PART XIII.

THE SALMON FISHING AND CANNING INTERESTS OF THE PACIFIC COAST.

By DAVID STARR JORDAN and CHARLES H. GILBERT.

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1.—THE SALMON FISHERIES OF CALIFORNIA AND OF OREGON SOUTH OF THE COLUMBIA RIVER.

1. THE SACRAMENTO RIVER.

FISHING TOWNS.

VALLEJO.—The regular salmon fishermen rarely come down the Sacramento as far as Vallejo, but there are three salmon-traps in the river at this point. There are also one or two fishermen catching sturgeon (*Acipenser transmontanus*) with hook and line.

The traps do not pay at present, the salmon in the river having decreased in number since they were first introduced.

A fisherman at Vallejo, Mr. A. Fürst, claims to have introduced the first trap pound-net in San Francisco Bay in 1861. It was of the same shape as those in use at present, and was, he says, modeled after one formerly used for catching whitefish in Lake Erie.

A long "leader" runs from the shore to the opening in a heart-shaped inclosure, which, in turn, leads into the trap proper. Pound-nets in the Sacramento never paid, even when fishing was at its best. The expense of keeping them up is too great. In the fall, when water is low in the river, the water becomes salt at Vallejo and barnacles entirely cover the meshes of the nets.

Mr. Fürst has been on the Sacramento since 1852, and thinks that salmon are not nearly so abundant in the river as formerly. He thinks that all kinds of fish are becoming scarcer in the neighborhood of San Francisco, and that even out at the Farallones, fishermen have to put out five times as many lines to load a boat as they formerly did. He states that prior to 1866 the fishing in the bay and on the river used to be very good. Men used to go out and make sometimes as high as $100 a night in herring fishing. Since 1866, fishing has fallen off very fast. Pound-nets now cannot catch one-tenth of what they used to do. He is greatly impressed with the destructiveness of seals and sea-lions. They run up the river and take the salmon from the gill-nets, leaving nothing but the heads. He has even seen seals go into a trap and take fish out.

The incoming run of salmon is first met by the fishermen near the mouth of the river. During the last of the season they can be caught as high up the river as nets can be worked.

SAN PABLO.—No fishermen work in the vicinity of San Pablo, but there are six or seven Chinese companies on the bay southwest of San Pablo engaged in the shrimp business, the methods being precisely like those employed by the Chinese colonies about San Francisco.

COLLINSVILLE AND BLACK DIAMOND.—In the year 1880 there were about 225 boats engaged in salmon fishing on the Lower Sacramento, each boat with a crew of two men. Most of the men are Italian, some are from the southern part of Austria, and a few are Greeks. On account of the nature of their work, most of them live on scows, which they tow from one part of the river to another, following the salmon in their migrations. The majority of the fishermen are unmarried. Those who have families generally live on shore; a few, however have large scows of two or more rooms and take their families with them up and down the river. During the season when few salmon are caught and the canneries are not running, many of the fishermen go down the river to Martinez and Benicia, but when the open season comes on, the most of them cluster around Black Diamond and Collinsville, where the canneries are.

OUTFIT.

A good outfit for salmon fishing is worth from $700 to $1,000. It consists of a scow, a sail boat, and a gill-net. These, of course, vary in price, but on an average the scow is worth $250, the boat $250, and the net $300. The men make their own nets. They are single thickness gill-nets, which drift down stream, catching the salmon as they run up. They are from 200 to 300 fathoms long, from 6 to 9 fathoms deep, and with an average mesh of 8⅜ inches (measured mesh is diagonally across when stretched).

Nearly all the boats are made in San Francisco. They are sharp at bow and stern, sloop-rigged, with a center-board, and probably average from two to three tons.

The scows are variable in shape and appearance. They are flat-bottomed, with vertical parallel sides narrowed and slanting somewhat towards each end. They are boarded over above and are nearly covered by the house, only a narrow margin being left around the sides. The house generally has but one room, with a door at one end and two windows on each side. It is flat-roofed. Probably an average sized scow would be 20 feet long and 12 feet wide, the house about 7 feet high and occupying all of the scow but a strip about 18 inches wide on each side and 2 feet wide at each end. Some of the fishermen, on account of poverty or other reasons, own no scows, but live on shore and fish always in the same locality. Of course these are placed at a disadvantage by not being able to follow the run of salmon.

METHODS OF FISHING.

Fishing is always done on the ebb tide, whether it be day or night. Two men always work together. They go out to their fishing-grounds, which are chosen chiefly by a clear channel, and the net is placed in the water, one man working the boat and the other paying out the net. Everything is governed by laws which the fishermen have made for themselves. Each of the two men has his own part in the work. It is always the same one who rows while the other manages the net. The two then rest in their boat, boat and net floating down together until they have gone far enough, when the net is taken out, and the fish removed. The distance they float of course varies with the grounds and the season.

According to a law among the fishermen, a second net is not to be placed in the water until the first one has floated down a certain distance, and although the fish are all caught running up stream the second, third, and even fourth net frequently catches more than the first. They generally begin fishing at about half ebb tide.

DISPOSITION OF FISH.

The salmon caught are either shipped to the San Francisco markets, sold to the canneries, or salted and smoked.

There are two great "runs" of salmon during the year. The first one begins about the middle of April, the second about the middle of August, and they last about forty days each. The canneries usually begin about the 15th of April and run until the 1st of August, when the "close season" begins. They begin again September 15, when the fishermen are allowed to commence fishing, when they run as long as the supply of fish will warrant, which is generally from three to four weeks. During the canning season each boat is expected to catch from twenty to one hundred fish daily, and sometimes they exceed this. From the end of the canning season the salmon continually grow scarcer through the winter, until, in January and February, the boats scarcely average one fish a day. The salmon average 15 to 20 pounds each.

While the canneries are not running all the salmon caught are shipped to the San Francisco markets. They are shipped exclusively on the river steamers. Each regular shipping place has a small building on the wharf for the reception of the fish. They are each marked with the owner's private mark, usually an eye gouged out, the snout cut off, or a cut of some particular shape on the gill covers. From 1 to 2 cents per salmon is charged for wharfage, and from 5 to 8 cents each for transportation.

During the canning season each boat is allowed to ship only 40 fish a week to the San Francisco markets. This is to prevent the market from being overstocked and is a law the fishermen have imposed on themselves. The remainder of the fish caught are sold, at a price fixed during the season, to the canneries, providing that the canneries and fisherman can agree on a price and that more fish are not caught than the canneries can put up.

When the canneries refuse to accept all the salmon caught, the fishermen preserve the surplus by salting or by salting and smoking. It is also asserted that much fishing is done during the "close season," and the fish cured. This curing is done exclusively by the fishermen themselves.

The fish are salted in metal tanks about 8 feet in diameter and 5 feet deep. One of these will hold about 500 salmon at a time. The process of salting and preparing for shipment takes about two weeks. They are usually packed in half-barrels for shipment, but Mr. William Hosking, of Collinsville, states that he has shipped them in tierces to London, and that after having twice crossed the tropics they arrived at their destination in good order. Salted salmon are extremely variable in price, but probably average 20 cents each.

In smoking salmon the salted fish are carefully washed and scrubbed, then dried for a day and hung up in a smoke-house in which is kept up a slow fire, usually of oak wood. It takes about a week to smoke salmon, and they find a ready sale at 40 cents per head.

SALMON CANNING ON THE LOWER SACRAMENTO IN 1880.

The salmon pack has been heavy on the Sacramento this year. There have been ten canneries at work, four in San Francisco, one at Benicia, three in the vicinity of Collinsville, one at Courtland, and one at Sacramento. Those in San Francisco and the one at Benicia pack other goods as well as fish.

Those packing in San Francisco had their fish shipped down the river by steamer or schooner, and the salmon were often old and unfit for canning before they were delivered. This was particularly true towards the last of the season, when the fish could only be caught well up the river. At this time the salmon brought in to be canned were in such condition that I think they could hardly be wholesome food, and with such an article placed on the market it is no wonder that the Sacramento fish bear an indifferent reputation.

The spring run was fairly good, and was remarkable for its unevenness and the length of time it lasted. The fish seemed to come up in a succession of schools, and while usually the run

becomes so slack in July that the canneries do not run at all, this year some of them ran along until the commencement of the close season. Much dissatisfaction is expressed concerning the time chosen for close season. It is claimed: (1) That it is at the time of the heaviest run, which is almost over by the time the river is again open; (2) that it is not at all observed, because, although the fishermen cannot sell to the canneries, they can and do salt a great quantity.

