pounds for those taken in May to 13.08 pounds for those taken during the week ending November 16. Those taken at Neah Bay do not show quite such a rapid growth.

While most authors state that the average weight of silver salmon is 5 to 8 pounds, we found that the average weight of those taken in the ocean after September 1 was 10.45 pounds. This average was obtained from 82,621 silver salmon taken at the mouth of the Columbia River and at Neah Bay during September, October and November.

THE TAKING OF IMMATURE SALMON IN THE WATERS OF THE STATE OF WASHINGTON DURING THE 1920 FISHING SEASON

By

E. VICTOR SMITH
University of Washington

SEATTLE, WASHINGTON, September 1, 1921.

Hon. L. H. Darwin, State Fish Commissioner, Seattle, Washington.

DEAR SIR: I am submitting you herewith a supplemental report on the result of the investigations which I have made at your request, of the taking of immature salmon in the waters of the State of Washington.

Respectfully,

E. VICTOR SMITH,
University of Washington.

At the request of the State Fish Commissioner, L. H. Darwin, the author undertook a further investigation of the fishing conditions in the salt water of the state to determine whether the results for 1920 corroborated those for the previous year published by the state fisheries department in a pamphlet entitled "The Taking of Immature Salmon in the Waters of the State of Washington."

REGIONS WHERE IMMATURE SALMON ARE TAKEN.

As in the report of the preceding year, three regions where the most serious destruction of immature salmon takes place will be considered.

1. The waters of the ocean lying within a few miles of the mouth of the Columbia river.
2. The banks extending along the coasts of Washington and Vancouver Island for a distance of fifty miles north of Cape Flattery and the same distance south of it.
3. The waters of the Puget Sound lying around the southern end of Whidby Island.

FISHING ON THE BANKS AT THE MOUTH OF THE COLUMBIA RIVER.

The pursuit of the salmon in these outside waters was carried on more vigorously during the 1920 season than during the previous season. While the number of trollers engaged in fishing was probably no more than for the 1919 season, yet the number of purse seiners was very decidedly increased.

One factor enters into the situation for 1920 that modifies the results so far as they will appear in this report, but which, in all probability, does not affect the actual conditions to a very great degree. The canners on the

Columbia found by experience that the canned product from the smaller of the immature salmon was of a decidedly inferior quality and could not be readily marketed; so at the beginning of the 1920 season they announced that they would not buy any Chinook salmon that weighed less than 8 pounds each.

During the 1919 season, up to July 1, more than 40 per cent of the Chinook salmon taken by 26 trollers were under 5 pounds in weight, in fact the entire catch for the season, up to July 1, averaged less than 8 pounds each; so that it will not be an unfair estimate to consider that at least 50 per cent of the number caught were under 8 pounds. It is impossible on any other basis than this to estimate the number of fish under 8 pounds that were taken during the 1920 season. It is true that some of those under 8 pounds, returned to the water, were not injured beyond recovery, but many of them were, and many of them were not returned to the water at all, but were retained for fresh fish consumption.

As in the report for 1919, the loss to the fishing industry through taking of immature salmon on the feeding grounds is estimated by comparing the catches of fish taken in the ocean by the trollers with those taken by gill-netters and traps within the mouth of the river.

We had at our disposal records of the daily catches of 25 gill net boats, 49 traps and 27 troll boats.

It seems evident that the estimated number of trollers operating outside the mouth of the Columbia river during the 1919 fishing season was too large. The trollers themselves stated that there were between 2,000 and 3,000 boats engaged in trolling. Our 1919 report estimated the number at 1,500, which is probably still higher than the number actually engaged. The author spent the entire time between 8 a.m. and 8 p.m., August 3, 1920, at the Lookout Station on the cliffs at the mouth of the river, on the north side. The day was bright and the water comparatively smooth. A careful count was made of the troll boats that entered the river between these hours. The number was 432. For one reason or another a rather large per cent of the boats are not fishing on any one day. Of the 27 trolling boats that landed fish at the Ilwaco cannery during the 1920 season, the daily average was 6.3 boats for the 20 days fishing in May, 10 boats for the 23 days fishing in June, 7 boats for the 25 days fishing in July, and 10 boats for the 22 days fishing in August. On August 3, the day the boats entering the river were counted, 8 trollers delivered fish at the Ilwaco cannery. During the entire season from May 1 to August 25 there were only 12 days when there were more than one-half of the 27 boats fishing. The average number fishing for the season was a little less than 9 boats per day. While probably not very exact, a fair estimate of the number of trollers, from all figures obtainable, would put it at 1,000 boats.

The following tables are compiled from the daily records of the catches of 27 troll boats, 25 gill net boats and 49 traps. All the fish were delivered to the Ilwaco cannery. Almost the entire catch of the trollers was taken in the ocean within 12 to 15 miles of the mouth of the Columbia river. A few were brought down from the neighborhood of Destruction Island during the latter part of the season. The gill-netters operated in the Columbia river within a few miles of its mouth. The traps were located along the north bank of the river and within a few miles of the mouth. For convenience, the tables show

the totals for each period of four weeks from the beginning of the season. The dates are arranged so as to be identical with those in the previous year's report, in order that comparisons may be more easily and accurately made. The first table shows in parallel columns the catches, first of the trollers, then of the gill-netters and, lastly, of the traps.

TABLE 1.—SUMMARY OF CHINOOK SALMON TAKEN AT THE MOUTH OF THE COLUMBIA RIVER.

(Fish in Round.)

FOUR WEEKS ENDING	TROLLERS			GILL-NETTERS			TRAPS		
	Number	Weight	Average Weight	Number	Weight	Average Weight	Number	Weight	Average Weight
June 1...	2,681	41,253	15.38	1,606	36,473	22.71	968	17,931	18.52
June 29...	2,050	33,659	16.42	1,639	43,184	26.35	1,237	33,313	26.93
July 27...	917	19,317	21.06	1,382	35,791	25.90	2,379	56,037	23.55
Aug. 24...	3,292	80,162	24.35	6,799	181,217	26.65	9,616	244,735	25.45
Sept. 21...	30	811	27.03	224	6,194	27.65	368	9,701	26.36
Oct. 19...	7	157	22.43				25	703	28.12
Nov. 22...	5	160	32.00				3	93	31.00
Totals.	8,982	175,519	19.54	11,650	302,859	26.00	14,596	362,513	24.84

The next table shows, in the second column, the total number of Chinook caught for each period of four weeks by both gill-netters and traps. The third column gives the total weights for the catches of both gill-netters and traps, while the fourth column gives the average weight. Column five gives the average weight of the Chinook caught by the trollers and the sixth column shows the average difference in weight between those caught inside and those trolled outside the mouth of the river, which is considered as loss through taking immature fish. The remaining three columns show the number of trolled fish, the losses due to the work of 27 trollers, and the estimated loss for 1,000 trolling boats.

TABLE 2.—SHOWING LOSSES ON TROLLED CHINOOK SALMON.

FOUR WEEKS ENDING	Number Caught Inside River	Weight	Average Weight	Average Weight Trolled Fish	Average Loss per Fish	Total Number Caught by 27 Trollers	Loss Due to 27 Trollers	Estimated Loss for 1000 Boats
June 1...	2,574	54,404	21.12	15.38	5.75	2,681	15,416	570,963
June 29...	2,876	76,497	26.60	16.42	10.18	2,050	20,869	772,926
July 27...	3,761	91,828	24.42	21.06	3.36	917	3,081	114,111
Aug. 24...	16,415	425,952	25.95	24.35	1.60	3,292	5,267	195,074
Sept. 21...	592	15,865	26.85	27.03				
Oct. 19...	25	703	28.12	22.43	5.69	7	40	1,481
Nov. 22...	3	93	31.00	32.00				
Totals.	26,246	665,372	25.35	19.54		8,947	44,673	1,654,555

An estimation made from table 5, page 19, of the author's report for 1919, shows that the loss due to 1,000 trollers fishing in the open sea was 1,631,333 pounds on all Chinook over 5 pounds. This year's estimation shows that the loss on the fish taken by the same number of boats for all fish over 8 pounds

was 1,654,555 pounds. It is probable that the entire loss was not less for 1920 than for 1919. It is interesting to compare the average weights of the fish caught by the different gears for the two years. The next table shows these weights.

TABLE 3.—AVERAGE WEIGHT OF CHINOOK SALMON CAUGHT BY DIFFERENT GEARS FOR 1919 AND 1920.

FOUR WEEKS ENDING	Trollers 1919	Trollers 1920	Gill-nettors 1919	Gill-nettors 1920	Traps 1919	Traps 1920
June 1.....	6.31	15.38	15.47	22.71	13.55	18.52
June 29.....	8.13	16.42	20.32	26.35	20.77	26.93
July 27.....	12.75	21.06	23.09	25.90	20.70	23.55
Aug. 24.....	22.09	24.35	23.59	26.65	22.59	25.45
Sept. 21.....	19.56	27.03	26.28	27.65	23.00	26.36
Oct. 19.....	20.97	22.43	.....	.....	21.64	28.12
Nov. 22.....	16.39	32.00	.....	.....	23.18	31.00
Totals.....	15.45	19.51	22.49	26.00	21.62	24.84

This table shows that there was a very marked increase in the average weight of the fish caught by all gears. It is probable that the average weight of those caught in the ocean would not have differed much for the two years if the Chinook salmon under 8 pounds taken by the trollers had been included in their catch. The foregoing tables tell a similar story to the report of the previous year. Of the 1,654,555 pounds loss to the fishing industry through the taking of immature Chinook salmon by the trollers, 1,343,889 pounds were lost through fishing operations before July 1, or to put it in other terms, over 81 per cent of the entire loss due to trolling was done before July 1.

SMALL CHINOOK SALMON TAKEN IN THE COLUMBIA RIVER.

A number of reports were current that fishermen were taking large numbers of small Chinook salmon from the Columbia river above its mouth. These fish were reported to weigh $2\frac{1}{2}$ to 3 pounds and were thought to be immature. The Doty Fish Company at Kalama furnished the author with a considerable number of these fish. They were weighed and examined as to their state of maturity. These fish averaged about 3 pounds in weight. All of them were males in their second year and their sex organs were nearly mature. These fish would go to the spawning grounds with the fall run of Chinook and would not outlive the breeding season. It is a wise move, therefore, to catch these fish and dispose of them for food, as they are not desirable for breeding purposes.

THE SILVER SALMON TAKEN AT THE MOUTH OF THE COLUMBIA RIVER.

As is generally known, the silver salmon spawn in their third year. Their life in the ocean is comparatively brief, as the most of them enter the salt water in their second year. In the spring of their second year they are between 3 and 4 inches in length. They grow quite rapidly during their second summer, attaining a length of 6 to 14 inches. Their growth during their second winter is not very great so that when the spring of their third year arrives they are not more than 10 to 18 inches in length, and vary in weight between 8 ounces and one and one-half pounds. At the beginning

of the fishing season in April, these fish are rarely more than one and one-half pounds, and as they mature in the fall of their third year, their growth during their last summer is very rapid. Silver salmon caught in the earlier part of the summer are not half grown, and when thus caught must be considered as contributing a big loss to the food supply of the state.

Observations at the mouth of the Columbia river were made on the catch of the same 27 trollers, whose records were obtained for the Chinook salmon. As in the case of the Chinook, the daily records were obtained, but for this report the four weekly period is all that is given.

The following table shows the condition of silver salmon fishing, both inside and outside the mouth of the Columbia river.

TABLE 4.—SILVER SALMON TAKEN AT THE MOUTH OF THE COLUMBIA RIVER.

FOUR WEEKS ENDING	TROLLERS			GILL-NETTERS			TRAPS		
	Number	Weight	Average Weight	Number	Weight	Average Weight	Number	Weight	Average Weight
June 1....	317	1,441	4.54	3	14	4.66	2	9	4.50
June 29....	2,034	11,677	5.74	54	330	6.11	13	67	5.15
July 27....	1,016	6,407	6.30	10	75	7.50	13	79	6.07
Aug. 24....	1,608	12,092	7.52	4	35	8.75	322	2,373	7.37
Sept. 21....	7	52	7.43	.....	.....	.....	103	713	6.92
Oct. 19....	.....	.....	.....	.....	.....	.....	206	1,961	9.52
Nov. 22....	846	9,378	11.08	.....	.....	.....	225	2,125	9.44
Totals....	5,828	41,047	7.04	71	454	6.39	884	7,327	8.29

The number of silver salmon taken by the gill-netters inside the mouth is so small that the figures are of little use for comparative purposes, the total catch being but 71 fish for 25 gill net boats. Their small catch is due to the fact that the meshes of their nets are so large that silver salmon can readily pass through them.

The table shows that the trollers caught the largest number of silver salmon early in the season when the salmon were scarcely more than half grown. The traps which caught a considerable number of silver salmon did not make any showing until late in the season after the trollers had ceased to catch them in large numbers. The trollers caught practically 85 per cent of their catch before August 24, while the traps caught nearly 61 per cent of theirs after this date. The average weight of the silver salmon caught after July 27 was 8.76 pounds. The loss to the fishing industry for 1920 due to fishing on the feeding banks of these fish is estimated on this base.

TABLE 5.—SUMMARY SHOWING LOSS DUE TO TAKING OF IMMATURE SILVER SALMON AT THE MOUTH OF THE COLUMBIA RIVER.

FOUR WEEKS ENDING	Number Silvers	Average Weight	Average Loss	Total Loss 27 Trollers	Estimated Loss for Fleet of 1,000 Boats
June 1.....	317	4.54	4.22	1,338	49,556
June 29.....	2,034	5.74	3.02	6,143	227,519
July 27.....	1,016	6.30	2.46	2,409	92,556
Aug. 24.....	1,608	7.52	1.24	1,994	73,852
Totals.....	4,975	11,974	443,483

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This table shows that the trolling fleet at the mouth of the Columbia river is responsible for a loss of 443,483 pounds as a result of catching silver salmon before they were mature. It also shows that practically 63 per cent of the loss was due to fishing before July 1.

PURSE SEINE FISHING AT THE MOUTH OF THE COLUMBIA RIVER.

Previous to 1920, a comparatively small number of purse seine boats operated in the neighborhood of the mouth of the Columbia river, but this year there were not less than 150 of them engaged in fishing on the shallow banks lying close to shore, both north and south of the river's mouth. The coast guardsmen at Lookout Point on the north side of the mouth of the river are required to keep, so far as they possibly can, an accurate record of all schooner-type vessels that enter and leave the river. Some days, on account of the thickness of the fog, it was impossible to get accurate counts, but the records are evidence enough that not less than 150 purse seine boats were operating off the mouth of the river. Their count on August 1st was 149 of these boats entering the river. The author counted 91 purse seine boats entering the river August 3, between 8 a. m. and 8 p. m.

The method of fishing is quite different to that usually followed by purse seine boats. Usually the fishing is done in water of a greater depth than the nets. Under such conditions the circle of the net is completed as expeditiously as possible and the net pursed without delay. At the mouth of the Columbia river the fishing is done in quite shallow water. In fact nearly all of the fishing was done along the shore north of the jetty in water 6 to 8 fathoms deep, and ranging from one-half mile to three or four miles from shore. Most of it was done close in shore. The method followed was to extend the net in a crescent at right angles to the flow of the tide. Throughout its entire length the lead line was on the bottom. The net was held in this position for about one hour, when the ends were slowly brought together. There was no haste in pursing the net as there was no possibility of the fish enclosed escaping. As the net was pursed, the lead line was dragged along the bottom and everything within the compass of the net was caught. Besides salmon there were bass, soles, flounders, skates, lake, dogfish, crabs and other forms of life.

It is certain that this method of fishing is very destructive to the fauna living on the bottom. The shore adjacent to where this fishing took place was thickly strewn with the remains of crabs. It was not possible to make extensive observations on the purse seine operations on the ocean, but the results of one may represent, to a fair degree, the results of all. August 10 was spent on board one of these boats. The crew of this boat made four hauls with the net, resulting in the taking of 155 Chinook salmon, 48 of which were less than the size accepted by the canneries. Forty-one of the 48 were under 5 pounds in weight. A large per cent of the 41 were hung up in the meshes of the net and had nearly half of their scales rubbed off. A few of them were dead. Nearly all the small ones which were still living were returned to the water and disappeared from sight. When the desirable fish were taken from the pocket in the net, all the fish that remained were turned free, probably not much the worse for being caught.

The efficiency of the purse seines in fishing along the coast is indicated by the record of a few days' fishing obtained at Tallant & Grant's cannery.

TABLE 6.—CATCH OF CHINOOK SALMON BY PURSE SEINE BOATS.

DATE	Number of Purse Seine Boats	Number Chinook	Total Weight	Average Weight
Aug. 9.....	12	1,290	33,380	25.88
Aug. 10.....	7	364	8,185	22.48
Aug. 12.....	8	835	21,607	25.68
Totals.....		2,489	63,181	25.38

These observations were made during that part of the fishing season when a comparatively small number of immature salmon were taken, yet if an estimate is made from the catch of one boat, August 10, there must have been about 770 Chinook salmon caught which were less than 8 pounds in weight, so that the total catch of 27 purse seine boats fishing one day was 3,259 Chinook weighing about 65,000 pounds. Besides the Chinook, these boats delivered at the cannery over one ton of silver salmon, steelheads and sturgeon. The number taken by 100 of these boats in 100 days is easily estimated. The purse seine boat is the last word in efficiency for taking fish.

FISHING AT CAPE FLATTERY.

The fishing conditions on the ocean banks off the coast of Northern Washington and the adjacent coast of Vancouver Island were practically the same as for 1919. The fishing fleet consisted of about 500 trolling boats and a small number of purse seine boats. The most of the fishing was done in a strip of water lying along the coast stretching from Destruction Island, fifty miles south of Cape Flattery, to Barclay Sound, fifty miles north of Cape Flattery, and extending out from shore 10 to 12 miles. The depth of the water in this strip is from 20 to 50 fathoms. Most of the fishing was done rather close to shore. On the American side, much fishing was done within the three miles limit; while on the Canadian side, American fishermen are not permitted to fish within the three miles limit. Some fishing was done within the Juan de Fuca Strait, but the conditions are not so favorable for fishing as outside the strait; consequently, the fishing inside the Cape was of minor importance.

Through the courtesy of the officers of the Fishermen's Union Cannery at Port Angeles, the records of the daily catches of 100 trollers for the entire season were placed at our disposal. This group of fishermen represented practically one-fifth of the entire fleet fishing out from Neah Bay. The Fishermen's Union Cannery being located at Port Angeles more than 50 miles from Neah Bay, it was necessary to have a receiving scow at the latter place, where the fishermen delivered all their fish. At this scow the fish were weighed and packed with ice in standard boxes. From this scow the fish were taken to the cannery at Port Angeles by the company's boat.

During the earlier part of the fishing season the fishermen started for the fishing banks between 2 and 3 o'clock in the morning and returned the evening of the same day. The fish taken were delivered at the scow in the round. As the season advanced and fishing became poorer in the waters comparatively close to Neah Bay, many of the fishermen extended their field of operations.

going so far from Neah Bay that it was impossible to return the same day they started out. When they could not return the same day, they usually prolonged the trip to three or even more days. On these protracted trips it was necessary to make proper provision for the preservation of their fish; accordingly, the fish were butchered and packed in boxes with enough ice to keep them in good condition until delivered at the receiving scow. As a result, the records show two groups of fish, one weighed in the round and the other butchered. In order to make the report uniform the average weight of those delivered in the round was used to estimate the weight in the round of those that had been butchered. The trollers catch, practically, only Chinook and silver salmon as these are the only members of the salmon genus that take the hook. These two species will be considered separately, the Chinook salmon being considered first.

THE TAKING OF CHINOOK SALMON AT NEAH BAY.

The estimates will be made on the daily catches of the 100 trollers, and the entire fleet will be considered as consisting of 500 boats. Comparisons are made with the catch throughout the season of a number of traps located in different parts of the Puget Sound. It seems fairer to take the catch of these traps for the entire season rather than for the period during which the trollers caught the greatest number of immature fish. The average weight of the Chinook salmon taken throughout the season in the Puget Sound is considerably less than that of the fish taken before the middle of July. The reports at our disposal of fish caught in the Puget Sound show that 21,721 red Chinook salmon averaged 20.48 pounds. The loss due to trollers taking immature salmon will be based on this as the average weight of mature Chinook salmon for the season 1920.

The following tables will show only totals for periods of one week and four weeks, and the dates will correspond with those given in the previous year's report.

TABLE 7. — CHINOOK SALMON TAKEN BY TROLLERS AT NEAH BAY.
(Fish in the round.)

WEEK ENDING	Number Red Chinook	Weight	Average Weight	No. White Chinook	Weight	Average Weight
June 24.....	117	930	7.95	10	147	14.7
July 1.....	391	6,501	16.62	30	637	21.9
July 8.....	1,704	26,997	15.84	84	1,137	13.53
July 15.....	3,048	46,402	15.22	401	8,254	20.58
	5,260	80,830	15.36	525	10,195	19.42
July 22.....	678	12,856	18.96	178	3,695	20.76
July 29.....	671	13,189	19.65	156	3,772	23.87
Aug. 5.....	196	4,490	22.91	48	1,394	29.04
Aug. 12.....	19	464	24.42	6	222	37.
	1,564	30,999	19.82	390	9,083	23.29
Aug. 19.....	50	907	18.14	12	415	34.58
Aug. 26.....	245	4,951	20.25	74	1,863	25.17
Sept. 2.....	361	6,910	19.14	82	1,967	23.99
Sept. 9.....	97	1,865	19.22	29	671	23.14
	753	14,643	19.44	197	4,916	24.95

This table shows the number of red and white Chinook that were delivered in the round at the receiving scow at Neah Bay. Column 4 gives the average weights of the reds and column 7 gives the average weights of the whites. It is interesting to note that the whites all through the season weighed much more than the reds.

The following table will show the entire number of Chinook salmon, both red and white, taken by 100 trollers for the season, and also the weights estimated on the average weights of fish taken in the round for the weekly period.

TABLE 8.—TOTAL NUMBER OF CHINOOK SALMON TAKEN BY 100 TROLLERS AT NEAH BAY.

WEEK ENDING	Number Red Chinook	Weight	Average Weight	No. White Chinook	Weight	Average Weight
June 24.....	117	930	7.95	10	147	14.7
July 1.....	500	8,460	16.62	49	1,073	21.9
July 8.....	2,927	46,364	15.84	178	2,408	13.53
July 15.....	3,048	46,300	15.22	401	8,253	20.58
	6,601	102,144	15.47	638	11,881	18.62
July 22.....	2,111	40,025	18.96	477	9,903	20.76
July 29.....	2,775	54,529	19.65	392	9,357	23.87
Aug. 5.....	936	21,444	22.91	210	6,098	29.04
Aug. 12.....	237	5,787	24.42	59	2,183	37.
	6,059	121,755	20.09	1,138	27,541	24.20
Aug. 19.....	209	3,791	18.14	65	2,248	34.58
Aug. 26.....	1,864	37,746	20.25	420	10,571	25.17
Sept. 2.....	1,889	36,155	19.14	350	8,397	23.99
Sept. 9.....	168	3,229	19.22	35	810	23.14
	4,130	80,921	19.59	870	22,026	25.32

This table is a statement of all the Chinook salmon taken by 100 trollers who delivered fish to the Union scow at Neah Bay. It shows the number taken each week and the totals for each four weeks period. The third column gives the weights of those delivered in the round and the estimated weights of the butchered. The fourth column gives the average weight of the fish for each week, based on the weight of those delivered in the round. The fifth, sixth and seventh columns give the corresponding figures for the white Chinook salmon caught by the same trollers.

ESTIMATED LOSS.

The loss due to taking many of these salmon before maturity is estimated on the assumption that these fish, if left until mature, would have averaged 20.48 pounds, which is probably less than they would have weighed. On this basis, the following table shows the loss for red Chinook salmon, the loss for the white Chinook salmon being so small as to be of little importance.

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TABLE 9. — LOSS ON RED CHINOOK SALMON TAKEN AT NEAH BAY.

FOUR WEEKS ENDING	No. Red Chinook Taken by 100 Trollers	Average Weight	Average Loss per Fish	Loss to 100 Trollers	Estimated Loss to 500 Trollers
July 15.....	6,601	15.47	5.61	33,071	165,355
Aug. 12.....	6,059	20.09	.39	2,363	11,815
Sept. 9.....	4,130	19.39	.89	3,676	18,380
	16,780			39,110	195,550

This table shows a loss sustained by the fisheries of the state of 195,550 pounds due to taking immature Chinook salmon by trolling on the feeding banks near Cape Flattery. Another important fact brought out by the table is that a very great part of the loss was due to fishing before July 15. A comparison with the report for 1919 shows a similar relation. In 1919 the per cent of loss before July 15 was 57.9 of the entire loss for that year, while this year 84.5 per cent of the entire loss was due to fishing before July 15.

THE TAKING OF SILVER SALMON BY THE TROLLERS AT NEAH BAY.

The silver salmon, as already stated, mature in their third year and grow so rapidly during their third summer that they are four to five times as heavy when they are ready to go to the spawning beds in October as they were in April of the same year; consequently, to catch them in the early part of the season means a very great loss. The trollers at Neah Bay caught large numbers of these fish throughout the season, but the heaviest catch was taken in the earlier part of the season, and therefore, attended with the greatest loss.

The only way to estimate the loss through taking silver salmon before they are mature is to compare the weight of the fish caught in the earlier part of the season with the weight of those caught at the time the silver salmon are mature. Silver salmon taken by the trollers after August 26th had an average weight of 9.67 pounds. This average is based on 3,128 fish having a total weight of 30,258 pounds, and is used as a basis for estimating the loss due to taking the fish before fully grown. These fish taken in the earlier part of the season are not nearly so fat as those taken at the end of the season, and therefore do not make nearly so desirable a canned product.

The silver salmon as caught at Neah Bay were subject to the same fishing conditions as the Chinook, so that many of them were delivered to the cannery butchered and it is necessary, for this report, to estimate their weight in the round. Consequently, in the two following tables we have recorded, in the first, the weekly catch of silver salmon in the round, while in the second we have the estimated weight of the entire weekly catch.

TABLE 10 — THE CATCH OF SILVER SALMON AT NEAH BAY BY TROLLERS.
(In the round.)

WEEK ENDING	Number Silvers	Weight	Average Weight
June 24.....	335	1,697	5.06
July 1.....	1,165	7,195	6.17
July 8.....	2,339	13,163	5.63
July 15.....	5,674	30,392	5.36
	9,513	52,447	5.51
July 22.....	1,608	10,828	6.73
July 29.....	957	6,747	7.05
Aug. 5.....	1,276	8,899	6.97
Aug. 12.....	63	488	7.74
	3,904	26,962	6.91
Aug. 19.....	275	2,072	7.53
Aug. 26.....	1,618	11,955	7.38
Sept. 2.....	2,310	22,520	9.75
Sept. 9.....	818	7,738	9.45
	5,021	44,285	8.82

TABLE 11 — THE ENTIRE CATCH OF SILVER SALMON AT NEAH BAY BY 100 TROLLERS.

WEEK ENDING	Number Silvers	Weight	Average Weight
June 24.....	335	1,695	5.06
July 1.....	1,480	9,132	6.17
July 8.....	3,912	21,025	5.63
July 15.....	5,674	30,392	5.36
	11,401	62,244	5.51
July 22.....	5,132	34,538	6.73
July 29.....	3,984	28,087	7.05
Aug. 5.....	3,285	22,896	6.97
Aug. 12.....	679	5,253	7.74
	13,080	90,776	6.91
Aug. 19.....	719	5,414	7.53
Aug. 26.....	4,262	31,454	7.38
Sept. 2.....	6,422	62,615	9.75
Sept. 9.....	1,329	12,559	9.45
	12,732	112,042	8.82
Total.....	37,212	265,052	

A comparison of these tables shows that more than half of the fish were butchered. This fact adds a possible factor of error, but since over 18,000 were in the round, the error cannot be of such a size as to materially affect the results. Table 11 shows that the taking of the fish was distributed, so far as numbers are concerned, fairly uniformly over the entire season.

Those taken at the last of the season were nearly twice as heavy as those taken at the beginning of the season. The next table, compiled from table 11,

will show the loss due to taking the fish in the earlier part of the season. The average weight, 9.67 pounds, of the fish after August 26 is taken as the basis for estimating the loss.

TABLE 12. — SHOWING LOSS DUE TO TAKING IMMATURE SILVER SALMON AT NEAH BAY BY 100 TROLLERS.

FOUR WEEKS ENDING	Number Silver Salmon	Average Weight	Average Loss in Pounds	Loss to 100 Trollers	Estimated Loss to Fleet of 500 Boats
July 15.....	11,401	5.51	4.16	47,428	237,140
Aug. 12.....	13,080	6.91	2.76	36,101	180,505
Aug. 26.....	4,981	7.40	2.27	11,307	56,535
	29,462			94,836	474,180

This table shows a total loss of 474,180 pounds silver salmon as a result of trolling on the feeding banks at the mouth of the Juan de Fuca Strait. One-half of the loss resulted from fishing before July 15.

FISHING IN PUGET SOUND.

During the spring fishing season following April 15, a similar inexcusable slaughter of immature salmon took place around the southern end of Whidby island that has taken place there for years. The principal loss was due to taking silver salmon in their third year. At this time of the year the silver salmon do not average one and one-half pounds. These fish would weigh on the average at least five times as much at maturity, and as many tons of these fish were taken, the loss was not less than four tons for every ton taken by the fishermen. A smaller number of young Chinook salmon are taken at the same time with the silver salmon. On these the proportionate loss is even greater.

With the present serious condition facing one of the most important industries of the state, this slaughter of young salmon should be stopped at once.

SUMMARY.

The taking of immature salmon for commercial purposes in the waters of the State of Washington presents very similar conditions and results to those of the previous year.

The action of the canners of the Columbia river in refusing to purchase any Chinook salmon under 8 pounds in weight modifies the results as shown in this report, but probably does not alter them much in fact, for in all probability the proportion of fish under 8 pounds taken by the trollers was as great as during the previous season.

There was a very great increase in the number of purse seine boats operating at the mouth of the Columbia river during the 1920 season over the number fishing during the 1919 season.

The loss through taking immature Chinook salmon outside the mouth of the Columbia river over 8 pounds in weight, was 44,673 pounds for 27 trollers and the estimated loss for the fleet was 1,654,555 pounds. Of this loss 81 per cent was due to fishing before July 1.

The loss through taking immature silver salmon in the ocean at the mouth of the Columbia river by 27 trollers was 11,974 pounds, and the estimated loss for the fleet was 443,483 pounds.

While it is impossible to estimate the loss due to purse seine boats taking immature salmon in these waters, there is not a doubt but that the total loss caused by them was much greater than that of the trolling fleet, as their total catch was very much larger than that of the trollers.

At Neah Bay 100 trollers took during the season 16,780 red Chinook salmon, which brought about a loss of 39,110 pounds through many of them being immature. The estimated loss for the entire fleet for the season was 195,550 pounds of red Chinook salmon. At least 84 per cent of this loss was due to fishing before July 15. The loss due to taking immature white Chinook salmon was insignificant.

Previous to August 26, the 100 trollers of the Union fleet took 29,462 silver salmon, which resulted in a loss of 94,836 pounds, and by estimation the loss to the entire trolling fleet for the season was 474,180 pounds through taking silver salmon before mature.

As in the previous year, the most inexcusable waste was in Puget Sound around the south end of Whidby Island, where four to five tons were lost for every one that was caught.

The present status of the salmon fishing industry is such that everything possible should be done to prevent loss through taking of immature salmon.



This picture shows how salmon eggs are secured and fertilized in a State hatchery. With the exception of the Steelhead, all salmon die after naturally depositing their spawn, so the salmon are killed before the eggs are taken from them, thus diminishing the egg loss. Scene at Chehalis Salmon Hatchery, Satsop, Mason County.

FISH CULTURE METHODS IN WASHINGTON STATE HATCHERIES

Prepared at request of
L. H. DARWIN, State Fish Commissioner,
By E. VICTOR SMITH,
University of Washington.

The growth of the fisheries industry furnishes a remarkably interesting page in the history of the commercial development of the Pacific Northwest. The importance of the industry may be readily appreciated when one considers the development of the salmon canning part of it. The canning of salmon began on the Sacramento River, Cal., in 1864, with an output of 96,000 pounds. From this small beginning the pack has increased until in 1917 there were more than 485,000,000 pounds canned.

The ever increasing demand for this article of food, coupled with the steady advance in prices has caused the industry to be exploited to such a degree that there is grave danger of its being ruined. Appreciation of this danger has led the states and territories interested to put forth strenuous efforts to conserve this important resource. Legal measures have been enacted to regulate the taking of salmon and to protect their spawning grounds. These measures have been attended with some degree of success. But by far the most important movement for the maintenance of the salmon fisheries has been the establishment of hatcheries and rearing ponds for the artificial propagation and care of the young salmon.

Hatchery operations were first undertaken on the Pacific Coast of America by the United States Bureau of Fisheries in 1872. The McCloud River, California, was chosen as the stream on which to make the first experiment in artificial propagation of the salmon. The total output for the year was 50,000 eggs, of which, owing to high temperature, 20,000 were lost. The remaining 30,000 were shipped east, all of which perished, except 7,000 fry which were planted in the Susquehanna River, Pennsylvania. From this rather discouraging beginning the industry has grown until in 1915 the total number of fry planted in the Pacific coastal streams was over 500,000,000.

The State of Washington began this industry in 1896 with an output of 4,500,000 chinook fry. Washington has shown a most remarkable growth in this important field. In 1915 the total output of fry for the state was over 245,600,000, or nearly half the entire output for the Pacific Coast of America. Of this number 131,510,000 were produced by the hatcheries owned and operated by the state, while about 114,090,000 were produced by the hatcheries belonging to the United States Bureau of Fisheries. In 1917 the state had increased its operations considerably, taking a total of 173,325,925 eggs. The State of Washington has constructed 36 hatcheries, which are distributed on the most important spawning streams of the state.

THE FISH OF IMPORTANCE TO THE CULTURIST.

There are five species of the Pacific Coast salmon belonging to the genus *Oncorhynchus*, all of which are of great commercial value and are,

therefore, of interest to the culturist. The largest and most valuable is the chinook salmon (*O. tshawytscha*), also called king, spring, tyee, quinnat, Sacramento River and Columbia River Salmon. The next in importance is the Sockeye or blueback salmon (*O. nerka*), known in Alaska as red salmon. The others in order of importance are the silver or coho salmon (*O. kisutch*), the humpback, or pink salmon (*O. gorbuscha*), and the dog salmon or chum (*O. keta*). Other members of the family Salmonidae that are of interest either commercially or from the sportsman's standpoint, and consequently of importance to the fish culturist are the steelhead trout (*S. gardneri*), the cutthroat trout (*S. clarkii*), and the rainbow trout (*S. iridens*). These belong to the genus *Salmo*. One other of the Salmonidae must be considered with those already mentioned, the eastern brook or speckled trout (*S. fontinalis*) belonging to the genus *Salvelinus*. This interesting and gamy fish has been introduced from the east and promises much for the western sportsman. There are numerous trouts known by other names in the streams and lakes of Washington but they are varieties of those already mentioned.

NATURAL PROPAGATION.

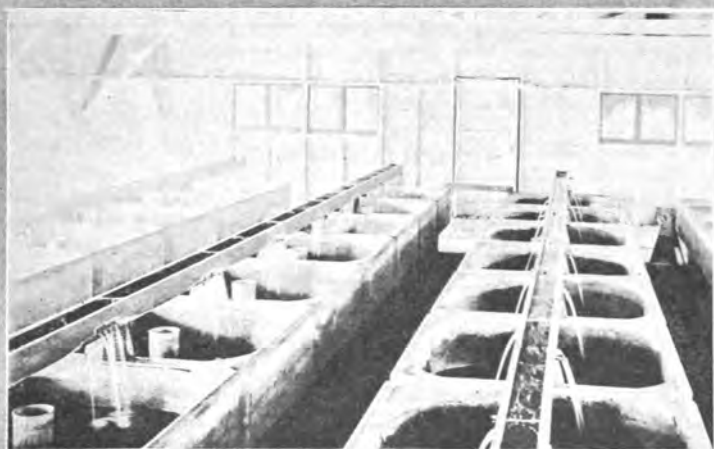
The salmon, which are anadromous fishes, i. e., run into fresh water to spawn, complete the major part of their growth in the ocean and at maturity seek their spawning beds in the upper waters of the rivers and streams flowing into salt water. All of the species seek gravel beds in which to spawn, where the water is comparatively shallow and flows rather swiftly. Some of the fish run hundreds of miles up stream before they spawn, others may enter very short streams and spawn within a few miles of the salt water. On starting for the spawning beds they cease to feed and continue fasting until they have completed the spawning act when they die. Thus, the salmon spawn but once in their life time. While some of the trouts are anadromous and others are not, they differ from the salmon in that they spawn a number of times.

The salmon, on their arrival at the spawning beds, wait for a longer or shorter period until the eggs and milt are ripe. In ripening, certain changes take place which prepare both eggs and sperm for the fertilizing process. At the same time the tissues of the ovaries disintegrate and permit the separation of the eggs from the stroma, so that the eggs may be readily extruded from the body. A similar change takes place in the spermaries which permits the easy escape of the sperm.

As soon as the eggs are ripe the spawning process begins. The female selects a gravelly spot at the upper end of a riffle where the current is strong. Here she turns over on her side, dips her tail into the gravel, and during swift undulatory motions of the body, extrudes a few eggs which lodge in the crevices of the gravel. She then moves away and the male takes her place and extrudes a small quantity of milt. It is said that this process is kept up at irregular intervals for about two weeks by each pair of chinook salmon before spawning is complete. After the spawning is ended, the fish are completely exhausted and soon after die. There is no authentic record of a salmon ever spawning twice.



WALLA WALLA TROUT HATCHERY



TROUT REARING TANKS IN THE
WALLA WALLA HATCHERY

WASTEFULNESS OF NATURAL PROPAGATION.

The question naturally arises as to the advantage of the artificial method of propagation over the natural method. As the country becomes settled the natural spawning beds of the salmon and trout are rendered less and less productive, because of the increasingly unfavorable conditions incident to the commercial enterprises along the rivers and streams. It is imperative, therefore, that some means be adopted to counteract the depletions arising from this source; but the most important reason for the artificial propagation is the fact that the natural method is extremely wasteful, which is not true of the artificial method. The average number of eggs deposited by the females of the five species of salmon is about 4,000. Were it not for very great losses, the increase in the number of these fishes would be so enormous that in a few years there would not be food enough to keep them from starving by myriads. The greatest loss comes, without doubt, in the earliest stages of development. While there is much work to be done in determining the efficiency of natural propagation, yet enough has been done to show that the losses are very great during the first three or four months of development. In natural spawning Rutter estimates that at least 15 per cent of the eggs are not fertilized. This loss, he says, is small compared to the number destroyed before the hatching period. A considerable number of eggs is destroyed by the movement of the fish and gravel incident to spawning, a larger number is devoured by predatory fishes which abound in the spawning streams, and a still larger number is buried so deeply by the shifting gravel and sand, due to the winter's freshets, that they are smothered; or, if hatched, the young are not able to make their way to the surface. Again, many eggs are buried not more than three to four inches in the gravel, so when these hatch the young struggle to the surface long before the yolk sac is absorbed, and being of a bright attractive color and exceedingly helpless, they soon become the prey of voracious enemies. So it is probable that not 15 per cent of the eggs produce fry that reach the stage of complete yolk-sac absorption.

ARTIFICIAL METHOD.

By the artificial method of propagation practically all the agencies so destructive to the salmon in their early stages of development under natural conditions are eliminated, and by the use of the most improved modern methods more than 90 per cent of the eggs may be hatched out and the young fish brought to the stage of complete yolk-sac absorption.

METHOD OF SECURING FISH FOR SPAWNING.

The hatcheries are built as near to the mouth of the spawning streams as is feasible in order to get the fish before they begin to spawn. At the most favorable place in the vicinity of the hatchery a rack is constructed across the stream in order to arrest the farther migration of the fish up stream. This rack is a temporary structure of strips of wood fastened about one and one-half inches apart to stringers placed across the stream. The whole structure is supported in place by tripods weighted down with stones. At some distance below this rack another one is built across the stream. In it are placed openings constructed in such a way that the fish

readily find their way up through them, but are not able to find their way back. In this area of the stream between the racks the fish are retained until they are ripe.

Various methods are used for taking the fish from this inclosure. One method is to build above the upper rack traps which have openings leading into them through the rack. These traps have floors constructed of slats which may be raised or lowered. While fishing, the floor is lowered and the lead through the rack is open. When it is desired to spawn the fish in the trap, the lead through the rack is closed and the floor is raised until the fish are partly out of the water. The hatchery men are then able to take the fish with ease. This method is used on the streams where a comparatively small number of fish are spawned daily. Such traps are used at the Green River hatchery near Auburn, Washington, and other places. Where large numbers of fish are to be spawned the drag seine is used. This net is swept through the river below the upper rack and the fish are brought into shallow water near the shore where they can be readily handled by the men. At Kalama, Wind River, and other places, platforms of slats are constructed in a shallow part of the river, down stream from the place where the seining is done. The platform is so arranged that it is easy to haul the seine with its catch of fish on to it, and as there is not more than one or two inches of water on this platform, the fish are rendered helpless and can be easily taken care of by the operators. The ripe males and females are quickly separated from the unripe, the latter being returned to the river, and the former retained for immediate spawning. The experienced spawn taker can as a rule tell by a look at the female whether she is ripe or not, but ordinarily he determines this by feeling the abdomen to determine whether the eggs are free or not. To get the best results, the fish should be perfectly ripe, otherwise a considerable number of the eggs will adhere to the tissues of the ovaries and the fertilization of those taken will not be as complete as if the female were dead ripe.

SPAWNING.

In the earlier years the method of taking the eggs was by a process called stripping. The ripe female having been captured and held carefully until she ceased to struggle, the operator then grasped the fish by the tail with his left hand, and held her body firmly between his left arm and his own body with the head high under his arm, and the tail pointing in a downward direction. He then proceeded to press out the eggs with a steady downward pressure along the abdomen, the stroke beginning just posterior to the pectoral fins and continuing to the vent. Several strokes were usually required before the operation was complete. The eggs were received in a moistened pan in which they were fertilized. By this method about 1 per cent of the eggs were destroyed by the pressure and on an average about 15 per cent remained in the female after the most skilled operator had finished his work. The stripping method of spawning salmon has been discontinued for several years, or since the incumbency of State Fish Commissioner L. H. Darwin, and is used only in taking the eggs of fish that spawn more than once in a lifetime.

Since the salmon spawns but once and then dies there is no necessity for preserving its life, so the stripping method has been superseded by the

method of incision. By this method the female is killed by a vigorous blow on the head with a club. The fish is then bled either by cutting the aorta just ventral to the gills, or by partially severing the head by cutting down from the dorsal surface until the dorsal aorta is severed. The bleeding is done in order to prevent the mixture of the blood with the eggs when the abdomen is opened, as much blood, when mixed with the eggs, interferes with their fertilization, probably because the blood clots around the eggs and prevents the access of the sperm. After the female has been thoroughly bled, the operator carefully slits the abdominal wall from the vent to the pectoral girdles, care being taken not to cut deeper than necessary, as the cutting of many eggs would liberate enough yolk material to interfere with the best fertilization. As soon as the incision is begun the eggs run out



Racks at Green River Hatchery near Auburn, Wash.

into a moist pan placed to receive them. On the completion of the incision the operator inserts his hand into the abdomen and gently shakes the remaining eggs loose from the meshes of the disintegrating ovaries. Eggs that adhere tightly to the ovaries should not be forcibly removed, as they are not ripe.

PROCESS OF FERTILIZATION.

In fertilization the main object is to bring the milt and eggs into contact as quickly as possible after they leave the body of the fish. Therefore, immediately after the eggs have been received in the spawning pan, one of the operators takes a ripe male and by a method similar to that used in stripping a female, forces the milt directly into the pan of eggs. The eggs are then gently stirred by the hand until the milt is thoroughly mixed with them. This may be facilitated by adding a little water to the pan after the milt has been introduced. At least an ounce of milt should be used to every

4,000 eggs. The eggs are almost instantly impregnated and washing may begin immediately after the germinal elements are thoroughly mixed. The washing is done by dipping the pan containing the eggs into the river until it is nearly full, then as soon as the eggs settle to the bottom, the water is carefully poured off. This process is repeated until all signs of milt have disappeared. The pans are now nearly filled with water and placed in racks, so that the lower half of the pan is in the water of the river. The eggs remain undisturbed for the next two hours during which the hardening process takes place. During this period the eggs are in such a delicate condition that the slightest disturbance is likely to cause injury. After the eggs have absorbed water until quite hard they are ready for removal to the hatchery.

Rutter has shown the importance of the time factor in the fertilization process. When mixed with water both eggs and sperm quickly lose their vitality. Rutter mixed fresh milt with water and then at intervals, portions of the mixture were used to fertilize freshly spawned eggs. He tabulated the following significant results:

Time milt had been in water.	Percentage of eggs fertilized.
0.25 minute	98
0.5 "	88
1 "	38
1.5 "	4

Eggs are not rendered nonfertilizable when placed in water quite so quickly as sperm, yet quickly enough to make it important that the fertilizing take place as quickly as possible after the eggs and sperm are extruded from the body.

Rutter's experiment with the eggs was similar to that with sperm. Eggs were mixed with water and at intervals portions of them were mixed with fresh milt. The following table shows the results:

Time eggs had been in water.	Percentage of eggs fertilized.
0.25 minute	98
0.5 "	96
1 "	95
2 "	57
3 "	17
4 "	4

It has been shown experimentally that if the milt and eggs were not mixed with water the vitality was retained for a much longer time. Milt kept in an open large-mouthed bottle was capable after 24 hours of fertilizing 74 per cent of the eggs with which it was mixed. Eggs exposed to the air in open pans but kept moist by the fluid of the body cavity were uninjured at the end of 30 minutes, as 99 per cent were fertilized when mixed with fresh milt. These and other experiments showed that water was not essential to fertilization, consequently the dry method of fertilization, as it is called, is the one now almost universally used. The outstanding and important conclusion resulting from all experiments and observations is that the milt and eggs should be brought together as quickly as possible after they leave the bodies of the parent fish.

TRANSPORTATION OF EGGS AFTER FERTILIZATION.

It has been the general belief until recently that eggs after fertilization could not be transported any considerable distance without great danger to them, consequently the practice has been to do the spawning as near as pos-

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UPPER RACK AND TRAP AT THE
GREEN RIVER HATCHERY



TRAPS FOR TAKING STEELHEADS AT PATEROS

sible to the hatchery, and that the eggs be carried thither with the greatest care. The method pursued was to attach the trays to yokes which were borne on the shoulders of the hatchery employees. It has been demonstrated conclusively by the Fisheries Department of the State of Washington (1913 to 1919) that these precautions were altogether unnecessary and that the eggs may be carried a considerable distance in automobiles over comparatively rough roads without appreciable injury.

The custom at the present time in the State of Washington is to seek the best possible spawning grounds without particular reference to their proximity to the hatcheries. At Kalama, for example, the most satisfactory place for taking the fish is four miles down stream from the hatchery. The racks are constructed at this place and all the work of spawning carried out. After the eggs are hardened they are put into the hatchery baskets. First a water-soaked gunny sack is spread over the bottom and along the sides of the basket, then about 30,000 eggs are placed in it and covered with another wet sack. The baskets are then placed in boxes which are made to hold six of them. The boxes are then transported in an automobile truck over the four miles of rough country road to the hatchery, where the gunny sacks are removed and baskets placed in the hatchery troughs. The results are found to be highly satisfactory, as no appreciable injury is done to the eggs. The adoption of this method of transportation has simplified a difficult problem found at more than one of the hatcheries of the state.

To test the ability of the eggs to be safely shipped for considerable distances at this stage of development, State Fish Commissioner Darwin had 30,000 eggs placed in a basket as described above and packed carefully in a box. This box was shipped by express from Kalama on the Columbia River to Bellingham. No marking of any kind was put on the box to indicate the contents or that any special care should be taken in handling it. It was found that practically no harm had been done to the eggs in transportation.

The author of this paper had a somewhat similar experience in transporting eggs. About 10,000 chinook eggs were spawned at the Green River hatchery and were allowed less than one hour to harden, when they were put on cotton flannel trays and packed in a box. They were then transported by automobile to the University of Washington, Seattle, a distance of about 25 miles. The automobile was driven rapidly so that the box containing the eggs was frequently severely jolted, but no serious injury was done to the eggs.

HATCHERY AND ITS EQUIPMENT.

The hatcheries are, for the most part, substantially constructed buildings, varying in size according to the number of eggs obtainable from the rivers on which they are located. Each hatchery usually consists of one very large room and one or more small ones. The large room is the hatchery proper and is filled to its capacity with hatching troughs. These troughs are usually 16 feet long with an inside width of 12 and a depth of 6 inches. They are arranged in pairs, with two or three pairs placed end to end in such a way that the water has a fall of three or four inches from the upper trough to the one next below. Each trough is divided into compartments about 26 inches in length by pairs of galvanized iron plates placed two

inches apart and known as riffle boards. These are so arranged that the upper plate of each pair forms a partition across the trough reaching from the bottom to about one inch from the top of the trough, while the lower one reaches from the top to within an inch of the bottom. This arrangement causes the water to flow over the upper and under the lower plate so that the water enters each compartment at the bottom of the trough at one end and leaves it at the top of the trough at the other end. The water is thus forced to flow upward through the basket giving the best possible supply to the eggs.

In these compartments are placed the hatching baskets. Each basket is about twenty-four inches long, 11 wide and 5 deep. They are made of woven wire with rectangular meshes five-eighths inch in length and varying in width, depending on the size of the eggs to be hatched in them. The eggs vary in size from those of the chinook, which are four-sixteenths to five-sixteenths of an inch in diameter, to those of the trout, which are about

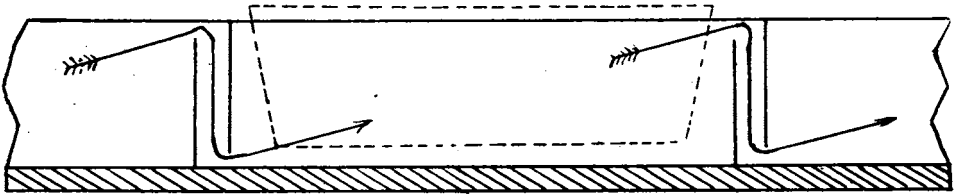


Fig. 1. A vertical section of hatching trough, showing the arrangement of riffle boards. Bent arrows indicate the flow of the water.

one-half of this diameter. The basket is supported in such a way that its bottom is about an inch above that of the trough.

The hatcheries of the state are provided with the means of excluding light from the hatching troughs. It has been found that the embryos and fry do not thrive nearly so well in the light as they do in the dark.

WATER SUPPLY.

An abundant and constant supply of the purest and most highly aerated water is necessary for the best results in fish culture. A river or stream with a rocky or gravelly bed in which the water is churned into foam by passing over falls or rapids will furnish the most highly aerated water, and the more highly aerated the water is the smaller the volume required to do a given amount of work. If the water cannot be well aerated it will be necessary to supply a proportionately larger quantity. Under favorable conditions not less than 3 to 4 gallons per minute should be allowed for each 100,000 eggs. In the hatcheries the aeration of the water is improved by causing the water to fall in thin sheets into the troughs.

Owing to the fact that there is always more or less sediment in river water and during times of freshets it is heavily charged with foreign matter, it has been found imperative to construct settling or filtering tanks through which the water passes before entering the hatching troughs. These tanks are arranged with screens, where necessary, to separate the lighter material, and are of such a size that the heavier material has plenty of time to settle out before the water reaches the overflow to the hatchery.

CARE OF THE EGGS.

It takes about six weeks for the eggs to hatch out, but the temperature is an important factor affecting the time. The colder the water the longer the time required for hatching. If the water is very cold the time may be lengthened by several weeks; on the other hand, the time is considerably shortened by a high temperature. The best results are obtained when the water is comparatively cold and constant in temperature.

During the period of development it is essential to successful results that the eggs be kept as clean as possible, that they be handled with proper care, and that they are supplied with an abundance of pure, well-aerated water.

Within 24 hours after the eggs have been placed in the hatching troughs the non-fertilized and the injured begin to turn white. These are removed each day by using a pair of tweezers, made of any convenient wood, the ends of which are tipped with a pair of wire loops of a convenient size for holding the eggs. During the first five or six days the eggs may be handled freely without danger, and during this period nearly all the bad eggs will have appeared and been removed.

It is conceded by all fish culturists that a critical period begins in the life of the embryo about the 5th or 6th day, which lasts for about two weeks. During this time the embryo is much more liable to suffer injury than at any other stage of its development; consequently, the custom has arisen of leaving the eggs absolutely untouched for this period. During these two weeks the eggs frequently become deeply covered with sediment, sometimes to such an extent that many of them are smothered. Again, it not infrequently happens that disease in the form of a fungus attacks the eggs and causes a very considerable mortality. In the State of Washington the hatchery men no longer neglect the eggs during this critical period but gently stir them up each day and remove all dead and diseased eggs. Their method is to gently raise the basket until the eggs are near the surface of the water, then to quickly lower the basket into its original place. The eggs settle down in a new position and the sediment passes through to the bottom of the trough. It has been found that by this new procedure the eggs suffer much less than when left untouched during this period. This movement of the eggs brings about a much better and more uniform aeration; all danger of suffocation is eliminated; the picking of the dead eggs removes the foci from which frequently spreads epidemics of fungous disease; and the young embryos develop more uniformly and are more uniformly strong and healthy.

After the critical stage has passed which is indicated by the presence of the black eye spots in the embryo, the baskets are removed while the troughs are thoroughly cleansed. The daily movement of the eggs and the removal of the dead ones are continued until the time of hatching which is three or more weeks later, depending on the temperature of the water. The extreme care in handling need not be observed after the eye spots have appeared, as the embryos have entered on a stage in which they are much hardier.

L. E. Baldrige of the Yes Bay station, Alaska, has developed to a high degree of efficiency a method of separating the dead eggs from the living.

and which is a great labor saver when there are large numbers of dead eggs to be removed. A brief description of this method follows: A tank, 4 feet long, 2½ feet wide, and 10 inches deep, is filled with a salt solution of such density that the living eggs sink in it and the dead ones float. The baskets of eggs are gently lowered into this solution and the floating dead eggs are carefully skimmed off; then the basket is lifted out and replaced in the hatching trough. It requires considerable skill in preparing the solution as there is but a very slight difference between the specific gravity of the living and the dead eggs. A full description of this method is given in document No. 766, published by the United States Bureau of Fisheries.

In the Washington state hatcheries this method is used only when accident or disease causes an unusual mortality among the eggs. By observing



Salmon fry shortly after hatching.

strict care and cleanliness and working the eggs over daily throughout the critical period the mortality is kept so low that very little labor is required in removing the dead eggs. There are possible advantages in giving the saline bath to the eggs, as it tends to prevent fungous growth and seems to stimulate the eggs, giving them a brighter, healthier appearance.

The hatching period covers nearly two weeks. The number hatched the first four or five days is usually small, then the rate of hatching increases very materially. After the young fish leave their shells they wriggle about until they work their way through the meshes of the basket and then drop to the bottom of the trough. Many of the shells are removed during the hatching period; on the completion of this period the baskets are taken out, all shells removed and the troughs made as clean as possible. About the

time the baskets are removed, each pair of riffle boards is replaced by a single perforated sheet of metal which makes a complete partition from the bottom to the top of the trough. This plate permits a ready flow of water through it but serves to keep the fry from crowding too much in one part of the trough and smothering one another as they would if all were allowed the freedom of the trough.

For the first ten or twelve days the fry lie in a comparatively helpless condition on the bottom of the trough, after this they begin to swim up and soon distribute themselves throughout the water.

The young fry, during the first six or seven weeks, obtain their nourishment from the contents of the ventral yolk sac. During this period they make no attempt to take any other nourishment. As the yolk approaches absorption hunger drives them to seek food. The practice among fish culturists during the earlier years was to liberate the fry at the time of complete yolk-sac absorption, and permit them to seek their natural food which consisted of small water crustaceans and insect larvae.

FEEDING THE FRY.

Observation has shown that fry liberated about the time of complete yolk absorption were weak and sluggish in their movements and not able to escape the ravages of numerous voracious enemies, consequently large numbers of them were destroyed. As a result of this discovery rearing ponds of various kinds have been constructed in connection with the hatcheries in which the fry are retained and fed until they are better able to take care of themselves.

At some places sections of small streams in the vicinity of the hatcheries have been enclosed by dams and used as rearing ponds; at other places artificial ponds of concrete have been constructed for this purpose. Some of them are under cover, others are exposed to the light. One of the most modern types of rearing ponds or tanks is at the state trout hatchery near Walla Walla. These tanks were designed by Mr. Mayhall, state superintendent of hatcheries. They are constructed of reinforced concrete, are square on the outside and round on the inside. They are six feet in diameter and 16 inches deep. The water is delivered to them from a trough running above them, and is supplied in such a way as to give it a rotary motion in the tanks. The outlet from each tank is through a pipe placed in the center, and which stands up from the bottom about 12 inches. There are 40 of these tanks in the hatchery, which have a total capacity of 400,000 trout fry. As the conditions under which this type of rearing equipment are so completely under the control of the operator the results obtainable should be of the best kind.

FOOD.

Almost every kind of food available has been used with very varied results. The food ordinarily obtained in nature by the fish themselves, as small water crustaceans and insect larvae, gives the best results, but this is too difficult and expensive to get. Finely ground, raw liver has given the best results of any of the easily obtained foods, but the high price has made it prohibitive. Fair results have been obtained by using the preserved, spawned-out salmon. These fish, after being spawned, were salted down and

packed in barrels until needed. When food was to be prepared some of these salted salmon were soaked for several days until all the salt had been removed. They were then thoroughly cooked with some wheat middlings, and before feeding ground as finely as possible, more recently the canned salmon known as "do-overs" has been extensively used. "Do-overs" is a term applied to cans of salmon which have been found defectively sealed after the first cooking and require after being resealed to be processed a second time in order to preserve them.

Carefully conducted experiments, by the author of this paper, show that this doubly cooked salmon gives but indifferent results, the young salmon not thriving on it nearly so well as those which were fed fresh salmon.

TRANSPORTATION OF EGGS AND FRY.

Shipping of fry is avoided as much as possible, as they require constant attention during the period of transit. When it is necessary to ship fry



Kalama hatchery. Covered rearing ponds on the left and hatchery on the right of the road.

they are placed in large cans of water (large milk cans serve the purpose well) and kept as cool as possible by the use of ice. In order to supply the amount of air necessary to keep them alive the attendants must, every few minutes, dip up water from the cans and let it fall from a considerable height back into the cans. The falling water absorbs a considerable amount of oxygen and at the same time carries much air in the form of bubbles to the bottom of the can. On arriving at their destination care must be taken that the fish are not changed to water that is much different in temperature, as sudden changes in temperature have a very harmful effect upon the fish.

