

UNITED STATES COMMISSION OF FISH AND FISHERIES

PART IV.

REPORT

OF

THE COMMISSIONER

FOR

1875-1876.

- A.—INQUIRY INTO THE DECREASE OF THE FOOD-FISHES.
- B.—THE PROPAGATION OF FOOD-FISHES IN THE WATERS OF THE UNITED STATES.

LEWIS
UNIVERSITY OF WASHINGTON
STATE

WASHINGTON:
GOVERNMENT PRINTING OFFICE,
1878.

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APPENDIX B.

INLAND FISHERIES.

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net, it will probably be useless, to introduce new food-fishes. But other streams, and the numerous lakes in this part of the State can be successfully restocked. Bels would without doubt succeed, and the finding of the small shad at Riverdale proves that they have lived for a few years in that stream.

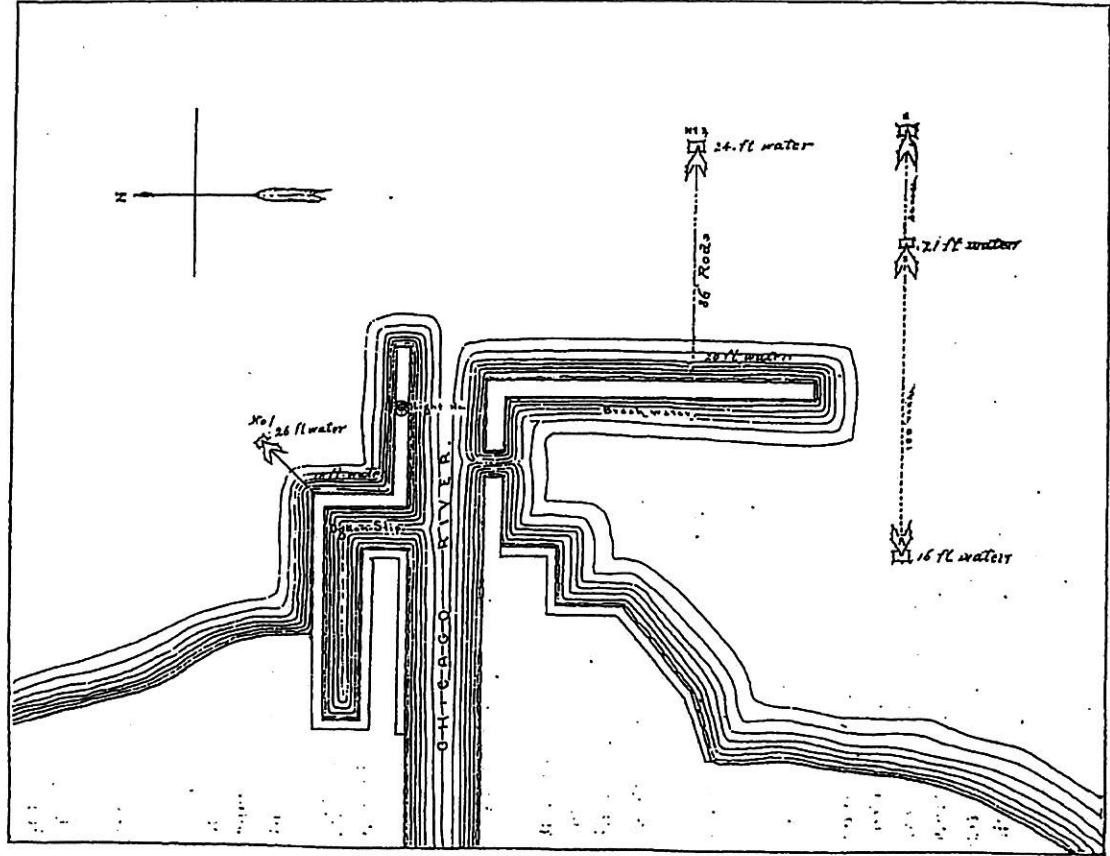


Diagram showing position of nets in Chicago Harbor.

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III.—THE SALMON FISHERIES OF THE COLUMBIA RIVER.

By LIVINGSTON STONE.

SAN FRANCISCO, CAL., December 31, 1875.

SIR: I beg leave to report as follows:

In pursuance of instructions received from you from Washington, I left San Francisco for the Columbia River on the 1st day of May, 1875, and arrived at Portland, Oreg., on the 6th day of the same month. From this point I made various excursions up the Willamette and up and down the Columbia from the ocean to Oclilo, 210 miles from the mouth of the river, giving special attention to the natural history of the salmon and the business of the river canneries, besides looking up a favorable point for the artificial propagation of salmon.

In regard to the natural history of the salmon I was able to gather quite a large number of facts, but could make only very little certain progress, in the limited time that I had to spend on the Columbia, toward determining the number and characteristics of the many varieties of salmon which frequent the river.