Usually for the first week or ten days after September 15, the fish run well, and the canneries can readily get all they can put up. At the first of this year's fall season, so many were caught and shipped to San Francisco in one day that the market was completely flooded. Part of them was sold by the steamboat company to pay freight charges, and the remainder, amounting to several thousand fish, was thrown into the bay. The fall run soon becomes light, and all the canneries had stopped work this year by October 15; those on the river stopping about October 1.

There were no difficulties between the fishermen and canners this year. The catch was good and the market more extensive than usual, owing to increased number of canneries at work. During the spring season all the fish caught found a ready sale at 30 cents and 35 cents each. In the fall the price fell to 25 cents. At Collinsville, October 10, most of the boats had stopped work. A boat then averaged about five salmon in one drift (one night), and the fish sold at the wharf for about 45 cents each. The fall salmon average larger than the spring fish, and are lighter in color.

The exact figures for this year's canning cannot be ascertained before the stock is disposed of. As there is a considerable amount yet on the market, it is with reluctance that the firms will give any figures, and it is possible that in some cases the amount canned is over or under estimated.

The Sacramento River salmon average four to each case, being one-fourth smaller than the same species in the Columbia River.

*Estimated pack of the Sacramento River canneries during season of 1880.**

[As reported by the canneries to C. H. Gilbert; some of the estimates probably too high.]

	Cases.
Emerson & Corville (San Francisco)	12,500
C. J. King (San Francisco)	7,300
J. Lask & Co. (San Francisco)	9,950
Cutting Packing Company (San Francisco)	12,500
Sacramento River Packing Company (two canneries)	18,686
Bradford & Co	8,525
Benicia Packing Company	5,512
Taylor & McDowell	1,685
Washington Cannery Company	3,689
Total	80,387

SALMON SALTED ON SACRAMENTO RIVER FOR 1880.

The amount of salmon salted during the fishing season is small. It is only when the run is very heavy and more fish are caught than are needed to supply the market, that the surplus is salted down. Most of the fish salted on the Sacramento River are put up by the fishermen during the close season. They then have their tanks hidden in the tules and put up great quantities.

* The estimate made by the fish commissioners of California is 62,000 cases canned on the Sacramento in 1880. The number of salmon sent fresh to the markets of San Francisco is estimated by the California fish commission as 188,296 or about 2,000,000 pounds. (Rept. Cal. Fish Comm., 1880.)

Of course when the work is done in this secret manner, no very close estimate can be made. The estimate given here is furnished by Mr. Silvestri, who has, to that end, corresponded with the principal salters on the river. The quantity of salmon salted during the fall of 1880 was 33,000 fish, averaging 12 pounds each.

STATISTICS OF SALMON INDUSTRY FOR CONTRA COSTA AND MARIN COUNTIES.

Fishermen:	
American	5
Chinese	25
Italian	345
Greek	25
German	100
Total	500
Number of boats	230
Amount of capital invested in boats	$60,000
Number of pounds of fish taken, including those canned and salted	10,000,000
Value of fish taken	$170,000

STATISTICS OF TOTAL CATCH OF SALMON FROM 1875 TO 1880.

The following figures have been obtained by the State commission of California, as the total number of pounds of salmon taken in the Sacramento River for the six years ending August 1, 1880:

1875 (August 1, 1874, to August 1, 1875)	5,098,781
1876	5,331,423
1877	6,493,563
1878	6,520,768
1879	4,432,250
1880	10,837,400

The increase in the run of 1880 over that of previous years is ascribed by the commissioners to the planting of young salmon in the river.

SALMON FISHING IN THE SACRAMENTO RIVER IN 1872–'73.

The following description of the salmon fisheries of the Sacramento River was prepared by Mr. *Livingstone Stone* in 1872:

"The fishing on the Sacramento is done in three ways: (1) By drift-nets; (2) by fyke-nets; (3) by sweep-seines.

"DRIFT-NET FISHING.—The drift-nets are used exclusively for catching salmon. They have an 8¼-inch mesh, are usually 40 meshes deep, and from 150 to 200 fathoms long. As nearly as I could learn, there were not far from a hundred salmon nets in operation on the Sacramento River in 1872. At the meeting of the salmon fishermen of the Sacramento that year, there were 95 boats represented.

"These nets are worked by simply drifting them with the tide. The salmon, which of course are heading against the tide, are gilled in the meshes. The turn of the tide is the most favorable time for this sort of fishing.

"The nets are frequently drifted a mile before being hauled in. The salmon-fishing is conducted entirely by white men, no Chinamen being allowed to participate in it. There is no law

regulating the matter, but public opinion is so strong in relation to it, and there is such a prejudice against the Chinamen, that any attempt on their part to engage in salmon fishing would meet with a summary and probably fatal retaliation.

"The number of fresh salmon shipped from Rio Vista to San Francisco in the year 1872 is as follows:

January	792
February	1,581
March	1,945
April	3,354
May	4,408
June	1,201
July	1,145
August	1,496
September	2,335
October	583
November	441
December	390
Total	19,671

"On one day in February, when I came down the river, there were put on board the steamer, at Courtland, 7 fresh salmon; at Rio Vista, 32 fresh salmon; at Sherman Island, 32 fresh salmon; at Collinsville, 123 fresh salmon.

"The daily number of fresh fish (salmon and sturgeon) brought down the Sacramento River to San Francisco in 1872 by the steamers of the Central Pacific Railroad Company is as follows:

Date.	Fish.	Date.	Fish.	Date.	Fish.	Date.	Fish.	Date.	Fish.	Date.	Fish.
January 1	87	February 1	326	March 1	247	April 1	243	May 1	1,485	June 1	536
2	97	2	174	2	199	2	57	2	1,758	2	.....
3	105	3	287	3	402	3	198	3	1,342	3	403
4	182	4	157	4	402	4	439	4	560	4	207
5	111	5	324	5	404	5	4,711	5	.....	5	229
6	115	6	250	6	401	6	114	6	909	6	174
7	133	7	337	7	1,030	7	.....	7	1,487	7	157
8	125	8	393	8	344	8	428	8	1,298	8	75
9	113	9	334	9	139	9	372	9	1,361	9	.....
10	109	10	262	10	334	10	416	10	1,046	10	175
11	211	11	415	11	272	11	599	11	482	11	220
12	224	12	296	12	356	12	578	12	.....	12	300
13	243	13	280	13	316	13	310	13	431	13	357
14	112	14	228	14	135	14	.....	14	578	14	348
15	166	15	253	15	447	15	589	15	689	15	210
16	234	16	432	16	283	16	960	16	1,216	16	.....
17	308	17	247	17	419	17	863	17	1,668	17	564
18	214	18	259	18	255	18	879	18	712	18	307
19	172	19	348	19	501	19	643	19	.....	19	306
20	302	20	408	20	425	20	581	20	694	20	158
21	73	21	285	21	452	21	.....	21	929	21	41
22	294	22	389	22	106	22	693	22	899	22	38
23	210	23	249	23	516	23	905	23	859	23	.....
24	221	24	223	24	396	24	827	24	950	24	89
25	216	25	334	25	192	25	1,123	25	637	25	167
26	267	26	376	26	253	26	835	26	.....	26	189
27	112	27	292	27	244	27	435	27	960	27	162
28	46	28	395	28	242	28	.....	28	1,198	28	160
29	76	29	272	29	384	29	1,014	29	1,297	29	190
30	301			30	344	30	990	30	1,242		
31	141			31	378			31	609		
Total	5,514	Total	5,779	Total	11,394	Total	15,612	Total	27,395	Total	5,661