Eggs just fertilized are seldom transported farther than from the spawning grounds to the nearest hatchery. When it is necessary to make

shipments for a considerable distance, the eggs are placed in cans of water kept as cool as possible with ice. At this stage of development there is little danger of their suffering for lack of air, as the germinal cells require a very small amount to keep them alive.

The best time for distribution of eggs is when the embryos are in the eyeing stage. At this period of development they are hardier and can be transported with the least attention. For transportation from one place to another in the state two kinds of shipping boxes are used, one for trout eggs and the other for salmon. The trout eggs, being more delicate than the salmon eggs, must be handled with greater care. The packing cases in which the trout eggs are shipped are of two sizes, one holding a single tier of twelve trays, and the other two tiers of 12 trays. These trays are made of perforated galvanized iron and are 12 inches square by about 1 inch in depth. They are constructed so that the bottom of the one fits deep enough into the top of the one below it that there may be no movement between them. Spaces are provided at the ends of each tier for sufficient ice to keep the eggs cool while on their journey. The bottom of each tray is covered with a piece of wet gunny sack or other cloth and upon this enough trout eggs are placed to nicely fill the space between it and the bottom of the tray that fits into it.

The boxes in which the salmon eggs are shipped are constructed so as to contain six of the ordinary hatching baskets, arranged in 3 rows of 2 each. The baskets are lined with wet gunny sacks and filled with 30,000 to 40,000 eggs. The upper baskets are supported by slats laid across the tops of the lower ones. In this way eggs are safely shipped from one hatchery to another in the state. Of course, if the eggs had to be shipped long distances greater attention would, of necessity, have to be given to them.

HATCHING SALMON FRY IN GRAVEL.

In 1910 John P. Babcock, Deputy Commissioner of Fisheries, British Columbia, suggested a new method of hatching salmon fry, which has since been developed by Mr. Robertson, superintendent of the Harrison, B. C., hatchery. As the method has met with excellent success under Mr. Robertson's management it cannot be out of place to give a brief description of it in this report. The method is an attempt to follow as closely as possible the conditions found in natural propagation. The equipment is very simple, consisting of a series of wooden boxes each of which is three feet long, one foot wide and 12 to 15 inches deep. The bottom is covered with coarse gravel to permit free passage of the water. The boxes are then filled with gravel that varies in size from two inches in diameter downward. The eggs, as soon as they are fertilized, are mixed with this gravel in the proportion of one part of eggs to ten of gravel, gravel and eggs being added alternately until within 2 inches of the top of the boxes. The water flows into the boxes on top of the gravel at the rate of 10 gallons per minute. The contents of the boxes are not touched again until the fry have emerged from the gravel. After the fry are hatched they wriggle about working their way gradually upward until about the time the yolk-sacs are absorbed, when they escape from the gravel and are ready to take care of themselves.

Mr. Robertson has been experimenting with this method for three or four years and claims that it gives much better results than the common hatchery method. He claims for this method that the fungous diseases are so completely eliminated that there is no danger whatever of the dead eggs doing any harm to the living, so that no attempt is made to remove the dead ones; again, the fry are more uniformly strong and healthy than those hatched in ordinary troughs; also, the hiding instinct is more highly developed by this method, as a consequence of which they are better able to take care of themselves when they make their escape into the streams. The expense item is also worthy of consideration. No expensive buildings are necessary as the eggs and fry are receiving the natural protection in the boxes; and as the eggs and fry are never touched all the care needed is for a watchman to see that a constant supply of water is furnished.

AN ANNOTATED LIST OF PUGET SOUND FISHES.

By TREVOR KINCAID, University of Washington.

Prepared at the Request of and Issued by

L. H. DARWIN.

State Fish Commissioner.

So many inquiries have been made in recent years in regard to our native fishes, it was deemed advisable to publish a brief popular survey of our fish fauna for the benefit of those interested in the marine life of this region.

The most recent list of the species of fish found in Puget Sound was published by Professor E. C. Starks of Stanford University in 1911. He enumerates 168 forms of fish life known to exist in our waters or recorded from contiguous Canadian territory with the presumption that they occur in Puget Sound. Several species have come to light since his paper was published and there is little doubt the number of kinds of fish in this region will be increased to at least 200 in the near future.

Many of the species now on record are extremely rare, although this may simply mean we do not know where or how to search for them. In some cases but a single specimen has ever been seen and a number are recorded from a knowledge of less than half a dozen examples. Some are strays from southern waters or have straggled down from Alaska, while others have been swept into Puget Sound by some unusual circumstance from the open ocean where they normally reside.

The richness of the Puget Sound fauna is doubtless due to the fact that we have here a meeting place for two great centers of marine evolution. Many species of animals originally developed in Alaska have gradually extended their range till they reached the Sound, while from the other great center off the shores of California a similar migration has occurred in times past. Thus Puget Sound is the southern limit of the distribution of many northern forms, while it is likewise the northern limit of a number of southern species.

The greatest diversity of fishes within our territory is to be found in the waters about the San Juan Islands, where a surprising diversity in depth and shore conformation make for a remarkable display of marine life. The central and southern sections of the Sound are, however, well provided with representatives of the finny tribes as may well be seen when the proper equipment is brought into use to compel them to emerge from their hidden haunts.

Owing to the limits of space it was deemed inadvisable to give detailed descriptions of the various species, but rather to point out a few of the more salient characteristics and to depend mainly on the use of copious illustrations to delineate as many as possible of the local forms. For those desiring to study our fishes in a more extended manner we would advise the use of the great monograph of the fishes of America published by Jordan and Evermann as Bulletin 47 of the United States National Museum, which is a veritable monument to the patience and taxonomic skill of the authors. For similar reasons it has been decided not to incorporate analytical keys of the species, as these involve a technical knowledge of fish anatomy which the average person is not likely to attempt to master. A further limitation of the present list is the exclusion of species confined to fresh water.

When we pass from the classification of our native fishes to a discussion of their habits and economic relations we discover a great hiatus, since little has been done along these lines except when some immediate economic stimulus has provided the spur to effort. Hardly a beginning has been made in this field of investigation.

Of the species listed at least 70 are definitely known to be of value as human food, but of course, many of these are not customarily marketed. Some of them are too small, others are rare or else do not attract the public taste in competition with well established food fishes. It is on the other hand rather obvious that most of the smaller varieties furnish food for the larger edible fish, and hence are of great indirect value in the maintenance of our fisheries.

In assembling the illustrations used in this report numerous sources were drawn upon. The majority of the cuts were originally published in the great monograph of American fishes previously mentioned and were made under the direction of Dr. David Starr Jordan of Stanford University. Several were taken from a bulletin of the United States Fish Commission dealing with the fishes of Alaska, written by Dr. B. W. Evermann. Professor Starks of Stanford has contributed a number of the important papers on the fishes of Puget Sound and several of his illustrations have been utilized. Use has also been made of figures prepared by Dr. Charles H. Gilbert, who has published many valuable papers dealing with the fishes of the Pacific. In a number of cases no illustration could be found in the literature available. To assist in the identification of such species closely similar forms, belonging to the same genus have been illustrated for comparison.

In attempting to point out the salient characteristics of the species enumerated in the following list, it is necessary to use some of the technical phraseology of the ichthyologist and a cut is therefore given to illustrate the more important superficial features in the structure of a fish. Where doubt exists as to the identification of fishes found in our waters, specimens may be sent to the College of Fisheries at the University of Washington where material is at hand for more exact comparison.

Many of our fishes are so seldom seen, even by persons in close contact with fishing operations, that but few of them have received common names, and many of these are more or less misleading. The names presented in the following pages are offered in the hope of filling this hiatus, although better ones will no doubt be evolved for many of the species as they become more familiar.

FAMILY 1. LAMPREY EELS; PETROMYZONIDAE.

In the strict sense of the word the lampreys are not really fish at all, but they are so fish-like in character it is customary to include them in a list of this group of vertebrates. They may be recognized by their elongate eel-like form, the absence of both the pectoral and ventral fins and the peculiar character of the mouth. No jaws are present, but in their place we have a sucking apparatus analogous to that of a leech.

Two species of lampreys occur in Puget Sound. The Sea Lamprey, *Entosphenus tridentatus* (Gairdner), (Fig. 1) is a large species several feet in length, which may be recognized by the form of the dorsal fin, the latter being divided into two separate parts. It has migratory habits similar to those of the salmon, leaving the sea and ascending the rivers to spawn. The Brook Lamprey, *Lampetra cibaria* (Girard), is a smaller species about five inches long. It

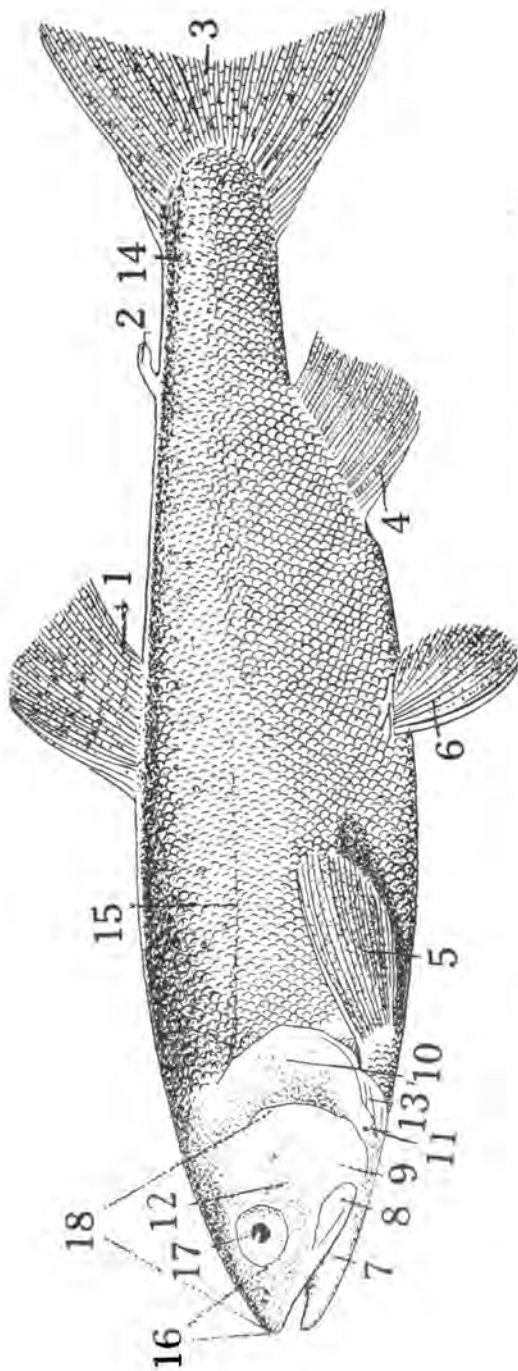


DIAGRAM OF A SALMON TO SHOW THE GENERAL EXTERNAL STRUCTURE

- | | | |
|------------------|---------------------------|----------------------|
| 1. Dorsal fin. | 7. Lower jaw. | 13. Branchiostegals. |
| 2. Adipose fin. | 8. Upper jaw. | 14. Caudal peduncle. |
| 3. Caudal fin. | 9. Lower part of cheek. | 15. Lateral line. |
| 4. Anal fin. | 10. Opercle. | 16. Snout. |
| 5. Pectoral fin. | 11. Lower opercular area. | 17. Eye. |
| 6. Ventral fin. | 12. Cheek. | 18. Head. |

differs from the Sea Lamprey in the form of the dorsal fins which are connected together so as to form a continuous structure. The Sea Lamprey is edible but is not commonly employed as food.

FAMILY 2. THE COW-SHARKS; HEXANCHIDAE.

Two species of this family are found in our waters. The Common Cow-Shark, *Hexanchus griseus* (Gmelin), (Fig. 3) is the most frequently seen of our larger sharks. It can easily be recognized by the presence of a single dorsal fin and the existence of six gill-clefts or openings into the gill chamber. It attains a great size, specimens over 28 feet in length being on record.

The Spotted Cow-Shark, *Notorhynchus maculatus* (Ayres), (Fig. 2) is a smaller and less common variety. Like the Cow-Shark it has a single dorsal fin, but the gill-clefts are seven in number. It is more slender in form than its relative, and as its name indicates it is covered with large black spots on a gray ground-color.

FAMILY 3. BLUE SHARKS; GALEIDAE.

Here belongs the beautiful Blue Shark, *Prionace glauca* (Linnaeus), (Fig. 4). This species attains dimensions of 25 feet but specimens of this size are rare in our waters. Two dorsal fins are present, but these do not have spines connected with them. The snout is long and sharp and the pectoral fin is elongate and wing-shaped. As suggested by the name, the color of this fish is bright blue-gray above and pale beneath.

FAMILY 4. CAT-SHARKS; SCYLLIORHINIDAE.

Only one member of this family is known to inhabit the Sound and it is very rare. The only specimens seen by the writer were taken in Hoods Canal. The Brown Cat-Shark, *Catulus brunneus* (Gilbert) may be recognized immediately by the peculiar form of the tail, which is bent downwards and not upwards as is almost invariably the case in other sharks. There are two dorsal fins, neither of which is provided with spines.

FAMILY 5. SCYMNOID SHARKS; DALATIDAE.

Here belongs the great Sleeper Shark, *Somniosus microcephalus* (Bloch). This species has no anal fin. The fins are all small and spines are lacking in the two dorsals. They are large clumsy fish, attaining dimensions of 25 feet, and are extremely ferocious.

FAMILY 6. DOG-FISHES; SQUALIDAE.

The most abundant of the sharks in our waters is the omnipresent Dog-fish, *Squalus sucklii* (Girard), (Fig. 5). It differs from the preceding species in that it has two dorsal fins, each provided with a long sharp spine. The anal fin is lacking and the lower lobe of the tail is comparatively small. This species has come into prominence recently, under the sobriquet of Grayfish, as an article of food. Owing to difficulties encountered in canning the packing of Grayfish has ceased for the present, but an excellent smoked product is put up, which commands a ready sale. The value of the Dog-fish in producing oil and fertilizer has long been recognized and great quantities have been taken from the Sound and utilized for these purposes.

FAMILY 7. RAYS AND SKATES; RAJIDAE.

The Rays are near relatives of the Sharks but are recognized by their strange flattened form. The wing-like extensions at the sides of the body represent the greatly modified pectoral fins of other fish. The tail is produced into a long whip-like structure and the gill openings are on the under side of the body. The eggs are laid in large brown cases from which the young escape when the yolk has been absorbed.

Three members of this family inhabit our waters. The Spotted Ray, *Raja binoculata* (Girard), is our commonest species. It becomes very large, specimens weighing over a hundred pounds being on record. The common name of this form is derived from the presence of two large eye-like spots on the back of the fish when it is young. These become faint as the animal grows older. The most distinctive structural feature of the Spotted Ray is the shape of the ventral fin which is regularly concave on its free margin. The Snouted Ray, *Raja rhina* (Jordan and Gilbert), is similar to the Spotted Ray but the snout is sharper and the ventral fins are of a different shape, a large rounded notch being present on the free border. The Spiny Ray, *Raja stellulata* (Jordan and Gilbert), (Fig. 6) resembles the two species just described, but differs in the presence of a great number of small spines over the surface of the body. The snout is blunt and rounded and the ventral fin is deeply notched on its free margin.

FAMILY 8. RAT-FISHES; CHIMAERIDAE.

The common Rat-fish, *Chimaera coliaei* (Lay and Bennett), (Fig. 7) is our only representative of this curious group which bridges the gap between the elasmobranch and teleost fishes. The gill openings are not exposed as in the shark but are protected by an operculum as in the higher fishes. The head is clumsy and irregular and the body tapers off to a long slender tail. The teeth resemble the incisors of a rat, which accounts for the common name. The eyes are large, prominent and of an opalescent greenish color. In the male a strange knobbed structure is found attached to the top of the head. The body is beautifully mottled with gray and silvery white. The rat-fish is valuable for the oil which is extracted from the liver.

FAMILY 9. STURGEONS; ACIPENSERIDAE.

Members of this family are recognized by the absence of scales which are replaced by rows of great bony plates which extend along the sides. The snout is shovel-shaped and has five long barbels hanging down in front of the mouth.

Two species of sturgeon occur in our waters. The White Sturgeon, *Acipenser transmontanus* (Richardson), (Fig. 8) is a fish which attains an immense size, specimens weighing 1,000 pounds having been taken. Like the salmon it ascends the rivers to spawn. The sturgeon is a valuable food fish and the roe is suitable for the manufacture of caviare. It was so eagerly fished it has become quite scarce.

The Green Sturgeon, *Acipenser medirostris* (Ayres) is a near relative of the White Sturgeon but does not attain such a great size. It is of a peculiar greenish hue, with light olive stripes on the ventral surface. It is not valued as a food fish and by some is thought to be poisonous, although this belief is not justified.

EXPLANATION OF FIGURES.

1. Sea Lamprey, *Entosphenus tridentatus* (Gairdner).
2. Spotted Cow-Shark, *Notorhynchus maculatus* (Ayres).
3. Cow-Shark, *Hexanchus griseus* (Gmelin).
4. Blue Shark, *Prionace glauca* (Linnaeus).
5. Dog-fish, *Squalus sucklii* (Girard).
6. Spiny Ray, *Raja Stellulata* (Jordan and Gilbert).
7. Rat-fish, *Chimaera colliaci* (Lay and Bennett).
8. Sturgeon, *Acipenser* sp.
9. Pacific Herring, *Clupea pallasii* (Cuvier and Valenciennes).
10. Snipe Eel, *Nemichthys avocetta* (Jordan and Gilbert).
11. California Sardine, *Sardinia caerulea* (Girard).
12. Northern Anchovy, *Engraulis mordax* (Girard).
13. Shad, *Alosa sapidissima* (Wilson).
14. Dog Salmon or Chum, *Oncorhynchus keta* (Walbaum).



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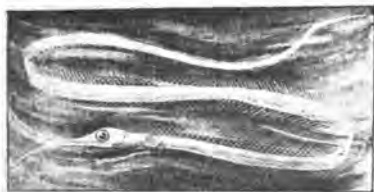
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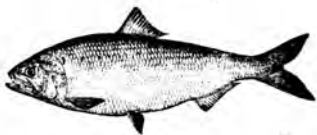
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FAMILY 10. SNIPE EELS; NEMICHTHYIDAE.

The Pacific Snipe Eel, *Nemichthys avocetta* (Jordan and Gilbert), (Fig. 10) is a strange and comparatively rare fish. It is a long snake-like creature, about two feet in length and one-third of an inch in thickness. The jaws are long and slender like the beak of a snipe, hence the name. It is almost transparent and is practically invisible as it swims through the water.

FAMILY 11. HERRINGS; CLUPEIDAE.

The members of this family, of which we have three species in our local waters, are constructed upon the plan of the common herring. The body is covered with large rounded scales. There is no adipose fin and the ventral fins are located well back on the under side. The tail is deeply forked. There are no scales on the head.

The Pacific Herring, *Clupea pallasii* (Cuvier and Valenciennes), (Fig. 9) is very closely related to the herring of the Atlantic. It is one of our most important food fishes and is destined to form the basis of an immense industry in the years to come. The young fish are already packed in great quantities on the California coast as sardines and in Alaska the salting of herring has assumed considerable proportions.

The California Sardine, *Sardinia caerulea* (Girard), (Fig. 11) resembles the herring but can be distinguished from the latter at a glance by the presence of a fan-shaped group of ridges on the gill cover. The lack of teeth in the roof of the mouth is also diagnostic as these are not present in the sardine. This fish is closely allied to the pilchard of Europe and is a most desirable food fish as it is superior in many respects to the herring.

The Shad, *Alosa sapidissima* (Wilson), (Fig. 13) is not native to our waters but was introduced into the Pacific a number of years ago and has now multiplied extensively. The general anatomical peculiarities of the shad follow the lines of the herring, but the body is deeper and the breast and belly possess saw-like serrations. It spawns in fresh water. This species is little appreciated as a food fish on the Pacific Coast, but is growing in importance.

FAMILY 12. ANCHOVIES; ENGRAULIDAE.

This family is closely related to the herrings, but may be distinguished by the large size of the mouth and the overhanging snout, which extends beyond the mouth opening.

The Northern Anchovy, *Engraulis mordax* (Girard), (Fig. 12) is a slender, graceful fish with a bluish back and silvery sides. It is a valuable food fish, but is little used at present, although some are canned as sardines on the California coast. The species attain a length of 7 inches.

FAMILY 13. SALMON AND TROUT; SALMONIDAE.

From an economic standpoint this family of fishes overshadows all others on the Pacific Coast, since it includes the five species of Pacific Salmon which form such a conspicuous feature in the preserved fish trade of the world.

The most characteristic structure in the anatomy of members of this group is the curious organ known as the adipose fin. This is not confined to the Sal-

monidae, however, as it exists in several other families of fishes. The ventral fins are far back on the body. The body is covered with circular scales, but these are absent from the head. The dorsal fin has from 9 to 15 rays. A lateral line is present on the side. Three genera are represented in our fauna.

The fish known commercially as Pacific Salmon are zoologically different from the Atlantic Salmon, the former belonging to the genus *Oncorhynchus* while the latter is a species of *Salmo*. The technical differences between these two genera are rather finely drawn, but the crucial point is in the count of the rays in the anal fin. In *Salmo* the number ranges from 9 to 12, while in *Oncorhynchus* there are from 14 to 20. Five species of Pacific Salmon exist in our waters.

The Chinook Salmon, *Oncorhynchus tshawytscha* (Walbaum), (Fig. 15) is the noblest of the salmon tribe since it outranks all other species in size and quality. Specimens are on record weighing more than 100 pounds. In different parts of its range it has been given a number of common names such as Tye, King, Quinnot, Spring, etc. The technical points that mark this species from its relatives are as follows: The gillrakers number from 20 to 25. The scales are of medium size, 135 to 155 in longitudinal series. The branchiostegal rays number from 15 to 19. The back and upper fins are marked with round black spots.

The Sockeye, *Oncorhynchus nerka* (Walbaum), (Fig. 17) is known in other parts of its range as Blueback and Red Salmon. It is of immense economic importance because it constitutes the main run of salmon in the rivers of Alaska and British Columbia. It is discriminated by the following combination of characters. The gillrakers are numerous, ranging from 30 to 40. The scales are large. The count of scales on the lateral line is about 130, while the number of branchiostegal rays is from 13 to 15. The color is clear blue above and silvery on the sides. In the adult there is no black spotting, but in the young fish obscure markings are present. During the breeding period the color changes, more or less dark red appearing on the back and sides. The Sockeye attains a length of two feet and a weight of from 3 to 7 pounds. It does not run in rivers that are unconnected with lakes.

The Silver Salmon or Coho, *Oncorhynchus kisutch* (Walbaum), (Fig. 16) stands third in commercial importance among the Salmon. It attains a length of 15 inches and a weight of from 3 to 8 pounds. It is particularly abundant in Puget Sound and is particularly valuable as a fresh product. The Silver can be recognized by its peculiar bluish green back and silvery sides. Spots are absent except a few obscure markings on the upper portions of the body. The scales are relatively large, with 125 to 135 in longitudinal series. The anal fin has 13 or 14 rays while the branchiostegals number the same.

The Humpback or Pink Salmon, *Oncorhynchus gorbuscha* (Walbaum), (Fig. 18) is the smallest species in the genus, attaining a weight of 3 to 6 pounds. It is regarded as of inferior merit as a canned product but considerable quantities of it are put up for the market. It may be distinguished by the scales, which are very small, with more than 200 in longitudinal series, and by the large oblong markings on the tail fin. The number of anal rays is 15 while in the branchiostegals 11 or 12 are present. The color of the back is

EXPLANATION OF FIGURES.

15. Chinook or Spring Salmon, *Oncorhynchus tshawytscha* (Walbaum).
16. Silver or Coho Salmon, *Oncorhynchus kisutch* (Walbaum).
17. Sockeye or Red Salmon, *Oncorhynchus nerka* (Walbaum).
18. Humpback or Pink Salmon, *Oncorhynchus gorbuscha* (Walbaum).
19. Steelhead Trout, *Salmo gairdneri* (Richardson).
20. Cut-throat Trout, *Salmo mykiss* (Walbaum).
21. Dolly Varden Trout, *Salvelinus malma* (Walbaum).
22. Surf Smelt, *Hypomesus pretiosus* (Girard).
23. Eulachon or Candlefish, *Thaleichthys pacificus* (Richardson).
24. Pacific Smelt, *Osmerus thaleichthys* (Ayres).
25. Lantern-fish, *Myctophum* sp.
26. Lancet-fish, *Plagyodus ferox* (Lowe).
27. Sparkler, *Arctozcenus coruscans* (Jordan and Gilbert).
28. Sand Lance, *Ammodytes personatus* (Girard).
29. Tube Snout, *Aulorhynchus flavidus* (Gill).



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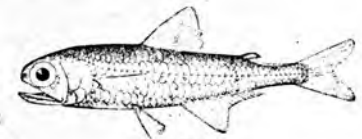
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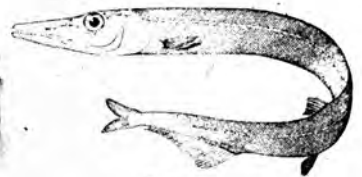
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blue, that of the sides silvery. Numerous small black dots are scattered over the dorsal surface.

The Dog Salmon or Chum, *Oncorhynchus keta* (Walbaum), (Fig. 14) is an abundant species in Puget Sound, but has not been utilized extensively until recent years, when the pressure for fish has brought it into the market. The scales are of medium size with 135 to 155 in longitudinal series. The anal rays and branchiostegals both vary from 13 to 14. The color is dusky above, with the sides paler. Black markings are absent or faintly indicated. The Dog Salmon attains a weight of 11 or 12 pounds. It runs in quite small streams and spawns near the sea.

The genus *Salmo* contains species that are, zoologically speaking, close kin to the Atlantic Salmon. We have three species in this region, but only two appear in the salt water.

Salmo gairdneri (Richardson), (Fig. 19) is the scientific name of the fish known as the Steelhead or Salmon Trout. This is one of our most valuable food fishes, since it is abundant in all of our coastal streams and attains a considerable size. Specimens may weigh up to 20 pounds, although the average is apt to be 5 or 6. Unlike the Pacific Salmon the Steelhead does not perish after spawning, but like its relative, the Atlantic Salmon, may return to the sea. Great quantities of this species are used, both fresh and canned. The Steelhead may be immediately separated from the Pacific Salmon by the lesser number of rays in the anal fin, the usual count being 11. The back of the Steelhead is dark blue and the sides silvery with a band of rose color running lengthwise. Numerous small black dots are scattered over the upper surface of the body, but not extending below the lateral line. The strip of red on the lower jaw so characteristic of the Cut-throat Trout, is lacking.

The Cut-throat Trout, *Salmo mykiss* (Walbaum), (Fig. 20) is ordinarily thought of as a fresh-water fish, but it descends to the estuaries of the rivers which it inhabits and may be found in salt water at considerable distances from any stream. It is extremely variable in its characteristics, and in some instances is hard to distinguish from the steelhead. The most constant mark of the species is the streak of red on the lower jaw, which gives rise to the common name. The scales are smaller than in the Steelhead and the black spotting is spread over the area below the lateral line and intensified in the region of the tail.

The Dolly Varden Trout, *Salvelinus malma* (Walbaum), (Fig. 21) is technically not a trout at all, but a charr. It has a number of common names including Bull Trout, Oregon Charr, etc. Aside from the anatomical peculiarities of this fish its color distinguishes it immediately from all allied forms. The sides are marked with round red spots which extend as smaller markings to the back. The delicate reticulate coloration, so characteristic of the brook trout and other charrs, is lacking. Like the Cut-throat Trout, the Dolly Varden is primarily a fresh water fish, and is merely a visitor in the brackish and salt water where it is so frequently found.

FAMILY 14. SMELTS; ARGENTINIDAE.

The smelts have much in common with the Salmonidae in structure. As in the latter an adipose fin is present. The ventral fins are small and are near the middle of the body. The dorsal fin is short and nearly median. The tail fin is deeply forked. Three genera are represented in our fauna, each with a single species.

The Surf Smelt, *Hypomesus pretiosus* (Girard), (Fig. 22) is an excellent food fish common in Puget Sound. It attains a length of a foot. The body is covered with scales of moderate size. The angle of the jaw extends to the middle of the eye, while anteriorly the lower jaw protrudes beyond the upper. It is light olive in color with a silvery band along the side. The eggs are laid in the surf.

The Eulachon or Candlefish, *Thaleichthys pacificus* (Richardson), (Fig. 23) is the finest of the smelts. The flesh is oily and of very delicate texture. The scales are small and firmly set in the skin. The mouth is large and the angle of the jaw extends beyond the middle of the eye. The color is pale with numerous fine dark dots over the upper surface. They are about a foot long and enter the rivers to spawn early in the spring.

The Pacific Smelt, *Osmerus thaleichthys* (Ayres), (Fig. 24) is a common fish in our waters, but is not highly regarded for its food value. It is smaller than the other smelts and its flesh is soft, although of agreeable flavor. The scales are of moderate size and loosely attached. The teeth are better developed than in the allied forms, those on the tongue being unusually large. The pectoral fins are elongated, reaching to the base of the ventrals.

FAMILY 15. LANTERN-FISHES; MYCTOPHIDAE.

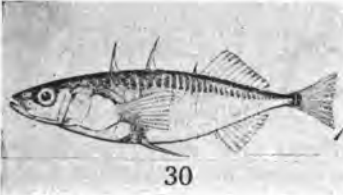
These are small deep-water fishes somewhat resembling smelt, since a small adipose fin is present. The scales are of relatively great size and along the sides occur a number of round clear spots, which in the live fish are phosphorescent, giving these fish their common name. Two species of this family occur in our waters. *Myctophum californiense* (Eigenmann and Eigenmann), (Fig. 25) may be termed the Pacific Lantern-fish. No figure of this species was available and an allied species of *Myctophum* has been reproduced in the accompanying cuts. Bean's Lantern-fish, *Tarletonbeania crenularis* (Jordan and Gilbert) is an allied form known from a few examples taken at widely separated points. It differs from *Myctophum* in the absence of a lateral line, as well as in other anatomical details.

FAMILY 16. LANCET-FISHES; PLAGYODONTIDAE.

In this family we have one of the rare species occasionally seen on our coast. The Lancet-fish, *Plagyodus ferox* (Lowe), (Fig. 26) is a large and ferocious creature, with long sharp teeth set in the wide opening mouth. The body tapers from head to tail and the dorsal fin, which is very high, extends nearly its whole length. The tail is long and deeply forked. The length of the fish is about three feet.

EXPLANATION OF FIGURES.

30. Alaska Stickleback, *Gasterosteus cataphractus* (Pallas).
31. Gray-lined Pipe-fish, *Syngnathus griseolineatus* (Ayres).
32. Barracuda, *Sphyraena* sp.
33. Mackerel, *Scomber* sp.
34. Pompano or Butterfish, *Rhombus* sp.
35. High Brow, *Zaprora silenus* (Jordan).
36. Willoughby's Rag-fish, *Acrotus willoughbyi* (Bean).
37. Bridled Surf-fish, *Brachyistius frenatus* (Gill).
38. Viviparous Perch, *Cymatogaster aggregatus* (Gibbons).
39. White Perch, *Damalichthys argyrosomus* (Girard).
40. Viviparous Perch, a female with the young enclosed.
41. White Surf-fish, *Phanerodon furcatus* (Girard).



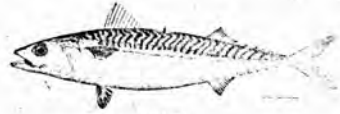
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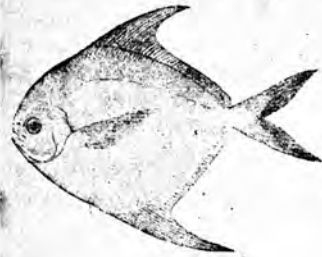
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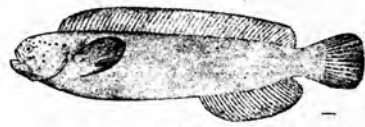
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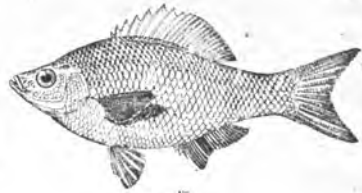
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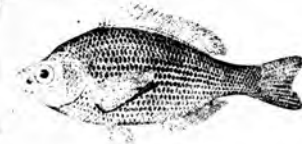
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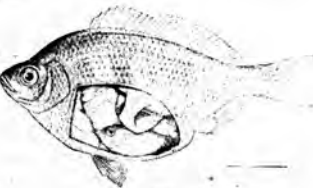
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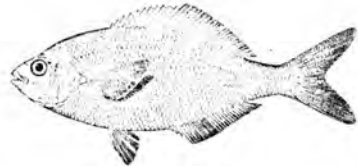
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FAMILY 17. THE PARALEPIDS; PARALEPIDIDAE.

The rare fish known as *Arctozenus coruscans* (Jordan and Gilbert), (Fig. 27) which may be termed the Sparkler, is the only member of this family recorded from our region. Only one specimen is known to exist. It was taken at Port Townsend in 1880. The Sparkler is a small fish resembling a miniature Barracuda and is noteworthy for a row of phosphorescent spots on the lower jaw, which suggests the common name.

FAMILY 18. SAND LANCES; AMMODYTIDAE.

The common Sand Lance, *Ammodytes personatus* (Girard), (Fig. 28) is the sole type of this family found locally. It is a small silvery fish, six to eight inches in length found along our shores, and having the peculiar habit of burying itself in the sand. The jaws are without teeth and the ventral fins are lacking. The dorsal fin is low and continuous. The body is covered with small scales and ends in a deeply forked tail. They are edible and are used also for bait.

FAMILY 19. TUBE-SNOUTS; AULORHYNCHIDAE.

In this family we have small odd-looking fish with the snout drawn out into a tubular projection. The eyes are large. Scales are absent and the tail is small and deeply forked. Our only species is the common Tube-snout, *Aulorhynchus flavidus* (Gill), (Fig. 29).

FAMILY 20. STICKLEBACKS; GASTEROSTEIDAE.

Sticklebacks are usually classed as fresh water fish, since they are abundant in interior lakes and streams, but marine and brackish water species are present along our coast. The Alaska Stickleback, *Gasterosteus cataphractus* (Pallas), (Fig. 30) is our local marine form. It is a small fish devoid of true scales, the latter being replaced by a series of large vertical oblong plates. The dorsal fin is preceded by several free spines and a large stout spine is developed in connection with the ventral fin. The damage done by the Stickleback is out of proportion to his size as he is able to kill the fry of larger fish, notably the salmon, for which reason the Stickleback is known locally as the Salmon Killer.

FAMILY 21. PIPE-FISHES; SYNGNATHIDAE.

Fishes of this family are the nearest relatives we have of the sea-horses so common in southern waters. The group is represented with us by the Gray-lined Pipe-fish, *Syngnathus griseolineatus* (Ayres), (Fig. 31). The body is extremely long and slender and is enclosed in a tough covering of bony plates. The snout is long and narrow, terminating in toothless jaws. The tail fin is small and fan-shaped, while the ventrals are absent. Fishes of this genus have unusual breeding habits, the male possessing a pair of pouches on the under side of the body in which the female places the eggs till they are hatched.

FAMILY 22. BARRACUDAS; SPHYRAENIDAE.

The Silver Barracuda, *Sphyraena argentea* (Girard), (Fig. 32) is not a common fish in Puget Sound, as this is the northern limit of the species, which is notably abundant in the waters of California. The Barracuda may be recognized by its long pike-shaped body, large mouth and projecting lower jaw. The

teeth are long and sharp. The two dorsal fins are small and widely separated. The lateral line is straight. The scales are small. It is a valuable food fish, but is not taken in sufficient numbers to enter into the market.

FAMILY 23. FIATOLES; STROMATEIDAE.

Like the Barracuda our local representative of the Stromateidae, the California Pompano or Butterfish, *Rhombus simillimus* (Ayres), (Fig. 34) may be regarded as a straggler from more southern climes, since it is comparatively rare in Puget Sound. Lacking a suitable illustration of the local species, a cut of a closely related form has been utilized in the plates.

The species known on the Pacific Coast as the California Pompano is not a true Pompano, since the latter belongs in an entirely different family of fishes, the Carangidae. The resemblance between the two types is quite superficial.

In the Butterfish or California Pompano the body is greatly flattened side-wise, and terminates in a mouth armed with feeble teeth. The cheeks are covered with scales, and the lateral line is well developed. The anal fin is much like the dorsal, and the tail is broadly forked. It attains a length of 10 inches and is a good food fish.

FAMILY 24. MACKERELS; SCOMBRIDAE.

Fishes of this family may be recognized by the unusual character of the dorsal fin, since the last rays are detached and form a series of separate finlets. The same structure appears in the anal fin. The head is pointed and the colors are richly metallic.

The California Bonito, *Sarda chilensis* (Cuvier and Valenciennes), is a large fish two to three feet in length and weighing 12 to 16 pounds. It is rare in our waters. The body is a dark metallic blue and the tail has a keel on either side.

The Chub Mackerel, *Scomber japonicus* (Hutuyn), is a near relative of the true Mackerel, but is a much less valuable fish. The latter *Scomber scomber* (Linnaeus), (Fig. 33) is the form figured in the plates. The Chub Mackerel is rare in Puget Sound. It has two keels on either side of the base of the tail fin. The color is blue with a number of wavy streaks of black on the back above the lateral line.

FAMILY 25. RAG-FISHES; ACROTIDAE.

A rare straggler from the outer ocean is our sole representative of this family, namely Willoughby's Rag-fish, *Acrotus willoughbyi* (Bean), (Fig. 36). The first specimen of this fish was taken on the outer coast of Washington but examples have now been taken as far south as Tacoma in Puget Sound. It is a strange fish, measuring between five and six feet in length, entirely devoid of scales, with a large caudal fin and lacking the ventral fins. The body is soft and yielding as the bones are cartilaginous, indicating a normal deep-water habitat.

FAMILY 26. POMFRETS; BRAMIDAE.

The Pomfret, *Brama raii* (Bloch), is reported from the northern section of Puget Sound. It is an excellent food fish. The body is compressed, of an oblong shape and covered with small scales. The mouth is very oblique. The dorsal and anal fin each have their three anterior rays developed as spines. The color is sooty gray with black on the vertical fins. It attains a length of three or four feet.

FAMILY 27. HIGH-BROWS; ZAPRORIDAE.

This is a rare and curious fish not yet observed in Puget Sound, but as it was taken on the inner coast of Vancouver Island it is probable it will be taken on our side of the line. It has a large coarse head with an elevated front which caused the learned savant who described it to call it *Zaprora silenus* (Fig. 35). Since the Greek from which the generic name is derived may be freely translated as "high-brow" the writer is responsible for the common name here applied.

FAMILY 28. SURF-FISHES; EMBIOTOCIDAE.

This family is one of the most characteristic groups of fishes found on the Pacific Coast. Their main distribution is southern, but we have in our fauna seven species, some of which are exceedingly abundant in Puget Sound. They are small perch-like fish from 6 to 18 inches in length. The anal fin has three spines and more than 15 soft rays. The lower pharyngeals are united.

The White Perch or Pacific Porgee, *Damalichthys argyrosomus* (Girard), (Fig. 39) is a species attaining a length of 15 inches. It is very abundant, but is not regarded highly as a food fish the flesh being dry and tasteless. The dorsal fin has 10 spines and 23 rays. The color is pale with a silvery luster.

The Striped Perch, *Taeniotoxa lateralis* (Agassiz), is a brightly colored fish rather common in the Sound. It is reddish above, becoming bright orange below. The rows of scales have blue edgings which gives the fish a delicately striped appearance. It is edible and attains a weight of two pounds.

The Common Surf-fish or Black Perch, *Embiotoca jacksoni* (Agassiz), is a species with a somewhat mottled and variable coloration. The ground color is brown, shading into yellow on the under side, and variegated with mottlings of blue, red or yellow. The sides have a number of faint vertical dusky bars. It attains a length of 12 inches and is classed as one of our edible fishes.

The Bridled Surf-fish, *Brachyistius frenatus* (Gill), (Fig. 37) is one of the rare species of this group. It is greenish brown above, shading into coppery red on the belly. The scales are flecked with blue and black dots. The fins are all bright red. It reaches a length of eight inches.

The Silver Surf-fish, *Amphistichus argenteus* (Agassiz) is recorded from the Straits of Fuca. Its general coloration is silvery, the sides being ornamented with vertical bars and spots of brassy green. It is abundant on sandy shores and reaches a length of one foot.

The White Surf-fish, *Phanerodon furcatus* (Girard), (Fig. 41) is re orded from Vancouver Island and enters the Straits of Fuca. It is light olive above, shading into silvery below.

The Viviparous Perch, *Cymatogaster aggregatus* (Gibbons), (Fig. 38) is exceedingly abundant in Puget Sound. The schools of young may be seen swimming about wharves in shallow water and are spoken of as Shiners. It is the smallest of the species in this family, attaining a length of six inches. Specimens vary greatly in details of color, some of the individuals being very dark. The scales have groups of black points which unite to suggest a longitudinal striping. These stripes are interrupted by several vertical bands of yellow. This species is edible but its small size renders it unsuitable for the market.

The strange habit of this fish, in common with other members of this family, of bringing forth its young alive, has attracted considerable attention, since this phenomenon is rare in the fish world. As many as 36 young in various stages of development have been found in the brood sack of the mother animal.

FAMILY 29. CROAKERS; SCIAENIDAE.

The only representative of this large family of southern fishes that extends its range into our territory is the California White Sea Bass, *Cynoscion nobilis* (Ayres). As might be expected, it is rare with us. It is a large fish, attaining a weight of 20 to 80 pounds. The body is compressed and is covered with ctenoid scales. The head is large and scaly and the caudal fin is rounded. The dorsal fin is notched to make two distinct parts. The color is bluish with fine spotting. Lacking a picture of this species, we have used a drawing of an allied but somewhat different species belonging to the same genus (Fig. 42).

FAMILY 30. HEAD-FISHES; MOLIDAE.

On several occasions in recent years specimens of the immense Head-fish, *Orthogoriscus mola* (Bloch), (Fig. 43) have been brought into Seattle from the Straits of Fuca and from the open sea beyond the Cape. Specimens are on record weighing nearly a ton. The name of the species is derived from the curious formation of the body, which has the appearance of a great head minus the major part of the trunk. The great dorsal and anal fins stand one above the other, while the tail fin has a sinuous outline.

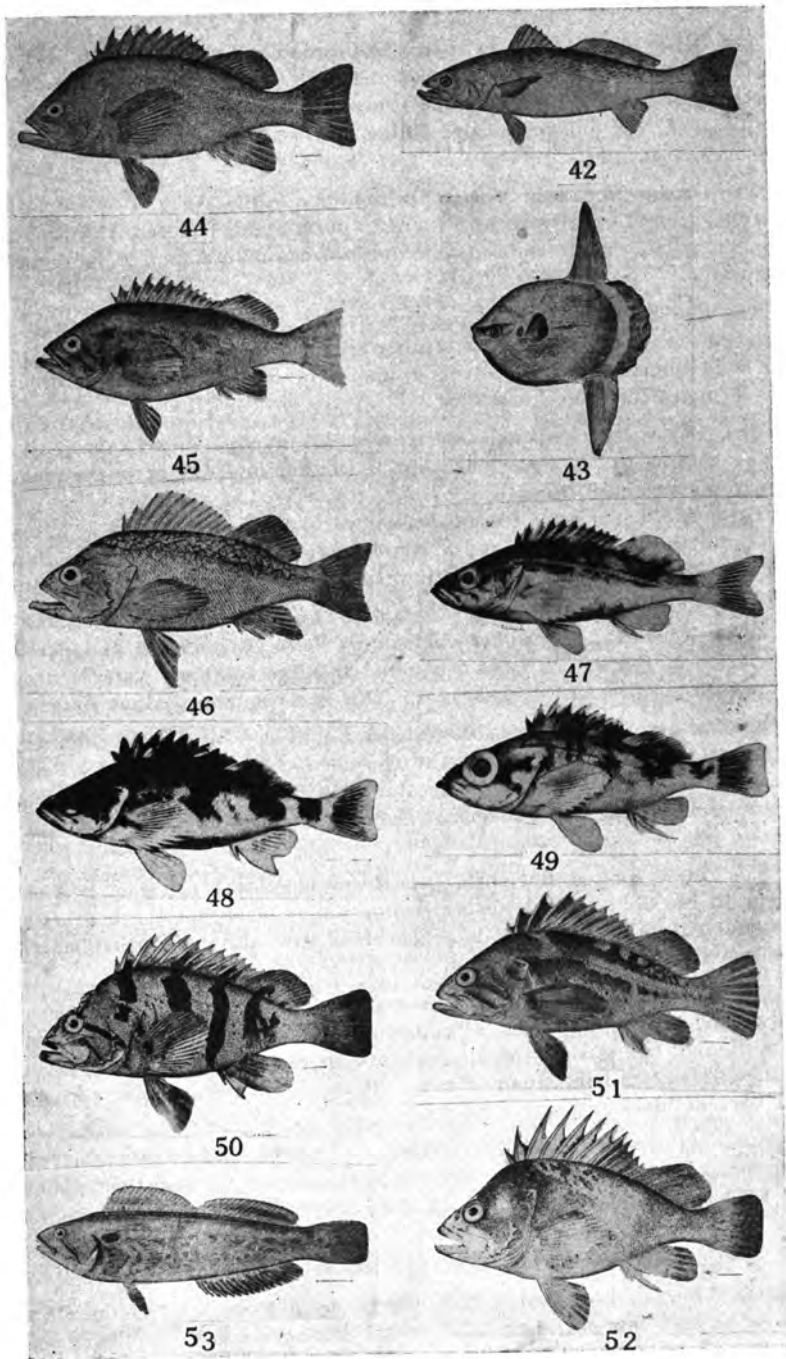
FAMILY 31. ROCK-FISHES; SCORPAENIDAE.

This family constitutes one of the most important and valuable groups of fishes found on the Pacific Coast. About 260 species are on record throughout the world, of which 13 are known to inhabit Puget Sound. They are bass-like in appearance with spines on the operculum. The dorsal is continuous but notched so as to mark the two portions of the fin. The head is crossed by ridges which in many cases terminate in spines. In this, as in several of the families that follow, a characteristic feature is the presence of a bony bar extending from beneath the eye across the cheek. All of our Puget Sound Rock-fishes belong in the genus *Sebastes*.

The Black Rock-fish, *Sebastes melanops* (Girard), (Fig. 44) is one of our abundant species. It is 20 inches in length and is a valuable food fish. It is dark greenish brown in color blotched with slaty black.

EXPLANATION OF FIGURES.

42. Sea Bass, *Cynoscion* sp.
43. Head-fish or Giant Sun-fish, *Orthogoriscus mola* (Bloch).
44. Black Rock-fish, *Sebastes melanops* (Girard).
45. Priest-fish, *Sebastes mystinus* (Jordan and Gilbert).
46. Orange Rock-fish, *Sebastes pinniger* (Gill).
47. *Sebastes clavilatus* (Starks).
48. Dean's Rock-fish, *Sebastes deani* (Starks).
49. *Sebastes emphaeus* (Starks).
50. Black-banded Rock-fish, *Sebastes nigrocinctus* (Ayres).
51. Northwestern Rock-fish, *Sebastes caurinus* (Richardson).
52. Yellow-backed Rock-fish, *Sebastes maliger* (Jordan and Gilbert).
53. Red Greenling, *Hexagrammos superciliosus* (Pallas).



The Priest-fish, *Sebastes mystinus* (Jordan and Gilbert), (Fig. 45) is very much like the preceding but has a spine over each eye. It is even darker in color than the Black Rock-fish, the prevailing hue on the upper surface being slatey black. The sides are paler and somewhat mottled. It is not so common as *S. melanops*.

The Orange Rock-fish, *Sebastes pinniger* (Gill), (Fig. 46) is a large and handsome representative of the family. It is richly colored, the ground tint being gray, but this is mottled with large areas of orange. It is abundant in deep water.

The Red Rock-fish or Red Snapper, *Sebastes ruberrimus* (Cramer) is the largest of this group of fishes, attaining a length of 30 inches or over. In color it is a brilliant vermillon. It is common in deep water and is brought to market in considerable quantities.

The Alaska Red Rock-fish, *Sebastes introniger* (Gilbert), is of the same reddish cast as the Red Rock-fish but is smaller and differs in certain details of anatomical structure.

Three small species of *Sebastes* named by Professor Starks, *S. deani* (Fig. 48), *S. clavilatus* (Fig. 47), and *S. emphaeus* (Fig. 49), occur in the San Juan Islands. They are somewhat similar in appearance, the ground color being reddish brown with irregular darker mottling over the back and sides.

Dall's Rock-fish, *Sebastes auriculatus dalli* (Eigenmann and Beeson), is a variation of the Brown Rock-fish found in more southern waters. It is pale brown with mottlings of darker color. This is a common shallow water species.

The Yellow-backed Rock-fish, *Sebastes maliger* (Jordan and Gilbert), (Fig. 52) is reported as being abundant in the northern section of Puget Sound. It reaches a weight of 6 pounds. In color it is light brown with rich mottlings of yellow on the back and extensive yellow markings on the breast and under parts.

The Yellow-spotted Rock-fish, *Sebastes nebulosus* (Ayres), is a common variety in the Sound. The general coloration is black but the body is spotted and speckled with yellow. It is a good food fish, although rather small, as it measures about one foot in length.

The Black-banded Rock-fish, *Sebastes nigrocinctus* (Ayres), (Fig. 50) is a large and beautiful species, attaining a length of 2 feet. It is not common in the Sound, but is reported as abundant in the Straits of Fuca. Specimens are taken about the San Juan Islands. It is orange red in color with five vertical bars of black.

The Northwestern Rock-fish, *Sebastes caurinus* (Richardson), (Fig. 52) is a species that is taken in abundance in the Sound and constitutes an important food fish. It is dark brown in color washed with copper.

FAMILY 32. GREENLINGS; HEXAGRAMMIDAE.

This family is represented in our fauna by five species. In these the body is covered with fine scales and the dorsal fins are united. A single nostril is present on either side of the head. The anal fin is elongate. They are carnivorous fishes of medium or large size inhabiting the kelp beds of the North

Pacific. Three of our species are classed in the genus *Hexagrammos* and constitute the true greenlings. They differ from the other members of the family in that the lateral line is branched, as many as five parallel lines being present on the side. The greenlings are often called Rock-trout and Kelp-cod. As they are in no wise related to either the trout or the cod family it would seem unfortunate to saddle these names upon the fishes.

The Ten-lined Greenling, *Hexagrammos decagrammus* (Pallas), (Fig. 55) attains a length of 18 inches and is an excellent food fish. Five distinct divisions of the lateral line may easily be traced across each side of the fish. Two pairs of small dermal flaps are present on the head in this form, whereas only one pair occurs in other species of greenlings. Scales are present over the entire surface of the cheek.

The Red Greenling, *Hexagrammos superciliosus* (Pallas), (Fig. 53) can be separated from the preceding by the absence of one of the pairs of small fleshy flaps on the head. It is extremely variable in color and is often finely mottled, which make the common name somewhat of a misnomer. Scales are present on the sides of the head except over the bony stay and the interopercular bone. It is equal in size and food value to the preceding species.

Steller's Greenling, *Hexagrammos stelleri* (Tilesius), (Fig. 56) resembles the preceding species, but the cheeks and opercular bones are almost free from scales and the dermal flaps are much smaller. As in the other species, there is a wide range of color.

The Ling Cod, *Ohtodon elongatus* (Girard), (Fig. 54) which is also known as the Cultus Cod and Blue Cod, is one of our large and valuable food fishes. It is marketed in the fresh state in large quantities. Efforts have been made to can it, but the results have not been entirely satisfactory. It attains a weight of 60 pounds and a length of five feet.

The Ling Cod, which by the way is related neither to the Lings nor to the Cods, may be distinguished from other members of its family by the presence of a single lateral line, the large mouth with powerful teeth, and the development of spines on the preoperculum. The ground color is dark brown, much mottled with rusty spots, shading into bluish green on the under side.

The Painted Greenling, *Oxylebius pictus* (Gill), (Fig. 57) is one of our most brilliantly colored fishes. It is common about docks where it may be seen nosing up and down the piles. It attains a length of 10 inches. The body is relatively deeper than in other members of this family and the snout is acutely pointed. The sides are traversed by alternate vertical stripes of black and of pale orange. It is not used for food.

The Broad-finned Greenling, *Zaniolepis latipinnis* (Girard), may be recognized by the great height of the dorsal fin and the presence of several exceedingly long free spines at its anterior end. The scales are small and very rough. It is edible but is not abundant. Its length is about 12 inches.

FAMILY 33. SKIL-FISHES; ANOPILOPOMATIDAE.

This family is a small one, containing but two genera, each with a single species, but both of these are of great interest. The group is closely allied to the preceding family, the *Hexagrammidae*, and by some authors the two are united.

The Black Cod or Skil-fish, *Anoplopoma fimbria* (Pallas), (Fig. 58) which is of course no relative of the true cod, has come into extensive use as a food fish in recent years, and is now supplied abundantly in our markets. It attains a length of two feet or more and, as its name indicates, is very dark in color. The body is gracefully formed, with two well-separated dorsal fins. The tail fin is set on an elongated base and is formed for speed. The scales are minute and ctenoid. The anal fin has three spines. Two nostrils are present on either side.

The Giant Sea-bass, *Erilepis zonifer* (Lockington), (Fig. 59) was originally described in 1880 from a specimen one foot in length taken at Monterey, California, but in recent years it has been discovered to exist in the North Pacific as a fish of great size, measuring 8 feet in length and of considerable weight. It is not related to the true sea-bass which belongs to the family *Serranidae*, a group not represented in our fauna. No better name has been suggested for the fish up to the present time.

Erilepis resembles the Black Cod, but is a much larger species, as has been indicated, and differs in the form of the body, which is much deeper and bass-like. The dorsal fins are united, the point of union being indicated by a deep notch. No specimens have been taken within the limits of Puget Sound, but a number of examples have been captured on the neighboring Canadian shore.

FAMILY 34. SCULPINS; COTTIDAE.

This is an immense family of fishes, represented in our waters by 28 species. The group is a difficult one to define on account of the wide range of characters. In common with several families already discussed these fishes have a bony bar across the cheek. The head is usually spiny. The dorsal fins are as a rule separate or slightly connected. The tail fin is rounded at the margin and the pectoral is large. A lateral line is present. The preoperculum is usually provided with one or more spines. The ventral fins are attached to the thoracic region. Very few of the sculpins are used as food, although the larger species may be classed among our edible fishes.

Jordan's Sculpin, *Jordania zonope* (Starks), (Fig. 60) is a small species about four inches in length. It has an unusually long dorsal fin. The ventral fins have one spine and five rays. The back is covered with rough scales.

The Perch-like Sculpin, *Radulinus asprellus* (Gilbert), (Fig. 61) is a slender species five or six inches in length with two spines on the operculum and a very short spinous dorsal fin. The back is covered with rough scales. A series of keeled plates is present on the lateral line.

The Darter Sculpin, *Radulinus boleooides* (Gilbert), is like the preceding but smaller, being only 3 or 4 inches in length. The space between the eyes is covered with scales, whereas in *R. asprellus* this space is scaleless.

Bean's Sculpin, *Triglops beani* (Gilbert), (Fig. 62) is a long slender fish, 5 to 7 inches in length, bearing upon each side a row of bony plates along the base of the dorsal fin. The breast is without scales, but the skin is thrown into fine cross folds. The color is olive brown with a stripe of dark brown along the side and four large blotches on the back.

The Spotted Sculpin, *Triglops macellus* (Bean), is similar to the preceding, but has a conspicuous black spot on the snout just above the edge of the maxillary.

The Rough-backed Sculpin, *Chitonotus pugetensis* (Steindachner), (Fig. 62) has the back clad with rough scales above the lateral line. The preoperculum has a long spine armed with three antler-like processes. The lateral line has a row of keeled scales. The fish is 6 inches in length.

The Broad-headed Sculpin, *Stelginotus latifrons* (Gilbert and Thompson), (Fig. 63) is a bright green species with a broad interspace between the eyes, and lacking spines on the head. A single curved spine is present on the preoperculum. It is a rare form, only two specimens having been taken, both at Friday Harbor.

Meany's Sculpin, *Ruscarius meanyi* (Jordan and Starks), (Fig. 66) is apparently a rare species since no additional specimens have been secured since the types were collected in Port Orchard in 1895. It was named in honor of Professor Edmond S. Meany of the University of Washington. The back of the fish is covered with rough scales, the head being particularly rough. There are no bony plates along the base of the dorsal fin. The spine on the preoperculum is long and bifurcate. The length of the specimens was one and one-half inches.

The Northern Sculpin, *Icelinus borealis* (Gilbert), (Fig. 65) has a set of enlarged plates along the lateral line and another series along the back, but the space between these is devoid of scales. There are a number of processes on the preoperculum. No filamentous spines are developed in connection with the dorsal fin. The length is 4 inches.

The Reindeer Sculpin, *Tarandichthys filamentosus* (Gilbert), is so named from the antler-like processes on the preopercular spine, which suggest the horns of the reindeer. Another striking feature is the development of the anterior spines of the dorsal fin which are lengthened and filamentous. This species is three and one-half inches in length.

