

FIG. 1.—SALMON ON THE SPAWNING BEDS,

PACIFIC SALMON FISHERIES.*

By JOHN N. COBB.

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*Appendix I to the Report of the U. S. Commissioner of Fisheries for 1921. B. F. Doc. No. 902.

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INTRODUCTION.

The most valuable commercial fisheries in the world, excepting only the oyster and herring fisheries, are those supported by the salmon. Of these the most important by far are the salmon fisheries of the Pacific coast of North America, where California, Oregon, Washington, and Alaska, including also British Columbia, possess industries representing millions of dollars of investment and millions of output annually. In Siberia the fishery is increasing in importance annually as means of transportation become better, while Japan is also becoming a large factor in the salmon markets of the world through her investments in the salmon fisheries of Siberia and, to a lesser extent, through fisheries prosecuted in her own waters.

In this third edition of the report^a considerable new material has been added, while some chapters have been entirely remodeled and materially enlarged. The statistical data have been brought up to January 1, 1920. The author is indebted to the Pacific Fisherman, of Seattle, Wash., for certain illustrations and to George C. Teal for permission to use his copyrighted picture shown as figure 11. Most of the illustrations are from pictures taken by the author.

THE SPECIES OF SALMON AND THE RUNS.

The Pacific coast salmons are all included in the genus *Oncorhynchus*. With them the fishermen incorrectly class the steelhead trout, which really belongs to the closely related genus *Salmo*.

As long ago as 1731 the species of *Oncorhynchus* were first made known by Steller, who, almost simultaneously with Krascheninikov, another early investigator, distinguished them with perfect accuracy under their Russian vernacular names. In 1792 Walbaum adopted these vernacular names in a scientific nomenclature for these fishes.

^a First edition: The Salmon Fisheries of the Pacific Coast. By John N. Cobb. U. S. Bureau of Fisheries Document No. 751, 180 pp. Washington, 1911.
Second edition: Pacific Salmon Fisheries. By John N. Cobb. U. S. Bureau of Fisheries Document No. 839, Appendix III, Report, U. S. Commissioner of Fisheries, 1916, 265 pp., 29 pls. Washington, 1917.

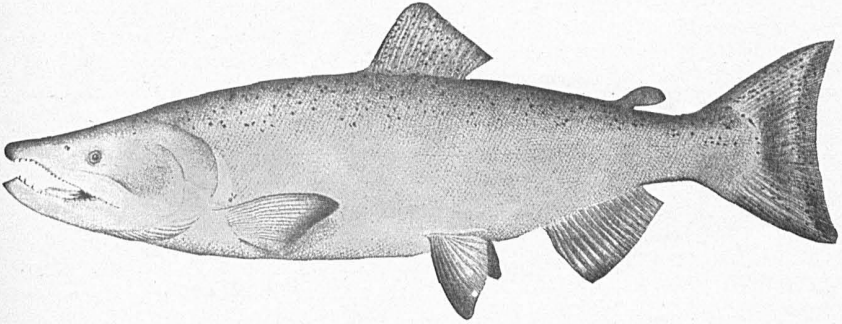


FIG. 2.—CHINOOK SALMON. BREEDING MALE.

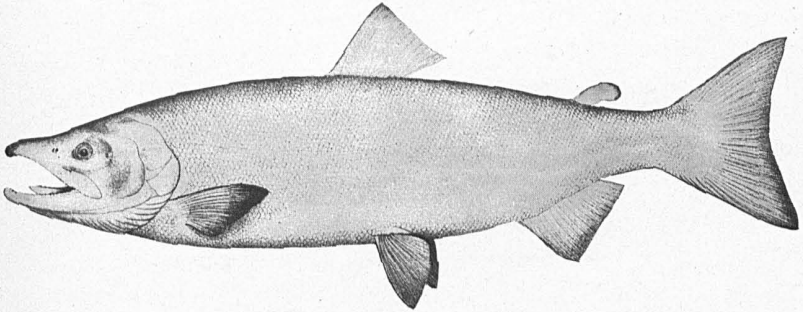


FIG. 3.—SOCKEYE SALMON. ADULT MALE.

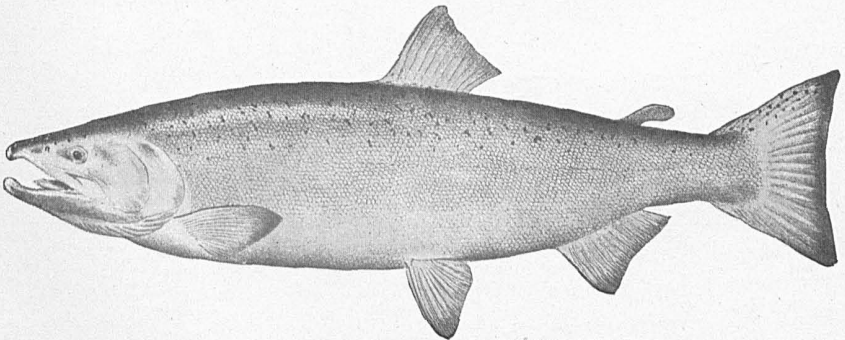


FIG. 4.—COHO SALMON. BREEDING MALE.

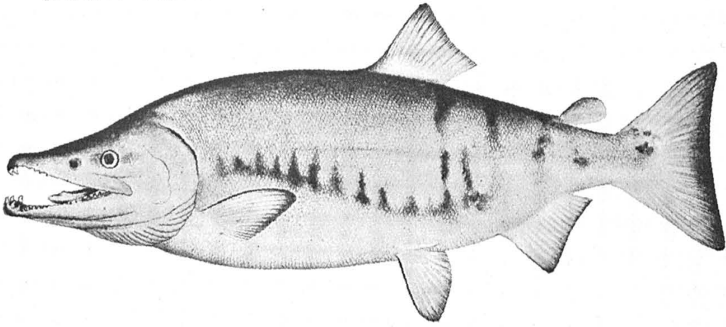


FIG. 5.—CHUM SALMON. BREEDING MALE.

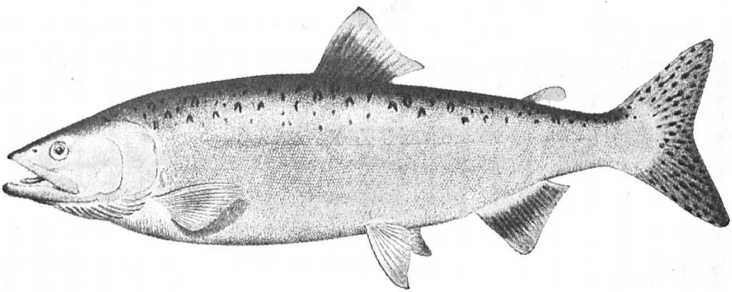


FIG. 6.—HUMPBACK SALMON. ADULT MALE.

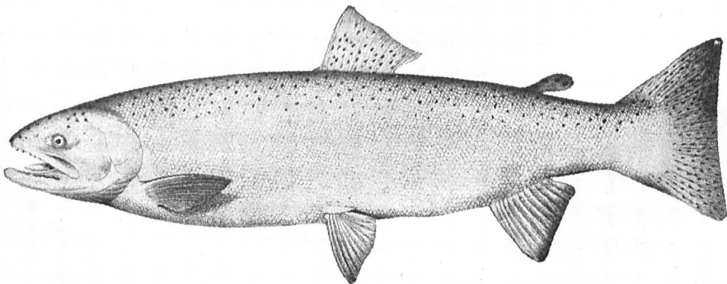


FIG. 7.—STEELHEAD TROUT.

Five species of salmon (*Oncorhynchus*) are found in the waters of the north Pacific, ranging northward from Monterey Bay on the American coast and Japan on the Asiatic, the extreme northern distribution of certain of the species having not yet been accurately determined. The five species are: (1) *Oncorhynchus tshawytscha*, quinnat, tyee, chinook, spring, or king salmon; (2) *Oncorhynchus nerka*, blueback, red, sukkegh, or sockeye salmon; (3) *Oncorhynchus kisutch*, silver, coho, or white salmon; (4) *Oncorhynchus keta*, dog, keta, or chum salmon; and (5) *Oncorhynchus gorbuscha*, humpback or pink salmon.

CHINOOK, QUINNAT, OR KING SALMON.

The largest, best known, and most valuable of these is the chinook or king salmon (*O. tshawytscha*). It is found throughout the region from the Ventura River, Calif., to Norton Sound, Alaska, and on the Asiatic coast as far south as northern China. As knowledge extends, it will probably be recorded in the Arctic.

In the spring the body is silvery, the back, dorsal fin, and caudal fin having more or less of round black spots, and the sides of the head having a peculiar tin-colored metallic luster. In the fall the color is, in some places, black or dirty red. The fish has an average weight of about 22 pounds, but individuals weighing 70 to over 100 pounds are occasionally taken. One was caught near Klawak, Alaska, in 1909, which weighed 101 pounds without the head. The Yukon River is supposed to produce the finest examples, although this supposition is not based on very reliable observations. The southeast Alaska fish average as high as 23 pounds in certain seasons, followed by an average of about 22 pounds in the Columbia River and about 16 pounds in the Sacramento.

In most places the flesh is of a deep salmon red, but in certain places, notably southeast Alaska, Bristol Bay, Puget Sound, and British Columbia, many of the fish, the proportion being sometimes as much as one-third of the catch, have white flesh. A few examples have been taken with one side of the body red and the other white, while some are found with mottled flesh. No reasonable explanation of this phenomenon has yet been given.

In its southern range the quinnat strikes in at Monterey Bay in sufficient numbers to justify commercial fishing about the middle of April, where it is seen feeding upon the inshore moving schools of herring and sardines, continuing until in August. There are two runs of spawning fish in the Sacramento, the first or "spring run" beginning in April and continuing throughout May and June, these fish spawning mainly in the cold tributaries of the Sacramento, such as the McCloud and Fall Rivers. The second or "fall run" occurs in August, September, and October, and these fish spawn in the riffles in the main river between Tehama and Redding, also entering the tributaries in that vicinity. The two runs merge into each other. It is also claimed that there is a third run which comes in December.

In former years the San Joaquin and the American and Feather Rivers of the Sacramento system had large runs of salmon, but excessive fishing and the operation of various mining and irrigation projects have practically depleted them.

The Eel and Mad Rivers of northern California have only a late or fall run, while the Klamath River has both a spring and a fall

run, and Smith River has a spring run alone. Rogue River in Oregon has both a spring and a fall run, and the Umpqua and several other coast streams of Oregon have small early runs.

The Columbia River has three runs, the first entering during January, February, and March, and spawning mainly in the Clackamas and neighboring streams. The second, which is the best run, enters during May, June, and part of July, spawning mainly in the headwaters. The third run occurs during late July, August, September, and part of October, and spawns in the tributaries of the lower Columbia.

In Puget Sound chinook salmon are found throughout the year, although it is only during the spawning season that they are very abundant. In the Fraser River, a tributary of the Sound, the run occurs from March to August.

In the Skeena River, British Columbia, the run occurs from May to July, the same being approximately true of the Nass also.

In southeast Alaska they are found all months of the year. From March to the middle of June they are abundant and feeding in the numerous straits and sounds; in May and June the spawning fish enter the Unuk, Stikine, Taku, Chilkat, Alsek, and Copper Rivers in large numbers, and in a few smaller streams in lesser abundance. In August, September, and October they are again to be found in large numbers feeding in the bays and sounds, while during the winter months a few have been taken on trawls set for halibut, showing that they are living in the lower depths at this time.

In Cook Inlet the run occurs during May and June and is composed wholly of red-meated fish; in the rivers of Bristol Bay the run comes in June and July, principally in the first-named month, and the same is true of the Togiak, Kuskokwim, and Yukon Rivers, the late appearance of the fish in the upper courses of the Yukon being due to the immense distance the fish have to cover.

SOCKEYE, BLUEBACK, OR RED SALMON.

The red or blueback salmon (*O. nerka*), which forms the greatest part of the canned salmon of the world, when it first comes in from the sea is a clear bright blue above in color, silvery below. Soon after entering the river for the purpose of spawning the color of the head changes to a rich olive, the back and sides to crimson, and finally to a dark blood red, and the belly to a dirty white. The maximum weight is about 12 pounds, and length 3 feet, with the average weight about 5 pounds, varying greatly, however, in different localities. Observations of Chamberlain^a in Alaska show that the average weight of a number of sockeyes taken from Yes Bay was 8.294 pounds, while the average weight of a number from Tamgas was only 3.934 pounds. Evermann and Goldsborough^b report as a result of the weighings of 1,390 red salmon, taken from as many different places in Alaska as possible, an average weight for the males of 7.43 pounds; for the females, 5.78 pounds; or an average weight for both sexes of 6.57 pounds. A run of small, or dwarf, males accompanies certain of the main runs, being especially noticeable in the Chignik Lagoon

^a Some Observations on Salmon and Trout in Alaska. By F. M. Chamberlain, naturalist, U. S. Fisheries steamer *Albatross*. U. S. Bureau of Fisheries Document No. 627, p. 80. Washington, 1907.

^b The Fishes of Alaska. By B. W. Evermann and E. L. Goldsborough. Bulletin, U. S. Bureau of Fisheries, 1906, Vol. XXVI, p. 267. Washington, 1907.

(Alaska) run. This species usually enters streams with accessible lakes in their courses.

These fish are occasionally found landlocked in certain lakes, especially in the State of Washington, and are always much smaller in size than the sea-run fish. In Bumping Lake, near North Yakima, Wash., they are quite abundant and are mature when about a pound in weight. Despite the fact that these fish have a soft mouth, anglers consider them very gamey. They take bait, the fly, and the trolling spoon. Large numbers are hatched and distributed by the Washington Fish and Game Commission under the name of "silver trout."

A few specimens of the sockeye have been taken as far south as the Sacramento River. In Humboldt County, Calif., small runs are said to occur in Mad and Eel Rivers, while 20 sockeyes are reported as having been taken in the Klamath River in the autumn of 1915. Only an occasional specimen appears in the coastal streams of Oregon. The Columbia is the most southern river in which this species is known to run in any considerable numbers, entering the river with the spring run of chinooks. From here south the species is called blueback exclusively. A considerable run enters the Quinault River, Wash., and there is also a small run in Ozette Lake, just south of Cape Flattery.

In the Puget Sound region, where it is known as the sockeye, this species ascends only the Skagit River in commercial numbers, although a small run appears in the Lake Washington system of lakes and, possibly, in the Snohomish, Stillaguamish, and Nooksack Rivers.

At one time, the greatest of all the sockeye streams was the Fraser River, British Columbia, a stream famous from very early days for its enormous runs of this species, a peculiar feature of which is that there is a marked quadrennial periodicity in the run. The maximum run occurs the year following leap year, the minimum on the year following that. The greater part of the catch of the Puget Sound fishermen is made from this run as it is passing through Washington waters on its way to the Fraser. The fish strike in during July and August on the southwest coast of Vancouver Island, apparently coming from the open sea to the northwest. They pass through the Straits of Juan de Fuca, Rosario, and Georgia, spending considerable time in the passage and about the mouth of the river. Small numbers run as early as May and as late as October, but the main body enters about the first week in August.

The sockeye occurs in most of the coastal streams of British Columbia, and is usually the most abundant species. The principal streams frequented are the Skeena, Rivers Inlet, Nass, Lowe Inlet, Dean Channel, Namu Harbor, Bella Coola, Smith Inlet, Alert Bay, and Alberni Canal.

In Alaska, where this fish is generally known as the red salmon, it is abundant and runs in great numbers in all suitable streams, of which the following are the most important: In southeast Alaska, Boca de Quadra, Naha, Yes Bay, Thorne Bay, Karta Bay, Nowiskay, Peter Johnson, Hessa, Hetta, Hunter Bay, Klawak, Redfish Bay, Stikine, Taku, Chilkoot, Chilkat, Alosek, Situk, Ankow, etc.; in central Alaska, Copper, Knik, Kenai, Susitna, Afognak, Karluk, Alitak, Chignik; and in the Bristol Bay region, the Ugashik, Ugaguk, Naknek, Kvichak, Nushagak, and Wood. It is also supposed to

occur in small numbers in the Togiak, Kuskokwim, and Yukon Rivers, which debouch into Bering Sea, and possibly occurs in the Arctic streams of Alaska. The run in western Alaska begins usually early in June and extends usually to the middle of August, the bulk of the run occurring in the first three weeks of July. It begins earlier in Prince William Sound, however, and sometimes extends into September in southeast Alaska. The duration of the run averages about the same in each section.

SILVER OR COHO SALMON.

The silver or coho salmon (*O. kisutch*) is silvery in spring, greenish on the upper parts, where there are a few faint black spots. In the fall the males are mostly of a dirty red. The flesh in this species is of excellent flavor, but paler in color than the red salmon, and hence less valued for canning purposes. The maximum weight is about 30 pounds, with a general average of about 6 pounds.

The silver salmon is found as far south as Monterey Bay, where it appears during the month of July, and is taken by the trollers. From Eel River, in California, north, it is found in most of the coastal streams. It usually appears in July, and runs as late as November, the time of appearance and disappearance varying somewhat in different sections. Owing to its late appearance comparatively few, and they usually in the early part of the season, are packed by the canneries, most of which shut down in August and September. This fish also tarries but a short time about the mouth of the stream it is to enter, and is wary of nets, which makes it rather unprofitable to fish for the latter part of the season when it is running alone.

HUMPBACK OR PINK SALMON.

The humpback or pink salmon (*O. gorbuscha*), the smallest of American species, weighs from 3 to 11 pounds, the average being about 4 pounds. Its color is bluish above, silvery below, the posterior and upper parts with many round black spots, the caudal fin always having a few large black spots oblong in shape. The males in fall are dirty red and are very much distorted in shape, a decided hump appearing on the back, from which deformity the species acquires its name. The flesh is pale, hence its canned name, "pink" salmon.

The southern limit of the fish is the San Lorenzo River, Santa Cruz County, but only occasional specimens are found here and in the rivers to the northward until Puget Sound is reached. Here a large run appears every other year, the only place on the coast where such is the case.

The humpback occurs in varying abundance in the waters of British Columbia, but it is in the waters of southeast Alaska that it appears in its greatest abundance. Many of the canneries in this region and some of those operating in central Alaska depend mainly upon the humpback for their season's pack, and the canned product now occupies an excellent position in the markets of the world. The fish spawn in nearly all of the small, short streams.

In western Alaska the runs are much smaller and the humpback is not much sought after by the cannery men, who are usually able to fill their cans with the more valuable species.

In southeast Alaska the run begins in June and continues until September. In western Alaska the period is somewhat shorter. In Puget Sound it continues until late in the fall, although but few are taken after September 15.

DOG OR CHUM SALMON.

The dog or chum salmon (*O. keta*) reaches a maximum weight of 16 pounds, the average being about 8 pounds. When it first appears along the coast it is dirty silvery, immaculate or sprinkled with small black specks, the fins dusky, the sides with faint traces of gridironlike bars. Later in the season the male is brick red or blackish, and its jaws are greatly distorted. Its flesh is light yellow, especially when canned. It is especially good for freezing, salting, and smoking.

This species has a wide distribution. It is found as far south as San Lorenzo River, Santa Cruz County, Calif., but is not utilized commercially in California except on Eel River. It is found in most of the coastal streams from here north, being especially abundant from Puget Sound northward to southeast Alaska, both inclusive. In this region it is being utilized in greater abundance each year, as the market for it widens.

In central, western, and arctic Alaska the species occurs in varying abundance, but it is utilized sparingly, except by the natives, with whom it is the favorite species dried for winter food for their dogs.

The run of dog salmon comes later than that of any other species except the coho. In Alaska it begins in June, but the height of the season does not occur until late in August or early in September, and fish are found as late as November. In Puget Sound they run from about the middle of August till late in November, and practically the same is true in the Columbia River.

STEELHEAD TROUT.

The steelhead trout (*Salmo gairdneri*) is commonly classed as one of the salmons by the fishermen of the Pacific coast, and it has been included in this report on this account. It is said to have received its common name from the hardness of the skull, several blows of the club being required to kill the salmon when taken into the boat. In different localities the average weight is placed at from 8 to 15 pounds, while extreme sizes reach 45 pounds. The excellent quality of its flesh causes it to be highly prized for the fresh and frozen markets, but owing to its pale color only limited quantities are canned.

The principal center of abundance of this species is the Columbia River. It is found from Carmel River, Calif., north to central Alaska, and possibly has an even wider range in Alaska. As a result of extensive plants made during the last five or six years the range has been much extended on the Pacific coast as well as elsewhere in this country. It seems to be found in the rivers during the greater part of the year. In the Columbia River the spawning season is from February to May, in Puget Sound in the spring, and in southeast Alaska in May and June. The best commercial fishing is in January, February, and March. In California the catching of this species is restricted to hook and line fishing.

AGE OF SALMON AT MATURITY.

As practically all salmon which have the opportunity spawn but once and then die, knowledge of the age at which this occurs is of great interest both from an economic and scientific standpoint. Many attempts have been made to solve the problem with the sockeye and king salmon, the most important commercially of the five species, by means of marking artificially reared fry, usually by clipping one of their fins before they are liberated, as noted elsewhere in this report, but with unsatisfactory results.

Fortunately, certain experiments carried on in Tomales Bay, Calif., and in New Zealand, where king fry were planted in streams not frequented by the species in question and the return of the adults noted, have yielded some interesting and accurate information on the subject. These indicated that the age was four or more years, as no run was reported until the fourth year.

A more certain method of determining the age of salmon has been developed in recent years through the adaptation by American scientists of the discovery by European investigators that the ridges observed on the scales of certain fishes indicated a period of growth of the animal itself.