Date.	Fish.	Date.	Fish.	Date.	Fish.	Date.	Fish.	Date.	Fish.	Date.	Fish.
July 1	268	August 1	554	September 1		October 1	189	November 1	40	December 1	
2	43	2	177	2	636	2	253	2	33	2	136
3	134	3	72	3	831	3	462	3		3	68
4	81	4		4	1,269	4	136	4	82	4	246
5	73	5	360	5	1,170	5	67	5	69	5	213
6	38	6	747	6	512	6		6	111	6	128
7		7	632	7	215	7	143	7	122	7	113
8	249	8	558	8		8	160	8	167	8	
9	202	9	573	9	708	9	148	9	43	9	234
10	214	10	150	10	636	10	218	10		10	248
11	260	11		11	412	11	85	11	91	11	234
12	177	12	105	12	512	12	74	12	67	12	283
13	75	13	661	13	331	13		13	123	13	123
14		14	297	14	258	14	95	14	147	14	151
15	103	15	1,014	15		15	81	15	81	15	
16	140	16	708	16	896	16	112	16	98	16	116
17	281	17	186	17	780	17	118	17		17	164
18	276	18		18	1,112	18	22	18	87	18	226
19	181	19	1,041	19	1,042	19	70	19	112	19	204
20	175	20	1,205	20	461	20		20	167	20	74
21		21	1,567	21	261	21	75	21	157	21	64
22	363	22	1,499	22		22	87	22	70	22	
23	330	23	1,061	23	567	23	122	23	50	23	88
24	337	24	165	24	563	24	114	24		24	62
25	323	25		25	395	25	52	25	53	25	93
26	353	26	427	26	303	26	50	26	58	26	127
27	270	27	243	27	225	27		27	118	27	100
28		28	341	28	154	28	62	28	78	28	75
29	520	29	591	29		29	18	29	51	29	
30	228	30	304	30	203	30	2	30	92	30	100
31	345	31	240			31	69			31	70
Total	*5,048*	*Total*	*15,677*	*Total*	*14,706*	*Total*	*3,682*	*Total*	*2,367*	*Total*	*3,716*

"The proportion of sturgeon and salmon in the shipments of the various months is estimated by the San Francisco market-men as follows:

"January, 10 per cent. salmon, 90 per cent. sturgeon. February, 10 per cent. salmon, 90 per cent. sturgeon. March, 50 per cent. salmon, 50 per cent. sturgeon. April, mostly salmon. May, all salmon. June, all salmon. July, all salmon. August, all salmon. September, all salmon. October, 50 per cent. salmon, 50 per cent. sturgeon. November, 50 per cent. salmon, 50 per cent. sturgeon. December, 10 per cent. salmon, 90 per cent. sturgeon.

"Besides the salmon above mentioned, a large number are taken by sailing vessels and by the opposition line of steamers and other conveyances to San Francisco and the larger towns.

"The points from which salmon are shipped on the river steamers are Sacramento City, Courtland, Emmatown, Rio Vista, Collinsville, Antioch, Benicia, Martinez.

"In the spring of 1872 about 25,000 salted salmon came from the Sacramento River to San Francisco, and in the fall of the same year about 9,000. The Rio Vista salmon fishermen recommend the prohibition of fishing from June 1 to October 1, or from June 15 to October 15.

"FYKE-NET FISHING.—The fyke-nets have a mesh of 2¼ inches. There were in the winter of 1872–73 eighty-five fyke-nets on the Sacramento at Rio Vista. They are stationary, of course, and are examined every twenty-four hours. All the kinds of fish that are found in the river are caught in these nets. Mr. John D. Ingersoll, a prominent fyke fisherman of Rio Vista, informed me that the daily catch for twenty nets is now about 75 pounds of fish.

"They include chubs, herring, perch, viviparous perch, sturgeons, hardheads, split-tails, Sacramento pike, suckers, crabs. Of these the perch, pike, and sturgeon are the best food-fishes, though all of the species named are sold in the market.

"There has been a vast decrease in the returns of the fyke-nets during the last twenty years. In 1852 and 1853 they used to catch 700 or 800 pounds a day in one fyke-net. An average of 250 pounds a day for one net at Sacramento City was usually expected in those times. The present catch of 75 pounds a day in twenty nets certainly presents an alarming contrast. The fyke-net fishing is conducted wholly by white men, I believe, the Chinese fishermen being ruled out by force of public sentiment. The fyke-nets are usually visited early in the morning of each day, and the catch is sent down to San Francisco by the noon boat. The fyke-net fishing begins in November and is continued till May. The best fishing is when a rise in the water drives the fish inshore, where the fyke-nets are placed. During the summer months the water is warmer, the fish are poor, and the fishing is discontinued.

"On the 27th of February, 1873, I went the rounds of Mr. Ingersoll's set of fyke-nets with him. We visited twenty nets, but as some of them had not been examined for over twenty-four hours, the yield was supposed to be equivalent to one day's fishing for thirty nets. The nets had four hoops each and 14-foot wings. We took out about 120 pounds of fish in all. Hardheads were the most numerous, and the Sacramento pike next. Mr. Ingersoll said that perch used to rank second in abundance in fyke-net fishing, the average for thirty nets being 200 or 300 pounds a day, but the perch were quite insignificant in numbers on this day. We found in the nets seven small viviparous perch and two small sturgeon. I learned also that mink, beaver, and otters are sometimes caught in the nets. In 1872 Mr. Ingersoll caught 8 minks, 2 beavers, and 1 otter in his fyke-nets.

"SWEEP-SEINE FISHING.—The sweep-seine fishing is given over to the Chinese, who are not allowed by public sentiment to engage in either of the other two kinds of fishing just described, but what they are not permitted to do by the prohibited methods they make ample amends for by their own methods. They are, I should say, the most industrious and persistent fishermen on the river. They fish all the year round. They use fine mesh-nets, with which they sweep every part of the river, especially the partially-stagnant fresh-water lagoons, or sloughs, as they are called in California, where the fish collect in myriads to spawn. With these nets they catch vast quantities of fish of all sizes, and so destructive has their fishing been on the Sacramento, that all the fish of that river except salmon are disappearing with unexampled rapidity.

"It is owing to this kind of fishing that the returns of the fyke-nets have diminished so alarmingly the last few years. The Chinese have been at it for seven or eight years, and if they keep on three or four years more at this rate, the small fish of the Sacramento will be practically exterminated. I had no means of ascertaining with any exactness how many Chinese fishermen there were on the river, but there are a large number, and Mr. Ingersoll said that they were increasing every year. The most of their fresh fish they send to the San Francisco Chinese markets as soon as caught, but they also dry a great quantity of them on bars and floors prepared for the purpose. These are both eaten by themselves and sent packed in barrels to the Chinese quarter in San Francisco. While at Rio Nita in February, 1873, I visited a Chinese fishing-station on the Sacramento River. It was located about 80 rods above the Rio Nita steamboat-landing, and consisted of a nest of Chinese fishing-boats numbering seven small boats and three large ones. There was also on the shore, just across the road, two old tumble-down buildings with drying-bars and floors near by in the open air, where some of the fishermen lived and attended to the drying of the fish. The small boats were small, flat bottomed dories, square at the stern, sharp at the bow, about 15 feet long, and strongly built.

"The large boats were also strongly built, but narrow and pointed at both ends, and constructed in the Chinese fashion. Two of the three large boats had one mast, and the other one

had two masts, considerably raking, with Chinese sails, which were not like anything used in this country for sails. Nearly amidships, but a little nearer one end than the other, was a tent in which the Chinamen lived. There was also considerable space in the hold of this really Chinese junk, which added a good deal to the house-room.

"The whole air and look of these crafts was decidedly foreign, and I might say oriental.

"If I understand their method rightly, the small boats are to visit the sloughs and various fishing points when they go out to draw the seine, and the larger boats are really only movable dwellings and store-houses, where they live and receive the fish that are brought in by the small boats, and which, of course, they move from place to place on the river as the exigencies of the changing fishing seasons may require."*

2. THE SALMON FISHERIES OF THE EEL AND SMITH RIVERS, CALIFORNIA, THE ROGUE RIVER, OREGON, AND THE ADJOINING SEA-BOARD COUNTIES.

In Eel River there is a fall run of salmon only, composed of *O. ckouicha*† and *O. kisutch*. The cannery usually runs till the last of November. About 6,000 cases were put up in 1880, 1,400 in 1878, and 8,500 in 1877. About $3,400 worth of salted salmon in half-barrels were shipped to San Francisco in 1878. The salmon are not counted at the canneries, but sold by weight, at $20 per ton. The cannery was built in 1877, and belongs to the Cutting Packing Company in San Francisco.

Mr. V. S. Treat, in a letter to Professor Baird, dated Ferndale, Cal., March 3, 1880, refers to the salmon-canning interests of Eel River in the following language:

"Eel River is about 225 miles north of San Francisco, and is a barred river; steamers make the trip from San Francisco in about twenty-four hours; a round trip in seven or eight days.