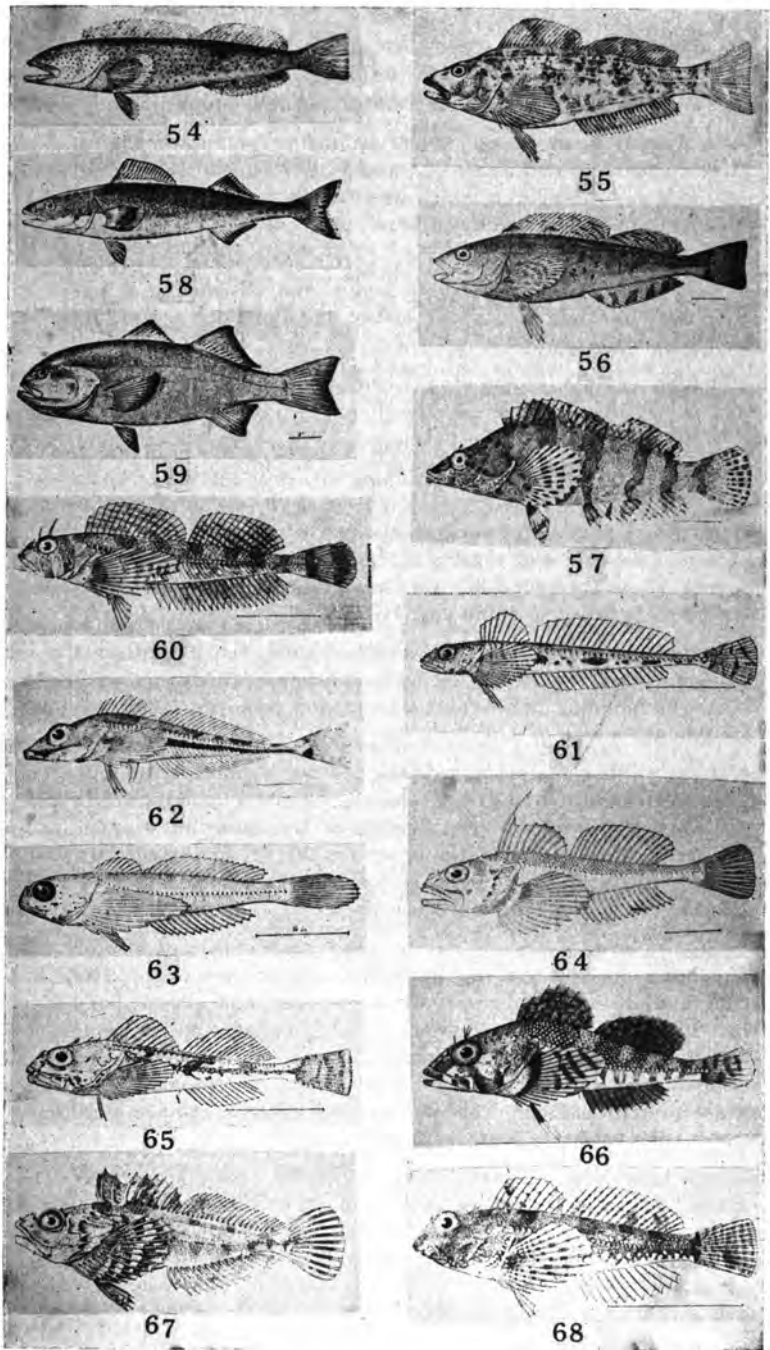
The Star-topped Sculpin, *Astrolytes fenestralis* (Jordan and Gilbert), is about five inches in length, and is distinguished by the presence of a number of star-shaped scales on the top of the head. The lateral line is unarmed and the preopercular spine is provided with a single hooked process. None of the dorsal spines are filamentous in form.

Harrington's Sculpin, *Axyrias harringtoni* (Starks), (Fig. 68) was first taken at Port Ludlow, Washington, in 1895 and was named in honor of Dr. Mark W. Harrington, who was at that time President of the University of Washington. It was later found in the San Juan Islands by Mr. Starks. It is about four inches long and has a considerable development of short cirri on the top of the head. The space between the eyes is concave. The ground color is olive with five bars of brown on the back.

Artedi's Sculpin, *Artedius lateralis* (Girard), is another of the small sculpins. It is similar to *Axyrias* but is five inches in length, the cirri are absent from the top of the head, and the space between the eyes is flat. In color it is richly mottled with olive, red and black.

EXPLANATION OF FIGURES.

54. Ling Cod or Cultus Cod, *Ophiodon elongatus* (Girard).
55. Ten-lined Greenling, *Hexagrammos decagrammus* (Pallas).
56. Steller's Greenling, *Hexagrammos stelleri* (Tilesius).
57. Painted Greenling, *Oxylebius pictus* (Gill).
58. Black Cod or Skil-fish, *Anoplopoma fimbria* (Pallas).
59. Giant Sea-bass, *Erilepis zonifer* (Lockington).
60. Jordan's Sculpin, *Jordania zonope* (Starks).
61. Perch-like Sculpin, *Radulinus asprellus* (Gilbert).
62. Bean's Sculpin, *Triglops beani* (Gilbert).
63. Broad-headed Sculpin, *Stelginotus latifrons* (Gilbert and Thompson).
64. Rough-backed Sculpin, *Chitonotus pugetensis* (Steindachner).
65. Northern Sculpin, *Icelinus borealis* (Gilbert).
66. Meany's Sculpin, *Ruscarius meanyi* (Jordan and Starks).
67. Red Sculpin or Irish Lord, *Hemilepidotus hemilepidotus* (Tilesius).
68. Harrington's Sculpin, *Axyrias harringtoni* (Starks).



The Red Sculpin or Irish Lord, *Hemilepidotus hemilepidotus* (Tilesius), (Fig. 67) is one of our larger species, extending over 18 inches. The back and sides have two separate bands of rough scales and the spinous dorsal is notched.

The Great Sculpin or Kalog, *Myoxocephalus polyacanthocephalus* (Pallas), (Fig. 74) is a species which attains a length of two feet. The top of the head is covered with small warty protuberances. The preopercle has three strong straight spines. The dorsal fins are barely in contact.

The Buffalo Sculpin, *Enophrys bison* (Girard), (Fig. 71) is one of our common species. It is about a foot in length and has a long simple spine on the preopercle. The body is without scales, but along the lateral line there is a band of coarse bony plates.

The Smooth Sculpin, or Cabezon, *Leptocottus armatus* (Girard), (Fig. 70) is abundant everywhere throughout the Sound region. The skin is smooth and the head is oblong. No cirri are developed. The preopercular spine is strong, with two or three points hooked upwards. The dorsal fins are separate. It attains a length of 12 inches.

The Marbled Sculpin, *Scorpaenichthys marmoratus* (Girard), is the largest of our cottoid fishes since it attains a length of 30 inches and a weight of 20 to 25 pounds. It is used for food but the flesh is coarse. The skin is smooth and the ventral fin has one spine and five rays.

The Round-headed Sculpin, *Blennicottus globiceps* (Girard), is a species with a perfectly smooth skin lacking both scales and prickles. The preopercular spine is short and blunt with the point turned upwards. The snout is very blunt. It reaches a size of 4 to 7 inches.

The Moss-dwelling Sculpin, *Oxycottus embryum* (Jordan and Gilbert), (Fig. 73) is a small species found living among the rocks and seaweeds along the shore. In its structure it is very similar to the following species, the main difference being in the form of the spine on the preoperculum. In *Oxycottus* it is simple while in *Oligocottus* it is forked. This species varies greatly in color, ranging from green to maroon. It is less than three inches in length and is quite rare.

The Johnny or Tide-pool Sculpin, *Oligocottus maculosus* (Girard), (Fig. 72) exists in countless numbers along our shores, and every pool left by the retreating tide has its quota. It is one of our smallest species, seldom measuring as much as three inches. The skin is smooth and the color ranges widely from green to gray or crimson, the darker mottling being also highly variable. The fins are prettily barred. The preopercular spine is slender and forked.

The Woolly Sculpin, *Dasycottus setiger* (Bean), (Fig. 69) is a species having a very large head with numerous bony tubercles over its surface. The skin covering the head supports a large number of filamentous growths which suggest the common name. The skin is without scales and the preoperculum bears two spines at its angle. The tail fin is rounded in outline. It attains dimensions of 8 inches.

Kincaid's Sculpin, *Malacottus kincaidi* (Gilbert), is related to the two preceding species. It is entirely devoid of scales and the spinous dorsal is separated from the posterior part of the fin by a deep notch. The preoperculum

is armed with three slender diverging spines. A series of mucous pores is arranged along the lateral line and similar pores are scattered over the surface of the head. All of the fins are more or less barred and mottled. The back and sides are gray with a number of irregular dark blotches.

The Sailor-fish, *Nautichthys oculofasciatus* (Girard), (Fig. 75) is a species of such unusual appearance one would hardly take it to be of the sculpin family. Its name is derived from the formation of the first dorsal fin, which is short and greatly elevated so as to suggest a triangular sail. Another striking characteristic is a broad band of black which passes diagonally through the eye. It is perhaps to be expected that a deep-water sailor-fish would carry a black eye. Specimens range up to 6 inches in length.

The Cirrhatid Sculpin, *Blepsias cirrhosus* (Pallas), (Fig. 76) is another species that departs rather widely from the general run of Sculpins. Its body is compressed so as to be quite thin and the head is comparatively small. The skin is devoid of scales, but is covered with small prickles. The first dorsal is elevated and is divided into two portions by a deep notch, the second portion being much the smaller. The second dorsal and the anal fin are relatively large. In color it is dark olive above, shading into yellow beneath. The back and sides are marked with black blotches and with several areas having a metallic sheen. Mature specimens are about 6 inches in length.

The Red-finned Sculpin, *Ascelichthys rhodorus* (Jordan and Gilbert), (Fig. 77) is a smooth species in which the ventral fins are entirely absent. The dorsal fins are connected by a membrane. In the living fish the first dorsal fin is edged with bright crimson. It is reported as abundant at Neah Bay.

The Tadpole Sculpin, *Psychrolutes paradoxus* (Gunther), (Fig. 78A) is one of the smallest of the *Cottidae*. It is seldom more than two inches in length, and is devoid of both scales and spines. The body is covered with loose movable skin. The color is creamy white mottled with dark blotches.

Gilbert's Sculpin, *Gilbertidia sigalutes* (Jordan and Starks), is similar to *Psychrolutes* but differs among other things in the shape of the dorsal fin, which is much larger in *Gilbertidia* and more elevated in front. The color of Gilbert's Sculpin is dusky, with hazy darker markings on the back about the front of the dorsal and above the base of the tail. It is two and one-half inches in length.

FAMILY 35. GRUNT-FISHES; RHAMPHOCOTTIDAE.

This is a small family, containing but a single genus with one known species of fish. It is allied to the great family of the sculpins, but has characters which link it up to another important group known as the Sea-poachers or *Agonidae*.

The Grunt-fish, *Rhamphocottus richardsoni* (Gunther), (Fig. 78B) is one of the most singular of our local species. The head is very large in proportion to the body and is rough with a number of projecting bony prominences, which would delight the heart of a fish phrenologist. The skin is without scales which are replaced by small prickles. The first dorsal is small, fitting into a groove in the back. The lower rays of the pectoral fin are free from the membrane. The eyes are large and prominent. The color is creamy white, with irregular oblique stripes passing downward across the sides. Mature specimens are about

three inches in length. When lifted from the water these fish produce a peculiar vibrant grunting sound which has caused the application of the above common name.

FAMILY 36. SEA-POACHERS; AGONIDAE.

This family, sometimes known as Alligator Fishes, is related to the Sculpins but may be recognized by the armature of bony plates which encloses the body. Most of our twelve species are of small size, and none are of any direct value as food for man. Many of the forms are of singular appearance.

The Spineless Sea-poacher, *Aspidiophoroides inermis* (Gunther), may be recognized by its close-fitting vestiture of smooth plates and the lack of sharp angles or spines. No figure of our local species was available so a closely allied form, native to Alaska, is used to illustrate the type (Fig. 79).

The Masking Sea-poacher, *Bothragonus swani* (Steindachner), (Fig. 81) is unquestionably the most singular fish inhabiting Puget Sound. The head is greatly out of proportion to the body, and in the top of the cranium there is a deep oval pit about the margin of which is a series of tooth-like spines, thus simulating a widely opened mouth. When viewed from above there is the suggestion of a caricature of the human countenance, the great pit in the skull representing the mouth, while the surrounding plates are grouped to simulate the forehead, cheeks, nose and chin. Only two specimens are known to exist. The type was collected at Port Townsend in 1876 by Judge Swan, after whom the species was named by Steindachner, and is now in the collection of the Imperial Austrian Museum in Vienna. The second specimen was taken in the San Juan Islands, and is now in the collection of the University of Washington.

The Four-horned Sea-poacher, *Hypsagonus quadricornis* (Cuvier and Valenciennes), (Fig. 85) is a singular fish with four rows of spines along each side of the body. The first dorsal is relatively large and high. On the top of the head are four strong horn-like spines which suggest the common name. The general color is gray, with several vertical bands of black across the body and fins.

Pallas' Sea-poacher, *Pallasina aix* (Starks), is a species with a long slender body and an elongated tubular snout. The plates enclosing the body are keeled, but lack spines. An allied form, *P. barbata*, (Fig. 80) is figured in the plates.

The Sturgeon Sea-poacher, *Podothecus acipenserinus* (Pallas), (Fig. 82) has a general appearance which suggests a small sturgeon. A fringe of barbels depending from the snout increases the similitude.

The Inky Sea-poacher, *Averruncus emmelane* (Jordan and Starks), (Fig. 84) has a very rough external surface, and is covered everywhere with rough coarse plates and spines. The general coloration is so dark as to suggest the above specific name. The ground color is, however, relieved through the presence of some beautiful white markings, especially on the fins, which are handsomely mottled.

The Black-finned Sea-poacher, *Bathygonus nigripinnis* (Gilbert), is a long slender fish with rough spiny exterior, and with the pectoral fins divided by a notch into two portions, the lower section being composed of simple spines. All of the fins are intensely blue-black. This species has been recorded from the

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outer coast of Washington, but no specimens have been reported from Puget Sound.

The Broad-headed Sea-poacher, *Xeneretmus latifrons* (Gilbert), is a familiar form in Puget Sound. In common with three other species of this genus which follow, it has a peculiarly formed pectoral, this fin being divided by a deep notch into two portions, the lower of which is composed of greatly thickened rays which are simple and longer than those of the upper lobe. The inter-orbital space is unusually narrow in the Broad-headed Sea-poacher which gives this form its specific name.

The Three-spined Sea-poacher, *Xeneretmus triacanthus* (Gilbert), (Fig. 83) differs from the preceding in minor anatomical details.

The Alaskan Sea-poacher, *Xeneretmus alaskanus* (Gilbert), is the third of these closely related forms. It differs from the two preceding forms in having three vertical spines on the rostral plate rather than one. The breast is composed of numerous plates.

The Weak-spined Sea-poacher, *Xeneretmus infraspinalus* (Gilbert), is very similar to *X. alaskanus*.

The Pitted Sea-poacher, *Odontopyxis trispinosus* (Lockington), rather suggests the Masking Sea-poacher but is much more slender in build. A pit is present on the top of the head but lacks the inwardly projecting spines of *Bothragonus*.

FAMILY 37. LUMP-SUCKERS; CYCLOPTERIDAE.

Here we have a small family of short, thick fishes having a ventral sucker-like organ formed by a modification of the ventral fins. By means of this structure they are able to cling to rocks or other submerged objects, a peculiarity which has led to the assignment of the common name. The body is covered with a skin lacking in scales and either smooth or warty. The spinous dorsal is distinct. Two species of these odd fish are recorded from our waters.

The Warty Lump-sucker, *Eumicrotremus orbis* (Gunther), attains a length of four inches. It is rounded in form and swims clumsily. The skin is covered with numerous warty projections. It is fairly common.

The Smooth Lump-sucker, *Lethotremis vinolentis* (Jordan and Starks), (Fig. 86) is known by a single specimen. It is a tiny sub-globular fish, half an inch in length, with a smooth skin and two distinct dorsal fins.

FAMILY 38. SEA-SNAILS; LIPARIDAE.

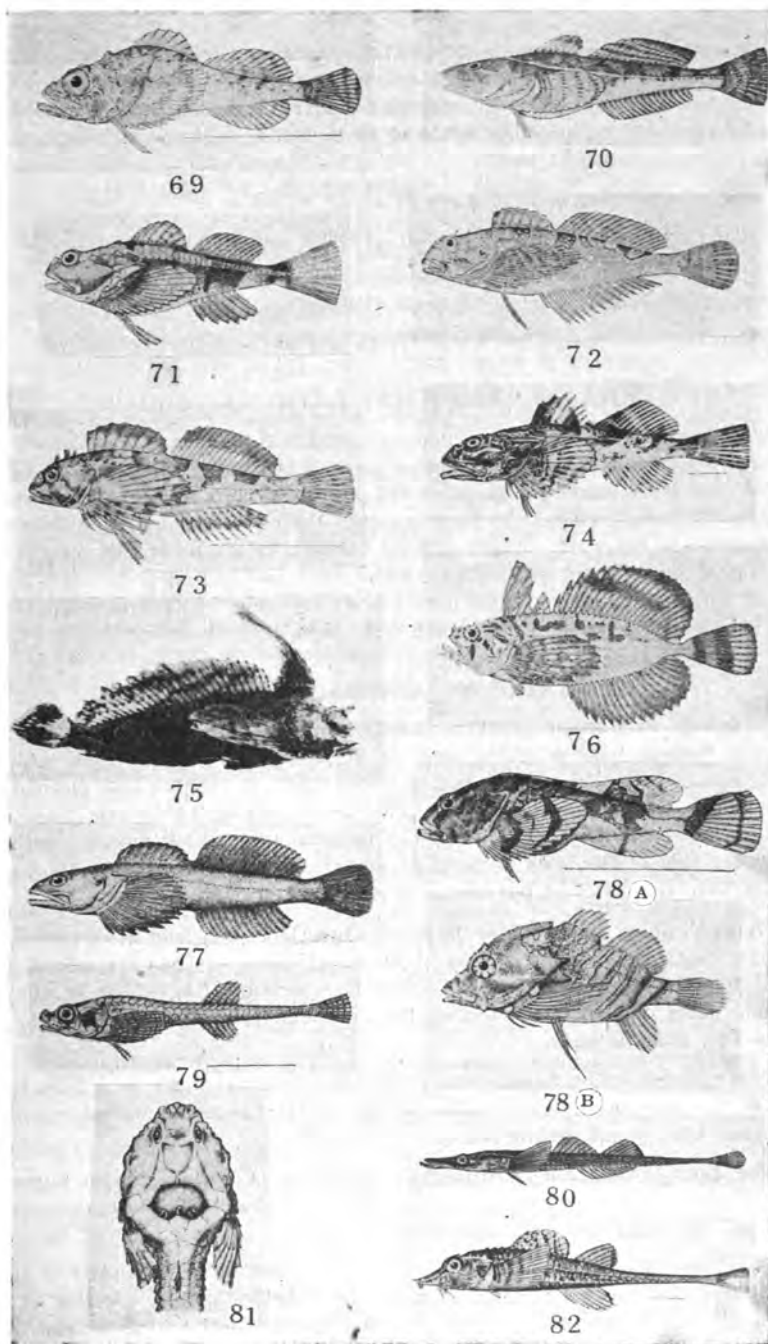
A group of tadpole-shaped fishes with a loose scaleless skin. The dorsal fins are joined to form a continuous structure. The ventral fins are modified as in the preceding group to form a sucking disk. Seven species of this family are on record from this region. All of these are placed in the genus *Liparis* and the specific distinctions are in some cases so technical they are hard to discriminate. Most of them are of small size, rarely more than six inches in length. The several species may be enumerated as follows:

Green's Sea-snail, *Liparis greeni* (Jordan and Starks), (Fig. 87).

Flora's Sea-snail, *Liparis florae* (Jordan and Gilbert).

EXPLANATION OF FIGURES.

69. Woolly Sculpin, *Dasycottus setiger* (Bean).
70. Smooth Sculpin, *Leptocottus armatus* (Girard).
71. Buffalo Sculpin, *Enophrys bison* (Girard).
72. Johnny or Tide-pool Sculpin, *Oligocottus maculosus* (Girard).
73. Moss-dwelling Sculpin, *Ozycottus embryum* (Jordan and Gilbert).
74. Great Sculpin or Kalog, *Myzocephalus polyacanthocephalus* (Pallas).
75. Sailor-fish, *Nautichthys oculoasciatus* (Girard).
76. Cirrhated Sculpin, *Blepsias cirrhosus* (Pallas).
77. Red-finned Sculpin, *Ascelichthys rhodorus* (Jordan and Gilbert).
- 78A. Tadpole Sculpin, *Psychrolutes paradoxus* (Gunther).
- 78B. Grunt-fish, *Rhamphocottus richardsoni* (Gunther).
79. Spineless Sea-poacher, *Aspidtophoroides* sp.
80. Pallas' Sea-poacher, *Pallasina* sp.
81. Masking Sea-poacher, *Bothragonus swani* (Steindachner).
82. Sturgeon Sea-poacher, *Podothecus acipenserinus* (Pallas).



Beautiful Tooth Sea-snail, *Liparis callyodon* (Pallas), (Fig. 88). The origin of the scientific name of this species is rather odd. When it was first studied by Pallas in 1811 in material derived from Alaska he noticed the peculiar tricuspid teeth of the fish, and he therefore called it *callyodon*, a Greek word meaning beautiful tooth.

Round-finned Sea-snail, *Liparis cyclopus* (Gunther).

Denny's Sea-snail, *Liparis dennyi* (Jordan and Starks). Named in honor of Mr. Charles L. Denny of Seattle.

Straits Sea-snail, *Liparis fucensis* (Gilbert).

Beautiful Sea-snail, *Liparis pulchellus* (Ayres).

FAMILY 39. RONQUILS; BATHYMASTERIDAE.

This small family is represented by a single species in Puget Sound. It is known as Jordan's Ronquil, *Ronquilus jordani* (Gilbert), (Fig. 89). The body in this fish is elongated, suggesting the blenny type, and the skin is covered with small ctenoid scales which extend onto the cheeks. Along the lateral line the scales are enlarged. There are no barbels, crests or spines on the head. The dorsal fin is long and high, and the anal has a similar formation. The lateral line is conspicuous and high up on the side. The coloration is quite variable, some specimens being much more beautifully marked than others.

FAMILY 40. GOBIES; GOBIIDAE.

Although five species of this family are recorded from Puget Sound or adjacent waters, none of them seem to be common. Most of them are quite small, rarely exceeding a few inches. The body is slender and clothed with scales. The lateral line is absent. The distinctive characteristic most easily noted is, however, the formation of the pectoral fins, which merge together on the under side of the body to form an imperfect suctorial organ. Most of the species have the habit of burrowing in the sand or mud.

Nichols' Goby, *Rhinogobius nicholsi* (Bean), is our sole representative of a genus which is mainly southern in its distribution. It has six spines in the dorsal fin, whereas the species that follow have seven. It is said to be abundant in some parts of Vancouver Island, but only one specimen has come to hand in the San Juan Islands.

The Shining Goby, *Lepidogobius lepidus* (Girard), must be a rare species as very few have been taken up to this time. It has seven dorsal spines and is clothed with small cycloid scales.

The Long-jawed Goby, *Gillichthys mirabilis* (Cooper), as its name suggests, has the jaw reaching far back, nearly to the base of the pectoral fin. The head and belly are devoid of scales.

The Y-marked Goby, *Quietula Y-cauda* (Jenkins and Evermann) is similar to *Gillichthys*, but with flaps of skin on the shoulder girdle. A row of spots extend along the side of the body, the last assuming the form of the capital "Y" of the Greek alphabet, hence the name.

The Arrow Goby, *Clevelandia ios* (Jordan and Gilbert), (Fig. 90) is a slender species, two inches in length, with four or five spines in the dorsal fin. The scales are minute and cycloid. Specimens were encountered in Hoods Canal when digging in a sandy beach at low tide.

FAMILY 41. TOAD-FISHES; BATRACHIDAE.

Only one species of this small family is native to Puget Sound, but this form, known as the Midshipman or Singing Fish, *Porichthys notatus* (Girard), is one of our commonest fish. It resembles a sculpin, but can be identified immediately by the branching lateral lines which extend across the head and body. Along these lines are distributed shining spots looking like rows of buttons, thus giving rise to the name. The female is frequently met with in collecting along the shore, since she deposits her eggs on the under side of loose rock or other debris, and stands guard over them till they are hatched. When disturbed the fish utters a loud vibrant noise which may be heard at a considerable distance. The illustration used is that of a closely allied species. (Fig. 92.)

FAMILY 42. CLING-FISHES; GOBIESOCIDAE.

The Common Cling-fish, *Caularchus meandricus* (Girard), (Fig. 91) is found almost everywhere along our shores. Between the wide-set ventral fins a broad sucking disk is developed, which enables it to cling tightly to rocks or other objects. There is no spinous dorsal fin. Scales are absent. It attains a length of six inches.

FAMILY 43. BLENNIES; BLENNIDAE.

This immense and variable family of fishes is represented with us by thirteen species. They may be recognized by their elongated eel-like form, small ventral fins, which are at times absent, the elongate dorsal fin, and the usually rounded tail fin. Most of the species are of small size and hence the group has little direct economic value.

The Decorated Blenny, *Bryostemma decoratum* (Jordan and Snyder), (Fig. 93) is one of the most striking of our local forms. The top of the head is covered with a growth of branching tentacles which suggested the name of the species. No lateral line is present. The ventral fins are well developed and the surface of the body is covered with small scales. The skin is richly mottled.

The Ornamented Blenny, *Bryostemma nugator* (Jordan and Williams), (Fig. 94) is closely allied to the preceding species, having the same sort of tufted head, but the coloration is quite different. There is a row of ocellated spots along the middle of the dorsal fin.

The Chameleon Blenny, *Pholis ornatus* (Girard), (Fig. 95) is a worthy recipient of this name on account of its extraordinary range of coloration. It may be red, green, brown or yellow, and various shades in between. The individual blenny does not seem to be able to change its hue as some fishes are known to do. The structural peculiarities of this species are as follows: The lateral line is obsolete and there are two small spines in connection with the anal fin. The ventrals are reduced to a single spine and one ray. The tail fin is well developed, as are the pectorals. The dorsal fin is long and low and is composed of short, stiff spines. It is about one foot long.

The Variable Blenny, *Apodichthys flavidus* (Girard), resembles *Pholis* in its wide range of coloration, varying from green to purple. In this species the ventral fins are lacking and the anal fin is provided with a single stout sheathed spine. A narrow bar of black passes through the eye from the top of the head to the lower part of the cheek. It is about ten inches in length.

The Amphibious Blenny, *Xererpes fucorum* (Jordan and Gilbert), resembles *Apodichthys* but differs in the smaller size of the anal spine and in the reduced size of the pectoral fins. Like the preceding it is extremely variable in color. It is found hiding in masses of seaweed at low tide and its ability to survive under these conditions has suggested the name.

The Crested Blenny, *Anoplarchus atropurpureus* (Kittlitz), (Fig. 96) can be singled out from its relatives by the presence of a prominent fleshy crest on the top of the head. The body is covered with very small hidden scales. The lateral line is obsolete and the mouth is set obliquely in the head. The dorsal fin is very low. This species is quite variable in color, some specimens being gray, others olive or brown. The type described by Kittlitz from Alaska in 1858 was evidently a variety with a dark purple shade. Mature specimens are eight inches in length.

The Belted Blenny, *Xiphistes chirus* (Jordan and Gilbert), (Fig. 97) is noteworthy for the presence of several parallel branches of the lateral line, each with many short cross branches. The pectorals are small but well formed. It measures about 12 inches in length. Color variable and more or less mottled. Several dark lines radiate from the eye.

The Rock Blenny, *Xiphidion rupestre* (Jordan and Gilbert), (Fig. 100) is a near relative of the preceding species, but the pectoral fins are extremely minute, not longer than the width of the eye. It lives among the rocks along the shore where it may be found hiding in masses of seaweed. It is about 12 inches in length. Several bands of color radiate from the eye.

The Dagger Blenny, *Xiphidion mucosum* (Girard), is one of the common Blennies of the Sound waters. It reaches a length of 18 inches and resembles the Rock Blenny very closely. The differences lie in certain relative measurements and in the character of the bands which radiate from the eye. The body tapers off posteriorly after the manner of a dagger, hence the name.

The Barred Blenny, *Plectobranchnus evides* (Gilbert), (Fig. 98) is one of our rare and beautiful fish forms. Only a few specimens have come to light since it was named in 1890. In this species there is no lateral line, the pectorals are long and rounded and the ventrals are well developed. The color is dusky, the sides being crossed by a considerable number of narrow whitish bars. It is four inches in length.

The Snake Blenny, *Lumpenus anguillaris* (Pallas), is a long snaky fish with an obsolete lateral line. The paired fins are well developed and the mouth is set obliquely in the head. It measures 18 inches.

The Striped Blenny, *Delolepis virgatus* (Bean), is of the same long snaky type as *Lumpenus*, but the ventral fins are lacking. It is brownish yellow in color with three brown stripes on each side of the body. It attains a length of 30 inches.

The Aleutian Blenny, *Lyconectes aleutensis* (Gilbert), (Fig. 99) is like unto a small edition of the Striped Blenny, but is smaller, measuring about seven inches in length. The body is without scales. The color is reddish. Only two specimens of this fish have ever been taken, one in Alaska and one in Puget Sound.

FAMILY 44. WOLF-FISHES; ANARRHICHADIDAE.

Our representative of this family is the large, powerful, eel-like species known as the Wolf-fish, *Anarrhichthys ocellatus* (Ayres). It measures as much as 8 feet in length and excites great interest wherever it is captured. It is shaped like an eel, but the head is large and wolfish in aspect, with a great array of sharp teeth set in the powerful jaws. The ventral fins are absent. The pectorals are broad and set low down on the body. Color dark green, with numerous faint ocellated spots over the head and body.

FAMILY 45. EEL-POUTS; ZOARCIDAE.

In this family are classified fishes with long eel-shaped bodies covered with small cycloid scales. The head is large, and the mouth is bordered by jaws set with conical teeth. The dorsal and anal fins are very long and the pectorals are small. The lateral line is absent. Three species occur in our fauna.

The Pacific Eel-pout, *Lycodopsis pacificus* (Collett), may be recognized by the black margins on the vertical fins. It reaches a length of 18 inches.

The Short-finned Eel-pout, *Lycodes brevipes* (Bean), can be discriminated by the minute size of the ventral fins, which are only one-third of the distance across the eye.

The Wattled Eel-pout, *Lycodes palearis* (Gilbert), originally described from Alaska, was unknown from Puget Sound till a few specimens were brought up in the trawl at Friday Harbor in 1909. The ventral fins are much longer than in *L. brevipes*, and in *L. palearis* a wide membranous border is present on the inner edge of the mandible, terminating in front in a pair of sharp-pointed flaps, the whole arrangement suggesting wattles. It is 7 inches in length.

FAMILY 46. VIPER-FISHES; SCYTALINIDAE.

The only species classified in this family is the curious Viper Fish, *Scytalina cerdale* (Jordan and Gilbert), (Fig. 101) originally described from Neah Bay and not since found elsewhere. It is a small blenny-like fish with a snaky head. The body is narrowed to a neck behind the head. There is no lateral line. The dorsal fin is very low, the pectorals are small and the dorsal and anal fins are united to the caudal. It burrows in the debris among rocks at low tide.

FAMILY 47. CODS; GADIDAE.

In this group we have the cod and its various relatives. They are readily recognized by the division of the dorsal fin into three separate parts, and by the presence of a barbel on the lower jaw. The anal fin is likewise divided to form two sections. Four species of the cod family occur in our waters.

The Pacific Codfish, *Gadus macrocephalus* (Tilesius), (Fig. 102) differs but little from the cod of the Atlantic, but the species have been regarded as

EXPLANATION OF FIGURES.

83. Three-spined Sea-poacher, *Xeneretmus triacanthus* (Gilbert).
84. Inky Sea-poacher, *Averruncus emmelane* (Jordan and Starks).
85. Four-horned Sea-poacher, *Hypsagonus quadricornis* (Cuvier and Valenciennes).
86. Smooth Lump-sucker, *Lethotremis vinolentis* (Jordan and Starks).
87. Green's Sea-snail, *Liparis greeni* (Jordan and Starks).
88. Beautiful-tooth Sea-snail, *Liparis callyodon* (Pallas).
89. Jordan's Ronquil, *Ronquilus jordani* (Gilbert).
90. Arrow Goby, *Clevelandia ios* (Jordan and Gilbert).
91. Cling-fish, *Caularchus meandricus* (Girard).
92. Midshipman or Singing Fish, *Porichthys* sp.
93. Decorated Blenny, *Bryostemma decoratum* (Jordan and Snyder).
94. Ornamented Blenny, *Bryostemma nugator* (Jordan and Williams).
95. Chameleon Blenny, *Pholis ornatus* (Girard).
96. Crested Blenny, *Anoplarchus atropurpureus* (Kittlitz).
97. Belted Blenny, *Xiphistes chirus* (Jordan and Gilbert).
98. Barred Blenny, *Plectobranchnus evides* (Gilbert).
99. Aleutian Blenny, *Lyconectes aleutensis* (Gilbert).
100. Rock Blenny, *Xiphidion rupestre* (Jordan and Gilbert).



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84



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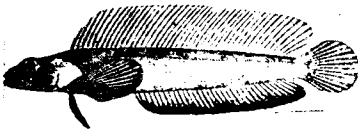
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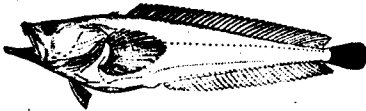
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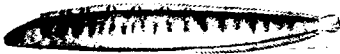
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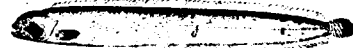
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zoologically distinct. The main distribution of the Pacific Cod is on the banks in the North Pacific. It does not occur in sufficient abundance in our waters to constitute a fishery.

The Tom-cod, *Microgadus proximus* (Girard), (Fig. 104) has the appearance of a miniature cod, the young of which it resembles very closely. The technical difference between the two genera is in the position of the vent. In *Gadus* it is below the second dorsal fin, while in *Microgadus* it is in front of the same fin. It is a valuable food fish, attaining a length of about one foot.

The Puget Sound Pollack, *Theragra fucensis* (Jordan and Gilbert) is closely related to the Alaska Pollack, *Theragra chalcogramma* (Pallas), (Fig. 103) which it replaces to the southward. It differs from the cod and Tom-cod in that the lower jaw projects beyond the upper and the barbel is of small size. It is a valuable food fish and attains a length of two feet.

The Cusk-Codling, *Brosomphycis marginatus* (Ayres), is a fish which was formerly classed in the family *Brotulidae* but its relationship with the Cod family having been established it is now placed with the latter. It is an exceedingly rare fish at present since our knowledge of it is based on two specimens, one taken at San Francisco, the other in Puget Sound. It rather does violence to the usual cod type, since the dorsal fin is not divided to form the usual three finlets but is a continuous structure, and the anal is formed on the same type. The ventral fins are developed as long filaments. There are no barbels on the head. The California example measures 12 inches.

FAMILY 48. HAKES; MERLUCCIIDAE.

A family of fishes closely allied to the cods, the differences between the groups being based on technical points in the skeleton. The only species on the Pacific Coast is the Horse Mackerel or Pacific Hake, *Merluccius productus* (Ayres), (Fig. 105). The second dorsal fin is deeply notched but not divided into two separate fins as in the cods. The head is sharply pointed. The scales are very small and are deciduous. The fish is silvery gray in color and attains a length of three feet.

FAMILY 49. RIBBON FISHES; TRACHYPTERIDAE.

The only species of this family recorded from Puget Sound is the remarkable fish known as the King of the Salmon, *Trachypterus rexsalmonorum* (Jordan and Gilbert), (Fig. 106). It is very rare as it appears to be a deep-water species which comes to our shores only through some accidental cause. Its body is from 5 to 7 feet in length, compressed so as to be exceedingly thin and covered with a skin shining like burnished silver. The dorsal fin extends far forward and at its anterior end there is a raised finlet consisting of four greatly lengthened rays. The eye is very large, and the tail-fin, instead of spreading out fan-like in the usual manner, is greatly elongated and directed diagonally upwards.

FAMILY 50. THE FLAT FISHES; PLEURONECTIDAE.

This large family which is represented in our waters by fifteen species contains fishes which are almost without exception of food value, although only a limited number of kinds ordinarily reach the market.

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The members of this family are immediately recognized by the characteristic flattened form, the animals actually swimming on one side, with a corresponding distortion of the bodily structure, the most noticeable change being in the position of the eyes, one of these organs necessarily shifting around from the under side. The shifting of the fins is also rather striking in most cases.

The forms commonly called flat fishes include two families, the second of these being the Soles (*Soleidae*). None of the latter occur within our faunal limits, so all of our flat fishes are necessarily halibuts, flounders and turbot.

The Halibut, *Hippoglossus hippoglossoides* (Linnaeus), (Fig. 107) is our largest and, commercially speaking, most important flat fish. The ventral fins are symmetrical and the one on the ventral side is not extended along the ridge of the abdomen. The mouth is but slightly distorted, and the caudal fin is lunate. The scales are small and cycloid in form. The lateral line has a bow anteriorly. It attains a length of 6 to 8 feet and a weight of upwards of 600 pounds, but specimens of these dimensions are naturally rare. Halibut are taken within the limits of Puget Sound, but the commercial catch comes from the banks off Cape Flattery or farther to the north.

Jordan's Flounder, *Eopsetta jordani* (Lockington), is sometimes erroneously called California Sole. The fins and mouth are formed much as in the halibut. The lateral line lacks the bow at the anterior end and is without an accessory dorsal branch. Two rows of teeth are present in the upper jaw, one row in the lower. The scales are small. The fish attains a length of 20 inches and is an excellent food fish, but is not abundant in Puget Sound.

The Puget Sound Sand-dab, *Hippoglossoides classodon* (Jordan and Gilbert), (Fig. 108) resembles *Eopsetta* but has a single row of teeth in the upper jaw instead of two, and possesses a spine developed in connection with the anal fin. It has a length of 18 inches.

The Slender Flounder, *Lyopsetta exilis* (Jordan and Gilbert), is another relative of *Eopsetta*, but the scales are unusually large and the proportions are more slender.

The Black-spotted Flounder, *Psettichthys melanostictus* (Girard), (Fig. 109), resembles the preceding species but has an accessory branch to the lateral line. It is grayish brown with fine black markings. It is 20 inches long and highly regarded as a food fish.

The Soft Flounder or Plaice, *Citharichthys sordidus* (Girard), (Fig. 110) is our only representative of the tribe of flat fishes known abroad as turbot. They differ from the above described species which are all related rather closely to the halibut and flounder, in possessing a relatively large mouth, and the eye and color is on the left side rather than on the right. The caudal fin is rounded and the ventral fins are dissimilar in form and position. The space between the eyes is concave. This species attains a weight of two pounds but is not highly regarded as a food fish, since the flesh is soft.

The Speckled Flounder, *Citharichthys stigmaeus* (Jordan and Gilbert), is of the same general type as the soft flounder, but with the space between the eyes raised in a sharp ridge. Very few specimens of this species have been taken.

EXPLANATION OF FIGURES.

101. Viper-fish, *Scytalina cerdale* (Jordan and Gilbert).
102. Cod-fish, *Gadus* sp.
103. Pollack, *Theragra* sp.
104. Tom-cod, *Microgadus proximus* (Girard).
105. Pacific Hake, *Merluccius productus* (Ayres).
106. King of the Salmon, *Trachypterus* sp.
107. Halibut, *Hippoglossus hippoglossoides* (Linnaeus).
108. Puget Sound Sand-dab, *Hippoglossoides classodon* (Jordan and Gilbert).
109. Black-spotted Flounder, *Psettichthys melanostictus* (Girard).
110. Soft Flounder or Plaice, *Citharichthys sordidus* (Girard).
111. Rough Flounder, *Inopsetta ischrya* (Jordan and Gilbert).
112. Rock Flounder, *Lepidopsetta bilineata* (Ayres).
113. Speckled Flounder, *Pleuronichthys nephelus* (Starks and Thompson).
114. Starry Flounder or Diamond Flounder, *Platichthys stellatus* (Pallas).



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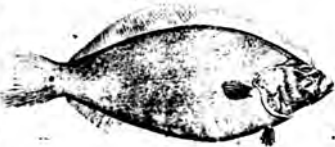
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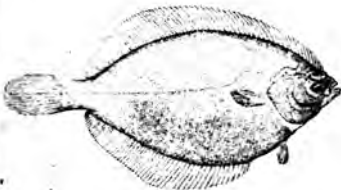
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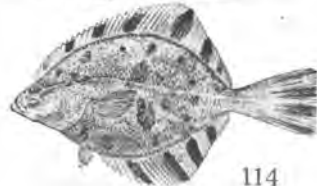
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The Scaly-finned Flounder, *Isopsetta isoleis* (Lockington), has a small unsymmetrical mouth, with the bones on the blind side strongly curved. The lateral line has an accessory branch and is arched but slightly in front. The fins are low, and are covered with ctenoid scales. It reaches a length of 15 inches and is a good food fish.

The Rough Flounder, *Inopsetta ischrya* (Jordan and Gilbert), (Fig. 111) is similar to the preceding species but the teeth are incisor-like and the scales are not imbricated. Specimens weigh up to four pounds. It is not common in our waters but is a good food fish.

The Near-eyed Flounder, *Parophrys vetulus* (Girard), is closely related to *Inopsetta* and has the same incisor-like teeth, but the scales are imbricated and the space between the eyes is very narrow.

The Rock Flounder, *Lepidopsetta bilineata* (Ayres), (Fig. 112) is of the same general type as *Isopsetta* and *Inopsetta*, but the lateral line has a distinct arch in front and an accessory branch is developed. The scales are imbricated. In color it is yellowish brown with many pale blotches.

The Starry Flounder or Diamond Flounder, *Platichthys stellatus* (Pallas), (Fig. 114) is one of our most familiar flat fishes, as it is very common and is constantly seen in the markets. It is immediately recognized by the absence of scales, their place being taken by a corresponding number of stellate tubercles. It is dark brown above with a number of pronounced blotches of black upon the fins. It attains a considerable size, specimens two feet in length being on record.

The Smear-dab or Slippery Sole, *Microstomus pacificus* (Lockington), is a species which secretes an extraordinary amount of mucus when taken from the water, which makes them extremely slippery. The mouth is small and the eyes unusually large. The pectoral fins are of about equal size. No spine is developed at the front end of the anal fin. Ground color, pale brown with darker blotches. The larger specimens weigh upwards of a pound and are used for food.

The Long-finned Flounder, *Glyptocephalus zachirus* (Lockington), is easily recognized by the extraordinary length of the pectoral fin on the upper side, which is fully one-quarter the length of the body. The lateral line is nearly straight. In color it is pale brown, varying to ashy. This species is so thin and the flesh so dry it is not regarded as a desirable food fish.

The Speckled Flounder, *Pleuronichthys nephelus* (Starks and Thompson), is an abundant species in Puget Sound. The lateral line is nearly straight and has a dorsal branch. The scales are large, circular and imbedded in the skin. The lips are thick and have several lengthwise folds. The anal fin is preceded by a spine. In color this species is mottled and speckled in a variegated pattern, but several conspicuous dark spots on the side and others on the tail fin give a distinctive marking to the fish. It attains a length of about a foot.

STATISTICS

FOR

FISCAL YEAR 1919

April 1, 1919, to March 31, 1920.

FISHERIES DEPARTMENT

STATE OF WASHINGTON

Appropriations, Receipts and Disbursements; Output of Salmon
and Trout Hatcheries and Costs; Licenses Issued;
Take and Value of Food Fishes; and Other
Information Regarding the Food
Fishing Industry.

**APPROPRIATION AND EXPENDITURES OF FISHERIES FUND.
Fiscal Year 1919.**

FUND	Appropriation for Two Years	Expended Fiscal Year 1919	Balance April 1, 1920
Salary of Fish Commissioner, of inspectors and employes; traveling expenses of Commissioner, inspectors and employes; rent and incidentals; construction, repair and maintenance of salmon hatcheries; construction of new hatcheries; patrol service; improvements, replacements, destruction of seals; printing, and for other necessary expenses of the office of the Fish Commissioner	\$243,100 00	\$108,200 78	\$134,899 22

ITEMIZATION OF EXPENDITURES OF FISHERIES FUND.

	Salaries	Labor	Mileage	Subsistence	General Expense	Maintenance	Improvements	Total Cost of Operation	Egg Output	Cost per Thousand
Office Expense	\$2,000 00	\$67 75	\$2,686 48	\$2,521 63	\$16,081 60	\$34 37	\$102 75	\$23,354 58		
Repair and Maintenance of Hatcheries	26,109 44	33,577 08	1,512 98	1,573 47	4,815 03	4,103 19	1,708 18	73,399 37	147,414,010	.49
Patrol Services	798 84	2,176 97	88 71	1,439 63	2,538 28	491 57	54 00	7,580 00		
Sundry Expense		105 30	275 74	247 28	3,038 51			3,668 83		
Totals	\$28,908 28	\$35,927 10	\$4,563 91	\$5,773 01	\$26,473 42	\$4,629 13	\$1,924 93	\$108,200 78		

APPROPRIATIONS AND EXPENDITURES OF GAME FUND.

Fiscal Year 1919.

FUND	Appropriation for Two Years	Expended Fiscal Year 1919	Balance April 1, 1920
For the Office of the State Game Warden; salary and traveling expenses of State Game Warden, and salary and traveling expenses of two special deputy state game wardens, under the State Game Warden; maintenance of state trout hatcheries; new hatchery construction; equipment, maintenance and stocking of state game farm at the Walla Walla penitentiary; new construction at the state game farm; salaries of employees, rent and incidentals, and printing of the State Game Warden, and purchase of game birds and animals.....	\$85,000 00	\$42,370 74	\$42,629 26
For the Office of the Chief Deputy Game Warden; salary of the chief deputy state game warden and traveling expenses; salary and traveling expenses of two special deputy state game wardens under the chief deputy state game warden; salaries of employees, rent, incidentals and printing of the chief deputy state game warden.....	12,770 00	6,125 13	6,644 87
Totals	\$97,770 00	\$48,495 87	\$49,274 13

ITEMIZATION OF EXPENDITURES OF GAME FUND.

	Salaries	Labor	Mileage	Subsistence	General Expense	Maintenance	Improvements	Total Cost of Operation	Egg Output	Cost per Thousand
Office Expense State Game Warden.....	\$1,000 00	\$89 01	\$82 83	\$1,007 16	\$6,581 96	.....	\$75 00	\$9,585 96	.....	.....
Repair and maintenance of Hatcheries....	6,725 10	5,347 81	1,302 84	1,092 95	1,335 29	\$908 33	369 82	17,347 14	23,509,835	.....
Maintenance Walla Walla Game Farm....	2,063 23	1,062 99	416 25	86 87	6,407 61	1,461 17	3,999 49	15,437 64	.....	* \$ .74
Office Expense Chief Deputy Game Warden	1,800 00	1,200 50	913 65	794 53	2,590 15	.....	6 00	6,125 13	.....	.....
Totals.....	\$11,588 33	\$6,460 31	\$3,555 90	\$2,981 51	\$16,975 01	\$2,454 50	\$4,080 31	\$48,495 87	.....	.....

* Includes cost of distribution of fry and of purchase of eggs in Eastern States, and transportation therefrom.

APPROPRIATION AND EXPENDITURES OF STATE OYSTER RESERVE FUND.
Fiscal Year 1919.

FUND	Appropriation for Two Years	Expended Fiscal Year 1919	Balance April 1, 1920
For the improvement and protection of the state oyster reserves	\$10,000 00	\$8,309 89	\$1,690 11

ITEMIZATION OF EXPENDITURES OF STATE OYSTER RESERVE FUND.

Patrol Service	\$1,280 39
Improvement of Oyster Beds	7,049 50
Total.....	\$8,309 89

RECEIPTS OF THE FISHERIES DEPARTMENT.
Fiscal Year 1919.

CREDITED TO THE FISHERIES FUND	Puget Sound District	Columbia River District	Grays Harbor District	Willapa Harbor District	Entire State	Totals
LICENSES—						
5,688 Fishing	\$29,213 47	\$14,046 61	\$7,486 25	\$2,437 50	.....	\$49,183 83
134 Buyers at \$1.00	114 00	8 00	4 00	8 00	.....	134 00
11 Scow buyer at \$50.00	550 00	550 00	550 00	550 00	.....	550 00
983 Retail dealer	721 00	191 00	48 00	23 00	.....	983 00
126 Wholesale dealer	770 00	180 00	140 00	170 00	.....	1,260 00
24 Halibut wholesale dealer	105 00	15 00	.....	.....	.....	120 00
6 Codfish, canning and curing	30 00	.....	.....	.....	.....	30 00
6 By-product manufacturing	150 00	.....	.....	.....	.....	150 00
8 Private hatchery	75 00	125 00	.....	.....	.....	200 00
3 Private hatchery product dealer	5 00	3 50	.....	.....	.....	7 50
13 Hotel serving private hatchery product	9 00	4 00	.....	.....	.....	13 00
15 Permit to collect birds .....	.....	.....	.....	.....	\$15 00	15 00
151 1918 Licenses	82 00	3 00	83 00	19 00	.....	187 00
8,118 Total						\$52,883 83
TAXES—						
Fish caught	\$,109 10	2,227 72	1,137 48	503 00	.....	12,039 30
Fish brought, sold or otherwise dealt in at \$1.25 per ton	14 47	1,572 44	.....	.....	.....	1,586 91
Fish brought, sold or otherwise dealt in at \$1.00 per ton	6,701 67	212 04	992 05	861 24	.....	8,006 00
Canned Salmon	13,523 88	9,465 70	360 89	615 70	.....	23,966 17
Canned food and shell fish other than salmon	79 21	56 77	226 13	31 73	.....	463 84
45,573 91						
SALLES—						
Salmon eggs	191 25	.....	.....	.....	.....	191 25
Spawmed fish	70 00	60 00	.....	.....	15,185 11	15,185 11
Condensed gear	34 82	1,123 46	.....	3 19	.....	1,200 00
Condensed fish .....	.....	.....	.....	.....	.....	1,101 08
10,667 41						
MISCELLANEOUS—						
Transfers	95 00	54 00	75 00	15 00	.....	237 00
Collected by State Fish Commissioner	\$60,146 67	\$29,875 33	\$6,891 40	\$4,198 17	.....	\$115,311 68
Fines and interest earnings on Fisheries Fund deposits reported by State Treasurer	6,913 54
Total credited to Fisheries Fund						\$122,225 22

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Receipts of the Fisheries Department—Continued.
Fiscal Year 1919.

	Puget Sound District	Columbia River District	Grays Harbor District	Willapa Harbor District	Entire State	Totals
CREDITED TO THE STATE OYSTER RESERVE FUND—						
13 Licenses to take seed oysters.....	65 00					65 00
Sale of seed oysters.....	7,713 20					7,713 20
Sale of merchantable oysters.....	39 50			36 30		156 80
Collected by State Fish Commissioner.....	\$7,836 70			\$95 30		\$7,932 00
Interest earnings on Oyster Reserve Fund reported by State Treasurer.....						\$68 98
Total credited to State Oyster Reserve Fund.....						8,003 98
Total Receipts.....						\$130,228 60

LICENSES ISSUED.
Fiscal Year 1919.

Fishing Licenses	6,638	
Dealers' and Miscellaneous Licenses	1,329	
Miscellaneous Receipts	151	8,118
Cannery Licenses	81	81
Total.....		8,199

	LICENSES			*Misc. Receipts	Fee	Amount Collected
	Fishing	Dealers and Misc	Cannery			
PUGET SOUND DISTRICT—						
Pound net	259				\$50 00	\$12,950 00
Set net	686				3 75	2,572 50
Gill net	540				\$5 and 1c ea. add. ft.	3,157 00
Drag seine	187				2c per ft.	1,251 62
Purse seine	258				27 50	7,095 00
Reef net	14				5 00	70 00
Hook and line	1,032				1 00	1,032 00
Smelt drag bag net.....	57				\$1 and 2c ea. add. ft.	251 35
Brush weir	11				25 00	275 00
Beam trawl	16				10 00	160 00
Clams and mussels.....	232				1 00	232 00
Crabs	124				1 00	124 00
Gill net extensions					1c per ft.	11 00
Drag seine extensions.....					2c per ft.	21 40
Smelt drag bag net extensions.....					2c per ft.	10 00
Buyers		114			1 00	114 00
Retail dealer		721			1 00	721 00
Wholesale dealer		77			10 00	770 00
Halibut wholesale dealer.....		21			5 00	105 00
Codfish, canning and curing.....		6			5 00	30 00
By-products, manufacturing		6			25 00	150 00
Private hatchery		3			25 00	75 00
Private hatchery product dealer.....		2			2 50	5 00
Hotel serving private hatchery product.....		9			1 00	9 00
Permit to collect birds.....		15			1 00	15 00
Cannery			43			
1918 Licenses				55		82 00
Totals.....	3,416	974	43	55		\$31,289 47
COLUMBIA RIVER DISTRICT—						
First class pound net	132				\$25 00	\$3,300 00
Second class pound net	145				15 00	2,175 00
Stationary fish wheel.....	17				35 00	595 00
Scow fish wheel.....	10				25 00	250 00
Set net	231				3 75	866 25
Gill net	517				7 50	3,877 50
Drag seine	45				3c per ft.	852 36
Purse seine	43				27 50	1,182 50
Hook and line.....	330				2 50	825 00
Bag net	118				1 00	118 00
Crabs	5				1 00	5 00
Buyer's		8			1 00	8 00
Scow buyer's		11			50 00	550 00
Retail dealer		191			1 00	191 00
Wholesale dealer		18			10 00	180 00
Halibut wholesale dealer.....		3			5 00	15 00
Private hatchery		5			25 00	125 00
Private hatchery product dealer.....		1			2 50	2 50
Hotel serving private hatchery product.....		4			1 00	4 00
Cannery			9			
1918 Licenses				3		3 00
Totals.....	1,593	241	9	3		\$15,125 11

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Licenses Issued—Continued.

Fiscal Year 1919.

	LICENSES			*Misc. Re- ceipts	Fee	Amount Collected
	Fishing	Dealers and Misc	Can- nery			
GRAYS HARBOR DISTRICT—						
Pound net	48				\$15 00	\$720 00
Set net	349				3 75	1,308 75
Gill net	117				7 50	877 50
Drag seine	1				3c per ft.	27 00
Hook and line.....	72				1 00	72 00
Clams and mussels.....	476				1 00	476 00
Crabs	5				1 00	5 00
Buyer's		4			1 00	4 00
Retail dealer		48			1 00	48 00
Wholesale dealer		14			10 00	140 00
Cannery			20			
1918 Licenses				83		83 00
Totals.....	1,068	66	20	83		\$3,761 25
WILLAPA HARBOR DISTRICT—						
Pound net	63				\$15 00	\$945 00
Set net	174				3 75	652 50
Gill net	76				7 50	570 00
Drag seine	2				3c per ft.	24 00
Hook and line.....	16				1 00	16 00
Bag net	1				1 00	1 00
Clams and mussels.....	164				1 00	164 00
Clams for bait.....	13				1 00	13 00
Crabs	52				1 00	52 00
Buyer's		8			1 00	8 00
Retail dealer		23			1 00	23 00
Wholesale dealer		17			10 00	170 00
Cannery			9			
1918 Licenses				10		19 00
Totals.....	561	48	9	10		\$2,657 50
ALL DISTRICTS COMBINED—						
Pound net	259				\$50 00	\$12,950 00
First class pound net.....	182				25 00	3,300 00
Second class pound net.....	145				15 00	2,175 00
Pound net	111				15 00	1,665 00
Stationary fish wheel.....	17				35 00	595 00
Scow fish wheel	10				25 00	250 00
Set net	1,440				3 75	5,400 00
Gill net	710				7 50	5,325 00
Gill net	540				\$5 and 1c ea. add. ft.	3,157 60
Drag seine	187				2c per ft.	1,251 62
Drag seine	48				3c per ft.	303 36
Purse seine	301				27 50	8,277 50
Reef net	14				5 00	70 00
Hook and line.....	1,120				1 00	1,120 00
Hook and line.....	330				2 50	825 00
Bag net	119				1 00	119 00
Smelt drag bag net.....	57				\$1 and 2c ea. add. ft.	251 35
Brush weir	11				25 00	275 00
Beam trawl	16				10 00	160 00
Clams and mussels.....	872				1 00	872 00
Clams for bait.....	13				1 00	13 00
Crabs	186				1 00	186 00
Gill net extensions.....					1c per ft.	11 00
Drag seine extensions.....					2c per ft.	21 40
Smelt drag bag net extensions.....					2c per ft.	10 00
Buyer's		134			1 00	134 00

Licenses Issued—Concluded.
Fiscal Year 1918.

	LICENSES			*Misc. Receipts	Fee	Amount Collected
	Fishing	Dealers and Misc	Can- nery			
Scow buyer's		11			\$50 00	\$550 00
Retail dealer		983			1 00	983 00
Wholesale dealer		126			10 00	1,260 00
Hallbut wholesale dealer		24			5 00	120 00
Codfish, canning and curing		6			5 00	30 00
By-products, manufacturing		6			25 00	150 00
Private hatchery		8			25 00	200 00
Private hatchery product dealer.....		3			2 50	7 50
Hotel serving private hatchery product.....		13			1 00	13 00
Permit to collect birds.....		15			1 00	15 00
Cannery			81			
1918 Licenses				151		187 00
Totals.....	6,638	1,329	81	151		\$52,833 33

* This item represents receipts which were issued in lieu of licenses, upon payment of license fees, to persons who had operated the previous year without securing licenses as required by law.

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CATCH OF SALMON AND VALUE.*
Fiscal Year 1919.

DISTRICT AND GEAR WITH WHICH TAKEN	Number of Chinook	Number of Dog	Number of Humpback	Number of Silver	Number of Sockeye	Number of Steelhead	Totals
PUGET SOUND DISTRICT—							
Pound nets	257,688	185,292	2,081,044	711,429	453,965	11,818	3,702,086
Set nets	9,823	30,000	3,431	72,491	60	8,529	126,334
Gill nets	47,022	62,038	37,584	129,895	4,803	2,275	284,517
Drag seines	726	86,885		12,113			98,074
Purse seines	12,250	1,112,404	2,513,521	427,586	283,690	1,878	4,351,289
Reef nets	162	3,404	29,042	9,689	3,210	50	46,307
Hooks and lines	19,345	171	298		990	158	20,844
Bag nets							171
Totals	347,766	1,475,091	4,667,220	1,363,153	746,604	24,698	8,635,222
Value	\$747,406 90	\$500,036 40	\$1,166,465 00	\$1,090,522 40	\$672,024 60	\$37,047 00	\$4,304,282 30
COLUMBIA RIVER DISTRICT—							
First class pound nets	64,785	23,636	37	50,850	5,027	31,144	176,050
Second class pound nets	23,409	8,922		15,770	2,043	11,550	62,663
Stationary fish wheels	7,374				11,010	2,196	20,580
Stow fish wheels	6,618				7,106	717	14,531
Set nets	3,628	3,953	10	465	3,307	3,491	14,154
Gill nets	162,586	72,711	741	22,325	11,421	86,824	296,008
Drag seines	91,430	57	32	15,128	9,401	14,027	61,027
Purse seines	79,810			16,200		1,021	94,603
Hooks and lines	54,918		500	80,365	876	251	136,913
Totals	421,666	108,579	1,300	199,233	51,217	91,683	876,608
Value	\$1,077,146 30	\$65,147 40	\$390 00	\$179,327 70	\$46,095 30	\$91,683 00	\$1,459,780 70
GRAYS HARBOR DISTRICT—							
Pound nets	8,666	65,869		23,295		1,088	98,948
Set nets	9,178	65,386	4,205	35,199	692	1,197,755	5,105
Gill nets	6,750	82,839		37,659		414	97,052
Drag seines	5						5
Hooks and lines	2,317						2,317
Totals	26,946	184,124	4,205	95,553	692	6,007	318,097
Value	\$61,975 80	\$110,474 40	\$1,281 50	\$85,597 70	\$728 20	\$9,910 50	\$270,348 10

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Catch of Salmon and Value*—Continued.
Fiscal Year 1919.