Dr. Charles H. Gilbert, of Stanford University, as early as 1910, applied this method to the determination of the age of the various species of Pacific salmon. As to its application to the Pacific salmon and the general method followed, Dr. Gilbert has the following to say:

While the method is new as regards Pacific salmon, it has been experimentally tested and fully approved by the Fisheries Board of Scotland in the case of the Atlantic salmon, and is now universally accepted as furnishing reliable data as to the age and many other facts in the life history of that fish. It has been shown to be applicable also to various species of trout, and its value has been demonstrated in fishes as widely divergent as the carp, the eel, the bass, the flounder, and the cod. Descriptions of this scale structure and its significance have appeared in a large number of papers, both scientific and popular. It will suffice here to repeat that the scale in general persists throughout life, and grows in proportion with the rest of the fish, principally by additions around its border. At intervals there is produced at the growing edge a delicate ridge upon the surface of the scale, the successive ridges thus formed being concentric and subcircular in contour, each representing the outline of the scale at a certain period in its development. Many of these ridges are formed in the course of a year's growth, the number varying so widely in different individuals and during successive years in the history of the same individual that number alone can not be depended on to determine age. For this purpose we rely upon the fact that the fish grows at widely different rates during different seasons of the year, spring-summer being a period of rapid growth and fall-winter a season when growth is greatly retarded or almost wholly arrested. During the period of rapid growth the ridges are widely separated, while during the slow growth of fall and winter the ridges are crowded closely together, forming a dense band. Thus it comes that the surface of the scale is mapped out in a definite succession of areas, a band of widely spaced rings always followed by a band of closely crowded rings, the two together constituting a single year's growth. That irregularities occur will not be denied, and this is natural, inasmuch as growth may be checked by other causes than the purely seasonal one. Also a considerable experience is requisite for the correct interpretation in many cases, and a small residue of doubtful significance has always remained. This element is too small to affect the general results, and further investigation will almost certainly eliminate the doubtful cases altogether.^a

^a Age at Maturity of the Pacific Coast Salmon of the Genus *Oncorhynchus*. By Charles H. Gilbert. Bulletin, U. S. Bureau of Fisheries, 1912, Vol. XXXII, pp. 4, 5. Washington, 1913.

As a result of his investigations up to this point, Dr. Gilbert presented the following conclusions drawn from the data collected:

1. The sockeye spawns normally either in its fourth or fifth year, the king salmon in its fourth, fifth, sixth, or seventh year, the females of both species being preponderantly 4-year fish.

2. The young of both sockeye and king salmon may migrate seaward shortly after hatching, or may reside in fresh water until their second spring. Those of the first type grow more rapidly than the second, but are subject to greater dangers and develop proportionately fewer adults.

3. Coho salmon spawn normally only in their third year. The young migrate either as fry or yearlings, but adults are developed almost exclusively from those which migrate as yearlings.

4. Dog salmon mature normally either in their third, fourth, or fifth years, the humpback always in their second year. The young of both species pass to sea as soon as they are free swimming.

5. The term "grilse," as used for Pacific salmon, signifies conspicuously undersized fish which sparingly accompany the spawning run. They are precociously developed in advance of the normal spawning period of the species. So far as known, the grilse of the king salmon, coho, and dog salmon are exclusively males; of the sockeye, almost exclusively males, except in the Columbia River, where both sexes are about equally represented. The larger grilse meet or overlap in size the smaller of those individuals which mature one year later at the normal period.

6. Grilse of the sockeye are in their third year, of the king salmon in their second or third year, of the coho and the dog salmon in their second year.

7. The great differences in size among individuals of a species observed in the spawning run are closely correlated with age, the younger fish averaging constantly smaller than those one year older, though the curves of the two may overlap.^a

Since 1910 Dr. Gilbert has devoted much of his time to investigations^b along this line, especially on the sockeye, with most interesting and valuable results.

His observations on the sockeye runs of British Columbia indicate that they consist principally of four and five year fish and that these two classes appear during successive seasons in widely differing proportions; that each stream has its distinctive race of sockeye, the progeny returning at maturity to the parent stream; that sockeye fry rarely survive when they proceed to sea within the year in which they are hatched; and that sea feeding, with the consequent rapid growth, is the most important factor in producing early maturity, an equal number of years in fresh water producing comparatively little effect.

MARKING SALMON.

A favorite recreation for quite a number of Pacific coast people has been the marking of salmon fry in order to find out the age at which they return to spawn, the rate of growth, etc. Scattered through the reports of the various State fish commissions, and occasionally in the reports of the United States Bureau of Fisheries, are to be found detailed reports of such markings and the sometimes remarkable

^a Age at Maturity of the Pacific Coast Salmon of the Genus *Oncorhynchus*. By Charles H. Gilbert. Bulletin, U. S. Bureau of Fisheries, 1912, Vol. XXXII, pp. 21, 22. Washington, 1913.

^b Contributions to the Life History of the Sockeye Salmon. (No. 1.) By C. H. Gilbert. Report of British Columbia Commissioner of Fisheries for the year ending Dec. 31, 1913, with Appendices, pp. 63-78. Contributions to the Life History of the Sockeye Salmon. (No. 2.) By C. H. Gilbert. Report British Columbia Commissioner of Fisheries for the year ending Dec. 31, 1914, with Appendices, pp. 64-75. Contributions to the Life History of the Sockeye Salmon. (No. 3.) By C. H. Gilbert. Report British Columbia Commissioner of Fisheries for the year ending Dec. 31, 1915, with Appendices, pp. 64-75. Contributions to the Life History of the Sockeye Salmon. (No. 4.) By C. H. Gilbert. Report British Columbia Commissioner of Fisheries for the year ending Dec. 31, 1917, with Appendices, pp. 63-80, 14 pls. Contributions to the Life History of the Sockeye Salmon. (No. 5.) By C. H. Gilbert. Report British Columbia Commissioner of Fisheries for the year ending Dec. 31, 1918, with Appendices, pp. 62-82, 24 pls. Contributions to the Life History of the Sockeye Salmon. (No. 6.) By C. H. Gilbert. Report, British Columbia Commissioner of Fisheries for the year ending Dec. 31, 1919, with Appendices, pp. 63-83, 6 pls. Victoria, British Columbia.

results attained, apparently at varying periods subsequent to the marking.

All sorts of marks were employed. The favorite was the removal of the adipose fin, the experimenters appearing to be of the opinion that the fish would miss this the least of any. However, the entire or partial removal of nearly every fin was practiced by some one or other of the many experimenters. Sometimes a V or a U was punched out of the tail or the gill cover, and in one or two instances a tag was employed.

In time these marking experiments became so numerous, and so imperfect a record was kept of them by any central authority, that frequently it was impossible to tell, when an apparently marked specimen was obtained, where and when it was marked, and as a result but little dependence could have been placed upon them even had there been no other factors conspiring to vitiate their value.

Fishermen are continually finding in their nets salmon which they feel sure have been marked by some hatchery. Scores of times in the course of his various investigations of the fisheries of this coast the writer has been told of or shown specimens which the fishermen thought had been marked. Many of these marks were on the side of the fish and represented an M or W, depending upon the angle from which viewed, and it was impossible, generally, to convince the fishermen that this mark was caused by the twine of his gill net pressing on the side of the fish. The obvious fact that a fish could not survive when in the fry stage the infliction of such a mark did not occur to them.

Frequently the scars left by the suctorial organs of the lamprey have been mistakenly supposed to be hatchery marks. This scar resembles very closely a date stamp on a canceled letter.

One of the most interesting cases of salmon marking, and one which drives home the necessity for accepting reports of returns from such markings with extreme caution, is that of F. M. Chamberlain, then naturalist of the Bureau of Fisheries steamer *Albatross*, on the Naha Stream in Alaska.

In August, 1903, 1,600 red salmon fry, reared for the purpose from the 1902 eggs, at the Fortmann hatchery of the Alaska Packers Association, near Loring, Alaska, were marked by Mr. Chamberlain by excising both ventrals with fine curved scissors. The fry were released in the Naha River as soon as marked, at which time they were about three months old.

In 1906 between 50 and 100 adult reds with ventral fins missing were reported by the superintendent of the hatchery at Yes Bay, which is located on the northern side of Behm Canal (Naha being on the southern side) and some 15 miles farther up the canal than the mouth of Naha Stream. Some of these also had the adipose removed, this mark having also been used on some of the fry. At the Fortmann hatchery, where they were marked, only two of these fish were obtained in 1906.

From then on until 1912, a period of 9½ years, the return of a number of these supposedly marked fish is noted each year at the two hatcheries in question, the number reported in the latter year being larger than in some of the intervening years. In 1912 Mr. Chamberlain himself pointed out the impossibility of these all being from the fry he had marked and no further attention was paid to them.

The principal thing that this and some of the other many experiments in salmon marking prove is that the percentage of salmon which accidentally lose, either through disease or the attacks of their many enemies, one or more of their fins, or portions of same, is much larger than most people suppose. Out of the many millions taken annually in commercial and fish cultural operations it is not surprising that some should be minus such exposed portions of their anatomy and this percentage would doubtless be found to be considerable were particular attention directed toward it. As it is now, it is only occasionally that the fisherman notices such loss, or mentions the same when he does, unless his attention has been directed to it by particular inquiry. In the Chamberlain experiment, for instance, after 1907 considerable publicity was given to the search for such marked fish, and the writer, in his travels through southeast Alaska during the succeeding years until the end of 1911, frequently was told by fishermen that they had caught salmon with missing fins. Inquiry developed that while a few of the lost fins were the same as Chamberlain had excised, a number were entirely different fins, showing that when the attention of fishermen was directed especially in this line many deformed fish would be found.

The confusion resulting from the many marking experiments carried on by different people shows the absolute necessity of some central authority regulating them if any real results are to be achieved from this line of endeavor. In 1908 the Secretary of Commerce, under authority of sections 11 and 12 of the Alaska fisheries law, directed that any persons desiring to mark and release salmon in Alaska first consult with and secure the written consent of the Commissioner of Fisheries or of the agent at the salmon fisheries of Alaska. It would be an excellent thing if some such control could also be exercised over these operations in the coastal States.

During the year 1916 Dr. Charles H. Gilbert, of Stanford University, assisted by Willis H. Rich, conducted salmon-marking experiments on an extensive scale. Late in the fall of 1915 a consignment of 100,000 eggs of the red salmon was forwarded to Seattle, Wash., from the station of the Bureau of Fisheries at Yes Bay, Alaska, of which 50,000 were reshipped to the Anderson Lake hatchery of the British Columbia Fisheries Department, located on the ocean side of Vancouver Island. The remaining 50,000 were sent to the Bureau of Fisheries hatchery at Quinault Lake, near the coast of Washington. The intention was as soon as the fry, hatched from these eggs, had developed into fingerlings to mark each lot with a distinctive marking and plant them in waters near the hatcheries, with the object of proving that the adult fish would return to the stream in which they had passed their early existence, no matter where the eggs were taken.

This plan could not be carried out at Anderson Lake, as the young fish resulting from the eggs, which were sent there, were not strong enough to survive the experiment. They were therefore liberated without marking. Those hatched at Quinault Lake were marked, however, and liberated in the summer of 1916. Dr. Gilbert has strong hopes that upon the return of the marked fish important data relating to the life history of the species will be obtained.

During February, March, and April, 1916, some 50,000 yearling sockeyes, which had been reared at the Bonneville hatchery of the Oregon Fish and Game Commission from eggs obtained from the Yes

Bay (Alaska) hatchery of the United States Bureau of Fisheries, were marked by the removal of the adipose and both ventral fins, and the fish then liberated in Tanner Creek, a tributary of the Columbia. The fish were in an apparently healthy condition when liberated. In order to make sure that they suffered no ill effects from the marking a few were held until the wounds had healed perfectly, and these were not affected adversely.

During the summer of 1918 a number of marked fish were reported to have returned and been caught.

During the same period close watch was kept on the Quinault River for the return of marked sockeyes from that marking experiment but none were observed so far as known.

OCEAN HOME OF THE SALMON.

All sorts of conjectures have been hazarded as to the ocean home of the salmon after the young fish have gone to sea and disappeared apparently from the ken of man. Many have conjured up visions of the vast schools of adult salmon surging along the coast hundreds of miles seeking for some suitable river in which to spawn, explaining in this wise the variations in the seasonal runs in different sections. Others think the fish go out into the greater depths of the ocean and there hide from man until the spawning instinct leads them back to the coast and thence to the stream in which they were born or planted.

Discoveries of recent years have quite altered this uncertainty, and we now are reasonably certain that the vast majority of the salmon are comparatively near our coast line, while others stay in the bays, straits, and sounds virtually all the time when not in the rivers.

Some years ago it was first noticed that king salmon would take the hook while in salt and brackish waters. At first only the anglers were interested in this fact, but as the demand for king salmon for mild curing became more insistent the commercial fishermen, attracted by the high prices paid, began to devote some attention to the fish during the early spring months, and soon trolling became a recognized branch of the industry. It was first taken up on a considerable scale in southeast Alaska in 1905.^a As the demand for the fish increased, the fishermen extended operations until almost all of southeast Alaska waters were being fished. The length of the fishing season was also increased until now only the severe weather of winter prevents them from fishing. However, the halibut trawls occasionally come up during the season with king salmon on them, showing that they are still on the ground.

The above is also true to a certain extent of the waters of British Columbia and Puget Sound and to a lesser extent, so far as has been disclosed, of Monterey Bay and the Oregon coast.

It has been known for some years that the silver, or coho, salmon would also take the hook under practically the same conditions as the king salmon, and the only reason this species has not been fished for to the same extent as the king has been because it was not large enough to be attractive to the mild curers, and hence there was a much lesser demand for it.

^aReport on the Fisheries of Alaska. By John N. Cobb. Bureau of Fisheries Document No. 618, pp. 19-21. Washington, 1907.

It had been supposed that the other species did not feed when in coastal waters, but Marsh and Cobb ^a state quite differently:

Other species of salmon, in addition to the king, are found to take the trolling hook. For several weeks in July trollers in Union Bay, in southeast Alaska, caught a number of cohos and humpbacks while trolling for kings. The humpbacks were caught mainly with a spoon, no bait being used. Most of them appeared to have been feeding on needlefish and herring, according to the cutter who dressed them. A few red salmon are reported to have been caught on the trolling line by fishermen operating for king salmon in the neighborhood of Mary Island, near Dixon Entrance. Several fishermen report having in previous years frequently taken dog salmon on a hook in the bays along Chatham Strait.

In 1909, Mr. J. R. Heckman, of Ketchikan, Alaska, a well-known cannery man, told the writer that, while he was trying to install a floating trap near Cape Chacon, at the lower end of Prince of Wales Island, southeast Alaska, he on several occasions observed red salmon feeding on what he called a red shrimp.

This was also observed in 1912, when Dr. Gilbert reported, in connection with his observations of salmon fishing on Swiftsure Bank, off the Straits of San Juan de Fuca, that "during the past summer it was observed by Mr. J. P. Babcock and the writer that the sockeye on the Bank were feeding extensively on a small shrimp-like crustacean (*Thysanoessa spinifera*, Holmes), which floats in incredible numbers on the tides and forms a favorite food for the other species as well as for the sockeye." ^b He also found all the other species feeding voraciously in this neighborhood.

The experience of the fishermen operating in and off Port Moller, in Bering Sea, also affords confirmatory evidence along this line. A cannery was established on Port Moller in 1913, the avowed purpose of the owners being to catch what they claimed would be the enormous schools which annually resort to the great rivers of Bristol Bay, some 210 miles to the eastward from Port Moller. This cannery made a fairly large pack for a season or two, using purse seines in Bering Sea and traps along the shore. Misled by this, three other canneries were built in 1916 and 1917. In a season or two the catches of the combined plants had dropped to much less than the catch of the one cannery when operating alone, thus showing that the fishermen were operating on a run which was local to that neighborhood. This is borne out by the fact that the Bristol Bay runs showed no appreciable diminution when the catch was lowest at Port Moller. The pack of the Port Moller canneries follows.

PACK OF THE PORT MOLLER CANNERIES.

Year.	Number of canneries.	Cases packed.	Year.	Number of canneries.	Cases packed.
1913.....	1	44,160	1917.....	4	39,688
1914.....	1	87,175	1918.....	4	124,834
1915.....	1	105,674	1919.....	2	29,849
1916.....	2	132,367			

^a The Fisheries of Alaska in 1909. By Millar C. Marsh and John N. Cobb. U. S. Bureau of Fisheries Document No. 730, p. 26. Washington, 1910.

^b The Salmon on Swiftsure Bank. By Charles H. Gilbert. Report of British Columbia Commissioner of Fisheries for Year ending Dec. 31, 1912, and Appendix, p. 116. Victoria, British Columbia.

These observations would tend to confirm the belief which has been steadily growing in favor for some years that the salmon either spend the greater part of their life in the bays, straits, and sounds, or else in regions adjacent to the coast line.

The reason they had not been found in this region earlier is doubtless due to the fact that during the fall, winter, and spring months the weather on the north Pacific coast is such that fishing operations can not be carried on along the open coast, while in summer the fishermen are all busy on the spawning runs and have no time to devote to fish not yet arrived at maturity, which are probably feeding along the coast as usual.

FISHING GROUNDS AND HISTORY OF THE FISHERIES.*

WASHINGTON.

Puget Sound.—Strictly speaking, the name Puget Sound should be restricted to that long, narrow arm extending south from the Strait of Juan de Fuca, but a practice has developed, and is now common among fishermen and others, of designating all the great water area in the State of Washington comprising Puget Sound proper, Strait of Juan de Fuca, Canal de Haro, Rosario Strait, the Gulf of Georgia, and the smaller straits, bays, and sounds, as Puget Sound, and this practice, for the sake of convenience, has been followed in this report.

This great indentation in the coast, with its numerous islands and many fine harbors, has greatly aided the development of this portion of Washington and has been specially favorable to the prosecution of the salmon and other fisheries. Numerous rivers and creeks enter the Sound, the more important of these being on the eastern shore and comprising the Nooksack, Skagit, Stillaguamish, Snohomish, Duwamish, Puyallup, and Nisqually. On the southern and western shores the tributary streams are nearly all small, the more important being the Skokomish, Quilcene, Dungeness, and Elwha.

As on other bodies of water on the Pacific coast frequented by salmon, the Indians were fishing for them when the first whites visited the country. The natives at this time, and for many years after, used reef nets and hooks and lines in the salt water, and spears, dip nets, and weirs in the rivers. Traders first reached the headwaters of the Fraser River and gradually worked down the same until they reached the sea.

For many years this region was comparatively isolated from the rest of the world, and the completion of transcontinental railroads has not completely changed this, owing to its distance from large consuming centers. As a result of this isolation, it was necessary for many years to resort to methods of preparation which would insure the preservation of the product for indefinite periods. Salting naturally came first, followed by canning, while the shipping of fresh salmon has been steadily growing in importance as transportation facilities increased.

The Northwest Co., a large fur-trading organization, about the beginning of last century first introduced the salting process and

* For some of the regions the historical data are fragmentary and can not be considered as other than historical notes. It is hoped that some one will write a history of the industry before all of the pioneers have passed away.

this was continued by the Hudson Bay Co. Both companies carried on the business primarily for the purpose of providing a winter stock for the use of their employees and for local sale. As shipping developed on the Pacific, a considerable export trade in salted salmon was developed with the Hawaiian Islands, Australia, China, and Japan, and with the eastern United States. Quinnet, or spring, and sockeye salmon were the principal species employed in the earlier years.

After the boundary line between Canada and the United States had been established in 1846, and what is now the State of Washington was acknowledged as part of the latter, a number of small traders and fish packers succeeded the Hudson Bay Co. In the early sixties several men were engaged in the business at Point Roberts, according to the Olympia Columbian of September 10, 1853. In 1873, V. T. Tull, of Olympia, established a salmon fishery at Mukilteo, principally for putting up fish in barrels. The first year 500 barrels were packed at Mukilteo, after which the fishery was moved temporarily to Seattle to take the late run up the Duwamish River, which is usually large. Fifteen hundred good large salmon have been taken at one haul of the seine in the Puyallup.

Bancroft's "History of Washington, Idaho, and Montana" contains among others the following references^a to the early fishermen of the Sound:

In 1874 Corbette & Macleay, of Portland, founded a fishery at Tacoma. Sixty barrels were packed in five days, only three men being employed.—New Tacoma Tribune, November 14, 1874. In 1876, John Bryggot, a Norwegian, founded another fishery at Salmon Bay, 6 miles north of Olympia. In 1878 a company of Puget Sound men established a fourth at Clallam Bay. They put up the first season 600 casks of salmon and 700 of halibut.—Morse's Wash. Terr., MS., xviii, 17-18. In the following season D. D. Hume established a fishery near Steilacoom for the purpose of salting salmon. In 1880 H. Levy, of Seattle, went to London with 100 barrels to introduce Puget Sound salted salmon to that market. In 1882 a salmon packing establishment was opened at Old Tacoma by — Williams. Salmon ran in great numbers this year. One boat brought in a thousand fish.

The extension of the railroad to Puget Sound, thus furnishing an outlet to the rapidly growing population in the Middle West, did much to aid the industry. This also gave opportunity to begin the shipping of fresh halibut and salmon to eastern points. Ainsworth & Dunn, of Seattle, operating later under the name of the Seattle Fish Co., were the first successful pioneers in this branch of the industry, beginning about 1889, and carrying it on until they sold out in 1901, as noted later.

In 1903 the San Juan Fishing & Packing Co., which had begun the fresh-fish business in 1899, bought this business from the Pacific Packing & Navigation Co., to which it had been sold in 1901.

In 1893 A. E. Wadhams, who had operated on the Columbia River for some years, established a sockeye plant at Point Roberts.

In 1894 both canneries were sold to their present owner, the Alaska Packers Association, an organization formed not long before this by a combination of a number of Alaska plants.

About 1894 A. E. Devlin came up from the Columbia River and established a plant at Friday Harbor, which is now operated by the Friday Harbor Packing Co.

^a History of the Pacific States, Washington, Idaho, and Montana, 1845-1889, vol. 26, pp. 345-349. By Hubert Howe Bancroft.

In 1895 three new canneries were built at Anacortes—one by Philip S. Cook (later owned by the Porter Fish Co. and now by the Anacortes Fisheries Co.), one by the Anacortes Packing Co. (now owned by the Alaska Packers Association), and the other by the Fidalgo Island Canning Co. In the same year a cannery was built at Port Angeles by the National Packing Co. In 1902 this plant was sold to the Manhattan Packing Co., which company was absorbed by the Gorman interests in 1906.

In 1896 J. R. Young and B. L. Williams built a small cannery at Blaine. They failed in 1900 through the failure of their trap fisheries and J. W. & V. Cook Packing Co., of Portland, bought their plant and put J. L. Smiley in charge of it. In 1909 Mr. Smiley purchased this plant from the company and operated it until 1916, when he disposed of it to Lee Wakefield and E. Schoenwald, who sold it the following year to the Wilson Fisheries Co.

As Ainsworth & Dunn found that they were receiving more salmon than they could dispose of in a fresh condition (they were first, in 1889, to ship fresh salmon from here to eastern points), the firm built a cannery on the Seattle water front, at what is now Pier 8, about 1895 or 1896, and about 1897 built another at Blaine.

In 1900 the Blaine Packing Co. built a cannery at Blaine and operated it nearly every season until 1916, when it was sold to the Blaine Cannery Co.