The facts which I collected in regard to the natural history of the salmon, together with the other results of my investigations, will be found in the course of the following report.

LIVINGSTON STONE.

Prof. SPENCER F. BAIRD,
United States Commissioner of Fish and Fisheries.

A.—THE COLUMBIA RIVER.

The Columbia, as is generally known, is the most productive salmon river of the world. Its vast tributaries, extending over many degrees of latitude and longitude, furnish immense spawning-grounds for the accommodation of the parent fish, while the broad and deep channel of the main stream for hundreds of miles affords a magnificent highway, free of obstruction, for their easy ascent of the river.

These advantages the salmon have availed themselves of in an extraordinary degree, and they pour through the mouth of the Columbia and up its current in an abundance unknown to any other river in the inhabited portions of the globe.

The abundance of the salmon, however, is not their only peculiarity in this wonderful river. They occur in greater variety also than in any other known river of the world.

While there is only one anadromous salmon in the Sacramento, one in the Penobscot, one in the Miramichi, one in the Rhine, and one in the British rivers, there are said to be no less than twelve distinct varieties in the Columbia. These in all their Protean forms, occasioned by differences of age, season, and sex, have constituted a labyrinth which has always been an invincible puzzle to naturalists.

In the very brief time that I spent on the Columbia it was quite impossible to acquire anything like an exhaustive knowledge of the different varieties in the river. I consequently confined myself chiefly to inquiries into the characteristics of the Chinook salmon (*Salmo ginnat*), which I had an opportunity to see and study, and to gathering such information as I could regarding the other kinds, from the fishermen and other salmon-experts of the river.

The results of my investigation in regard to the *Salmo ginnat* will be found in the form of answers to Professor Baird's very valuable series of questions relating to fishes.

B—QUESTIONS RELATIVE TO THE FOOD-FISHES.—SALMO GINNAT.

I.—NAME.

Question. What is the name by which this fish is known in your neighborhood? If possible make an outline sketch for better identification.

Answer. This fish is known in the Columbia River as the "Chinook salmon," the "Tyee salmon," and the "common salmon of the Columbia."

2.—DISTRIBUTION.

Question. Is it found throughout the year, or only during a certain time; and for what time?

Answer. The Chinook salmon are not found in the main Columbia throughout the year, but begin to enter the river in February and continue to run until some time in September.

Question. If resident, is it more abundant at certain times of the year, and at what times?

Answer. They are most abundant from April to August, the greatest number making their appearance in the month of July.

3.—ABUNDANCE.

Question. How abundant is it, compared with other fish?
 Answer. They vastly exceed in abundance any other fish of the river.

Question. Has the abundance of the fish diminished or increased within the last ten years, or is it about the same?

Answer. The salmon have not increased in the Columbia River during the last ten years, and it is not known that they have diminished any. Fewer Chinook salmon now make their appearance in the upper rivers, but this is sufficiently accounted for by the fact that such a vast quantity are now netted in the main river on their way up. On the Willamette River the fishermen claim that the salmon have very much diminished, and that they caught only twenty or thirty now where they used to catch a hundred. This is undoubtedly true, but it does not prove that the salmon of the Columbia are diminishing, for it may be, and probably is, only the natural result of so many thousand more being stopped and caught in the main river below than there used to be. This must, of course, lessen the number that enter the Willamette.

Question. If diminished or increased, what is the supposed cause?

Answer.

Question. What is the amount, or extent, of the change in abundance?

Answer.

4.—SIZE.

Question. What is the greatest size to which it attains (both length and weight), and what the average?

Answer. The largest specimen that I ever saw weighed had a length of 35 inches, a girth of 31 inches, and a weight of 65½ pounds. One of the fishermen told me that he saw one caught in May, 1843, which weighed 83 pounds. This is the largest Columbia River salmon that I have heard of. The average weight is 22 or 23 pounds whole, and 16½ or 17 pounds dressed. Out of 98,000 salmon taken at Clifton, Oreg., in 1874, only one weighed as much as 65 pounds.

Question. State the rate of growth per annum, if known, and the size at one, two, three, or more years.

Answer. The rate of growth is not known. There is every reason to believe, however, that it is similar to that of the Sacramento salmon. (See Report of United States Commissioner of Fish and Fisheries, 1872-73, pp. 185, 186.)

Question. Do the sexes differ in respect to shape, size, rate of growth, &c.?

Answer. In the spring the sexes are exactly alike in appearance. At and near the spawning-season they differ very much. Their rate of growth appears to be nearly the same.

5.—MIGRATIONS AND MOVEMENTS.