"A good harbor inside the bar. The river is about 150 miles long and subject to heavy freshets in fall and winter. There is but one cannery on the river, put up in 1877. In 1878, 1,400 cases were put up against 3,500 in 1877, which, at $6 per case, amounted to $6,600. Other shipments of salmon in half-barrels, amounting in all to $100,000. About one hundred and sixty men are employed. The salmon are taken in seines and fine gill-nets of 7-inch mesh. There are two or three kinds of salmon here; several kinds of trout; sturgeon are plenty; perch and smelts are plenty; quahaug, clams, and crabs are found here, though shell-fish are very scarce. Parties here talk of putting in lobsters and shad from Sacramento River this season. Salmon are not counted here, but are sold by the ton, live weight, at $20 per ton."

At Ellensburg, on Rogue River, Oregon, near its mouth, is a salmon cannery, belonging to Mr. R. D. Hume.

In Del Norte County, California, there is no sea-fishing of any importance. The salmon run in considerable numbers in Smith River in the fall, and at the town of Smith River there is a salmon cannery. Its product for 1880 was 7,000 cases. About 500 barrels have also been salted down. The total annual catch outside of salmon probably does not exceed 3,000 pounds.

Rogue River is fed in spring by melting snows from the mountains, and has consequently both a spring and a fall run of salmon. In spring, when the river is high, the water is fresh for a considerable distance beyond the bar.

The fish do their playing outside, and as soon as they reach the mouth of the river, run straight up. At this season they are therefore caught with gill-nets. In fall the water is salt or brackish

* Report U. S. Fish Commission, III, 1874, pp. 382-5.

† We now (1886) prefer the name *O. tschawytscha*.

for a considerable distance up-stream. The fish then enter the river and run up and down with the tides, usually starting up-stream when the first fall rain comes. During the fall they have to be caught with seines. The spring run this year was good, but the fall run promises to be light. *Nine thousand three hundred cases have been put up during the present year.*

A hatchery is in operation on Rogue River, and it is the intention of Mr. Hume, who controls the river, to use every effort to keep it stocked in case the expected falling off in the product of the Columbia River comes to pass.

Canneries have been in operation at Siuslaw and Umpqua Rivers, in Douglas County, but *both are now closed. More or less of salmon are salted on the Umpqua, Siuslaw, and Yaquina* Rivers.

The total catch of the entire coast, outside of fish taken by the Indians, will not vary far from 1,000,000 pounds.

2.—THE SALMON FISHERIES OF THE LOWER COLUMBIA.

1. THE SALMON.

The fishing interests of the Lower Columbia River are entirely concentrated in the canning of salmon. Their importance far exceeds that of all other fishing interests on the Pacific coast combined.

The species making up almost the entire catch on the Columbia River is the quinnat, or king salmon, *Oncorhynchus chouicha*, the chinnook salmon of the Columbia River canners.

This species usually begins running in the Columbia late in March, the principal run being from May to July. The laws of Oregon and Washington forbid the capture of salmon in March, August, and September, and from 6 p. m. on Saturday to 6 p. m. on Sunday.

As taken at the canneries early in the season, the average weight is 22 pounds, or 16 pounds when "dressed." Larger individuals, weighing as high as 70 pounds, are sometimes taken. The largest one seen by the writers weighed 58 pounds. Later in the season many smaller ones are taken, so that the average weight is then much less.

The following pages give in brief all that is known of the life history of the different species of salmon:

There are five species of salmon (*Oncorhynchus*) in the waters of the North Pacific. All of these are widely distributed and all are now known to occur in the waters of Kamchatka as well as in those of Alaska and Oregon. There is at present no trustworthy evidence of the existence of any other species on either the American or the Asiatic side of the ocean.

These species are (1) *Oncorhynchus chouicha*, the quinnat, chinnook or king salmon; (2) *O. nerka*, the blue-back salmon or redfish; (3) *O. kisutch*, the silver salmon; (4) *O. keta*, the dog salmon; (5) *O. gorbuscha*, the humpback salmon.

The different species, non migratory or imperfectly migratory, properly called trout, are excluded from this discussion.

Of these species, the blue-back predominates in Frazer's River, the silver salmon in Puget Sound, the quinnat in the Columbia and the Sacramento, and the silver salmon in most of the small streams along the coast. All the species have been seen by us in the Columbia and in Frazer's River; all but the blue-back in the Sacramento, and all but the blue-back in waters tributary to Puget Sound. Only the quinnat has been noticed south of San Francisco. The blue-back has not yet been noticed from any stream south of the Columbia.

Of these species, the quinnat and blue-back salmon habitually "run" in the spring, the others in the fall. The usual order of running in the rivers is as follows: *nerka*, *chouicha*, *kisutch*, *gorbuscha*, *keta*.

The economic value of the spring running salmon is far greater than that of the other species, because they can be captured in numbers when at their best, while the others are usually taken only after deterioration.

The habits of the salmon in the ocean are very imperfectly known. Quinnat and silver salmon of every size are taken with the seine at almost any season in Puget Sound. The quinnat takes the hook freely in Monterey Bay, both near the shore and at a distance of 6 or 8 miles out. We have reason to believe that these two species do not necessarily seek great depths, but probably remain not very far from the mouth of the rivers in which they were spawned.

The blue-back and the dog salmon probably seek deeper water, as the former is seldom or never taken with the seine in the ocean, and the latter is known to enter the Straits of Fuca at the spawning season.

The great majority of the quinnat salmon and nearly all the blue-back salmon enter the rivers in the spring. The run of both begins generally the last of March; it lasts, with various modifications and interruptions, until the actual spawning season in November; the time of running and the proportionate amount of each of the subordinate runs, vary with each different river. In general, the runs are slack in the summer and increase with the first high water of autumn. By the last of August only straggling blue-backs can be found in the lower course of any stream, but both in the Columbia and the Sacramento the quinnat runs in considerable numbers till October at least. In the Sacramento the run is greatest in the fall, and more run in the summer than in spring. In the Sacramento and the smaller rivers southward, there is a winter run, beginning in December.

The spring salmon ascend only those rivers which are fed by the melting snows from the mountains, and which have sufficient volume to send their waters well out to sea. Such rivers are the Sacramento, Rogue, Klamath, Columbia, and Frazer's Rivers.

Those salmon which run in the spring are chiefly adults (supposed to be at least three years old). Their milt and spawn are no more developed than at the same time in others of the same species, which will not enter the rivers until fall. It would appear that the contact with cold fresh water, when in the ocean, in some way caused them to turn toward it and to "run," before there is any special influence to that end exerted by the development of the organs of generation.

High water on any of these rivers in the spring is always followed by an increased run of salmon. The canners think, and this is probably true, that salmon which would not have run till later, are brought up by the contact with the cold water. The cause of this effect of cold fresh water is not understood. We may call it an instinct of the salmon, which is another way of expressing our ignorance. In general, it seems to be true that in those rivers, and during those years when the spring run is greatest, the fall run is least to be depended on.

As the season advances, smaller and younger salmon of these two species (quinnat and blue-back) enter the rivers to spawn, and in the fall these young specimens are very numerous. We have thus far failed to notice any gradations in size or appearance of these young fish by which their ages could be ascertained. It is, however, probable that some of both sexes reproduce at the age of one year. In Frazer's River, in the fall, quinnat male grilse of every size, from 8 inches upwards, were running, the milt fully developed, but usually not showing the hooked jaws and dark colors of the older males. Females less than 18 inches in length were rare. All large and small, then in the river, of either sex, had the ovaries or milt well developed.

Little blue-backs of every size down to 6 inches are also found in the Upper Columbia in the fall, with their organs of generation fully developed. Nineteen-twentieths of these young fish are males, and some of them have the hooked jaws and red color of the old males; others do not. Some of them apparently have never been to the sea.

The average weight of the quinnat in the Columbia, in the spring, is 22 pounds; in the Sacramento about 16. Individuals weighing from 40 to 60 pounds are frequently found in both rivers, and some as high as 80 pounds are reported. It is questioned whether these large fishes are: (*a*) Those which, of the same age, have grown more rapidly; (*b*) those which are older, but have, for some reason, failed to spawn; or (*c*) those which have survived one or more spawning seasons. All of these origins may be possible in individual cases; we are, however, of the opinion, that the majority of these large fish are those which have hitherto run in the fall and so may have survived the spawning season previous.