In 1901 Ainsworth & Dunn sold all its fresh fish and canned salmon holdings to the newly organized Pacific Packing & Navigation Co. When the latter company failed and its assets were sold in 1904, the firm bought back its former Blaine plant and has operated it ever since. Mr. Ainsworth, the senior member of the firm, died in 1914, but the business is still operated under the name of Ainsworth & Dunn.

The Pacific American Fisheries Co. was incorporated in 1899. The company purchased at the time of its organization the cannery and trap properties of the Island Packing Co., San Juan Island, and the cannery of the Franco-American North Pacific Packing Co., at Fairhaven. The last-named cannery had been built the previous year.

By 1900 a number of canneries had been erected on the shores of Puget Sound, most of which were then in active operation. In 1901 the Pacific Packing & Navigation Co. was organized under the laws of the State of New Jersey, for the purpose of acquiring a number of salmon canneries on the coast. It was supposed to be backed by unlimited eastern capital, and its authorized capitalization was as follows: Common stock, \$12,500,000; 7 per cent accumulative preferred stock, \$12,500,000; and 6 per cent debentures, \$7,000,000. It actually issued \$6,037,000 common stock, \$6,963,000 preferred stock, and \$3,000,000 debentures. Subsequently the management effected an exchange of preferred stock for debentures, increasing the former to about \$7,500,000 and decreasing the debentures to about \$1,650,000.

The new company purchased a number of canneries in Alaska, also the following Puget Sound plants: Pacific American Fisheries Co.'s canneries at Fairhaven (now Bellingham) and Friday Harbor; the Ainsworth & Dunn canneries at Blaine and Seattle, and the Fairhaven Packing Co. cannery at Fairhaven.

The company had a very short career, ending up in the bankruptcy courts in 1903, and when all its affairs were wound up the stockholders received nothing, while the bondholders got but an exceedingly paltry sum out of all the money put into it.

Most of the canneries secured on Puget Sound were repurchased by their former owners or by new people.

The Apex Fish Co. was incorporated in 1904 and built a cannery at Anacortes which has been operated continuously since.

B. A. Seaborg, a well-known Columbia River packer, early in the century established a cannery in South Bellingham and operated it under the name of the Washington Packing Co. In 1905 it was purchased by R. A. Welsh, then of Vancouver, British Columbia, and Loggie Bros., of Bellingham, and has been operated since under the name of the Bellingham Canning Co.

The Hillside Canning Co.'s plant was built and operated for the first time at Port Townsend in 1905 by Andrew Weber, H. Ellerbeck, William McKee, and E. C. Seeley.

In 1906 T. J. Gorman, since deceased, purchased the cannery of the Rosario Straits Packing Co. at Anacortes.

In 1906 E. A. Sims leased the cannery at Port Townsend which had been built some years earlier by Mr. Cook and operated under the name of the Port Townsend Packing Co.

A one-line cannery was erected in the spring of 1906 by the Wadham-Curtis Canning Co. at Blaine, but it burned down the same year.

In 1897 the Chlopeck Fish Co. (now the Booth Fisheries Co.), which had been operating in Portland for several years, started a fresh fish and freezing business at Seattle.

The first salmon cannery on Puget Sound was erected by Jackson, Myers & Co., in 1877, at Mukilteo, in Snohomish County. The members of this firm had all been engaged previously in salmon canning on the Columbia River. The first pack was of 5,000 cases, composed wholly of silver, or coho, salmon. Later at this plant were put up the first humpbacks ever canned. In order to divert the minds of purchasers from the fact that the meat of the humpback was much lighter in color than the grades then known to the consuming public, the company printed on its label the legend, "Warranted not to turn red in the can." Even with this shrewd sizing up of the weak side of the consuming public the demand for humpback, or pink, salmon developed very slowly, and it was some years before it became a factor in the markets.

Within a year or two after the opening of the above plant another was started at Mukilteo by a man named Bigelow.

In 1880 the Myers's cannery was destroyed by a heavy fall of snow. It was rebuilt in West Seattle and was operated till 1888, when it was destroyed by fire. George T. Myers, now sole owner, built a new cannery at Milton, which was burned two years later, and he then came back to Seattle and built a cannery about where Ainsworth & Dunn's dock now stands. He remained here only one season, after which he moved to where the Pacific Coal Co.'s bunkers are now. Late in 1901 he sold out his plant to the United Fish Co., which company moved the plant to the foot of Connecticut Avenue, where they continued operations for two or three years and then quit.

In 1889 a man named Morse established a cannery at Seattle and operated it for only one year.

The first Puget Sound sockeye cannery was built at Semiahmoo, near Blaine, by J. A. Martin and John Elwood about the year 1891. It was bought in 1892 for \$500 by D. Drysdale, who shortly afterward rebuilt and greatly enlarged the plant. In the same year Mr. Drysdale demonstrated the commercial success of fish traps. Traps had been in operation before this, however. In 1893 Ainsworth & Dunn had a trap at Five Mile Rock, just beyond the lighthouse at Magnolia Bluff (now a part of Seattle), and there had been a trap or two in Elliott Bay even prior to this. Traps had not been profitable in this section, however, owing to the cheapness and abundance of salmon, haul seines being cheaper and more profitable to operate. A man named H. B. Kirby, who came originally from Nova Scotia, and another named Goodfellow (now living at Point Roberts) put in the first trap for Mr. Drysdale.

From this time on the industry fluctuated considerably, 41 canneries, an increase of 10 over 1914, being operated in 1915, while 35 were operated in 1919.

During the early years of sockeye canning they were not sold to the trade as sockeyes, but as Alaska reds and Columbia River salmon, for which there had been an established market for some years.

H. Bell-Irving & Co., of Vancouver, British Columbia, were the pioneers in the labeling of the fish as sockeyes, this being in 1894-95. Like all virtually new products, sockeye salmon had a hard fight for several years to secure a foothold in the salmon markets, and it was not until the Spanish-American War in 1898 caused a heavy demand for canned foods that its position became finally established.

Soleduck River.—This is a small stream, about 30 miles in length, which flows through the southwestern part of Clallam County and empties directly into the ocean. The Quillayute Indian Reservation is located here and the natives formerly caught salmon and marketed them on Puget Sound, but a small cannery, started at Mora, on this river, in 1912, furnished a market for the catch up to the end of 1915, when it was abandoned.

Hoh River.—This is a comparatively small river, which is wholly within Jefferson County, and debouches into the ocean in the northwestern part of the county. It passes through the Hoh Indian Reservation in its lower reaches. A cannery was built here in 1917 by Fletcher Bros., and has been operated each season since. In the spring of 1919 it was moved to a more convenient location about a mile from the original site.

Queets River.—This river, which is about 35 miles long, rises in the northern part of Jefferson County and empties directly into the ocean in the northwestern part of Grays Harbor County, within the bounds of the Quinault Indian Reservation. A small salmon cannery was built at Queets, in Jefferson County, in 1905, and has been operated every season since.

Quinault River.—This river, which enters the ocean in the northwestern part of Grays Harbor County, has a length from the ocean to Quinault Lake of about 40 miles, wholly within the boundaries of the Quinault Indian Reservation.

This stream is especially noted for its long-continued annual run of Quinault salmon (*O. nerka*). These fish, which are noted for

their especially red-colored flesh, make their appearance early in December, when the Indians generally catch them for their own use, as they fear that, if the whites got hold of the fish, they might throw away the hearts. Should a heart be eaten at this time by a dog or chicken, the Indians believe the run would not come. In January, when the fish begin to be abundant, all danger of this seems to have passed, for the Indians then usually have a considerable number for sale, and these are generally shipped to distant markets in a fresh condition by the buyers. As soon as the canneries open at Moclips most of the fish are disposed of at that place. The run continues up to July 1. May and June are the best fishing months.

There is a fall run of chinooks in this river, which usually arrives in August and ends about October 15.

The silver salmon appear about October 1 and the run is generally over by November 15; the dog salmon appear about November 1 and the run is usually over by the middle of the same month, while the steelhead trout run between November 20 and May 1. None of the latter are canned.

Moclips, the terminus of the railroad, is about 10 miles from the river, and the fish are all taken by team to this place. Twenty fish, weighing approximately 100 pounds, are put in each box, and these are piled onto the wagons until a load has been accumulated. The team owners get 50 cents a box for hauling the loaded ones to Moclips and 5 cents a box for bringing the empty ones back.

In 1915 the records of the Indian agent show that the Indians fishing on the north side of the river caught 219,654 Quinault salmon, valued at \$49,820, while those on the south side caught 135,353 of these fish, valued at \$30,528.60, or a grand total of 355,007 fish, valued at \$80,348.60. This does not take into account the results of the fishing for the other species of salmon and steelhead trout, which quite materially swell the total.

Fishing is restricted to the Indians, who also make their own fishery laws, with the advice and approval of the Office of Indian Affairs, as the State laws have no force inside the bounds of the reservation. Under the regulations now in force, a clear channel of one-third the width must be left in the middle of the stream, which is from 250 to 300 yards in width. Each owner of a fishing location has to fish it in person; provided, however, that widows, orphans, minor children, old Indians, and those who are sick or have gainful occupations other than fishing, are allowed to lease their locations or hire some one to fish them, and then only with the approval of the officer in charge.

During the Quinault season stake nets are used, while the rest of the time, as a result of the freshets, drift gill nets are used in the eddies. The stake nets are arranged in a rather peculiar manner. A line of stakes is run out for about one-third the width at right angles to the shore, and to these are attached a net by short ropes. From each stake a section of net is run out and downstream, curving inward like a hook at the end, the latter part being held in place by three stakes.

The stake nets are 40 to 60 meshes deep, with $5\frac{1}{4}$ -inch stretch mesh, and are set 85 yards apart. A set of these as described above forms one fishing location.

The chinook gill nets are usually 8½ to 9 inches stretch mesh and 24 meshes deep, while the gill nets for silvers, dogs, and steelheads are of 7-inch stretch mesh and 35 meshes deep.

For some years the salmon from the Quinault River were brought to Hoquiam and Aberdeen for canning. In 1911 W. W. Kurtz, of the former place, began the erection of a cannery at Moclips for the purpose of packing these fish, and the same season his example was followed by Frank Shafer. Mr. Kurtz still operates his plant, but the other is now owned by the Pacific Fisheries & Packing Co.

Grays Harbor.—This is the first important indentation on the coast of Washington south of Cape Flattery. It is about 40 miles long from east to west and about 20 miles wide in the widest part. The principal tributary is the Chehalis River, but there are a number of small streams which debouch into the harbor.

In 1883 B. A. Seaborg, who operated a cannery on the Columbia River, established a plant at what was later to be the thriving city of Aberdeen, although at that time it was practically a wilderness.

In 1902 the North American Fisheries Co. built a plant at Aberdeen. Shortly after it came into the possession of the Grays Harbor Packing Co., and on June 8, 1903, it was destroyed by fire. It was rebuilt and operated by this company until 1906, when it was sold to S. Elmore & Co., who still own it.

The Hoquiam Packing Co. built a cannery at Hoquiam in 1904 and have operated it ever since.

In 1910 two canneries were in operation at Aberdeen and Hoquiam, respectively; in 1915 there were three at the former place and one at the latter, while in 1919 there were six in operation.

Willapa Harbor.—The entrance to this harbor, which also includes Shoalwater Bay, is about 27 miles south of Grays Harbor. The harbor runs east and west and is about 25 miles long. Shoalwater Bay extends south from it a distance of about 30 miles, its southern portion ending about a mile from the Columbia River and its western side being separated from the ocean by a spit varying in width from three-fourths to 1 mile. The bay is shallow, excepting in the main channel. The principal salmon streams entering the harbor are the Nasel and North Rivers, in which most of the pound or trap nets are located.

In 1884 B. A. Seaborg, a Columbia River canner, established a plant on Shoalwater Bay, as the whole of Willapa Harbor was then known.

About 1900 F. C. Barnes established a cannery at Sunshine, on the Nasel River, but the run of salmon on this river soon became so small that the plant was abandoned and the machinery moved to Mr. Barnes's cannery at South Bend.

In 1904 P. J. McGowan, the Columbia River canner, opened a cannery on the North River. Mr. McGowan, who was over 80 years of age at the time, had turned the control of his important Columbia River canning interest over to his sons, but finding idleness not to his liking, started this cannery in order to have something to occupy his time. He operated it for several years and then abandoned the project.

In 1912 the Chetlo Harbor Packing Co. established a cannery at Chetlo Harbor, but operated it only that year and in 1914.

In 1919 only two canneries, both of them at South Bend, operated on Willapa Harbor.

COLUMBIA RIVER.

The Columbia, which is the largest river of the Pacific coast, rises in British Columbia, flows through Washington, reaching the northern border of Oregon about 75 miles west of the State's eastern boundary; from this point the river forms the dividing line between Oregon and Washington, its general course being westerly. It empties into the Pacific at Cape Disappointment. Its principal tributaries are the Spokane, Yakima, Snake, John Day, Deschutes, and Willamette Rivers, and through these the main river drains an enormous extent of territory.

This river, which has produced more salmon than any other river in the world, has had a most interesting history. Many years before the white man saw its waters the Indians visited its banks during the annual salmon runs and caught and cured their winter's supply of food. Along the shores of the river at The Dalles for 15 miles were notable fisheries where various bands, who lived south and north, had their respective fishing locations, and to which all others were forbidden access. They used spears and dip nets in catching the salmon, the majority of which were dried and smoked for winter use. This dip, or basket, net was fastened to a pole about 30 feet long and slid on a hoop. The Indian filled it by slinging it as far as possible up the stream and then hauling it up, the weight of the fish closing the net by drawing it on the hoop.

A favorite preparation of the Indians who resorted to the river was pemmican. This was the meat of the salmon cleaned of the bones, pounded up fine, and then packed in hempen sacks of home manufacture. A sack of pemmican weighed from 80 to 90 pounds and was worth in barter as much as an ordinary horse.

Capt. Wilkes, U. S. N., has the following to say with respect to salmon fishing by natives at Kettle Falls on the Columbia River near the present city of Colville, Wash., at the time of his visit there in 1841:

There is an Indian village on the banks of the great falls, inhabited by a few families, who are called "Quiaripi" (basket people), from the circumstance of their using baskets to catch their fish (salmon). The season for the salmon fishery had not yet (in June?) arrived, so that our gentlemen did not see the manner of taking the fish; but, as described to them, the fishing apparatus consists of a large wicker basket supported by long poles inserted into it and fixed in the rocks. The lower part, which is of the basket form, is joined to a broad frame spreading above, against which the fish in attempting to jump the falls strike and are thrown back into the basket. This basket during the fishing season is raised three times in the day (24 hours), and at each haul not unfrequently contains 300 fine fish. A division of these takes place at sunset each day under the direction of one of the chief men of the village, and to each family is allotted the number it may be entitled to; not only the resident Indians, but all who may be there fishing, or by accident, are equally included in the distribution.^a

The first American to engage in fishing on the Columbia River was Capt. Nathaniel J. Wyeth, of Massachusetts, who in 1832 crossed overland to Oregon with the purpose of establishing salmon fisheries in connection with prosecuting the Indian and fur trade. He dispatched a vessel via Cape Horn to the Columbia with trading goods, but she was never heard from after sailing. In the meantime Wyeth

^a Narrative of the United States Exploring Expedition during the Years 1838, 1839, 1840, 1841, and 1842. By Charles Wilkes, U. S. Navy, commander of the expedition. In 5 volumes. Vol. IV, pp. 444, 446. Philadelphia, Lee & Blanchard, 1845.

had established a station at Fort Hall, on the Lewis River, a branch of the Columbia.

In 1833 Capt. Wyeth returned overland to Boston, while the rest of his party dispersed throughout the Columbia Valley. Far from disheartened by the disaster to his vessel, Capt. Wyeth dispatched the brig *May Dacre*, Capt. Lambert, laden with trading goods and supplies, to the Columbia River via Cape Horn, while he crossed overland with 200 men. He established a salmon fishery and fort at the lower end of Wappatoo (now Sauvies) Island, at the mouth of the Willamette River.

The salmon fishery did not prove successful and the brig sailed in 1835 with only a half cargo of fish and did not come back. The same year Capt. Wyeth broke up both the establishment here and on the Lewis River and, disheartened, returned to Massachusetts, having found the competition of the Hudson Bay Co. too powerful for him.

In August, 1840, Capt. John H. Couch, in command of the brig *Maryland*, which belonged to Cushing & Co., of Newburyport, Mass., arrived in the Columbia River. After taking a few salmon the vessel left in the autumn never to return. On April 2, 1842, Capt. Couch reappeared in the river with a new vessel, the *Chenamus*, named after the chief of the Chinooks. With his cargo of goods he established himself at the present site of Oregon City, the first American trading house to be established in the Willamette Valley. He also established a small fishery on the Columbia River. The vessel returned to Newburyport in the autumn.

The next American vessel to come in established a far from enviable record. There is no record of her name, but she was commanded by a man named Chapman and entered the river April 10, 1842. She came for the purpose of trading and fishing and remained till autumn. During her presence in the river it is charged she sold liquor to the Clatsop and other savages, as a result of which much bloodshed and discord resulted.

About 1857 John West began salting salmon in barrels at Westport, on the lower Columbia.

In February, 1859, the Washington Legislature passed an act prohibiting nonresidents from taking fish on the beach of the Columbia between Point Ellis and Cape Hancock.

Bancroft ^a states:

On the 26th of January, 1861, J. T. Lovelace and W. H. Dillon were granted the exclusive right to fish in the Columbia for a distance of 1 mile along its banks and extending from low-water mark half a mile toward the middle of the stream.

In 1861, H. N. Rice and Jotham Reed began packing salted salmon in barrels at Oak Point, 60 miles below Portland. The first season's pack amounted to 600 barrels. The venture proved fairly profitable and was soon participated in by others.

In the spring of 1866 William Hume, who had assisted in starting the first salmon cannery in the United States on the Sacramento River in 1864, finding the run of fish in the latter stream rather disappointing, started a cannery for Hapgood, Hume & Co. on the Columbia at Eagle Cliff, Wash., about 40 miles above Astoria.

^a History of the Pacific States, Washington, Idaho, and Montana, 1845-1889, vol. 26, p. 349. By Hubert Howe Bancroft.

The year this first cannery operated the following fishermen were operating in the river: Jotham Reed used a trap and a small gill net opposite Oak Point; Mr. Wallace fished a small seine from the shore of an island of that name a short distance below; John T. M. Harrington (who was later to establish the Pillar Rock cannery), in conjunction with a man named Fitzpatrick, operated a seine at Tenasillie, as did also a Mr. Welch; P. J. McGowan, who, with his sons, in 1884 started a cannery at McGowan, and later, at Warrendale, Ilwaco, etc., operated two small seines at Chinook Beach; and Hapgood, Hume & Co. had two small gill nets about 125 fathoms in length and 32 meshes deep. The gill net of Mr. Reed was much smaller than these. At this period the river literally swarmed with salmon, and the cannery had no trouble in packing 4,000 cases, which it increased to 18,000 the next year and to 28,000 cases in 1868.

In 1867 a crude cannery on a scow was started by S. W. Aldrich, a ship carpenter. The scow was about 50 by 20 feet, with a cabin on it, and in one end of this he constructed a brick furnace in which he set a large cast-iron cauldron for a cooker. Along one side he rigged a bench and manufactured the cans. Aldrich was a regular jack-of-all-trades, as he did everything from catching the fish to canning and cooking them ready for the market.

In 1868 a cannery was built near Eagle Cliff by one of the Humes, while in 1873 R. D. Hume built another at Bay View, Wash. He operated it until 1876, when Mr. Leveridge, of Leveridge, Wadhams & Co., of San Francisco, bought it and operated it during 1877 and 1878. George W. Hume took it then and a few years later sold it to David Morgan, jr., who got into financial difficulties, and the plant was ordered sold by the court. C. W. Fulton, of Astoria, later a United States Senator, had the matter in charge, but was unable to find a customer, and finally in desperation offered it to W. H. Barker, of George & Barker, for \$600. Mr. Fulton closed with him the same day. It proved a most profitable transaction for the purchasers, who acquired a million and a half labels which could be utilized, the machinery was taken out for other plants, the timber on the land belonging to the tract sold, and the floating property sold for a considerable sum, after which the stripped plant and land were sold back to Mr. Morgan for \$600, the purchase price. He sold it to George W. Hume, who wanted it to correct a title. It was sold for taxes a couple of years later and was bought in by B. A. Seaborg, who operated it for two years, since when it has been idle.

George W. Hume was the first salmon canner to employ Chinese. This was at Eagle Cliff in 1872. At this period the white laborers in the canneries were recruited from the riffraff and criminal element of Portland. He had a Chinese working for him and through this man secured a Chinese gang from Portland. This labor proved so satisfactory that the custom soon spread to the other canneries. It was not found that the Chinese could do the work any better or quicker than the white laborer, but they proved more reliable in their work and gave less trouble.

Donald and Kenneth Macleay, of Portland, and William Corbitt, of San Francisco, who were in business in Portland, were the first to make a direct shipment of canned salmon to Liverpool. This

was in 1871, and the shipment abroad that year amounted to 30,000 cases.

Of the 35 canneries on the Columbia River in 1881, it is said that about one-half had been established by the Hume brothers. G. W. and William Hume were partners in the firm of Hapgood, Hume & Co., on the Sacramento River, and established the first cannery on the Columbia. In 1881 William was the proprietor of two canneries, one at Astoria, Oreg., and one at Eagle Cliff, Wash. R. D. Hume, a third brother, in the same year had a cannery in operation on the Rogue River, and established three others, one at Eagle Cliff (then owned by William Hume), one at Rainier (then belonging to Jackson & Myers), and one at Astoria. The fourth brother, Joseph, came to the coast in 1871 and some time later established a cannery on the river.

One of the pioneer cannerymen on the river was the late F. M. Warren, operating as the Warren Packing Co., who established a cannery at Cathlamet, Wash., in 1869. The same company is still operating the plant. Later another cannery was established at Warrendale, Oreg., and it also is still operated by this company. Mr. Warren was the inventor of a retort, patented on April 10, 1877, which was in use by the principal canneries on the coast for a number of years.

John West was another pioneer. He built a cannery at Hungry Harbor, Wash., about 1869. In 1881 he moved his plant to Westport, on the Oregon side of the river. Mr. West was the inventor of a packing machine for placing the fish in the cans.

In 1871 the firm of Megler & Jewett established a cannery on the present site of Brookfield, Wash., and named it in honor of Mrs. Megler's birthplace, North Brookfield, Mass. In 1876 the plant was greatly enlarged and J. S. Megler bought out his partners and took in Mr. Macleay, of Corbitt-Macleay, wholesale grocers, of Portland and San Francisco, and changed the firm name to J. S. Megler & Co., under which title it still operates. In 1879 Mr. Megler bought out this partner and owned the plant until his death in 1915, since when it has been operated by his widow.