Question. By what route do these fish come in to the shore, and what the subsequent movements?

gression to that point is about 100 miles a month. Dr. Suckley, in the Pacific Railroad Reports, estimates that the *Salmo scouleri* ascends the river at the rate of 100 miles a week. This variety, however, is a fall salmon and in great haste to deposit its spawn, which undoubtedly accounts for the difference of speed in the two instances. The spring (or summer) salmon are a week going from the Cascades to the Dalles. They are only a day or two getting through the Dalles, for they are seen above the Dalles a day or two after their first appearance at the mouth of the Dalles.

Question. If andirouous, what is the length of their stay in fresh water, and when do they return to the sea?

Answer. This question cannot be determined until it is known whether the fall runs of salmon are distinct from the *Salmo ginnat*. All of this latter variety return to the sea (or die) in August and September, as none are found in the river after that time having the characteristics of the spring run of the *Salmo ginnat*. It may be added here that vast shoals of the young of some salmon descend the Columbia in summer, passing the lower fisheries in June and July, and also that full-grown salmon of some variety are caught in considerable quantities, nearly exhausted, on the back of the drift-nets of the Lower Columbia in July and August.

Question. Do the different sexes or ages vary in this respect?

Answer. They do not.

Question. Do these fish come on to the breeding grounds before they are mature; or do you find the one or two year old fish with the oldest?

Answer. Fish of all sizes and ages above a year old are found together, on the breeding-grounds, except the salmon parrs recently hatched.

Question. What are the favorite localities of these fish? Say whether in still water or currents; shallow or deep water; on the sand; in grass; about rocks, &c.

Answer. These salmon are found anywhere in the river in deep water, in shallow water, over sand, gravel, and rocks; everywhere except in lagoons or sloughs, aside from the river, where the water stagnates.

Question. What depth of water is preferred by these fish?

Answer. No depth in particular.

Question. What the favorite temperature and general character of water?

Answer. The temperatures of the Lower Columbia are given below.

Table of daily temperatures of the water of the Columbia River at Clifton, Oreg., Sunday excepted.

1875		1873		1871	
Date.	7 a. m.	Date.	7 a. m.	Date.	7 a. m.
May 10	51	June 13	52	July 14	67
11	51	14	53	15	66
12	50	15	53	16	66
13	50	16	53	17	67
14	51	17	53	18	68
15	52	18	53	19	68
16	52	19	53	20	68
17	51	20	53	21	68
18	51	21	53	22	68
19	51	22	53	23	68
20	51	23	53	24	68
21	51	24	53	25	68
22	51	25	53	26	68
23	51	26	53	27	68
24	51	27	53	28	68
25	51	28	53	29	68
26	51	29	53	30	68
27	51	30	53	31	68
28	51	July 1	53	Aug. 1	68
29	51	2	53	2	68
30	51	3	53	3	68
31	51	4	53	4	68
June 1	51	5	53	5	68
2	51	6	53	6	68
3	51	7	53	7	68
4	51	8	53	8	68
5	51	9	53	9	68
6	51	10	53	10	68
7	51	11	53	11	68
8	51	12	53	12	68
9	51	13	53	13	68
10	51	14	53	14	68

The headwaters are, of course, much colder in the summer months. All parts of the river seem to suit the salmon, from which it may be inferred that all the temperatures of the table, together with the colder ones of the tributaries, are satisfactory to the *Salmo ginnat*.

6.—RELATIONSHIPS.

Question. Do these fish go in schools after they have done spawning, or throughout the year, or are they scattered and solitary?

Answer. They do not go in proper schools as mackerel and other sea fish do. I think each salmon makes its progress on its own individual account; but such vast numbers ascend the river at a time that they appear to move in schools.

Question. Have they any special friends or enemies?

Answer. Seals, sea-lions, otters, eagles, and ospreys are their special enemies. They have no friends that are of any good to them, that I am aware of. I should, however, except the Oregon legislature, which has at last provided a close-time for salmon, which example the Washington Territory assembly ought to follow as soon as possible.

Question. To what extent do they prey on other fish; and on what species?

Answer. The salmon devour great quantities of smelts and other smaller fish, when in salt water; but in fresh water they do not eat anything. Out of 98,000 salmon examined at the cannery of J. W. Cook & Co., at Clifton, Oreg., in 1875, only three had food in their stomachs,

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the Silverside Salmon, the Hard-heads, the Humpback Salmon, the Hooknosed Salmon, the Brook Trout, the larger Brook Trout, the Salmon Trout, the Lake Trout.

I discovered afterward that Mr. Cook was right as far as he went; but as I had just arrived on the river and had not identified any of the fishes at that time except the *Salmo gairdneri*, the contradictory character of my information seemed very discouraging.

The varieties mentioned by Mr. Cook I afterward found to be as follows:

The Chinook Salmon is the *Salmo gairdneri*.

The Blueback is the *Salmo gairdneri*.

The Silverside Salmon is the *Salmo* sp. 1

The Hard-head is the *Salmo truncatus*.