DISTRICT AND GEAR WITH WHICH TAKEN	Number of Chinook	Number of Dog	Number of Humpback	Number of Silver	Number of Sockeye	Number of Steelhead	Totals
WILLAPA HARBOR DISTRICT—							
Pound nets	6,694	96,038		21,773	396	55	125,056
Set nets	3,455	38,311	20	9,046		1,338	52,170
Gill nets	42,142	29,078		12,800		271	84,891
Drag seines	3						5
Hooks and lines	1			57			58
Totals	52,297	164,327	20	43,776	796	1,664	262,610
Value	\$120,283 10	\$98,596 20	\$6 00	\$43,776 00	\$973 00	\$2,466 00	\$265,736 90
ALL DISTRICTS COMBINED—							
Pound nets	361,282	380,687	2,081,961	823,117	402,161	55,064	4,165,172
Fish wheels	13,992				18,296	36,111	36,111
Set nets	26,054	136,350	9,666	117,201	1,059	18,463	312,803
Gill nets	258,530	217,566	38,325	202,239	16,524	29,764	782,668
Drag seines	25,175	80,892	32	25,341	9,404	11,037	114,761
Purse seines	89,069	1,112,404	2,513,521	443,876	283,993	8,020	4,445,892
Reef nets	962	3,404	29,042	9,639	3,210	53	4,46,892
Hooks and lines	76,581	47	798	80,422	1,872		160,132
Bag nets		171					171
Totals	851,075	1,632,121	4,673,345	1,701,735	799,659	124,652	10,082,627
Value	\$2,007,102 10	\$864,254 40	\$1,168,612 50	\$1,399,623 80	\$710,426 70	\$141,136 50	\$6,300,156 00

* Value based on average price paid fishermen.

CATCH OF SHELL AND FOOD FISH (OTHER THAN SALMON), AND VALUE.*
Fiscal Year 1919.

DISTRICT AND GEAR WITH WHICH TAKEN	Pounds of Clams and Mussels	Number of Crabs	Pounds of Herring	Pounds of Shad	Pounds of Striped	Pounds of Smelt	Number of Sturgeon	Pounds of Clams for Bait	Total Value
PUGET SOUND DISTRICT—									
Pound nets.....									
Set nets.....		300				2,058	54		
Gill nets.....				2		5,748	2		
Drag seines.....		396,113				651,010			
Purse seines.....						11,805	1		
Small drag bag nets.....		110,605				257,063			
Brush weirs.....		223,600				8,584			
Beam trawls.....					74,584				
Clams.....	925,631								
Crabs.....		488,151							
Totals.....	925,631	488,151	700,618	2	74,584	968,318	57		
Value.....	\$23,138 27	\$50,849 06	\$7,006 18	\$0 15	\$5,220 88	\$88,782 72	\$5 65		\$124,965 81
COLUMBIA RIVER DISTRICT—									
First class pound nets.....				12,563			102		
Second class pound nets.....				2,690			31		
Stationary fish wheels.....				6,373			71		
Snow fish wheels.....				8,538			42		
Gill nets.....				70,069			136		
Drag seines.....				110,007			1,401		
Purse seines.....				10,870			370		
Hooks and lines.....							41		
Bag nets.....							22		
Crabs.....		5,160				977,054			
Totals.....		5,160		229,700		977,054	2,116		
Value.....		\$57 50		\$6,621 00		\$14,656 26	\$211 60		\$22,026 36

* Value based on average price paid fishermen.

Catch of Shell and Food Fish (Other Than Salmon), and Value—Concluded.
Fiscal Year 1919.

DISTRICT AND GEAR WITH WHICH TAKEN	Pounds of Clams and Mussels	Number of Crabs	Pounds of Herring	Pounds of Shad	Pounds of Shrimp	Pounds of Smelt	Number of Sturgeon	Pounds of Clams for Bait	Total Value
GRAY'S HARBOR DISTRICT—									
Round nets.....							151		
Set nets.....		3					3		
Gill nets.....							23		
Drug seines.....							1		
Crabs.....	2,063,218	6,503							
Totals.....	2,063,218	6,503					178		
Value.....	\$222,241 35	\$680 77					\$35 00		\$222,963 72
WILLAPA HARBOR DISTRICT—									
Round nets.....							3		
Set nets.....							1		
Gill nets.....							279		
Crabs.....	628,637	370,802						86,294	
Totals.....	628,637	370,802					283	86,294	
Value.....	\$37,718 22	\$46,361 50					\$28 30	\$3,411 70	\$87,510 72
ALL DISTRICTS COMBINED—									
Round nets.....			300	15,143		2,658	341		
Fish wheels.....				6,373			118		
Set nets.....				8,538			142		
Gill nets.....				70,071		5,734	1,703		
Drug seines.....			306,113	110,007		661,010	271		
Purse seines.....				10,570		11,805	42		
Hooks and lines.....						177,084	22		
Bag nets.....			110,006			287,063			
Snoot drag bag nets.....			223,000			8,834			
Brush weirs.....					74,354				
Beam trawls.....	4,517,386	870,796						87,294	
Crabs.....									
Totals.....	4,517,386	870,796	700,618	220,702	74,354	1,945,462	2,684	86,294	
Value.....	\$283,017 84	\$26,434 83	\$7,000 18	\$0,621 15	\$5,220 98	\$53,865 85	\$24 05	\$3,411 70	\$457,465 07

* Value based on average price paid fishermen.

FOOD AND SHELL FISH CANNED.

Fiscal Year 1919.

DISTRICTS	Number of 48-Pound Cases	Value
PUGET SOUND DISTRICT—		
Chinook salmon.....	71,190	\$640,710 00
Dog salmon.....	529,967	3,179,802 00
Humpback salmon.....	437,730½	3,392,411 37
Silver salmon.....	201,606½	1,815,268 50
Sockeye salmon.....	67,087	764,791 80
Steelhead salmon.....	62	620 00
Clams and mussels.....	3,788	26,516 00
Clam nectar.....	619	3,714 00
Other food and shell fish.....	3,585	21,510 00
Totals.....	1,315,725	\$9,845,343 67
COLUMBIA RIVER DISTRICT		
Chinook salmon—Spring.....	106,328	\$1,382,264 00
Chinook salmon—Fall.....	21,740	273,924 00
Dog salmon.....	39,279	235,674 00
Humpback salmon.....	2,117	14,819 00
Silver salmon.....	34,927	349,270 00
Sockeye salmon.....	2,329	18,682 00
Steelhead salmon.....	7,148	71,480 00
Shad.....	4,017	24,102 00
Totals.....	217,885	\$2,370,165 00
GRAYS HARBOR DISTRICT—		
Chinook salmon.....	5,186	\$57,046 00
Dog salmon.....	30,193	150,065 00
Humpback salmon.....	1,750	8,750 00
Silver salmon.....	13,632	136,320 00
Sockeye salmon.....	710	8,875 00
Steelhead salmon.....	11	110 00
Clams and mussels.....	35,458	248,206 00
Clam nectar.....	153	918 00
Totals.....	87,093	\$611,190 00
WILLAPA HARBOR DISTRICT—		
Chinook salmon.....	1,152	\$12,672 00
Dog salmon.....	9,301	65,107 00
Humpback salmon.....	1,688	8,440 00
Silver salmon.....	1,491	14,910 00
Clams and mussels.....	3,820	28,650 00
Totals.....	17,452	\$129,779 00
ALL DISTRICTS COMBINED—		
Chinook salmon.....	205,596	\$2,366,616 00
Dog salmon.....	608,740	3,631,548 00
Humpback salmon.....	443,285½	3,424,420 37
Silver salmon.....	251,746½	2,315,768 50
Sockeye salmon.....	70,126	792,298 80
Steelhead salmon.....	7,221	72,210 00
Clams and mussels.....	43,066	303,372 00
Clam nectar.....	772	4,632 00
Shad.....	4,017	24,102 00
Other food and shell fish.....	3,585	21,510 00
Totals.....	1,638,155	\$12,956,477 67

FOOD AND SHELL FISH, FRESH AND PRESERVED (OTHER THAN CANNED), AND VALUE.
Fiscal Year 1919.

	PUGET SOUND DISTRICT		COLUMBIA RIVER DISTRICT		GRAYS HARBOR DISTRICT		WILLAPA HARBOR DISTRICT		ALL DISTRICTS COMBINED	
	Number Pounds	Value	Number Pounds	Value	Number Pounds	Value	Number Pounds	Value	Number Pounds	Value
FRESH—										
Chinook salmon	3,630,921	\$434,510 52	449,323	\$60,658 60	104,619	\$10,461 90	70,768	\$7,076 80	4,245,631	\$512,707 82
Dog salmon	2,774,514	138,725 70	290,487	14,034 09	53,175	2,658 75			3,028,176	155,418 54
Humpback salmon	1,290,682	30,074 24			876	43 80			1,300,508	30,118 04
Silver salmon	1,200,975	117,087 75	107,374	12,908 88	246,164	22,154 76	20,847	2,084 70	1,675,360	154,236 04
Sockeye salmon	96,955	19,331 00	4,889	472 80	2,917	2,457 55			104,171	20,301 44
Steelhead salmon	234,495	37,519 26	516,346	61,241 52	110,854	16,628 10	10,183	1,527 45	865,578	116,019 27
Salmon trout	57,758	9,238 68							37,738	9,238 08
Herring	328,527	4,352 40							328,527	4,352 40
Shad			229,271	11,188 53	200	10 00			229,471	11,498 55
Squid	636,467	39,028 02	473,668	7,104 12	490	20 00	3,250	162 30	1,127,725	46,314 64
Sturgeon	1,288	257 60	67,490	8,065 20	4,039	929 80	395	39 30	73,792	9,322 10
Clams and mussels	265,537	12,222 28			8,700	652 50	73,358	4,401 48	387,615	17,276 26
Crabs	358,596	55,859 60			2,760	276 60	695,038	60,569 80	1,107,204	116,720 40
Shrimp	73,670	7,367 00			169	12 80			73,839	7,379 80
Miscellaneous	442,371	26,512 26	987	57 22	96,643	1,232 15			470,001	27,983 63
Totals	10,875,916	\$932,746 65	2,042,853	\$176,063 07	562,117	\$55,618 11	784,739	\$75,896 23	14,266,627	\$1,240,314 06
PRESERVED—										
Frozen			197,105	\$17,739 45					197,105	\$17,739 45
Kippered	428,691	\$85,618 20							428,691	\$85,618 20
Mild cured	987,524	246,881 00	80,000	20,000 00					1,067,524	266,881 00
Smoked	361,017	60,203 40							361,017	60,203 40
Totals	1,716,632	\$392,702 60	277,105	\$37,739 45					1,993,737	\$430,442 05
Grand Totals	12,592,548	\$1,325,449 25	2,320,960	\$213,802 52	562,117	\$55,618 11	784,739	\$75,896 23	16,260,364	\$1,670,756 11

FISH BY-PRODUCTS.**Fiscal Year 1919.**

OUTPUT	Quantity	Value
Oil	90,921 gal.	\$56,179 59
Fertilizer	658.9 tons	40,732 00
Fish meal	404.7 tons	30,210 87
Poultry food	50 tons	4,500 00
Total value		\$131,622 46

APPROXIMATE AVERAGE PRICE—

Oil	\$00 62 per gal.
Fertilizer	61 82 per ton
Fish meal	74 65 per ton
Poultry food	90 00 per ton

HALIBUT HANDLED BY DEALERS.**Fiscal Year 1919.**

Fresh	10,999,665 pounds, valued at \$2,804,944 73
Approximate average price	16½c per pound
Halibut is taken mostly in Bering Sea and Alaskan waters and brought to Puget Sound to be marketed.	

CODFISH HANDLED BY DEALERS.**Fiscal Year 1919.**

Fresh or frozen	68,100 pounds, valued at \$1,812 50
Salted	4,200,000 pounds, valued at 306,550 00
Total	4,268,100 pounds, valued at \$308,362 50

APPROXIMATE AVERAGE PRICE—

Fresh or frozen	26c per pound
Salted	7c per pound

This codfish is taken from Bering Sea and Alaskan waters from the first of May to the first of August of each year and brought to plants on Puget Sound, where it is prepared for market. The salted is packed in one-pound cartons.

IMPROVEMENTS ON STATE OYSTER RESERVE.**Fiscal Year 1919.**

5 7-8 Acres, Clifton Oyster Reserve, Mason County, graded and diked with concrete.

Number Licenses issued to take oysters from State Reserves, 13.
Fiscal Year 1919

OYSTERS SOLD FROM STATE RESERVES.

Fiscal Year 1919.

DISTRICT AND RESERVE	County	NUMBER OF SACKS		
		Seed	Merchant-able	Totals
PUGET SOUND DISTRICT—				
Clifton Reserve	Mason	3,492.6	4	3,496.6
Oakland Bay Reserve (Hammersley Inlet)	Mason	818		818
Port Orchard Reserve	Mason		9	9
Totals		4,310.6	13	4,323.6
WILLAPA HARBOR DISTRICT—				
Long Island Reserve	Pacific		183	183
Both Districts Combined		4,310.6	196	4,506.6

OYSTER INDUSTRY.

Fiscal Year 1919.

Oysters Marketed.

	No. Sacks		Value	
PUGET SOUND DISTRICT—				
Native	16,555½		\$173,558 20	
Eastern	5,296		41,556 20	
Totals		21,851½		\$215,114 40
WILLAPA HARBOR DISTRICT—				
Native	1,143		\$7,272 00	
Eastern	10,856		106,622 59	
Totals		11,999		113,894 59
BOTH DISTRICTS COMBINED—				
Native	17,698½		\$180,830 20	
Eastern	16,152		148,178 79	
Totals		33,850½		\$329,008 99

Average Value of Oysters Per Sack.

	Puget Sound District	Willapa Harbor District
Native	\$10 48	\$6 96
Eastern	7 55	9 32

Oyster Lands Owned.

	No. Acres		Value	
PUGET SOUND DISTRICT—				
Native	3,046.72		\$597,500 00	
Eastern	* 14		7,000 00	
Totals.....		3,060.72		\$604,500 00
WILLAPA HARBOR DISTRICT—				
Native	1,534		\$97,920 00	
Eastern	4,309		161,890 00	
Totals.....		5,843		259,810 00
BOTH DISTRICTS COMBINED—				
Native	4,580.72		\$695,420 00	
Eastern	4,323		168,890 00	
Totals.....		8,903.72		\$864,310 00

Oyster Lands Producing.

	No. Acres		Value	
PUGET SOUND DISTRICT—				
Native	306.5		\$275,050 00	
Eastern	* 15		3,000 00	
Totals.....		321.5		\$278,050 00
WILLAPA HARBOR DISTRICT—				
Native	680		\$50,150 00	
Eastern	2,408		133,600 00	
Totals.....		3,088		183,750 00
BOTH DISTRICTS COMBINED—				
Native	986.5		\$325,200 00	
Eastern	2,423		136,600 00	
Totals.....		3,409.5		\$461,800 00

* That the number of acres producing Eastern oysters is greater than the number of acres of Eastern oyster lands owned, is accounted for by reason of the fact that a portion of the oyster lands cultivated by private parties is leased from the state.

VALUE OF FISHERIES PRODUCT.*

Fiscal Year 1919.

PRODUCT	Value
Food and shell fish canned.....	\$12,966,477 67
Food and shell fish handled fresh.....	1,240,314 06
Food and shell fish preserved (other than canned)	430,442 05
Fish by-products.....	131,622 46
Hallbut	2,804,944 73
Codfish	306,962 50
Oysters	329,186 79
Totals.....	\$18,201,329 26

* Value based on average wholesale price.
The Hallbut and Codfish items are not strictly Washington products, as these fish are taken mostly in the waters of Bering Sea and Alaska and brought to Puget Sound to be marketed.

OUTPUT OF SALMON FROM THE STATE HATCHERIES.
Fiscal Year 1919.

	Number Females Spawmed	Number Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs On Hand March 31, 1919	Number Eggs Lost	Number Eggs Shipped March 31, 1920	No. Eggs On Hand March 31, 1919	Number Fry Hatched	Number Fry Lost	Number Fry Planted	Number Fry Shipped	No. Fry On Hand March 31, 1920
CHINOOK SALMON												
PUGET SOUND DIST.—												
Dungouss	150	722,125	.....	.....	68,078	57,006	.....	507,047	18,947	578,100	.....	.....
Green River	1,546	6,081,160	.....	.....	415,700	1,884,000	.....	8,770,400	4,748	2,450,600	.....	1,324,657
Green River No. 2	40	168,100	1,250,000	.....	45,000	.....	.....	1,372,500	13,700	1,386,800	.....	.....
Samish	.....	.....	2,000,000	.....	52,000	.....	.....	1,947,400	7,400	1,940,000	.....	.....
Oliver State Fish Com.	.....	.....	37,000	.....	1,000	.....	.....	56,000	400	.....	55,000	.....
Totals	1,746	6,971,325	3,307,000	.....	582,978	1,943,000	.....	7,752,347	45,100	6,326,900	55,000	1,324,657
COLUMBIA RIVER DIST.—												
Chinook	194	1,101,500	1,000,000	.....	19,000	.....	.....	2,082,500	6,200	2,076,800	.....	.....
Kalama	3,071	18,127,700	.....	.....	1,307,700	2,000,000	.....	14,820,000	35,000	14,785,000	.....	.....
Wind River	728	4,203,530	.....	.....	240,580	.....	.....	3,983,000	7,800	3,985,200	.....	.....
Totals	3,993	23,432,730	1,000,000	.....	1,567,280	2,000,000	.....	20,895,500	49,000	20,816,500	.....	.....
GRAYS HARBOR DIST.—												
Chehalis	44	221,360	.....	.....	17,310	.....	.....	204,050	250	203,800	.....	.....
Humtulpis	33	142,000	.....	.....	20,300	.....	.....	115,700	700	115,000	.....	.....
Totals	77	363,360	.....	.....	43,610	.....	.....	319,750	950	318,800	.....	.....
WILLAPA HARBOR DIST.—												
Nusel	1,085	4,472,200	1,000,000	.....	427,700	1,000,000	.....	2,144,500	10,000	2,127,600	.....	.....
North River	656	2,917,950	1,000,000	.....	14,700	1,000,000	.....	1,885,300	6,800	1,875,500	.....	.....
Willapa	.....	.....	.....	.....	432,650	.....	.....	1,465,900	9,000	1,456,400	.....	.....
Totals	1,741	7,389,250	1,000,000	.....	894,450	2,000,000	.....	5,494,800	36,300	5,458,500	.....	.....
RECAPITULATION—												
Puget Sound Dist.	1,746	6,971,325	3,307,000	.....	582,978	1,943,000	.....	7,752,347	45,100	6,326,900	55,000	1,324,657
Columbia River Dist.	3,993	23,432,730	1,000,000	.....	1,567,280	2,000,000	.....	20,895,500	49,000	20,816,500	.....	.....
Grays Harbor Dist.	77	363,360	.....	.....	43,610	.....	.....	319,750	950	318,800	.....	.....
Willapa Harbor Dist.	1,741	7,389,250	1,000,000	.....	894,450	2,000,000	.....	5,494,800	36,300	5,458,500	.....	.....
Grand Totals	7,917	38,156,655	6,207,000	.....	3,088,288	6,843,000	.....	34,432,397	131,440	32,990,700	55,000	1,324,657

* 20,000 sold to S. A. Feden, private hatchery.
16,000 given to University of Washington.
50,000 sold to F. A. Beeler, private hatchery.
559,000 shipped to eastern states in exchange for Eastern brook trout eggs.

Output of Salmon From the State Hatcheries—Continued.
Fiscal Year 1919.

DOG SALMON	Number Females Spawmed	Number Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs On Hand March 31, 1919	Number Eggs Lost	Number Eggs Shipped	No. Eggs On Hand March 31, 1920	Number Fry Hatched	No. Fry On Hand March 31, 1919	Number Fry Lost	Number Fry Planted	Number Fry Shipped	No. Fry On Hand March 31, 1920	
PUGET SOUND DIST.—														
Chambers Creek.....	4,401	11,148,000	.....	2,828,000	382,000	15,000	7,054,000	5,970,000	1,895,000	.....	6,024,000	.....	1,181,000
Eiwha.....	1,031	2,120,000	.....	.....	239,000	.....	.....	1,881,000	.....	21,000	.....	.....	1,860,000
Green River.....	242	734,800	.....	.....	92,500	.....	.....	642,300	.....	1,100	641,200	.....	.....
Green River No. 2.....	.....	.....	476,000	.....	6,100	.....	.....	469,900	.....	2,492	.....	.....	467,408
Nooksack.....	592	1,003,800	2,160,000	.....	63,500	.....	.....	3,190,300	.....	13,410	.....	.....	3,176,890
M. F. Nooksack.....	175	882,000	805,000	.....	65,270	.....	551,730	820,000	.....	1,700	.....	.....	828,300
Pilchuck.....	.....	.....	1,164,800	.....	170,800	.....	.....	994,000	.....	5,567	.....	.....	988,433
Puyallup River.....	24	59,500	1,800,000	.....	144,800	.....	.....	1,715,200	775,287	13,413	772,700	.....	1,704,374
Samsish.....	645	1,865,100	3,750,000	.....	164,100	.....	.....	5,511,000	.....	6,827	1,000,000	.....	4,504,173
Skokomish.....	600	1,716,000	1,000,000	.....	39,100	.....	.....	2,676,000	.....	8,735	1,178,925	.....	1,498,840
Skykomish.....	.....	.....	888,000	.....	74,250	.....	.....	810,800	.....	1,080	.....	.....	1,809,720
Stuhonish.....	.....	.....	4,320,000	.....	172,000	.....	.....	4,148,000	.....	20,900	1,200,000	.....	2,927,100
Tahuya Ercing Station.....	396	2,590,100	800,000	.....	174,100	.....	.....	3,210,000	.....	39,700	2,351,000	.....	915,200
Office State Fish Com.....	.....	.....	15,000	.....	1,000	.....	.....	14,000	.....	600	13,400	.....	.....
Totals.....	8,090	21,734,360	17,265,800	2,828,000	1,738,370	15,000	8,005,730	32,069,000	2,610,287	136,464	13,086,325	.....	20,856,498
COLUMBIA RIVER DIST.—														
Chinook.....	112	272,500	.....	.....	14,300	.....	.....	258,200	.....	600	257,600	.....	.....
Wind River.....	.....	.....	2,169,000	.....	35,400	.....	.....	2,124,600	.....	12,600	2,112,000	.....	.....
Totals.....	112	272,500	2,169,000	.....	49,700	.....	.....	2,382,800	.....	13,200	2,369,600	.....	.....
GRAVS HARBOR DIST.—														
Chehalis.....	10,501	30,708,800	.....	.....	3,622,600	20,400,800	.....	6,654,400	.....	986	730,000	.....	5,923,414
Chehalis No. 2.....	.....	.....	6,000,000	.....	251,000	.....	.....	5,749,000	.....	11,005	2,000,000	.....	8,737,005
Humtulsips.....	2,846	8,528,000	.....	.....	708,000	4,929,000	.....	2,900,000	.....	20,000	2,880,000	.....	.....
Totals.....	13,437	39,296,800	6,000,000	.....	4,532,600	25,410,800	.....	15,303,400	.....	31,991	5,610,000	.....	9,663,409
WILLAPA HARBOR DIST.—														
Naselle.....	221	646,500	.....	.....	28,600	.....	.....	617,000	.....	6,200	611,700	.....	.....
Willapa.....	117	369,500	43,800	325,600	900	324,700	
Totals.....	338	1,016,000	72,500	942,500	7,100	936,400	

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Output of Salmon From the State Hatcheries—Continued.
Fiscal Year 1919.

	Number Females Spawmed	Number Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs On Hand March 31, 1919	Number Eggs Lost	Number Eggs Shipped	No. Eggs On Hand March 31, 1920	Number Fry Hatched	No. Fry On Hand March 31, 1919	Number Fry Lost	Number Fry Planted	Number Fry Shipped	No. Fry On Hand March 31, 1920
DOG SALMON—Continued.													
RECAPITULATION—													
Puget Sound Dist.....	8,000	21,734,300	17,295,500	2,823,000	1,738,370	15,000	8,005,730	32,060,000	2,610,287	130,464	13,686,325	.....	20,856,408
Columbia River Dist.....	112	273,500	2,160,000	.....	40,700	.....	.....	2,382,800	.....	13,200	2,369,600	.....	.....
Grays Harbor Dist.....	13,437	39,290,800	6,000,000	.....	4,582,000	25,410,800	.....	15,303,400	.....	31,501	5,610,000	.....	9,661,469
Willapa Harbor Dist.....	338	1,016,000	.....	.....	72,600	.....	.....	143,500	.....	7,100	936,400	.....	.....
Grand Totals.....	22,547	62,319,600	25,425,800	2,823,000	6,443,170	25,425,800	8,005,730	50,608,700	2,610,287	188,755	22,602,325	.....	30,517,907
HUMPBACK SALMON													
PUGET SOUND DIST—													
Dungeness.....	847	1,642,800	.....	.....	100,400	.....	.....	1,462,400	.....	22,150	698,500	.....	721,760
Green River.....	31	60,000	.....	.....	5,250	.....	.....	54,750	.....	250	54,500	.....	.....
Puyallup River.....	318	582,250	.....	.....	13,820	.....	.....	568,930	.....	6,430	562,500	.....	.....
Totals.....	1,196	2,285,050	.....	.....	208,970	.....	.....	2,076,080	.....	38,830	1,315,500	.....	721,760
SILVER SALMON													
PUGET SOUND DIST—													
Chambers Creek.....	122	334,000	.....	.....	34,000	.....	.....	300,000	.....	.....	300,000	.....	.....
Dungeness.....	77	215,000	.....	985,000	30,070	.....	180,050	982,880	49,000	5,315	1,010,700	.....	15,305
Green River.....	474	1,549,500	.....	.....	141,800	925,000	.....	1,382,700	.....	2,200	1,380,500	.....	.....
Green River No. 2.....	.....	1,202,200	.....	.....	135,350	.....	.....	354,500	177,671	1,689	177,200	.....	222,068
Nookach.....	699	1,960,000	839,300	774,100	33,200	219,800	219,800	2,315,400	298,420	4,227	2,106,900	.....	1,002,603
M. F. Nookach.....	354	567,000	.....	670,250	22,530	339,300	827,470	437,650	157,630	1,070	408,400	.....	100,700
Pilehuck.....	406	1,000,000	.....	.....	217,000	.....	.....	778,000	.....	.....	605,700	.....	270,721
Puyallup River.....	219	698,000	.....	75,705	25,405	.....	.....	573,600	.....	1,070	605,700	.....	.....
Skamish.....	2,271	6,678,450	.....	.....	216,400	.....	1,047,000	5,413,000	425,051	4,404	497,000	.....	639,947
Skykomish.....	300	708,000	.....	857,000	48,150	.....	.....	858,850	1,510,210	7,000	3,118,100	.....	8,800,041
Skykomish.....	1,005	2,040,000	.....	.....	112,350	.....	.....	2,831,300	2,045	3,480	1,047,200	.....	204,075
Tahuya Eyeing Station.....	4	7,600	.....	.....	4,500	.....	.....	2,700	.....	.....	2,000	.....	2,048,225
Totals.....	6,370	18,466,650	339,300	3,444,775	1,035,875	384,300	3,877,920	16,973,600	5,206,207	33,765	13,705,200	.....	8,439,842

* 25,000 sold to F. A. Beeler, private hatchery.

Output of Salmon From the State Hatcheries—Continued.
Fiscal Year 1919.

	Number Females Spawmed	Number Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs On Hand March 31, 1919	Number Eggs Lost	Number Eggs Shipped	No. Eggs On Hand March 31, 1920	Number Fry Hatched	No. Fry On Hand March 31, 1919	Number Fry Lost	Number Fry Planted	Number Fry Shipped	No. Fry On Hand March 31, 1920
SILVER SALMON—													
Continued.													
COLUMBIA RIVER DIST.—													
Chinook.....	97	269,500	.....	.....	7,500	.....	.....	262,000	.....	1,300	260,700	.....	.....
Patterson.....	1	3,000	.....	117,800	1,775	.....	2,825	116,000	.....	100	116,100	.....	.....
Metlow.....	388	1,112,600	.....	.....	29,880	.....	62,740	1,020,000	.....	4,005	710,000	.....	305,985
Tilton River.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals.....	486	1,385,100	.....	117,800	39,135	.....	65,565	1,308,200	.....	5,405	1,086,800	.....	305,985
GRAYS HARBOR DIST.—													
Chinooks.....	2,111	7,514,675	.....	2,461,639	725,244	.....	2,542,070	6,649,000	5,181,358	2,487	7,930,200	.....	3,897,671
Humpbacks.....	228	667,000	.....	692,700	120,500	.....	.....	1,232,900	1,435,600	5,600	2,662,900	.....	.....
Totals.....	2,339	8,181,675	.....	3,004,339	862,044	.....	2,542,070	7,881,900	6,616,958	8,087	10,593,100	.....	3,897,671
WILLAPA HARBOR DIST.—													
Nasel.....	146	451,700	670,000	198,185	26,886	.....	279,590	1,013,400	605,443	9,548	987,000	.....	651,365
Willapa.....	771	2,531,000	.....	211,765	340,655	670,000	592,000	1,166,700	668,713	5,933	1,227,000	.....	596,490
Totals.....	917	3,002,700	670,000	409,940	366,950	670,000	871,590	2,174,100	1,274,156	15,481	2,184,900	.....	1,247,875
RECAPITULATION—													
Puget Sound Dist.....	6,370	18,466,650	339,300	3,444,775	1,035,875	364,300	3,877,920	16,972,630	5,290,207	33,795	13,705,200	.....	8,430,842
Columbia River Dist.....	486	1,385,100	.....	117,800	39,135	.....	65,565	1,308,200	1,435,600	5,405	1,086,800	.....	305,985
Grays Harbor Dist.....	2,339	8,181,675	.....	3,004,339	862,044	.....	2,542,070	7,881,900	6,616,958	8,087	10,593,100	.....	3,897,671
Willapa Harbor Dist.....	917	3,002,700	670,000	409,940	366,950	670,000	851,590	2,174,100	1,274,156	15,481	2,184,900	.....	1,247,875
Grand Totals.....	10,112	31,036,125	1,069,300	7,066,854	2,294,004	1,034,300	7,357,145	28,426,830	13,187,321	62,768	27,460,000	.....	13,861,363

Output of Salmon from the State Hatcheries—Continued.
Fiscal Year 1919.

	Number Females Spawning	Number Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs On Hand March 31, 1919	Number Eggs Lost	Number Eggs Shipped	No. Eggs On Hand March 31, 1920	Number Fry Hatched	No. Fry On Hand March 31, 1919	Number Fry Lost	Number Fry Planted	Number Fry Shipped	No. Fry On Hand March 31, 1920
STEELHEAD SALMON													
PUGET SOUND DIST.—													
Chambers Creek.....	118	384,000		145,000	46,000		253,000	140,000	125,000		100,000	100,000	45,000
Lake Crescent.....			100,000		100			90,900		100		90,800	
Dunsmuir.....	377	1,213,250		51,700	125,150	350,000		780,800		5,000		784,800	
Elwha.....			250,000		4,000			240,000				240,000	
Green River No. 2.....	6	19,300	302,000	46,473	63,600	9,000		308,700		1,200		277,500	130,000
Nooksack.....	134	433,500			3,500			63,000		2,000		61,000	
Pitchuck.....	26	66,500			172,700			942,300		4,300		898,000	100,000
Puyallup River.....	338	1,115,000			12,100			133,600		400		133,200	
Samish.....	50	105,700			2,212			132,600		2,000		129,700	
Skokomish.....	32	58,200		45,812	1,500			56,700		140		56,560	
Skykomish.....	52	200,600		120,615	20,615			339,700		500		339,200	
Office State Fish Com.....			9,000		2,200			6,800		300		6,500	
Totals.....	1,166	3,764,450	721,000	409,600	581,950	721,000	253,000	3,380,100	125,000	16,840	3,005,000	336,300	45,000
COLOMBIA RIVER DIST.—													
Dumppka Lake-Eying Stu.....			52,000		1,200			50,200		200		50,000	
Falcos-Methow.....	810	3,760,000			429,500	1,352,200		1,738,300		3,000		885,300	850,000
Tilton River.....	560	1,619,000		159,680	29,880			1,748,800		5,200		1,743,600	
Wenatchee.....			500,000		4,000			496,000		1,000		494,000	
Totals.....	1,370	5,379,000	552,000	159,680	465,180	1,352,200		4,033,300		10,000	2,628,900	1,304,400	
GRAYS HARBOR DIST.—													
Chobits.....	483	2,837,700		54,781	30,191	1643,000	140,300	2,039,900		1,500	2,008,400		
Humtupps.....	26	104,000		81,650	5,250			179,700		2,400	177,300		
Total.....	509	2,941,700		136,431	35,441	643,000	140,300	2,249,600		3,900	2,245,700		
WILLAPA HARBOR DIST.—													
North River.....	126	254,400			45,000			209,400		390	209,100		
Willapa Harbor.....	336	1,277,000		82,580	107,830		522,250	730,900		8,000	722,900		
Total.....	472	1,531,400		82,580	152,830		522,250	939,400		8,300	731,100		

* 540,200 eggs to Stevens County.
 † 543,000 eggs to King County.
 ‡ 30,000 fry sold to Fred Cough, private hatchery.
 § 100,000 eggs sold to F. A. Beeler, private hatchery.

Output of Salmon From the State Hatcheries—Continued.
Fiscal Year 1919.

STEELEHEAD SALMON— Continued.	No. Females Spawmed	Number Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs On Hand March 31, 1919	No. Eggs On Hand March 31, 1920	Number Eggs Shipped Lost	Number Eggs Shipped	Number Fry Hatched	No. Fry On Hand March 31, 1919	Number Fry Lost	Number Fry Planted	Number Fry Shipped	No. Fry On Hand March 31, 1920
REGAPITULATION— Puget Sound Dist.....	1,196	3,764,456	721,000	409,660	253,000	581,950	721,000	3,339,100	125,000	16,540	2,025,000	396,330	45,000
Columbia River Dist.....	1,370	5,379,000	552,000	139,680	1,592,200	405,180	1,592,200	4,033,390	.....	10,000	2,698,000	1,394,400	.....
Grays Harbor Dist.....	509	2,941,700	.....	139,731	643,000	39,441	643,000	2,249,000	.....	3,900	2,245,700	.....	.....
Willapa Harbor Dist.....	472	1,531,400	.....	82,580	152,330	152,330	.....	939,400	.....	8,300	931,100	.....	.....
Grand Totals.....	3,517	13,016,550	1,273,000	791,501	2,924,640	1,238,901	2,459,200	10,571,400	125,000	39,940	8,871,600	1,730,700	45,000
ALL SPECIES COMBINED	4,641	11,811,000	100,000	2,973,000	7,907,000	412,000	15,000	6,450,000	1,000,000	.....	7,084,000	100,000	1,236,000
PUGET SOUND DIST— Chambers Creek.....	1,451	2,794,075	.....	1,037,300	180,050	492,698	407,000	3,821,027	40,000	61,412	3,072,100	90,800	737,115
Lake Oregan.....	1,081	2,120,000	250,000	.....	.....	713,000	.....	2,137,000	.....	21,000	246,000	.....	1,860,000
Elwha.....	2,250	5,043,700	.....	.....	.....	.....	1,920,000	6,107,850	.....	9,468	4,803,700	30,000	1,324,657
Green River.....	613	1,063,800	1,726,000	46,473	992,350	315,023	862,000	2,006,900	177,671	18,178	1,536,000	.....	730,393
Neokosack.....	1,257	3,120,200	2,409,300	774,100	105,200	105,200	319,800	6,068,700	298,450	19,037	2,107,000	.....	4,170,583
M. F. Neokosack.....	329	1,339,000	865,000	670,250	561,000	571,800	339,300	1,367,050	137,630	2,000	468,400	.....	685,000
Pilehuck.....	744	2,211,000	1,164,800	.....	.....	.....	.....	2,314,700	.....	11,780	1,443,700	100,000	1,250,314
Puyallup River.....	614	1,475,650	1,800,000	75,796	195,215	195,215	.....	2,154,030	1195,533	24,647	1,085,400	.....	2,344,321
Samish.....	2,946	8,062,650	5,790,000	46,873	435,312	.....	.....	13,006,000	1,519,210	24,106	6,187,800	.....	8,313,214
Skokomish.....	992	2,542,200	1,000,000	357,030	122,850	.....	.....	3,687,200	889,320	70,420	2,977,685	.....	1,787,615
Skykomish.....	1,057	3,200,000	885,000	702,615	578,350	207,465	.....	4,001,300	2,301,905	5,000	3,440,700	.....	2,887,045
Snohomish.....	.....	4,320,000	.....	.....	172,000	.....	.....	4,148,000	.....	20,300	1,260,000	.....	2,997,100
Tabuya Eyeing Station.....	954	2,507,700	800,000	.....	179,000	.....	.....	3,213,700	.....	40,400	2,363,100	.....	915,300
Office State Fish Com.....	.....	81,000	.....	.....	.....	4,200	.....	76,800	.....	1,300	13,400	62,100	.....
Totals.....	19,128	53,221,775	21,633,100	6,682,375	4,148,143	3,043,300	12,136,650	62,209,157	8,031,404	271,119	38,189,885	391,000	81,387,747

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Output of Salmon From the State Hatcheries—Concluded.
Fiscal Year 1919.

ALL SPECIES COMBINED—Continued.	Number Females Spawmed	Number Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs On Hand March 31, 1919	Number Eggs Lost	Number Eggs Shipped March 31, 1919	No. Eggs On Hand March 31, 1919	Number Fry Hatched	No. Fry On Hand March 31, 1919	Number Fry Lost	Number Fry Planted	Number Fry Shipped March 31, 1919	No. Fry On Hand March 31, 1919
Chinook.....	403	1,643,560	1,000,000	40,800	1,807,760	2,000,000	2,462,700	50,200	8,100	2,594,600	50,000	.....	.....
Taipupka Lake Eyeing Sta.....	.....	52,000	.....	1,800	1,807,760	2,000,000	50,200	.....	200	.....	.....	.....	.....
Kalama.....	3,071	18,127,700	.....	431,275	1,807,760	2,000,000	14,820,000	35,000	3,100	14,785,000	850,000	.....	.....
Puget Sound.....	811	3,765,000	.....	117,800	.....	.....	3,882,800	.....	.....	.....	.....	.....	.....
Tilton River.....	948	2,731,000	.....	130,680	59,740	.....	2,790,680	.....	0,205	2,453,000	.....	305,065	.....
Wenatchee.....	.....	500,000	.....	4,000	.....	.....	496,000	.....	1,000	.....	494,000	.....	.....
Wind River.....	728	4,203,550	2,160,000	275,950	.....	.....	6,087,000	.....	20,400	6,067,200	.....	.....	.....
Totals.....	5,961	30,469,350	3,712,000	277,480	2,121,205	2,302,200	28,670,800	.....	77,935	28,001,800	1,394,400	.....	305,065
GRAY'S HARBOR DIST.—													
Chehalis.....	13,229	41,342,535	.....	2,456,420	4,306,345	21,133,800	15,577,350	5,181,958	5,225	10,022,400	.....	.....	0,821,085
Chehalis No. 2.....	.....	6,000,000	.....	.....	251,000	.....	5,749,000	.....	11,005	2,000,000	.....	.....	5,737,695
Humtulpis.....	3,133	9,441,000	.....	777,650	.....	4,020,000	4,428,200	1,435,600	28,700	5,885,200	.....	.....	.....
Totals.....	16,362	56,783,535	6,000,000	3,234,070	5,117,605	26,053,800	26,661,400	6,616,958	44,928	18,767,600	.....	.....	13,550,089
WILLAPA HARBOR DIST.—													
Naselle.....	1,452	5,570,400	670,000	198,185	483,165	1,000,000	270,500	3,775,800	605,443	32,648	3,607,900	.....	651,305
Naselle River.....	1,136	254,400	1,000,000	59,700	.....	.....	2,004,700	.....	10,100	2,084,600	.....	.....	.....
Willapa.....	1,820	7,114,550	.....	294,335	943,335	1,070,000	1,114,250	3,681,300	663,713	24,633	3,729,100	.....	596,480
Totals.....	3,408	12,669,350	2,670,000	492,520	1,486,230	3,570,000	1,303,840	9,561,800	1,274,156	67,181	9,510,000	.....	1,247,873
RECAPITULATION—													
Puget Sound Dist.....	19,128	53,221,775	21,653,100	6,682,375	4,149,149	3,043,300	12,136,050	62,260,137	8,031,404	271,119	38,180,885	391,000	31,687,747
Columbia River Dist.....	5,091	30,469,350	3,712,000	277,480	2,121,205	3,692,200	65,505	28,670,800	.....	77,000	26,901,800	1,394,400	305,065
Gray's Harbor Dist.....	16,362	56,783,535	6,000,000	3,234,070	5,117,605	26,053,800	26,661,400	6,616,958	44,928	18,767,600	.....	.....	13,550,089
Willapa Harbor Dist.....	3,408	12,669,350	2,670,000	492,520	1,486,230	3,570,000	1,303,840	9,561,800	1,274,156	67,181	9,510,000	.....	1,247,873
Grand Totals.....	44,919	147,414,010	33,015,100	10,689,445	13,273,333	36,250,300	16,287,515	126,105,407	16,922,908	460,833	93,370,185	1,778,500	60,460,007

SUMMARY OF OUTPUT OF SALMON FROM STATE HATCHERIES.
Fiscal Year 1919.

	CHINOOK	DOG	HUMPBACK	SILVER	STEEL-HEAD	TOTALS
Number females spawned.....	7,547	22,547	1,186	10,112	3,517	44,919
EGGS Taken by state hatcheries.....	38,156,685	62,319,600	2,285,050	31,086,125	18,016,550	147,414,010
On hand April 1, 1919.....		2,828,000		7,066,854	791,591	10,686,445
Total.....	38,156,685	65,147,600	2,285,050	38,102,979	14,408,141	158,100,455
Lost.....	3,088,288	6,443,170	209,970	2,294,004	1,238,901	13,273,333
Shipped to eastern states on exchange agreement.....	530,000					530,000
Furnished to University of Washington (experimental purposes).....	10,000					10,000
Furnished to county hatcheries for hatching and planting as follows:						
King County.....						
Spokane County.....						
Stevens County.....						
Sold to F. A. Beeler (private hatchery).....						543,000
Sold to S. A. Feden (private hatchery).....						500,000
On hand March 31, 1920.....	50,000			25,000	100,000	540,200
	20,000					175,000
		8,065,730		7,357,143	924,640	20,000
FRY Hatched.....	34,432,307	50,698,700	2,076,080	28,496,830	10,571,400	136,196,407
On hand April 1, 1919.....		2,610,267		13,187,821	125,000	15,922,608
Lost.....	131,440	188,156	39,830	69,768	30,040	400,833
Sold to Fred Clough (private hatchery).....						30,000
Furnished to counties (planted in lieu of trout).....						1,756,300
Planted.....	55,600	22,602,325	1,315,000	27,660,000	1,700,700	28,270,185
On hand March 31, 1920.....	1,324,657	30,517,907	721,750	13,871,383	8,571,660	46,500,697

PERCENTAGE OF LOSS ON SALMON EGGS AND FRY.
Fiscal Year 1919.

SPECIE	Loss on		SPECIE	Average Number Eggs
	Eggs	Fry		
Chinook.....	8%	0.8%	Chinook.....	5,055
Dog.....	10%	0.8%	Dog.....	2,764
Humpback.....	9%	1.8%	Humpback.....	1,970
Silver.....	7%	0.2%	Silver.....	3,069
Steelhead.....	9%	0.8%	Steelhead.....	3,872

OUTPUT OF TROUT FROM STATE HATCHERIES.
Fiscal Year 1919.

HATCHERIES	Number Females Spawners	Number Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs on Hand March 31, 1919	Number Eggs Lost	Number Eggs Shipped	No. Eggs on Hand March 31, 1920	No. Fry Hatched March 31, 1919	No. Fry on Hand March 31, 1920	No. Fry Lost	No. Fry Planted	No. Fry on Hand March 31, 1920	
BEARDSLEE— Lake Crescent Trout Hatchery.....	12	24,000		16,700	685		23,675	16,400		400	10,000		
BLACK-SPOTTED— Samish Salmon Hatchery..... Spokane Trout Hatchery.....			* 16,000 * 16,000		10,000 1,500			6,600 15,100		1,500 200	5,100 14,900		
Totals			33,200		11,500			21,700		1,700	20,000		
CRESCENTII— Lake Crescent Trout Hatchery.....	51	57,000		6,800	41,500		39,000	25,300	25,880	430	32,500	16,250	
CUT-THROAT— Chambers Creek Salmon Hatchery..... Lake Chelan Trout Hatchery..... Lake Crescent Trout Hatchery..... Green River Salmon Hatchery..... Paterson-Methow Salmon Hatchery..... Spokane Trout Hatchery..... Tilton River Trout Hatchery..... Twin Lakes Eysing Station..... Walla Walla Trout Hatchery..... Lake Wantrom Trout Hatchery..... Wenatchee Salmon Hatchery..... Othello State Fish Commissioner.....	276 862 27 27 31 31 1,778 21	275,000 909,100 50,500 1,185 12,400 4,000 20,000 900 120,980 11,900 7,531 6,600 500				29,500 29,100 1,185 12,400 4,000 20,000 900 120,980 11,900 7,531 6,600 500		245,500 50,000 58,300 177,000 96,000 370,000 17,100 293,100 58,000 39,933 962,700 9,500			245,500 49,500 100 175,500 1,000 368,800 300 288,300 57,800 4,400 957,300 9,500		
Totals	3,025	2,671,300	1,964,320	71,040	244,616	2,080,320	34,933	2,337,800		15,400	2,322,500		

* Received from U. S. Bureau of Fisheries, Montana.
† 125,600 eggs to King County.

Output of Trout From State Hatcheries—Continued.
Fiscal Year 1919.

HATCHERIES	Number Females Spawmed	Number Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs on Hand March 31, 1919	Number Eggs Lost	Number Eggs Shipped	No. Eggs on Hand March 31, 1920	No. Fry Hatched	No. Fry on Hand March 31, 1919	No. Fry Lost	No. Fry Planted	No. Fry on Hand March 31, 1920
EASTERN BROOK—												
Chambers Creek Salmon Hatchery.....	25	18,500	*2,189,975	.....	248,975	.....	.....	1,941,900	.....	27,925	1,161,000	762,975
Famous Springs Eyeing Station.....	1,272	907,500	.....	.....	100	892,450	.....	18,400	.....	.....	18,400	.....
Lost Lake Eyeing Station.....	285	765,000	.....	.....	165,050	600,000	.....	.....	.....	.....	.....	.....
Owhi Lake Eyeing Station.....	.....	.....	.....	.....	3,900	.....	.....	71,100	.....	100	.....	71,000
Pateros-Methow Salmon Hatchery.....	.....	.....	75,000	.....	14,900	.....	.....	315,400	.....	2,000	313,400	.....
Samish Salmon Hatchery.....	.....	.....	* 330,000	.....	145,450	.....	.....	1,162,000	.....	2,800	1,159,200	.....
Spokane Trout Hatchery.....	.....	.....	†1,307,450	.....	61,000	.....	.....	539,000	.....	3,200	535,800	.....
Little Spokane Trout Hatchery.....	.....	.....	* 600,000	.....	298,000	.....	.....	502,000	.....	15,400	486,600	.....
Walla Walla Trout Hatchery.....	.....	.....	* 750,000	.....	.....	† 750,000	.....	.....	.....	.....	.....	.....
Office State Fish Commissioner.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals.....	1,532	1,691,000	6,052,425	.....	961,175	2,232,450	.....	4,549,800	.....	51,425	3,674,400	683,975

* Eggs from Eastern states.
† 500,000 eggs from Eastern states.
‡ Shipped 600,000 to King County.
100,000 to Stevens County.
50,000 to Ferry County.

Output of Trout From State Hatcheries—Continued.
Fiscal Year 1919.

HATCHERIES	Number Females Spawned	Number Eggs Taken	No. Eggs Received from Other Hatchery*	No. Eggs on Hand March 31, 1919	Number Eggs Lost	Number Eggs Shipped	No. Eggs on Hand March 31, 1920	No. Fry Hatched	No. Fry on Hand March 31, 1919	No. Fry Lost	No. Fry on Hand March 31, 1920	
RAINBOW—												
Chehalis Salmon Hatchery.....	762	380,000	100,000	.....	1,000	520,000	.....	99,000	.....	200	98,800
Dumarka Lake Eying Station.....	542	125,000	.....	.....	19,100	134,800	.....	.....	.....	.....	.....
Fish Lake Eying Station.....	.....	.....	.....	.....	.....	.....	.....	604,000	.....	.....	.....
Green River Salmon Hatchery.....	3,380	893,500	892,000	.....	25,000	828,000	.....	504,000	.....	5,200	558,800
Packwood Lake Eying Station.....	.....	.....	.....	.....	.....	.....	.....	40,000	.....	.....	.....
Samsish Salmon Hatchery.....	.....	.....	.....	.....	4,200	.....	.....	131,800	.....	3,500	128,300
Spokane Trout Hatchery.....	234	204,800	196,000	.....	26,800	.....	.....	298,000	.....	2,900	295,100
Walla Walla Trout Hatchery.....	.....	.....	420,000	.....	17,625	.....	.....	402,375	.....	5,575	396,800
Totals.....	4,080	1,027,400	1,482,800	.....	182,225	1,482,800	.....	1,445,175	.....	16,975	1,428,200
SILVER TROUT—												
Chumbers Creek Salmon Hatchery.....	.....	.....	538,500	.....	31,500	.....	.....	502,000	.....	.....	502,000
Chumbers No. 2 Salmon Hatchery.....	.....	.....	450,000	.....	54,300	.....	.....	395,700	.....	8,628	387,072
Lake Crescent Trout Hatchery.....	.....	.....	* 840,000	.....	34,400	.....	.....	805,600	.....	600	805,000
Dungeness Salmon Hatchery.....	.....	.....	150,000	.....	5,005	.....	144,995	.....	.....	.....	.....
Green River Salmon Hatchery.....	.....	.....	2,758,000	.....	258,000	2,500,000	.....	.....	77,070	.....	.....
Kalama Salmon Hatchery.....	.....	.....	677,000	.....	45,000	.....	.....	832,000	.....	2,800	829,200
Paterok-Methow Salmon Hatchery.....	.....	.....	1,000,000	.....	95,700	.....	.....	104,300	796,420	1,600	794,820
Sawtooth Salmon Hatchery.....	.....	.....	400,000	.....	27,000	.....	.....	300,000	.....	.....	.....
Skykomish Salmon Hatchery.....	.....	.....	† 420,000	.....	11,000	.....	122,070	307,600	.....	400	307,200
Spokane Trout Hatchery.....	.....	.....	.....	97,800	800	.....	.....	97,000	.....	.....	.....
Little Spokane Trout Hatchery.....	.....	.....	1,180,000	.....	66,500	.....	.....	1,114,000	.....	300	1,109,700
Walla Walla Trout Hatchery.....	.....	.....	900,000	.....	58,000	.....	.....	842,000	.....	15,000	1,000,000
Lake Washington Eying Station.....	42,000	4,943,000	.....	.....	.....	4,943,000	.....	.....	.....	.....	.....
Lake Whatcom Trout Hatchery.....	25,562	6,579,500	.....	460,650	583,550	13,014,000	.....	460,650	1,700,000	9,400	2,151,200
Wenatchee Lake Eying Station.....	238	112,400	.....	.....	.....	100,000	.....	.....	.....	.....	.....
Other State Fish Commissioner.....	.....	.....	2,185,000	.....	89,400	\$2,027,000	.....	56,600	.....	1,000	57,600
Totals.....	67,700	11,684,900	11,694,000	558,450	1,814,945	12,284,000	8,249,065	6,730,400	2,527,400	40,919	7,000,000	

* Received from King County.
† 229,000 received from King County.
‡ 1,300,000 shipped to Eastern states.
§ 250,000 shipped to Skamania County.
|| 500,000 shipped to Kittitas County.

Output of Trout From State Hatcheries—Concluded.
Fiscal Year 1919.

HATCHERIES	Number Females Spawmed	Number Eggs Taken	No. Eggs Received from Other Hatch'rs	No. Eggs on Hand March 31, 1919	Number Eggs Shipped	No. Eggs on Hand March 31, 1920	No. Fry Hatched March 31, 1919	No. Fry on Hand March 31, 1920	No. Fry Lost	No. Fry Planted	No. Fry on Hand March 31, 1920	
												No. Fry Hatched March 31, 1919	No. Fry on Hand March 31, 1920
ALL SPECIES CONTINUED—												
Chandler's Creek Salmon Hatchery.....	276	275,000	2,723,475	.....	300,075	.....	2,680,400	.....	27,025	1,908,500	752,075
Chandler's Salmon Hatchery.....	.....	.....	100,000	.....	1,000	.....	99,000	.....	200	98,800	.....
Chandler's Salmon Hatchery No. 2.....	.....	.....	450,000	.....	54,300	.....	395,700	.....	3,628	.....	392,072
Lake Cleelan Trout Hatchery.....	892	966,100	.....	.....	29,100	920,000	.....	.....	500	49,500	.....
Lake Crescent Trout Hatchery.....	19	171,500	840,000	30,685	77,900	.....	807,400	25,880	1,530	905,700	16,250
Pumpkin Lake Eysing Station.....	752	580,000	.....	.....	60,000	520,000	.....	.....	.....	.....	.....
Dunguress Salmon Hatchery.....	.....	.....	150,000	.....	5,065	.....	144,935	.....	770	76,300	.....
Famous Springs Eysing Station.....	25	18,500	.....	.....	100	.....	18,400	.....	.....	18,400	.....
Fish Lake Eysing Station.....	542	153,900	.....	.....	19,100	134,800	.....	.....	.....	.....	.....
Gresp River Salmon Hatchery.....	.....	.....	3,540,000	.....	298,400	2,500,000	.....	.....	7,300	734,300	.....
Kahama Salmon Hatchery.....	.....	.....	877,000	.....	45,000	.....	832,000	.....	2,300	829,700	.....
Lost Lake Eysing Station.....	1,272	907,500	.....	.....	25,050	882,450	.....	.....	.....	.....	.....
Owbi Lake Eysing Station.....	235	705,000	.....	.....	105,000	600,000	.....	.....	.....	.....	.....
Tackwood Lake Eysing Station.....	3,386	893,500	.....	.....	25,500	828,000	.....	.....	.....	.....	.....
Paterson's Methow Salmon Hatchery.....	.....	.....	1,175,000	.....	23,000	.....	40,000	.....	.....	40,000	.....
Samseli Salmon Hatchery.....	.....	.....	882,000	.....	46,730	.....	1,141,400	750,420	2,700	844,800	1,044,230
Skykomish Salmon Hatchery.....	.....	.....	420,000	.....	29,400	.....	713,800	.....	7,933	446,800	250,769
Stokane Trout Hatchery.....	.....	.....	1,048,010	97,800	104,610	.....	1,852,100	.....	7,000	1,845,100	.....
Little Spokane Trout Hatchery.....	.....	.....	1,780,500	.....	127,500	.....	1,653,000	.....	18,200	1,634,800	.....
Tilton River Trout Hatchery.....	31	18,000	.....	.....	900	.....	17,100	.....	300	16,800	.....
Walla Walla Trout Hatchery.....	1,778	1,200,300	.....	.....	120,200	1,109,320	.....	.....	30,175	2,008,700	.....
Walla Walla Trout Hatchery.....	.....	.....	2,425,000	.....	885,525	.....	2,039,475	.....	.....	.....	.....
Lake Washington Eysing Station.....	12,000	1,943,000	.....	.....	4,943,000	.....	.....	.....	.....	.....	.....
Lake Whatcom Trout Hatchery.....	25,373	6,617,000	.....	518,714	591,081	3,014,000	518,600	1,700,000	9,600	2,309,000	.....
Winatchee Lake Eysing Station.....	238	112,400	.....	.....	12,400	100,000	.....	.....	.....	.....	.....
Winatchee Salmon Hatchery.....	.....	.....	900,320	.....	6,620	.....	962,700	.....	5,400	957,300	.....
Office State Fish Commissioner.....	.....	.....	2,945,000	.....	99,900	2,777,000	.....	.....	1,000	66,500	.....
GRAND TOTALS.....	77,000	17,745,000	21,229,805	647,149	2,756,796	18,886,370	15,127,575	2,563,370	127,440	15,088,200	2,405,296	

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SUMMARY OF OUTPUT OF TROUT FROM THE STATE HATCHERIES.
Fiscal Year 1919.

	Beardslee	Black Spotted	Crescentli	Cut-Throat	Eastern Brook	Rainbow	Silver	Totals
Number females spawned.....	12		51	3,025	1,532	4,080	67,790	77,000
EGGS—								
Taken by State Hatcheries.....	24,000		97,000	2,671,300	1,691,000	1,027,400	11,634,000	17,745,000
Received from U. S. Bureau of Fisheries.....		33,200						33,200
Received from Eastern States on exchange agreement, as follows:								
State of Connecticut.....					200,000			200,000
State of Massachusetts.....					200,000			200,000
State of New Hampshire.....					796,000			796,000
Furnished by the State, as follows:								
Brookdale Trout Co., Duxbury, Mass.....					500,000			500,000
A. R. Graham & Son, Berkeley, Mass.....					223,975			223,975
Glean Fisheries Trout Co., Paw Paw, Mich.....					1,900,000			1,900,000
Paradise Brook Trout Co., Henryville, Pa.....						1,160,000		1,160,000
Taken by King County and turned over to the State for hatching	24,000	83,200	97,000	2,671,300	6,260,975	1,027,400	12,794,900	23,508,885
Totals.....	10,760	83,200	6,800	71,049	6,260,975	1,027,400	558,450	647,149
On hand April 1, 1919.....	34,700	33,200	103,800	2,742,349	6,260,975	1,027,400	13,353,350	24,135,084
GRAND TOTALS	985	11,500	41,500	244,616	981,175	182,225	1,314,945	2,756,796
Lost.....							1,300,000	1,300,000
Shipped to Eastern States.....								
Shipped to county hatcheries for hatching and planting, as follows:								
Ferry County.....				125,000	50,000			50,000
King County.....				125,000	600,000			725,000
Kittitas County.....							500,000	500,000
Skamania County.....							250,000	250,000
Stevens County.....					100,000			100,000
On hand March 31, 1920.....	23,675		39,000	34,633			3,249,005	3,346,613
FRY—								
Hatched.....	10,400	21,700	23,300	2,337,800	4,549,800	1,445,175	6,730,400	15,197,675
On hand April 1, 1919.....			25,800				2,537,400	2,537,400
Lost.....	400	1,700	300	15,600	31,425		60,911	127,440
Planted.....	10,000	20,000	32,500	2,322,200	3,678,400	1,428,200	7,000,000	15,088,500
On hand March 31, 1920.....			10,250		833,175		1,625,071	2,465,296

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PERCENTAGE OF LOSS ON TROUT EGGS AND FRY.