The first soldering machine used on the Columbia River was in this plant, while the steam box and lacquering machines were first put in use on the river in this plant.

In 1874 the Adair brothers, S. D. and John, jr., erected a cannery at Astoria, the second one to be built there. Before packing began, A. Booth, the well-known Chicago fish dealer, and progenitor of the present Booth Fisheries Co., acquired a half interest in the plant, which was then named A. Booth & Co. John Adair, jr., was the manager. The brothers established canneries on the Fraser River and in some seasons exchanged places in operating on the two rivers. S. D. Adair sold out his cannery on the Fraser and bought one on the Columbia and operated it under the firm name of S. D. Adair & Co. After selling out his interest in A. Booth & Co., S. D. Adair formed a partnership with Wm. B. Adair under the style of S. D. Adair & Co. in 1881. The brothers were active in the industry for a number of years.

J. O. Hanthorn, under the firm name of J. O. Hanthorn & Co., established one of the largest canneries on the river at Astoria in 1876. He invented a rotary can washer for washing cans after they were filled ready for soldering and before the tops were put on.

In the same year Marshall J. Kinney began his long and interesting career in the canning business by establishing a cannery at Astoria.

One of the most noted men the Columbia River produced was Mathias Jensen, a Dane, who fished there for some years. He achieved especial fame from his important inventions in canning machinery. His first invention, however, was a machine for filling needles for knitting salmon nets. He next invented a can-filling machine, which is in common use to-day. He also invented the first topping machine, which was a marked success. The patent rights of both these machines were sold to the Alaska Packers Association. The machines were all made at the plant of the Astoria Iron Works, at Astoria, of which Mr. John Fox was the founder.

The first fish trap or pound on the river was constructed by Mr. Graham, in Baker Bay, on the Washington shore, in 1879. In 1881 Mr. P. J. McGowan built some traps just below the bay. The traps were very successful at times.

The first purse seine on the river was operated by William Graham & Co. in 1906.

Below appears a list of the canneries operated on the Columbia River in 1881, together with the pack of each during the year in question:

J. Williams (Oregon side).....	9,000	F. M. Warren.....	12,000
Astoria Packing Co.....	30,000	J. West.....	12,000
Elmore Packing Co.....	7,890	Jackson & Myers (2 canneries) ..	13,000
Astoria Fishery (M. J. Kinney) .	26,000	Aberdeen Packing Co. (Wash-	
Wm. Hume.....	20,000	ington Territory side).....	17,000
Geo. W. Hume.....	18,000	Jos. Hume, Knappton.....	20,225
Devlin & Co.....	20,000	Pillar Rock Co.....	15,000
Occident Packing Co.....	15,000	J. G. Megler & Co.....	25,000
West Coast.....	15,000	Columbia Canning Co.....	8,000
Badollet & Co.....	25,000	R. D. Hume & Co.....	8,300
Booth & Co.....	23,000	Cathlamet Cannery.....	8,000
Eagle Cannery.....	17,300	Jas. Quinn.....	5,000
Timmins & Co.....	8,000	Cutting & Co.....	20,000
Fishermen's Packing Co.....	19,000	Eureka Packing Co.....	20,000
S. D. Adair & Co.....	10,000	Hapgood & Co.....	13,000
Anglo-American Packing Co....	10,300	Eagle Cliff Cannery.....	10,000
Hanthorn & Co.....	19,000		
Scandinavian Co.....	20,000	Total.....	549,115
J. W. & V. Cook.....	30,000		

An interesting compilation prepared by the Portland Board of Trade ^a shows the total product in cases, the price per case of 48 pounds, and the price for each fish paid by the canneries to the fishermen from 1866 to 1881:

Year.	Total product.	Price.	Cost of fish.	Year.	Total product.	Price.	Cost of fish.
			<i>Cents.</i>				<i>Cents.</i>
1866.....	4,000	\$16.00	15	1874.....	350,000	\$6.50	25
1867.....	18,000	13.00	15	1875.....	375,000	5.80	25
1868.....	28,000	12.00	20	1876.....	450,000	4.50	25
1869.....	100,000	10.00	20	1877.....	480,000	5.20	25
1870.....	150,000	9.00	20	1878.....	480,000	5.00	25
1871.....	200,000	9.50	22½	1879.....	480,000	4.80	50
1872.....	250,000	8.00	25	1880.....	530,000	4.80	50
1873.....	260,000	7.00	25	1881.....	550,000	5.00	60

^a The Commerce and Industries of the Pacific Coast of North America, pp. 372, 373. By John S. Hittell. San Francisco, 1882.

The banner year in the canning industry was 1884, when 620,000 cases of chinook salmon were marketed. At this time the runs were so enormous that tons and tons of salmon were thrown overboard by the fishermen because the canneries were unable to handle them.

As in other sections, there came a time when the market began to be glutted by the packs of the numerous canneries, and it was found necessary to combine some of the plants in order to operate more cheaply and also to reduce the output.

In 1885 W. H. Barker and George H. George, who had been connected with various canneries, formed a partnership as George & Barker and purchased the Astoria cannery of the Port Adams Packing Co., then 2 years old.

Shortly before this a combination which was named the Eureka & Epicure Packing Co. had been formed and comprised the following plants: Knappton Packing Co., Knappton; North Shore Packing Co., just below Knappton; and the Eureka Packing Co. This combination got into financial difficulties, and the reorganizers persuaded George & Barker to join the combination and take charge.

In 1887 the Eureka & Epicure Packing Co., the plants of Samuel Elmore, M. J. Kinney, and J. W. Seaborg, all of Astoria; J. O. Hanthorn & Co., Astoria; Fishermen's Packing Co., Astoria; Scandinavian Packing Co., Astoria; Columbia Canning Co., and J. W. & V. Cook, Clifton, were combined under the name of the Columbia River Packers Association. In 1889 the association built a new cannery at Rooster Rock. Mr. George was with the association until his death, but Mr. Barker left it to become general manager of the British Columbia Packers Association, where he is at present, the dean of the Pacific coast cannerymen.

Early in the eighties the California Can Co. was engaged in the business of making cans in San Francisco. Later the Pacific Sheet Metal Works absorbed the company. A factory was started at Astoria, with Mr. F. P. Kendall in charge. The latter, who is one of the deans of the industry, has had a long and interesting connection with all branches of the industry and in most sections. The American Can Co. later on bought the Pacific Sheet Metal Works, and the Astoria plant was moved to Portland.

The American Can Co. was the first to install sanitary can-packing machinery in the salmon industry, the venture being made in 1911, at the Sanborn-Cutting plant in Astoria.

At the present time (1919) there are 21 canneries in operation on the river, while large quantities of salmon are also frozen, mild cured, pickled, smoked, and sold fresh in the markets of the world.

Commercial fishing is carried on mainly between the mouth of the Columbia and Celilo, a distance of about 200 miles, and in the Willamette River. The most of it is in the lower part of the river, within about 40 miles of its mouth. Bakers Bay, on the Washington or north side, and just within the river's mouth, is the favorite ground for pound-net fishing. The principal gill-net drifting ground is from the river's mouth to about 20 miles above Astoria, but drifting is done wherever convenient reaches are found much farther up the river. Most of the drag seines are hauled on the sandy bars in the river near Astoria, which are uncovered at low water. Wheels are operated in the upper river above the junction of the Willamette with the main river.

Astoria is the principal center for all branches of the industry, but more especially for canning. Other places in addition to Astoria at which canneries are located are Ilwaco, Eagle Cliff, Altoona, Brookfield, Pillar Rock, Cathlamet, on the Washington shore, and at Warrendale, Rooster Rock, and Seuferts, on the Oregon shore.

OREGON.

Necanicum Creek.—This short stream is in Clatsop County and enters the Pacific Ocean about 10 miles south of the Columbia River. Its fisheries are of small importance.

Nehalem River.—The Nehalem is a small coastal river that rises in the mountains of Clatsop and Columbia Counties, and flows into the Pacific Ocean in the northern part of Tillamook County. As early as 1887 there was a small cannery here, and the business has been followed ever since. In 1911 an additional plant was built and both have operated each year since, except in 1913, when one was shut down.

Tillamook Bay and River.—Tillamook River is a very short stream which enters Tillamook Bay, the latter being in Tillamook County and about 45 miles south of the mouth of the Columbia River.

Fishing is carried on mainly in the bay. The earliest record we have of canneries on this bay is of 1886, when two were in operation. From 1891 to 1910 but one was operated, but in 1911 another plant was started. In 1915 a third cannery was built, and all three operated until 1918, when only one was in operation. In 1919, two operated.

Nestugga River.—This stream enters the ocean in the southwestern part of Tillamook County. A cannery operated here in 1887 and the business has been carried on each season with but one intermission since 1905.

Siletz River.—This river has its source in the mountains of Polk County and enters the ocean in the northern part of Lincoln County. The commercial development of the fisheries was hampered for many years owing to the fact that the river was within the boundaries of what was then the Siletz Indian Reservation. The first cannery was established here in 1896. An additional one was built in 1918.

Yaquina Bay and River.—The Yaquina ("crooked") River is about 60 miles long; its general course is nearly west through the county of Benton. The river is narrow throughout the greater part of its length. A few miles from its mouth it suddenly broadens out into an estuary from one-half to three-fourths of a mile wide, which is commonly called Yaquina Bay. The river enters the Pacific about 100 miles south of the Columbia.

Salmon canning was begun on this river in 1887, when two small canneries were constructed. The next year an additional plant was erected. The business has fluctuated considerably since then and there is now but one cannery, which has not been operated since 1911. In 1917 this plant was consolidated with the one at Waldport.

The fishing grounds are all in the bay and the lower section of the river. The fishermen of this section are fortunate in that they have railroad communication with the outside world.

Alsea Bay and River.—Alsea River rises in the southwestern part of Benton County, and flows in nearly a northwesterly direction to

the Pacific, a distance of about 60 miles. Like the Yaquina, the "bay" is merely a broadening out of the river just inside its mouth.

The first cannery was established in 1886 and by 1888 there were three in operation. For many years but one was operated. In 1911 and each season since two canneries have been operated.

The best fishing grounds are from the mouth of the river to about 5 miles inland.

Siuslaw River.—This river has its source in the mountains of Lane County, and its course lies first in a northwesterly direction and to the westward until the Pacific is reached. Through part of its course it is the dividing line between Lane and Douglas Counties. In 1915 a railroad line from Eugene to the mouth of the Siuslaw River, at which point it connected with a line to the Coquille River, was opened for traffic.

As early as 1878 there were two canneries operated on this river, but from 1879 till 1888 there are no data available showing the extent of the fisheries. In 1888 the Florence Canning Co., the Lone Star Packing Co., and the Elmore Packing Co. each operated a cannery. In 1896 A. W. Hurd built a cannery which was destroyed by fire in 1908. At present there are two canneries, but of recent years only one has been operated. The opening of a railroad line from Eugene to here, thus furnishing an outlet for fresh salmon shipments, will doubtless greatly help in developing its fisheries.

The salmon fishing grounds extend from near the mouth of the river to about 20 miles upstream.

Umpqua River.—With the exception of the Columbia this is the largest and longest river in Oregon. It is formed by north and south forks, which unite about 9 miles northwest of Roseburg, and the river then flows northwestwardly and enters the Pacific. Practically all of this river is within the boundaries of Douglas County, one of the largest counties in the State. A railroad has recently been built along this river and in time there will doubtless be a large development of the fisheries of this region owing to the opportunities which will be offered for shipping fresh fish.

With the exception of Rogue River, this is the only river in Oregon south of the Columbia River in which a spring run of chinook salmon occurs.

As early as 1878 there were two canneries located on the Umpqua, one of which was built by George W. Hume. The number has never been larger than this, and usually there has been but one operating. In 1912 there was but one at Gardiner. In 1919 one was operated.

In 1918 the Reedsport Fish Co., of Reedsport, purchased the cannery of the Umpqua Cooperative Co., at Gardiner.

Coos Bay and River.—Coos Bay is a navigable semicircular inlet of the ocean with numerous arms or branches. There is much marshy ground in the bay, and a number of sloughs, or small creeks, which empty into the bay from both sides. Coos River proper is an unimportant stream, but a few miles in length. North Bend, Marshfield, and Empire are the principal towns on the bay. A branch railroad is being built to these points from the main line of the Southern Pacific Railway, and as soon as this is completed the fishing industry will receive a great impetus. Heretofore this region has depended upon steamers and sailing vessels plying to Portland and San Francisco for its communication with the outside world, and

this slow and infrequent means of shipment has very seriously handicapped the fisheries.

Salmon canning began here in 1887, when two canneries opened for business. The business has fluctuated considerably since, most of the time but one cannery being operated; none was operated in 1919.

Fishing is carried on mainly in the bay. A few set nets are operated in the river.

Coquille River.—This river is formed by three branches, called the North, Middle, and South Forks, which rise in the Umpqua Mountains and unite near Myrtle Point, the head of tidewater, about 45 miles by river from the mouth of the stream. It is a deep and sluggish river, with no natural obstructions to hinder the free passage of fish. Its fisheries have been seriously hampered by the lack of railroad communication, but this has recently been remedied, as the railroad to Coos Bay connects with a short line now in existence between the Coquille River and Coos Bay, and thence on to the Siuslaw and from there to Eugene.

The principal towns on the Coquille River are Bandon, Prosper, Coquille, and Myrtle Point. Bandon is the shipping port.

Pickled salmon were cured and shipped from this river very early, the first recorded instance of any considerable quantity being in 1877, when 3,000 barrels of salmon were sent to San Francisco. The salt shipments were important until within recent years. The first salmon cannery was erected in 1883, at Parkersburg. In 1886 another was built at the same place, and the following year still another was erected close by. This was the largest number ever in operation in any one year. Since 1909 two canneries have been operated, both at Prosper. In 1916 the Macleay estate took over the Coquille River Fishermen's Cooperative Co.'s cannery near Bandon.

The fishing grounds are from the mouth to Myrtle Point, about 45 miles inland.

Sizes River.—This small river is located in the northern part of Curry County, and is about 40 miles in length, entering the Pacific a very short distance above Cape Blanco. The salmon caught here are either salted or shipped fresh to the canneries on the Coquille River.

Elk River.—This is another small stream about 40 miles in length, which enters the Pacific just south of Cape Blanco. As on the Sixes River, the salmon are either salted or sold fresh to the canneries on the Coquille River.

Rogue River.—This river has as its source Crater Lake in the Cascade Mountains, on the western border of Klamath County, flowing a distance of about 325 miles to the ocean, which it enters at Wedderburn. Its principal tributaries are the Illinois, Applegate, and Stewart Rivers. Owing to canyons and falls in the main river between the mouth of the Illinois River and Hellgate, the latter near Hogan Creek which runs through the town of Merlin, navigation and fishing are impossible in that section. Except at the mouth of the river the population is very sparse until about the neighborhood of Hogan Creek, where the river approaches the railroad, and from here on for some miles there are numerous growing towns.

Owing to the fact of there being both a spring and a fall run of salmon in this river, the fisheries early became of importance,

although sadly hampered because of being compelled to depend wholly on vessel communication with San Francisco, many miles away. In the early years the salmon were pickled and shipped to San Francisco. Strong, Baldwin & Co. started in the business as early as 1859. In 1877 R. D. Hume, who had been canning salmon on the Columbia River, removed to the Rogue River, and established near the mouth a cannery which he operated every season (except 1894, when the cannery burned down) until his death in November, 1908, after which date it was operated by his heirs. Mr. Hume also operated a large cold-storage plant at Wedderburn for several years.

The development of the fisheries of the lower Rogue River was very much hampered by the monopoly which Mr. Hume acquired and maintained until his death. He bought both shores of the river for 12 miles from its mouth, and also owned an unbroken frontage on the ocean shore extending 7 miles north from the mouth of the river. As a result of this, independent fishermen could find no convenient places for landing, which was necessary in order to cure, handle, and ship the fish caught. Since Mr. Hume's death the property has been sold to the Macleay estate, but the people of Oregon, upon an initiative and referendum petition, voted in 1910 to close Rogue River to all commercial fishing, and it was so closed in 1911 and 1912 but reopened in 1913. A second cannery was built here in 1915 by the Seaborg Canning Co.

In the upper river ranchers living along the banks have engaged in fishing for a number of years, the catch for the most part being sold fresh. In recent years, as the country has developed, this fishery has become fairly important.

Chetco and Windchuck Rivers.—These two unimportant streams empty into the Pacific in the lower part of Curry County, not far from the California line. The former is about 20 miles and the latter about 25 miles in length. Both have runs of salmon, and small fisheries have been maintained for some years, the catch being either pickled or sold to the California canneries.

CALIFORNIA.

Smith River.—This river, which is the most northerly one in the State, rises near the Siskiyou Mountains, and runs in a westerly direction to the Pacific Ocean.

The river has only a spring run of salmon, and the early recorded history of the fisheries is fragmentary. The pickling of salmon was the main business at first and has been important ever since, as the cannery, which was first established in 1878, operated irregularly, and seems to have shut down entirely in 1895. Canning began again in 1914 by H. E. Westbrook and has been prosecuted each year since.

Klamath River.—This is the most important river in California north of the Sacramento. It issues from the Lower Klamath Lake in Klamath County, Oreg., and runs southwesterly across Siskiyou County, passes through the southeastern section of Del Norte County, keeping its southerly course into Humboldt County, where it forms a junction with the Trinity River, and thence its course is directed to the northwest until it reaches the Pacific Ocean.

The Klamath River is important as a salmon stream because it has both a spring and fall run of salmon. In 1888 a cannery was estab-

lished at Requa, at the mouth, and this has been operated occasionally ever since. The pickling of salmon has been done here for a number of years. Some years part of the catch has been shipped fresh to the cannery on Smith River or to the Rogue River (Oreg.) cannery. Since 1908 the cannery has been operated continuously by the Klamath River Packers Association.

Humboldt Bay and tributaries.—The shore line of Humboldt County is bold and high, except in the vicinity of Humboldt Bay, where it is rather flat. The latter is the only harbor along the county shore, and it is quite difficult of access, owing to the bar at the entrance upon which the sea breaks quite heavily. The bay is about 12 miles long and about 3 miles wide. Mad River, which has its rise in the lower part of Trinity County, runs in a northwesterly direction, then makes a sharp turn and enters the bay from the north side. Eel River, which has its rise in Lake County, far to the southeast, runs in a northwesterly direction and enters the bay at its southern extremity. Small railroads running south from Eureka traverse the shores of both rivers for some miles. A railroad now runs from the north side of San Francisco Bay to Eureka, and it has aided very materially in extending the market for salmon caught in these rivers.

Mattole River.—This is a small and unimportant river in the southern part of Humboldt County, and is said to have a good run of salmon each year, but no commercial fishing has as yet been carried on here.

Noyo River.—In 1915 salmon fishing began at Fort Bragg, in Mendocino County, where the Noyo River debouches into the ocean. The building of a branch railroad to this point made the shipping of salmon a possibility. In 1915 and 1916 considerable salmon were caught and shipped fresh. In 1917 the Tillamook Ice & Cold Storage Co., built and operated a cannery here, while the Columbia & Northern Fishing & Packing Co., in the same year built and operated a cold-storage and mild-curing plant.

Sacramento and San Joaquin Rivers.—These two rivers are the most important rivers in California. The Sacramento is quite crooked, the distance by river from Red Bluff to San Francisco being about 375 miles, while the distance by rail between these two places is only 225 miles. The river rises in several small lakes in the mountains about 20 miles west of Sisson, in Siskiyou County, and for nearly half its length flows through a narrow canyon. The upper portion is a typical mountain stream, with innumerable pools and rapids. A little above Redding the river emerges from the canyon and widens into a broad shallow stream. Below Sacramento it runs through a level country and is affected by tides. Sloughs are numerous in this stretch, some connecting it with the San Joaquin. The Sacramento and San Joaquin Rivers join as they empty into Suisun Bay.

The principal tributaries of the Sacramento which are frequented by salmon are the Pit and McCloud Rivers and Battle Creek. At one time salmon frequented the American and Feather Rivers, but mining and irrigation operations along these streams either killed them off or drove them away.

The San Joaquin River has its source in the Sierra Nevada Mountains. Flowing westerly and forming the boundary between Fresno and Madera Counties for a considerable distance, it then turns abruptly to the north just where it is joined by Fresno Slough, which

drains Lake Tulare. From here its general course is northwesterly until it joins the Sacramento River, near the latter's mouth. The Chouchilla and Fresno Rivers are the principal tributaries of the San Joaquin.

The principal fishing grounds for salmon are Suisun Bay, the lower part of San Joaquin River, and the Sacramento River as high as the vicinity of Sacramento. Drift gill nets are used almost exclusively in this section. From Sacramento to Anderson there is considerable commercial fishing, more particularly with haul seines.

Owing to the early and excellent railroad facilities which the fisheries of the Sacramento River have enjoyed, they have not been handicapped so seriously as most of the other Pacific coast rivers in finding profitable outlets for the catch. Soon after the first trans-continental line was opened the shipping of fresh salmon to eastern points began, and it has been an important feature of the industry ever since.

The chief event in the history of the salmon fisheries of this river is the fact that the canning of salmon on the Pacific coast had its inception here in 1864. The circumstances leading up to this event and its consummation are interestingly told by R. D. Hume in the following words:

The first salmon cannery of the United States was located at Washington, Yolo County, Calif. A part of the building was originally a cabin situated on the river bank outside of the levee just opposite the foot of K Street, Sacramento City. It was built in 1852 and occupied by James Booker, Percy Woodsom, and William Hume. William Hume came to California in the spring of 1852, bringing with him a salmon gill net which he had made before leaving his home at Augusta, Me. In company with James Booker and Percy Woodsom, Mr. Hume began fishing for salmon in the Sacramento River just in front of the city of Sacramento. William Hume had been salmon fishing in the Kennebec River in the State of Maine with his father, where his father and grandfather had been engaged in the same business since 1780, and their ancestors in Scotland had for pleasure pursued the sportive salmon on the Tweed and Tay for centuries before. In 1856 William Hume went back to Maine, and on his return to California the same year was accompanied by his brothers, John and G. W. Hume, who also engaged in salmon fishing in the Sacramento River. Among the schoolmates of G. W. Hume was one Andrew S. Hapgood, who had learned the tinsmith's trade, and who a short time after G. W. Hume left for California went to Boston and entered the employ of J. B. Hamblen, a pioneer in the canning business, and was sent by him to Fox Island on the coast of Maine to engage in canning lobsters. The canning of lobster was a new and growing industry, and Mr. Hamblen, to increase his business, a short time after sent Mr. Hapgood to the Bay of Chaleur, an arm of the sea which divides the Province of Quebec from that of New Brunswick, where, in addition to the canning of lobster, they also canned a few salmon. I believe this was the first salmon canned on the American Continent, and I am informed that the business in a small way is still carried on in that section of the country. In 1863 G. W. Hume went back to Maine, and while there visited Mr. Hapgood at Fox Island, to which place he had been again sent by J. B. Hamblen to take charge of the works at that place. During the visit of G. W. Hume to his friend Hapgood a talk about salmon was had, and it was agreed that if salmon on the Pacific coast were as plentiful as represented by Mr. Hume much money could be made in a salmon-cannery business. The plan decided on was that G. W. Hume, on his return to California, should try and induce his brother William to engage in the business with them, and, if he succeeded in so doing, Mr. Hapgood should purchase the necessary machinery and come out to California in time for the spring season of 1864. William Hume being agreeable to take part in the enterprise, Mr. Hapgood set out on the journey and arrived at San Francisco on March 23, 1864, and a few days later at the location where the operations were afterwards conducted.^a

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^a The description of the machinery used and the methods of canning have been quoted in full under "Canning" elsewhere in this report.