The Humpbacked Salmon is the *Salmo protectus*.

The Hooknosed Salmon is the *Salmo scouleri*.

The Brook Trout is the *Pario stellatus*.

The large Brook Trout is the *Salmo masoni*.

The Salmon Trout is the *Salmo gibbsii*.

The Lake Trout is the *Salmo* sp. 2

On the Willamette I was told by the fishermen that there were, besides the varieties just mentioned, the Dog Salmon, the Klackamas Chinook Salmon, the Klackamas Trout, the Fall Chinook Salmon, the Fall Silver Salmon, and, in fact, a different salmon or trout in almost every different river. I could not identify any of these except the first, which is certainly the *Salmo canis* of Suckley, but it is very doubtful whether the *Salmo canis* and also the *Salmo Scouleri* are not merely the altered forms of some of the varieties of fish already mentioned after undergoing the very great changes which come on as the eggs and milt become ripe for the spawning-season. Indeed I feel very sure that the *Salmo canis* is a form of one of the other varieties which it takes at the approach of the spawning-period.

D—METHODS OF FISHING.

The various methods of fishing for the *Salmonidae* on the Columbia may be found mentioned in the answers given above to Professor Baird's questions on the *Salmo gairdneri*, but I will also offer here a recapitulation of the different methods of capturing the fish. They are—

1. By drifting with drift-nets, as at all the canneries of the Columbia.
2. By hauling a seine, as at Chinook and various points on the Columbia.
3. By set (gill) nets, as at Oregon City, on the Willamette.
4. By scoop-nets, as at the Dalles and the Falls of the Willamette.
5. By dip-nets, as at the Dalles.
6. By hook and line, as at the mouth and also at the headwaters of the Columbia, for salmon, and in all the smaller streams for trout.

7. By traps and weirs, as at Oak Point and various places on the Columbia.

8. By fishing-rakes, as at the Lower Columbia, and the Gowitz for smelts.

9. By "twitching-hooks," as at the Falls of the Willamette for salmon.

10. By spearing, as everywhere, among the Indians, where the water is shallow enough.

E—THE CANNERIES OF THE COLUMBIA.

Every one has heard of the canneries of the Columbia. They have well deserved the reputation they have acquired, for seldom has a branch of industry assumed so quickly such large proportions or yielded such large profits to those engaged in it. It is only a very few years since the first salmon-cannery on the Columbia, commenced operations, and last year (1874) there were fourteen large establishments, employing in the aggregate nearly two thousand men and turning out nearly twenty million pounds of salmon in cans.

In May, 1875, I visited the cannery of the Oregon packing company carried on by J. W. and V. Cook through whose kindness I was enabled to obtain much information about the process of canning salmon, as well as about the fisheries and natural history of the salmon of the Columbia. The Messrs. Cook employ about one hundred and fifty men, mostly Chinamen. They run an average of twenty boats through the fishing season, (from the middle of April to the middle of August) and their buildings which are conveniently located and very methodically constructed cover nearly half an acre of ground. The buildings extend to the waters edge or rather they are built out over the water so that small boats can go under them. In front of the cannery is a platform very firmly built on piles which forms a wharf to which the ocean steamers can run up. At one corner of the establishment, and just in the rear of the wharf is a large rack opening on the river which receives the salmon fresh from the water just as the boats bring them in from the seines. This rack is capable of holding one or two thousand salmon. From the rack the salmon are passed to the cleaning bench, where the heads, tails, fins, and entrails are removed, and the body of the fish thoroughly washed in three different waters and with a hose. From the cleaning bench the salmon is passed on to the cutter where a system of revolving knives cuts the fish transversely into pieces about 4 inches long. These pieces are then passed on to the canning bench, where Chinamen who are required to wash their hands every half hour, cut up the fish with meat knives into pieces of a suitable size for canning, and pack them into cans. The filled cans are then pushed on to the next bench where the covers are fitted on. The next set of Chinamen solder on the covers and pass them on to another set, who place them on iron racks and lower them into the boilers. After being sufficiently boiled the cans are taken out, washed, cooled, tested, labelled, cased, and placed on the wharf ready for shipment. In the course of the entire

process the salmon pass through forty or fifty hands. In 1874, the Cook Bro's. cut up 98,000 salmon, averaging in weight between 16 and 17 pounds when dressed. They shipped upwards of 30,000 cases containing 48 one-pound cans each.

There were in all in the spring of 1875, fourteen canneries on the Columbia the first being at Astoria, only a few miles above the bar at the mouth of the Columbia, and the last or uppermost being 60 miles up the river at Rainier.

I give below a list of the Columbia River canneries in May, 1875, in the order in which they come as one descends the river from Portland, Oregon.