Fiscal Year 1919.

SPECIES	Loss on Eggs	Loss on Fry
Beardlee	1.0%	8.8%
Black Spotted	34.7%	7.8%
Crescentli	40 %	1.8%
Cut-Throat	8.9%	0.6%
Eastern Brook	16.8%	1.1%
Rainbow	11.1%	1.1%
Silver	9.8%	0.6%

AVERAGE NUMBER EGGS TAKEN TO FEMALE.

Fiscal Year 1919.

SPECIES	Average Number Eggs
Beardlee	2,000
Crescentli	1,801
Cut-Throat	888
Eastern Brook	1,108
Rainbow	846
Silver	171

DISTRIBUTION OF TROUT FRY PLANTED FROM THE STATE HATCHERIES.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)
Fiscal Year 1919.

COUNTIES AND WATERS	Beardslee	Black Spotted	Crescentif	Cut-Throat	Eastern Brook	Rainbow	Silver	Total Trout	Chinook	Steelhead	Total Salmon	Grand Totals
WESTERN WASHINGTON DISTRICT												
CLALLAM COUNTY—												
Lake Crescent	10,000		32,500	58,200			805,000	938,700		90,800	99,800	1,038,500
Lake Sutherland				33,000								
CLARKE COUNTY—												
Cedar Creek				28,000		30,000		538,000				538,000
Washougal River							475,000					
Canas Lake												
COWLITZ COUNTY—												
Kalama River						28,500		318,200				318,200
Silver Lake												
GRAYS HARBOR COUNTY—												
Cloquallum River				7,000		84,000						
Hoquiam River						30,000						
Lesters Dam						5,000						
West Branch Salsop River				7,000		5,000						
Mox Chehalis River				7,000								
Wild Cat Creek				7,000								
Rock Creek				7,000								
Cedar Creek				7,000	5,000							
East Homalim River				7,000								
Porter Creek				7,000								
Gorald Creek				7,000								
Dezainic Creek				7,000								
Zigler Creek					20,000							
Humphalps River					16,000							
Wishkah River					10,000			194,000				194,000
ISLAND COUNTY—												
Greenbank Lake				28,000				28,000				28,000
JEFFERSON COUNTY—												
Lake Crocker												
Lake Hooker							38,150					
Little Quilteps River				18,500			38,150					
Dosewallips River						19,000		113,800				113,800

Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beardslee	Black Spotted	Crescent	Cut-Throat	Eastern Brook	Rainbow	Silver	Total Trout.	Chinook	Steelhead	Total Salmon	Grand Totals
WESTERN WASHINGTON DIST.												
KING COUNTY—												
Cedar River			100,000			60,500						
Issaquah Creek				9,500		48,400						
Lake Sammamish				6,500		51,400	57,000	320,300				320,300
Suns Creek				12,000								
KITSAP COUNTY—												
Horseshoe Lake						4,000				6,500		
Big Roof Creek				9,500								
Ross Creek				6,500								
Kanillehe Creek				12,000								
Black Jack Creek						5,000						
Kitsap Lake						15,000		52,000			6,500	58,500
LEWIS COUNTY—												
Winston Creek				8,400								
Mill Creek				8,400								
Packwood Lake						40,000						
Coal Creek				4,000								
South Fork Newakum River				8,000								
Lost Creek				4,000								
Lacamas Creek				4,000								
Mill Creek and Slide Creek				17,000								
Elk Creek				4,000				97,800				97,800
MASON COUNTY—												
Goldsober Creek				10,000		10,000						
Dwer Creek				15,000		4,800						
Tahuya River						10,000						
Mill Creek				10,000								
Cranberry Creek				10,000				60,800				60,800
PACIFIC COUNTY—												
Palix River				9,500								
Middle Palix River					6,000							
Butte Creek				9,000								
Wilson Creek						31,500						
Brown Creek						5,000						
McClamma Creek						30,000						
Smith's Creek					12,500							
Upper Willapa River					31,000							
Court House Pond					500			135,000				135,000

Distribution of Trout Fry Planted from the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beardsize	Black Spotted	Cres-centil	Cut-Throat	Eastern Brook	Rainbow	Silver	Total Trout	Chinook	Steelhead	Total Salmon	Grand Totals
WESTERN WASHINGTON DIST.												
PIERCE COUNTY—												
Balchs Lake										50,000		
American Lake						50,000				50,000		
South Prairie Creek						25,000						
Clear Lake						25,000						
Tidwax Creek						10,000						
Murray Creek				5,000								
Popad				37,000								
Muck Creek				10,000								
Clayton Creek				45,500								
Shubbers Creek							90,000					
Spinnaway Lake							212,000					
Stellacoom Lake								1,502,500			100,000	1,602,500
Asylum Creek					395,000							
SAN JUAN COUNTY—												
Cascade Lake						31,000		31,000				31,000
SKAGIT COUNTY—												
Poss Lake						15,000						
Lake Erie						5,000						
Lake Otniel						5,000						
Big Lake						10,000						
McMurry Lake						10,000		45,000				45,000
SKAMANIA COUNTY—												
Rock Creek					10,000	47,500		67,500				67,500
Lake of the Woods					10,000							
SNOHOMISH COUNTY—												
Crabapple Lake				20,000								
Lake Ki									35,000		25,000	
Lake Stevens							60,000				25,000	
Lake Goodwin							99,200				50,000	
Lake Rossler							50,000		20,000			
Lake Stillagnamish				25,000								
Lake Chain				10,000								
Lake Hughes				5,000								
Lake Cochran				5,000								
Lake Martha				5,000								
Lake Howard				20,000								
Flowing Lake				10,000								
Silver Lake							138,000	497,200			155,600	652,800
							50,000					

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**Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)**

COUNTIES AND WATERS	Beardslee	Black Spotted	Crescent	Cut-Throat	Eastern Brook	Rainbow	Silver	Total Trout	Chinook	Steelhead	Total Salmon	Grand Totals
WESTERN WASHINGTON DIST.												
THURSTON COUNTY—												
Des Chutes River				23,000		48,000	100,000					
Summit Lake							75,000					
Clear Lake							25,000					
Lawrence Lake												
Black Lake					40,000			317,000				317,000
WAHIAKUM COUNTY—												
Eikoman River						24,000	30,000	80,000				80,000
Skamokawa River							35,000					
WHATCOM COUNTY—												
Lake Whatcom				57,800	70,000		1,551,200					
Lake Padden							200,000					
Toad Lake						10,000	100,000					
North Fork Nooksack River												
Bagley Creek						10,000						
Big Beaver Creek						10,000						
Lost Lake						22,300						
Ten Mile Creek					10,000							
Silver Lake		5,100			86,000							
Kendall Creek					90,400							
Dakota Creek					30,000							
Bertrand Creek					27,000			2,579,800				2,579,800
Totals W. W. District	10,000	5,100	32,500	763,300	1,474,400	825,000	4,818,400	7,929,600	55,600	306,300	381,900	8,291,500
EASTERN WASHINGTON DISTRICT												
ADAMS COUNTY—												
Cow Creek				31,000	86,500	17,500	40,000	175,000				175,000
ASOTIN COUNTY—												
Asotin Creek					37,000							
Pintler Creek					20,000							
Ten Mile Creek					10,000							
George Creek					20,000			124,000				124,000
Totals												154,000

Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beardslee	Black Spotted	Crescent	Cut-Throat	Eastern Brook	Rainbow	Silver	Total Trout	Chinook	Steelhead	Total Salmon	Grand Totals
EASTERN WASHINGTON DIST.												
CHELAN COUNTY—												
Stehkan River.....				49,500								
Dumfries Lake.....										50,000		
First Creek.....										100,000		
Eastlet River.....							40,000			100,000		
Squidblank.....										20,000		
Stemmit Creek.....										10,000		
Clackin Creek.....										10,000		
Ingle Creek.....										30,000		
Pishatin Creek.....					10,000		25,000			70,000		
Wells Creek.....										100,000		
Wenatchee River.....				127,300						50,000		
Clear Lake.....										5,000		
Chewanu River.....				150,000						20,000		
Nathan Creek.....				150,000			40,000			50,000		
Rainbow Creek.....										20,000		
Wenatchee Lake.....				150,000						30,000		
Chewatum Creek.....					20,000							
Chelan Lake.....				100,000								
Little Wenatchee River.....				50,000								
Snow Lakes.....				20,000								
Roaring Creek.....				10,000								
Chump Stick Creek.....							15,000					
Fish Lake.....							19,500					
Hidden Lake.....					10,000							
Coon Lake.....					30,000							
								1,046,300			794,400	1,840,700
COLUMBIA COUNTY—												
North Fork Touchet River.....						68,000						
South Fork Touchet River.....				37,800								
Tucannon River.....					48,800							
Touchet River.....					45,500							
Butch Creek.....							48,000					
Bear Pond.....							90,100					
Wernhards.....							90,100					
Youngs.....							48,100					492,300
DOUGLAS COUNTY—												
Rock Island Creek.....				20,700		17,500						
Douglas Creek.....					71,500							
								109,700				109,700

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Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beardslee	Black Spotted	Crescent	Cut-Throat	Eastern Brook	Rainbow	Silver	Total Trout	Chinook	Steelhead	Total Salmon	Grand Totals
EASTERN WASHINGTON DIST.												
FERRY COUNTY—												
Swan Lake			6,000			17,500						
San Poll Lake			12,800									
Hall Creek				10,000								
Stenger Creek				10,000								
San Poll Creek				28,400								
Curlow Creek					22,500							
Twin Lake							17,500	124,700				124,700
GARFIELD COUNTY—												
Deadmans Creek						7,300						
Pataha Creek				66,200			69,800					
Tucuman River						51,500		222,000				222,000
GRANT COUNTY—												
Crab Creek				18,800				89,800				89,800
KUITTAS COUNTY—												
Tannu Creek				16,700								
Fogarty Slough					36,800	37,800						
Wabash Creek				40,000								
Tilliers Slough				16,000								
Water Plant Slough				16,000								
Monastosh Creek				28,500				191,800				191,800
KLICHTAT COUNTY—												
Little Kluckhat River				56,700	48,500							
Trout Lake						37,800	95,800					
Spring Creek				48,900								
Northwestern Lake							95,800	883,400				883,400
LINCOLN COUNTY—												
Crab Creek				61,000	52,500							
Wilson Creek					18,000							
White Creek					25,000			191,500				191,500

Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beardslee	Black Spotted	Crescentif	Cut-Throat	Eastern Brook	Rainbow	Silver	Total Trout	Chinook	Steelhead	Total Salmon	Grand Totals
EASTERN WASHINGTON DIST.												
OKANOGAN COUNTY—												
Patterson Lake							35,000					
Davis Lake							35,000					
Bonner Lake							35,000					
Horse Lake							17,500					
Shaw Lake							17,500					
Brewster Lake							55,000					
Spartan Lake					36,000		70,000			75,000		
Sidley Lake							75,000			65,000		
Patterson Lake				30,000	13,000		75,000			25,000		
Mirror Lake							31,125					
Little Goose Lake							31,125			15,000		
Buzzard Lake							31,125			10,000		
Osoyoos Lake							43,250			100,000		
Riverside Lake							11,670					
Smith Lake							23,300					
Pomparte Lake				30,000			80,000			65,000		
Crawfish Lake							32,770					
Long Lake							14,750					
Round Lake							14,750					
"L" Lake							14,750					
Salmon Creek				95,000								
Rogers Lake				10,000						85,000		
Crunk Lake										10,000		
Hendrix Lake										5,000		
Marpie Lake										5,000		
Turner Lake										20,000		
Blue Lake										25,000		
Twin Lakes										25,000		
Alta Lake										5,000		
Bowen Lake										5,000		
Lodiway Lake										5,000		
Rainbow Lake										5,000		
Owhi Lake										5,000		
Fall Creek					55,000					10,000		
Twisp River					12,500							
Antwip Creek					12,500							
Johnson Creek					12,500							
Lost Lake					25,000			1,013,800			500,000	1,513,800

**Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)**

COUNTIES AND WATERS	Beardslee	Black Spotted	Cres-centli	Cut-Throat	Eastern Brook	Rainbow	Silver	Total Trout	Chhook	Steelhead	Total Salmon	Grand Totals
EASTERN WASHINGTON DIST.												
PEND OREILLE COUNTY—												
Big Muddy Creek							56,700					
Lost Creek							89,000					
Reed Lake				47,000						100,000		
Brown Lake						20,300						
Half Moon Lake					18,400							
Calispel Creek					28,000							
Little Spokane River					55,000							
Tacoma Creek							40,000					
La Claire Creek							55,000	406,400			100,000	506,400
Cedar Creek												
SPOKANE COUNTY—												
Chapman Lake		14,000										
Liberty Lake				67,000								
Newman Lake				67,000								
Dragon Creek						89,200						
Long Lake							270,000					
Williams Lake							123,000					
Above Nine Mile Dam							140,500	1,536,000				1,536,000
Holding in feeding ponds					815,400							
STEVENS COUNTY—												
Little Pend Oreille Lakes				18,800		17,500						
Chewelah Creek				18,700		17,500						
Waits Lake							30,000					
Loon Lake							30,000					
Deer Lake							30,000					
Cobville River							39,000					
Lost by county								231,500				231,500
WALLA WALLA COUNTY—												
Mill Creek				53,400	48,800	48,800	272,300					
Dry Creek				27,000	18,600		15,000					
Copper Creek					30,000	24,000		537,000				537,000
WHITMAN COUNTY—												
Union Creek						22,800						
Overflow city water supply, Colfax						15,000						
Palouse River					42,500			80,300				80,300

Distribution of Trout Fry Planted from the State Hatcheries—Concluded.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beardslee	Black Spotted	Crescentii	Cut-Throat	Eastern Brook	Rainbow	Silver	Total Trout	Ohnook	Steelhead	Total Salmon	Grand Totals
EASTERN WASHINGTON DIST.												
YAKIMA COUNTY—												
Upper Naches River			56,700	48,500	87,800							
Moxee Slough				48,900				191,800				191,800
Toppenish Creek												
Totals E. W. District		14,000	92,500	1,658,900	2,200,000	602,300	2,782,500	7,158,800		1,394,400	1,394,400	9,658,000
GRAND TOTALS	10,000	20,000	2,322,200	3,674,400	1,428,200	7,600,900	15,089,200	1,756,800	55,600	1,700,700	1,756,800	16,844,500

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TROUT AND STEELHEAD EGGS FURNISHED BY STATE TO COUNTIES.**Fiscal Year 1919.**

COUNTIES	TROUT				SALMON	
	Cut-Throat	Eastern Brook	Silver	Total Trout	Steelhead	Grand Total
Ferry.....		50,000		50,000		50,000
King.....	125,000	600,000		725,000	543,200	1,268,200
Kittitas.....			500,000	500,000		500,000
Skamania.....			250,000	250,000		250,000
Spokane.....					500,000	500,000
Stevens.....		100,000		100,000	540,000	640,000
Totals.....	125,000	750,000	750,000	1,625,000	1,583,200	3,208,200

TROUT EGGS PURCHASED AND HATCHED BY THE COUNTIES.**Fiscal Year 1919.**

(Orders placed by the State Fish Commissioner, for the counties, with Paradise Brook Trout Co., of Henryville, Pa., for Eastern Brook trout eggs.)

COUNTIES	Number Eastern Brook
King.....	1,500,000
Snohomish.....	500,000
Stevens.....	100,000
Total.....	2,100,000

PERMITS GRANTED FOR THE PLANTING OF FRY FROM COUNTY HATCHERIES.
Fiscal Year 1919.

COUNTIES AND WATERS	TROUT					SALMON				Black Bass and Crappies	Grand Total	
	Black-Spotted	Cut-Throat	Eastern Brook	Rainbow	Silver	Total Trout	Chinook	Silver	Steelhead			Total Salmon
WESTERN WASHINGTON DIST.												
CLARKE COUNTY—												
Wahougal River	25,000	30,000		182,000		237,000						
Cedar Creek												
Totals	25,000	30,000		182,000		237,000						237,000
KING COUNTY—												
Bear Creek, Soos Creek, Tokul Creek			108,648									
White River, tributaries to Lake Sammamish, Snoqualmie Lake		145,000					8,000					
Kirkland Lake				148,000								
South fork Snoqualmie River, Cedar River tributaries, Issaquah Creek, Tokul Creek, south fork Snoqualmie River					1,450,000	1,851,648				324,120		
Lake Sammamish							8,000			324,120		
Totals		145,000	108,648	148,000	1,450,000	1,851,648	8,000			324,120		2,183,768
SKAMANIA COUNTY—												
Wahougal River												
Little White Salmon River												
Big White Salmon River												
Wind River												
Rock Creek												
Dead Horse Lake												
Trapper Creek												
Little Blue Lake												
Totals												250,000
Total Western Washington District	25,000	175,000	108,648	330,000	1,450,000	2,088,648	8,000			574,120		2,470,768

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Permits Granted for the Planting of Fry From County Hatcheries—Continued.

COUNTIES AND WATERS	TROUT					SALMON				Black Bass and Crappies	Grand Total	
	Black-Spotted	Cut-Throat	Eastern Brook	Rainbow	Silver	Total Trout	Chinook	Silver	Steelhead			Total Salmon
EASTERN WASHINGTON DIST.												
KITTITAS COUNTY—												
Tonaway River			86,000									
Swank Creek			29,000									
Yakima River and tributaries	10,000	15,000	135,000									
Cle Elum River			110,000									
Cle Elum Lake						70,000						
Kachess Lake						100,000						
Kachichus Lake						98,000						
Fish Lake	7,000											
Slough at hatchery	5,000											
Totals	22,000	15,000	374,000			268,000				674,000		674,000
PEND OREILLE COUNTY—												
Kings Lake			200,000									
South Skookum Lake			69,000									
North Skookum Lake			40,000									
Davis Lake			40,000									
Marshall Lake			50,000									
Yokum Lake			50,000									
Edger's Crescent Lake			10,000									
Crescent Lake			20,000									
Skookum Creek			20,000									
Indian Creek			30,000									
Little Spokane River			40,000									
Sold			475,000									
Totals			1,085,000			1,085,000						1,085,000
SPokane COUNTY—												
Newman, Liberty and Clear Lakes	14,000											
Spokane River									500,000			75,000
Long and Williams Lakes									941,000			

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Permits Granted for the Planting of Fry From County Hatcheries—Continued.

COUNTIES AND WATERS	TROUT					SALMON			Grand Total		
	Black-Spotted	Cut-Throat	Eastern Brook	Rainbow	Silver	Total Trout	Chinook	Silver		Steelhead	Total Salmon
EASTERN WASHINGTON DIST.											
SPOKANE COUNTY—Continued.											
Chapman Lake, Little Spokane River and tributaries.....		144,000	359,000								
Thompson and Kalez Creeks.....				48,200		565,200					
Blanchard Creek and tributaries of Little Spokane River.....						565,200					
Williams Lake.....										5,000	
Totals.....	14,000	144,000	359,000	48,200		565,200		941,000	500,000	1,441,000	
STEVENS COUNTY—											
Pey Creek.....			76,000								
Sheep Creek.....			25,000								
Sherwood Creek.....			30,000								
Colville Creek.....			25,000								
Pond Oreille Lakes.....			150,000								
Swamp Creek.....			25,000								
Mill Creek.....			50,000								
Pond Oreille River.....			50,000								
Chevelah Creek.....			5,000								
East Chevelah Creek.....			40,000								
Little Chevelah Creek.....			40,000								
Cottonwood Creek.....			20,000								
Leon Lake.....			30,000								
Chamakane Creek.....			25,000								
Thompson Creek.....			20,000								
Spruce Lakes.....			25,000								
Little Sheep Creek.....			15,000								
Big Sheep Creek.....			30,000								
Gold Creek.....			5,000								
Duck Creek.....			50,000								
South Fork Deer Creek.....			10,000								
Upper Colville River.....			25,000								
Lower Colville River.....			35,000								

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Permits Granted for the Planting of Fry From County Hatcheries—Concluded.

COUNTIES AND WATERS	TROUT					SALMON			Black Bass and Crappies	Grand Total	
	Black-Spotted	Cut-Throat	Eastern Brook	Rainbow	Silver	Total Trout	Chinook	Silver			Steelhead	Total Salmon
EASTERN WASHINGTON DIST.											
STEVENS COUNTY—Continued.											
Dunlap Creek.....			30,000								
Huckleberry Creek.....			10,000								
Deer Creek.....			20,000								
Bear Creek.....			10,000								
Crown Creek.....			10,000								
Pepone Lake.....			15,000								
Walt's Lake.....									80,000		
Lown Lake.....									80,000		
Deer Lake.....									80,000		
Pond Otelle Lakes.....									20,000		
Black Lake.....											
Totals.....			900,000						340,000	340,000	1,240,000
YAKIMA COUNTY—											
Satus Creek.....				100,000							
Sinopo Creek.....				40,000							
Wenas River.....				70,000							
Courchea River.....				200,000							
Naches River.....				880,000							
Auktanum River.....				400,000							
Bumping Lak.....				60,000							
Totals.....				1,700,000							1,750,000
Total Eastern Washington District..	36,000	159,000	2,668,000	1,798,200	263,000	4,924,200			941,000	840,000	1,781,000
Grand Totals.....	61,000	384,000	2,776,648	2,128,200	1,713,000	7,012,848	8,000	941,000	1,414,120	2,368,120	78,000
											78,000
											78,000

* Yakima County Game Commission has no hatchery of its own. Fry reared in private hatcheries.

PERMITS GRANTED FOR THE PLANTING OF FRY FROM OTHER THAN STATE AND COUNTY HATCHERIES.
Fiscal Year 1919.

COUNTIES AND WATERS	T R O U T					SALMON	BASS	Grand Total
	Black-Spotted	Cut-Throat	Eastern Brook	Rainbow	Total Trout				Steelhead
WESTERN WASHINGTON DISTRICT								
COWLITZ COUNTY—								
Coal Creek.....				10,000	10,000			10,000
GRAYS HARBOR COUNTY—								
Wishkah River.....	5,000							
Wynoni Creek.....	5,000							
Humpatulls RIVER.....	15,000				25,000			25,000
KING COUNTY—								
Lake Sawyer.....			165,000					
Snoqualmie Lake.....	68,950				233,950		241,202	475,152
Lake Washington.....								
LEWIS COUNTY—								
Mill Creek No. 2.....	5,000				5,000			5,000
PIERCE COUNTY—								
Spurway Creek.....	16,000							
Muck Creek.....	9,500							
Choway Creek.....	9,500							
Mashell River.....	19,000				54,000			54,000
SKAMANIA COUNTY—								
Trwan Creek.....	6,000							
Rook Creek.....				5,000				
Nelson Creek.....				5,000				
Little White Salmon River.....				5,000				
Washougal River.....				6,000				
SNOHOMISH COUNTY—								
Lake Evans.....	1,000							
Bondien Creek.....				2,000				
Squider Creek.....				4,000				
Clair Creek.....				4,000				
Lake Roosevelt.....	500			6,000				
Totals.....	160,450		165,000	47,500	372,950		241,202	614,152

Permits Granted for the Planting of Fry From Other Than State and County Hatcheries—Concluded.

COUNTIES AND WATERS	TROUT				SALMON	BASS	Grand Total
	Black-Spotted	Cut-Throat	Eastern Brook	Rainbow				Total Trout	Steelhead
EASTERN WASHINGTON DISTRICT—							
Concluded.							
SPOKANE COUNTY—							
Newman, Liberty and Chapman Lakes.....	100,000	100,000					200,000
Thompson and Kales Creeks.....							200,000
STEVENS COUNTY—							
Popoia Lake.....	10,000						
Deep Creek.....	10,000						
Sheep Creek.....	10,000						
Lower Colville River.....				55,000			
Pend Oreille Lakes.....				60,000			
Colville River.....							
Black Lake.....				10,000			
Upper Colville River.....				20,000			
Walt's Lake.....		10,000					
Deer Lake.....		25,000					
							380,000
YAKIMA COUNTY—							
Streams on W. L. Steinweg's farm.....			200,000				
Bumping River.....					25,000		
Totals.....	101,450	185,000	503,800	740,000	25,000		1,705,250
Grand Totals.....	321,000	185,000	758,800	787,500	25,000	241,202	2,319,402

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SUMMARY OF FRY PLANTED.
Fiscal Year 1919.

SALMON—		
Chinook	32,984,300	
Dog	22,602,325	
Humpback	1,315,500	
Silver	28,601,000	
Steelhead	12,011,480	97,514,605
TROUT—		
Beardslee	10,000	
Black Spotted	402,900	
Crescentli	32,500	
Cut-Throat	2,841,200	
Eastern Brook	7,209,848	
Rainbow	4,343,900	
Silver	9,313,900	24,154,248
MISCELLANEOUS—		
Black Bass and Crappies	319,202	319,202
Total.....		121,988,055

ARRESTS MADE FOR VIOLATIONS OF THE FOOD FISH LAWS.
Fiscal Year 1919.

Date of Arrest	OFFENDER	CHARGE	Disposition of Case	Penalty Imposed	Totals
1919 Nov. 23	D. Bourgette	CLALLAM COUNTY Gaffing salmon	Guilty	\$10 00	\$20 00
Nov. 23	H. McNutt				
1919 Apr. 29	James Goddard	OLARKE COUNTY Having in possession fish caught during closed season	Guilty	\$50 00	
Apr. 28	Steve Stalinger				
Apr. 28	Wm. Steenson				
Apr. 28	Arne Broklyn				
Apr. 28	A. Larson				
S-ept. 2	Frank Reed				
1919 Sept. 9	Roger Risley	COWLITZ COUNTY Fishing during closed season	Dismissed		
Sept. 8	Roger Risley				
Sept. 10	John Ohonen				
Sept. 10	Ed. Sax				
Oct. 8	Judd Murray				
Oct. 14	C. A. Taylor				
1919 Oct. 23	Charles Stenson	GRAYS HARBOR COUNTY Fishing without license	Guilty	None	
Oct. 23	John Mikelson				
Nov. 1	Lyn Leedham				
1920 Feb. 15	Lee Smith	Shooting food fish	Guilty	25 00	
1919 June 2	C. H. Ritchey	Digging clams without license	Guilty	10 00	45 00
1919 Nov. 18	Victor B. Hansen	ISLAND COUNTY Taking and selling crabs under size	Guilty	\$11 50	
July 27	Booth Fisheries Co.				
Apr. 8	Mike Huget				
Apr. 8	Pete Diklich				
		Fishing during closed season	Guilty	150 00	
		Fishing herring inside reserve during closed period	Guilty	75 00	
		Destroying food fish	Guilty	250 00	480 50

Arrests Made for Violations of the Food Fish Laws—Continued.

Date of Arrest	OFFENDER	CHARGE	Disposition of Case	Penalty Imposed	Totals
1919 May 8	Pete Dilleh	JEFFERSON COUNTY Destroying food fish	Gulley	\$200 00	200 00
1919 Dec. 31 Dec. 17	I. Kikumoto Fred August	KING COUNTY Operating without retail license Selling short salmon	Gulley Gulley	\$10 00 15 00	
1920 Jan. 19 Feb. 13	National Ind. Fisheries Jack Brown	Failure to make November, 1919, report Operating set net within 300 feet of another	Gulley Gulley	Dismiss'd 5 00	30 00
1919 Nov. 5 Nov. 5 Nov. 9 Nov. 11 Nov. 12 Nov. 23 Nov. 29 Dec. 29	A. G. Lindgren W. W. White Chas. Merrill Ed. Gaken Eight boys Siam Leon Bailey	KITSAP COUNTY Gaffing salmon Gaffing salmon Gaffing salmon Gaffing salmon Gaffing salmon Gaffing salmon Gaffing salmon	Gulley Gulley Gulley Gulley Gulley Gulley Gulley	\$30 00 25 00 25 00 25 00 Costs 20 00 2 00	
1920 Jan. 3	Fred Muscher	Shooting salmon	Gulley	50 00	177 00
1919 Sept. 9 Sept. 21 Sept. 27	Lon Stultz Geo. Kelley J. A. Schmidt	MASON COUNTY Shooting fish Fishing in closed stream Polluting waters of State with sawdust	Gulley Gulley Gulley	\$25 00 25 00 100 00	150 00
1919 Apr. 1 June 12 June 12 June 12 June 12 July 5 July 11 July 11 July 11 July 16	Clayton Foster John Jalonen John Jalonen W. H. Walker Axel Corland Chris Olsen J. A. Smith Otto Tiilo Frank Waltz Jacob Mylyola	PACIFIC COUNTY Foul hooking salmon Resisting an officer Operating as scow buyer without license Operating as scow buyer without license Operating as scow buyer without license Operating scow on Columbia River without license Fishing with hook and line without license Allen fishing and no license Fishing hook and line without license Operating as scow buyer without license	Gulley—Sentence suspended Dropped Gulley Gulley Gulley Dismissed Gulley Gulley Gulley Dismissed	(minor) \$50 00 25 00 50 00 50 00 50 00 50 00 50 00	

Arrests Made for Violations of the Food Fish Laws—Continued.

Date of Arrest	OFFENDER	CHARGE	Disposition of Case	Penalty Imposed	Totals
PACIFIC COUNTY (Concluded)					
1919	Axel Coreland	Operating as scow buyer without license second offense.	Dismissed		
July 21	Jos. Toivonen	Operating as scow buyer without license.	Law held unconstitutional.		
July 24	Jacob Mylloyaja	Operating as scow buyer without license second offense.	Law held unconstitutional.		
July 30	Bonvino Martino	Allen fishing without license.	Guilty	25 00	
July 30	Bonvino Martino	Allen fishing without license.	Guilty	25 00	
Aug. 8	Joe Favoloro	Allen fishing without license.	Guilty	50 00	
Aug. 8	T. Walters	Allen fishing without license.	Guilty	\$75 00	
Aug. 15	John Olla	Fishing in closed stream.	Guilty	50 00	
Aug. 24	Arthur Kayra	Allen fishing and no license.	Dismissed		
Aug. 24	Victor Ahola	Allen fishing	Guilty	50 00	
Aug. 27	Mike Vitalich	Fishing in closed stream	Guilty	75 00	
Aug. 27	John Marinovich	Fishing in closed stream	Guilty	75 00	
Aug. 27	Tony D. Marincovich	Fishing in closed stream	Guilty	75 00	
Sept. 1	C. E. Broughton	Fishing with gill net over legal size.	Guilty	50 00	
Sept. 2	Lunard Roberts	Fishing gill net out of season.	Guilty	50 00	
Sept. 2	Andrew Anderson	Fishing gill net out of season.	Guilty	20 00	
Sept. 2	M. Sjoland	Fishing gill net out of season.	Guilty	20 00	
Sept. 2	C. Sjoland	Fishing gill net out of season.	Guilty	25 00	
Nov. 16	Fred Thompson	Fishing without license.	Guilty	50 00	
Dec. 31	I. A. Johnson	Possessing salmon in closed season.	Guilty	97 50	
1920					
Jan. 18	Sam Brandomf	Snagging salmon	Guilty	5 00	
Mar. 3	Bert Andrews	Possession of clams for sale in closed season.	Guilty	10 00	
Mar. 8	O. G. Fisher	Dealing in clams at wholesale without license.	Not guilty		
Mar. 8	Ed. Perry	Dealing in clams at wholesale without license.	Not guilty		
Mar. 11	Walter Williams	Fishing during closed season.	Guilty	10 00	
Mar. 12	Arthur Jernstrom	Fishing during closed season.	Guilty	10 00	
Mar. 11	Millard Ford	Fishing during closed season.	Guilty	10 00	
PIERCE COUNTY					
1919	National Fish Co.	Having short salmon for sale.	Guilty	\$10 00	
Apr. 25	Anton Kordich	Scaling short salmon.	Forfeited bail		
Apr. 27	D. Constanti	Operating as wholesaler without license.	Case dismissed	50 00	
Nov. 18	C. H. Moriarty	Gaffing salmon	Guilty	10 00	
Nov. 18	C. C. Helmbecker	Gaffing salmon	Guilty	10 00	
Nov. 19	J. S. Green	Gaffing salmon with light.	Guilty	10 00	
					1,082 50

Arrests Made for Violations of the Food Fish Laws—Continued.

Date of Arrest	OFFENDER	CHARGE	Disposition of Case	Penalty Imposed	Totals
		PIEROE COUNTY (Concluded)			
1919	T. G. Smith	Gaffing salmon with light	Guilty	10 00	
Nov. 19	R. G. Lake	Gaffing salmon with light	Guilty	10 00	
Nov. 19	A. Shepersky	Gaffing salmon with light	Guilty	10 00	
Nov. 19	A. H. Friis	Gaffing salmon with light	Guilty	10 00	
Dec. 4	T. Y. S. Ballantyne	Casting sawdust in water of State	Guilty		
Dec. 4	Frank Isley	Casting sawdust in water of State	Guilty		
1920	Sifro Babich	Fishing within one mile of Chambers Creek	Guilty	50 00	
Jan. 9	Nick Costellan	Fishing within one mile of Chambers Creek	Guilty	50 00	
Jan. 9	J. Jeluich	Fishing within one mile of Chambers Creek	Guilty	50 00	
Jan. 9	Joseph Mych	Fishing within one mile of Chambers Creek	Guilty	50 00	
Jan. 12	Anton Naterlin	Fishing within one mile of Chambers Creek	Guilty	Imposed	
Jan. 16	Anton Naterlin	Failure to make November, 1919, report	Dismissed	No fine	330 00
		SAN JUAN COUNTY			
1919	Mick Novak	Fishing during weekly closed season	Guilty—Sentence suspended	\$250 00	
Aug. 15	Tony Novak	Fishing during weekly closed season	Guilty	50 00	
Aug. 15	Tony Gilich	Fishing during weekly closed season	Guilty	50 00	
Aug. 15	Alexander Radich	Fishing during weekly closed season	Guilty	50 00	
Aug. 15	Pete Jasin	Fishing during weekly closed season	Guilty	50 00	
Aug. 15	John Stanbuck	Fishing during weekly closed season	Guilty	50 00	
Aug. 15	Nick Mosich	Fishing during weekly closed season	Guilty	50 00	
Sept. 15	Geo. Jasich	Fishing during weekly closed season	Guilty	50 00	
Sept. 4	American Packing Co.	Fishing purse seine during closed season	Guilty	250 00	
Sept. 4	American Packing Co.	Fishing purse seine during closed season	Dismissed		800 00
		SKAGIT COUNTY			
1919	John Jacobson	Fishing near mouth of river	Guilty	\$50 00	
Oct. 11	Ole Reitan	Fishing near mouth of river	Guilty	50 00	
Nov. 17	Nels Nelson	Taking and selling crabs under size	Guilty	25 00	
Nov. 17	Anton Barach	Taking and selling crabs under size	Guilty	25 00	
Nov. 17	H. Carlson	Taking and selling crabs under size	Guilty	25 00	
Nov. 17	Wm. Eaton	Taking and selling crabs under size	Guilty	25 00	
Nov. 17	E. Rose	Taking and selling crabs under size	Guilty	25 00	
Nov. 17	Thos. Steels	Taking and selling crabs under size	Guilty	25 00	

Arrests Made for Violations of the Food Fish Laws—Continued.

Date of Arrest	OFFENDER	CHARGE	Disposition of Case	Penalty Imposed	Totals
1919 Nov. 17 Nov. 17 Nov. 17 Nov. 17 Nov. 17	Dick Lewis T. Lundckavan N. D. Anderson Marco Barot John Mirosvich	SKAGIT COUNTY (Concluded) Taking and selling crabs under size Taking and selling crabs under size Taking and selling crabs under size Taking and selling crabs under size Taking and selling crabs under size	Guilty Guilty Guilty Guilty Guilty	25 00 25 00 25 00 25 00 25 00	375 00
1919 Nov. 12	C. T. Smith	SKAMANIA COUNTY Fishing during closed season with pound net.	Guilty	\$125 00	125 00
1919 Oct. 12 May 12	R. B. Stearns Albert Ellason	SNOHOMISH COUNTY Gaffing salmon Fishing with nets in closed stream.	Guilty Guilty	\$10 50 10 00	20 50
1918 May 22 May 22 May 22 May 22 May 22 May 22 May 22 May 28	John Reistakka Henry Maki John Kynski C. C. Miers C. C. Miers Wm. Hoffman Robert Butler L. S. Lush Claus Gilbertson	WAKIYAKUM COUNTY Failure to make March 31, 1918, report. Failure to make March 31, 1918, report. Failure to make March 31, 1918, report. Failure to make March 31, 1918, report. Failure to make March 31, 1918, report. Failure to make March 31, 1918, report. Failure to make March 31, 1918, report. Failure to make March 31, 1918, report. Failure to make report.	Dismissed Dismissed Dismissed Dismissed Dismissed Dismissed Guilty Guilty Guilty	50 00 50 00 50 00 50 00 50 00 50 00 50 00 50 00	
1919 Aug. 6 Sept. 5 Sept. 4 Sept. 4 Sept. 4 Sept. 4 Sept. 4 Sept. 4 Sept. 4 Sept. 4 Sept. 4 Sept. 4	Fridolf Sairanen J. T. Nassa John Lindquist John Lindquist Osterman & Benson Osterman & Benson Ole C. Nelson Ole C. Nelson Hjalmer Johnson Hjalmer Johnson Mary E. Burke Mary E. Burke	Operating as scow buyer without license. Fishing during closed season. Fishing pound net 17 during closed season. Fishing pound net 16 during closed season. Fishing pound net 3512 in closed season. Fishing pound net 3511 in closed season. Fishing in closed season with pound net 2120. Fishing in closed season with pound net 2121. Fishing pound net 2970 in closed season. Fishing pound net 2971 in closed season. Fishing pound net 8 in closed season. Fishing pound net 9 in closed season.	Guilty Guilty Guilty Guilty Guilty Guilty Guilty Guilty Guilty Guilty Guilty Guilty	50 00 50 00 50 00 50 00 50 00 50 00 50 00 50 00 50 00 50 00 50 00 50 00	

Arrests Made for Violations of the Food Fish Laws—Concluded.

Date of Arrest	OFFENDER	CHARGE	Disposition of Case	Penalty Imposed	Totals
		WAHIAKUM COUNTY (Concluded)			
1919					
Sept. 4	Elohomn Fishing Co.	Fishing first class pound net 128 in closed season.	Guilty	90 00	
Sept. 4	Elohomn Fishing Co.	Fishing pound net 129 in closed season.	Guilty	90 00	
Sept. 9	L. M. Davis	Fishing during closed season pound net 180.	Guilty	90 00	
Sept. 9	L. M. Davis	Fishing during closed season pound net 289.	Guilty	90 00	
Sept. 9	Upton & Smalley	Fishing during closed season pound net 653.	Guilty	50 00	
Sept. 10	Albert Erickson	Fishing during closed season.	Guilty	50 00	1,610 00
		WHATCOM COUNTY			
1919					
Apr. 5	Anton Boranich	Taking crabs without license.	Guilty	\$1 00	
Apr. 11	John A. Taylor	Selling salmon caught closed season.	Guilty	15 00	
Apr. 11	A. C. Doly	Selling salmon caught closed season.	Guilty	5 00	
Apr. 11	John Trekus	Selling salmon caught closed season.	Guilty	10 00	
Apr. 16	L. F. Buchholz	Buying and selling salmon caught closed season.	Guilty	10 00	
Sept. 23	Geo. J. Leander Filmore	Set net in form of hook.	Not guilty		
Sept. 25	Ray Buawel	Fishing with net in other than straight line.	Guilty	25 00	
Sept. 25	Wm. Cooper	Fishing with net in other than straight line.	Guilty	25 00	
Sept. 25	Frank B. Dewey	Fishing with net in other than straight line.	Guilty	25 00	
Sept. 25	Oscar Reiderblike	Fishing with net in other than straight line.	Guilty	25 00	
Sept. 25	T. S. Kettredge	Set net in form of hook.	Guilty	25 00	
Oct. 9	Elmer Collier	Set net in form of hook.	Guilty	25 00	
Oct. 9	Frank B. Lyons	Set net in form of hook.	Guilty	25 00	
Oct. 15	Wmce Elich	Selling fish without license.	Guilty	10 00	
Nov. 3	Robert Custer	Fishing with net in fresh water.	Guilty	20 00	
Nov. 3	F. Johnson	Fishing with net in fresh water.	Guilty	20 00	
Nov. 3	M. J. Johnson	Fishing with net in fresh water.	Guilty	20 00	
Nov. 3	P. Flinsen	Fishing with net in fresh water.	Guilty	20 00	
Nov. 4	Jason West	Fishing in river with net (unlawfully).	Guilty	25 00	
Nov. 22	Richard Gifford	Garfing salmon	Guilty	5 00	
Dec. 26	William Frazier	Garfing salmon	Guilty	15 00	
1920					
Jan. 9	Douglas Campbell	Garfing salmon	Guilty	15 00	
Feb. 6	J. W. Semere	Fishing with other than hook and line in closed season.	Guilty	10 00	
Feb. 27	C. Fair	Fishing in fresh water stream with net.	Guilty	25 00	
		Total.			\$6,311 50

NUMBER AND VALUE OF CANNERIES AND FACTORIES OPERATED, AND THEIR FISHING APPLIANCES, AND CAPITAL INVESTED.

Fiscal Year 1918.

	PUGET SOUND DISTRICT		COLUMBIA RIVER DISTRICT		GRAYS HARBOR DISTRICT		WILLAPA HARBOR DISTRICT		ALL DISTRICTS COMBINED	
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Canneries, salmon (buildings and machinery).	39	\$2,874,157.46	9	\$221,785.82	12	\$157,074.56	2	\$53,000.00	62	\$3,306,027.84
Canneries, other than salmon.	5	79,500.00			7	19,250.00	6	14,000.00	18	113,850.00
Factories, fish by-products.	5	210,091.34							5	210,091.34
Warehouses, cold storages, smoke houses, packing plants, fuel houses, residences for labor, real estate.	24	1,228,643.65	32	30,228.48	4	25,283.75	1	8,000.00	61	1,292,155.88
Automobiles, trucks or other land conveyances.	10	6,745.00	2	1,100.00	3	2,700.00	2	1,400.00	17	11,945.00
Steamboats.	9	115,700.00							9	115,700.00
Launches.	32	131,638.95	12	36,400.00	9	19,450.00	2	2,000.00	55	180,508.95
Scows.	234	150,714.76	7	3,219.87	10	3,443.00			251	157,377.63
Cannery tenders.	80	257,439.73	5	12,800.00	3	11,510.25			88	281,730.98
Fishing boats.	34	250,694.07	64	21,763.55	18	6,754.21			116	279,141.63
Fish buyers' boats.	6	12,000.00							6	12,000.00
Tide drivers' boats.	18	69,017.30	2	1,100.00			1	1,000.00	21	101,117.30
Pound net locations operated.	88	1,347,568.24	17	17,000.00	6	8,000.00	8	4,000.00	119	1,376,565.24
Stationary or scow fish wheels.	56	600,977.10							60	600,977.10
Nets and seines.	2	2,000.00	10	95,729.00					10	95,729.00
Net racks.	20	2,000.00	153	83,216.00	33	2,500.00			187	89,716.00
Miscellaneous equipment.		98,835.15	80	6,310.00	5	751.80			105	9,061.90
Total Invested in Plant and Equipment.		\$7,467,700.75		\$462,653.52		\$558,717.57		\$84,000.00		\$8,372,071.84
Operating expenses.		9,580,151.67		1,031,867.50		509,540.28		71,630.44		11,292,180.80
Grand Total Capital Invested.		\$17,056,852.42		\$1,494,521.02		\$856,257.85		\$155,630.44		\$19,506,261.73

STATISITCS

FOR

FISCAL YEAR 1920

April 1, 1920, to March 31, 1921

FISHERIES DEPARTMENT

STATE OF WASHINGTON

Appropriations, Receipts and Disbursements; Output of Salmon
and Trout Hatcheries and Costs; Licenses Issued;
Take and Value of Food Fishes; and Other
Information Regarding the Food
Fishing Industry.

APPROPRIATION AND EXPENDITURES OF FISHERIES FUND.

Fiscal Year 1920.

FUND	Appropriation for Two Years	Expended Fiscal Year 1919	Expended Fiscal Year 1920
Salary of Fish Commissioner, of inspectors and employes; traveling expenses of Commissioner, inspectors and employes; rent and incidentals; construction, repair and maintenance of salmon hatcheries; construction of new hatcheries; patrol service; improvements, replacements, destruction of seals; printing, and for the other necessary expenses of the office of the Fish Commissioner.....	\$243,100 00	\$108,200 78	\$134,899 22

ITEMIZATION OF EXPENDITURES OF FISHERIES FUND.

	Salaries	Labor	Mileage	Subsistence	General Expense	Maintenance	Improvements	Total Cost of Operation	Egg Output	Cost per Thousand
Office Expense	\$2,000 00	\$226 69	\$2,866 49	\$3,385 25	\$15,393 52	\$153 57	\$490 76	\$27,551 28	.....	.....
Repair and Maintenance of Hatcheries.....	30,316 30	39,128 60	2,052 89	2,443 23	7,501 50	7,211 76	7,016 15	94,670 48	186,906 525	\$0 51
Patrol Service	745 00	2,038 79	42 78	1,574 04	2,645 00	574 10	.....	7,619 71	.....	.....
Sundry Expense	88 33	1,101 68	179 05	207 10	3,451 92	79 71	.....	5,057 80	.....	.....
Totals.....	\$33,099 63	\$41,496 76	\$5,171 22	\$7,609 62	\$31,991 94	\$8,024 14	\$7,506 91	\$134,899 22	.....	.....

APPROPRIATIONS AND EXPENDITURES OF GAME FUND.
Fiscal Year 1920.

FUND		Appropriation for Two Years	Expended Fiscal Year 1919	Expended Fiscal Year 1920
For the Office of the State Game Warden. Salary and traveling expenses of State Game Warden, and salary and traveling expenses of two special deputy state game wardens, under the state game warden, maintenance of state trout hatcheries, new hatchery construction, equipment, maintenance and stocking of state game farm at the Walla Walla penitentiary, new construction at the state game farm, salaries of employees, rent and incidentals, and printing of the state game warden and purchase of game birds and animals				
		\$85,000 00	\$42,370 74	\$42,029 26
For the Office of the Chief Deputy Game Warden. Salary of chief deputy state game warden and traveling expenses, salary and traveling expenses of two special deputy state game wardens under the chief deputy state game warden, salaries of employees, rent, incidentals and printing of the chief deputy state game warden				
		12,770 00	6,125 13	6,644 87
Totals		\$97,770 00	\$48,495 87	\$48,674 13

ITEMIZATION OF EXPENDITURES OF GAME FUND.

	Salaries	Labor	Mileage	Subsistence	General Expense	Maintenance	Improvements	Total Cost of Operation	Egg Output	Cost per Thousand
Office expense State Game Warden.....	\$1,000 00	\$115 87	\$1,586 15	\$1,796 39	\$6,492 14	.....	\$54 23	\$11,047 59	.....	.....
Repair and maintenance of hatcheries.....	8,237 64	7,509 62	1,689 34	1,951 04	2,253 20	\$993 16	679 20	22,644 10	.....	.....
Maintenance Walla Walla Game Farm.....	1,526 78	463 16	556 13	186 95	5,277 11	105 15	822 30	8,937 59	.....	\$0 71*
Office expense Chief Deputy Game Warden.....	1,350 00	32 25	1,675 19	724 69	2,161 85	.....	500 00	6,644 87	.....	.....
Totals.....	\$12,134 42	\$6,123 70	\$6,717 81	\$4,069 95	\$16,184 30	\$966 31	\$2,055 73	\$49,274 13	.....	.....

* Includes cost of distribution of fry and of purchase of eggs in eastern states, and transportation therefrom.

APPROPRIATION AND EXPENDITURES OF STATE OYSTER RESERVE FUND.
Fiscal Year 1920.

F U N D	Appropriation for Two Years	Expended Fiscal Year 1919	Expended Fiscal Year 1920
For the improvement and protection of the state oyster reserves.....	\$10,000 00	\$8,309 89	\$1,690 11

ITEMIZATION OF EXPENDITURES OF STATE OYSTER RESERVE FUND.

Patrol service	\$1,424 84
Improvement of oyster beds.....	265 27
Totals.....	\$1,690 11

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RECEIPTS OF THE FISHERIES DEPARTMENT.
Fiscal Year 1920.

CREDITED TO THE FISHERIES FUND		Puget Sound District	Columbia River District	Grays Harbor District	Willapa Harbor District	Entire State	Total
Licenses—							
5,262 Fishing		\$22,960 62	\$14,572 50	\$2,653 50	\$1,276 25		\$44,462 87
72 Buyer's, at \$1.00		52 00	13 00	5 00	2 00		72 00
2 Snow buyer's, at \$50.00			100 00				100 00
84 Retail dealer		553 00	208 00	50 00	23 00		834 00
116 Wholesale dealer		690 00	180 00	140 00	150 00		1,160 00
25 Halibut wholesale dealer or broker		115 00	10 00				125 00
4 Codfish, canning and curing		30 00					30 00
6 By-products, manufacturing		125 00	25 00				150 00
13 Private hatchery		125 00	200 00				325 00
5 Private hatchery product dealer		5 00	7 50				12 50
10 Hotel serving private hatchery product		6 00	4 00				10 00
27 Permit to collect birds						\$27 00	27 00
61 1919 licenses		41 50	40 00	43 00	22 00		146 50
5,469 Total							\$47,464 87
Taxes—							
Fish caught		3,979 65	1,622 44	1,579 88	972 16		\$8,164 13
Fish bought, sold or otherwise dealt in at \$1.25 per ton		10 23	876 95	0 44	2 22		889 85
Fish bought, sold or otherwise dealt in at \$1.00 per ton		6,682 72	249 50	693 95	439 58		7,925 76
Canned salmon		2,313 85	8,067 09	39 89	0 92		10,421 42
Canned food and shell fish other than salmon		71 00	23 43	391 74	59 69		515 86
Sales—							
Salmon eggs		940 00		150 00	150 00		\$1,240 00
Spawnee fish		822 93		440 00			1,262 93
Confiscated gear		25 00			20 00		45 00
Confiscated fish		27 54	267 45				294 99
Miscellaneous—							
Transfers		67 00	25 00	20 00	6 00		\$127 00
Receipts from other sources, refunds, etc.		395 50	71 50		7 36		474 45
Collected by State Fish Commissioner		\$40,018 64	\$24,573 36	\$6,056 37	\$6,130 80	\$27 00	\$78,846 26
Collections reported by State Treasurer—							
Fines							\$6,804 35
Interest earnings							490 79
Sale of public property							29 23
Total credited to Fisheries Fund							\$86,170 63

Receipts of the Fisheries Department—Concluded.

CREDITED TO THE STATE OYSTER RESERVE FUND		Puget Sound District	Columbia River District	Grays Harbor District	Willapa Harbor District	Entire State	Total
16 Licenses to take seed oysters.....		\$70 00			\$10 00		\$80 00
Sale of seed oysters.....		5,007 88					5,007 88
Sale of merchantable oysters.....		483 92					483 92
Collected by State Fish Commissioner.....		\$5,561 75			10 00		\$5,571 75
Collections reported by State Treasurer—Interest earnings.....							112 70
Total credited to Oyster Reserve Fund.....							\$5,684 45
Total Receipts.....							\$91,855 08

YEARLY COMPARATIVE TABLE OF RECEIPTS.

YEAR	FISHERIES FUND					OYSTER RESERVE FUND					Grand Total
	Licenses	Taxes	Sales	Miscellaneous	Fines and Interest Earnings	Total	Licenses	Sales	Interest Earnings	Total	
1905.....	839,508 20	\$10,587 88		\$471 95		\$50,568 03		\$4,464 00		\$4,464 00	\$56,032 03
1906.....	41,954 96	2,903 38		284 62		45,132 96		3,766 70		3,766 70	48,899 66
1907.....	33,538 10	9,159 18				47,698 28		4,264 90		4,264 90	51,963 18
1908.....	39,884 40	3,312 57				43,696 97		2,989 80		2,989 80	46,686 77
1909.....	40,802 60	17,039 86	\$110 70	16 80		57,968 86		4,021 65		4,021 65	61,990 51
1910.....	45,942 80	5,331 91				51,274 81		1,186 00		1,186 00	52,460 81
1911.....	49,174 80	14,370 19			\$1,010 83	64,555 92		3,662 35		3,662 35	68,218 27
1912.....	57,752 10	6,190 47				63,942 57		1,032 75		1,032 75	64,975 32
1913.....	55,519 25	32,405 74	23 10	17 50	6,716 37	94,681 96	\$60 00	2,585 90		2,645 90	97,327 86
1914.....	59,421 70	9,594 16	218 65	63 57	362 25	78,590 83	5 00	574 57		579 57	72,578 71
1915 (8 months).....	48,166 91	29,863 02	655 76	54 38	1,418 76	83,752 56	255 00	2,660 86		2,915 86	81,506 69
1916.....	45,767 61	35,856 05	3 00	31 87	948 40	146,523 37	25 00	970 38	\$114 23	1,109 61	84,962 17
1917 (4 months).....	1,835 46	9,235 98	20,236 46	234 50	3,981 94	12,054 16					12,054 16
1918.....	48,119 04	36,966 01	12,301 51	237 25	4,367 25	102,011 36	95 00	5,545 79		5,702 55	152,095 92
1919.....	52,838 33	45,573 91	16,667 44	237 00	6,913 54	122,225 23	10 00	7,870 34		7,880 34	130,298 69
1920.....	47,484 87	27,917 02	2,842 92	630 69	7,296 14	86,170 63	80 00	5,491 75	112 70	5,604 45	91,855 08

LICENSES ISSUED.
Fiscal Year 1920.

	PUGET SOUND		COLUMBIA RIVER		GRAYS HARBOR		WILLAPA HARBOR		ALL DISTRICTS COMBINED	
	Number Licenses	Amount Collected	Number Licenses	Amount Collected	Number Licenses	Amount Collected	Number Licenses	Amount Collected	Number Licenses	Amount Collected
FISHING LICENSES—										
Pound net.....	243	\$12,150 00							243	\$12,150 00
First class pound net.....			126	\$3,150 00					126	\$3,150 00
Second class pound net.....			144	2,160 00					144	2,160 00
Pound net.....					45	\$735 00	64	\$960 00	113	1,695 00
Stationary fish wheel.....			18	630 00					18	630 00
Scow fish wheel.....			9	225 00					9	225 00
Set net.....	439	1,646 25	200	750 00	200	1,037 50	95	356 25	1,024	\$3,840 00
Gill net.....			483	8,690 00			32	240 00	565	4,237 50
5 00 and 10 ea. add. ft.	864	2,040 90							864	2,040 90
Drag seine.....	144	912 51							144	912 51
Drag seine.....			40	832 50					40	832 50
Purse seine.....	172	4,730 00	64	2,310 00	1	27 50	88	2,420 00	345	9,487 50
Reef net.....	10	50 00							10	50 00
Hook and line.....	1 00								1	
Hook and line.....	2 50				23	29 00	16	16 00	658	658 00
Bag net.....	1 00		268	665 00					268	665 00
Smelt drag bag net.....			125	125 00			1	1 00	126	126 00
1 00 and 25 ea. add. ft.	56	278 46							56	278 46
Brush weir.....	5	125 00							5	125 00
Beam trawl.....	14	140 00							14	140 00
Clams and mussels.....	145	145 00	5	5 00	418	418 00	206	206 00	774	774 00
Clams for bait.....	1								1	
Crabs.....	112	112 00	11	11 00	15	15 00	55	55 00	193	193 00
Gill net extension.....										
Drag seine extension.....										
Drag seine extension.....										
Smelt drag bag net extension.....										
Totals.....	2,315	\$22,960 62	1,517	\$14,572 50	851	\$2,663 50	579	\$4,276 25	5,362	\$44,462 87

Licenses Issued—Concluded.

	PUGET SOUND		COLUMBIA RIVER		GRAYS HARBOR		WILLAPA HARBOR		ALL DISTRICTS COMBINED		
	Number Licenses	Amount Collected	Number Licenses	Amount Collected	Number Licenses	Amount Collected	Number Licenses	Amount Collected	Number Licenses	Amount Collected	
DEALERS AND MISCELLANEOUS LICENSES—											
Buyer's	1 00		13	13 00		5	5 00	2	2 00	72	72 00
Scow buyer's	50 00	52 00	2	100 00						2	100 00
Retail dealer	1 00	583 00	205	208 00		50	50 00	23	23 00	864	864 00
Wholesale dealer	10 00	690 00	18	180 00		14	140 00	15	150 00	116	1,160 00
Halibut wholesale dealer or broker	5 00	115 00	2	10 00						25	125 00
Codfish, canning and curing	5 00	30 00								6	30 00
By-product, manufacturing	25 00	125 00	1	25 00						6	150 00
Private hatchery	25 00	125 00	8	200 00						13	325 00
Private hatchery product dealer	2 50	5 00	3	7 50						5	12 50
Hotel serving private hatchery product	1 00	6 00	4	4 00						10	10 00
Permit to collect birds	1 00	27 00								27	27 00
Totals	778	\$1,758 00	250	\$747 50		69	\$105 00	40	\$175 00	1,146	\$2,875 50
MISCELLANEOUS RECEIPTS—											
1919 Licenses	7	41 50	7	40 00		43	43 00	4	22 00	61	146 50
CANNERY LICENSES											
23			9			14		6		52	
REGAPITULATION—											
Fishing licenses	2,315	\$92,460 02	1,517	\$14,572 50		851	\$9,652 50	579	\$4,276 25	5,202	\$44,462 57
Dealers and Miscellaneous Licenses	778	1,758 00	251	747 50		69	105 00	40	175 00	1,146	2,875 50
1919 Licenses	7	41 50	7	40 00		43	43 00	4	22 00	61	146 50
Totals	3,100	\$24,760 12	1,788	\$15,860 00		963	\$9,891 00	623	\$4,473 25	6,469	\$47,484 57
Cannery Licenses	23		9			14		6		52	
GRAND TOTALS.	3,123	\$24,760 12	1,792	\$15,900 00		977	\$9,891 00	629	\$4,473 25	6,521	\$47,484 57

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YEARLY COMPARATIVE TABLE OF LICENSES ISSUED.