For a considerable time after the salmon-canning business was inaugurated the packers suspended operations in the early part of July of each year as at that time the market would take only goods which showed a rich oil and the best food values.^a

The business languished after the firm established its cannery on the Columbia River, but in 1874 was renewed again by others and continued with varying success until 1905, when it ceased temporarily, owing to the smaller quantity of fish available and the difficulty of competing with the mild-cure packers and the fresh-fish dealers. Several times since small packs have been made when, for some reason, mild-curing was unprofitable.

Monterey Bay.—The first harbor south of San Francisco is Monterey Bay, a large indentation cutting into Santa Cruz and Monterey Counties. Only a portion of it is well sheltered, however. For a number of years it had been known that salmon frequented the waters of this bay for the purpose of feeding on the young fishes which swarmed there. Sportsmen frequently caught them with rod and reel, but it was not until the early eighties that the industry was established on a commercial basis. It has since grown very rapidly. The catch has either been mild cured at Monterey or shipped fresh. A few have been canned in recent years.

ALASKA.^b

Alaska is the most favored salmon-fishing region. Many rivers, some of great length and draining enormous areas, intersect the district in every direction, while the number of small creeks is countless. Almost every one of these have runs of salmon of varying abundance. The principal streams entering Bering Sea are the Yukon, Kuskokwim, Togiak, Nushagak, Kvichak, Naknek, Ugaguk, and Ugashik; in central Alaska the Chignik, Karluk, Alitak, Susitna, and Copper Rivers are the main streams, while in southeast Alaska are found, among many others, the Anklow, Situk, Alsek, Chilkat, Chilkoot, Taku, Stikine, and Unuk Rivers. Most of the fishing in Alaska is carried on in the bays into which these rivers debouch. In southeast Alaska, which is composed largely of islands, the fishing is carried on mainly in the bays, sounds, and straits among these.

Even before the purchase of the district from Russia in 1867 our fishermen occasionally resorted to southeast Alaska and prepared salted salmon. The salmon fisheries did not become important, however, until canning was begun.

SOUTHEAST ALASKA.

One of the most favorable sections for carrying on fishing operations is southeast Alaska. Here a narrow strip of mainland, about 30 miles wide, separates British Columbia from salt water and forms the "panhandle" of Alaska. Outside this is a fringe of numerous islands, large and small, close to the coast line, conform-

^a The First Salmon Cannery. By R. D. Hume. Pacific Fisherman, Seattle, Wash., Vol. II, No. 1, January, 1904, pp. 19-21.

^b The material for the history of the salmon fisheries of Alaska for the period from the inception of salmon canning to 1900 was obtained almost wholly from the following excellent and valuable reports by Capt. Jefferson F. Moser, to whom I am deeply indebted for this and other valuable data:

The Salmon and Salmon Fisheries of Alaska. Report of the Operations of the United States Fish Commission Steamer *Albatross* for the Year ended June 30, 1898. By Jefferson F. Moser. Bulletin, U. S. Fish Commission, 1898, Vol. XVIII, pp. 1-178. Washington, 1899.

Alaska Salmon Investigations in 1900 and 1901. By Jefferson F. Moser. Bulletin, U. S. Fish Commission, 1901, Vol. XXI, pp. 173-398. Washington, 1902.

ing to its irregularities and separated from it and from each other by deep straits and channels. These islands, about 1,100 in number, extend from the coast an average distance of about 75 miles and along the general contour for about 250 miles. Some of these islands are very large, indented with deep bays and sounds, and they in turn fringed with smaller islands.

The largest streams in this region are the Unuk, Stikine, Taku, and Chilkat, all of which take their source in the interior and drain considerable areas. The other rivers are usually streams, and the greater number are simply outlets to a lake or system of lakes.

All species of salmon are to be found in this region, but the hump-back is by far the most abundant.

This region has been the favorite fishing ground for the smaller operators, although a few of the largest canneries in Alaska are located here. Of recent years transportation facilities have been exceedingly good and fairly cheap, while the nearness to the States and the considerable resident population which could be drawn upon for labor have been big factors in its development.

The Russians did considerable salting of salmon. Petroff, in his report in the Tenth Census on the "Population, industries, and resources of Alaska," writes as follows of the Redoubt near Sitka: "The once famous Redoubt or deep-lake salmon fishery on Baranof Island, which at one time during the Russian rule supplied this whole region, and whence 2,000 barrels of salmon were shipped in 1868, now lies idle."

Bancroft^a in speaking of the king salmon of Alaska says: "So choice is its flavor, that during the régime of the Russian American Co. several barrels of the salted fish were shipped each season to St. Petersburg for the use of the friends of the company's officials."

One of the earliest operators in southeast Alaska was a Greek, or Slav, named Baronovich, who married the daughter of Skowl, one of the old-time chiefs of the Kasaans, and received from him the fishery on Karta Bay, a part of Kasaan Bay, and one of the best red salmon streams south of Wrangell Narrows. Baronovich built a saltery here, kept a store and traded with the Indians. He died some years ago, and for some time after his death his sons operated it. It finally collapsed a couple of years ago.

For a number of years a saltery was operated at Klawak, on the west coast of Prince of Wales Island. In 1878 the North Pacific Trading & Packing Co. purchased the saltery and erected the first cannery in Alaska here. A pack was made the same year, and the plant has operated every year since. In 1899 the cannery burned down, but it was immediately rebuilt on the opposite side of the bay. For some years this plant was operated almost exclusively with native labor, and at present the majority employed are natives.

The same year that the above cannery was established the Cutting Packing Co. built a cannery at old Sitka, and operated it in 1878 and 1879, then it was closed down. In 1882 the machinery was taken by another company to Cook Inlet.

In 1882 M. J. Kinney, of Astoria, under the name of the Chilkat Packing Co., built a cannery on the eastern shore of Chilkat inlet and made a pack the same year. The cannery changed hands several times

^a History of Alaska, Vol. XXXIII, p. 661. By Hubert Howe Bancroft. San Francisco, 1886.

and finally was burned in 1892, and not rebuilt. The cannery packed every year from 1883 to 1891, both inclusive, except in 1888, when it was closed.

In 1883 the Northwest Trading Co. built a cannery on Pyramid Harbor, a little bay on the western side of Chilkat Inlet. It was operated by this company in 1883 and 1884, was idle in 1885, and in 1888 was sold to D. L. Beck & Sons, of San Francisco, and operated by that firm. In the spring of 1889 it was burned, but was rebuilt at once and a pack made that year. In 1893 it joined the Alaska Packers Association, which operated it, except in 1905, until the end of the season of 1908, when it was finally abandoned.

On the north shore of Boca de Quadra, about 8 miles from the entrance, a cannery was built in 1883 by M. J. Kinney, of Astoria, and operated under the name of the Cape Fox Packing Co. from 1883 to 1886. Late in the last-named year it was sold and moved to Ketchikan, operating there under the name of the Tongass Packing Co. during 1887, 1888, and until August, 1889, when it was burned and not rebuilt.

In 1886 Rhode & Johnson erected a saltery at Yes Bay. The following year the firm became Ford, Rhode & Johnson. In 1887 work was begun on a cannery which was finished in 1888. Packing was begun in 1889 under the name of the Boston Fishing & Trading Co. In 1901 it was included in the Pacific Packing & Navigation Co. consolidation, and when that concern failed was purchased in 1905 by the Northwestern Fisheries Co. In 1906 the cannery was purchased by C. A. Burckhardt & Co., who have operated it each year to date, either under that name or subsequent incorporations known as the Yes Bay Canning Co. and the Alaska Pacific Fisheries.

In 1887 the Aberdeen Packing Co. of Astoria, Oreg., built a cannery on the Stikine River, about 8 miles above the mouth. In 1889 the cannery was moved to Point Highfield, on the northern end of Wrangell Island, and operations commenced under the name of the Glacier Packing Co. In 1893 it joined the Alaska Packers Association, who have operated it continuously, except in 1905.

The Loring cannery of the Alaska Packers Association was built in 1888 by the Alaska Salmon Packing & Fur Co., of San Francisco, and operated by the Cutting Packing Co. The company was incorporated in 1883 and operated a saltery until the cannery was built. When the Alaska Packers Association was formed in 1893 it joined that organization. The cannery has operated every year since it was built, and in some seasons has made the largest pack of any in the Territory.

Shortly after William Duncan and his community of Tsimpsian Indians had settled, in 1887, on Annette Island, which island had been set aside by the Federal Government as a reserve for them, plans were under way for a salmon cannery, but funds came in so slowly that it was not until 1890 that any pack was attempted. In 1891 it was in full operation, and operated from then continuously until 1913, when the plant was shut down for that and the two succeeding years. Much dissatisfaction had been expressed by the natives over the operation of this and other industrial plants on the island, and finally the Federal authorities took possession of practically everything, as guardian of the natives, and early in 1916 leased the cannery to P. E. Harris & Co., of Seattle, the understanding being that they were to employ natives when available. Un-

fortunately the plant burned down on May 17, just before the fishing season began. In 1918 the Annette Island Packing Co. built and operated a cannery here.

For the purpose of assisting the natives of Annette Island in operating this cannery the President in 1916 issued a proclamation making a fishery reserve of the island and among other things provided that—

the waters within 3,000 feet from the shore lines at mean low tide of Annette Island, Ham Island, Walker Island, Lewis Island, Spire Island, Hemlock Island, and adjacent rocks and islets, located within the area segregated by the broken line upon the diagram hereto attached, and made a part of the proclamation, also the bays of said islands, rocks, and islets, are hereby reserved for the benefit of the Metlakatlans and such other Alaskan natives as have joined them or may join them in residence on these islands, to be used by them under the general fisheries laws and regulations of the United States as administered by the Secretary of Commerce.

One white trap net owner refused to remove his trap from the waters in question, and when decision was rendered against him in the lower court, carried the case to the United States Supreme Court, which, in December, 1918, upheld the right of the President to grant exclusive fishing rights in public waters.

James Miller operated a saltery on Burroughs Bay, on Behm Canal, in 1886 and 1887. In 1888 Andrew and Benjamin Young, of Astoria, Oreg., built a cannery here and operated it under the name of the Cape Lees Packing Co. in 1888, 1889, and 1890. It was closed in 1891 and 1892. In 1893 it became a part of the Alaska Packers Association, and was dismantled the following year.

About 1888 a saltery was established on Thorne Bay, Prince of Wales Island. The following year it was sold to the Loring cannery. In 1892 it was sold to Robert Bell, who moved it to the upper end of the northwest arm, on the western shore. Salting was not carried on each season, as it was sometimes found to be more profitable to sell the fish fresh to the canneries. The plant was finally abandoned.

In 1889 Messrs. Sanborn and Ellmore, of Astoria, built a cannery in Pavlof Harbor, Freshwater Bay, on the eastern side of Chichagof Island, and operated it under the name of the Astoria & Alaska Packing Co. It made a pack that year and in the spring of 1890 was moved to Point Ellis, on the eastern side of Kuiu Island, packing that year and also in 1891. It was burned in May, 1892. Only one building was left standing, and it and the site were purchased by John H. Mantle, of Wrangell, who operated a saltery on each arm of the bay. Mr. Mantle began operations here in 1893.

In 1889 the Baranof Packing Co. built and first operated a cannery at the Redoubt, about 12 miles below Sitka. It was also operated in 1890 and then moved to Redfish Bay, on the western coast of Baranof Island. It made its first pack here in 1891 and was then operated every year until 1898, when it was sold to the Alaska Packers Association and dismantled.

In 1889 the Thlinket Packing Co., organized at Portland, Oreg., built a cannery at Point Gerard, on the mainland opposite Point Highfield, at the head of Wrangell Island. It was operated that and the subsequent year.

In 1901 this company built another cannery at Santa Anna, on the north side of Cleveland Peninsula, and made a pack the same year.

In 1901 both plants became part of the Pacific Packing & Navigation Co. In 1902 the Gerard Point plant was closed and was not opened again. In 1903, 1904, and 1905 the Santa Anna plant was closed also. Early in 1905 these plants were purchased by the Northwestern Fisheries Co. at the assignee's sale of the old corporation's properties. The Santa Anna plant was operated in 1906 and has been operated each year since.

The Chilkat Canning Co. put up a plant at Chilkat village, on Chilkat Inlet, in 1889. It was operated from 1889 to 1893, and then sold to the Alaska Packers Association. It was held in reserve for some years but was finally dismantled.

In 1889 D. Blauw, of Tacoma, Wash., built a saltery on Grouse Island, Boca de Quadra, and dry-salted dog salmon. He operated only one season.

In 1890 a cannery was built by the Bartlett Bay Packing Co. on Bartlett Bay, Icy Straits, and operated by Williams, Brown & Co., of San Francisco. A saltery was constructed here prior to that date, and in 1889 a pack of 4,300 cases was made in a crude way. In 1891 the ice piled up in Glacier Bay to such an extent that the cannery could do almost nothing. It was not operated after this date. In 1893 it became a part of the Alaska Packers Association and was dismantled in 1894.

About 1890 a saltery was established on the north shore of the mouth of Quadra Stream, on Boca de Quadra, by Clark & Martin. It was operated intermittently until about 1898, when it was abandoned. The same parties also established a saltery at Ketchikan shortly after the one on Quadra Stream was built, and operated this until about 1898, when the plant was turned into a steamer wharf and warehouse for the new town of Ketchikan which was building up around it.

In 1896 the Pacific Steam Whaling Co. built a cannery on the northern side of Hunter Bay, near the southern end of Prince of Wales Island, and made a pack the same year. Miller & Co. had a saltery at this place and it was purchased by the company and removed to make room for the cannery. Miller & Co. also had a saltery on Nutqua Inlet, which was built in 1896, and this also was sold to the canning company. In 1901 the cannery became a part of the Pacific Packing & Navigation Co. It was closed in 1904. Upon the dissolution of the company in 1905 this plant was purchased by the Northwestern Fisheries Co., which company, after keeping it closed in 1905 and 1906, has operated it each season since.

The Quadra Packing Co. built a cannery on Mink Arm, in Boca de Quadra, in the spring of 1896 and made its first pack that year. In 1901 the plant was purchased by the Pacific Packing & Navigation Co. It was closed in 1904, 1905, and 1906. Upon the dissolution of the company in 1905 the plant was purchased by the Northwestern Fisheries Co. It was reopened in 1907 and has been operated each season since.

In 1897 a saltery was built on Taku Point, near the head of Taku Inlet. In 1898 and 1899 it was operated by the Quadra Packing Co. In 1900 the Icy Straits Packing Co. operated it.

In 1897 a small saltery was in operation by Cyrus Orr at Point Barrie, Kupreanof Island. In the same year Walter Kosmikoff

operated a small saltery at Shipley Bay, on Prince of Wales Island. In 1900 he sold it to the Icy Straits Packing Co.

Fred Brockman in 1897 built and operated a small saltery on Sarkar Stream, Prince of Wales Island. Mr. Brockman operated this saltery intermittently until his death in 1915.

In 1897 Banter & West were operating a saltery at Sukkwan, on Sukkwan Island. In the same year Miller & Co. started another saltery on Kassoock Inlet, on Sukkwan Island, while Thomas McCauley was operating a saltery on Whale Passage.

In 1899 the Icy Straits Packing Co., consisting of stockholders of the Quadra Packing Co., built a cannery and sawmill at a point on the southeastern shore of Wrangell Narrows, about a mile south of the northern entrance to same, and named the town site Petersburg. The cannery was feady and operated in 1900. In 1901 it became a part of the Pacific Packing & Navigation Co. It was closed in 1903, 1904, and 1905. In 1905 it was purchased at the sale of the company's properties by the Northwestern Fisheries Co. In 1906 the Pacific Coast & Norway Packing Co., which had been operating a cannery at Tonka, on Wrangell Narrows, purchased this plant and transferred its activities to the latter. In 1915 the plant was leased to the Petersburg Packing Co., composed of stockholders of the old company.

In 1900 the Western Fisheries Co., of Portland, built a cannery at the head of Dundas Bay, and made a pack the same year. In 1901 it became a part of the Pacific Packing & Navigation Co. It was closed in 1904. At the assignee's sale of the company's properties in 1905 this plant was purchased by the Northwestern Fisheries Co. and operated in 1905 and each subsequent year.

In 1900 the Fidalgo Island Packing Co. built a cannery on the southern side of Ketchikan Creek. A pack was made the same year. The plant was closed in 1903, only a little salting being done that year, was reopened in 1904, was closed again in 1905, and was reopened in 1906, since when it has been operated each season to date, except in 1909.

In 1900 the Pacific Coast & Norway Packing Co. operated a floating saltery while prospecting for a cannery location. In 1901 the company built a cannery at Tonka, about midway of Wrangell Narrows, on the western side, and made a pack in that and subsequent years until 1906. In that year the company purchased the Petersburg cannery and thenceforth operated from there. The Tonka plant was dismantled a few years later.

In 1900 the Royer-Warnock Packing Co., of San Francisco, built a small cannery on Beecher Pass, which connects Duncan Canal with Wrangell Narrows, using the old Buck saltery for the cannery proper. It operated only the one season. It was a hand-pack plant.

The Taku Fishing Co. in 1900 built a cannery on the southern side of the entrance to Port Snettisham, and made a pack in that year. In 1901 it became a part of the Pacific Packing & Navigation Co. The plant was closed in 1902 and not reopened again.

In 1900 the Taku Packing Co., organized in Astoria, Oreg., built a cannery on the western shore of Taku Inlet and made a pack the same year. In 1901 it became a part of the Pacific Packing & Navigation Co. It was closed in 1904 and not reopened again. In 1905 it became the property of the Northwestern Fisheries Co.

In 1900 the Chilkoot Packing Co., organized at Aberdeen, Wash., built a cannery at the head of Chilkoot Inlet, and operated the same year. In 1901 it became a part of the Pacific Packing & Navigation Co. It was closed in 1904 and not reopened again.

In 1900 the Great Northern Fish Co. operated a floating saltery. Its principal business was salting dog salmon for the Japanese trade, and it operated only one season. J. E. Rice, of Whatcom, Wash., in the same year packed dog salmon on Karta Bay for the same trade.

The Pacific Packing & Navigation Co. (an account of whose inception, operation, and failure appears under Puget Sound) was organized in 1901 and acquired the following canneries in Alaska: Canneries of Pacific Steam Whaling Co. at Nushagak, Bristol Bay; Chignik, Alaska Peninsula; Uyak, Kodiak Island; Kenai, Cook Inlet; Orca, Prince William Sound; Hunter Bay, southeast Alaska. Also the Hume Bros. & Hume canneries at Chignik and Uyak; the Thlinket Packing Co. with canneries at Gerard Point and Santa Anna; the Western Fisheries Co. cannery at Dundas Bay, Icy Straits; Chilkoot Packing Co. cannery at Chilkoot Inlet; the Taku Packing Co. cannery at Taku Inlet; the Taku Fishing Co. cannery at Port Snettisham; the Boston Fishing & Trading Co. cannery at Yes Bay; the Chatham Straits Packing Co. cannery on Sitkoh Bay; the Icy Straits Packing Co. cannery at Petersburg, Wrangell Narrows; and the Quadra Packing Co. cannery at Mink Arm, Boca de Quadra.

The company met with financial disaster in 1904, and at the resulting sale most of its properties were bought by the Northwestern Fisheries Co., a corporation formed for the purpose. Of the Alaska canneries the Sitkoh Bay plant was sold to George T. Myers & Co., while the Orca plant was leased to Capt. Omar J. Humphreys, from whom the Northwestern Fisheries Co. later on secured it.

The San Juan Fishing & Packing Co., of Seattle, established a cannery and cold-storage plant in 1901 at Taku Harbor, a small bay on the mainland a short distance south of Taku Inlet, and made a pack the same year. This plant was purchased in 1903 by the Pacific Cold Storage Co. and operated by it in 1903, 1904, and 1905. In 1906 it was leased and operated by the Taku-Alaska Packing Co. From 1907 to 1911 the plant was leased and operated by John L. Carlson & Co. In 1911 the plant was purchased by Mr. Carlson and the name changed to the Taku Cannery & Cold Storage Co., under which name it has been operated each year since. In 1918 it was purchased by Libby, McNeill & Libby.

In 1901 the Chatham Straits Packing Co. built a cannery on Sitkoh Bay, Chichagof Island. The same year this cannery became a part of the Pacific Packing & Navigation Co. Upon the dissolution of the latter, early in 1905, this plant was purchased by George T. Myers & Co., which company has operated it to date without a break.

In 1901 F. C. Barnes, of Portland, Oreg., built a cannery at Lake Bay, on the east side of Prince of Wales Island, and made a pack that season. This cannery was operated in 1902, but was closed in 1903. It was reopened in 1904, and operated each season after that. In 1910 it was incorporated under the name of F. C. Barnes Co.

In 1901 the Union Packing Co., organized in Tacoma, Wash., built a cannery on Kell Bay, an arm of Affleck Canal, on the southern side

of Kuiu Island. In 1904 this plant was moved to the Kvichak River in Bering Sea.

Buhring & Heckman operated a small saltery in Union Bay, on the north side of Cleveland Peninsula, in 1901. Packing was carried on aboard a barge.

In 1901 the Muir Glacier Packing Co. put up a saltery on Ideal Cove, Dry Pass, near Wrangell. It has operated mainly as a mild-cure station. It was closed down in 1903 but was opened in 1904. It was then closed in 1905, 1906, and 1907. It was opened in 1908 by K. J. Johansen and operated in 1908 and 1909.