Those fish which enter the rivers in the spring continue their ascent until death or the spawning season overtakes them. Probably none of them ever return to the ocean, and a large proportion fail to spawn. They are known to ascend the Sacramento as far as the base of Mount Shasta, or to its extreme headwaters, about 400 miles. In the Columbia they are known to ascend as far as the Bitter Root Mountains, Spokan Falls, and the Falls of Snake River, and their extreme limit is not known. This is a distance of 600 to 1,000 miles.

At these great distances, when the fish have reached the spawning-grounds, besides the usual changes of the breeding season, their bodies are covered with bruises, on which patches of white fungus develop. The fins become mutilated, their eyes are often injured or destroyed, parasitic worms gather in their gills, they become extremely emaciated, their flesh becomes white from the loss of the oil, and as soon as the spawning act is accomplished, and sometimes before, all of them die. The ascent of the Cascades and the Dalles probably causes the injury or death of a great many salmon.

When the salmon enter the river they refuse bait, and their stomachs are always found empty and contracted. In the rivers they do not feed, and when they reach the spawning-grounds their stomachs, pyloric cœca and all, are said to be no larger than one's finger. They will sometimes take the fly, or a hook baited with salmon roe, in the clear waters of the upper tributaries, but there is no other evidence known to us that they feed when there. Only the quinnat and blueback (then called redfish) have been found in the fall at any great distance from the sea.

The spawning season is probably about the same for all the species. It varies for all in different parts of the same river, and doubtless extends from July to December.

The manner of spawning is probably similar for all the species, but we have no data for any except the quinnat. In this species the fish pair off, the male, with tail and snout, excavates a broad shallow "nest" in the gravelly bed of the stream, in rapid water, at a depth of 1 to 4 feet; the female deposits her eggs in it and after the exclusion of the milt they cover them with stones and gravel. They then float down the stream tail foremost. A great majority of them die. In the headwaters of the large streams unquestionably all die. In the small streams, and near the sea, an unknown percentage probably survive. The young hatch in about sixty days, and most of them return to the ocean during the high water of the spring.

The salmon of all kinds in the spring are silvery, spotted or not according to the species, and with the mouth about equally symmetrical in both sexes.

As the spawning season approaches the female loses her silvery color, becomes more slimy, the scales on the back partly sink into the skin, and the flesh changes from salmon red and becomes variously paler, from the loss of the oil; the degree of paleness varying much with individuals and with inhabitants of different rivers.

In the Lower Sacramento the flesh of the quinnat in either spring or fall is rarely pale. In the Columbia, a few with pale flesh are sometimes taken in spring, and a good many in the fall. In Frazer's River the fall run of the quinnat is nearly worthless for canning purposes, because so many are white meated. In the spring very few are white meated, but the number increases towards fall, when there is every variation, some having red streaks running through them, others being red toward the head and pale toward the tail. The red and pale ones cannot be distinguished externally, and the color is dependent neither on age nor sex. There is said to be no difference in the taste, but there is no market for canned salmon not of the conventional orange color.

As the season advances, the differences between the males and females become more and more marked, and keep pace with the development of the milt, as is shown by dissection.

The males have (*a*) the premaxillaries and the tip of the lower jaw more and more prolonged, both of them becoming finally strongly and often extravagantly hooked, so that either they shut by the side of each other like shears, or else the mouth cannot be closed; (*b*) the front teeth become very long and canine-like, their growth proceeding very rapidly, until they are often half an inch long; (*c*) the teeth on the vomer and tongue often disappear; (*d*) the body grows more compressed and deeper at the shoulders, so that a very distinct hump is formed; this is more developed in *O. gorbuscha*, but is found in all; (*e*) the scales disappear, especially on the back, by the growth of spongy skin; (*f*) the color changes from silvery to various shades of black and red or blotchy, according to the species. The blue-back turns rosy-red, the dog salmon a dull, blotchy red, and the quinnat generally blackish. In the case of the blue-back, the flesh grows pale in direct proportion to the external redness.

These distorted males are commonly considered worthless, rejected by the canners and salmon salters, but preserved by the Indians. These changes are due solely to influences connected with the growth of the testes. They are not in any way due to the action of fresh water. They take place at about the same time in the adult males of all species, whether in the ocean or in the rivers. At the time of the spring runs, all are symmetrical. In the fall all males of whatever species are more or less distorted. Among the dog salmon, which run only in the fall, the males are hook-jawed and red-blotched when they first enter the Straits of Fuca from the outside. The hump-back, taken in salt water about Seattle, shows the same peculiarities. The male is slab-sided, hook-billed, and distorted, and is rejected by the canners. No hook-jawed females of any species have been seen.

It is not positively known that any hook-jawed male survives the reproductive act. If any do, their jaws must resume the normal form.

On first entering a stream the salmon swim about as if playing; they always head towards the current, and this "playing" may be simply due to facing the flood tide. Afterwards they enter the deepest parts of the stream and swim straight up, with few interruptions. Their rate of travel in the Sacramento is estimated by Mr. Stone at about 2 miles per day; in the Columbia at about 3 miles per day.

As already stated, the economic value of any species depends in great part on its being a "spring salmon." It is not generally possible to capture salmon of any species in large numbers until they have entered the rivers, and the spring salmon enter the rivers long before the growth of the organs of reproduction has reduced the richness of the flesh. The fall salmon cannot be taken in quantity until their flesh has deteriorated; hence the "dog salmon" is practically almost worthless, except to the Indians, and the hump-back salmon is little better. The silver salmon, with the same breeding habits as the dog salmon, is more valuable, as it is found in Puget Sound

for a considerable time before the fall rains cause the fall runs, and it may be taken in large numbers with seines before the season for entering the rivers. The quinnat salmon, from its great size and abundance, is more valuable than all other fishes on our Pacific coast together. The blue-back, similar in flesh but much smaller and less abundant, is worth much more than the combined value of the three remaining species.

The fall salmon of all species, but especially the dog salmon, ascend streams but a short distance before spawning. They seem to be in great anxiety to find fresh water, and many of them work their way up little brooks only a few inches deep, where they soon perish miserably, floundering about on the stones. Every stream, of whatever kind, has more or less of these fall salmon.

It is the prevailing impression that the salmon have some special instinct which leads them to return to spawn in the same spawning-grounds where they were originally hatched. We fail to find any evidence of this in the case of the Pacific coast salmon, and we do not believe it to be true. It seems more probable that the young salmon, hatched in any river, mostly remain in the ocean within a radius of 20, 30, or 40 miles of its mouth. These, in their movements about in the ocean, may come into contact with the cold waters of their parent rivers, or perhaps of any other river, at a considerable distance from the shore. In the case of the quinnat and the blue-back, their "instinct" leads them to ascend these fresh waters, and in a majority of cases these waters will be those in which the fishes in question were originally spawned. Later in the season the growth of the reproductive organs leads them to approach the shore, and to search for fresh waters, and still the chances are that they may find the original stream. But undoubtedly many fall salmon ascend, or try to ascend, streams in which no salmon was ever hatched.

It is said of the Russian River, and other California rivers, that their mouths in the time of low water in summer generally become entirely closed by sand bars, and that the salmon, in their eagerness to ascend them, frequently fling themselves entirely out of water on the beach. But this does not prove that the salmon are guided by a marvelous geographical instinct which leads them to their parent river. The waters of these rivers soak through these sand bars, and the salmon "instinct," we think, leads them merely to search for fresh waters.

This matter is much in need of further investigation; at present, however, we find no reason to believe that the salmon enter the Rogue River simply because they were spawned there, or that a salmon hatched in the Clackamas River is any the more likely on that account to return to the Clackamas than to go up the Cowlitz or the Des Chutes.

"At the hatchery on Rogue River the fish are stripped, marked, and set free, and every year since the hatchery has been in operation some of the marked fish have been recaught. The young fry are also marked, but none of them have been recaught."

This year the run of silver salmon in Frazer's River was very light, while on Puget Sound the run was said by the Indians to be greater than ever known before. Both these cases may be due to the same cause, the dry summer, low water, and consequent failure of the salmon to find the rivers. The run in the sound is much more irregular than in the large rivers. One year they will abound in one bay and its tributary stream, and hardly be seen in another, while the next year the condition will be reversed. It is evident that often the salmon are swimming about in search of fresh water, and that they will enter the first river they find.