Name.	Number of cans shipped in 1874. (If beyond amount running now.....)	Not
1. R. D. Hume, Rainier. (Sixty miles from the mouth of the river.	6,000	
2. William Hume.....	23,000	
3. George W. Hume.....	35,000	
4. Joseph Hume.....	30,000	
5. A. S. Haggood.....	25,000	
6. John West & Co.....	35,000	
7. T. M. Warren.....	25,000	
8. Watson Bro's & Irtaman.....	16,000	
9. Oregon Packing Company, (J. W. & V. Cook).....	30,000	
10. R. D. Hume, Bayview.....	37,000	
11. Columbia River Salmon Company.....	10,000	
12. Meigler & Co.....	16,000	
13. Badolot & Co., Astoria.....	15,000	
14. Booth & Co., Astoria. (Had not begun operations).....		
Total.....	303,000	

As each case contains 48 one-pound cans* this makes a total of 14,256,000 pounds of canned salmon that were put up at the canneries of the Columbia River in 1874.

The cannery of Booth & Co., at Astoria, which made no returns last year for the simple reason that it was not built, was ready to commence work at the beginning of the season of 1875. This establishment now employs about 175 men and does a large share of its work by steam. It is the largest on the river and in May, 1875, the proprietors expected to turn out 45,000 cases of salmon, the coming season.

Some notion of the magnitude of these establishments may be arrived at by considering that at some of the larger ones the tin alone for the cans costs between \$50,000 and \$100,000. The salmon themselves that are consumed in all the canneries of the river in a year, if placed lengthwise in a line, would reach upwards of 500 miles; while the cans if laid on their sides and placed end to end would reach from New York to Omaha.

The prices of canned salmon have varied very much during the last few years. In 1874 the average price was \$6 a case, or 12½ cents per

* Usually, though, some two-pound cans are put up.

pound can. At the beginning of the season in April, 1875, prices had dropped to \$4.80 a case, or 10 cents a can, which did not pay expenses, the cost being on an average, \$5 a case. In consequence the canneries in 1875 did not open at all at first, but a little later prices went up again to \$5.90, which gave a margin of profit, and the canneries began operations.

Prices have averaged between \$5.20 and \$5.40 a case this year, which has enabled the canning establishments to make a moderate profit; but the business is not as it has been in past years, when the larger canneries cleared from \$30,000 to \$70,000 in a season.

Besides the fish that were canned on the Columbia last year, (1874,) there were about 250,000 salted and barreled. The salted salmon bring from \$7 to \$8 per barrel of 200 pounds in San Francisco. A considerable number of salmon are, of course, consumed fresh, but owing to the very limited market for them at home, and the impracticability of exporting them fresh, the quantity so used is in comparison exceedingly small. (See answers to questions relative to food fishes of the United States pages 4-44.)

In concluding these notes on the Columbia River, I will say that in pursuance of my instructions to look up a suitable point for hatching the Columbia River salmon artificially, I made careful inquiries and at last found a place which appears to be in every way suited to the purpose. It is at Klackamas Falls, about 26 miles up the Klackamas River, where both the *Salmo ginnat* and the *Salmo truncatus* can be captured at their respective spawning seasons in vast quantities. Should the United States Fish Commission ever decide to carry on salmon hatching operations on the Columbia, I think it can be done here with distinguished success.