In 1902 the Kasaan Bay Co. built a cannery on the north side of Kasaan Bay, Prince of Wales Island, and made a pack the same year. It was shut down in 1904 and 1905, but reopened in 1906 by Gorman & Co., of Seattle, who had purchased control of the company. Shortly after the closing of the packing season the plant burned down, but it was rebuilt in time to operate the following season. In 1909 the plant was closed, but was reopened in 1910. On September 12 of that year the plant was again destroyed by fire, but was rebuilt in time to operate the following season. On October 29, 1911, the plant was once more destroyed by fire, but was rebuilt in time to operate in 1912. In 1915 the plant was purchased and operated by the Anacortes Fisheries Co., a subsidiary of the Booth Fisheries Co.

In 1902 the Alaska Fish & Lumber Co. built a cannery at Shakan, on Kosciusko Island, near the head of Prince of Wales Island, and made a pack the same year. It was shut down in 1904. In 1905 the property was taken over by the Shakan Salmon Co., a new company composed largely of members of the old corporation, who operated it that season. In 1906 Gorman & Co., of Seattle, obtained control of this cannery and operated it each season under the name of the Shakan Salmon Co. until 1915, when it was sold to the Anacortes Fisheries Co., a subsidiary of the Booth Fisheries Co.

In 1902 the Columbia Canning Co. built a cannery on the southern side of Chilkoot Inlet, and made a pack that year. In 1910 C. A. Burckhardt & Co., under the name of the Chilkoot Fisheries Co., purchased and operated this plant. In 1911 the name was changed to the Alaska Pacific Fisheries. Early in 1919 the plant was totally destroyed by fire.

The only cannery in this section lost to Alaska by action of the Federal Government was that of the Wales Island Packing Co., which was built on Wales Island, near Dixon Entrance, in 1902. When the Alaska Boundary Arbitration Commission declared Wales Island a part of Canada in 1903, this cannery automatically ceased to be an American one. After the change of government it lay idle for some time, but is now in use once more by Canadian parties.

In 1902 the Thlinket Packing Co. built a cannery on Funter Bay, on the west side of Admiralty Island, and made a pack that year and every subsequent year to date.

The same year the Pillar Bay Packing Co. built and operated a cannery near Point Ellis, on Kuiu Island, and operated it until 1918, when it was sold to the Fidalgo Island Packing Co.

In 1902 the Alaska Fisheries Union, organized in Seattle, built a cannery on the east side of Chilkat Inlet, and made a pack that year. After operating to 1905, the plant was in that year leased to and operated by the Lynn Canal Packing Co. The plant was purchased

in 1906 by the Pacific American Fisheries. In 1908 it was moved to Excursion Inlet and has been operated each season to date.

The Tacoma Fishing Co. in 1902 established a saltery and halibut station at Tee Harbor, on Lynn Canal, and made a pack that year. Later it became the property of the International Fisheries Co. In 1910 the plant was purchased by the Tee Harbor Packing Co., which established a cannery and operated first in 1911. It has been operated each season since, being sold to the Alaska Pacific Fisheries Co. in 1920.

The Seattle-Scandinavian Fish Co. built a saltery on Snug Harbor, Tenakee Inlet, Chichagof Island, in 1902, and made a pack. It packed in 1903 also, but shut down in 1904. The plant was leased in 1905, and then shut down for good.

The Alaska Fish & Mining Co. built and operated a saltery at Revilla, on Tongass Narrows, during the single season of 1902, while the Rice Fisheries Co., in the same year, built and operated a saltery on Boca de Quadra.

The United Fish Co., of Seattle, salted at Tolstoi Bay, east side of Prince of Wales Island, 1903 and 1904.

In 1907 the Alsek Fisheries Co. did some salting on the Alsek River. Malcolm Campbell was interested in the above company and in subsequent years operated under his own name. In 1910 the St. Elias Packing Co. established a cannery near the saltery and made a pack the same year, and in 1911 and 1912. Since then the plant has been closed and was sold in 1916 to Libby, McNeill & Libby.

The Astoria & Puget Sound Packing Co., in 1908, built and operated a cannery on Excursion Inlet. It was closed the following year, but has been operated each year since. It was burned in 1917, but was rebuilt in time to operate the following season.

The year 1911 witnessed a considerable increase in the number of canneries. Among the new plants built and operated were the following: Hidden Inlet Canning Co., Hidden Inlet, Portland Canal; Hawk Fish Co. (later changed to P. E. Harris & Co.), Hawk Inlet, Admiralty Island; Lindenberger Packing Co., Roe Point, Behm Canal; Deep Sea Salmon Co., Cape Edwards, Chichagof Island; L. Gustave & Co., Skowl Arm, Prince of Wales Island (changed in 1912 to Skowl Arm Packing Co.), and M. E. Lane (a small hand-pack plant), Myers Chuck, Cleveland Peninsula.

An innovation in Alaska salmon canning this year was when the old ship *Glory of the Seas* was fitted out as a floating cannery by the Alaska Fish Co., and operated in Hawk Inlet, Admiralty Island, and at Ketchikan. Quarters for the crew were built over the cabins on the quarter deck, the latter being reserved for officials. The remainder of the upper deck was used for receiving, dressing, and cleaning the fish, which were brought on board by means of a portable elevator attached to the side of the ship. The "iron chink" and the sliming and cleaning tanks were also on this deck. The fish were carried in chutes to the second deck, where a line of sanitary machinery had been installed. The retorts were placed on the forward part of the second deck. The third deck was used for cooling and storing the pack. No lacquering or labeling was carried on aboard the vessel.

In 1912 this plant and the ship *William H. Smith*, the latter by the Weiding & Independent Fisheries Co., of Seattle, were operated. The *William H. Smith* also did some freezing of salmon.

In 1913 the *Glory of the Seas* was sold to the Glacier Fisheries Co., which operated it as a cold-storage plant. The floating cannery and cold-storage ship *William H. Smith* was not operated in Alaska during this season.

In 1912 still more canneries were built, among these being the following: Admiralty Trading Co., Gambier Bay, Admiralty Island; Alaska Sanitary Packing Co., Wrangell; Canoe Pass Packing Co., Canoe Pass; Herbert Hume Packing Co., Nakat Inlet, Portland Canal; Hoonah Packing Co., Hoonah, Icy Straits; Irving Packing Co., Karheen; Kake Packing Co., Kake; Kuiu Island Packing Co., Point Beauclaire, Kuiu Island; Lindenberger Packing Co., Craig, Fish Egg Island; Oceanic Packing Co., Waterfall; Point Warde Packing Co., Point Warde, Bradfield Canal; Pure Food Fish Co., Ketchikan; Revilla Fish Products Co., Ketchikan; Sanborn-Cram Co., Burnett Inlet; Starr-Collinson Packing Co., Moira Sound; Sunny Point Packing Co., Cholmondeley Sound; Swift, Arthur & Co., Heceta Island; Walsh-Moore Canning Co., Ward Cove, and Wiese Packing Co., Rose Inlet.

In 1913 the plant of Swift, Arthur & Co. was used as a mild-cure station alone, while the name was changed to the Swift-Arthur-Crosby Co. The Alaska Fish Co. absorbed the Oceanic Packing Co. and transferred its activities to the former company's cannery at Waterfall. The following other plants were shut down: Canoe Pass Packing Co., Herbert Hume Packing Co., Point Warde Packing Co., and the Revilla Fish Products Co.

In 1914 one new cannery was built. This was erected on George Inlet, Revillagigedo Island, by the George Inlet Packing Co. The canneries of the Point Warde Packing Co., located at Point Warde, and the G. W. Hume Packing Co. (formerly the Herbert Hume Packing Co.), at Nakat Inlet, which were not operated in 1913, were reopened in 1914. The cannery of the Swift-Arthur-Crosby Co. was also reopened. The Walsh-Moore Canning Co. changed its name to the Ward Cove Packing Co., while the Sanborn-Cutting Co. took over the cannery operated by the Kake Packing Co. The canneries of the Admiralty Trading Co. and the Skowl Arm Packing Co. were closed in 1914. The plant of the Kuiu Island Packing Co. burned down in the fall.

In 1915 the Admiralty Trading Co. did not operate. Late in the summer it was sold to the Hoonah Packing Co., which company operated it in 1916 and succeeding years. The new canneries in 1915 were the Doyhof Fish Products Co., at Doyhof, on Wrangell Narrows, and Edward Verney & Son (a hand plant), at Metlakatla. The name of the Irving Packing Co. was changed to the Karheen Packing Co. The Straits Packing Co. purchased the Skowl Arm cannery of the Skowl Arm Packing Co. and operated it.

In 1916 the following new canneries were constructed and put into operation: Auk Bay Salmon Canning Co., Auk Bay; Beegle Packing Co., Northland Packing Co., and J. I. Smiley & Co., all at Ketchikan; Sanitary Packing Co., George Arm; Seattle Packing Co., floating plant in Idalo Inlet; Tenakee Fisheries Co., Tenakee; and Union Bay Fisheries Co., Union Bay.

The George W. Hume Co.'s plant at Nakat Inlet, formerly operated by the Herbert Hume Packing Co., burned down shortly after the

season's operations had begun. It was rebuilt in time to operate in 1917.

Late in 1916 the Lindenberger Packing Co. sold its Roe Point plant to the Northwestern Fisheries Co. and its Craig plant to the Columbia Salmon Co. About the same time the Seattle Packing Co. disposed of its floating cannery *Amelia* to the Northland Fish Co., which operated it at Metlakahtla in 1917. The Sanitary Packing Co. changed to the Ketchikan Packing Co., while the Sunny Point Packing Co. took over all the interests of the Northland Packing Co., and in 1917 operated the cannery also located at Ketchikan.

In 1917 the heavy demand throughout the world for foodstuffs caused a considerable increase in the number of new canneries in Alaska. In the southeast Alaska section, nine were built and operated as follows: Alaska Herring & Sardine Co., Port Walter; Alaska Pacific Herring Co., Big Port Walter; Baranof Packing Co., Red Bluff Bay; R. L. Cole & Co., Token; Haines Packing Co., Letinkof Cove; Lane & Williams, Moira Sound; Northland Fish Co. (floating plant *Amelia*), Metlakahtla; Sitka Packing Co., Sitka; and Robert Scott, a floating cannery at Craig. The two first named were built in 1916 but were not then engaged in canning salmon.

On September 13, 1917, the cannery of the Sunny Point Packing Co., at Sunny Point, was totally destroyed by fire, while on October 2 the same fate befell the cannery of the Astoria & Puget Sound Canning Co. at Excursion Inlet. Wilson Fisheries Co., of Chicago, took over the J. L. Smiley & Co. plant at Ketchikan.

In 1918 the following new canneries were put into operation: Alaska Clam Canning Co., Petersburg; Alaska Packing & Navigation Co., Pavlof Harbor; Columbia Salmon Co., Tenakee Inlet; Hidden Inlet Canning Co., Hood Bay; Hunter & Dickinson, Washington Bay; T. E. P. Keegan, Douglas; J. H. Long Packing Co. and Northern Packing Co., Juneau; Noyes Island Packing Co., Noyes Island; Pybus Bay Fish & Packing Co., Pybus Bay; Pyramid Packing Co. and Sitka Packing Co., Sitka; Southern Alaska Canning Co., Quadra; Todd Packing Co., Peril Strait; and H. Van Vlack & Co., Petersburg.

The name of the Sanborn-Cram Co. was changed to Burnett Inlet Packing Co. The Deep Sea Salmon Co. established a new plant at Port Althorp and used part of the equipment of its former Knik Arm cannery in equipping it. G. W. Hume Co. purchased the Doyhof Packing Co. cannery at Scow Bay. The Marathon Fishing and Packing Co. operated the barge *Amelia* at Petersburg. The Southern Alaska Canning Co. took over the Rose Inlet plant of the Wiese Packing Co.

The following new plants were constructed and operated in 1919: Alaska Salmon & Herring Co., Tyee; Alaska Sanitary Packing Co., an additional plant at Cape Fanshaw; Beauclaire Packing Co., Port Beauclaire; Cape Fanshaw Fishing & Packing Co., Cape Fanshaw; J. L. Carlson & Co., Auk Harbor; Douglas Island Packing Co., Douglas; Hood Bay Packing Co., Hood Bay; Olympic Fisheries Co., floating barge at Ketchikan, etc.; Petersburg Packing Corporation, Washington Bay.

The Southern Alaska Canning Co. took over the Alaska Pacific Herring Co., while the Alaska Clam Canning Co. changed its name to the Mountain Point Packing Co. The American Packing Co. took over the J. H. Long Packing Co.

In 1919 the Northwestern Fisheries Co. did not operate its Santa Ana, Hunter Bay, and Roe Point canneries, while the Anacortes Fisheries Co. shut down its Shakan cannery. Other canneries which did not operate were the following: Craig cannery, of Columbia Salmon Co.; T. E. P. Keegan, Douglas.

At one time salteries were of considerable importance in this section, but the establishment of canneries, with the consequent heavy demand for fresh salmon, induced most of the salteries to sell their high-grade fish to the canneries and pack only the cheaper grades. Many of them quit the business as a result of the competition, while others were forced out by the low prices prevailing at times for salted salmon. As many of the salters moved from place to place, and frequently changed their operating name, it has been difficult to keep track of them, and in this review only those are listed who attained to some prominence either through longevity or largeness of pack.

James Millar, one of the earliest whites to take up his residence here after the purchase of Alaska, and his sons were very active in starting and operating salteries, and it was an unusual thing during the period previous to 1910 when one of the family was not operating such a plant.

Jacob Louth established a saltery on the south arm of Moira Sound about 1900 and operated it for some years.

John C. Frey established a saltery on Etoline Island in the nineties and ran it until his death in 1904, when John H. Mantle purchased and operated it until about 1910.

Anderson & King built a saltery on Cholmondeley Sound, Prince of Wales Island, in the nineties. In 1904 it was operated under the name of A. E. King. After Mr. King's death his widow operated it from 1906 to 1909. In 1910 the saltery was purchased by C. A. Burckhardt & Co., who built a cannery on the site and began operations in 1911. In 1912 the name was changed to the Alaska Pacific Fisheries.

The Alaska Fish & Development Co. built a saltery on Pleasant Bay, Admiralty Island, in 1903, and operated it from 1903 to 1905. In 1907 it was operated by the Alaska-American Fish Co., but has been closed since.

Yakutat Bay is the only harbor available for vessels from Cape Spencer to Prince William Sound. In 1902 C. A. Fredericks & Co., of Seattle; Mulvey & Wilson, of Yakutat; Jewell Fish Co.; and Ankow Fish Co. all established salteries here. While their primary purpose was the salting of herring, considerable salmon was also salted. These plants operated only the one season.

In 1904 the Yakutat & Southern Railway Co. built a cannery here. This plant is noted for being the only one that hauls its fish by railway from the fishing streams to the cannery. The railroad is a little over 9 miles in length, and for some years an engine which had seen service on the elevated railroads of New York City and was discarded when the latter were electrified was used. A more modern engine is now in use. The fish are carried in open freight cars. Later this company was purchased by Gorman & Co., and now is the property of Libby, McNeill & Libbey, although operated under the original name.

PRINCE WILLIAM SOUND AND COPPER RIVER.

The great indentation known as Prince William Sound, and the Copper River delta, a short distance south of the sound, were not exploited as much as many other portions of Alaska until about 1915, due largely to the limited means of transportation and the consequent heavy expense of operation.

The principal source of salmon supply is the Copper River, a glacial stream about 300 miles long, which empties into the Gulf of Alaska through a delta nearly 40 miles in width and extending upstream about 25 miles.

Owing to the constantly shifting shoals in the delta, special knowledge is needed in navigating them, while special flat-bottomed vessels are required as run boats. The gill net and dip net are the only important apparatus in use in the river. In Prince William Sound traps and purse seines catch most of the salmon.

In 1889 a company known as the Central Alaska Co. built a cannery on Wingham, or Little Kayak Island, about 15 miles west from Cape Suckling. It made a pack that year, and the following spring was moved to Thin Point, on the southern side of the Alaska Peninsula.

The Peninsula Trading & Fishing Co. built a cannery on the same island in 1889. In 1891 it was moved to one of the sloughs of the Copper River delta, known as Coquenhena, and operated in 1891. It was closed in 1892 and 1893. The Pacific Steam Whaling Co. operated it until 1897, when it was abandoned.

In 1916 the Hoonah Packing Co. built and operated a cannery on Bering River.

Louis Sloss & Co., of San Francisco, built a cannery under the title of Pacific Packing Co. in 1889 at the extreme eastern end of the sound, close by the present site of Cordova, and called it Odiak. The cannery was closed in 1892. In 1893 it joined the Alaska Packers Association and was operated each season until 1905. In 1906 the buildings and site were sold to the Copper River & Northwestern Railroad Co., which was preparing to build a railroad from Odiak to the headwaters of the Copper River.

In 1889 the Pacific Steam Whaling Co. built a cannery close by the Odiak plant, but in the spring of 1895 it was moved to the spot now known as Orca, about 3 miles north of Cordova. It was closed in 1892, and has been operated ever since except in 1919 and 1920. In 1901 it was taken into the Pacific Packing & Navigation Co. combination. When the latter's assets were sold in 1904, this cannery was not included in the sale, as at the time the plant was under lease to Capt. Omar J. Humphrey. In 1905 it was sold to the Northwestern Fisheries Co., which had purchased most of the Alaska plants of the defunct company, and they have operated it since.

In 1915 the Copper River Packing Co. built a cannery on the Copper River at Mile 55, and made a pack the same year. The cannery uses no run boats, but has an arrangement with the Copper River & Northwestern Railroad Co. to haul the fish from the fishing stations to the cannery, and bring the finished product to Cordova for shipment by steamer. In 1918 the name was changed to the Abercrombie Packing Co.

The Canoe Pass Packing Co., which had built a cannery at Canoe Pass, southeast Alaska, in 1912, and had not operated it subsequently, in 1915 moved the machinery to Cordova and installed it in a rented building and made a pack. It built its own cannery at Shepard Point, near Cordova, in 1917.

In 1916 the Carlisle Packing Co. built a cannery at Cordova, while the Clark-Graham Co. built one at Eyak, a few miles away.

In 1917 the following new canneries were operated: Valdez Packing Co., Valdez; Copper River Packing Co., Port Nellie Juan; Lighthouse Canning Co. and Moore Packing Co., Cordova; and San Juan Fishing & Packing Co., Seward. The latter plant was also equipped for freezing salmon and other fishes. The Lighthouse Canning Co. was canning clams in 1916, the first year of its operation. The Alaska Sea Food Co. took over the Turner cannery, which had been built in 1916 and used in packing clams. The plant was destroyed by fire on April 4, but was rebuilt the same year, although not operated with salmon until 1918.

A number of salmon salteries were started in Prince William Sound after 1915. Charles Matthews in 1916 operated a salmon saltery at Seward; The Kenai Fishing & Trading Co. in 1916 acquired the J. Bettles saltery on Eshamy Bay. In 1918 the company expanded into a canning plant. A. C. Hoodenpyle operated a saltery at Port Wells in 1918.

In 1919 the following new canneries were started: Franklin Packing Co., Port Ashton; and Pioneer Packing Co., Cordova (this plant had been operating on clams for a couple of seasons). The Eyak River Packing Co. took over the Clark-Graham Co., while the Hillery-Scott Co. succeeded the Lighthouse Canning Co.

COOK INLET.

While this great inlet has an abundant supply of salmon, it is one of the most difficult sections in all Alaska in which to fish successfully. The tides and currents in the inlet are strong and treacherous, increasing in height and force as its head is approached, where the tide comes in with a bore which is extremely dangerous to small craft. Shoals make out a long distance from shore and are continually changing.

The first cannery to be built on the inlet was in 1882, when the Alaska Packing Co., of San Francisco, built one at Kasilof, on the right bank of the Kasilof River at the mouth, utilizing the available machinery from the cannery built by the Cutting Packing Co. at old Sitka in 1878. In 1885 this cannery was sold to the Arctic Fishing Co. In 1890 the loss of its cannery ship forced it to close that season. In 1893 it joined the Alaska Packers Association. At the height of the season of 1905 the plant was burned. It was rebuilt the next spring and has been operated each year since.

The cannery of the Northern Packing Co. was built in 1888 on the eastern side of Cook Inlet, at Kenai, at the mouth of the Kakmu River. It was operated up to and including 1891. In 1893 it joined the Alaska Packers Association, but has not been operated since 1891.

In 1897 the Pacific Steam Whaling Co. built a cannery at Kenai, but did not install the machinery and operate it until the next year. In 1901 this cannery was taken over by the Pacific Packing & Navigation Co. In 1903 the plant burned down. Upon the sale of it

assets in 1905 the site passed to the Northwestern Fisheries Co. In 1910 the company put up a new plant here and has operated it continuously since. During the period when the site was unused a mild-curing establishment was operated here by the San Juan Fishing & Packing Co. in 1907 and 1908. This plant burned down just before the fishing season of 1916 began, but was rebuilt in time to operate in 1917.

In 1890 George W. Hume, of San Francisco, built a cannery at Kasilof, on the right bank of the river, about half a mile above its mouth. It was operated in 1890, 1891, and 1892. In 1893 it joined the Alaska Packers Association and was consolidated with the plant of the Arctic Fishing Co.

C. D. Ladd operated a saltery on the left bank and at the mouth of the Chulitna River, about 6 miles above Tyonek. This saltery was purchased by the Alaska Salmon Association in 1899. The following spring it erected a cannery here and made a small pack. It was operated also in 1901 and 1902, and then abandoned.

In 1907 J. A. Herbert & Co. established a saltery at English Bay and operated it until 1910.

In 1911 the Seldovia Salmon Co. built a cannery at Seldovia and operated it until late in 1915, when the company went into the hands of a receiver. In 1916 it was reopened by the Columbia Salmon Co. In 1917 it was bought by the Northwestern Fisheries Co. and operated in this and the succeeding year, but was closed in 1919.

In 1912 the Fidalgo Island Packing Co., which already operated a cannery at Ketchikan, in southeast Alaska, built a cannery at Port Graham, at the lower end of the Kenai Peninsula. A pack was made that year and each year since.

The same year Libby, McNeill & Libby built a cannery at Kenai and operated that year and each subsequent year.

In 1915 the Deep Sea Salmon Co., which operates a cannery in southeast Alaska, built a plant near Knik, on the west side of Cook Inlet, and made a small pack. This plant was abandoned at the end of 1917 and part of the equipment sold to a new plant in southeast Alaska.