There has been much discussion pro and con among canners as to whether the hooked-jawed fall fish are really different species from the spring salmon, or whether they are merely different states of the same fish. Both views are in a measure true. Two additional species (*keta*, *kisutch*), not found in the spring, make up a large part of the fall run. On the other hand, the same species that form the spring run are also found in the fall, but so transformed that it is not strange that

they are not at once recognized. The idea that each river on any coast has its own peculiar species of salmon is grossly erroneous. The impression, prevalent for a time, that some twenty different species occurred in the Columbia, each with a peculiar time to run and to spawn, is also incorrect. The ability to tell a trout from a young salmon, or to recognize the same fish through all its protean changes, has been vouchsafed to few of those who have written on them. It is fair to say that the account written in 1740 by Steller, the first discoverer of these species, is to this day the most accurate notice of the different species.

The blue-back salmon, as above noticed, runs in the spring with the quinnat. It is a handsomer and more gracefully-formed fish, but much smaller, its average weight being 5 or 6 pounds and rarely exceeding 10. At the canneries four blue-backs are usually counted as one quinnat salmon.

With the salmon, in spring, a large trout is taken (*Salmo gairdneri* Rich), known as the steel-head or steel-head salmon. Its usual weight is about 16 pounds. It has no value to the canner, as its flesh is pale and its bones are not soft when boiled. Most of those seen in spring are spent fish, not yet recuperated from the last spawning season.

2. THE FISHERMEN.

There are about twenty-five hundred men employed in the salmon fishery of the Lower Columbia River, about half of them living in Astoria, the rest in the other canning towns. A discussion of their characteristics and nationality will be found in the chapters on fishermen, in Section IV. Their rate of wages and profits will also be discussed in another section of this report.

3. THE CANNERIES AND THEIR OUTFIT.

The canneries in operation in 1880 are the following:

OREGON.

Astoria.—Astoria Packing Company, Astoria Fishery (A. C. Kinney), John A. Devlin & Co., William Hume, George W. Hume.

Upper Astoria.—Anglo-American Packing Company, Badollet & Co., A. Booth & Co., Fisherman's Packing Company, J. O. Hanthorn & Co., Watson & Baman, West Coast Packing Company, S. D. Adair & Co., James Williams & Co. (Tanzy Point).

Clifton.—Oregon Packing Company (J. W. & V. Cook).

Quinn's.—James Quinn.

Westport.—John West & Co.

Rainier.—Jackson & Myers.

WASHINGTON.

Unity.—Aberdeen Packing Company.

Knappton.—Joseph Hume.

Pillar Rock.—Pillar Rock Packing Company.

Fisherton.—Columbia Canning Company.

Eagle Cliff.—William Hume, Cutting Packing Company.

Eureka.—Eureka Packing Company.

Hapgood's.—Hapgood & Co.

Brookfield.—J. G. Megler & Co.

Cathlamet.—F. M. Warren.

Bay View.—R. D. Hume.

The average running outfit of each cannery is rather more than $30,000. The total amount of capital invested in the canneries is therefore from $900,000 to $1,000,000.

APPARATUS AND METHODS OF CAPTURE.—Each cannery is provided with some forty to fifty boats, which they rent to the fishermen. Very few fishermen—not fifty in all—have their own boats.

These boats are mostly made in San Francisco, but as they can be made in Astoria somewhat more cheaply than they can be bought in San Francisco, some of the canneries are having them made in their own establishments. They can be built in Astoria for $175, without paint or rigging; painted and rigged they are worth about $225. The boats are sloop-rigged, with flat bottom and center-board, and usually without deck. The chief danger which the Columbia River fishermen run is getting into the rough water on the bar. The breakers then turn the boats end over end and a deck would not prevent it.

The salmon are caught chiefly by means of gill-nets, although seines are used by some fishermen in the latter part of the season, when young fish of from 8 to 10 pounds are in the river. The young salmon count the same as the blue-back at the canneries, *i. e.*, four and a half count as one quinnat.

The gill-nets used are mostly made for the canneries by the fishermen. Some of the canneries employ a few fishermen to work for them during the winter, and repair their old nets and knit new ones. The nets average from 200 to 300 fathoms long and from 40 to 45 feet deep; mesh, 8½ inches. It takes about 170 pounds of twine to make a net, the twine worth about $1.10 per pound. Fishermen are paid 20 cents a fathom for knitting nets. The nets are worth about $300 to $400. There are two men and one net to each boat.

As competition between the canneries becomes more close the nets are being yearly increased in length. Formerly the nets were furnished by the fishermen, but now very rarely. The chief reason for this is that the custom of home canneries of taking fish and asking no questions as to how they were obtained led to the stealing of nets, and no fisherman could afford to run the risk of having his net stolen. When a net is cut loose from the buoys and ropes it cannot be identified.

When a fisherman has his own net he seldom "catches a steamboat in it." Fishermen working cannery nets often have them run into by steamers.

Most of the canneries keep an extra supply of nets constantly on hand, so that in the height of the season no boat need lie idle when a net is lost.

The number of boats on the river has been much increased in the last three years. Some firms thought that by doubling the number of boats the profits would be correspondingly doubled. Other firms had to increase their number similarly, and the result is that the average of fish per boat is greatly decreased. There is hardly room on the river for so many to fish at once. A hundred salmon boats may be counted at almost any time in sight at Astoria. No one cannery can, however, afford to reduce unless all the others should do so. The following record of the catch of Badollet & Co. will show the decrease in the average per boat with the increase of boats:

	1876 (18 boats).	1877 (40 boats).	1878 (45 boats).	1879 (45 boats).
April	1,015	1,830	5,216	9,407
May	19,165	17,825	27,723	31,668
June	30,661	19,474	22,781	25,119
July	33,900	31,081	31,735	31,904
Total	84,741	60,210	87,455	98,098
Average per boat	4,652	1,505	1,943	2,179

One boat now carries three times as much netting as was formerly carried. The gill-nets, at first 125 fathoms, are now 350 fathoms long, and they are now made 45 feet deep.

The sea-lions and seals destroy immense numbers of salmon in the mouth of the Columbia. They watch the gill-nets, and take the caught salmon by the throat, devouring that choice morsel as it comes through the net, for a salmon is "gilled" just in front of the middle of the body. From a fishery point of view, the seal is an egregious nuisance.

4. PROCESS OF CANNING.

The salmon are brought to the wharf usually in the morning, counted and thrown in a heap. A Chinaman then takes each, cuts off its head, tail, and fins, and removes the viscera, throwing them into a large tub. Some of the cutters become very expert and will clean 1,700 fish per day.

Next the fish are washed and sometimes scraped with a knife, though the scales are not removed. Then they are placed in a trough in which several knives acting like a feed-cutter cut the salmon into sections as long as the height of a can. These sections are set on end and split by a Chinaman into about three pieces, one large enough to fill a can, the others smaller.

These fragments are placed on tables and Chinamen there fit them into the cans. Other Chinamen put on the covers, and still others solder them. In some canneries the soldering is done by machinery. In this case the cans are rolled along by an iron chain belt and the end rolls in the melted solder. Most of the canners think hand-soldering safer, although much more labor is required.

After soldering, the cans are placed in hot water and carefully watched to see if any bubbles rise from them indicating a leak in the can. If perfect the can is placed in an iron tank and boiled in salt water, it being possible to raise salt water to a higher temperature than fresh. After being boiled about one and one-fourth hours the can is taken out and vented, the pressure within driving out all the air through the aperture made. The hole is immediately soldered up, and the cooking completed by again boiling (one and one-half hours) in salt-water kettles. If the process of cooking were completed before the cans were vented, the pressure would be sufficient to burst the cans.

The cans are afterwards tested by being tapped on the head with a large nail. If the can is leaky it gives back a "tinny" sound easily recognized. This is a very important process, as some canneries lose largely by careless testing, the leaky cans afterwards bursting and damaging more or less the entire box. The cans are usually tested three or four times, and by different workmen. A leaky can is simply sent back to be soldered.

The cans are all made on the premises from sheet-tin imported for that purpose. The cost of the tin can is estimated at one-ninth of the cost of the can of salmon.

On an average three salmon fill one case of forty-eight 1-pound cans.

5. LABOR AT THE CANNERIES.

In the canneries a white foreman, book-keepers, and a few subordinate overseers are employed, and sometimes a few white boys or girls. The bulk of the work is done by Chinese.