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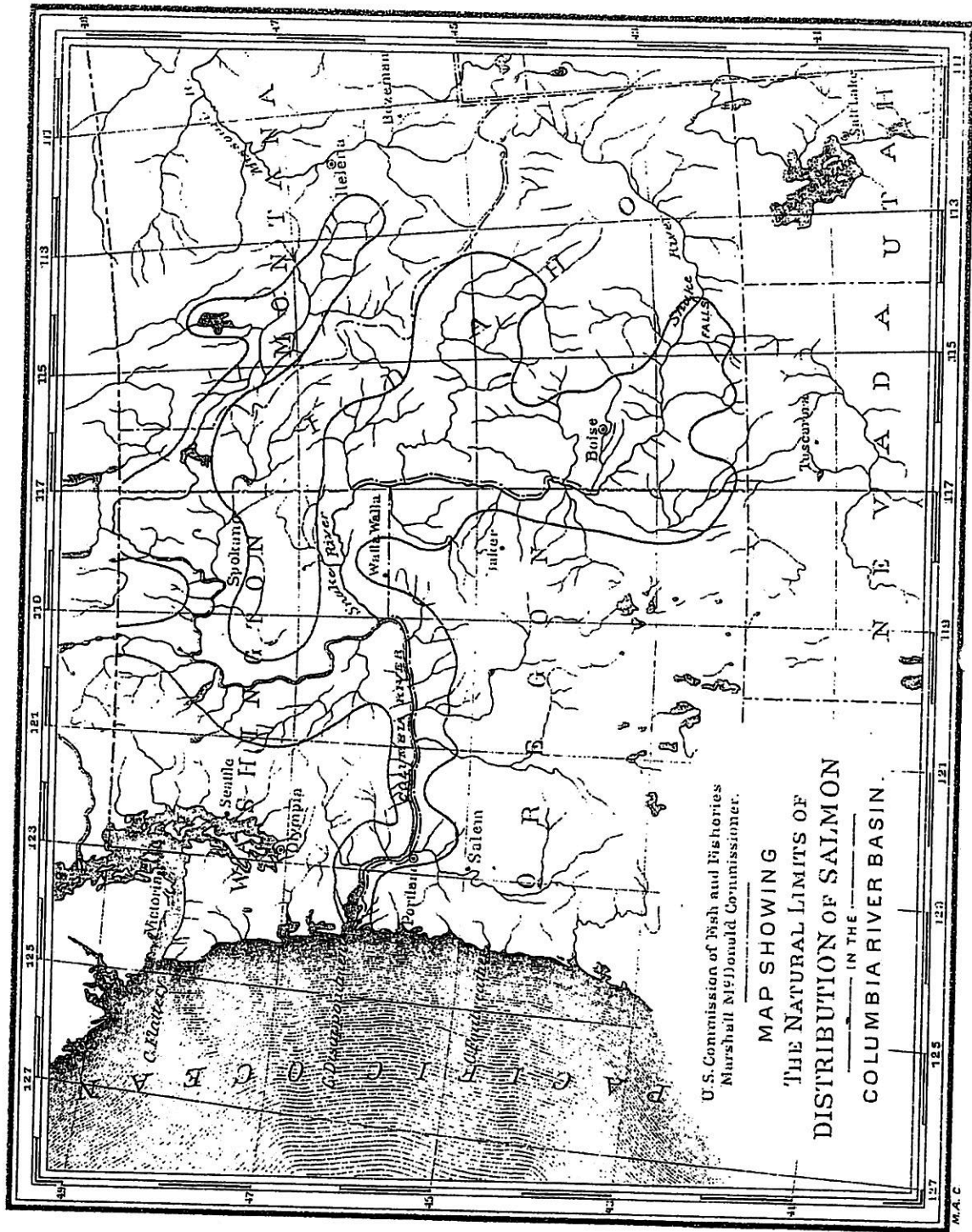
INVESTIGATIONS IN THE COLUMBIA RIVER BASIN

IN REGARD TO

THE SALMON FISHERIES.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1894.

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THE SALMON FISHERIES OF THE COLUMBIA RIVER BASIN.

By MARSHALL McDONALD,
United States Commissioner of Fish and Fisheries.

U. S. COMMISSION OF FISH AND FISHERIES,
Washington, D. C., May 31, 1894.

Hon. ADLAI E. STEVENSON,
President of the Senate:

SIR: In compliance with instructions conveyed in the provisions of the Sundry Civil Bill, which became a law August 5, 1892, I have the honor to submit a report of investigations in the Columbia River Basin.

The first of the provisions above referred to authorized the expenditure from the appropriation for inquiry respecting food-fishes of \$2,000, or so much thereof as may be necessary, "In examining the Clarke's Fork of the Columbia River, with the view to ascertain the obstructions which prevent the ascent of salmon up said river to the Flathead Lake and adjacent waters."

The second provision directed an investigation and report respecting the advisability of establishing a fish-hatching station at some suitable point in the State of Washington, and appropriated for the same "\$1,000, or as much thereof as may be necessary."

It was not known whether the failure of the salmon to enter the Clarke Fork of the Columbia was due to natural obstructions preventing their ascent, or was to be attributed to the extensive fishing operations prosecuted in the Lower Columbia, or possibly to other causes to be disclosed by the proposed investigation. Again, the location of the hatchery proposed for the State of Washington would be necessarily determined by our ability to secure an adequate supply of spawning salmon within convenient distance of the hatchery.

It appearing probable that the methods of the large fisheries pursued in the Lower Columbia, if permitted to continue, would effectually intercept the run of salmon to the headwaters, and thus defeat the object for which the hatchery is proposed, it was thought proper and expedient to institute a general investigation covering the entire Columbia River Basin, and if conditions were disclosed threatening disaster to these valuable and productive fisheries, to bring the matter to the attention of Congress and the States interested in their prosperity.

The direction of the field investigation was intrusted to Prof. B. W. Evermann, assistant in the Division of Inquiry Respecting Food-Fishes, whose report is appended to and constitutes an integral part of the report of the Commissioner of Fisheries.



A very complete statistical investigation into the history, methods, apparatus, present conditions, product, and annual value of the salmon fisheries of the Columbia has also been made by Mr. W. A. Wilcox, under the direction of Dr. H. M. Smith, assistant in charge of the Division of Statistics and Methods of the Fisheries, the results of which are embodied and discussed in the report which is herewith respectfully submitted.