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
PUGET SOUND DISTRICT																
FISHING LICENSES—																
Pound net, double head.....	1	277	219	1	1	298	300	335	311	270	297	275	290	250	259	243
Pound net.....	258	618	755	686	686	666	813	829	807	458	559	541	658	646	686	439
Set net.....	348	310	329	362	366	403	459	377	427	544	612	449	537	417	540	364
Gill net.....	69	123	176	253	242	247	307	243	238	354	187	189	218	185	187	144
Purse seine.....	91	79	64	69	95	127	137	169	252	288	392	375	420	204	258	172
Reef net.....											13	13	13	13	14	10
Set line.....											73	54	782	982	1,032	611
Hook and line.....											11	51	56	50	57	56
Small drag bag net.....											46	8	9	6	11	5
Smelt and herring.....											2	27	25	18	16	14
Brush weir.....											183	147	236	177	232	145
Beam trawl.....											4					
Clams and mussels.....											91	64	68	89	124	112
Clams for ball.....																
Crabs.....																
Totals.....	1,341	1,407	1,544	1,782	1,621	1,741	2,016	1,563	2,035	1,914	2,337	2,003	3,305	3,043	3,410	2,315
DEALERS AND MISC. LICENSES—																
Buyer's.....											32	22	162	102	114	52
Scow buyer's.....											1	446	360	680	721	583
Retail dealers.....	67	161	224	240	223	253	363	260	293	351	48	49	63	67	77	69
Wholesale dealer.....											9	6				
Brokers.....													16	19	21	23
Hallbut wholesale dealer or broker.....													3	5	6	6
Codfish, canning and curing.....													11	11	6	5
By-product manufacturing.....													2	2	3	5
Private hatchery.....	1	5	3	4	4	2	2	1	3	5	5	2	2	2	2	2
Private hatchery product dealer.....											2	4	2	2	2	2
Hotel serving private hatchery product.....													7	8	9	6
Permit to collect birds.....				14	12	7	4	8	12	10	16	8	8	11	15	27
Totals.....	68	166	227	297	240	262	269	269	310	308	539	437	634	907	974	778
MISCELLANEOUS RECEIPTS																
CANNERY LICENSES																
	24	13	14	10	23	14	22	22	32	22	45	38	52	41	43	23

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Yearly Comparative Table of Licenses Issued—Continued.

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
PUGET SOUND DISTRICT—																
Continued.																
RECAPITULATION—																
Fishing licenses.....	1,341	1,407	1,544	1,782	1,621	1,741	2,016	1,968	2,085	1,914	2,537	2,093	3,305	3,043	3,416	2,315
Dealers and miscellaneous licenses.....	68	166	227	267	249	262	269	269	310	365	539	437	684	907	974	778
Miscellaneous receipts.....													1	9	55	7
Totals.....	1,409	1,573	1,771	2,049	1,870	2,003	2,285	2,232	2,345	2,282	2,876	2,530	3,940	3,959	4,445	3,100
Cannery licenses.....	24	13	14	10	23	14	22	22	32	22	45	38	52	41	48	23
Grand Totals.....	1,433	1,586	1,785	2,059	1,893	2,017	2,307	2,244	2,377	2,304	2,921	2,568	3,992	4,000	4,493	3,123
COLUMBIA RIVER DISTRICT																
FISHING LICENSES—																
First class pound net.....	23	25	92	19	21	18	20	21	17	14	20	33	74	131	132	126
Second class pound net.....	351	365	322	307	274	232	244	247	230	242	229	263	205	139	145	144
Stationary fish wheel.....	9	10	10	15	14	14	11	15	16	17	18	17	17	17	17	18
Scow fish wheel.....	4	7	7	4	6	4	6	9	9	11	10	10	11	8	10	9
Set net.....	79	120	102	123	142	214	230	261	221	272	218	184	200	199	251	200
Gill net.....	444	666	620	846	768	563	677	768	586	491	676	633	601	627	617	488
Drag seine.....	60	53	47	53	30	30	27	23	25	45	36	38	46	46	45	40
Purse seine.....		1	8	9	2	3	1				6	19	24	30	43	84
Set line.....											18	37				
Hook and line.....													167	232	380	265
Bag net.....										148	3	210	292	180	118	125
Smelt and herring.....											92					
Beam trawl.....														2		
Clams and mussels.....																
Clams for bait.....																
Crabs.....											5	13	4	2	5	11
Totals.....	970	1,247	1,143	1,376	1,257	1,078	1,216	1,332	1,104	1,150	1,337	1,417	1,642	1,513	1,568	1,517

Yearly Comparative Table of Licenses Issued—Continued.

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
COLUMBIA RIVER DISTRICT— Continued.																
DEALERS AND MISC. LICENSES—																
Buyer's	26	19	16	7	3	5	3	3					6	9	8	13
Scow buyer's	108	80	79	96	141	209	216	212	12	14	3	1	5	3	11	2
Retail dealer								225	243	260	230	237	237	183	191	205
Wholesale dealer										8	15	15	21	17	18	18
Broker										2	2	3				
Hallbut wholesale dealer or broker													1	2	3	2
By-product, manufacturing																
Private hatchery										1	1	3	5	3	5	8
Private hatchery product dealer													3	1	1	3
Hotel serving private hatchery product													3	5	4	4
Permit to collect birds													3			
Totals.....	134	99	95	105	144	214	219	215	237	237	276	258	284	225	241	259
MISCELLANEOUS RECEIPTS																
CANNERY LICENSES	9	8	7	6	6	6	6	6	6	8	12	7	4	7	3	7
RECAPITULATION—																
Fishing licenses	970	1,247	1,143	1,376	1,257	1,078	1,216	1,332	1,104	1,150	1,337	1,417	1,642	1,513	1,593	1,517
Dealers and miscellaneous licenses	134	99	95	105	144	214	219	215	237	257	276	258	284	225	241	259
Miscellaneous receipts										2			4	7	3	7
Totals.....	1,104	1,346	1,238	1,481	1,401	1,292	1,435	1,547	1,341	1,409	1,613	1,675	1,930	1,745	1,837	1,783
Cannery licenses	9	8	7	6	6	6	6	6	6	8	12	7	4	7	3	7
Grand Totals.....	1,113	1,354	1,245	1,487	1,407	1,298	1,441	1,553	1,347	1,417	1,625	1,682	1,939	1,755	1,846	1,792

Yearly Comparative Table of Licenses Issued—Continued.

	1906	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
GRAYS HARBOR DISTRICT																
FISHING LICENSES—																
Pound net	16	20	21	17	18	21	32	42	38	33	51	36	53	52	48	49
Set net	73	114	100	100	69	110	240	302	235	249	186	141	276	316	349	240
Gill net	68	63	54	86	10	79	111	72	65	65	117	113	105	94	117	45
Drag seine					1	4		7	13	12	4		3	2	1	
Purse seine																
Set line											1					1
Hook and line													13	25	72	29
Clams and mussels											619	347	254	304	476	418
Clams for bait											2		2			4
Crabs											38	8	13	10	5	15
Totals	159	197	175	153	98	210	387	423	372	410	908	645	749	803	1,068	851
DEALERS AND MISO. LICENSES—																
Buyer's												2	1	2	4	5
Snow buyer's			3	1	3	2	3	3	7	4						
Retail dealer			6	5	7	14	16	12	37	39	28	38	31	42	48	50
Wholesale dealer	1	7									8	11	11	9	14	14
Habitat wholesale dealer or broker													1			
Totals	1	7	9	6	10	16	19	15	44	43	36	51	44	53	66	69
MISCELLANEOUS RECEIPTS																
CANNERY LICENSES	2	2	1	1	1	3	5	6	8	7	8	19	21	21	20	14
RECAPITULATION—																
Fishing licenses	159	197	175	153	98	210	387	423	372	410	903	645	749	803	1,069	851
Dealers and miscellaneous licenses	1	7	9	6	10	16	19	15	44	43	36	51	44	53	66	69
Miscellaneous receipts	160	204	184	159	108	225	406	438	416	453	944	606	803	890	1,217	963
Totals	2	2	1	1	1	3	5	6	8	7	8	19	21	21	20	14
Cannery licenses	162	206	185	160	109	229	411	444	424	460	952	715	824	881	1,227	977
Grand Totals																

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Yearly Comparative Table of Licenses Issued—Continued.

	1905	1906	1907	1908	1900	1910	1911	1912	1913	1914	1915	1916	1917	1918	1920	
WILLAPA HARBOR DISTRICT																
FISHING LICENSES--																
Pound net	50	74	45	51	42	40	51	67	83	44	50	53	48	62	64	
Set net	36	52	53	64	65	152	289	271	100	171	81	101	222	184	95	
Gill net	5	2	17	16	15	14	80	65	29	52	46	54	84	54	32	
Drag seine		3		8	7	3	4				1				2	
Purse seine															84	
Hook and line													3	9	10	
Bag net													2	10	1	
Clams and mussels										364	364	134	83	62	204	
Clams for bait													43	13	22	
Crabs											160	129	90	56	55	
Totals	91	131	116	134	129	299	424	423	171	267	501	475	543	449	501	579
DEALERS AND MISO. LICENSES--																
Buyer's															9	8
Retail dealer			1	2	4	17	13	7	6	14	18	13	11	16	23	2
Wholesale dealer											10	14	10	10	17	15
Totals			1	2	4	17	13	7	6	14	37	27	30	31	48	40
MISCELLANEOUS RECEIPTS																
CANNERY LICENSES																
	2	2	2	2	1	1	2	3	2	2	2	5	5	5	9	6
RECAPITULATION--																
Fishing licenses	91	131	116	134	129	299	424	423	171	267	501	475	543	449	501	579
Dealers and miscellaneous licenses			1	2	4	17	13	7	6	14	37	27	30	31	48	40
Miscellaneous receipts													4	4	10	4
Totals	91	131	117	136	133	223	437	430	177	291	538	502	617	484	619	623
Cannery licenses	2	2	2	2	1	1	2	3	2	2	2	5	5	5	9	6
Grand Totals	93	133	119	138	134	227	439	433	179	293	540	507	622	489	628	629

Yearly Comparative Table of Licenses Issued—Continued.

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
ALL DISTRICTS COMBINED																
FISHING LICENSES—																
Pound net.....	630	761	630	695	557	600	647	712	620	602	610	630	664	636	647	626
Fish wheel.....	13	17	22	10	20	18	17	22	26	28	27	27	28	25	27	27
Set net.....	764	904	1,010	1,123	962	1,142	1,572	1,682	1,302	1,150	964	977	1,350	1,245	1,440	1,024
Gill net.....	865	1,041	1,030	1,260	1,150	1,050	1,222	1,107	1,107	1,114	1,314	1,240	1,227	1,046	1,250	1,229
Drag seine.....	129	170	224	320	280	280	342	278	276	288	230	228	207	223	226	184
Purse seine.....	91	80	72	78	97	130	138	169	252	288	368	294	444	224	301	345
Reef net.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hook and line.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bag net.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Smet drag bag net.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Smet and herring.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Brush weir.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Beam trawl.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Clams and mussels.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Clams for bait.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Crabs.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals.....	2,561	2,982	2,978	3,445	3,105	3,238	4,043	4,131	3,082	3,741	5,082	4,630	6,279	5,808	6,638	5,262
DEALERS AND MISC. LICENSES—																
Buyer's.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Snow buyer's.....	26	19	19	8	6	7	6	6	19	18	32	27	178	118	134	72
Retail dealer.....	176	248	310	354	385	493	508	491	561	647	732	627	639	923	983	864
Wholesale dealer.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Broker.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Halibut wholesale dealer or broker.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Codfish, canning and curing.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
By-product, manufacturing.....	1	5	3	4	4	2	2	1	3	5	6	5	7	5	6	6
Private hatchery.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Private hatchery product, dealer.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hotel serving private h'chery product.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Permit to collect birds.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals.....	203	272	332	380	407	500	520	506	507	682	838	773	962	1,216	1,329	1,146

Yearly Comparative Table of Licenses Issued—Concluded.

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
ALL DISTRICTS COMBINED— Continued.																
*MISCELLANEOUS RECEIPTS	37	25	24	19	31	24	35	37	48	2	57	69	16	24	151	61
CANNERY LICENSES										39	87	89	87	77	81	52
RECAPITULATION—																
Fishing licenses	2,561	2,082	2,978	3,445	3,105	3,238	4,043	4,131	3,682	3,741	5,083	4,630	6,279	5,809	6,638	5,292
Dealers and miscellaneous licenses	203	272	332	380	407	509	520	506	597	682	888	773	872	1,216	1,329	1,146
Miscellaneous receipts										2			19	24	151	61
Totals	2,764	3,254	3,310	3,825	3,512	3,747	4,563	4,637	4,279	4,425	5,971	5,403	7,200	7,048	8,118	6,409
Cannery licenses	37	25	24	19	31	24	35	37	48	39	87	89	87	77	81	52
Grand Totals	2,801	3,279	3,334	3,844	3,543	3,771	4,598	4,674	4,327	4,464	6,058	5,472	7,377	7,125	8,199	6,521

* This item represents receipts which were issued in lieu of licenses, upon payment of license fees, to persons who had operated the previous year without securing licenses as required by law.

CATCH OF SALMON AND VALUE.*
Fiscal Year 1920.

DISTRICTS, AND GEAR WITH WHICH TAKEN	Number Chinook Salmon	Number Dog or Chum Salmon	Number Humpback Salmon	Number Silver Salmon	Number Sockeye Salmon	Number Steelhead Salmon	Totals
PUGET SOUND DISTRICT—							
Pound nets	217,245	111,433	13,753	247,651	595,304	9,837	1,186,223
Set nets	7,953	5,638	33	39,634	39,404	5,475	59,217
Gill nets	22,482	19,334	157	76,920	3,241	2,566	118,860
Drag seines	123	5,073	.....	2,370	.....	2	7,568
Purse seines	17,715	541,213	4,943	158,467	53,083	14	775,435
Reef nets	69	143	13	2,351	313	.....	2,890
Hooks and lines	6,348	16	667	43,102	298	226	55,597
Totals	271,925	683,070	19,566	593,505	652,613	18,119	2,214,799
Value	\$62,622 40	\$119,637 25	\$1,956 00	\$199,326 75	\$391,567 30	\$21,742 80	\$1,886,853 00
COLUMBIA RIVER DISTRICT—							
First class pound net	54,381	28,029	.....	23,107	934	16,382	123,574
Second class pound net	17,051	5,940	.....	8,508	967	6,930	39,405
Stationary fish wheel	6,018	.....	.....	.....	13,252	5,419	24,689
Scow fish wheels	5,175	.....	.....	.....	5,167	1,463	11,805
Set nets	3,141	493	.....	389	1,298	3,027	5,938
Gill nets	154,544	5,233	.....	6,362	2,153	16,237	185,029
Drag seines	18,204	1,750	.....	4,772	2,530	10,462	37,870
Purse seines	39,633	1,127	.....	4,046	20	1,723	46,556
Hooks and lines	51,554	217	.....	36,324	32	185	88,512
Totals	350,393	42,791	81,297	26,426	61,871	565,778
Value	\$372,905 62	\$6,418 65	\$27,563 95	\$14,534 30	\$65,683 90	\$585,046 42

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Catch of Salmon and Value—Concluded.*

DISTRICTS, AND GEAR WITH WHICH TAKEN	Number Chinook Salmon	Number Dog or Chum Salmon	Number Humpback Salmon	Number Silver Salmon	Number Sockeye Salmon	Number Steelhead Salmon	Totals
GRAYS HARBOR DISTRICT—							
Pound nets	13,034	13,887		35,525		1,067	63,514
Set nets	4,318	2,882	156	19,697	30	3,413	30,490
Gill nets	9,752	1,953		19,011	1,065	419	32,120
Hooks and lines	667			119			786
Totals	27,751	18,722	156	74,353	1,035	4,809	126,910
Value	\$76,592 76	\$2,808 30	\$15 00	\$26,023 55	\$569 25	\$4,409 10	\$110,417 96
WILLAPA HARBOR DISTRICT—							
Pound nets	6,351	10,544		5,979		11	22,885
Set nets	1,586	935		940		621	3,401
Gill nets	2,481	168		1,478		114	4,231
Purse seine	110,138			5,165	3	3,759	119,105
Hooks and lines	744			6			750
Totals	121,300	10,042		13,572	3	4,545	150,462
Value	\$334,783 00	\$1,656 30		\$4,780 20	\$1 65	\$4,060 50	\$345,286 65
ALL DISTRICTS COMBINED—							
Pound nets	508,692	160,833	13,753	320,861	597,255	34,237	1,441,601
Fish wheels	11,193				18,410	6,882	36,494
Set nets	16,998	9,370	183	60,669	7,780	12,536	101,596
Gill nets	180,230	26,883	157	98,226	6,369	19,335	340,270
Drag seines	18,419	6,823		7,142		10,465	45,488
Purse seines	167,486	542,340	4,643	167,677	2,559		941,096
Reef nets	60	143	13	2,361	318		2,895
Hooks and lines	250,313	233	697	84,751	240		145,615
Totals	771,370	755,025	19,716	741,727	680,977	89,434	3,057,940
Value	\$1,036,968 75	\$130,589 50	\$1,971 60	\$259,004 45	\$406,673 00	\$95,926 39	\$2,881,604 68

* Value based on average price paid fishermen.

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YEARLY COMPARATIVE TABLE OF SALMON CATCH, SEGREGATED AS TO GEAR AND SPECIES.

DISTRICTS, AND GEAR WITH WHICH TAKEN	Number Chinook Salmon	Number Dog or Chum Salmon	Number Humpback Salmon	Number Silver Salmon	Number Sockeye Salmon	Number Steelhead Salmon	Totals
PUGET SOUND DISTRICT—							
1913							
Pound nets	212,507	150,473	11,353,709	731,329	11,540,069	17,137	24,023,824
Gill nets							
Set nets	77,537	445,394	4,554,001	403,796	10,049,295	36,148	15,046,151
Drag seines							
Purse seines							
Totals.....	290,044	604,867	15,907,710	1,225,115	21,589,364	43,285	39,069,375
1914							
Pound nets	224,397	254,154	25,888	479,155	2,107,398	25,883	3,116,825
Gill nets							
Set nets	201,582	1,431,983	49,003	1,030,161	1,344,004	38,785	4,089,109
Drag seines							
Purse seines							
Totals.....	425,979	1,686,137	75,491	1,499,306	3,451,402	64,618	7,202,833
1915							
Pound nets	244,011	180,190	2,007,463	525,350	533,729	17,510	4,458,249
Gill nets	24,334	93,151	35,083	127,327	18,913	4,900	304,577
Set nets	6,900	21,405	38,030	63,734	2,475	5,885	138,639
Drag seines	2,910	30,541	9,271	6,060	58	58	31,887
Purse seines	22,624	1,566,865	4,301,203	382,750	197,869	10,130	6,541,181
Hooks and lines.....	182	827	23,228	3,070	1,640	18	28,967
Reef nets	124	1,050	925	510	.....	.....	2,214
Drag bag nets.....							
Totals.....	301,192	1,864,114	7,363,713	1,108,806	804,385	38,452	11,505,782

Yearly Comparative Table of Salmon Catch, Segregated as to Gear and Species—Continued.

DISTRICTS, AND GEAR WITH WHICH TAKEN	Number Chinook Salmon	Number Dog or Chum Salmon	Number Humpback Salmon	Number Silver Salmon	Number Sockeye Salmon	Number Steelhead Salmon	Totals
PUGET SOUND DISTRICT—Continued.							
1916							
Pound nets	244,011	180,181	9,294	525,356	583,729	17,511	1,500,082
Gill nets	24,334	98,151	1,591	127,527	18,913	4,870	270,186
Set nets	6,970	21,496	478	63,785	2,476	5,886	101,091
Drag seines	2,911	20,541	33	6,059	58		20,700
Purse seines	22,635	1,696,895	56,702	382,750	197,570	10,190	2,236,682
Reef nets	192	828		3,071	1,641		5,732
Drag bag nets.....	125	1,055		510			1,690
Totals.....	301,178	1,884,147	68,098	1,108,898	804,387	38,455	4,205,168
1917							
Pound nets	285,464	131,804	4,426,436	455,631	2,849,245	12,573	8,101,278
Gill nets	77,591	84,518	184,470	96,082	1,113,660	3,153	569,763
Set nets	13,622	16,098	9,417	44,476	986	10,191	94,090
Drag seines	4,181	27,973	4,536	12,659	938	10	60,297
Purse seines	38,155	832,922	8,711,055	232,703	1,080,191	2,184	11,808,210
Hooks and lines.....	21,792	590	1,888	35,080	946	42	82,828
Reef nets	49	820	57,978	6,011	7,558		73,016
Totals.....	440,864	1,985,015	13,345,280	936,242	4,061,933	28,138	20,807,467
1918							
Pound nets	351,489	172,752	60,181	703,173	405,910	11,968	1,696,463
Set nets	15,121	26,446	554	97,796	154	8,316	148,387
Gill nets	36,946	98,639	1,518	179,810	17,652	2,453	333,017
Drag seines	964	59,788	23	24,681	77		86,583
Purse seines	14,781	799,883	3,097	513,973	45,073	11,015	1,388,672
Reef nets	1,515	914	12,448	12,634	2,036		29,547
Hooks and lines.....	24,457	120	28	106,406	523	8	131,548
Drag bag nets.....	3	2,050		52			2,105
Totals.....	477,246	1,156,571	77,849	1,637,525	561,431	34,650	3,945,272

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Yearly Comparative Table of Salmon Catch, Segregated as to Gear and Species—Continued.

DISTRICTS, AND GEAR WITH WHICH TAKEN		Number Chinook Salmon	Number Dog or Chain Salmon	Number Humpback Salmon	Number Silver Salmon	Number Sockeye Salmon	Number Steelhead Salmon	Totals
PUGET SOUND DISTRICT—Concluded.								
1919								
.....	.....	257,638	185,292	2,051,044	711,429	453,965	11,818	3,702,080
.....	.....	0,823	30,000	5,481	72,401	60	8,539	186,394
.....	.....	47,022	62,438	37,584	120,895	4,803	2,275	284,517
.....	.....	726	80,835	.....	12,113	.....	.....	83,674
.....	.....	12,250	1,112,404	2,513,621	427,526	283,620	1,968	4,321,980
.....	.....	962	3,404	29,042	9,630	8,210	50	46,397
.....	.....	19,345	47	298	.....	598	153	20,844
.....	.....	.....	171	.....	.....	.....	.....	171
Totals.....	.....	347,705	1,475,091	4,667,820	1,263,153	746,694	24,698	8,025,222
1920								
.....	.....	217,245	111,423	13,753	247,651	595,394	9,827	1,196,223
.....	.....	7,953	5,638	33	39,634	404	5,475	59,217
.....	.....	22,482	19,534	157	70,920	3,241	2,565	118,860
.....	.....	123	5,073	.....	2,370	.....	2	7,568
.....	.....	17,413	541,213	4,943	158,467	33,683	14	773,455
.....	.....	60	13	13	2,361	.....	.....	2,800
.....	.....	6,348	16	667	48,102	208	226	55,567
Totals.....	.....	271,229	683,070	19,566	569,505	652,613	18,119	2,214,709
COLUMBIA RIVER DISTRICT—								
1913								
.....	.....	181,600	25,067	5,621	169,280	56,288	38,072	395,483
.....	.....	.....	42,065	.....	100,350	38,856	93,014	636,965
Totals.....	.....	462,330	67,732	5,621	269,640	95,144	131,986	1,032,453

Yearly Comparative Table of Salmon Catch, Segregated as to Gear and Species—Continued.

DISTRICTS, AND GEAR WITH WHICH TAKEN	Number Chinook Salmon	Number Dog or Chum Salmon	Number Humpback Salmon	Number Silver Salmon	Number Sockeye Salmon	Number Steelhead Salmon	Totals
COLUMBIA RIVER DISTRICT—Continued.							
1914							
Pound nets	142,378	29,350	2,009	178,306	140,893	79,028	572,473
Fish wheels							
Gill nets	453,811	180,320	4,731	187,847	190,553	69,082	1,085,244
Set nets							
Drag seines							
Totals	596,189	209,670	7,240	366,153	340,446	140,010	1,657,717
1915							
Stationary fish wheels	174,921	35,016	4,710	89,808	11,701	60,889	377,135
Scow fish wheels	8,441			59	25,080	5,880	39,800
Gill nets	5,169	19,773	1,249	10,251	4,546	641	12,886
Set nets	129,162	1,066	433	919	4,347	21,370	186,354
Drag seines	2,659	326	37	4,200	7,640	16,347	10,374
Purse seines	32,800	3,593	35,350	8,252	462	9,421	61,046
Totals	14,095	59,716	41,779	113,579	57,840	118,647	758,928
1916							
Stationary fish wheels	174,921	35,016	2,040	89,808	11,702	60,889	374,466
Scow fish wheels	8,442			00	25,979	5,380	39,801
Gill nets	5,169	19,776	2,261	10,252	4,347	641	12,887
Set nets	129,163	1,065	121	918	4,347	21,371	187,370
Drag seines	2,660	327	4,200	8,253	7,641	16,548	10,000
Purse seines	32,801	3,593			462	9,422	61,013
Totals	14,095	59,717	4,422	113,581	57,841	118,650	721,582

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Yearly Comparative Table of Salmon Catch, Segregated as to Gear and Species—Continued.

DISTRICTS, AND GEAR WITH WHICH TAKEN	Number Chinook Salmon	Number Dog or Chum Salmon	Number Humpback Salmon	Number Silver Salmon	Number Sockeye Salmon	Number Steelhead Salmon	Totals
COLUMBIA RIVER DISTRICT—Continued.							
1917							
First class pound net.....	71,798	7,921	61	33,068	3,378	23,564	139,490
Second class pound net.....	33,412	19,148	37	46,927	2,237	17,693	144,384
Stationary fish wheels.....	11,668	.....	.....	.....	34,524	8,565	54,757
Scow fish wheels.....	7,609	.....	.....	.....	10,359	890	18,558
Gill nets.....	461,810	37,260	1,029	24,112	11,442	69,667	606,308
Set nets.....	7,015	4,468	465	.....	3,890	7,579	23,772
Drug seines.....	24,009	1,563	.....	19,365	2,311	14,890	62,068
Purse seines.....	11,583	245	34,634	3,608	9,484	677	60,232
Hooks and lines.....	25,479	20	.....	14,851	750	133	42,242
Bag nets.....	79	.....	.....	.....	.....	.....	79
Totals.....	680,462	70,065	36,226	142,700	78,381	143,688	1,151,522
1918							
First class pound net.....	80,225	8,491	172	74,146	11,882	40,847	215,766
Second class pound net.....	15,630	3,196	.....	22,087	6,189	13,155	60,266
Stationary fish wheels.....	6,600	.....	.....	.....	59,532	5,005	71,247
Scow fish wheels.....	2,967	.....	.....	11	42,231	1,671	46,878
Set nets.....	4,682	1,628	6,518	1,890	21,185	43,695	73,882
Gill nets.....	217,422	32,792	3,080	51,781	106,823	49,603	401,503
Drug seines.....	21,384	700	237	6,983	13,569	19,821	62,684
Purse seines.....	43,278	.....	385	24,318	187	3,480	71,648
Hooks and lines.....	58,369	20	.....	62,726	1,140	159	122,463
Drug bag nets.....	126	23	101	253
Totals.....	450,783	46,827	10,382	243,970	262,777	141,664	1,156,408

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Yearly Comparative Table of Salmon Catch, Segregated as to Gear and Species—Continued.

DISTRICTS, AND GEAR WITH WHICH TAKEN	Number Chinook Salmon	Number Dog or Chum Salmon	Number Humpback Salmon	Number Silver Salmon	Number Sockeye Salmon	Number Steelhead Salmon	Totals
COLUMBIA RIVER DISTRICT—Concluded.							
1919.							
First class pound net.....	64,785	29,636	17	50,850	5,697	31,144	176,059
Second class pound net.....	23,400	8,922	.....	15,770	2,043	11,859	62,063
Stationary fish wheels.....	7,374	.....	.....	.....	11,010	2,196	20,580
Scow fish wheels.....	9,018	.....	.....	.....	7,196	717	14,531
Set nets.....	3,628	3,233	10	465	3,307	3,491	14,154
Gill nets.....	102,985	72,711	741	22,385	11,421	26,824	206,668
Drum seines.....	24,130	57	32	13,128	9,404	14,037	61,097
Purse seines.....	76,819	.....	.....	16,290	333	1,161	94,603
Hooks and lines.....	54,918	.....	500	80,365	876	254	136,913
Totals.....	424,995	108,579	1,300	199,253	51,217	91,683	876,608
1920.							
First class pound net.....	54,981	28,029	.....	23,197	984	16,383	123,574
Second class pound net.....	17,051	5,940	.....	8,508	967	6,930	39,405
Stationary fish wheels.....	6,018	.....	.....	.....	13,252	5,419	24,689
Scow fish wheels.....	5,175	.....	.....	.....	5,107	1,403	11,805
Set nets.....	3,141	495	.....	830	1,986	3,027	8,888
Gill nets.....	154,544	5,233	.....	6,872	2,153	16,237	185,029
Drum seines.....	18,296	1,750	.....	4,772	2,539	10,493	37,870
Purse seines.....	39,633	1,127	.....	4,045	.....	1,729	46,536
Hooks and lines.....	51,554	217	.....	30,524	32	158	88,512
Totals.....	350,993	42,791	.....	84,297	26,426	61,871	505,778

Yearly Comparative Table of Salmon Catch, Segregated as to Gear and Species—Continued.

DISTRICT, AND GEAR WITH WHICH TAKEN	Number Chinook Salmon	No. Dog or Chum Salmon	Number Hump-back Salmon	Number Silver Salmon	Number Sockeye Salmon	Number Steelhead Salmon	Totals
GRAYS HARBOR DISTRICT—							
1913							
Pound nets	5,601	19,447	.....	53,942	.....	288	79,279
Gill nets	79,046	53,092	33,844	35,315	263,198	86,494	555,980
Set nets							
Drag seines							
Totals	54,647	72,539	33,844	89,257	263,198	86,782	635,267
1914							
Pound nets	17,873	24,972	347	48,824	639	8,858	101,518
Gill nets	16,865	107,732	85	151,615	80,814	18,131	375,262
Set nets							
Drag seines							
Totals	34,743	132,724	432	200,439	81,453	26,989	476,780
1915							
Pound nets	23,471	35,728	.....	41,666	82	1,018	101,965
Gill nets	12,669	32,763	73	17,963	21	985	64,474
Set nets	7,072	15,983	.....	14,777	28	1,992	33,852
Drag seines	673	17	.....	2,309	.....	.....	2,999
Totals	43,885	84,491	73	76,715	131	3,995	209,290
1916							
Pound nets	23,471	35,728	1,028	41,666	82	1,018	102,993
Gill nets	12,670	32,763	360	17,962	22	98	64,761
Set nets	7,071	15,982	.....	14,776	28	1,991	39,849
Drag seines	672	17	.....	2,309	.....	.....	2,998
Totals	43,884	84,490	1,388	76,713	132	3,99	210,601
1917							
Pound nets	16,836	15,702	.....	35,186	.....	2,227	69,751
Gill nets	18,854	8,428	.....	14,071	120	422	41,925
Set nets	13,491	19,048	8	39,068	3	3,668	75,286
Hooks and lines	449	.....	.....	1,899	.....	.....	2,348
Totals	49,460	43,178	8	90,224	123	6,317	189,310
1918							
Pound nets	2,307	2,865	.....	9,212	.....	7	14,391
Set nets	7,666	11,992	161	54,630	326	3,354	78,129
Gill nets	18,903	12,782	.....	70,595	825	515	103,630
Hooks and lines	510	111	.....	5,695	.....	.....	6,316
Totals	29,386	27,750	161	140,132	1,151	3,876	202,456
1919							
Pound nets	8,666	65,809	.....	23,295	.....	1,083	98,948
Set nets	9,178	65,386	4,205	35,199	662	5,105	119,735
Gill nets	6,780	52,839	.....	37,059	.....	414	97,692
Drag seines	5	.....	.....	.....	.....	.....	5
Hooks and lines	2,317	.....	.....	.....	.....	.....	2,317
Totals	26,946	184,124	4,205	95,553	662	6,607	318,097
1920							
Pound nets	13,034	13,887	.....	35,526	.....	1,067	63,514
Set nets	4,318	2,882	159	19,697	30	3,413	30,490
Gill nets	9,732	1,953	.....	19,011	1,005	419	32,120
Hooks and lines	667	.....	.....	119	.....	.....	786
Totals	27,751	18,722	150	74,353	1,035	4,899	126,910

Yearly Comparative Table of Salmon Catch, Segregated as to Gear and Species—Continued.

DISTRICT, AND GEAR WITH WHICH TAKEN	Number Chinook Salmon	No. Dog or Chum Salmon	Number Hump-back Salmon	Number Silver Salmon	Number Sockeye Salmon	Number Steelhead Salmon	Totals
WILLAPA HARBOR DISTRICT—							
1913							
Pound nets	1,923	22,445		13,347			37,715
Gill nets	3,802	42,243		11,537		6,449	64,031
Set nets							
Totals.....	5,725	64,688		24,884		6,449	101,740
1914							
Pound nets	8,561	16,336	66	21,716	1,278	890	48,847
Gill nets	11,527	45,998		44,272		189	101,986
Set nets							
Totals.....	20,088	62,334	66	65,988	1,278	1,079	150,833
1915							
Pound nets	16,831	46,440	531	27,102		191	91,095
Gill nets	6,513	4,750		4,930		103	16,296
Set nets	4,912	14,938		6,459	415	358	27,112
Totals.....	28,256	66,128	531	38,491	415	662	134,503
1916							
Pound nets	16,532	46,440	362	27,102		191	90,927
Gill nets	6,512	4,750		4,931		102	16,295
Set nets	4,911	14,939	1,866	6,460	416	388	28,980
Totals.....	28,255	66,129	2,228	38,493	416	681	136,202
1917							
Pound nets	11,054	37,076		24,568		1,041	73,739
Gill nets	10,352	13,232	42	8,451		171	32,248
Set nets	4,088	31,457		8,968	86	825	45,423
Hooks and lines.....	2			381			383
Totals.....	25,496	81,765	42	42,368	86	2,037	151,793
1918							
Pound nets	8,204	22,066		42,234		14	72,518
Set nets	1,815	16,361		22,418	94	569	40,757
Gill nets	6,064	5,080		17,027	3	43	28,217
Hooks and lines.....	74			506			580
Totals.....	15,657	43,507		82,185	97	626	142,072
1919							
Pound nets	6,604	96,938		21,773	526	55	125,996
Set nets	3,455	38,311	20	9,046		1,338	52,170
Gill nets	42,142	29,078		12,900		271	84,391
Drag seines	5						5
Hooks and lines.....	1			57			58
Totals.....	52,207	164,327	20	43,776	526	1,664	262,610
1920							
Pound nets	6,351	10,544		5,979		11	22,885
Set nets	1,546	335		949		621	3,491
Gill nets	2,481	163		1,477		114	4,231
Furse seines	110,138			5,166	3	3,799	119,105
Hooks and lines.....	744			6			750
Totals.....	121,300	11,042		13,572	3	4,545	150,402

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Yearly Comparative Table of Salmon Catch, Segregated as to Gear and Species—Continued.

YEAR AND GEAR	Number Chinook Salmon	No. Dog or Chum Salmon	Number Hump- back Salmon	Number Silver Salmon	Number Sockeye Salmon	Number Steelhead Salmon	Totals
ALL DISTRICTS COMBINED—							
1913							
Pound nets	319,691	227,032	1,359,330	967,898	11,605,957	56,397	24,536,305
Fish wheels							
Gill nets							
Set nets							
Drag seines							
Purse seines	523,055	582,784	4,592,845	640,998	10,351,349	212,105	16,903,136
Totals	842,746	809,816	15,952,175	1,608,896	21,957,306	268,502	41,439,441
1914							
Pound nets	393,214	324,321	28,810	728,001	2,250,208	114,609	3,839,663
Fish wheels							
Gill nets							
Set nets							
Drag seines							
Purse seines	683,785	1,766,053	54,419	1,401,885	1,624,371	118,087	5,648,600
Totals	1,076,999	2,000,874	83,229	2,129,886	3,874,579	232,696	9,488,263
1915							
Pound nets	459,234	297,364	2,912,704	684,022	596,512	79,608	5,028,444
Fish wheels	13,640	.....	.....	59	32,528	6,021	52,248
Gill nets	172,678	150,439	37,306	160,471	23,281	27,527	571,701
Set nets	21,612	53,422	38,463	85,939	4,077	12,464	215,977
Drag seines	36,473	20,884	2,308	12,608	7,704	16,605	96,582
Purse seines	36,729	1,570,488	4,396,558	391,002	198,031	19,551	6,612,354
Hooks and lines	18	.....	.....	.....	.....	.....	18
Reef nets	192	827	23,238	3,070	1,640	.....	29,967
Drag bag nets	124	1,055	525	510	.....	.....	2,214
Totals	740,700	2,094,479	7,411,096	1,337,681	862,771	161,776	12,608,503
1916							
Pound nets	259,235	297,365	12,724	684,022	596,513	79,609	2,128,468
Fish wheels	13,641	.....	.....	60	32,526	6,021	52,248
Gill nets	172,679	150,440	4,212	160,472	23,282	27,527	538,612
Set nets	21,612	53,422	2,465	85,939	4,077	12,465	179,980
Drag seines	36,474	20,885	33	12,608	7,705	16,606	94,311
Purse seines	36,730	1,570,488	56,702	391,003	198,032	19,552	2,272,507
Reef nets	192	828	.....	3,071	1,641	.....	5,732
Drag bag nets	125	1,055	.....	510	.....	.....	2,680
Totals	740,688	2,094,483	76,136	1,337,685	862,776	161,780	5,273,548
1917							
Pound nets	443,384	211,051	4,426,534	625,380	2,854,960	57,328	8,618,637
Fish wheels	19,277	.....	.....	.....	44,883	9,455	73,615
Gill nets	568,627	143,738	135,541	142,716	125,231	73,393	1,189,246
Set nets	38,216	71,071	9,890	93,081	4,270	22,063	239,591
Drag seines	28,190	29,566	4,536	32,224	3,249	14,900	112,665
Purse seines	49,738	833,168	8,745,689	296,311	1,998,075	2,861	11,896,442
Hooks and lines	48,722	609	1,388	75,211	1,696	175	127,801
Reef nets	49	820	57,978	6,611	7,558	.....	73,016
Bag nets	79	.....	.....	.....	.....	.....	79
Totals	1,196,282	1,290,023	13,381,556	1,211,534	5,040,522	180,175	22,300,092
1918							
Pound nets	487,837	210,400	60,353	850,852	513,981	65,061	2,189,404
Fish wheels	9,655	.....	.....	11	101,783	6,676	118,125
Set nets	28,784	56,427	7,233	178,734	21,769	20,021	310,986
Gill nets	291,335	144,292	4,596	318,215	125,303	52,614	926,357
Drag seines	22,348	60,488	250	31,664	13,646	19,821	148,217
Purse seines	58,059	799,833	3,482	538,291	45,260	15,395	1,450,320
Reef nets	1,515	914	12,448	12,634	2,036	.....	29,547
Hooks and lines	83,410	251	28	175,333	1,078	207	290,907
Drag bag nets	129	2,050	78	101	2,358
Totals	973,072	1,274,655	88,392	2,103,812	825,456	180,816	5,446,203

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Yearly Comparative Table of Salmon Catch, Segregated as to Gear and Species—Concluded.

YEAR AND GEAR	Number Chinook Salmon	No. Dog or Chum Salmon	Number Hump-back Salmon	Number Silver Salmon	Number Sockeye Salmon	Number Steelhead Salmon	Totals
ALL DISTRICTS COMBINED (Continued)—							
1919							
Pound nets	361,282	380,687	2,081,961	823,117	462,161	55,964	4,165,172
Fish wheels	13,992				18,206	2,913	35,111
Set nets	26,084	136,950	9,666	117,201	4,029	18,463	312,393
Gill nets	258,530	217,566	38,325	202,239	16,224	29,784	792,668
Drag seines	25,175	80,892	32	25,241	9,404	14,087	154,781
Purse seines	89,069	1,112,404	2,513,521	443,876	283,993	3,029	4,445,892
Reef nets	962	3,404	29,042	9,639	3,210	50	46,307
Hooks and lines.....	76,581	47	798	80,422	1,872	412	160,132
Drag bag nets.....		171					171
Totals.....	851,675	1,932,121	4,673,345	1,701,735	799,069	124,652	10,082,627
1920							
Pound nets	308,662	169,833	13,753	320,861	597,255	34,237	1,444,601
Fish wheels	11,193				18,419	6,882	36,494
Set nets	16,998	9,370	183	60,669	1,780	12,536	101,536
Gill nets	189,239	26,883	157	98,266	6,399	19,335	340,279
Drag seines	18,419	6,823		7,142	2,550	10,495	45,438
Purse seines	167,486	542,340	4,943	167,677	53,112	6,538	941,066
Reef nets	60	143	13	2,361	313		2,860
Hooks and lines.....	59,313	233	667	84,751	240	411	145,615
Totals.....	771,370	755,625	19,716	741,727	680,077	89,434	3,057,949

CATCH OF SHELL AND FOOD FISH (OTHER THAN SALMON) AND VALUE.
Fiscal Year 1920.

DISTRICT, AND GEAR WITH WHICH TAKEN	Pounds of Clams and Mussels	Number of Crab	Pounds of Herring	Pounds of Shad	Pounds of Shrimp	Pounds of Smelt	Number of Sturgeon	Pounds of Clam for Salt	Total Value
PUGET SOUND DISTRICT—									
Pound net			500				3		
Gill net						6,285	1		
Drag seine			79,783			295,279			
Purse seine			3,000			7,632	1		
Smelt drag bag net.....			295,685			886,869			
Brush weir			74,665						
Beam trawl					82,947				
Clam	487,955	625,623							
Crab		625,623	423,633		82,947	636,015	5		
Totals	487,955	625,623	423,633		82,947	636,015	5		
Value	\$12,173 87	\$65,158 64	\$4,226 37		\$12,442 05	\$34,800 75	\$13 50		\$128,825 14
COLUMBIA RIVER DISTRICT—									
First class pound net.....				14,240			72		
Second class pound net.....				4,478			61		
Stationary fish wheel.....				13,653			25		
Snow fish wheel				848			34		
Set net				58			84		
Gill net				34,380			1,198		
Drag seine			89,235			700	411		
Purse seine				705			160		
Hook and line							77		
Bag net						1,050,883			
Clam	4,816	2,208							
Crab		2,208							
Totals	4,816	2,208	89,235	68,688		1,051,283	2,134		
Value	\$120 40	\$230 00	\$3,569 40	\$2,000 64		\$5,256 41	\$5,335 00		\$16,371 85

Catch of Shell and Food Fish (Other Than Salmon) and Value—Concluded.

DISTRICT, AND GEAR WITH WHICH TAKEN	Pounds of Clams and Mussels	Number of Crab	Pounds of Herring	Pounds of Shad	Pounds of Shrimp	Pounds of Smelt	Number of Sturgeon	Pounds of Clam for Bait	Total Value
GRAYS HARBOR DISTRICT—									
Pound nets							165		
Set nets							10		
Gill nets							40		
Clams	3,040,758							7,827	
Crabs		52,563							
Totals	3,040,758	52,563					215	7,827	
Value	\$76,018 95	\$5,475 31					\$500 25	\$117 40	\$82,417 91
WILLAPA HARBOR DISTRICT—									
Gill nets							38		
Purse seines							218		
Clams	826,773							97,633	
Crabs		843,176							
Totals	826,773	843,176					256	97,633	
Value	\$20,669 32	\$35,747 50					\$000 00	\$1,404 49	\$58,871 31
ALL DISTRICTS COMBINED—									
Pound nets							391		
Fish wheels			500	18,718			59		
Set nets				13,901			04		
Gill nets				34,387			1,277		
Drag seines			169,015	920		6,635	514		
Purse seines			3,000	705		7,632	388		
Hook and lines							77		
Bag nets						1,050,583			
Smelt drag bag nets			295,683			386,869			
Brush welts			74,063						
Beam trawls						52,047			
Clams	4,359,392							107,460	
Crabs		1,023,470							
Totals	4,359,392	1,023,470	512,863	68,633	82,047	1,747,298	2,610	107,460	
Value	\$108,932 54	\$105,671 45	\$7,805 73	\$2,000 64	\$12,442 05	\$40,057 16	\$7,114 75	\$1,611 80	\$286,066 21

FOOD AND SHELL FISH CANNED.

Fiscal Year 1920.

	Number of 48-lb. Cases	Value
PUGET SOUND DISTRICT--		
Chinook salmon.....	27,482	\$274,820 00
Dog or Chum salmon.....	47,531	179,366 25
Humpback salmon.....	4,921	23,620 80
Silver salmon.....	25,321	164,586 50
Sockeye salmon.....	62,751	1,211,094 30
Steelhead salmon.....	28	168 00
Clams and mussels.....	3,524	26,782 40
Clam nectar.....	154	308 00
Totals.....	172,012	\$1,680,746 25
COLUMBIA RIVER DISTRICT--		
Chinook salmon--Spring.....	138,258	\$2,073,870 00
Chinook salmon--Fall.....	2,061	24,319 80
Dog or Chum salmon.....	4,911	15,715 20
Silver salmon.....	7,398	51,786 00
Sockeye salmon.....	1,237	20,752 00
Steelhead salmon.....	4,977	59,724 00
Shad.....	4,343	15,634 80
Totals.....	163,245	\$2,261,801 80
GRAYS HARBOR DISTRICT--		
Chinook salmon.....	861½	\$10,336 00
Dog or Chum salmon.....	36½	84 80
Silver salmon.....	412½	2,887 50
Sockeye salmon.....	235	4,230 00
Clams and mussels.....	33,138	314,811 00
Clam nectar.....	466	932 00
Crab.....	12	432 00
Totals.....	35,151½	\$333,715 30
WILLAPA HARBOR DISTRICT--		
Chinook salmon.....	62	\$637 00
Clams and mussels.....	5,589	53,095 50
Clam nectar.....	462	924 00
Totals.....	6,113	\$54,656 50
ALL DISTRICTS COMBINED--		
Chinook salmon.....	168,724½	\$2,384,184 80
Dog or Chum salmon.....	52,768½	196,166 25
Humpback salmon.....	4,921	23,620 80
Silver salmon.....	33,131½	219,260 00
Sockeye salmon.....	64,283	1,235,076 30
Steelhead salmon.....	5,005	59,892 00
Clams and mussels.....	42,251	394,686 90
Clam nectar.....	1,092	2,164 00
Crab.....	12	432 00
Shad.....	4,343	15,634 80
Totals.....	376,321½	\$4,531,119 85

YEARLY COMPARATIVE TABLE OF FOOD AND SHELL FISH CANNED.

PUGET SOUND DISTRICT	NUMBER FORTY-EIGHT POUND CASES						NUMBER FORTY-EIGHT POUND CASES					
	Chinook	Dog	Humpback	Silver	Sockeye	Steel-head	Totals	Clams and Mussels	Crabs	Shad	Other Food and Shell Fish	Grand Totals
1890.....		4,000		4,000	72,079		8,000					
1896 (Spring).....	13,405			82,640			169,114					
1896 (Fall).....	26,550			18,600	252,000		297,150					
1898.....	31,200			182,600	612,500		833,300					
1899.....	24,500		254,000	102,300	229,400		580,350					
1900.....	23,350			128,200	572,301		584,051					
1902.....	30,049		181,326	103,450	167,211		478,488					
1903.....	14,300			117,845	107,943		296,272					
1904.....	17,900		70,922	79,335	825,453		1,018,641					
1905.....	1,804	41,067		94,497	178,748		430,692	3,500				1,023,141
1906.....	8,139	149,218		119,472	93,122		608,080	8,850	1,250			440,702
1907.....	1,874	50,249	433,423	128,922	170,951		608,080	8,850	1,250			708,180
1908.....	95,270	47,607	6,075	130,632	972,180		448,765	8,200	1,100			458,063
1909.....	22,233	58,174	340,449	130,632	972,180		1,532,065	5,000				1,537,065
1910.....	10,064	146,942	108	162,756	248,014		567,883	8,200				577,283
1911.....	21,680	101,830	1,050,338	275,223	132,340		1,361,361	6,200	1,150			1,367,761
1912.....	22,081	62,730	1,202	157,117	193,442		430,692	6,000	12,000			454,572
1913.....	1,805	55,789	802,040	62,492	1,662,942		2,585,085	8,200				2,593,285
1914.....	27,140	290,476	1,016	158,032	330,793		817,350	5,000				822,350
1915 (6 months).....	28,942	422,728	586,195	185,531½	86,430½		1,311,817	875				1,312,692
1916.....	26,042	398,445	139,798	148,204	82,340½	14	795,372½	3,529				798,901½
1917 (4 months).....	18,130	165,749	5,008	60,143	6,516		237,544	524				238,068
1917.....	70,018	278,077	1,200,163	115,860	454,536	4	1,960,258	19,566			6,074	2,016,891
1918.....	69,800½	294,922	6,607	235,795	52,587½		622,732	7,944				630,676
1919.....	71,100	523,967	437,530½	201,616½	67,087	62	1,307,733	3,758	619		8,585	1,315,725
1920.....	27,462	47,851	4,921	25,321	62,751	28	168,334	3,524				172,012

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Yearly Comparative Table of Food and Shell Fish Canned—Continued.

COLUMBIA RIVER DISTRICT	NUMBER FORTY-EIGHT POUND CASES						NUMBER FORTY-EIGHT POUND CASES					
	Chinook	Dog	Humpback	Silver	Socketeye	Steel-head	Totals	Clams and Mussels	Crabs	Shad	Other Food and Shell Fish	Grand Totals
1890.....	167,050					40,799	167,050					167,050
1891.....	371,391				16,985	8,700	429,175					429,175
1896 (Fall).....	7,102			41,008	8,750	8,700	59,810					59,810
1898.....	78,450			17,910	9,690	6,470	119,525					119,525
1899.....	80,300			19,469	7,720	8,380	127,190					127,190
1900.....	91,580			4,435	4,235		98,813					98,813
1902.....	77,910	10,333		4,400	4,140		95,440					95,440
1903.....	76,900	10,000		36,390	4,227		119,513					119,513
1904.....	130,688	18,608		18,071	914		157,966					157,966
1905.....	120,598	18,283		25,262	316		148,264					148,264
1906.....	103,272	19,414		36,469	364		142,270					142,270
1907.....	87,262	18,175		17,077	680		114,090					114,090
1908.....	83,522	12,811		32,081	2,478	5,188	119,508					119,508
1909.....	68,466	6,993		21,160	11,577	2,440	117,546					117,546
1910.....	108,961	16,575		41,258	593	2,440	175,546					175,546
1911.....	81,255	22,294		23,883	1,250	6,296	131,338					131,338
1912.....	77,046	18,654		33,507	3,189	2,600	124,334					124,334
1913.....	96,898	18,062		20,072	11,226	3,953	168,797					168,797
1914.....	146,491	27,648		30,072	2,240	10,953	197,639			2,170		197,639
1915 (8 months).....	156,292½	25,083		30,074	1,345½	11,315½	226,404½			846		227,250½
1916.....	22,820	37,404		6,714	31	8,030	41,250			275		41,524
1917 (4 months).....	146,140	14,539	56	15,982	2,901	6,053	185,592			200		187,429
1918.....	145,511	12,173		26,746	19,450	8,699	221,579			8,174		224,753
1919.....	128,098	39,279		34,927	2,330	7,148	213,983			4,017		217,985
1920.....	140,310	4,911	2,117	7,398	1,297	4,977	168,902			4,943		168,245

Yearly Comparative Table of Food and Shell Fish Canned—Continued.

GRAYS HARBOR DISTRICT	NUMBER FORTY-EIGHT POUND CASES							NUMBER FORTY-EIGHT POUND CASES					
	Chinook	Dog	Humpback	Silver	Socketeye	Steel-head	Totals	Clams and Mussels	Clams Nectar	Crabs	Shad	Other Food and Shell Fish	Grand Totals
1890 (None packed)							21,274						
1894	7,816	4,180		9,278			9,900						
1898	5,100			4,800			12,800						
1899	5,500			7,300			19,600						
1900	6,700			12,900			31,500						
1902	4,000	17,600		10,000									
1903 (None packed)													
1904	4,530	10,800		11,570			26,600						
1905	2,050	7,000		13,000			22,060						
1906	2,540	8,000		11,500			22,000						
1907	1,000	3,800		9,500			14,000						
1908	1,000	3,500		9,500			10,000						
1909	2,000	500		10,000	1,500		14,000	10,000					
1910	15,495	18,867		21,768			51,130	27,787					
1911	11,650	22,455		43,297			87,272	21,408					
1912	12,502	21,864	1,880	21,435	9,870		53,981	33,025					
1913	2,196	9,405	2,708	8,020	30,879	55	43,063	50,852					
1914	5,848	19,922	4,496	22,552	18,756	496	72,110	29,492					
1915 (8 months)	11,629	23,861	4,084	15,016½	24,626		71,977	15,339	1,600				
1916	29,839	8,746	11,303	10,069			66,616	19,647	706				
1917 (4 months)	3,642½	3,602	50	1,986½			9,497	11,296½					
1918	13,518	12,888	11,279	13,598	4,530	129	55,942	15,516			463		
1919	10,983½	5,573	1,373	29,512	2,469½	15	49,611	20,728	30				
1920	5,186	30,198	1,750	13,682	710	11	51,482	35,468	153				
	80,114	29½		412½	235		1,585½	83,138	496	12			
													35,151½

Yearly Comparative Table of Food and Shell Fish Canned—Continued.

WILLAPA HARBOR DISTRICT	NUMBER FORTY-EIGHT POUND CASES						NUMBER FORTY-EIGHT POUND CASES						
	Chinook	Dog	Humpback	Silver	Socketeye	Steel-head	Totals	Clams and Mussels	Clam Nectar	Crabs	Shad	Other Food and Shell Fish	Grand Totals
1890 (None packed)													
1896	4,551	8,450		11,840			24,841						
1898	5,885			9,809			15,674						
1899	6,320			10,210			16,530						
1900	6,700			12,400			19,100						
1902	5,836	24,528		9,128			39,492						
1903	2,300	1,200		2,890			5,890						
1904	3,000	15,000		7,500			25,500						
1905	4,650	6,000		4,300			14,950						
1906	4,000	5,100		5,240			14,440						
1907	3,530	624		9,228			13,382						
1908	4,017	10,517		5,923			20,457						14,950
1909	2,650	6,337		3,470			12,517						18,882
1910	2,923	6,489		5,066			14,508						20,457
1911	5,717	10,482		9,238			25,437						12,517
1912	6,123	9,533		5,266			20,922						14,508
1913				4,462			25,148						25,437
1914	2,924	8,872	4,462	8,030			25,288						28,148
1915 (8 months)	3,842	6,734		2,547			11,486						19,086
1916	1,513	5,927		2,214			16,837						24,937
1917 (4 months)	3,602	5,014		1,600			8,172	94					12,214
1917	1,720	4,516		2,143			10,381						18,881
1918	921	2,657		5,249			8,870	1,546					10,291
1919	1,152	9,301	1,666	1,491			13,632	3,820					17,452
1920							62	5,589	462				6,113

Yearly Comparative Table of Food and Shell Fish Canned—Concluded.

ALL DISTRICTS COMBINED	NUMBER FORTY-EIGHT POUND CASES						NUMBER FORTY-EIGHT POUND CASES						
	Chinook	Dog	Humpback	Silver	Sockeye	Steel- head	Totals	Clams and Mussels	Nectar	Crabs	Shad	Other Food and Shell Fish	Grand Totals
1890.....	167,050	4,000	.....	4,000	.....	49,449	175,050	.....	.....	.....	.....	.....	.....
1896.....	430,965	12,680	.....	147,846	89,064	49,449	730,844	.....	.....	.....	.....	.....	.....
1898.....	100,615	.....	.....	121,959	267,645	8,680	498,849	.....	.....	.....	.....	.....	.....
1899.....	122,620	.....	254,000	137,250	522,120	6,470	1,042,480	.....	.....	.....	.....	.....	.....
1900.....	127,310	.....	.....	172,960	237,520	8,380	546,170	.....	.....	.....	.....	.....	.....
1901.....	106,440	.....	.....	208,000	1,230,767	2,000	1,680,119	.....	.....	.....	.....	.....	.....
1902.....	117,795	121,862	.....	169,380	376,536	.....	749,464	.....	.....	.....	.....	.....	.....
1903.....	93,700	23,201	181,326	110,240	112,151	.....	579,818	.....	.....	.....	.....	.....	.....
1904.....	156,268	96,502	.....	163,365	119,170	.....	528,185	.....	.....	.....	.....	.....	.....
1905.....	120,102	72,340	70,992	114,706	179,084	.....	1,213,507	.....	1,950	.....	.....	1,217,007	
1906.....	117,911	181,732	.....	136,569	179,084	.....	528,185	.....	.....	.....	.....	.....	.....
1907.....	68,006	79,546	483,423	174,669	93,486	.....	897,732	.....	.....	.....	.....	.....	.....
1908.....	182,749	74,485	6,075	161,422	171,631	.....	597,312	.....	.....	.....	.....	.....	.....
1909.....	82,237	73,084	349,149	164,662	96,237	.....	1,638,877	.....	.....	.....	.....	.....	.....
1910.....	146,066	183,871	108	221,700	250,492	5,188	1,533,119	.....	.....	.....	.....	.....	.....
1911.....	146,066	157,111	1,050,338	349,176	142,903	.....	1,849,876	.....	.....	.....	.....	.....	.....
1912.....	121,961	112,281	7,494	210,465	196,542	2,440	635,039	.....	.....	.....	.....	.....	.....
1913.....	92,245	96,108	804,748	96,108	1,667,010	6,246	2,764,884	.....	.....	.....	.....	.....	.....
1914.....	82,850	344,780	5,512	217,735	369,768	4,449	1,075,094	.....	.....	.....	.....	.....	.....
1915 (9 months).....	183,714½	476,069	506,229	213,354	112,296½	10,953	1,506,546	.....	.....	.....	.....	.....	.....
1916.....	106,346½	470,747	142,544	181,801	93,794	11,332½	1,046,565	.....	.....	.....	.....	.....	.....
1917 (4 months).....	48,194½	.....	5,112	70,608¾	8,763	6,030	318,681	.....	.....	.....	.....	.....	.....
1917.....	232,266	250,920	1,141,442	401,667	6,180	.....	2,240,101	.....	.....	.....	.....	.....	.....
1918.....	219,921	268,325	7,980	306,392	74,507	.....	1,586,715	.....	.....	.....	.....	.....	.....
1919.....	205,546	608,740	443,285½	251,746½	70,126	7,221	1,586,715
1920.....	108,724½	52,708¾	4,021	33,131½	64,293	5,005	328,833½

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FOOD AND SHELL FISH, FRESH AND PRESERVED (OTHER THAN CANNED) AND VALUE.
Fiscal Year 1920.