Some of the Chinese, as the fish-cutter, the Chinese foreman, and other very capable persons, receive $40 to $45 per month. The most of them receive $1 per day of eleven hours and work as wanted, *i. e.*, leaving when told and coming at any hour set, only the time in which they are actually engaged being counted.

It is certain, in brief, that no white laborers could live and work on these terms, and that no cannery could be run in the present state of things with any profit with other than Chinese labor.

The Chinese come in April and go in August, and comparatively few return. Each man is employed directly without the intervention of agents of the Six Companies or any other person.

As a rule, the Chinese work very faithfully. They are never engaged in drunken riots, and their work is very uniform. On the other hand, they are not, as a rule, devoted to their employers. If dissatisfied, "they are the hardest class in the world to manage." They would "use a knife for 2 cents." There are not half a dozen Chinamen that "I would dare let their pay run over a day after due." They are inveterate gamblers, and their wages go from one to another as earned, to pay gaming debts. Some of the canners take pains to continue employment for such Chinese as show themselves tractable, in order to have leaven for next year's lump.

The white fishermen tolerate the Chinamen in the canneries because they know that the canneries must close were it not for them. It is, however, the unwritten law of the Columbia that any Chinaman daring to fish for salmon is to be killed on sight. So they do not fish.

The canneries employ from 100 to 200 Chinamen each. Badollet & Co. paid last year $13,000 to Chinamen. The entire amount paid by all canneries yearly to Chinamen is nearly $300,000.

6. PROFITS AND LOSSES OF THE CANNERIES; RECLAMATIONS.

PROFITS.—The business of canning salmon partakes more of the nature of a speculation than of a legitimate manufacturing business. That it shall not be run at a loss demands, of course, that the profits for the time being shall be very great. The season is only three and one-half months long, and the buildings, machinery, and outfit must lie idle for the rest of the year. The rate of interest is extremely high (12 per cent. or more), and the danger of loss through strikes in the active season is great. Finally, most canners are not strong enough to resist the necessity of forced sales through the action of speculative combinations. These men depress the market when the year's "put-up" is ready for sale. The bankers who furnish the money furnish it for "manufacturing and not for speculating purposes," and the canner is forced to sell for what he can get, unless strong enough to hold over, in which case the profits are reduced by loss of interest, or unless strong enough to ship directly to England.

Outside of losses through strikes and speculative combinations are several minor leaks, which may destroy all the profits.

RECLAMATIONS.—All cases exported are guaranteed, and security is given for the return of the money paid for all cases proving faulty. Whenever, through any means, a can is not perfectly sealed the salmon in it decays, pushing up the top. The can is then called a "swell-head." Sometimes such a can bursts and often the whole case is ruined by it. Great losses are thus often sustained, especially by those new in the business, from want of foremen and others fully competent to supervise the business. Two large canneries (at least) have been driven into bankruptcy through the great number of "swell-heads." One firm lost 35 per cent. of its shipment to Liverpool. The average reclamation amounts to 2 to 3 per cent. With some of the best established firms it is less than 1 per cent.

OTHER LOSSES.—Besides faulty canning one source of swell-heads is this: Some salmon are often left over from one day to the next and in the morning more are brought in. If these are piled on the first, the latter are left still another day, during which time they spoil, and if canned are still rotten salmon. If not canned they are a dead loss. Much money has been lost from not attending to the salmon in the order in which they are received.

Others lose through packing cans in green boxes, through economy. In the ship's hold the boxes sweat, the labels come off, and the saleableness of the salmon is depreciated if not the fish itself.

Some lose from leaving the canneries untenanted for the idle season, leaving boats to shrink, boards to be stolen, and things generally to go to ruin.

Some lose through not having a stock of nets, &c., sufficient to make up losses without delay.

There are also numerous minor leaks, which are known only to those thoroughly conversant with the business.

7. HISTORY OF THE CANNING INDUSTRY.

The Humes first began canning salmon on the Columbia, in a small way, about 1870, at Eagle Cliff. At first the salmon were obtained at about 10 cents each and sold at $8 per case. The first years were very profitable, except 1873, when loss was occasioned through the failure of numerous banks.

Since then improved methods have come in. Competition and strikes have raised the price of fish, and from 1876 to 1880 the river has become a perfect web of nets. In 1876, the river was first fished "for all that it was worth." The canneries on the lower river or "bay" are gradually "cutting out" those above, and to get fish enough now a fisherman must operate very near the mouth of the river. Some of the canneries 20 miles up the river now send their boats to Astoria and take up the fish on steam-tugs. The canneries above Astoria must, therefore, in the nature of things, be forced to suspend in time unless a change takes place.

It became evident three or four years ago to the canners that the supply of salmon would not last forever, and a contribution was first made to form a joint-stock company for the purpose of building a hatchery which should keep up the supply.

A fishery law was passed in Washington and in Oregon, to take effect in each district, if ratified by the other, substantially as follows:

(1) Fishing was prohibited in March, August, and September.

(2) Fishing was prohibited from 6 p. m. Saturday to 6 p. m. Sunday.

(3) Gill-net mesh should not be less than $4\frac{1}{2}$ inches square, seines not less than 3, and traps should not have their slats less than $2\frac{1}{2}$ inches apart.

(4) Licenses were charged as follows:

Each boat	$10 00
Each man with gill-net	5 00
Each dip-net	2 00
Each trap	50 00
Each seine	10 00

(5) The proceeds of these licenses should be applied to the propagation of salmon under the direction of a "fish commissioner of the Columbia."

A point on a tributary of the Columbia River was selected as being the most available for the purpose, and a hatchery was built. The support of the State and Territory has now been withdrawn, as the law under which it was given has been for some reason declared unconstitutional. Its future depends on the re-enactment of some similar law, as the hatchery cannot be kept up by voluntary contributions.

8. FUTURE OF THE SALMON FISHERIES.

As to the question of the diminution of salmon in the Columbia River the evidence appears somewhat conflicting; the catch during the present year (1880) has been considerably greater than ever before (nearly 540,000 cases), although the fishing since 1876 has been very extensive. On

the other hand, the high water of the present spring has undoubtedly caused many fish to become spring salmon which would otherwise have run in the fall. Moreover, it is urged that a few years ago, when the number caught was about half as great as now, the amount of netting used was perhaps one-eighth as much. With a comparatively small outfit the canners caught half the fish; now, with nets much larger and more numerous, they catch them all, scarcely any escaping during the fishing season (April 1 to August 1). Whether an actual reduction in the number of fish running can be proven or not, there can be no question that the present rate of destruction of the salmon will deplete the river before many years. A considerable number of quinnat salmon run in August and September, and some stragglers even later; these now are all which keep up the supply of fish in the river. The non-molestation of this fall run, therefore, does something to atone for the almost total destruction of the spring run.

This, however, is insufficient. A well-ordered salmon hatchery is the only means by which the destruction of the salmon in the river can be prevented. This hatchery should be under the control of Oregon and Washington, and should be supported by a tax levied on the canned fish. It should be placed on a stream where the quinnat salmon actually come to spawn.

It has been questioned whether the present hatchery on the Clackamas River actually receives the quinnat salmon in any numbers. It is asserted, in fact, that the eggs of the silver salmon and dog salmon, with scattering quinnat, are hatched there. We have no exact information as to the truth of these reports, but the matter should be taken into serious consideration.

9. SALMON OIL.

A factory for making oil from salmon-heads is in operation at Astoria, Mr. T. C. George being the proprietor. It was established last year, when 18,000 gallons were made, and sold at about 24 cents. The salmon-heads are bought from the canneries at the rate of 1,000 heads for $1. On an average, a thousand heads make 30 to 35 gallons of oil. The factory is only run during the canning season. The heads are cooked by steam, and the oil is run off from the top. The process is here rather crude, the factory not having yet ventured on improved machinery. After the salmon season this year Mr. George proposes to make oil from seals and bears. Many of the fishermen propose to use their gill-nets for catching seals and sea-lions after the salmon run. An oil factory in Upper Astoria has been leased by Mr. George, but is not now running. Another belongs to Watson, but is (probably) now silent. There is scarcely any oil in the viscera of *Oncorhynchus chouicha*. Salmon oil is usually mixed with other and dearer oils, and not thrown separately on the market.