CONDITIONS DETERMINING THE SALMON PRODUCTION OF A RIVER BASIN.

There are fundamental conditions determining the salmon production of a river basin and the nature and extent of the fisheries which may be maintained without overtaxing the productive capacity of the river. All the species of salmon which are the object of the fisheries are alike under the constraint of a natural law, which compels them to enter the fresh waters for the purpose of spawning. Some species ascend to a relatively short distance above tide water. Others, like the chinook, push their migrations to the remotest sources of the rivers and tributary streams when not prevented by natural or artificial obstructions. Where the area of distribution is contracted by the erection of barriers, dams, or other obstructions which the salmon can not surmount, the production of the river is diminished *pro tanto*, for the reason that the young salmon remain for some months in the waters in which they are hatched—they must here find their food—and consequently the extent of the feeding-grounds open to them will be the measure of nature's ability to repair the waste occasioned by natural casualties and the fishing operations. If there be no contraction of the breeding area by artificial obstructions, but, on the other hand, the times, methods, and apparatus of the fisheries are such as to intercept or in a large measure prevent the run of salmon into and up the rivers, then a serious decline in the fisheries is inevitable.

It is possible by fish-cultural operations pursued on an adequate scale, by hatching and planting the fry in the head waters of the Columbia and its tributary streams, to realize the full productive capacity of the river, so long as eggs can be obtained in sufficient numbers to furnish a basis for the extensive operations required. This would not be possible, however, if the fishing operations in the lower river practically excluded the salmon from the streams to which it would be necessary to have recourse to obtain a supply of eggs. It is evident, therefore, that fish-cultural operations can not be relied upon exclusively or chiefly to maintain the salmon supply in the Columbia. The regulation of the times, methods, and apparatus of the fisheries should be such as to assure the largest opportunity practicable for reproduction under natural conditions. Artificial propagation should be invoked as an aid and not as a substitute for reproduction under natural conditions.

THE LIMITS OF MIGRATION OF SALMON.

The limits of migration of salmon in the Columbia River basin, as determined by impassable falls in the larger tributaries of the Columbia and their affluents, is shown in the accompanying chart, there being no serious obstructions existing in the main river within the limits of the United States.

The area of distribution is approximately 90,000 square miles. This immense tract is drained by innumerable streams of clear cold water, into which the salmon enter for the purpose of spawning and up which they ascend till their progress is stopped

by falls or other obstructions which they cannot surmount. These waters furnish the feeding-grounds of the young salmon during their early life, which is spent in the fresh waters. Their migration seaward does not begin until they are at least a year old and have attained a length of from 8 to 10 inches. These streams are the nurseries of the great salmon fisheries of the lower Columbia. From each goes out every year a colony, more or less numerous, to swell the aggregate of young salmon necessary to repair the waste by natural casualty and by capture.

The area of natural distribution has not as yet been very materially abridged. Certain streams, such as the Bruneau and the Boise, have been obstructed by dams near their mouths, but the vast extent of waters still accessible to salmon and affording suitable breeding and feeding grounds, indicates that we must look to other causes to explain any ascertained deterioration in the salmon fisheries of the Columbia.

DECREASE OF SALMON IN THE HEAD WATERS OF THE COLUMBIA RIVER.

The investigations made by Prof. Evermann and the parties under his direction establish conclusively the fact that there has been a very great reduction in the number of salmon frequenting the head waters of the Columbia River and its tributaries. This decrease is more notable in the main river. In the early history of the fishery salmon were found in the head waters in marvelous abundance. According to the information obtained by Prof. Evermann:

They were abundant in the Columbia River at Kettle Falls as late as 1878. Since then there has been a great decrease. They have been scarce since 1882. Since 1890 there have been scarcely any at Kettle Falls. The Meyers Brothers say that they have been almost unable to buy any salmon for their own table from the Indians for three years. Certain Indians with whom we talked at Kettle Falls said salmon were once very abundant there, but that very few are seen now. Other persons testified to the same effect. Essentially the same information was obtained regarding the decrease of salmon in other parts of the upper tributaries of the Columbia, viz: at Spokane, in both the Big and Little Spokane rivers, and in the Snake River and its various tributaries.

Dr. O. P. Jenkins, an assistant of Prof. Evermann, makes the following report in reference to the Yakima River, Washington:

The Yakima is the main stream of the valley. It receives many tributaries, the main ones being Manistash and Wilson creeks. The river near the city (Ellensburg) is 160 feet wide, by an average of 10 feet deep, and flows with a velocity of 1 foot per second. Temperature at 9:15 a. m., August 24, 1893, 60° F.; water clear. Those acquainted with the facts state that formerly, up to about 1885, salmon of three or four kinds, including the chinook, ran up the stream to this valley and spawned in the river in great numbers; at present very few make their appearance.