	PUGET SOUND DISTRICT		COLUMBIA RIVER DISTRICT		GRAYS HARBOR DISTRICT		WILLAPA HARBOR DISTRICT		ALL DISTRICTS COMBINED	
	Number Pounds	Value	Number Pounds	Value	Number Pounds	Value	Number Pounds	Value	Number Pounds	Value
FRESH—										
Chinook salmon	2,444,347	\$801,065 52	296,152	\$44,422 80	339,000	\$50,850 90	53,601	\$8,040 15	3,133,106	\$894,409 37
Dog salmon	2,305,878	449,516 82	124,436	3,733 05	100,558	3,016 74	.....	.....	2,500,871	456,206 61
Humpback salmon	26,822	804 66	.....	.....	.....	.....	.....	.....	26,822	804 66
Silver salmon	1,573,769	198,862 28	164,541	9,872 46	549,410	32,964 60	17,475	2,067 00	2,305,195	233,796 34
Sockeye salmon	81,531	9,783 72	252,605	26,712 00	37,128	4,455 30	2,047	317 64	81,531	9,783 72
Steelhead salmon	149,867	23,978 72	.....	.....	.....	.....	.....	.....	412,247	56,464 32
Salmon trout	236,235	37,797 60	.....	.....	.....	.....	.....	.....	236,235	37,797 60
Herring	135,257	2,028 85	.....	.....	.....	.....	.....	.....	135,257	2,028 85
Shad	279	15 34	6,955	243 42	.....	.....	.....	.....	7,234	258 76
Smelt	552,506	33,155 76	491,175	9,223 50	1,250	25 00	.....	.....	1,045,021	43,004 26
Sturgeon	1,598	287 64	55,801	7,812 14	3,358	470 12	527	73 78	61,284	8,043 68
Clams and mussels	545,054	19,076 89	.....	.....	10,071	402 84	111,795	4,471 80	666,920	23,951 53
Crabs	802,514	66,207 40	.....	.....	70,504	5,640 32	765,362	61,268 96	1,657,363	134,040 92
Shrimp	75,541	4,532 46	.....	.....	.....	.....	.....	.....	75,541	4,532 46
Miscellaneous	442,319	22,115 95	20,000	1,200 00	2,403	140 58	18	1 08	464,880	23,406 61
Totals	9,433,607	\$1,240,249 01	1,401,217	\$105,384 21	1,113,778	\$97,975 40	951,425	\$76,230 41	12,900,027	\$1,528,889 09
PRESERVED—										
Frozen	7,701,413	\$126,113 04	289,294	\$20,006 40	.....	.....	6,815	613 35	1,007,522	162,762 85
Kipered	623,331	140,210 47	.....	.....	1,021	255 00	.....	.....	140,504 47	.....
Milk cured	783,262	187,980 48	.....	.....	.....	.....	.....	.....	783,262	187,980 48
Salbed	17,805	4,431 25	115,079	45,079 75	90,384	24,846 00	.....	.....	292,268	72,677 00
Smoked	242,684	66,671 00	.....	.....	.....	.....	.....	.....	242,684	66,671 00
Totals	3,908,485	\$529,465 24	464,373	\$69,716 21	190,404	\$25,101 00	6,815	613 35	3,940,077	\$624,895 80
GRAND TOTALS	12,802,092	\$1,778,714 86	1,865,590	\$175,100 42	1,214,182	\$123,076 40	958,240	\$76,843 76	16,840,104	\$2,153,735 40

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FISH BY-PRODUCTS.

Fiscal Year 1920.

OUTPUT	Quantity	Value
Oil	21,850 gals.	\$7,671 25
Fertilizer	59 tons	4,900 00
Fish meal	293 tons	25,171 00
Total Value		\$37,742 25

APPROXIMATE AVERAGE PRICE—

Oil .....	.35 per gal.
Fertilizer	83 00 per ton
Fish meal	86.90 per ton

HALIBUT HANDLED BY DEALERS.

Fiscal Year 1920.

Fresh	16,174,190 pounds, valued at \$2,781,962 23
Approximate average price	\$.172 per pound

CODFISH HANDLED BY DEALERS.

Fiscal Year 1920.

Fresh or frozen	520,350 pounds, valued at \$18,212 25
Cured	5,590,138 pounds, valued at 340,249 68
Codfish tongues cured	12,000 pounds, valued at 600 00
Total Value	6,122,488 pounds, valued at \$359,061 93

APPROXIMATE AVERAGE PRICE—

Fresh or frozen	\$.03½ per pound
Cured06 per pound
Codfish tongues cured05 per pound

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STATE OYSTER RESERVES.

Plat	LOCATION	County	Acres
.....	Bay Center Reserves Nos. 1-2.....	Pacific.....	254.520
138½	Cases Inlet Reserves Nos. 1-2-3.....	Mason.....	176.860
139	Clifton Reserves—1 to 6, 22-2 west and 1, 22-1 west...	Mason.....	523.194
137	Dewatto Bay Reserve No. 2.....	Mason.....	62.409
90	Dog Fish Bay Reserve—Poulsbo Tract No. 1.....	Kitsap.....	63.920
89	Dog Fish Bay Reserve—West of Keyport Tracts 1-2.	Kitsap.....	81.490
102	Eld Inlet Reserve.....	Thurston.....	46.990
136½	Hamahama Reserve No. 1.....	Mason.....	44.058
.....	Hammersley Inlet Reserve—Reserves A-B, Old Reserve 1-2-3-4.....	Mason.....	246.912
139	Hammersley Inlet Reserve—Reserve No. 5.....	Mason.....	5.760
133	Lillwaup Bay Reserve—Nos. 1-2.....	Mason.....	40.004
.....	Long Island Slough Reserve.....	Pacific.....	578.832
.....	Long Island Reserve Ext.....	Pacific.....	5,990.255
.....	Nemah Reserve.....	Pacific.....	2,553.662
96	Oak Passage Reserve No. 1.....	Mason.....	23.132
59½	Ostrich Bay Reserve.....	Kitsap.....	150.690
88	Ostrich Bay Reserve—Tracts 1-2.....	Kitsap.....	60.754
86	Ostrich Bay Reserve—Tracts 1-2-3.....	Kitsap.....	37.683
.....	Port Discovery Bay Reserve.....	Jefferson.....	133.740
87	Port Orchard Reserve—Tracts 1-2.....	Kitsap.....	122.500
132	Reserve East of Tahuyeh Bay—No. 7.....	Mason.....	14.530
136	Reserve opposite Chinom Point No. 2.....	Mason.....	21.046
134	Skykomish River Reserve—No. 1.....	Mason.....	22.680
135	Tahuyeh Bay Reserve—No. 1.....	Mason.....	31.639
99	Totten Inlet Reserve—10 lots.....	Thurston.....	711.963
.....	Totten Inlet Reserve Nos. 1-2.....	Thurston-Mason.....	24.093
.....	Totten Inlet Reserve "Pot Holes".....	Mason.....	9.015
135	Union City Reserve—No. 2.....	Mason.....	179.130
.....	Willapa River Reserve.....	Pacific.....	476.500
Total.....			12,688.011

Number Licenses Issued to Take Oysters From State Reserves..... 16
Fiscal Year 1920

OYSTERS SOLD FROM STATE RESERVES.

Fiscal Year 1920.

DISTRICT	NUMBER OF SACKS		
	Seed	Merchant'ble	Total
Puget Sound District.....	2,857 91	113 89	2,971 80

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OYSTER INDUSTRY.

Fiscal Year 1920.

(Compiled from reports received from 23 companies or individuals in Puget Sound District, and 5 in Willapa Harbor District.)

	OYSTERS MARKETED		
	No. Sacks	Value	
PUGET SOUND DISTRICT—			
Native	15,600	\$182,448 25	
Eastern	3,707	37,896 00	
Totals.....		19,307	\$220,344 25
WILLAPA HARBOR DISTRICT—			
Native	573	\$3,601 50	
Eastern	3,004	31,930 00	
Totals.....		3,577	\$35,531 50
ALL DISTRICTS COMBINED—			
Native	16,173	\$186,049 75	
Eastern	6,711	69,826 00	
Totals.....		22,884	\$255,875 75

AVERAGE VALUE OF OYSTERS PER SACK.

	Puget Sound District	Willapa Harbor District
Native	\$11 70	\$6 28
Eastern	10 22	10 62

OYSTER LANDS.

DISTRICT	NUMBER OF ACRES				
	Owued	Leased	Native Producing	Eastern Producing	Total Producing
Puget Sound	2,777.23	15	437.9	25	462.9
Willapa Harbor	2,720	.....	60	210	270
Totals.....	5,497.23	15	497.9	235	732.9

Valuations not obtainable on all of above lands. From the Puget Sound District four reports show a valuation of \$141,500.00 on a total of 970 acres owned (an average value of \$145.97 per acre) and of this number 31 acres were under cultivation and valued at \$75,000.00 (an average value of \$2,419.35 per acre).

VALUE OF FISHERIES PRODUCT.*

Fiscal Year 1920.

Food and shell fish canned.....	\$4,531,119 85
Food and shell fish handled fresh.....	1,528,839 69
Food and shell fish preserved (other than canned).....	624,895 80
Fish by-products	37,742 25
Halibut	2,781,982 23
Codfish	359,061 93
Oysters	256,359 67
Total.....	\$10,119,981 42

* Value based on average wholesale price. The Halibut and Codfish are not strictly Washington products, as these fish are taken mostly in the waters of Bering Sea and Alaska and brought to Puget Sound to be marketed.

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YEARLY COMPARATIVE TABLE OF VALUE OF FISHERIES PRODUCT.

	Food and Shell Fish Canned	Food and Shell Fish Handled Fresh	Food and Shell Fish Preserved (Other Than Canned)*	Fish By-products	Halibut	Codfish	Oysters	Totals
1905.....	\$6,614,391 80	\$3,436,209 00	.....	\$44,564 00	.....	.....	\$284,169 00	\$10,361,363 80
1906.....	3,457,275 50	3,472,969 00	.....	19,885 00	.....	.....	292,409 00	7,242,478 50
1907.....	3,590,109 50	2,976,809 00	.....	19,885 00	.....	.....	300,817 00	6,877,623 50
1908.....	3,484,560 00	2,716,800 00	.....	16,540 00	.....	.....	307,700 00	6,595,600 00
1909.....	9,196,656 40	3,714,693 70	.....	41,760 00	.....	.....	581,000 00	13,534,010 10
1910.....	4,225,522 00	2,706,830 00	.....	21,770 00	.....	.....	468,500 00	7,622,122 00
1911.....	9,297,885 40	3,511,177 77	.....	97,665 00	.....	.....	567,350 00	13,474,078 17
1912.....	3,943,016 47	3,611,950 30	.....	79,000 00	.....	.....	330,980 00	7,964,346 77
1913.....	13,121,785 28	1,007,780 57	\$696,718 38	82,721 00	.....	.....	318,680 50	15,215,674 73
1914.....	6,193,237 58	757,235 64	942,890 51	74,781 43	.....	.....	900,000 30	8,168,264 46
1915 (8 months).....	6,812,934 70	492,083 43	53,036 44	114,439 20	.....	.....	334,641 63	7,807,145 40
1916.....	5,451,414 60	1,502,860 72	40,774 90	118,775 00	.....	.....	288,675 29	7,407,590 51
1917 (4 months).....	1,496,512 53	145,869 24	25,500 95	.....	.....	.....	.....	1,667,882 74
1917.....	17,044,726 90	728,241 17	518,009 75	258,182 99	\$3,447,687 21	\$308,422 24	239,577 15	22,664,688 41
1918.....	8,870,124 45	1,063,190 84	829,004 29	198,109 88	2,663,743 74	849,521 66	317,482 81	13,864,767 10
1919.....	12,956,477 67	1,240,314 06	430,442 05	131,692 48	2,584,944 73	306,362 60	329,166 79	18,201,329 26
1920.....	4,531,119 86	1,528,839 69	624,866 80	37,742 25	2,781,962 23	559,061 93	296,369 67	10,119,981 42

* For the years 1905 to 1912, inclusive, the fish preserved (other than canned) is included in the amount of fish handled fresh.

STATE SALMON HATCHERIES.

Comparison Between Fry Capacity of Hatcheries in 1913 and 1920.

SALMON HATCHERIES	FRY CAPACITY IN 1913			FRY CAPACITY IN 1920		
	Hatcheries	Ponds	Totals	Hatcheries	Ponds	Totals
PUGET SOUND DISTRICT—						
Chambers Creek				6,720,000	5,000,000	11,720,000
Dungeness	1,800,000	1,000,000	2,800,000	1,800,000	1,000,000	2,800,000
Elwha				1,920,000		1,920,000
Green River	4,320,000	500,000	4,820,000	5,280,000	500,000	5,780,000
Green River No. 2	4,400,000		4,400,000	4,400,000		4,400,000
Nooksack	4,480,000		4,480,000	4,480,000	1,000,000	5,480,000
Middle Fork Nooksack				2,720,000		2,720,000
South Fork Nooksack	960,000		960,000			*
Nisqually	3,000,000		3,000,000			†
Pilchuck				3,040,000		3,040,000
Puyallup				3,200,000		3,200,000
Saminh	4,880,000	1,000,000	5,880,000	14,160,000	3,000,000	17,160,000
Skagit River	1,440,000		1,440,000			‡
Skokomish	4,200,000		4,200,000	4,200,000		4,200,000
Skokomish (Startup)	880,000		880,000	6,720,000		6,720,000
Snohomish	4,640,000	1,500,000	6,140,000	4,640,000	1,500,000	6,140,000
Stillaguamish	960,000		960,000			§
Tahuya				1,560,000		1,560,000
Totals.....	35,960,000	4,000,000	39,960,000	64,840,000	12,000,000	76,840,000
COLUMBIA RIVER DISTRICT—						
Chinook	2,340,000	1,000,000	3,340,000	7,440,000	2,000,000	9,440,000
Kalama	6,400,000	2,400,000	8,800,000	14,560,000	2,400,000	16,960,000
Lewis River	1,600,000		1,600,000	1,600,000		1,600,000
Pateros-Methow	2,200,000		2,200,000	2,560,000	4,000,000	6,560,000
Spokane				2,000,000		2,000,000
Wenatchee				1,920,000		1,920,000
Wind River	4,960,000		4,960,000	4,960,000		4,960,000
Totals.....	17,500,000	3,400,000	20,900,000	35,040,000	8,400,000	43,440,000
GRAYS HARBOR DISTRICT—						
Chehalis	2,720,000		2,720,000	23,840,000		23,840,000
Chehalis No. 2				6,720,000		6,720,000
Humtulpis				7,840,000		7,840,000
Totals.....	2,720,000		2,720,000	38,400,000		38,400,000
WILLAPA HARBOR DISTRICT—						
Nasel River				3,200,000	200,000	3,400,000
North River				2,720,000	500,000	3,220,000
Willapa	3,120,000		3,120,000	3,120,000		3,120,000
Willapa No. 2				2,560,000		2,560,000
Totals.....	3,120,000		3,120,000	11,600,000	700,000	12,300,000
Grand Totals.....	59,300,000	7,400,000	66,700,000	149,880,000	21,100,000	170,980,000

* S. F. Nooksack Hatchery troughs transferred to the M. F. Nooksack Hatchery.
 † Nisqually Hatchery building destroyed by floods of 1918.
 ‡ Skagit River Hatchery buildings destroyed by floods of 1917.
 § Stillaguamish Hatchery troughs transferred to Pilchuck Hatchery.

Increase in fry capacity of State Salmon Hatcheries from 1913 to 1920.
 Puget Sound District..... 92 per cent
 Columbia River District..... 108 per cent
 Grays Harbor District..... 1,311 per cent
 Willapa Harbor District..... 294 per cent

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STATE TROUT HATCHERIES.

Comparison Between Fry Capacity of Hatcheries in 1913 and 1920.

TROUT HATCHERIES	FRY CAPACITY IN 1913			FRY CAPACITY IN 1920		
	Hatcheries	Ponds	Totals	Hatcheries	Ponds	Totals
Lake Chelan	1,600,000			1,600,000		1,600,000
Lake Crescent				2,400,000		2,400,000
Lake Whatcom				5,500,000	500,000	6,000,000
Lewis River	800,000			800,000		800,000
Little Spokane	200,000			2,000,000		2,000,000
Tilton River				2,400,000	100,000	2,500,000
Walla Walla	900,000			2,300,000		2,300,000
Totals.....	3,500,000			17,000,000	600,000	17,600,000

Increase in fry capacity of State Trout Hatcheries from 1913 to 1920, 403 per cent.

OUTPUT OF SALMON FROM THE STATE HATCHERIES.

Fiscal Year 1920.

	No. Females Spaw'ed	No. Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs On Hand April 1, 1920	No. Eggs Lost	No. Eggs Shipped	No. Eggs On Hand March 31, 1921	No. Fry Hatched	No. Fry On Hand April 1, 1920	No. Fry Lost	No. Fry Planted	No. Fry Shipped	No. Fry On Hand March 31, 1921
CHINOOK													
PUGET SOUND DIST.—													
Dungeness.....	151	697,300	.....	.....	55,940	.....	.....	551,960	.....	12,207	539,053	.....	.....
Ehewa.....	42	137,000	.....	.....	8,000	.....	.....	134,000	.....	1,000	133,000	.....	.....
Green River.....	354	1,827,200	.....	.....	200,850	.....	.....	1,617,550	1,324,657	7,001	2,494,246	.....	.....
Green River No. 2.....	16	60,100	.....	.....	6,500	.....	.....	53,600	.....	600	53,000	.....	.....
Skykomish.....	13	50,500	.....	.....	2,000	.....	.....	57,500	.....	385	57,115	.....	.....
Totals.....	576	2,691,100	.....	.....	277,300	.....	.....	2,413,710	1,324,657	21,053	2,716,414	.....	.....
COLUMBIA RIVER DIST.—													
Chinook.....	332	1,827,500	624,250	.....	83,000	.....	.....	2,368,750	.....	10,000	2,352,750	.....	.....
Wind River.....	121	632,400	.....	.....	8,150	624,250	.....	.....	.....	.....	.....	.....	.....
Totals.....	453	2,459,900	624,250	.....	91,150	624,250	.....	2,368,750	.....	10,000	2,352,750	.....	.....
GRAYS HARBOR DIST.—													
Chehalis.....	398	1,794,030	.....	.....	242,677	175,000	.....	1,376,353	.....	3,322	1,372,671	.....	.....
Chehalis No. 2.....	167	637,200	175,000	.....	7,500	.....	.....	107,300	.....	580	106,920	.....	.....
Houmpulps.....	167	637,200	.....	.....	367,510	.....	.....	387,000	.....	742	388,948	.....	.....
Totals.....	565	2,451,230	175,000	.....	517,687	175,000	.....	1,933,644	.....	4,704	1,928,339	.....	.....
WILLAPA HARBOR DIST.—													
North River.....	5	17,000	.....	.....	200	.....	.....	16,800	.....	30	16,704	.....	.....
Willapa.....	(6)	306,000	.....	.....	26,200	.....	.....	279,800	.....	1,900	277,900	.....	.....
Totals.....	74	323,000	.....	.....	26,400	.....	.....	296,600	.....	1,936	294,604	.....	.....
RECAPITULATION—													
Puget Sound District.....	576	2,691,100	.....	.....	277,300	.....	.....	2,413,710	1,324,657	21,053	2,716,414	.....	.....
Columbia River District.....	453	2,459,900	624,250	.....	91,150	624,250	.....	2,368,750	.....	10,000	2,352,750	.....	.....
Grays Harbor District.....	565	2,451,230	175,000	.....	517,687	175,000	.....	1,933,644	.....	4,704	1,928,339	.....	.....
Willapa Harbor District.....	74	323,000	.....	.....	26,400	.....	.....	296,600	.....	1,936	294,604	.....	.....
Grand Totals.....	1,668	7,925,230	799,250	912,627	799,250	7,012,003	1,324,657	44,653	8,262,007

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Output of Salmon From the State Hatcheries—Continued.

DOG	No. Females Spaw'ed	No. Eggs Taken	No. Egg Receive from Oth Hatcheri	No. Eggs on Hand April 1, 1920	No. Eggs Lost	No. Eggs Shipped	No. Eggs on Hand March 31, 1921	No. Fry Hatched	No. Fry On Hand April 1, 1920	No. Fry Lost	No. Fry Planted	No. Fry Shipped	No. Fry On Hand March 31, 1921
PUGET SOUND DIST.—													
Chambers Creek.....	1,261	2,941,825	1,500,00	7,654,000	433,880	.....	281,745	11,880,200	1,181,000	24,150	11,834,600	.....	602,450
Dungeness.....	.....	.....	500,00	.....	15,045	.....	.....	484,955	.....	22,836	.....	.....	462,559
Elwha.....	1,833	3,987,000	.....	217,000	2,500,000	.....	.....	1,280,000	1,860,000	8,000	1,857,000	.....	1,275,000
Green River.....	1,063	3,492,700	.....	186,471	1,010,000	.....	.....	2,236,229	.....	10,664	1,350,000	.....	986,566
Green River No. 2.....	2,001	5,272,900	3,157,000	.....	14,450	1,587,000	.....	3,149,550	487,408	84,883	1,510,700	.....	2,014,375
Nooksack.....	622	1,704,000	.....	183,730	372,900	1,587,000	218,000	3,013,000	3,176,800	10,565	1,925,270	.....	2,438,000
Middle Fork Nooksack.....	85	196,500	1,897,000	851,730	.....	.....	.....	3,691,000	828,300	55,530	1,925,270	.....	.....
Pilchuck.....	313	778,750	2,000,000	.....	46,800	.....	.....	2,146,700	988,403	6,193	3,132,000	.....	.....
Puyallup River.....	763	2,068,300	1,200,000	.....	100,720	.....	.....	1,878,630	1,704,374	19,224	2,100,100	.....	1,463,060
Samish.....	2,320	5,774,000	7,000,000	.....	217,600	1,020,000	.....	8,850,700	1,403,840	32,340	10,701,300	.....	2,621,233
Skokomish.....	78	214,500	3,120,000	.....	233,060	.....	.....	5,767,000	1,403,840	25,215	5,963,300	.....	1,242,325
Snohomish.....	.....	.....	4,640,000	.....	290,900	.....	.....	3,101,435	809,720	12,515	1,833,700	.....	2,064,940
Tahuya Eyling Station.....	1,443	3,990,000	1,020,000	.....	58,000	1,144,000	.....	4,349,100	2,927,100	30,420	6,067,000	.....	1,178,780
Lake Crescent Trout H.....	.....	.....	500,000	.....	5,600	.....	.....	494,000	.....	400	4,355,960	.....	306,600
Totals.....	11,850	30,430,475	27,668,000	8,005,730	2,487,161	7,561,000	499,745	55,565,290	20,856,498	382,145	59,434,745	.....	16,604,907
COLUMBIA RIVER DIST.—													
Chinook.....	.....	.....	4,000,000	.....	98,500	.....	.....	3,001,500	.....	9,300	3,902,900	.....	.....
Kalama.....	.....	.....	13,000,000	.....	205,000	.....	.....	12,785,000	.....	22,220	12,772,680	.....	.....
Patros-Methow.....	.....	.....	1,000,000	.....	61,000	.....	.....	989,000	.....	530	988,430	.....	.....
Wenatchee.....	.....	.....	500,000	.....	10,275	.....	.....	489,725	.....	2,390	.....	.....	487,335
Wind River.....	.....	.....	4,000,000	.....	133,600	.....	.....	3,860,400	.....	68,650	3,797,750	.....	.....
Totals.....	.....	.....	22,500,000	.....	608,375	.....	.....	21,991,625	.....	103,210	21,401,080	.....	487,335
GRAYS HARBOR DIST.—													
Chehalis.....	16,175	51,076,000	.....	.....	2,223,866	30,085,900	.....	9,766,805	5,922,414	2,795	15,087,424	.....	.....
Chehalis No. 2.....	5,948	14,488,030	5,468,300	.....	230,800	.....	.....	5,228,000	8,737,995	9,970	8,946,925	.....	.....
Humtulsps.....	.....	.....	.....	.....	1,448,530	10,000,000	.....	3,944,500	.....	3,500	3,041,000	.....	.....
Totals.....	21,523	65,569,030	5,403,800	.....	3,902,725	49,085,900	.....	18,049,305	9,661,407	16,295	27,994,449	.....	.....

* 10,000 Shipped to University of Washington.

Output of Salmon From the State Hatcheries—Continued.

	No. Females Stocked	No. Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs On Hand April 1, 1920	No. Eggs Lost	No. Eggs Shipped	No. Eggs On Hand March 31, 1921	No. Fry Hatched	No. Fry On Hand April 1, 1920	No. Fry Lost	No. Fry Planted	No. Fry Shipped	No. Fry On Hand March 31, 1921
DOG—Concluded													
WILLAPA HARBOR DIST.—													
Nasal River.....	1,773	5,274,500	.....	.....	523,285	1,500,000	.....	3,248,215	.....	18,480	3,140,000	.....	89,735
North River.....	11	35,000	1,500,000	.....	0,302	.....	.....	1,528,638	.....	3,185	1,525,453	.....	.....
Willapa.....	14	42,000	.....	.....	2,000	.....	.....	40,000	.....	.....	40,000	.....	.....
Willapa No. 2.....	.....	.....	1,000,000	.....	31,700	.....	.....	968,300	.....	59,970	908,330	.....	.....
Totals.....	1,800	5,348,500	2,500,000	.....	563,347	1,500,000	.....	5,785,153	.....	81,635	5,613,783	.....	89,735
RECAPTULATION—													
Puget Sound District.....	11,850	30,430,475	27,068,000	8,005,730	2,487,101	7,561,000	400,745	55,565,900	20,856,408	483,145	59,434,745	.....	16,604,007
Commbia River District.....	.....	.....	22,500,000	.....	508,373	.....	.....	21,991,627	103,210	103,210	21,401,080	.....	487,335
Grays Harbor District.....	21,523	65,600,030	5,468,800	.....	3,192,725	49,083,800	.....	18,049,303	9,067,469	16,365	27,694,440	.....	.....
Willapa Harbor District.....	1,800	5,348,500	2,500,000	.....	563,347	1,500,000	.....	5,785,153	.....	81,635	5,613,783	.....	89,735
Grand Totals.....	35,173	101,357,005	58,136,800	8,005,730	7,461,608	58,146,800	400,745	101,861,382	30,517,907	583,355	114,144,057	.....	17,181,977
HUMBACK													
PUGET SOUND DIST.—													
Dungeness.....	.....	.....	.....	.....	.....	.....	.....	.....	721,750	3,150	718,600	.....	.....

Output of Salmon From the State Hatcheries—Continued.

SILVER	No. Females Spawed	No. Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs On Hand April 1, 1920	No. Eggs Lost	No. Eggs Shipped	No. Eggs On Hand March 31, 1921	No. Fry Hatched	No. Fry On Hand April 1, 1920	No. Fry Lost	No. Fry Planted	No. Fry Shipped	No. Fry On Hand March 31, 1921
PUGET SOUND DIST.—													
Chambers Creek.....	220	578,500	.....	.....	124,920	.....	793,655	448,580	.....	5,050	386,100	.....	57,430
Dunsmuir.....	293	1,022,900	.....	180,050	178,600	.....	.....	210,600	15,375	4,305	185,000	.....	36,000
Elwha.....	73	143,000	.....	.....	3,005	.....	.....	140,000	.....	.....	75,000	.....	65,000
Green River No. 1.....	1,466	4,691,100	.....	.....	573,588	11,022,000	36,512	4,050,000	252,085	16,487	2,500,000	.....	1,533,520
Green River No. 2.....	783	2,091,650	.....	402,350	296,050	.....	387,350	2,880,000	1,002,693	13,494	1,144,164	.....	1,475,985
Nooksack.....	2,569	8,015,700	.....	179,800	137,800	1,125,000	404,000	6,258,700	106,750	37,230	1,220,000	.....	3,011,173
Middle Fork Nooksack.....	531	1,571,000	.....	827,470	141,970	.....	1,062,000	2,379,000	270,791	9,460	2,222,000	.....	1,287,000
Pileouck.....	337	572,300	.....	.....	30,050	.....	.....	1,056,200	639,917	.....	745,000	.....	45,050
Puyallup River.....	372	1,087,250	.....	.....	33,000	.....	7,165,200	4,112,800	3,809,041	7,075	4,169,400	.....	468,787
Samish.....	3,067	10,827,500	.....	1,047,650	46,350	110,000	146,300	302,300	294,075	1,058	488,600	.....	2,944,438
Skokomish.....	340	874,000	.....	.....	182,850	510,000	140,000	2,052,300	2,045,255	4,000	3,074,600	.....	1,021,220
Skykomish.....	840	2,458,500	.....	578,350	174,315	.....	816,035	607,650	.....	3,625	446,700	.....	1,921,925
Tahuya Eyeing Station.....	4	9,500	.....	510,000	11,850	.....	.....	.....	.....	.....	.....	.....	57,825
Totals.....	11,140	33,919,900	2,616,000	3,877,920	2,390,088	2,807,000	10,825,252	24,421,480	8,439,842	135,278	20,672,664	.....	12,055,380
COLUMBIA RIVER DIST.—													
Chinook.....	26	81,500	.....	.....	1,300	.....	.....	80,200	.....	1,300	68,000	.....	10,900
Paterson-Methow.....	122	328,000	.....	2,825	36,425	.....	301,700	3,289,925	305,975	6,095	2,700	.....	1,022,825
Tilton River Trout B.....	561	1,772,000	1,500,000	62,740	44,815	.....	.....	.....	.....	.....	2,567,500	.....	.....
Totals.....	749	2,181,500	1,500,000	65,565	72,540	.....	301,700	3,372,825	305,965	7,395	2,638,200	.....	1,033,225
GRAYS HARBOR DIST.—													
Chehalis.....	4,982	17,118,540	.....	2,542,070	1,705,205	.....	1,914,405	16,040,800	3,897,671	5,096	12,857,200	.....	7,075,572
Chehalis No. 2.....	39	124,000	.....	.....	5,020	.....	470,215	118,980	.....	425	118,555	.....	118,555
Humptulps.....	2,401	6,331,700	.....	.....	1,428,485	1,500,000	.....	3,133,000	.....	3,615	159,000	.....	2,970,355
Totals.....	7,421	20,574,240	.....	2,542,070	3,138,710	1,500,000	2,384,620	19,262,780	3,897,671	9,709	13,134,755	.....	10,045,927
WILLAPA HARBOR DIST.—													
Naselle River.....	315	100,400	.....	279,500	128,315	.....	149,775	910,000	651,385	3,515	927,700	.....	631,080
North River.....	85	251,550	.....	.....	20,257	.....	.....	231,203	.....	845	290,448	.....	290,448
Willapa.....	1,270	4,328,000	.....	592,000	391,900	.....	610,500	4,069,500	596,450	17,480	2,842,500	.....	1,836,000
Willapa No. 2.....	.....	.....	1,000,000	.....	47,600	.....	.....	952,400	.....	67,780	884,620	.....	884,620
Totals.....	1,670	5,580,850	1,000,000	871,500	408,072	.....	769,275	6,194,003	1,247,875	89,620	4,885,268	.....	2,467,080

* 961,000 Received from King County.
 † 22,000 Shipped to University of Washington.
 ‡ 100,000 Shipped to State of Connecticut.
 § 50,000 Shipped to N. W. Klefer, Seeley Lake, Mont.

Output of Salmon From the State Hatcheries—Continued.

	No. Females Spaired	No. Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs On Hand April 1, 1920	No. Eggs Lost	No. Eggs Shipped	No. Eggs On Hand March 31, 1921	No. Fry Hatched	No. Fry On Hand April 1, 1920	No. Fry Lost	No. Fry Planted	No. Fry Shipped	No. Fry On Hand March 31, 1921
SILVER—Concluded													
RECAPITULATION—													
Puget Sound District.....	11,146	33,919,900	2,616,000	3,877,920	2,930,088	2,807,000	10,825,252	24,421,480	8,433,842	135,278	20,672,664	.....	12,053,980
Columbia River District.....	749	2,181,500	1,500,000	65,565	72,541	301,700	301,700	3,372,825	365,925	7,365	2,698,200	.....	1,033,225
Grays Harbor District.....	7,421	23,774,040	.....	2,542,070	3,198,710	1,500,000	2,384,620	3,827,671	9,769	13,134,755	.....	10,045,927	
Willapa Harbor District.....	1,676	5,589,850	1,000,000	871,590	496,072	.....	769,275	6,194,093	1,247,875	80,620	4,985,268	.....	2,467,080
Grand Totals.....	20,980	65,465,290	5,116,000	7,357,145	6,069,410	4,307,000	14,280,847	53,281,178	13,891,388	242,062	41,330,887	.....	25,349,612
STEELHEAD													
PUGET SOUND DIST.—													
Chambers Creek.....	125	545,250	.....	253,000	86,810	70,000	324,450	307,000	45,000	250	273,000	25,000	53,750
Duwamish.....	314	1,261,200	.....	.....	133,525	.....	6,875	1,100,800	.....	29,700	1,049,100	10,000	.....
Elwha.....	166	178,000	.....	.....	12,500	.....	14,000	151,500	.....	1,000	150,500	.....	.....
Green River.....	6	24,300	.....	.....	8,700	.....	.....	15,600	.....	300	15,300	.....	.....
Green River No. 2.....	254	833,300	.....	.....	261,300	445,000	27,600	70,000	300	200	84,800	15,000	.....
Nooksack.....	33	82,550	.....	1,200	1,200	.....	.....	81,300	.....	1,000	80,300	.....	.....
Pilehuck.....	84	364,000	.....	.....	365,800	136,000	.....	291,500	.....	1,600	229,900	60,000	.....
Samish.....	70	300,400	.....	.....	7,820	.....	282,580	10,000	.....	243	9,757	.....	.....
Skykomish.....	57	188,200	.....	.....	7,500	.....	29,100	151,600	.....	400	151,200	.....	.....
Tahuya Eyeing Station.....	4	6,900	.....	.....	4,800	.....	.....	2,100	.....	100	2,000	.....	.....
Totals.....	1,653	3,784,650	.....	253,000	680,645	581,000	684,005	2,181,400	45,000	27,863	2,034,737	110,000	53,750
COQUIMBA RIVER DIST.—													
Patterson Method.....	596	2,399,000	.....	.....	392,000	350,000	.....	1,597,000	.....	1,500	945,500	650,000	.....
Tilton River Trout H.....	234	790,500	.....	.....	60,500	.....	47,450	673,500	.....	4,440	682,060	.....	.....
Walla Walla Trout H.....	.....	.....	.....	.....	60,000	.....	.....	100,000	.....	19,900	.....	80,100	.....
Dumppa Lake Eyeing Sta.....	.....	.....	.....	.....	300	.....	.....	49,700	.....	100	.....	49,600	.....
Totals.....	764	3,189,500	.....	210,000	431,800	500,000	47,450	2,429,200	.....	23,940	1,614,560	779,700	.....

* 70,000 Sold to E. P. Doolittle. † 200,000 Shipped to Kittitas County. ‡ 36,000 Shipped to King County. § 200,000 Shipped to Chelan County.
 275,000 Shipped to King County. 200,000 Shipped to Stevens County.
 50,000 Shipped to State of Connecticut.

Output of Salmon From the State Hatcheries—Continued.

	No. Females Shown	No. Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs On Hand April 1, 1920	No. Eggs Lost	No. Eggs Shipped	No. Eggs On Hand March 31, 1921	No. Fry Hatched	No. Fry On Hand April 1, 1920	No. Fry Lost	No. Fry Planted	No. Fry Shipped	No. Fry On Hand March 31, 1921
STEELHEAD—Concluded													
Chehalis.....	454	1,748,850	149,890	65,700	620,000	287,480	1,185,100	45	1,007,500	175,000	56,955		
Humptulips.....	58	231,850		10,900		163,450	57,000						
Totals.....	512	1,979,700	149,890	76,600	390,000	450,930	1,242,100	2,045	1,007,500	175,000	56,955		
WILLAPA HARBOR DIST—													
Naselle River.....	11	31,550		1,005		30,455							
North River.....	292	821,700		116,500		562,000	705,200		705,000				
Willapa.....	353	1,371,500	322,250	140,500	1,200,000	991,500	19,000		1,000,500		10,000		
Totals.....	656	2,224,750	322,250	258,145	200,000	592,455	1,000,400	19,000	1,000,500		10,000		
RECAPITULATION—													
Puget Sound District.....	1,653	3,784,650	253,000	530,645	581,000	694,005	2,181,400	45,000	2,034,757	110,000	53,750		
Columbia River District.....	760	3,180,500	210,000	431,850	500,000	47,457	2,420,200	25,040	1,614,500	770,700	56,955		
Grays Harbor District.....	512	1,979,700	149,890	76,600	300,000	450,930	1,242,100	2,045	1,007,500	175,000	10,000		
Willapa Harbor District.....	656	2,224,750	322,250	258,145	200,000	592,455	1,000,400	19,000	1,000,500		10,000		
Grand Totals.....	2,981	11,178,000	924,640	1,346,700	1,641,000	1,781,840	7,540,100	45,000	6,829,817	1,064,700	120,705		
ALL SPECIES COMBINED													
PUGET SOUND DIST—													
Chambers Creek.....	1,615	4,960,575	1,500,000	645,600	70,000	616,105	12,135,750	29,450	12,308,700	25,000	713,630		
Duane.....	718	2,871,400	500,000	403,205		800,530	3,247,715	64,018	2,811,853	10,000	408,550		
Elwha.....	4,114	4,455,000		225,500	2,000,000	14,000	1,705,500	1,800,000	2,215,500		1,340,000		
Green River No. 1.....	1,832	10,085,300	681,000	578,700	2,032,000	20,512	7,070,070	1,824,657	35,100	6,700,546	9,469,085		
Green River No. 2.....	1,653	9,985,050	817,500	508,900	475,000	414,350	5,646,750	730,304	90,119	2,762,064	15,000	3,400,300	
Nooksack.....	1,463	3,371,100	371,000	371,000	8,012,000	404,400	1,070,883	41,883	10,480,125		3,011,175		
Middle Fork Nooksack.....	1,141	3,275,000	3,032,000	373,700	1,179,200	1,229,000	5,970,500	855,000	62,820	3,147,770	3,605,000		
Plehuok.....	400	1,182,800	2,000,000	138,500	36,000		2,963,450	1,250,214	4,106,000	60,000	85,000		
Puyallup River.....	683	1,868,000	1,200,000	138,700			2,084,321	28,684	3,315,000		1,631,807		
Samish.....	4,302	13,106,500	7,000,000	671,570	190,000	7,447,780	12,973,500	6,313,314	10,361	15,080,457	5,565,045		
Skokomish.....	2,600	6,648,000	1,144,000	109,050	1,580,000	146,500	6,063,800	1,787,915	26,270	6,478,000	1,382,045		
Skykomish.....	994	2,920,700	3,120,000	578,350	200,000	889,185	3,322,885	2,857,945	17,300	5,116,015	3,086,865		
Snohomish.....	1,451	4,615,400	4,640,000	200,900	200,000		4,349,100	2,627,100	30,420	6,067,000	1,178,780		
Tahuya Eysing Station.....			1,530,000	104,600	1,144,000		4,290,750	915,200	4,804,650		983,925		
Lake Crescent Trout.....			500,000	5,600			494,400	400					
Totals.....	21,619	70,884,525	30,284,000	12,136,650	5,705,284	10,019,000	84,581,880	31,387,747	86,377,180	110,000	28,712,037		

* 200,000 Sold to F. A. Beeler. † 200,000 Sold to C. W. McLeod.

Output of Salmon From the State Hatcheries—Concluded.

ALL SPECIES COMBINED —Continued.	No. Females Spawed	No. Eggs Taken	No. Eggs Received from Other Hatcheries	No. Eggs On Hand April 1, 1920	No. Eggs Lost	No. Eggs Shipped	No. Eggs On Hand March 31, 1921	No. Fry Hatched	No. Fry On Hand April 1, 1920	No. Fry Lost	No. Fry Planted	No. Fry Shipped	No. Fry On Hand March 31, 1921
COLUMBIA RIVER DIST.—													
Chinook.....	368	1,969,000	4,624,250	182,800	36,600	6,350,450	36,600	12,772,680	6,312,950	22,320	12,772,680	630,000	10,900
Kalama.....		13,000,000	1,000,000	2,825	2,030	12,778,000	2,030	1,886,650	1,886,650				
Pateros-Mathow.....	648	2,727,000	1,000,000	2,825	389,725	480,725	2,381	3,797,750	3,797,750	68,660	3,797,750	487,385	
Wenatchee.....		500,000	4,000,000	141,750	624,250	3,896,400	305,995	10,338	3,236,360	19,900		80,100	1,022,325
Wind River.....	121	682,460	1,500,000	62,740	60,000	100,000	100	49,700					
Tilton River.....	825	2,562,500	160,000	300									
Walla Walla Trout.....			50,000										
Dumppka Lake Eyeing Sta.													
Totals.....	1,962	7,880,900	24,834,250	1,103,915	1,124,250	30,153,400	305,995	152,543	28,006,500	779,700		1,620,360	
GRAY'S HARBOR DIST.—													
Chehalis.....	22,000	71,786,720	2,631,460	4,296,437	39,620,800	2,231,885	28,360,638	9,521,083	14,476	30,925,065	175,000	7,075,572	
Chehalis No. 2.....	30	124,000	5,643,830	243,320	3,155,425	11,500,000	635,965	6,624,190	7,932	3,588,948		3,027,310	
Humptulps.....	7,973	21,913,280											
Totals.....	30,023	93,774,000	5,643,800	2,691,460	7,635,182	51,120,800	2,835,550	40,517,728	13,559,050	33,383	43,765,543	175,000	10,102,882
WILLAPA HARBOR DIST.—													
Nesel River.....	2,000	6,212,450	1,500,000	652,695	1,500,000	180,230	4,130,115	631,305	21,995	4,067,700		720,815	
North River.....	303	1,255,250	1,500,000	143,310	470,650	200,000	2,481,691	6,326	2,475,665				
Willapa.....	1,768	6,148,400	2,000,000	70,300			5,410,500	596,480	37,060	4,123,900		1,846,000	
Willapa No. 2.....							1,920,700		127,750	1,792,650			
Totals.....	4,206	13,486,100	3,500,000	1,345,964	1,700,000	1,361,730	13,972,246	1,247,675	193,151	12,460,155		2,566,815	
RECAPITULATION—													
Fugate Sound District.....	24,619	70,834,525	30,284,000	5,705,294	10,949,000	12,019,002	84,581,489	31,387,747	570,436	86,577,180		110,000	28,719,037
Columbia River District.....	1,962	7,880,900	24,834,250	1,103,915	1,124,250	30,153,400	305,995	152,543	28,006,500	779,700		1,620,360	
Grays Harbor District.....	30,023	93,774,000	5,643,800	2,691,460	7,635,182	51,120,800	2,835,550	40,517,728	13,559,060	33,383	43,765,543	175,000	10,102,882
Willapa Harbor District.....	4,206	13,486,100	3,500,000	1,345,964	1,700,000	1,361,730	13,972,246	1,247,675	193,151	12,460,155		2,566,815	
Grand Totals.....	60,802	185,925,525	64,262,050	15,700,345	64,804,050	16,365,432	169,225,293	46,500,697	949,496	170,800,468		1,064,700	42,002,294

SUMMARY OF OUTPUT OF SALMON FROM THE STATE HATCHERIES.
Fiscal Year 1920.

	Chinook	Dog	Humpback	Silver	Steelhead	Totals
Number females spawned.....	1,668	86,173	.....	20,980	2,981	60,802
EGGS—						
Taken by state hatcheries.....	7,925,230	101,887,065	.....	65,465,230	11,178,000	185,925,525
Received from King County.....	.....	.....	.....	981,000	.....	981,000
Totals.....	7,925,230	101,887,065	.....	66,446,230	11,178,000	186,906,525
On Hand April 1, 1920.....	.....	8,065,730	.....	7,357,145	924,640	16,287,515
GRAND TOTALS.....	7,925,230	109,952,795	.....	73,803,435	12,102,640	203,194,040
Lost.....	912,627	7,461,008	.....	6,069,410	1,846,700	15,790,345
Furnished to University of Washington (experimental purposes).....	.....	22,000	.....	.....	.....	22,000
Sold to State of Connecticut.....	.....	10,000	.....	.....	.....	10,000
Sold to F. A. Boeler (private hatchery).....	.....	.....	.....	100,000	50,000	150,000
Sold to E. P. Doolittle (private hatchery).....	.....	.....	.....	.....	200,000	200,000
Sold to N. W. Kiefer, Saeley Lake, Mont. (private hatchery).....	.....	.....	.....	.....	70,000	70,000
Sold to C. W. McLeod (private hatchery).....	.....	.....	.....	50,000	.....	50,000
Furnished to county hatcheries for hatching and planting, as follows:						
Chelan County.....	.....	.....	.....	.....	200,000	200,000
King County.....	.....	.....	.....	.....	311,000	311,000
Kittitas County.....	.....	.....	.....	.....	200,000	200,000
Stevens County.....	.....	.....	.....	.....	200,000	200,000
On hand March 31, 1921.....	.....	499,745	.....	14,250,847	1,784,840	16,565,432
FRY—						
Hatched.....	7,012,668	101,891,882	.....	53,987,178	7,540,100	169,225,263
On hand April 1, 1920.....	1,324,667	30,517,907	721,750	19,891,988	45,000	40,500,697
Lost.....	44,663	585,255	3,150	942,062	76,378	949,498
Furnished to counties (planted in lieu of trout).....	.....	.....	718,600	.....	1,064,700	1,064,700
Planted.....	8,292,607	114,144,067	41,850,867	6,823,817	170,809,468
On Hand March 31, 1921.....	17,181,977	25,509,612	120,706	42,902,294

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AVERAGE NUMBER OF EGGS TAKEN TO FEMALE.
Fiscal Year 1920.

SPECIE	Average Number Eggs
Chinook	4,750
Dog	2,800
Humpback	3,120
Silver	8,750
Steelhead	

PERCENTAGE OF LOSS ON EGGS AND FRY.
Fiscal Year 1920.

SPECIE	Loss on Eggs	Loss on Fry
	Percentage	Percentage
Chinook	19%	0.6%
Dog	7%	0.5%
Humpback .....	.....	0.4%
Silver	9%	0.5%
Steelhead	12%	1.0%

YEARLY COMPARATIVE TABLE OF OUTPUT OF SALMON FROM THE STATE HATCHERIES, COST OF OPERATION AND COST OF OUTPUT PER THOUSAND.

DISTRICT AND YEAR	Chinook	Dog	Humpback	Silver	SOCKERE	Steelhead	Totals	Cost of Operating Hatcheries	Cost of Output per Thousand
PUGET SOUND DISTRICT—									
1900									
1901									
1902	2,680,000	2,000,000		11,400,436			37,673,000		
1903	5,101,000	14,300,000		25,900,000	820,000		45,029,285		
1904	4,275,900	2,278,330		28,304,000		2,306,150	17,302,140		
1905	7,828,400	6,048,000	2,655,900	24,350,752		2,896,928	16,485,776		
1906	9,252,750	7,748,500		20,961,200		3,463,970	36,207,928		
1907	10,825,650	13,265,500	519,600	25,949,100		4,629,575	50,343,870		
1908	4,742,350	3,959,500		28,212,500		3,683,450	41,672,977		
1909	4,662,775	19,777,000	300,300	33,542,972		4,855,000	39,943,400		
1910	7,000,450	7,032,800		50,415,100		5,924,240	49,897,850		
1911	4,249,000	11,482,790	1,600,750	37,017,356		5,013,666	51,444,500		
1912	5,369,000	11,686,138		33,469,445	13,300	1,069,000	48,468,203		
1913	3,207,240	11,686,138	6,148,000	32,425,087	1,003,463	4,975,460	53,472,894		
1914	7,187,450	17,178,850	6,491,400	32,425,087	1,286,200	5,945,662	55,310,955		
1915	8,308,530	15,887,400		6,125,900	12,649,000	5,687,625	64,160,319		
1916	6,971,325	21,734,300	2,285,060	13,792,050	1,499,000	3,651,800	43,038,880		
1917	2,691,100	30,430,475		18,466,650		3,764,450	53,251,776		
				34,900,900		3,794,060	71,616,625		
COLUMBIA RIVER DISTRICT—									
1900									
1901									
1902									
1903									
1904	3,500,000			185,000			16,635,000		
1905	6,470,000			650,000			29,431,210		
1906	5,173,000			2,050,000			17,856,270		
1907	9,947,600			922,850			3,686,000		
1908	7,718,000	413,000		1,278,000			7,120,000		
1909	9,494,500			3,304,000			7,223,000		
1910	11,692,300	464,000		1,241,000			10,940,550		
1911	19,035,400	114,000		1,890,000			12,788,500		
1912	24,190,000	115,000		2,615,000			13,497,800		
1913	31,982,000	687,000		1,088,500			36,298,400		
1914	20,239,650	1,831,100		1,826,500			33,705,500		
1915	44,764,975	737,460		1,247,800		2,869,750	46,662,076		
1916	47,166,676	1,247,800		1,247,800		2,839,150	49,662,076		
1917	70,286,560	182,500		3,581,000		4,301,900	78,231,860		

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Yearly Comparative Table of Output of Salmon From the State Hatcheries, Cost of Operation and Cost of Output Per Thousand—Continued.

DISTRICT AND YEAR	Chinook	Dog	Humpback	Silver	Sockeye	Steelhead	Totals	Cost of Operating Hatcheries	Cost of Output per Thousand
COLUMBIA RIVER DISTRICT—									
(Continued)									
1918.....	38,776,730	221,000		1,835,000		3,492,600	44,325,330		
1919.....	23,432,750	272,500		1,382,100		5,370,000	30,469,350		
1920.....	2,430,900			2,181,500		3,180,500	7,880,900		
GRAYS HARBOR DISTRICT—									
1900.....							2,122,000		
1902.....							5,100,000		
1903.....							1,000,000		
1904 (Not operated).....									
1905.....	600,000	1,629,000		1,500,000			5,060,200		
1906.....	464,000	1,060,000		2,500,000			2,966,000		
1907.....	763,000	2,084,000		3,275,000			3,562,000		
1908.....	748,000	1,084,000		1,800,000			3,705,000		
1909.....	903,000	1,737,000		1,577,000			2,839,000		
1910.....	117,000	1,088,000		4,401,000		1,250,000	6,846,000		
1911.....	125,000	1,122,000		3,421,000		125,000	5,385,000		
1912.....	124,000	1,478,000		3,673,000		550,000	6,008,000		
1913.....	150,000	3,454,000		4,119,000		820,000	6,275,000		
1914.....	163,000	1,180,000		4,625,000			6,486,000		
1915.....	778,000	14,215,000		7,841,900		1,059,790	21,591,000		
1916.....	516,900	42,497,600		7,841,900		1,059,790	52,137,250		
1917.....	510,500	23,442,350		9,610,000		1,648,000	36,610,900		
1918.....	311,000	4,942,300		14,789,415		1,670,000	21,613,215		
1919.....	363,960	30,286,600		8,181,675		2,941,700	50,788,585		
1920.....	2,451,230	65,369,030		23,774,040		1,979,700	98,774,000		
WELAPA HARBOR DISTRICT—									
1900.....							726,000		
1902.....							4,958,910		
1903.....							1,605,300		
1904.....	706,000			2,000,000		320,000	3,020,000		
1905.....	588,500			2,400,000		189,500	3,178,000		
1906.....	437,400			2,500,000		585,000	3,522,400		
1907.....	678,600			654,500		148,500	1,481,600		
1908.....	322,200			504,000		309,000	1,225,200		
1909.....	455,200			64,000			519,200		
1910.....	773,000			2,781,000		400,000	3,904,000		

OUTPUT OF TROUT FROM THE STATE HATCHERIES.
Fiscal Year 1920.

	Number Females Spawners	Number Eggs Taken	No. Eggs Received from Other Hatch'rs	No. Eggs on Hand April 1, 1920	Number Eggs Lost	Number Eggs Shipped	No. Eggs on Hand March 31, 1921	No. Fry Hatched April 1, 1920	No. Fry on Hand April 1, 1920	No. Fry Lost	No. Fry Planted	No. Fry on Hand March 31, 1921
BEARDSLEE—				23,675	275	* 5,000		18,400		100	18,300	
Lake Crescent Trout Hatchery.....												
BLACK-SPOTTED—			† 25,000		1,000			24,000		2,000	22,000	
Office State Fish Commissioner.....												
CRESCENTII—	72	173,040		30,000	142,240	† 10,000	7,960	51,800	16,250	400	56,300	11,350
Lake Crescent Trout Hatchery.....												
CUT-THROAT—												
Lake Chelan Trout Hatchery.....	631	710,300			25,300	513,000		172,000		1,200	170,800	
Lake Crescent Trout Hatchery.....	48	84,600		4,000	8,100	25,000	7,070	48,500		400	48,100	
Lake Whatcom Trout Hatchery.....	53	123,050		30,933	5,239		83,544	65,200		130	29,100	35,970
Spokane Trout Hatchery.....			282,000		21,400			260,600		2,200	258,400	
Tilton River Trout Hatchery.....	9	1,500			200			1,300		35	1,265	
Walla Walla Trout Hatchery.....			200,000		19,200			180,800		6,200	174,600	
Felco Lake Eyeing Station.....	221	93,200			20,200	65,000		8,000			8,000	
Chambers Creek Salmon Hatchery.....	342	823,100	‡ 324,500		105,430	** 75,000		467,170		17,800	449,370	
Dungeness Salmon Hatchery.....			25,000		1,000			24,000		1,200	22,800	
Elwha Salmon Hatchery.....					3,000			9,000			9,000	
Green River Salmon Hatchery.....	16	12,000						30,150		150	30,000	
Patros-Matlow Salmon Hatchery.....			31,000		1,100			23,000		800	23,600	
Samish Salmon Hatchery.....	1	250			55			185		7	188	
Totals.....	1,313	1,348,000	887,500	34,933	211,074	678,000	90,544	1,230,315		29,622	1,225,223	35,970

* Shipped to Kittitas County Hatchery.
† Received from U. S. Bureau of Fisheries.
‡ Shipped to Pierce County Hatchery.
§ 289,566 received from Chelan County.
** 30,000 shipped to King County Hatchery.

Output of Trout From the State Hatcheries—Continued.

	Number Females Spawmed	Number Eggs Taken	No. Eggs Received from Other Hatch'rs	No. Eggs on Hand April, 1920	Number Eggs Lost	Number Eggs Shipped	No. Eggs on Hand March 31, 1921	No. Fry Hatched	No. Fry on Hand April, 1920	No. Fry Lost	No. Fry Planted	No. Fry on Hand March 31, 1921
EASTERN BROOK—												
Lake Whatcom Trout Hatchery.....			* 375,000		18,900			356,800		269		356,540
Little Spokane Trout Hatchery.....			† 1,016,000		313,000			703,000		4,000	699,000	
Spokane Trout Hatchery.....			‡ 958,640		14,800	120,000		822,050		2,310	697,000	122,540
Walla Walla Trout Hatchery.....			† 221,000		10,000			211,000		4,846	206,155	
Lost Lake Eyling Station.....	1,323	1,046,100			14,400	1,031,640						
Owhi Lake Eyling Station.....	621	1,617,275			1,217,275	400,000						
Chambers Creek Salmon Hatchery.....			§ 500,000		41,700	** 56,000		462,300	732,975	122,600	1,092,675	
Green River Salmon Hatchery.....			† 160,000		17,847			142,653		1,051	141,602	
Pateros-Methow Salmon Hatchery.....			‡ 75,000		3,000			72,000	71,000	975	142,025	
Samish Salmon Hatchery.....			§ 160,000		10,997			149,903		1,908	148,000	
Skykomish Salmon Hatchery.....			|| 136,000		7,000	‡ 129,000						
Wenatchee Salmon Hatchery.....			§ 200,000		27,830			172,170		2,170	170,000	
Totals.....	1,834	2,663,375	3,869,640		1,664,469	1,736,640		3,091,876	823,975	140,314	3,236,457	479,080

* 375,000 purchased by Whatcom County from Paradise Brook Trout Co., Henryville, Pa.
 † 221,000 purchased by State from C. L. Caldwell, Ruby, Wash.
 ‡ 375,000 purchased by State from State of New Hampshire.
 § 160,000 purchased by Spokane County from Paradise Brook Trout Co., Henryville, Pa.
 ¶ 221,000 purchased by State from C. L. Caldwell, Ruby, Wash.
 § 200,000 purchased by State from State of New Hampshire.
 || 160,000 purchased by Thurston County from Paradise Brook Trout Co., Henryville, Pa.
 ** 56,000 shipped to Pierce County Hatchery.
 †† 160,000 purchased by State from Paradise Brook Trout Co., Henryville, Pa.
 ‡‡ 160,000 purchased by Skagit County from Paradise Brook Trout Co., Henryville, Pa.
 §§ 136,000 received from King County (for eyling only).
 ||| 129,000 shipped to King County Hatchery.

Output of Trout From the State Hatcheries—Continued.

	Number Females Spawmed	Number Eggs Taken	No. Eggs Received from Other Hatch'rs	No. Eggs on Hand April 1, 1920	Number Eggs Lost	Number Eggs Shipped	No. Eggs on Hand March 31, 1921	No. Fry on Hand Hatched April 1, 1920	No. Fry Lost	No. Fry Planted	No. Fry on Hand March 31, 1921	
MACKINAW—												
Lake Crescent Trout Hatchery.....			50,000		1,650			48,350	500	9,000	88,850	
Lake Whatcom Trout Hatchery.....			300,000		102,700			197,300	1,586		195,714	
Spokane Trout Hatchery.....			200,000		155,000			45,000	1,586	43,421		
Office State Fish Commissioner.....			1,145,000		82,578	11,065,000		27,423	2,945	24,477		
Chambers Creek Salmon Hatchery.....			100,000		23,000			77,000	13,000	64,000		
Humphreys Salmon Hatchery.....			100,000		9,550			40,450	226	40,224		
Patros-Methow Salmon Hatchery.....			100,000		32,500			60,500	780	65,720		
Skykomish Salmon Hatchery.....			150,000		31,250			118,750	4,000	114,750		
Totals.....			2,065,000		379,228	11,065,000		620,772	24,961	381,547	234,264	
RAINBOW—												
Spokane Trout Hatchery.....			335,500		17,700			321,800	2,000	518,900		
Walla Walla Trout Hatchery.....			80,000		3,100			76,900	675	76,225		
Dumpra Lake Eysing Station.....	415	383,000			37,000	346,000						
Fish Lake Eysing Station.....	751	281,250			7,750	273,500						
Packwood Lake Eysing Station.....	2,250	442,250			22,250	420,000						
Chambers Creek Salmon Hatchery.....			108,000		38,000			100,000	5,000	155,000		
Green River Salmon Hatchery.....			1,585,000		29,375	1,555,625		205,625	533	205,092		
Totals.....	3,416	1,106,470	1,402,500		155,145	1,850,500		964,325	9,108	955,217		

2,065,000 eggs received from the State of Wisconsin in exchange for silver trout eggs.
 † 500,000 eggs shipped to King County Hatchery.
 † 150,000 eggs shipped to Kittitas County Hatchery.
 † 100,000 eggs shipped to Stevens County Hatchery.
 † 100,000 eggs shipped to Pend Oreille County Hatchery.
 † 45,000 eggs shipped to Skamania County Hatchery.
 † 200,000 eggs shipped to Pierce County Hatchery.
 † 75,000 eggs shipped to King County Hatchery.
 † 150,000 eggs shipped to King County Hatchery.
 † 100,000 eggs shipped to Kittitas County Hatchery.
 † 48,000 eggs received from State of Wisconsin.