Of recent years considerable salting of salmon has been carried on in Cook Inlet. In 1916 Dr. Knut A. Kyvig, of Anchorage, did some salting at Swanson Creek, Turnagin Arm, under the name of the Kyvig Packing Co. In 1917 the Beluga Whaling Co. salted salmon at Beluga. In 1918 Dr. Kyvig disposed of his interest in the Kachemak Bay plant to the Kachemak Canning Co.

AFOGNAK ISLAND.

Afognak Island lies to the northwest of Kodiak, and it is separated from it by a narrow strait.

In 1889 the Royal Packing Co. built a cannery at the head of Afognak Bay and operated it in 1889 and 1890. It became a member of the Alaska Packers Association in 1893. It has not been operated since 1892.

The Russian-American Packing Co. in 1889 built a cannery immediately above that of the Royal. It was operated in 1889 and 1890. In 1893 it became a member of the Alaska Packers Association. It has not been operated since 1890.

In accordance with an act of Congress approved March 3, 1891, the President, by proclamation of December 24, 1892, set aside the whole island and within 1 mile from the shores thereof as a fish-cultural reserve for the use of the United States Commission of Fish and Fisheries. As a result of this action both canneries were forced to move from the island entirely.

KODIAK ISLAND.

This island has been the scene of some of the best fishing in Alaska. The Russians early settled here, one of the most fertile spots in the usually sterile soil of Alaska, and undoubtedly they must have prosecuted the fisheries from an early date, although but little data are extant showing their operations in this line.

Karluk River and Lagoon.—One of the greatest salmon streams in the world is the Karluk River, and although its importance is much diminished now through long continued and heavy fishing, it still produces annually a large pack of canned-salmon, and has the distinction of having produced more salmon than any other river in Alaska.

It will doubtless surprise most readers to hear that the river which has yielded so many countless thousands of salmon is only 16½ miles in length. It has its source in two lakes, the larger of which is about 8, the smaller, 3 miles long. The mouth of the river is about 2 miles above the canneries, and spreads out here into a lagoon. This lagoon has at the head a width of about 300 yards, and gradually widens until it is nearly half a mile across as it approaches the spit. The lagoon has a general east and west direction, is about 2 miles in length, and, except for the shingle spit which is thrown across its mouth by the action of the sea, its shores are bluff, rising from about 50 to 100 feet. The spit is three-fourths of a mile long with an average width of about 200 feet. The outlet of the lagoon is only 90 feet wide at its mouth. The western side of the mouth of the lagoon is Karluk Head, a precipitous mountain mass about 1,600 feet high.

The outer side of the spit is where the fishing is carried on. Haul seines are used exclusively. As bowlders used to be common here it was necessary to remove a number of them in the early days when a seine shore was to be prepared. The red salmon run here is an exceptionally long one, the season extending from about the middle of June to about the middle of September. The other species of salmon also run here; sometimes humpbacks appear in large numbers. As the beach is open to Shelikof Strait, in which storms are frequent, seining is often interrupted.

As early as 1867 the salting of salmon was carried on at Karluk. In 1870 the Alaska Fur Trading Co. and the Alaska Commercial Co. began to salt salmon and continued this on a gradually expanding scale.

In 1882 Smith & Hirsch, who had been engaged in salting on Karluk Spit, built the first cannery on Kodiak Island. After operating it until 1884 it was organized under the title of the Karluk Packing Co., and packed under that name every year until 1911, when canning operations were transferred to the new cannery in Larsen Bay. In 1893 it joined the Alaska Packers Association.

The Kodiak Packing Co. in 1888 built a cannery on the eastern side of the spit and operated it in 1888, 1889, 1890, 1891, and 1893. It joined the Alaska Packers Association in 1893, but has not been operated since that season.

The Hume Packing Co. built a cannery on the spit about 400 yards westward of Kodiak cannery in 1889. In 1892 it was consolidated with the Aleutian Islands Fishing & Mining Co., which had built a cannery about 100 yards westward of the Hume cannery in 1888. In 1893 the consolidation became a member of the Alaska Packers Association. This plant was not operated in 1900.

In 1888 the Alaska Improvement Co. built a cannery on the left bank of the outlet, opposite the point of the spit and facing the Shelikof Strait. It was ready to pack in 1888, but was not operated on account of the loss of its cannery ship, the *Julia Ford*. In the spring of 1897 it was sold to the Alaska Packers Association and has since been operated by that company.

In 1893 the Hume Canning & Trading Co. built a cannery on the beach under Karluk Head, about three-fourths of a mile northward of the Alaska Improvement Co., in what is known locally as Tanglefoot Bay. It was operated in 1893 and 1894, and in 1895 it was sold to the Alaska Packers Association and operated by that company. It has been closed since.

The great increase in the number of canneries in Alaska in 1888 and 1889 caused such an enlargement of the pack that the markets became glutted, and it was soon apparent that steps would have to be taken to reduce the output if the operators were to avoid bankruptcy.

Capt. Moser in "Salmon and Salmon Fisheries of Alaska" ^a thus describes the attempts of the canners to find a working solution of this important problem and the final result of their endeavors:

In 1890 the three canneries at Chignik combined under an operating agreement known as the Chignik Bay Combination, under which the plant of the Chignik Bay Co. was operated, the three canneries sharing the expense and dividing the output equally. This arrangement remained in force during the seasons of 1890 and 1891. Its evident success in 1890 probably led to the local combinations on Kodiak Island in 1891, and then to the association which now exists.

The large packs during this period and the glutted market caused the cannery interests to devise some scheme to meet the conditions. The combination at Chignik in 1890 permitted the pack to be made there at a lower rate and, as previously stated, it was continued in 1891. The same year (1891) the canneries at Karluk, Uyak, and Afognak entered a combination, under the name of the Karluk River Fisheries, under which it was agreed that each cannery should have a quota of fish from the several localities, based upon the average packs of each cannery in 1889 and 1890. The estimated pack for the canneries interested was placed at 250,000 cases, and upon this estimate the apportionment of the work at each cannery was made. Under this agreement four of the eight canneries were closed, their quota being packed in the other four canneries as follows, viz, that of the Royal at the Karluk, of the Arctic at the Kodiak, of the Aleutian Islands at the Hume, and of the Russian-American at the Alaska Improvement.

In the summer of 1891 the Kodiak Packing Co. and the Arctic Packing Co., both at Alitak Bay, also had a mutual agreement under which only one cannery, the Arctic, was operated, the quota of fish of the Kodiak being packed in the Arctic cannery. By these combinations the full pack of the Karluk district was made in half the number of canneries and the expense of packing very considerably reduced.

In September, 1891, the Alaska Packers Association was formed to dispose of the unsold salmon of that season's pack (some 363,000 cases) and five trustees were ap-

^a The Salmon and Salmon Fisheries of Alaska. Report of the Operations of the U. S. Fish Commission Steamer *Albatross* for the Year ended June 30, 1893. By Jefferson F. Moser. Bulletin, U. S. Fish Commission, 1893. Vol. XVIII. pp. 18-21. Washington, 1899.

pointed to manage the business. This association was not incorporated and expired after the salmon were sold.

The successful operation of these arrangements led, in 1892, to an arrangement in which nearly all (31) of the canneries joined, entering under the name of the Alaska Packing (not Packers) Association, for the purpose of leasing and operating and therefore controlling the canneries and reducing the Alaska pack for that year, it being found too great for the market's demands. All the canneries in operating condition in 1892 were members of this association except the following: Metlakahltla Industrial Co., at Metlakahltla; Boston Fishing & Trading Co., at Yes Bay; Baranoff Packing Co., at Redfish Bay; Chilkat Canning Co., at Pyramid Harbor; Alaska Improvement Co., at Karluk; and the Bering Sea Packing Co., at Ugashik.

The association was regularly incorporated on January 13, 1892, and shares were distributed on the basis of 1 for each 2,000 cases packed in 1891, and the profits were divided equally on all shares, regardless of the amount of profits derived at the different points. Of the 31 canneries, 9 were operated by the association, while the others were closed, the Alaska pack being reduced one-half.

The year 1893 found the Alaska Packers Association organized and incorporated February 9. This association was formed from the canneries that had joined the Alaska Packing Association of 1892, except the Pacific Steam Whaling Co., at Prince William Sound, and the Peninsula Trading & Fishing Co., the latter's cannery having been moved from Little Kayak Island to the Copper River delta in 1891.

The agreement of 1893 was similar to that of 1892, except that the amount of profit was taken into consideration in addition to the probable average quantity which could be packed at the different points. This was subject to adjustment for each district, and no arbitrary rule was followed. Each cannery entering the association was obliged to purchase an additional amount of stock, equaling two-thirds of the number of shares received by it for its plant; that is, a company which received 1,500 shares for its plant was required to purchase 1,000 shares additional. The money received from this sale of extra stock was used as working capital. No shares were sold to the general public, the owners of canneries subscribing for the full amount.

This association was then and is now (1920) the largest operator in Alaska, and, with its three canneries on Puget Sound, is also a factor in that region.

At a number of its canneries the association has always maintained physicians, whose services and supplies have been free to its own employees and to all natives applying for medical advice and medicines. This service has been of incalculable benefit to the latter, a large proportion of whom suffer from disease in some form or other.

No canning has been done at Karluk since 1911, when a new cannery was built at Larsen Bay, a branch of Uyak Bay, and the equipment remaining in the plants on the spit removed to it. This was done because frequent storms had caused havoc to vessels anchored in the open straits opposite the mouth of the lagoon. Since then fishing has been carried on as usual, the fish being carried to the canneries on Uyak Bay. The Alaska Packers Association and Northwestern Fisheries Co., the only operators now, have an agreement to divide the fish on the basis of seven to the former for every three given to the latter.

Alitak Bay.—Alitak Bay, or the "South End," as it is termed locally, is a deep indentation, with several arms, on the southwestern end of Kodiak Island, about 65 miles from Karluk. The seine is the principal apparatus used here.

In 1889 the Arctic Packing Co. built a cannery in the southwest bight of Olga Bay, which is a branch of Alitak Bay and is connected with it by a long, narrow passage. In 1893 it entered the Alaska Packers Association.

In 1889 the Kodiak Packing Co. built a cannery at Snug Harbor, a cove in the passage connecting Olga Bay with Alitak Bay, and operated it in 1889 and 1890. Its quota of fish was packed by the

Arctic Packing Co. in 1891. In 1893 it joined the Alaska Packers Association and the same year was dismantled.

In 1918 the Alitak Packing Co. built a cannery on Alitak Bay.

Uyak Bay.—Uyak Bay is on the northwestern side about the middle of Kodiak Island and is a considerable body of water with ramifying arms. On the western shore, near the entrance and about 18 miles from Karluk, is Uyak Anchorage. The harbor is formed by the main shore of the island and Bear and Harvester Islands, and is frequently used as an anchorage by cannery ships and the steamers from Karluk during bad weather. As there are no red salmon streams in Uyak, fishing is carried on elsewhere. Most of it is at Karluk Spit.

In the spring of 1897 the Pacific Steam Whaling Co. and Hume Bros. & Hume built canneries on the main shores at Uyak Anchorage. In 1901 both plants became a part of the Pacific Packing & Navigation Co. and were operated by it. In 1905 the Uyak plants were purchased by the Northwestern Fisheries Co., and the same year one of the plants was destroyed by fire and was not rebuilt. The remaining plant has been operated each year since.

Five miles southeast from Uyak Anchorage is a narrow arm called Larsen Bay. It is 4 miles long. Immediately within the entrance on the northern shore is the site of the cannery of the Arctic Packing Co., which was built in 1888, and operated in that year and 1889 and 1890, since which date it has been closed. In 1893 it became a part of the Alaska Packers Association and in 1896 it was dismantled.

As the association had lost several ships while loading at Karluk, it finally decided to move its plants from that place, and in 1911 a cannery was built at the old site on Larsen Bay, and from that time all cannery operations formerly carried on at Karluk have been performed at this plant.

Uganuk Bay.—This bay is next to the eastward of Uyak. For several years a saltery was operated here by Oliver Smith, who sold it to the Alaska Packers Association in 1896. The same year the latter built a cannery on the bay. It made a pack in 1896 and a partial pack in 1897. This cannery was abandoned in 1900.

Kodiak.—Salting operations have been carried on at this old Russian settlement for a number of years.

In order to furnish work for the natives, the Alaska Commercial Co. and Blodgett & Blinn salted the catches made by them in 1906 and subsequent years until 1912, when the Kodiak Fisheries built a cannery and has operated it each year since.

The Woman's American Baptist Home Missionary Society had carried on a home and school for native children on Wood Island, close to Kodiak, for some years. In 1902 the society established a salmon saltery here in order to furnish employment for the natives. No data are recorded in the official reports of further activities on the part of this plant.

CHIGNIK BAY.

Chignik Bay is on the southern side of the Alaska Peninsula and is the first important indentation after leaving Cook Inlet on the way to the westward. The bay is about 150 miles southwest of Karluk. On the westward side of the bay is a small deep bay known as Anchorage Bay. Several of the canneries are located here, and the trans-

porting vessels of all the canneries make their anchorage at this point. In the extreme southwest corner of Chignik Bay is the entrance to Chignik Lagoon. At the head of this lagoon, from which all the canneries draw their supplies of red salmon, is the mouth of the stream up which go the schools.

Chignik River is about 6 miles long, with an average width of 100 yards, and its depth is such that a boat can ascend only at high water. It has its rise in two lakes, each about 10 miles long.

Red salmon predominate in the runs, although all five species are to be found. A run of very small red salmon, weighing about 2 pounds, and known as Arctic salmon, appears here every year.

Practically all of the fishing here is with traps, although gill nets and seines have also been used at times.

This bay, next to Karluk Spit, has been the scene of more bitter fights for supremacy in canning than any other place in Alaska.

In 1888 the Fishermen's Packing Co., of Astoria, Oreg., sent a party to Chignik Bay to prospect for fish, and they returned in the fall with 2,160 barrels of salt salmon.

The next year, this company, operating under the name of the Chignik Bay Co., built a cannery on the eastern shore of the Lagoon, $2\frac{1}{2}$ miles from the entrance.

The same year the Shumagin Packing Co., composed of capitalists from Portland, Oreg., and the Chignik Bay Packing Co., of San Francisco, built and operated canneries close to that of the Chignik Bay Co. All three of these companies soon arrived at a working agreement and finally combined into one organization. All were operated in 1889, 1890, and 1891. In 1892 they all joined the pool of the Alaska Packing Association, and the cannery of the Chignik Bay Co. alone operated. In 1893 they all became members of the Alaska Packers Association.

Since 1891 only the cannery of the Chignik Bay Co. has been operated. The Shumagin building has been moved alongside the former and the machinery consolidated, so as to form practically one large cannery.

In the spring of 1896 Hume Bros. & Hume built a cannery on the eastern side of Anchorage Bay and made a pack that year and in 1897.

The same spring the Pacific Steam Whaling Co. built a cannery one-fourth of a mile south of the Hume cannery, and made a pack that year and in 1897. In 1901 this plant, also that of Hume Bros. & Hume, became part of the Pacific Packing & Navigation Co. The failure of this company in 1904 threw its properties onto the market and most of them, including the two Chignik canneries, were purchased by the Northwestern Fisheries Co., which in 1905 shut down the Hume Bros. & Hume plant for good and has operated the other plant ever since.

In 1910 the Columbia River Packers Association built and operated a cannery on Anchorage Bay, and has operated it every year since.

The three companies operating here have an amicable agreement under which they each operate the same number of traps and divide equally the salmon caught.

ALASKA PENINSULA, SOUTH SIDE.

Ozernoy.—In 1889 a cannery, under the title of the Western Alaska Packing Co., was built at Ozernoy, on the western side of Stepovak Bay, south side of the Alaska Peninsula. It packed that year and in 1890, but the fish were so scarce that the cannery was dismantled in 1891 and the site abandoned.

Nothing was done with it for some years, but about 1905 Bostrop Omundsen located there and established a saltery. In the winter of 1912–13 August Lindquist purchased a half interest in the plant and it was operated under their joint names until the death of the senior partner in the fall of 1915; since then it has been operated by Lindquist alone.

Thin Point.—Thin Point is on the southern side of the Alaska Peninsula, near its extreme western end. A saltery was operated here for several years, until the Thin Point Packing Co. was organized by Louis Sloss & Co., of San Francisco, and the cannery was built in 1889. It was operated in 1889, 1890, and 1891, and was closed after that date. In 1890 the cannery ship *Oneida*, en route for this place, struck on the Sannaks in April and nearly all of the 77 Chinese on board were lost. In 1893 the plant became a member of the Alaska Packers Association. In 1894 the cannery was moved to the Naknek River, in Bering Sea, and became a part of the cannery of the Arctic Packing Co.

The Alaska Packers Association operated a saltery at Thin Point in 1894, 1895, and 1896, and then abandoned the place.

The cannery of the Central Alaska Co. was moved in 1890 from Little Kayak Island, near Katalla, to Thin Point. It operated during 1890 and 1891, was closed in 1892, and in 1893 joined the Alaska Packers Association, but was no longer operated. In 1895 the available machinery was moved to Koggiung, on the Kvichak River, in Bering Sea.

In 1908 Osmund & Andersen established a saltery at Thin Point and operated it in 1908, 1909, and 1910.

In 1911 the Pacific American Fisheries built a cannery at King Cove, on the south side of the Alaska Peninsula, a few miles east of Thin Point, and in the fall purchased the saltery. The cannery was operated in 1911 and each year since.

In 1917 the Pacific American Fisheries built and operated a new cannery at Ikatan, on Isanotski Strait, at the eastern end of Unimak Island. The Sockeye Salmon Co. built and operated in the same year a new cannery on Morzhovia Bay, a few miles from the strait, and on the Alaska Peninsula. In 1920 the latter was moved to the Unimak Island side of the strait.

SHUMAGIN AND SANNAK ISLANDS.

Small salteries have been operated at different places on the Shumagin and Sannak groups. The plants have usually been rude and primitive affairs and were operated whenever the price of salted salmon was high enough to justify same. As the ownership, and the location in many instances changed frequently, no attempt has been made even to list them.

In 1920 the Shumagin Packing Co. installed the necessary machinery in its saltery and put up a pack of canned salmon.

BERING SEA.

Bristol Bay.—The great redfish producing section of the world is in the Bristol Bay portion of Bering Sea. This bay lies in the eastern section of Bering Sea, inside of a line drawn from Port Moller to Cape Newenham, and a number of important rivers debouch into it, in all of which the annual runs of salmon, especially reds, are important.

Bristol Bay is considerably off the line of steamship travel, and as a result the companies operating here are compelled to have ships in which to bring up their employees and supplies in the spring and to take back the men and prepared products in the late summer or early fall when the season has ended.

Cannery ships belonging to the Nushagak plants are taken into the bay and anchored as near the canneries as possible. Owing to shoals this can not be done on Kvichak Bay and the Naknek and Ugaguk Rivers. In the early days of the fisheries the ships running to the latter canneries were brought as close to the plants as possible, unloaded by means of scows, and then taken to the Nushagak for shelter. When their numbers were too great to permit of this they were moored in the open about 5 miles off the point separating Kvichak Bay and Naknek River, where the anchorage is good and the vessels have very little trouble in riding out storms. Usually the captain and a boy are left aboard the ship.

NUSHAGAK RIVER AND BAY.

The Nushagak River, sometimes called the Tahlekuk, with its tributaries, and the Wood River, which enters the head of Nushagak Bay close by the mouth of the Nushagak, form a favorite resort of the red salmon, while all other species also ascend them.

But little is known of the upper courses of the Nushagak River, except that they drain the region between Lakes Clark and Iliamna on the east and the Kuskokwim on the west.

The river is said to be 200 miles long to the first lake, a large one. Beyond this lake there are three other smaller lakes, all connected by short stretches of river. The largest tributary of the river is the Malchatna, which enters it about 100 miles from the mouth. There are also several small tributaries, two of these being Tikchik River and Portage Creek. There are three or four Indian villages on the Nushagak, Kaknak being the largest. A launch drawing 3 to 3½ feet of water can navigate about 120 miles from the mouth. It is necessary to use a "bidarka" to go into the upper reaches. There are four rapids, around which a portage must be made in each case.

The river on its lower course is large, and flows a great quantity of water into the head of Nushagak Bay.

Wood River is about 24 miles long from its mouth to the first lake. Shoals and bars are frequent in the river, the depth on these at low water being 2½ feet and at high water 4 feet.

Aleknagik Lake, the first of the chain of three, is about 24 miles long, and has an average width of about 2 miles.

Wood River is noted especially for the interesting counting experiment the Bureau of Fisheries is carrying on here. This very important work was first taken up in 1908, as an indirect result of the order closing Wood and Nushagak Rivers to the commercial fisher-

men, as noted below, and has been continued, with the exception of 1914, to the present time. This work is made possible by the generosity of the Alaska Packers Association of San Francisco and the Alaska-Portland Packers Association of Portland, Oreg., who furnish the material and erect the barricade, also the labor needed throughout the season, while the Bureau of Fisheries furnishes the personnel required to carry on the direct work of counting the fish and making other observations.

A rack or trap is constructed across the foot of Lake Aleknagik, at a constriction in the lake contour something more than 200 yards wide, for the purpose of intercepting all salmon entering the lake and passing them through gates or tunnels at such a rate and in such a manner that an accurate estimate of their numbers can be obtained. The pot of the trap is located near the left bank, and this has three gates by which the salmon can be passed from the pot into the lake. Each gate is 2 feet in width, and its bottom rests on a wooden platform covered with white oilcloth, so that the fish can readily be seen as they pass over it when the gate is raised. When fish are passing through a gate a small wooden frame with a glass center is arranged so it will float on the water, and in order to hold it in position it is fastened to the framework of the gate. This is for the purpose of making the water smooth so the fish can readily be seen even though the surface be disturbed by ripples, etc.

When the fish are coming rather slowly, every one is counted by means of a tally register as it passes out through the gates. When the large run comes the following method is employed: An actual tally of every salmon passing through is made for one minute, and this is repeated 15 minutes later, the number passing through for 1 minute being regarded as the average for 15 minutes. A sheet with the whole day divided into quarter hours is kept ready at the gate and the number for one minute as taken from the tally register is immediately entered thereon by the attendant who made the tally. From these figures the total for the day is obtained. During only a small part of the season has it been found necessary to resort to this method of estimating the run.