There is no reason to doubt—indeed, the fact is beyond question—that the number of salmon now reaching the head waters of streams in the Columbia River basin is insignificant in comparison with the number which some years ago annually visited and spawned in these waters. It is further apparent that this decrease is not to be attributed either to the contraction of the area accessible to them or to changed conditions in the waters which would deter the salmon from entering them. We must look to the great commercial fisheries prosecuted in the lower river for an explanation of this decrease, which portends inevitable disaster to these fisheries if the conditions which have brought it about are permitted to continue.

The relations of the decreased number of salmon in the head waters to the development of the commercial fisheries is brought out in a very instructive way by an analysis of the following table:

INVESTIGATIONS IN THE COLUMBIA RIVER BASIN.

Summary of the salmon-canning industry of the Columbia River from its origin to the present time.

Year.	Gross weight of salmon utilized.	Number of cases packed.	Value.	Average value per case.	Year.	Gross weight of salmon utilized.	Number of cases packed.	Value.	Average value per case.
	<i>Pounds.</i>					<i>Pounds.</i>			
1866.....	260,000	4,000	\$64,000	\$16.00	1881.....	35,750,000	550,000	\$2,475,000	\$4.50
1867.....	1,170,000	18,000	288,000	16.00	1882.....	25,184,500	541,300	2,800,000	5.19
1868.....	1,320,000	28,000	392,000	14.00	1883.....	40,911,000	829,400	2,147,000	5.30
1869.....	6,500,000	100,000	1,350,000	13.50	1884.....	40,300,000	620,000	2,915,000	4.71
1870.....	9,750,000	150,000	1,800,000	12.00	1885.....	35,907,000	553,300	2,500,000	4.51
1871.....	13,000,000	200,000	2,100,000	10.50	1886.....	39,152,000	448,300	2,135,000	4.76
1872.....	16,250,000	250,000	2,325,000	9.30	1887.....	22,140,000	358,000	2,124,000	5.97
1873.....	16,250,000	250,000	2,250,000	9.00	1888.....	24,211,005	372,477	1,809,820	5.34
1874.....	22,750,000	350,000	2,825,000	7.50	1889.....	20,685,495	309,885	2,240,854	5.82
1875.....	24,375,000	375,000	2,250,000	6.00	1890.....	28,781,385	455,774	2,407,984	5.30
1876.....	20,250,000	450,000	2,475,000	5.50	1891.....	26,450,635	208,963	2,240,384	5.30
1877.....	24,700,000	380,000	2,052,000	5.40	1892.....	22,185,995	487,348	2,373,000	5.30
1878.....	20,300,000	460,000	2,300,000	5.00	1893.....	24,050,000	370,000	2,107,500	5.35
1879.....	31,200,000	480,000	2,640,000	5.50	Total.....	658,424,515	10,098,427	50,020,790	5.35
1880.....	34,450,000	530,000	2,850,000	5.00					

Canning operations on the Columbia River began in 1866, when 4,000 cases were packed and sold at an average of \$16 per case. As early as 1872 the total pack reached 250,000 cases, the price per case having declined to \$9. Each succeeding year operations were extended and reached their culmination in 1883 and 1884, when upwards of 600,000 cases were packed each season. From this time on the catch declined, having reached its lowest point in 1889, the number of cases packed that season being 309,885, or less than half the number of cases packed in 1883 and 1884.

Up to 1888, practically the entire pack consisted of the king or chinook salmon, and the fishing season did not extend beyond the first of August. In 1889 the packers began canning bluebacks and steelheads to make up the deficiency in the supply, and extended their operations to the first of September.

DETAILED STATISTICS OF THE SALMON INDUSTRY OF THE COLUMBIA RIVER, 1889-92.

The following series of tables shows, in some detail, the extent of the salmon fishery and canning industry of the Columbia River during the years 1889 to 1892, inclusive, as determined by the inquiries conducted by this Commission.

The number of fishermen and shore employes connected with the salmon industry in each of the years named is indicated in Table A:

A.—Table showing the number of persons employed in the salmon industry of the Columbia River from 1889 to 1892.

How engaged.	1889.	1890.	1891.	1892.
Oregon:				
Fishermen.....	1,606	1,648	1,929	2,064
Shoreshmen and cannery employes.....	870	1,028	1,057	1,100
Total.....	2,476	2,712	2,986	3,164
Washington:				
Fishermen.....	1,535	1,510	1,575	1,677
Shoreshmen and cannery employes.....	594	602	654	704
Total.....	2,129	2,112	2,229	2,381
Total for river:				
Fishermen.....	3,141	3,194	3,504	3,741
Shoreshmen and cannery employes.....	1,464	1,630	1,711	1,804
Total.....	4,605	4,824	5,215	5,545