Output of Trout From the State Hatcheries—Continued.

	Number Females Spawmed	Number Eggs Taken	No. Eggs Received from Other Hatch'rs	No. Eggs on Hand April 1, 1920	Number Eggs Lost	Number Eggs Shipped	No. Eggs on Hand March 31, 1921	No. Fry on Hatch'd April 1, 1920	No. Fry Lost	No. Fry Planted	No. Fry on Hand March 31, 1921
SILVER—											
Lake Crescent Trout Hatchery.....			1,000,000	2,682,000	6,500	4,725,000	408,350	993,500	1,000	300,000	692,500
Lake Watcom Trout Hatchery.....	35,390	7,073,500			454,680			4,467,500	4,000	2,904,000	1,598,900
Little Spokane Trout Hatchery.....			940,000		23,000			917,000	4,000	973,000	
Spokane Trout Hatchery.....			1,000,000		90,000			910,000	2,700	967,300	
Wain Wall Trout Hatchery.....			250,000		2,000			248,000	1,188	246,815	
Lake Sammamish Eyling Station.....	136,966	14,058,950				114,058,950					
Office State Fish Commissioner.....			35,000		2,160			32,840	840	32,000	
Chambers Creek Salmon Hatchery.....			2,000,000		41,000			1,959,000	28,000	1,931,000	
Chehalis No. 2 Salmon Hatchery.....			250,000		3,505			246,495	2,412	636,155	
Dungeness Salmon Hatchery.....			150,000	144,985	6,415			288,520	2,032	286,488	
Green River Salmon Hatchery.....			12,653,000		676,200	11,976,800					
Humtullips Salmon Hatchery.....			250,000		11,780			238,220	620	237,600	
Kalama Salmon Hatchery.....			500,000		2,908			497,092	1,592	495,500	
Paleros-Melow Salmon Hatchery.....			1,000,000		14,000			986,000	1,500	1,037,656	
Samish Salmon Hatchery.....			1,000,000	122,070	64,570			1,037,500	6,490	1,310,770	
Skokomish Salmon Hatchery.....			150,000		1,000			149,000	100	148,900	
Skykomish Salmon Hatchery.....			1,000,000		19,275			980,725	4,065	976,660	
Totals.....	172,891	21,132,450	22,178,000	3,249,005	1,418,963	30,760,750	408,350	13,971,392	60,625	13,284,438	2,251,400

- * 500,000 eggs shipped to State of New Hampshire.
- * 500,000 eggs shipped to State of Minnesota.
- * 500,000 eggs shipped to Stevens County Hatchery.
- + 1,405,950 eggs shipped to King County Hatchery.
- 5,000,000 eggs shipped to State of Wisconsin.
- 250,000 eggs shipped to Shamania County Hatchery.
- 426,800 eggs shipped to Pierce County Hatchery.

Output of Trout From the State Hatcheries—Concluded.

	Number Females Spawmed	Number Eggs Taken	No. Eggs Received from Other Hatch'ies	No. Eggs on Hand April 1, 1920	Number Eggs Lost	Number Eggs Shipped	No. Eggs on Hand March 31, 1921	No. Fry on Hand Hatched	No. Fry on Hand April 1, 1920	No. Fry Lost	No. Fry on Hand March 31, 1921
WHITE FISH—											
Office State Fish Commissioner			* 120,000			† 120,000					
ALL SPECIES COMBINED—											
Lake Chelan Trout Hatchery	681	710,300		66,675	25,306	513,000	172,000		16,250	1,200	170,800
Lake Crescent Trout Hatchery	120	237,000	1,050,000	66,675	158,765	40,000	11,000	1,100,550		2,700	431,700
Lake Watcom Trout Hatchery	35,449	7,107,550	675,000	3,612,633	580,780	4,725,000	491,804	5,086,800		5,976	2,983,700
Little Spokane Trout Hatchery			1,956,000		330,000			1,626,000		8,000	1,612,000
Spokane Trout Hatchery			2,978,146		298,690	12,000		2,680,456		11,800	2,672,650
Tilton River Trout Hatchery	2	1,500			206			1,294		35	1,259
Walla Walla Trout Hatchery			751,000		34,800	346,000		716,700		12,905	708,795
Dempka Lake Trout Hatchery	415	383,000			37,000	346,000					
Echo Lake Eying Station	221	937,500			20,200	65,000		8,000			8,000
Fish Lake Eying Station	751	281,250			7,750	273,500					
Lake Sammamish Eying Station	136,665	14,058,950				14,058,950					
Lost Lake Eying Station	1,223	1,046,100				1,031,640					
Owl Lake Eying Station	621	1,617,275			14,400	1,602,875					
Packwood Lake Eying Station	2,250	442,250			52,200	420,000					
Office State Fish Commissioner			1,325,000		95,738	1,215,000		84,202		5,785	78,417
Chambers Creek Salmon Hatchery	843	393,100	3,182,500		249,130	131,000		3,225,470	752,975	186,400	3,039,075
Dungeness Salmon Hatchery			250,000		8,505			946,465	302,072	2,412	639,155
Elwha Salmon Hatchery	16	12,000	175,000	144,885	7,415	3,000		312,500		8,282	304,218
Green River Salmon Hatchery			18,429,000		793,772	12,329,800		0,000			
Itumtuhtis Salmon Hatchery			500,000		20,330			378,428		1,754	376,674
Klamath Salmon Hatchery			500,000		2,008			278,070		840	277,230
Placeros-Methow Salmon Hatchery			1,200,000		51,400			1,148,460	1,044,250	1,562	1,146,698
Sauish Salmon Hatchery	1	250	1,100,000	122,070	74,723			1,297,368	259,769	8,469	1,435,058
Skokomish Salmon Hatchery			150,000		1,000	140,000		149,000		100	148,900
Skykomish Salmon Hatchery			1,280,000		57,323	124,000		1,099,475		8,115	1,091,360
Wenatchee Salmon Hatchery			200,000		27,880			172,170		2,170	170,000
Totals	179,048	26,423,226	30,567,640	3,346,613	1,002,424	35,794,800	506,884	20,053,380	2,465,236	2,170	19,219,452

* Received from State of Wisconsin.
† Shipped to King County Hatchery.

SUMMARY OF OUTPUT OF TROUT FROM THE STATE HATCHERIES.
Fiscal Year 1920.

	Beards- lee	Black Spott'd	Cres- centli	Cut Throat	Eastern Brook	Mack- inaw	Rain- bow	Silver	Total Trout	White Fish	Grand Totals
Number females spawned.....			72	1,315	1,854		3,416	172,391	179,048		
EGGS Taken by state hatcheries.....			173,000	1,348,000	2,663,375		1,106,470	21,132,450	26,423,295		
Received from U. S. Bureau of Fisheries.....		25,000							25,000		
Received from eastern states on exchange agreement, as follows:											
State of New Hampshire.....					500,000		438,000		500,000	120,000	
State of Wisconsin.....						2,065,000			2,535,000		
Purchased by the state, as follows:											
C. I. Caldwell, Ruby, Wash.....					442,000				442,000		
Paradise Brook Trout Co., Henryville, Pa.					100,000				100,000		
Taken by county hatcheries and turned over to state, as follows:				259,500					259,500		
Chelan County.....					130,000				130,000		
King County (for cycling only).....											
Purchased by counties from Paradise Brook Trout Co., Henryville, Pa., and turned over to the State for hatching for benefit of counties, as follows:											
Skagit County.....					100,000				100,000		
Spokane County.....					375,000				375,000		
Thurston County.....					160,000				160,000		
Whatcom County.....					375,000				375,000		
Totals.....	23,675	25,000	173,000	1,007,500	4,971,375	2,065,000	1,544,470	21,132,450	31,548,795		
On hand April 1, 1920.....	23,675		89,000	34,833				3,249,005	3,346,613		
Grand totals.....	23,675	25,000	212,000	1,642,433	4,971,375	2,065,000	1,544,470	24,381,455	34,895,408	120,000	35,015,418
Lost.....	275	1,000	142,240	211,074	1,694,400	379,228	155,145	1,418,963	4,002,424		

Summary of Output of Trout From the State Hatcheries—Concluded.

	Beards- lee	Black- Spotted	Cres- centif	Cut- throat	Eastern Brook	Mack- inaw	Rain- bow	Silver	Total Trout	White Fish	Grand Total
EGGS Shipped to eastern states on exchange agreement, as follows:											
State of New Hampshire								500,000	500,000		500,000
State of Wisconsin								5,000,000	5,000,000		5,000,000
Sold to State of Minnesota.								500,000	500,000		500,000
Furnished to county hatcheries, for hatch- ing and planting, as follows:											
King County				50,000	120,000	500,000	325,000	1,405,050	2,400,050	120,000	2,520,050
Kititas County	5,000					150,000	100,000		255,000		255,000
Pend Oreille County						100,000			100,000		100,000
Pierce County			10,000		56,000	300,000		426,500	682,500		682,500
Skamania County						45,000			45,000		45,000
Stevens County						100,000			100,000		100,000
On hand March 31, 1921.			7,900	90,544				408,350	506,854		506,854
FRY Hatched	18,400	24,000	31,800	1,290,815	3,051,576	620,772	964,325	13,971,392	20,028,380		20,028,380
On hand April 1, 1920.			16,250		823,975			1,025,071	2,465,296		2,465,296
Lost	100	2,000	400	29,622	140,314	24,961	9,108	60,025	267,130		267,130
Planted	18,300	22,000	56,300	1,225,223	3,296,457	361,547	955,217	13,284,438	19,219,482		19,219,482
On hand March 31, 1921.			11,350	35,970	479,080	234,264		2,251,400	3,012,064		3,012,064

PERCENTAGE OF LOSS ON EGGS AND FRY.
Fiscal Year 1920.

SPECIE	Loss on Eggs	Loss on Fry
Beardslee	4 %	005 %
Black-spotted	82 %	08 %
Crescentif	13 %	008 %
Cut-throat	34 %	2 %
Eastern Brook	37.97 %	4 %
Mackinaw	10 %	4 %
Rainbow	6.7 %	1 %
Silver		005 %

AVERAGE NUMBER OF EGGS TAKEN TO FEMALE.

SPECIE	Average Number Eggs
Crescentif	2,400
Cut-throat	1,025
Eastern Brook	1,436
Rainbow	324
Silver	123

YEARLY COMPARATIVE TABLE OF OUTPUT OF TROUT FROM THE STATE HATCHERIES.

	Bearslies	Black Spotted	Crescentil	Cut-Throat	Eastern Brook	Macginnaw	Rainbow	Silver	Totals
1905.....				1,000,070	300,000				821,270
1906.....				1,996,000	352,686		180,000		1,801,000
1907.....				649,000	900,000		138,150		2,478,686
1908.....				1,573,700	1,340,000		127,950		1,887,150
1909.....				1,076,250	2,161,000		523,000		3,041,650
1910.....				920,300	1,537,800		629,000		3,760,250
1911.....				652,000	1,704,300		1,375,000		3,087,100
1912.....		119,000		444,464	754,150		631,648		3,850,300
1913.....	291,500			2,187,185	652,290		859,107	719,195	2,843,987
1914.....	45,000	400,000		3,249,100	698,250		1,113,992	3,472,400	7,570,982
1915.....	45,000	300,000	136,000	3,249,034	698,250		1,113,202	7,021,670	13,463,292
1916.....	97,000	100,000	287,000	2,476,081	1,729,070		1,360,176	7,021,705	13,463,251
1917.....	84,000		42,000	2,646,300	2,147,340		1,445,037	9,843,411	16,037,752
1918.....	24,060	33,280	87,000	2,671,300	6,200,973		1,627,400	13,314,170	20,579,707
1919.....		25,000	173,000	1,607,500	4,971,375	2,006,000	1,544,470	12,794,900	23,508,835
1920.....									31,649,795

(The above table does not include take of steelhead eggs, which, under the laws of this state, are classed as salmon).

DISTRIBUTION OF TROUT FRY PLANTED FROM THE STATE HATCHERIES.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)
Fiscal Year 1920.

COUNTIES AND WATERS	Board- lice	Black- Spotted	Cres- centif	Cut- Throat	Eastern Brook	Mack- inaw	Rainbow	Silver	Total Trout	Steelhead Salmon	Grand Totals
WESTERN WASHINGTON DISTRICT—											
OLALLAM COUNTY—											
Lake Orcutt	15,300		56,300	29,500		9,000		300,000		10,000	
Mud Lake				27,000							
Lake Suborland											
Totals									440,700	10,000	450,700
CLARKE COUNTY—											
Burns Bridge					60,000						
Soldi Creek				20,000			15,000				
E. F. Lewis River								230,500			
Lackamas Creek								275,000			
Battle Ground Lake									500,500		500,500
Totals				8,000			7,000		15,000		15,000
COOWLITZ COUNTY—											
Coal Creek											
Gobel Creek											
Totals											
GRAYS HARBOR COUNTY—											
Lake Quinault						40,230		237,600			
Wishkah River				8,000			5,000				
Bush Creek				30,000							
Mox Chehalis River							5,000				
Wild Cat Creek											
E. B. Satsop River				9,000							
W. B. Satsop River											
Hoquiam River											
Wynoochee River				12,500							
E. Hoquiam River				12,500							
Cloquiam River				8,000							
Trib. of E. Hoquiam River				15,000							
Totals									417,880		417,880

Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beards- lee	Black- Spotted	Cres- centli	Out- Throat	Eastern Brook	Mack- inaw	Rainbow	Silver	Total Trout	Steelhead Salmon	Grand Totals
WESTERN WASHINGTON DISTRICT (Continued)											
ISLAND COUNTY—											
Deer Lake							16,300		16,300		16,300
JEFFERSON COUNTY—											
Lake Crocker								90,000			
Lake Hooker								78,000			
Devils Lake								16,000			
Hawley Lake			23,800								
Sandy Shore Lake								50,000			
Collis Lake								48,488			
Anderson's Lake								10,000			
Totals.....									309,288		309,288
KING COUNTY—											
Lake Burien					8,000					15,000	
Covington Creek					8,000						
Susac Creek					8,000						
Jenkins Creek					8,000						
Webster Creek					8,000						
Issaquah Creek					61,602						
Trib. S. F. Snoqualmie River					15,000						
Boise Creek											
Totals.....									116,602	15,000	131,602
KITSAP COUNTY—											
Long Lake						24,477	36,000				
Horseshoe Lake				30,000							
Fairview Lake								32,000			
Panther Lake					25,000						
Totals.....									147,477		147,477
LEWIS COUNTY—											
Mill Creek No. 2					20,000						
Short Creek					8,000			6,065			
Trib. Upper Chehalis River								140,000			
Coal Creek No. 2								15,000			

Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beards-les	Black-Spotted	Cres-centil	Cut-Throat	Eastern Brook	Mack-inaw	Rainbow	Silver	Total Trout	Steelhead Salmon	Grand Totals
WESTERN WASHINGTON DISTRICT (Continued)											
LEWIS COUNTY (Continued)—											
Lacamas Creek								15,000			
Mill Creek No. 1					5,000			25,000			
Donahue Lake					20,000			35,100			
Olaqua Creek					10,000			18,000			
Salzer Creek								10,000			
Coal Creek								20,000			
Gowen Lake					15,000			50,000			
Silver Creek								22,000			
Roundtree Creek								18,000			
Rock Creek								40,000			
Green Creek								14,000			
Dunn Creek								18,000			
Big Creek								10,000			
Dillinghaugh Creek								5,000			
Tilton River				1,996							
Novakum River				7,300							
Mill Creek No. 3				13,000							
Silver Creek No. 2											
Totals									585,720		585,720
MASON COUNTY—											
Kamitch's Creek				14,000							
Goldshoro Creek							7,000				
Benson Lake								50,000			
Spencer Lake								50,000			
Mason Lake								48,900			
Totals									169,900		169,900
PACIFIC COUNTY—											
Smith's Creek											
Upper Willapa River							20,882				
S. F. Willapa River				28,000				174,000			
Mill Creek								16,000			
Totals									257,882		257,882

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Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beards-lee	Black-Spotted	Cres-centil	Cut-Throat	Eastern Brook	Mack-inaw	Rainbow	Silver	Total Trout	Steelhead Salmon	Grand Totals
WESTERN WASHINGTON DISTRICT (Continued)											
PIERCE COUNTY—											
Spinaway Lake					40,000						
Stellacoom Lake					60,000						
Echo Lake			8,000								
American Lake					130,000						
Crescent Lake					30,000						
Hart's Lake					30,000						
Balch's Lake					30,000						
Trapp's Lake					25,000						
Stansbury Lake					30,000						
Goat Lake					5,000						
Clear Lake					56,675						
Clark's Creek					40,000						
Orring Creek					40,000						
South Prairie Creek					20,000						
Miner Creek					20,000						
Lynch Creek					20,000						
Green Water River					80,000						
Muck Creek					20,000						
Voigt Creek					20,000						
Evans Creek					15,000						
Jung Creek					15,000						
Tobnie Creek					15,000						
Wilkeson Creek					15,000						
Chambers Creek					5,000						
Held in Pierce County Hatchery			152,370								
Totals.....					91,000				988,045		988,045
SAN JUAN COUNTY—											
Cascade Lake								145,000	145,000		145,000
SKAGIT COUNTY—											
Big Lake							12,000	320,000			320,000
Lake Campbell								160,000			160,000
Lake McMurray							20,000	50,000			50,000
Pass Lake								50,000			50,000

Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beard- lee	Black- Spotted	Cres- centif	Cut- Throat	Eastern Brook	Mack- inaw	Rainbow	Silver	Total Trout	Steelhead Salmon	Grand Totals
WESTERN WASHINGTON DISTRICT (Continued)											
SKAGIT COUNTY (Continued)											
Clear Lake							10,500	80,000			
Friday Creek			188					58,800			
Upper Friday Creek			19,000				10,000	230,000			
Lake Sixteen								100,000			
Lake Murray								40,000			
Lake Erie								20,000			
Minkler Lake											
Hart Lake											
Colloek Lake					20,000						
Two Lakes east of Mountborne					30,000						
Lake Campbell					15,000						
Lake Erie					15,000						
Big Lake					7,000						
McMurray Lake					6,000						
Two Lakes on Chuckanut Mountain					15,000						
Finney Creek					15,000						
Grandy Creek					15,000						
Bear Creek					10,000						
Totals									1,806,888		1,806,888
SKAMANIA COUNTY—											
Rock Creek		10,000									
Woodard Creek		2,000									
Little White Salmon River							5,000				
Wind River							5,000				
Totals							3,000		25,000		25,000
SNOHOMISH COUNTY—											
Lake Stevens						25,000		175,000			
Lake Roosiger						25,000		350,000			
Lake Goodwin						25,000		296,650			
Lake Kl						8,000					
Lake Isobel						14,700					
Boulder Lake		2,500									
Crabapple Lake		7,500									

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**Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)**

COUNTIES AND WATERS	Beards- Ice	Black- Spotted	Cres- centif	Out- Throat	Eastern Brook	Mack- inaw	Rainbow	Silver	Total Trout	Steelhead Salmon	Grand Totals
WESTERN WASHINGTON DISTRICT (Continued)											
SNOHOMISH COUNTY (Continued)—											
Wallace Lake						17,000					
Martha Lake			13,000								
Lake Howard			7,000				25,000				
S. F. Stillaguamish River							2,000				
Balloger's Lake											
Totals									1,148,300		1,148,300
THURSTON COUNTY—											
Scatter Creek					60,000						
Black Lake										25,000	
Scott's Lake									175,000		60,000
Ofutt's Lake						32,000			175,000		35,000
St. Clair Lake						32,000					40,000
Waddell Creek											40,000
Des Chutes River				20,000	67,000		16,000				
Lake Patterson										296,000	
Hicks' Lake										175,000	
Long Lake									600,000		
Chambers Lake									175,000		
Hewitt Lake									85,000		
Moss Lake									25,000		
Wards Lake									100,000		
Bigelow Lake									50,000		
Munn Lake									25,000		
Arnold Lake									50,000		
Totals									2,158,000	200,000	2,358,000
WAHIAKUM COUNTY—											
Elochoman River			8,000				7,000				
Totals									15,000		15,000

Distribution of Trout Fry Planted from the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beards- lee	Black- Spotted	Cres- centif	Cut- Throat	Eastern Brook	Maack- Inaw	Rainbow	Silver	Total Trout	Steelhead Salmon	Grand Totals
WESTERN WASHINGTON DISTRICT (Continued)											
WHATCOM COUNTY—											
Lake Padden							20,000	156,970			
Silver Lake											
Ten Mile Creek			23,700								
Lake Whatcom			20,100					2,664,600			
Toad Lake								80,000			
Lake Samish							20,000	80,000			
Sumas Creek											
Totals	18,300	22,000	50,300	578,820	1,882,377	253,407	360,002	9,250,678	11,929,872	225,000	12,154,872
Total Western Washington District											3,074,370
EASTERN WASHINGTON DISTRICT—											
ADAMS COUNTY—											
Upper Cow Creek				10,000	75,000		22,500				
Lower Cow Creek											
Totals				10,000	75,000		22,500				107,500
ASOTIN COUNTY—											
Asotin Creek					20,000		18,800				
George Creek				8,000	20,000						
Alpowa Creek								25,000			
Conise Creek								15,000			
Ten Mile Creek								10,000			
Totals									110,000		110,000
CHELAN COUNTY—											
Dumarka Lake											
Coon Creek				40,000							40,000
Bowen Slough				40,000							40,000
Little Boulder Creek				30,000							30,000

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Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beards- lee	Black- Spotted	Cres- centil	Out- Throat	Eastern Brook	Mack- inaw	Rainbow	Silver	Total Trout	Steelhead Salmon	Grand Totals
EASTERN WASHINGTON DISTRICT (Continued)											
CHELIAN COUNTY (Continued)—											
Rainbow Creek				10,800						40,000	
Peshaatin Creek										10,000	
Inglis Creek										15,000	
Big Creek										15,000	
Lille Creek										50,000	
Entiat River										10,000	
Deep Creek										10,000	
Goose Creek										10,000	
Alder Creek										15,000	
Chimacum Creek										15,000	
Phillips Creek										5,000	
Wenatchee Lake					98,000					30,000	
Held in feeding ponds											
Totals									218,800	259,600	478,400
COLUMBIA COUNTY—											
Main Touchet River				25,000							
North Fork Touchet River				49,600							
Dutch Creek											
White Spray Creek											
Totals											181,600
FERRY COUNTY—											
Daniel's Lake				6,000							
West Fork Creek				3,000							
San Poll Creek							7,550				
							10,050				
Totals									26,600		26,600
GARFIELD COUNTY—											
Bihmeier Gulch				18,000							
Pataha Creek							36,000				
Totals											168,155

Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beard-ice	Black-Spotted	Cres-centil	Out-Throat	Eastern Brook	Mack-inaw	Rainbow	Silver	Total Trout	Steelhead Salmon	Grand Totals
EASTERN WASHINGTON DISTRICT (Continued)											
GRANT COUNTY—											
Brook Lake				4,000			9,400				
Crab Creek				4,000	50,000		9,500				
Totals									76,900		76,900
KITTITAS COUNTY—											
Monastosh Creek				9,000							
Teanaway River				23,000							
Kachopus Lake							20,000				
Kachopus Lake							20,000				
Cle Elum Lake							23,900				
Fogarty Slough					12,000						
Cherry Creek					18,000						
Tillers Slough					12,000						
Watson Slough					12,000						
Stone Breakers Slough					36,000						
Hand Slough					20,000						
Diamond Slough					20,000						
Thorp Pond					20,000						
Totals									245,900		245,900
Klickitat County—											
Spring Creek							50,500	250,000			
Trout Lake				25,000				121,815			
Roman Creek					75,000			125,000			
White Salmon River											
Totals									647,315		647,315
LINCOLN COUNTY—											
Crab Creek					50,000		60,500				
Tamrack Creek				27,000	10,000						
Hoock Creek					16,000						
Condon Creek					10,000						
Wilson Creek					14,000						
Totals									187,600		187,600

Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beards- lee	Black- Spotted	Cres- centil	Cut- Throat	Eastern Brook	Mack- inaw	Rainbow	Silver	Total Trout	Steelhead Salmon	Grand Totals
EASTERN WASHINGTON DISTRICT (Continued)											
OKANOGAN COUNTY—											
Sziahakin Creek				7,500	17,500					60,000	
Chopaka Lake			5,000		12,500		15,000				
Bonaparte Lake					82,300			80,000		80,000	
Spectacle Lake					46,725	45,720		101,350		60,000	
Palmer Lake						20,000		60,000		30,000	
Alta Lake								194,000		60,000	
Parrygin Lake								115,000			
Patterson Lake								110,000		40,000	
Whitestone Lake								35,000			
Bonner Lake								28,000			
Horse Lake								28,000			
Squaw Lake								20,000			
Twin Lake								110,000		40,000	
Long Lake								40,000			
Round Lake								45,000			
Buzzard Lake								20,000			
Shibley Lake								180,000		60,000	
Roberts Lake								7,000			
Terrace Lake								98,000		30,000	
Foot Lake								5,000			
Wild Goose Lake								5,000			
Dorley Lake								15,000			
Coles Lake								85,000		10,000	
Omak Lake								10,000			
Castor Lake								60,000			
Horseshoe Lake								20,000			
British Columbia Lake								40,000			
Munson Lake								30,000			
Osoyoos Lake								152,300			
Little Patterson Lake								15,000		10,000	
Mirror Lake								10,000			
Methow River			23,600					150,000		10,000	
Conenully Lake								150,000			
Marple Lake								5,000			
Simlakameen Dam								25,000			

Distribution of Trout Fry Planted From the State Hatcheries—Continued.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beards- lee	Black- Spotted	Cres- centil	Cut- Throat	Eastern Brook	Mack- inaw	Rainbow	Silver	Total Trout	Steelhead Salmon	Grand Totals
EASTERN WASHINGTON DISTRICT (Continued)											
OKANOGAN COUNTY (Continued)—											
Bonaparte Swamp					30,000						
Lobby Creek					10,000						
Eight Mile Creek					15,000		24,000				
Lost in Transit				56,000							
Totals									2,369,495	500,000	2,869,495
PEND OREILLE COUNTY—											
Half Moon Lake							32,100				
Brown's Lake				14,000							
Little Spokane River					50,000						
Le Clerc Creek					25,000						
Crescent Lake					25,000						
Davis Lake								90,300			
Totals									245,400		245,400
SPOKANE COUNTY—											
Newman Lake				22,500			50,000				
Liberty Lake				22,500			45,500				
Long Lake								450,000			
Holding in feeding ponds						32,420		921,000			
Totals					581,000				2,074,920		2,074,920
STEVENS COUNTY—											
Pond Oreille Lakes							15,000				
Mill Creek				7,500			7,500				
Walt's Lake				7,500			22,000				
Held in County Hatchery					150,000						
Totals									300,500		300,500
WALLA WALLA COUNTY—											
Mill Creek				100,000						80,100	
Totals									100,000	80,100	180,100

Distribution of Trout Fry Planted from the State Hatcheries—Concluded.
(Including Salmon Fry Planted in Fresh Waters in Lieu of Trout.)

COUNTIES AND WATERS	Beards- lee	Black- Spotted	Cres- centli	Out- Throat	Eastern Brook	Mack- Inaw	Rainbow	Silver	Total Trout	Steelhead Salmon	Grand Totals
PASTERN WASHINGTON DISTRICT (Continued)											
WHITMAN COUNTY—											
Palouse River				8,000			18,900	3,500			
Paradise Creek								6,500			
Alnota Creek								8,000			
Pine Creek at head of Rock Lake								32,000			
Rock Creek 2 miles below Rock Lake											
Totals									76,900		76,900
YAKIMA COUNTY—											
Clear Lake				38,900							
Rumping Lake						11,000	19,000				
Bachelor Creek					125,000						
Lost in transit							58,225				
Totals									251,125		251,125
Total Eastern Washington District	18,300	22,000	56,300	646,400	1,914,150	109,140	566,125	4,024,765	7,289,610	839,700	8,129,310
GRAND TOTALS											
	18,300	22,000	56,300	1,225,222	3,236,457	361,547	965,217	13,284,438	19,219,482	1,064,700	20,284,182

TROUT AND OTHER EGGS FURNISHED BY THE STATE TO COUNTIES.
Fiscal Year 1920.

COUNTIES	Beardsee	Ores-centil	Cut-throat	Eastern Brook	Mackinaw	Rainbow	Silver	Total Trout	Steelhead Salmon	White Fish	Grand Totals
Chelan.....			50,000	120,000	500,000	325,000	1,405,950	2,407,950	20,000		200,000
King.....					150,000	100,000		255,000	311,000	120,000	2,840,950
Kittitas.....	5,000				100,000			100,000	200,000		455,000
Pend Oreille.....		10,000		56,000	200,000		426,800	692,800			100,000
Pierce.....					45,000		250,000	295,000			692,800
Skamania.....					100,000		500,000	600,000	200,000		295,000
Stevens.....											800,000
Totals.....	5,000	10,000	50,000	186,000	1,095,000	425,000	2,582,750	4,352,750	911,000	120,000	5,383,750

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TROUT EGGS PURCHASED BY THE COUNTIES.**Fiscal Year 1920.**

(Orders placed by the State Fish Commissioner with Paradise Brook Trout Company, of Henrysville, Pa., for Eastern Brook Trout eggs.)

COUNTIES	Number Eastern Brook Eggs	WHERE HATCHED
King.....	160,000	King County Hatchery
Skagit.....	160,000	Samish (State) Salmon Hatchery
Snohomish.....	375,000	Snohomish County Hatchery
Spokane.....	375,000	Spokane (State) Trout Hatchery
Thurston.....	160,000	Chambers Creek (State) Salmon Hatchery
Whatcom.....	375,000	Lake Whatcom (State) Trout Hatchery
Total.....	1,605,000	

PERMITS GRANTED FOR THE PLANTING OF FRY FROM COUNTY HATCHERIES.
Fiscal Year 1920.

COUNTIES AND WATERS	Black Spotted	Cut-throat	Eastern Brook	Mack-inaw	Rain-bow	Silver	Total Trout	SALMON		White Fish	Pike and Muskellunge	Grand Totals
								Chinook	Steel-head			
WESTERN WASHINGTON DIST.												
GRAYS HARBOR COUNTY—												
Wishah River.....	15,000											
East Branch Satsop River.....	10,000											
Totals.....	25,000						25,000					25,000
KING COUNTY—												
Cedar River Water Shed.....	70,000											
Snoqualmie River Water Shed.....	70,000											
Judd Creek.....	7,000		15,000									
Tributaries to Lake Sammamish.....	365,000		71,000	155,000	20,000	1,416,000			51,000	58,000	300,000	
Lake Maple.....												
Skykomish River.....			100,000									
Issaquah River.....	40,000		100,000									
Green River.....			400,000									
Snoqualmie River.....			800,000									
Cedar River.....	6,340		613,500									
Lake Sammamish.....												
Lake Hancock.....					250,000				18,000			
Phillips Creek.....	25,000				5,000							
Tributaries of Tye River.....	5,000											
Issaquah Creek.....	80,080				21,000							
Lake four miles from Tye.....	2,000											
Stillwater Creek.....	4,000											
North Fork Snoqualmie River.....	5,000									40,000		
South Fork Snoqualmie River.....	2,000									60,000		
Tokul Creek.....	14,500									30,000		
Tributaries of Cedar River.....										18,000		
Issaquah River Water Shed.....	40,000											
North Lake.....												
TRD. to S. F. Snoqualmie River.....	12,000											
Tributaries to Lake Washington.....				62,000		14,400				35,000		
Green Lake.....						80,000			5,000			
Totals.....	26,500	722,020	2,096,500	220,000	296,000	1,400,400	4,824,420	5,000	250,000	113,000	300,000	5,462,420

Permits Granted for the Planting of Fry From County Hatcheries—Continued.

COUNTIES AND WATERS	Black Spotted	Cut-throat	Eastern Brook	Mack-inaw	Rain-bow	Silver	Total Trout	SALMON		White Fish	Pike and Muskellunge	Grand Totals
								Chinook	Steel-head			
WESTERN WASHINGTON DIST.												
—Concluded.												
SKAMANIA COUNTY—												
Rock Creek.....					10,000							
Little White Salmon River.....					15,000							
Goose Lake.....									17,000			
Blue Lake.....									20,000			
Lost Lake.....									13,000			
McKeighan Lake.....									2,200			
Totals.....					25,000		25,000		52,200			77,200
Total Western Washington Dist.	26,500	747,020	2,069,500	220,000	321,000	1,460,400	4,874,420	5,000	272,200	113,000	300,000	5,564,020
EASTERN WASHINGTON DIST.												
CHELAN COUNTY—												
Icele River.....												
Entiat River.....		100,000										
First Creek.....		200,000										
Nason Creek.....		25,000										
Ingles Creek.....		15,000										
Twin Creek.....		15,000										
Grouse Creek.....		20,000										
Gatz Creek.....		75,000										
Chiwaukum Creek.....		50,000										
Rock Creek.....		43,200										
Pushastin Creek.....		15,000										
Deep Creek.....		15,000										
Goose Creek.....		20,000										
Alder Creek.....		300,000										
Wenatchee River.....		25,000										
Mill Creek.....		100,000										
Wenatchee Lake.....		5,000										
Lake Jullius.....		5,000										
Lock-Eileen.....												

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Permits Granted for the Planting of Fry From County Hatcheries—Continued.

COUNTIES AND WATERS	Black Spotted	Out-throat	Eastern Brook	Mack-inaw	Rain-bow	Silver	Total Trout	SALMON		White Fish	Pike and Muskellunge	Grand Totals
								Chinook	Steel-head			
EASTERN WASHINGTON DIST.												
—Continued.												
CHELAN COUNTY—Concluded.												
Lalichtenwasser.....		10,000										
Lost Lake.....		10,000										
Lake Chelan.....		100,000										
Myrtle Lake.....		10,000										
Totals.....		1,158,200					1,158,200		200,000			1,358,200
KITITITAS COUNTY—												
Lake Ole Elum.....												
				12,500			12,500					12,500
PEND OREILLE COUNTY—												
Indian Creek.....			10,000									
Skookum Creek.....			20,000									
Kalspell Creek.....			40,000									
Small Creek.....			20,000									
Lost Creek.....			20,000									
Le Clerc Creek.....			30,000									
Lemona Creek.....			30,000									
Winchester Creek.....			20,000									
Sachuen Creek.....			55,000									
Marshall Lake.....			45,000									
King's Lake.....			40,000									
North Skookum Lake.....			40,000									
South Skookum Lake.....			40,000									
Yokum Lake.....			40,000									
Dream Lake.....			20,000									
Crescent Lake.....			60,000									
Ione Mill Pond.....			20,000									
Farker Lake.....			25,000									
Half Moon Lake.....					40,000							
Totals.....			550,000		40,000		620,000					620,000

Permits Granted for the Planting of Fry From County Hatcheries—Concluded.

COUNTIES AND WATERS	Black Spotted	Cut-throat	Eastern Brook	Mack-inaw	Rain-bow	Silver	Total Trout	SALMON		White Fish	Pike and Muskellunge	Grand Totals
								Chinook	Steel-head			
EASTERN WASHINGTON DIST.												
—Concluded.												
STEVENS COUNTY—												
Little Pend Oreille River.....			110,000									
Chewelah Creek.....			77,000		25,000							
Little Chewelah Creek.....			112,000									
Chewelah Creeks (3).....			105,000									
Mt. Creek.....			75,000									
Pend Oreille Lake.....		25,000	371,000		270,000				170,000			
Big Sheep Creek.....			80,000									
Little Sheep Creek.....			15,000									
Deep Sheep Creek.....			110,000									
Twin Lakes.....			30,000									
Phalan's Lake.....			40,000									
Sheep Creek.....			20,000									
Cottonwood Creek.....			40,000									
Swamp Creek.....			25,000									
Thompson Creek.....			20,000									
Sherwood Creek.....			30,000									
Dunlap Creek.....			20,000									
Huckleberry Creek.....			20,000									
Pepone Lake.....			20,000		10,000							
Upper Colville River.....			80,000		100,000							
Lower Colville River.....			20,000									
Clark's Lake.....			20,000									
Hunter's Creek.....			10,000									
Deer Creek.....			30,000		90,000					65,000		
Bear Creek.....			20,000									
Coffin's Lake.....			15,000									
Lake Leo.....			20,000							90,000		
Black Lake.....					50,000							
Walt's Lake.....					90,000							
Loon Lake.....					90,000					65,000		
Totals.....		25,000	1,485,000		725,000		2,235,000		400,000			2,635,000
YAKIMA COUNTY *—												
Bumping Lake.....				12,500			12,500					12,500
Total Eastern Washington Dist..		1,183,200	2,065,000	25,000	765,000		4,038,200		600,000			4,638,200
Grand Totals.....	20,500	1,980,200	4,164,500	245,000	1,086,000	1,460,400	8,912,620	5,000	872,200	113,000	300,000	10,202,820

* Yakima County Game Commission has no hatchery of its own. Fry reared in private hatchery.

PERMITS GRANTED FOR THE PLANTING OF FRY FROM OTHER THAN STATE AND COUNTY HATCHERIES.

Fiscal Year 1920.

COUNTIES AND WATERS	Black Spotted	Cut-throat	Eastern Brook	Rainbow	Total Trout	Steelhead Salmon	Bass	Catfish	Crapples	Perch	Sunfish	Grand Totals
WESTERN WASHINGTON DIST.												
KING COUNTY—		8			8		53			42	25	128
Green Lake.....												
KITSAP COUNTY—												
Kitsap Lake.....							9,000			1,000		
Lake Flora.....							6,000			1,000		
Mary Garden Lake.....							1,000					
Totals.....							16,000			2,000		18,000
LEWIS COUNTY—												
Sluggish water between Chehalis and Centralia.....									500			500
PIERCE COUNTY—												
South Prairie Creek.....			47,500									
Pond Lake.....			2,500									
Beaver Creek.....			12,500									
Gale Creek.....			7,500									
Huckleberry Creek.....			20,000									
Muck Creek.....	6,500											
Totals.....	6,500		90,000		96,500							96,500
THURSTON COUNTY—												
Des Chutes River.....	4,000			4,000	8,000							8,000
WHATCOM COUNTY—												
Hozomeen Lake.....						40,000						40,000
Totals.....	10,500	8	92,000	4,000	106,508	40,000	16,088		500	2,042	25	165,128
Total Western Wash. Dist.		8										

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Permits Granted for the Planting of Fry From Other Than State and County Hatcheries—Concluded.

COUNTIES AND WATERS	Black Spotted	Cut-throat	Eastern Brook	Rainbow	Total Trout	Steelhead Salmon	Bass	Catfish	Crappies	Perch	Sunfish	Grand Totals
EASTERN WASHINGTON DIST.												
CHELAN COUNTY—												
Bowen Slough.....								2,000				2,000
LINCOLN COUNTY—												
Hawk Creek.....				90,000								
Wilson Creek.....				80,000								
Crab Creek.....				250,000								
Spokane River.....				50,000								
Welch Creek.....				15,000								
Meechum Creek.....				15,000								
Totals.....				500,000	500,000							500,000
PEND OREILLE COUNTY—												
Babbitz Lake.....			10,000		10,000							10,000
STEVENS COUNTY—												
Pierre Lake.....							5,000					
Williams Lake.....							5,000					
White Mud Lake.....							5,000					
Private Pond—J. H. Root.....			300									
Totals.....			300		300		15,000					15,300
YAKIMA COUNTY—												
Bumping Lake.....				40,000	40,000							40,000
Total Eastern Wash. Dist.			10,300	540,000	550,300		15,000	2,000				567,300
Grand Totals.....	10,500	8	102,300	544,000	656,808	40,000	31,083	2,000	500	2,042	25	732,428

SUMMARY OF FRY PLANTED.
Fiscal Year 1920.

SALMON—		
Chinook.....	8,297,607	
Dog.....	114,144,057	
Humpback.....	718,600	
Silver.....	41,320,887	
Steelhead.....	8,300,217	172,791,368
TROUT—		
Beardslee.....	18,300	
Black Spotted.....	59,000	
Crescentil.....	56,300	
Out-throat.....	3,155,451	
Eastern Brook.....	7,563,257	
Mackinaw.....	686,547	
Rainbow.....	2,585,217	
Silver.....	14,744,838	28,788,910
MISCELLANEOUS—		
Bass.....	31,053	
Catfish.....	2,000	
Crappies.....	500	
Perch.....	2,042	
Pike and Muskellunge.....	300,000	
Sunfish.....	25	
Whitefish.....	113,000	448,620
Total.....		202,028,898

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ARRESTS MADE FOR VIOLATIONS OF THE FOOD FISH LAWS.

Fiscal Year 1920.

Date of Arrest	OFFENDER	CHARGE	Disposition of Case	Penalty Imposed
1920—		OLALLAM COUNTY		
June 26	W. A. Alexander.....	Gaffing salmon in Dungeness River.....	Discharged (minor).....	.....
June 26	George Brazil.....	Gaffing salmon in Dungeness River.....	Guilty.....	\$10 00
June 26	Ed. Casselery.....	Gaffing salmon in Dungeness River.....	Guilty.....	10 00
Oct. 29	Charles Lewis.....	Operating seine without license.....	Guilty.....	10 00
June 25	Herman Moorbeck.....	Fishing with net stretched entire width of river.....	Guilty.....	50 00
June 25	Herman Moorbeck.....	Fishing without license.....	Guilty.....	100 00
Oct. 29	Herman Peterson.....	Operating seine without license.....	Guilty.....	10 00
June 26	John Potter.....	Gaffing salmon in Dungeness River.....	Guilty.....	10 00
June 26	Robert Priest.....	Gaffing salmon in Dungeness River.....	Guilty.....	10 00
Oct. 29	Ed. Sampson.....	Operating seine without license.....	Guilty.....	10 00
Oct. 29	Harry Sampson.....	Operating seine without license.....	Guilty.....	10 00
Oct. 29	Morris Sampson.....	Operating seine without license.....	Guilty.....	10 00
June 26	J. A. Sanford.....	Gaffing salmon in Dungeness River.....	Guilty.....	10 00
Oct. 29	Charles Wilson.....	Operating seine without license.....	Guilty.....	10 00
June 26	William Wright.....	Gaffing salmon in Dungeness River.....	Guilty.....	10 00
				\$270 00
		OLARKE COUNTY		
Dec. 28	H. C. Dittmer.....	Having short sturgeon in possession.....	Guilty.....	\$15 00
May 28	J. H. Peters.....	Having short sturgeon in possession.....	Guilty.....	10 00
May 3	Leo Reed.....	Having short sturgeon in possession.....	Guilty.....	23 00
		COOWLITZ COUNTY		
June 11	Allen & Hendrickson.....	Having short sturgeon in possession.....	Guilty.....	\$25 00
1921—				
Feb. 7	Oscar Beebe.....	Fishing with Chinese gear.....	Guilty.....	25 00
Feb. 7	R. Colvin.....	Fishing with Chinese gear.....	Guilty.....	50 00
Feb. 7	John Dethman.....	Fishing with Chinese gear.....	Acquitted.....	.....
1920—				
April 29	E. D. Erway.....	Fishing with gill net during closed season.....	Guilty.....	75 00
April 23	Ora Jarnot.....	Having fish in possession during closed season.....	Guilty.....	25 00
1921—				
Jan. 20	Victor Lamp!.....	Buying fish without buyers license.....	Guilty.....	20 00

Arrests Made for Violations of the Food Fish Laws—Continued.

Date of Arrest	OFFENDER	CHARGE	Disposition of Case	Penalty Imposed
1920— May 18	Edward Mustola	COWLITZ COUNTY—Concluded Destroying food fish. Fishing with Chinese lines. Fishing with Chinese lines. Fishing without license.	Guilty.....	\$25 00
Feb. 7	John E. Nelson			
Feb. 7	Walter Rivers			
Jan. 23	S. E. Sarajarvi			
1920— Jan. 27	Albert Brisman	GRAYS HARBOR COUNTY Fishing with two set nets within 900 feet of fish trap.....	Guilty.....	\$25 00
1920— Oct. 25	Andrew Matson	Destroying food fish.....	Guilty.....	10 00
Nov. 3	Northwest Electric & Water Works	Failure to maintain fishway over dam.....	Guilty.....	100 00
Oct. 25	Sea Beach Packing Co.	Destroying food fish.....	Guilty.....	10 00
Oct. 25	Gus Strand	Destroying food fish.....	Guilty.....	10 00
1921— Feb. 3	John Anderson	KING COUNTY Operating gill net in closed stream..... Having short salmon in possession..... Having short salmon in possession..... Operating gill net in closed stream..... Operating set net in closed stream..... Having short salmon in possession for sale..... Having short salmon in possession for sale..... Operating fish market without license..... Selling short salmon..... Having short salmon in storage..... Operating retail fish market without license..... Having short salmon in possession..... Destroying food fish (cutting out bellies and wasting balance of salmony).....	Guilty..... Guilty..... Guilty..... Acquitted..... Guilty..... Guilty..... Guilty..... Guilty..... Guilty..... Guilty..... Guilty..... Guilty.....	\$10 00 15 00 15 00 10 00 15 00 25 00 5 00 25 00 5 00 5 00 10 00 10 00
Feb. 2	Fred August			
Jan. 31	A. G. Austin			
Feb. 3	John Brunn			
1920— Oct. 16	C. A. Carlson			
May 7	H. L. Chase (Whiz Fish Co.)			
May 7	W. B. Corcoran (Ocean Fisheries Co.)			
May 22	Morris Pakenezki			
May 11	Roy Jensen (Washington Fish Market)			
1921— Feb. 1	W. E. Laure (Newport Fish Co.)			
1920— Dec. 6	Joe Niek			
July 2	Jars Peterson (Lyon Oyster House)			
Nov. 6	Ripley Fish Co.			
			Under advisement.....	
				\$370 00
				155 00

Arrests Made for Violations of the Food Fish Laws—Continued.

Date of Arrest	OFFENDER	CHARGE	Disposition of Case	Penalty Imposed
1921—				
Feb. 16	Sebastian-Stuart Fish Co.	KING COUNTY—Concluded	Gulley	\$25 00
Feb. 1	C. G. Sheldon		Gulley	10 00
Feb. 16	Angelo Sismanis		Under advisement	
Feb. 16	Angelo Sismanis		Gulley	\$200 00
1920—				
Oct. 9	Leo Armstrong	KITSAP COUNTY		
June 1	John Doe Berg	Having gaff in possession on salmon stream for purpose of fleshing	Acquitted	
Nov. 2	W. Blanchard	Casting sawdust in waters of Puget Sound	Gulley	\$1 00
Nov. 9	E. D. Craig	Fishing with set net across entire width of Curley Creek	Gulley	50 00
Nov. 9	C. Gasset	Gaffing salmon	Gulley	25 00
Oct. 24	C. E. Lansdorff	Fishing for salmon in Ross Creek with gaff hook	Gulley	5 00
Oct. 23	O. Letter	Fishing for salmon in Black Jack Creek with gaff hook	Pending	
Oct. 23	E. W. Mitchell	Fishing for salmon in Black Jack Creek with gaff hook	Pending	
Oct. 24	J. Tero	Fishing for salmon in Black Jack Creek with gaff hook	Gulley	5 00
Nov. 9	F. Potter	Gaffing salmon	Gulley	5 00
Nov. 9	E. M. Walton	Fishing with purse seine in waters of Port Orchard Bay during closed season	Gulley	25 00
Nov. 20	Frank White	Gaffing salmon	Gulley	5 00
Nov. 9	E. E. Winberg	Gaffing salmon	Gulley	25 00
Nov. 9	G. E. Wordley	Gaffing salmon	Gulley	5 00
May 5	E. J. Eldenmiller	MASON COUNTY		
		Obstructing fishway on Shelton Creek	Gulley	\$5 00
1920—				
June 22	Sander Aho	PACIFIC COUNTY		
Dec. 17	Ernest Anderson	Allen fishing without license	Gulley	\$95 00
July 25	John Bakovic and crew of seven men	Fishing out of season	Gulley	8 00
		Fishing with purse seine in Willapa Harbor without license	Gulley	445 00

Arrests Made for Violations of the Food Fish Laws—Continued.

Date of Arrest	OFFENDER	CHARGE	Disposition of Case	Penalty Imposed
PACIFIC COUNTY—Concluded				
1920— July 25	John Bertapelli and crew of six men.	Fishing with purse seine in Willapa Harbor without license.	Guilty.....	\$396 00
July 26	Paul Boenich and crew of seven men.	Fishing with purse seine in Willapa Harbor without license.	Guilty.....	445 00
1921— Jan. 25	W. H. Dennis.....	Selling clams during closed season.....	Guilty.....	2 50
1920— July 25	Vinc. Dunleth and crew of seven men.	Fishing with purse seine in Willapa Harbor without license.	Guilty.....	445 00
July 25	James Elias and crew of six men.....	Fishing with purse seine in Willapa Harbor without license.	Guilty.....	395 00
1921— Mar. 30	Charles Foster	Having salmon in possession during closed season.....	Guilty.....	20 00
1920— July 25	John Kuljis and crew of seven men.....	Fishing with purse seine in Willapa Harbor without license.	Guilty.....	445 00
1921— Jan. 25	Robert Lawrence	Selling clams during closed season.....	Guilty.....	2 00
1920— July 25	Chris Lucas and crew of seven men.....	Fishing with purse seine in Willapa Harbor without license.	Guilty.....	445 00
July 25	Ed. Mattison and crew of six men.....	Fishing with purse seine in Willapa Harbor without license.	Guilty.....	395 00
July 25	Nicholas Milosevitch and crew of seven men.....	Fishing with purse seine in Willapa Harbor without license.	Guilty.....	445 00
July 25	Nick Morine and crew of seven men.....	Fishing with purse seine in Willapa Harbor without license.	Guilty.....	445 00
June 22	Elmer Puikkinen	Alien fishing without license.....	Guilty.....	50 00
July 25	Frank Shimstovich and crew of seven men.....	Fishing with purse seine in Willapa Harbor without license.	Guilty.....	445 00
Aug. 3	Arthur Strans	Retailing clams without license.....	Guilty.....	5 00
PIERCE COUNTY				
May 10	Steve Burke	Selling and having in possession short salmon.....	Guilty.....	\$25 00
Mar. 15	A. Harris	Snagging salmon in trap at Chambers Creek Hatchery.....	Guilty.....	25 00
Nov. 20	N. J. La Patt.....	Snagging salmon.....	Ball forfeited.....	25 00
1921— Mar. 16	Nick Mosich	Failure to make catch report.....	Guilty.....	50 00
1920— Mar. 15	Charles Williams	Snagging salmon in trap at Chambers Creek Hatchery.....	Guilty.....	25 00
Nov. 31	Max Ziolkowski	Snagging salmon.....	Ball forfeited.....	25 00
				\$4,927 50

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Arrests Made for Violations of the Food Fish Laws—Concluded.

Date of Arrest	OFFENDER	CHARGE	Disposition of Case	Penalty Imposed
1920 - Sept. 27 June 8 Sept. 27 June 8	J. Bjorge Columbia River Packers Assn. H. Romick Warren Packing Company	WAHIAKUM COUNTY Having small sturgeon in possession. Having short sturgeon in possession. Having short salmon in possession. Having short sturgeon in possession.	Guilty Guilty Guilty Guilty	\$95 00 50 00 50 00 80 00 \$225 00
1921— Mar. 9	John A. Taylor	WHATCOM COUNTY Buying food fish that were caught in illegal waters (Samish River)	Guilty	\$15 00 15 00
1920— April 14	Roy Evans	WHITMAN COUNTY Fishing during closed season.	Bail forfeited.	\$50 00 50 00
May 31	Fred Garberding	YAKIMA COUNTY Selling salmon without license.	Guilty	\$1 00 1 00
	Total			\$6,812 00

FISHWAYS REPAIRED, INSTALLED OR ORDERED INSTALLED.**Fiscal Years 1919 and 1920.**

OWNER OF DAM	STREAM LOCATED ON	COUNTY	CONDITION
PUGET SOUND DISTRICT— Colony Mill		Skagit.....	Uncompleted
GRAYS HARBOR DISTRICT— Black Diamond Lumber Company..... Stillwater Lumber Co. and W. E. Brown O'Connell Lumber Company.....	Olequa Creek..... Olequa Creek..... Olequa Creek.....	Lewis..... Lewis..... Lewis.....	Uncompleted Uncompleted Uncompleted
WILLAPA HARBOR DISTRICT— Siler Mill Company.....	Smith Creek (two dams)	Pacific.....	Uncompleted
COLUMBIA RIVER DISTRICT— Horn Rapids Irrigation Company..... North Coast Power Company..... Richland Irrigation District..... Columbia Irrigation District..... Cotterell Electric Company.....	Yakima River..... Kalama River..... Yakima River..... Yakima River..... Washougal River.....	Benton..... Cowlitz..... Benton..... Benton..... Clarke.....	Uncompleted Uncompleted Uncompleted Uncompleted Uncompleted

The Northwestern Electric Company, who in 1916 constructed a fishway over a dam in the Big White Salmon River, Klickitat County, was permitted to discontinue the fishway, inasmuch as the dam was much higher than over which a successful fishway can be maintained, and the state accepted in lieu of the fishway \$5,000.00 to be used for the construction of a hatchery, as provided by Section 79 of the Fisheries Code. Inasmuch as the Federal Government operates a hatchery on the Big White Salmon River, it was deemed advisable to use the money for the construction of a hatchery on some other stream, and the Chinook River, Pacific County, was chosen. The hatchery was completed in July, 1920.

NUMBER AND VALUE OF CANNERIES AND FACTORIES OPERATED, AND THEIR FISHING APPLIANCES AND CAPITAL INVESTED.
Fiscal Year 1920.

	PUGET SOUND DISTRICT		COLUMBIA RIVER DISTRICT		GRAYS HARBOR DISTRICT		WILJAPA HARBOR DISTRICT		ALL DISTRICTS COMBINED	
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Canneries, salmon (buildings and machinery)	19	\$1,822,054 44	9	\$276,769 48	7	\$53,826 74	4	\$11,912 71	35	\$2,152,680 66
Canneries, other than salmon	4	25,500 00			5	21,080 00			13	50,000 71
Factories, by-products	2	125,000 00	1	5,000 00					3	130,000 00
Warehouses, cold storages, smoke houses, packing plants, fuel houses, residences for labor, real estate		1,014,227 35		48,861 03		54,475 00		24 00		1,117,590 39
Automobiles, trucks and other land conveyances	11	14,151 01	17	11,475 00	10	8,296 00	2	1,200 00	40	35,122 04
Steamboats	11	234,000 00							11	234,000 00
Launches	29	184,938 49	15	37,320 90	2	3,000 00			46	224,256 39
Scows	164	177,783 44	29	12,147 41	6	3,850 00			190	133,783 85
Cannery tenders	18	89,643 14	6	16,549 00					24	106,393 14
Fishing boats	27	46,137 32	148	78,600 25	7	4,403 53			182	129,147 40
Fish buyers boats	1	2,800 00							1	2,800 00
Tide drivers or pullers	19	83,849 49	2	980 00					21	84,379 49
Round net locations operated	56	714,042 20	14	22,556 14	5	9,195 00			75	746,353 34
Round net locations not operated	79	757,045 52	11		1	300 00			91	757,345 52
Stationary or scow fish wheels		24,548 51	209	183,370 00	2	350 00			9	38,027 30
Net and seines	2	2,000 00	103	10,401 83	6	500 00			233	205,218 51
Net racks		181,771 30		6,234 00		4,053 00			113	12,901 83
Miscellaneous equipment		\$748,235 34		\$748,235 34		\$164,592 57		\$13,136 71		\$937,964 94
Total invested in plant and equipment		3,489,066 94		1,432,747 18		306,837 27		25,589 22		5,253,190 61
Operating expenses		\$8,937,052 19		\$2,180,982 52		\$471,369 84		\$38,675 93		\$11,628,080 48
Grand Total Capital Invested										

NUMBER AND EARNINGS OF LABORERS EMPLOYED IN OPERATION OF CANNERIES, FACTORIES, AND THEIR APPLIANCES.
Fiscal Year 1920.

	PUGET SOUND DISTRICT			COLUMBIA RIVER DISTRICT			GRAYS HARBOR DISTRICT			WILLAPA HARBOR DISTRICT			ALL DISTRICTS COMBINED		
	No. Em- ploy'd	Average Season's Earn- ings	Total Earnings	No. Em- ploy'd	Average Season's Earn- ings	Total Earnings	No. Em- ploy'd	Average Season's Earn- ings	Total Earnings	No. Em- ploy'd	Average Season's Earn- ings	Total Earnings	No. Em- ploy'd	Average Season's Earn- ings	Total Earnings
CLERICAL CAPACITY—															
Male.....	40	\$1,801.41	\$72,056.31	13	\$1,396.92	\$35,060.00	7	\$625.61	\$3,679.27	.....	.....	.....	60	\$1,604.92	\$101,605.68
Female.....	5	1,248.62	9,389.09	3	920.00	2,760.00	4	1,295.00	5,180.00	.....	.....	.....	15	1,195.26	17,929.06
OPERATING															
Canneries, Ware- houses, Etc.—															
White labor—male.....	462	790.77	366,109.24	73	964.28	70,302.38	107	351.73	37,635.56	.....	.....	.....	637	732.15	481,025.40
White labor—female.....	163	191.71	31,245.59	40	185.52	7,431.19	102	290.37	29,426.55	.....	.....	.....	343	190.51	65,946.33
Original labor.....	135	336.71	52,749.94	219	614.57	139,000.07	.....	.....	.....	.....	.....	.....	345	527.39	181,810.01
Indian labor.....	172	138.65	23,745.82	.....	.....	.....	8	55.43	443.42	.....	.....	.....	130	154.89	24,189.24
OPERATING															
The drivers and pub- lishers, boats, scows, nets and other fish- ing appliances.....	408	1,022.71	475,627.69	46	713.33	32,813.32	3	167.39	502.48	.....	.....	.....	517	988.29	511,943.49
Miscellaneous Labor.....	28	818.41	22,915.61	30	243.35	7,309.00	.....	.....	.....	.....	.....	.....	58	521.11	30,224.61
Totals.....	1,476	\$717.77	\$1,650,441.20	415	\$694.57	\$275,715.06	231	\$293.79	\$67,867.28	53	\$210.17	\$11,139.22	2,175	\$650.19	\$1,414,163.00

OUTPUT OF THE PRIVATE FISH HATCHERIES.
Fiscal Year 1920.

Spawn sold.....	442,000
Fry sold.....	1,755,647
Fish sold.....	5,205

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