The following is the record of a salmon oil factory at Astoria:

Capital invested		$2,000
Men employed	number	6
One boiler, one engine	horse-power	35
Average wages per day of ten hours		$2
Total paid in wages		$1,000
Length of season	months	3
Value of material		$2,500
Value of product		$7,000

10. STATISTICS OF SALMON-FISHERIES OF THE COLUMBIA.

Estimates of amount of salmon canned on the Columbia, 1869 *to* 1880.

[Mostly from printed circulars of salmon dealers.]

Year.	Number of cases of 48 pounds each.	Year.	Number of cases of 48 pounds each.
1869	26,729	1875	244,203
1870	98,730	1876	428,730
1871	84,865	1877	468,804
1872	43,606	1878	417,637
1873	102,722	1879	448,000
1874	291,621	1880	539,587

Estimates for whole river in 1880.

Total capital invested in canneries	*$1,100,100*
Total number of hands employed	4,000
Total paid in wages	$600,000
Total wages paid to Chinese	$500,000
Value of material consumed	$1,200,000
Value of product	$2,697,930

Pack of salmon on the Columbia River, 1875 *to* 1880.

[Tabulated by canneries.]

	1875.*	1876.*	1877.*	1880.†
	Cases.	*Cases.*	*Cases.*	*Cases.*
S. D. Adair & Co				11,000
Aberdeen Packing Company				12,500
Anglo-American Packing Company			13,247	16,000
Astoria fishery				29,700
Astoria Packing Company				35,000
A. Booth & Co	34,000	37,000	23,160	28,000
Badollet & Co		25,600	20,690	29,000
Bradley, Davis & Co			9,056	
Columbia Canning Company				12,996
Cutting Packing Company	20,000	24,681	16,866	16,500
Clackamas Packing Company			858	
J. W. & V. Cook				23,000
Dodge, Sweeny & Co	12,500	10,000	10,240	
Eureka Packing Company				18,487
Fisherman's Packing Company			14,955	28,000
Fitzpatrick, Davis & Co		20,375	10,540	
George W. Hume			11,277	25,500
Joseph Hume	25,000	21,800	22,058	19,000
William Hume	16,000	17,500	8,801	22,000
Do				9,500
R. D. Hume	20,000	48,000		19,000
Hanthorn & Co			14,002	28,000
Hepburn & Co			3,320	
Leveridge & Prindle			10,015	
J. G. Megler & Co	16,000	28,000	10,246	17,775
Oregon Packing Company	22,000	36,986	24,553	
Pillar Rock Company			6,645	16,000
James Quinn			2,977	5,400
Sternberger & Co			84,029	
John West	15,000	13,870	7,595	15,932
F. M. Warren	10,000	28,500	16,958	15,000
West Coast Packing Company				14,300
Watson & Bannon	*13,000*	*17,500*	*6,858*	14,029
Watson Bros			8,144	
Hapgood & Co	18,000	21,425	11,718	16,335
Jas. Williams				10,638
John A. Devlin		21,500	19,056	17,000
Jackson & Myers		12,000	8,311	6,000
Kinney Bros		38,500	51,291	
	221,500	428,730	468,804	539,587

* Oregon Immigration Company.

† From statements made to the Census Office by the different canners.

STATISTICS OF CAPITAL, ETC.

We have full statistics of the capital, number of men employed, wages paid, &c., of all but two of the canneries located in Oregon. The two not included are the canneries at Ranier and Quinn's.

The averages of these are given in the table below. Most of the remaining canneries are smaller than these here enumerated.

The total capital of the sixteen canneries in Clatsop County, above referred to, is $733,500, or, on an average, $45,844 each. An approximate estimate of the amount of capital invested in the remaining thirteen canneries, or those of Washington Territory and of Columbia County, Oregon, may be made by comparing their pack of salmon with that of the sixteen canneries in Clatsop County.

The average number of cases packed by the sixteen canneries is 22,256 each; by the thirteen, 14,115 each. Assuming that the pack of salmon is in proportion to the capital invested, which is generally true, we have $29,096 for each of the thirteen canneries, or $349,248 for the total. The total amount of capital invested in the canneries on the Columbia may therefore be set down as not far from $1,081,748, or say $1,100,000.

Other statistics for the sixteen Clatsop canneries are the following, to which an addition of about one-half more to each total will give an approximate total for the whole river.

Statistics for canneries in Clatsop County, Oregon.

	Average for each cannery.	Total for 16 canneries.
Capital invested (real and personal)	$45,844	$733,500
Greatest number of hands employed (at any one time)	179	2,862
Men (above 16 years)	89	1,426
Women (above 15 years)	11	174
Children	.....	9
Number of hours per day	10 to 11	.....
Wages of skilled laborers	$2 55	.....
Wages of ordinary laborers (Chinese)	$1 26½	.....
Total paid in wages	$25,831 50	$413,304
Value of material consumed	$54,625 00	$874,000
Value of product	$68,295 00	$1,092,400

PRICES OF SALMON.

The business of canning salmon was first begun in 1863, on the Sacramento River, by William Hume, G. W. Hume, and A. S. Hapgood as Hapgood, Hume & Co.

The general price, wholesale, has usually ranged from $1.50 to $2; the lowest price before 1878 having been $1.25.

In 1878 the stock on hand was very large, and weak holders began to cut prices in order to realize. The price finally fell to $1 per dozen. Nearly all the salmon in the market was bought up by speculators, and the price rose to $1.40. The prices since have ranged generally from $1.10 to $1.20

Most of the salmon canned on the Columbia is shipped directly to England. The number of cases packed in 1880 (539,587) represents on an average three salmon to the case or 1,618,761 salmon. Each salmon when fresh weighs about 22 pounds, a total of 35,612,742 pounds. Adding an estimate for the salmon salted or consumed fresh, and we have a total of 38,500,000 pounds as an estimate of the total product of the Lower Columbia for the year 1880. Not half a million pounds of this is made of species other than the quinnat salmon (*Oncorhynchus chouicha*).

The total sum paid by the canners to fishermen in 1880 for salmon is about $809,380, or 50 cents each.

The total value of the pack, estimated at $5 per case, would be $2,697,930.

3.—STATISTICAL RECAPITULATION.

STATISTICS OF PACIFIC SALMON FISHERY AND CANNING INDUSTRY FOR 1880.

Number of persons employed	8,310
Capital invested	$1,381,900
Value of product	3,399,574

The total catch was 2,887,900 salmon, weighing 53,844,000 pounds. Of this amount 1,585,500 pounds were salted, 200,000 pounds smoked, 2,000,000 pounds sold fresh at San Francisco, 43,379,542 pounds canned, and the rest consumed locally or unaccounted for.

The extent of the canning industry was as follows:

	Canneries.		Number of factory hands.	Sold to the canneries.		Product of the canneries.		
	Number.	Capital.		Pounds of fresh salmon.	Value.	Cases.	Pounds in 1-pound cans.	Value.
Sacramento River	10	$100,000	800	5,305,000	$79,600	80,387	3,858,576	$400,935
Smith and Eel Rivers, California, Rogue River, Oregon, and vicinity	3	25,000	95	1,591,800	15,918	22,300	1,070,400	111,590
Columbia River	29	1,160,000	4,000	35,612,742	809,280	539,587	25,900,176	2,697,930
Puget Sound	1	4,000	15	198,000	1,560	3,000	144,000	15,000
Alaska	2	10,000	30	672,000	3,360	10,000	480,000	30,000
	45	1,299,000	4,940	43,379,542	909,818	655,274	31,453,152	3,255,365

SALMON CANNING AT PORT BLAKELY.

The salmon cannery of Jackson & Myers, formerly at Muchilteo, has now been removed to Port Blakely, on the west side of Admiralty Inlet opposite Seattle. Here salmon are abundant in summer and fall in the salt water and are taken with seines. During the past year (1880) the run has been very good, and 3,000 cases have been packed. The species chiefly taken is the silver salmon or "coho" (*O. k'sutch*), with an occasional quinnat salmon. On alternate years (1877, 1879) there is a considerable run of the humpback salmon or "haddo" (*O. gorbuscha*), the female of which species is canned, the male thrown away or given to the Indians to be salted. These small salmon usually sell at the canneries at 3 to 5 cents each, twelve to fifteen of them filling a case.

The details of the Alaska salmon fishery, are fully discussed by Dr. Bean in another section of this report in connection with the fishing-grounds and fishery resources of Alaska. (See Section II, FISHING GROUNDS, pp. 81–115.)