The following table shows for each year since 1908 the commercial catch of salmon made in Nushagak Bay, the number of fish passing from Wood River into Lake Aleknagik, the total of both and the percentage of salmon that escaped the fishermen:

Year.	Nushagak Bay catch.	Wood River tally.	Total.	Per cent of escape.
1908.....	6,140,031	2,603,655	8,740,686	30.0
1909.....	4,687,635	893,244	5,580,879	16.0
1910.....	4,384,755	670,104	5,054,859	13.2
1911.....	2,813,637	354,299	3,167,936	11.1
1912.....	3,866,950	325,264	4,192,214	7.7
1913.....	5,233,008	753,109	5,986,117	12.5
1914.....	6,174,097	(a)	.....	.....
1915.....	5,676,457	259,341	5,935,798	4.3
1916.....	3,582,574	551,959	4,144,533	13.3
1917.....	5,679,818	1,081,508	6,761,326	15.9
1918.....	6,078,965	943,202	7,022,167	13.4
1919.....	1,462,981	145,114	1,598,045	9.0

a Work not carried on this year.

Snake River, a tributary of Nushagak Bay, is about 30 miles in length, very crooked, and has its rise in a single lake close by Aleknagik Lake. There is an Indian village on the river just below the lake. Red salmon are abundant in this stream.

Igushik River is about 50 miles in length and enters Nushagak Bay about 4 miles above Nichols Hills. So far as known it has its source in two lakes—Amanka and Ualik. A short distance below the first lake there are rapids and a small falls. The quite large Indian village of Yacherk is located here, and the natives do most of their fishing in the rapids. Peter M. Nelson established a saltery about 10 or 12 miles above its mouth in 1902, and operated it until he sold it to the Alaska Fishermen's Packing Co., who have operated it since. There is a small Indian village close by the saltery.

Nushagak Bay, in which practically all the fishing is carried on, is about 35 miles long and from 5 to 15 miles in width. Sand bars and mud flats, which are visible at low water, occupy the greater part of its area.

The drift gill net is the favorite apparatus in this bay, although a few traps are also used. The fish begin to run very early here. Kings usually appear about June 5, reds about June 5 to 8, cohos either late in June or early in July, dog salmon about the middle of June, and humpbacks about the same time. The reds do not run in large numbers until late in June.

Considerable fishing was carried on in both the Nushagak and Wood Rivers until in 1908, when, as a result of a hearing held by the Secretary of Commerce and Labor on December 16 and 17, 1907, it was decreed that beginning January 1, 1908, "it is hereby ordered that until further notice Wood River, a tributary of Nushagak Bay, in the district of Alaska, and the region within 500 yards of the mouth of said Wood River be closed to all commercial fishing, and that all commercial fishing be prohibited in Nushagak River proper."

The earliest fishing by whites in the Bristol Bay section was for salting purposes by the trading companies, more particularly the Alaska Commercial Co., which had an important station at Fort Alexander on Nushagak Bay. Petroff, in the census report of 1880, refers to exports from this section of "from 800 to 1,200 barrels of salted salmon per annum from the Nushagak River."

In 1883 the schooner *Neptune* visited the Nushagak on a salting trip. The next year the Arctic Packing Co. erected a cannery here and made a trial pack of 400 cases. This was the first cannery to operate in Bering Sea. It was located close to the Moravian mission. This cannery eventually became a member of the Alaska Packers Association, and has not been operated for several years.

The second cannery to be built was by an Astoria company, the Alaska Packing Co., and it was erected on the western side near the head of the bay and about 1½ miles below the junction of the Wood and Nushagak Rivers. It has been operated every year to date, being since 1893 a member of the Alaska Packers Association. It is popularly known as the "Scandinavian" cannery.

In 1886 the Bristol Bay Canning Co. was organized by San Francisco parties, and built a cannery on the western shore of Nushagak Bay in a bend about 2 miles below the cannery of the Alaska Packing Co., at a place called Dillingham. It became a member of the Alaska Packers Association in 1893 and was operated each year until 1907.

A couple of years later it was dismantled. This plant was popularly known as the "Bradford" cannery.

The Nushagak Canning Co. built a cannery on the eastern shore of Nushagak Bay in 1888, at a place known as Clark Point, 5½ miles below Fort Alexander. This cannery also became a member of the Alaska Packers Association in 1893, but from 1891 to 1901 was not operated, but held in reserve. In the last-named year a large double cannery was built here and put into operation and has been operated each year since.

This company also built and operated a saltery on the Igushik River in 1886. Three years later it was moved to the mouth of the Nushagak. In 1893 C. E. Whitney & Co. purchased an interest in it and by 1899 owned it all. In 1902 the saltery was sold to the Alaska Packers Association, which closed it down.

In 1899 the Pacific Steam Whaling Co. built a cannery and commenced canning on the eastern shore of Nushagak Bay at Fort Alexander, or Nushagak village. This cannery was purchased by the Pacific Packing & Navigation Co. in 1901, and upon the sale of its properties in 1904 became a part of the Northwestern Fisheries Co. It has been operated each year since the latter company acquired it.

The same year the Alaska Fishermen's Packing Co., of Astoria, built a cannery immediately below that of the Pacific Steam Whaling Co., and operated it every year to date, control of the company passing to Libby, McNeill & Libby in 1913.

In 1901 the Columbia River Packers Association, the Alaska-Portland Packers Association, and the Alaska Salmon Co. all built canneries on the Nushagak and have operated them to date, except the last named in 1909, when its supply ship was wrecked. The Alaska Fishermen's Packing Co. also built a saltery here. The latter plant was abandoned in 1904.

In 1903 the North Alaska Salmon Co. operated a new cannery on the Nushagak, a few miles below Clark Point.

In 1910, on August 10, shortly after the packing season had ended, the plant of the Alaska-Portland Packers Association was completely destroyed by fire. The plant was rebuilt in time to operate the next season.

KVICHAK RIVER AND BAY.

The Kvichak River is about 80 miles in length, varies from 100 yards to a mile in width, and discharges a vast quantity of water. The influence of the tide is felt 30 miles from the mouth. The current is very swift, running in places as much as 7 miles an hour. The upper half of the river is filled with low, grassy islands, the channels in many places being quite narrow. A launch drawing 3 feet of water can reach Lake Iliamna with very little difficulty. In most sections there are over 2 fathoms of water in the channels. The river drains Iliamna Lake, the largest lake in Alaska, which is about 90 miles long and about 30 miles wide, and Lake Clark. There are a number of Indian villages along the shores of the river and lakes.

Practically all of the fishing here is carried on in Kvichak Bay, gill nets being the only form of apparatus in use. As it is not convenient for the fishermen to take the catch to the canneries, large house lighters and scows are moored in convenient places and the fishermen live aboard the former, while the fish are put aboard the

latter and taken to the canneries by the run boats. The numerous shoals in the bay seriously impede both fishing and navigation.

The first fishing operations on the Kvichak were in 1894, when the Prosper Fishing & Trading Co. and the Alaska Packers Association each established a saltery and operated that year and in 1895; in 1896 the latter purchased the plant of the former and consolidated the two.

In 1895 the Point Roberts Packing Co., which was owned by the Alaska Packers Association, built a cannery at Koggiung, the site of the former saltery, and operated it the next year.

In 1900 there was a considerable development in this region. The Kvichak Packing Co., owned by the Alaska Packers Association, built a cannery on the northern point of entrance to Bear Slough, while the North Alaska Salmon Co. built two canneries about 1,000 feet apart on the left bank of the Kvichak, about 6 miles above Koggiung.

The latter company built a cannery at Hallerville on the Lockenuck River, a tributary of the Kvichak, in 1904. In 1913 a large new cannery to take the place of the Hallerville plant was built on the lower side of Pedersen Point, lower down on Kvichak Bay. In 1916 all the plants of this company were purchased by Libby, McNeill & Libby and have been operated by that company since.

The second plant of the Alaska Packers Association, known as the Coffee Creek plant, was burned down in 1906. It was rebuilt in 1908 and operated again in 1909, and has been operated continuously ever since.

In 1904 the Union Packing Co. established a cannery on the left bank a little distance above the canneries of the North Alaska Salmon Co., having moved this plant from its original location on Kell Bay, in southeast Alaska. It was operated until 1907, when it was abandoned.

About 1905 the Northwestern Packing Co. built a saltery on the east side of the bay. In 1908 it was sold to and operated by Nelson, Olsen & Co., who in 1910 sold it to the Alaska Fishermen's Packing Co., which the following year turned it into a cannery. In 1913 Libby, McNeill & Libby bought this and the Nushagak plant, and continued to operate them under the old name. This cannery was destroyed by fire in the spring of 1915. It was rebuilt and operated in 1916.

NAKNEK RIVER.

But little is known of the Naknek River for more than 10 or 15 miles from its mouth. It is said that the river is about 60 miles long, and has its rise in a lake which is of considerable size. With the exception of a short series of rapids, up which it is possible to haul a boat with a rope from the shore, the river is navigable for small craft. Shoals and banks, many of which uncover at low water, are abundant in the lower courses of the river.

Red salmon is the principal species entering this river, although all the other species are to be found here in lesser abundance. They appear here a little later than in the Nushagak Bay. Only gill nets are used in fishing.

The first commercial fishing on the Naknek River was in 1890, when the Arctic Packing Co. built and operated a saltery on the east bank about 4 miles from the mouth. This plant was sold to the Alaska

Packers Association in 1893. The next year the latter built a cannery here, made the first pack in 1895, and has operated the cannery every year since. Ultimately the saltery was merged with the cannery.

In 1901 the association built another cannery about a mile nearer the mouth, and in 1911 still another was built close to the mouth.

In 1890 L. A. Pedersen built and operated a small saltery on the right bank about 3 miles from the mouth. In 1894 the Naknek Packing Co. purchased the saltery and erected a cannery a short distance above. This saltery and another built on the shore of Kvichak Bay in 1897 were operated for some years. In 1907 the latter was turned into a cannery and operated by Mr. Pedersen under the name of the Bristol Bay Packing Co. The Naknek Packing Co. cannery has been operated to date.

In 1916 the Red Salmon Canning Co. built and operated a cannery on the river about 2 miles above the plant of the Naknek Packing Co.

In 1918 the Northwestern Fisheries Co. operated a new cannery on the river about 2 miles below the plant of the Naknek Packing Co.

In 1919 the Alaska-Portland Packers Association operated a new cannery on the river several miles above the upper cannery of the Alaska Packers Association.

UGAGUK RIVER.

According to the natives this river, which is frequently called the Egegak, or Igagik, is about 80 miles long from the mouth to Lake Becharof, at the head. The lake itself is about 45 miles long and 15 miles wide. The river is navigable for small boats to within 10 miles of the lake, whence there is a succession of rapids, around which it is necessary to portage. The lower part of the river has numerous shoals, some of which are exposed at low water. King Salmon River, the principal tributary, enters about $7\frac{1}{2}$ miles from the mouth.

The red salmon is the principal species, although all the other species are found in much lesser abundance. Gill nets alone are used here.

In 1895 the Alaska Packers Association established a fishing station on the right bank about 5 miles from the mouth and operated as a saltery until 1900, when the apparatus was moved to the cannery site.

In 1899 the Alaska Packers Association, under the name of the Egegak Packing Co., commenced building a cannery on the left bank opposite and a little above the salting station. This plant was finished in 1900 and packs were made that year and each succeeding year except 1905 and 1906.

In 1903 the North Alaska Salmon Co. built and operated a cannery on the opposite shore from the Alaska Packers Association, and has operated it each year to date, of late years under the name of its new owners, Libby, McNeill & Libby.

UGASHIK RIVER.

This river has its rise in a chain of two lakes, but with the exception of that portion below the upper cannery, about 25 miles, it is very little known to the whites. The river is very tortuous in its

course. It has two known tributaries—King Salmon River, which enters through the left bank about 17 miles from the bar at the mouth, and Dog Salmon River, which enters through the left bank about 37 miles from the bar. From Smoky Point to the capes at the mouth the river widens very greatly, being about 20 miles across at the mouth. Shoals are numerous, but there is a channel with about 9 feet at low water. Gill nets exclusively are used here.

This river is essentially a red salmon stream, but the other species are also taken in small numbers, although the humpback is very scarce. This river is noted for the great falling off in the run of red salmon of recent years, 769,002 red salmon being taken in 1901, 1,640,973 in 1902, 1,703,536 in 1903, 564,492 in 1904, 432,779 in 1905, and 152,140 in 1906. About 1916 the run showed signs of improvement and during 1917 and 1918 was excellent, but the run of 1919 was small, the same as elsewhere in Bristol Bay.

C. A. Johnson was the first man to operate commercially on this river, having erected a saltery on the left bank, about 23 miles above Smoky Point, in 1889, and operated it continuously from 1889 to 1898, both inclusive. This saltery was merged in the cannery of the Bering Sea Packing Co. In 1894 Mr. Johnson established and operated another saltery on the right bank of the river, about 12 miles from the bar, which he sold in 1899 to the Alaska Packers Association, who absorbed it in their cannery plant.

The Bering Sea Packing Co., a branch of the Alaska Improvement Association, in 1890 built the first cannery on the river, this being located on the left bank near the first Johnson saltery. A small pack was first made in 1891. The plant was closed in 1892 and 1893, and as the location had proven far from suitable, it was, in 1894, moved to a point on the left bank, about 15 miles above Smoky Point, where it was operated until 1896. The next year it was sold to the Alaska Packers Association. The machinery and equipment were utilized in the latter company's cannery, and the old location abandoned.

In 1893 Charles Nelson established a saltery on the left bank of the Ugashik, immediately above the last site of the Bering Sea Packing Co. It was operated in 1893 and 1894, and then sold to the Alaska Packers Association, who closed it down.

In 1893 the Alaska Packers Association also built a saltery on the left bank of the river about a mile below the last site of the Bering Sea Packing Co. It was operated each year until 1895, when it was merged into the association's cannery.

In 1895 the Alaska Packers Association built a cannery, known as the Ugashik Fishing Station, on the right bank of the river immediately above the pilot station, which is about 12 miles from the bar. It made the first pack in 1896 and packed every year until 1907, when it was closed. In 1906 its outfit was destroyed in the San Francisco fire, and it was decided to operate it as a saltery, but the burning down of the Coffee Creek cannery of the association on the Kvichak changed the plans, and a part of the saved outfit of the latter was sent to the Ugashik and the plant operated as a cannery.

The Bristol Packing Co. built a cannery on the left bank of the river about 25 miles from Smoky Point in 1900. A pack was made the same year and the plant operated continuously until 1906, when it was shut down, and a small salting crew operated a portion of the

plant. Eventually the plant was dismantled without operating again as a cannery.

In 1901 the Alaska Packers Association built and put into operation another cannery about 15 miles up the river from the other one. In 1906 this plant was shut down and eventually it was dismantled.

In 1901 the Red Salmon Canning Co. also built and operated a cannery still farther up the river and has operated it continuously to date.

ALASKA PENINSULA, BERING SEA SIDE.

Of recent years canneries have been located on the Bering Sea side of the Alaska Peninsula, outside of Bristol Bay proper, but it is probable that their numbers will not be large in the future, as the fisheries tributary to them are not very extensive, and are also very much scattered, making transportation expensive.

Port Heiden.—This important indentation on the Bering Sea side of the Alaska Peninsula, about midway between the Ugashik River and Port Moller, has never figured to any considerable extent in fishing operations. In 1912 and 1913 Gorman & Co. had the schooner *Harriet G.* located here throughout the season, engaged in salting salmon. The Illnik Packing Co. operated a saltery here in 1918.

Port Moller.—This great indentation in the Alaska Peninsula, between Port Heiden and Nelson Lagoon, was neglected for many years for the more profitable Bristol Bay region.

About 1902 the Bering Sea Packing & Trading Co. (there seems to be some confusion between this name and that of the Peninsular Packing Co., the latter being the name the company was known by after the first year or two in the official records), established a saltery on Bear River, which debouches a little east of Port Moller, and operated it until 1906, after which operations were suspended and but little is now left of the plant.

In 1912 the Pacific American Fisheries erected a cannery on Port Moller, but it was not operated until 1913. This concern has been successful mainly because of its introduction of purse seines in fishing.

In 1916 the Bering Sea Packing Co. built and operated a cannery on Herendeen Bay, a branch of Port Moller. In 1917 two new canneries were built and operated here, that is, the Fidalgo Island Packing Co. and the Phoenix Packing Co. In 1918 the Bering Sea Packing Co. was taken over by the Everett Packing Co. In 1919 all three Herendeen Bay canneries, as a result of the exceedingly slight runs of the two previous seasons, combined forces for the season and put up all the fish caught at the plant of the Fidalgo Island Packing Co.

Nelson Lagoon.—Nelson Lagoon is on the Bering Sea side of the Alaska Peninsula, is about 6 miles in length and about 2 miles in width. At its western end debouches the Nelson River, which is about a mile wide at its mouth. About 18 miles from the mouth the river divides, both branches having their rise in lakes. There is an easy portage from the lakes to Pavlof Bay, on the Pacific side of the peninsula, and this route is used frequently by both white men and Indians. The run is mainly of red salmon, and gill nets and traps are utilized. During the last few years purse seines have been used in this region with considerable success.

In 1902 Charles Johnson, who had operated on the Ugashik River, established a saltery here and operated it under the name of the Lagoon Salmon Co., and made a pack that and the succeeding year. In 1904 and 1905 it was shut down. It was reopened in 1906 and continued to operate until it was sold in 1914. In 1915 the new owners, the Nelson Lagoon Packing Co., built a cannery here which was operated until 1920, when it was shut down.

Unalaska Island.—In 1916 the Pacific American Fisheries, having obtained a permit from the Department of Commerce, built a cannery at Unalaska, on Unalaska Island. This cannery is located inside of the Aleutian Islands reserve, and permit was given for its building and operation so that it might be possible for the Indians of Unalaska and Dutch Harbor to obtain work at home and save them the long trip to the Bristol Bay plants. It ceased operations at the end of the 1917 season.

KUSKOKWIM RIVER.

This, one of the great rivers of Alaska, has been but little exploited as yet. Very little accurate data have been obtainable about the river until within the last couple of years, and this relates mainly to the bay and a few miles of the adjacent river, which the United States Coast and Geodetic Survey has charted.

We know that the river has considerable runs of salmon, but usually ice conditions have been such in the spring that a cannery crew frequently could not get in in time to prepare for the run. In 1906 a salting outfit was sent here by Seattle dealers, but arrived too late for the run of fish. The outfit was cached at Bethel.

During the last seven years some mild curing of king salmon has been carried on here, but the lack of cold storage, both ashore and on the vessels operating to and from the river, has prevented any considerable development of this industry.

YUKON RIVER.

The 1918 report of the Alaska agent of the United States Bureau of Fisheries ^a contains the following account of the development of the salmon fisheries of the Yukon River:

The development of the Yukon salmon fisheries began in 1918 with the establishment of a floating cannery at Andreafski. The season's operations resulted in a pack of 13,463 cases of salmon, divided as follows: Cohos 2,661, chums 6,471, humpbacks 107, and kings 4,224 cases. In addition to this, 10,400 pounds of cohos and chums were dry-salted. The total catch of salmon for the cannery was 115,531, of which 26,144 were cohos, 73,921 chums, 3,227 humpbacks, and 12,239 kings. Fishing was carried on from the mouth of the Yukon to a point above the junction of Clear River, chiefly in that part of the Yukon delta known as Kwikluak Pass. The fishing seasons were as follows: Kings, June 26 to August 17; chums, June 23 to September 8; humpbacks, July 7 to July 29; and cohos, August 3 to September 8. Some of the cannerymen and others frequently refer to salmon of one kind by the name "Yukons" or "Yukon salmon." In so doing they mean bright or fresh-run chums.

An investment of \$48,000 was made in the plant. One stern-wheeler, the *Martha Clow* (65 tons net), one gas boat, the *Allthea* (17 tons net), and three smaller power boats were operated in connection with the cannery. Salmon were taken with 124 gill nets aggregating 9,869 fathoms, and 6 wheels of the two-scoop pattern. Employment was given to 169 men, 55 being fishermen, 102 shoresmen, and 12 transporters. Of these 36 were natives, 13 of whom were listed as fishermen.

^a Alaska Fisheries and Fur Industries in 1918. By Ward T. Bower. Appendix VII, Report, U. S. Commissioner of Fisheries, 1918, pp. 29-30. Washington, 1919.

Stokes & Stokes operated a small saltery on the lower Yukon, packing 15 barrels of chum salmon. Their plant was valued at \$1,500. Equipment consisted of one power boat and 300 fathoms of gill nets. They report having located too far up the river, but before another season will move to a point lower down.

Warden C. F. Townsend reported that one Sepella operated a saltery on the Yukon about 12 miles from salt water and that a pack of 110 barrels of chums and cohos was made. Salmon were taken with gill nets and one wheel. Mr. Townsend also advised that the Delta Fishing Co. was in the field in a small way.

Statistics compiled at the close of the season of 1918 indicate that exclusive of gear operated by the cannery and salteries near the mouth of the river, the whites and natives on the Yukon and tributary waters used 393 fish wheels, valued at \$19,650, and 130 gill nets aggregating 3,250 fathoms, valued at \$6,500. The estimated catch for local requirements was 1,400,000 salmon, which when dried represented approximately 700 tons of fish, valued at \$140,000.

The total population of the Yukon region of Alaska, dependent in some measure on the fisheries, was estimated late in 1918 as being 10,907, of which number 6,638 were whites and 4,269 were natives. The number of dogs in the region was estimated at 6,133.

Prior to the season of 1918 the size of the run of salmon in the Yukon was an almost unknown quantity. The belief was expressed in some quarters that a comparatively small run ascended its waters, but others who were interested in the commercial exploitation of its fisheries held the opinion that a run aggregating many millions of salmon annually ascended the river. The necessity of maintaining the fisheries is paramount at all times, and if it is reasonable to suppose that a serious depletion of the supply by unrestricted fishing seems imminent, limitations must necessarily be imposed. This was done on December 14, 1918, by the promulgation of regulations affecting commercial fishing for salmon in the Yukon River. The closing order which is published in full on page 11 in this report became effective January 1, 1919.

MISCELLANEOUS PLACES.

At times small quantities of salted salmon have been packed in Bering Sea in the neighborhood of Nome and St. Michael. In 1917 the Arctic Fish Co. operated on a large scow on Golovin Bay, near Nome.

ARCTIC OCEAN.

Although it is known that there are good runs of salmon in some of the rivers debouching into the Arctic, the ice and other conditions have deterred people from attempting to extend their operations into this region. In 1912, however, the Midnight Sun Packing Co. built and operated a small cannery on Kotzebue Sound, in the Arctic Ocean. A small pack, mostly of Dolly Varden trout, was made in that and subsequent years. The plant was not operated in 1919.

BRITISH COLUMBIA.^a

Fraser River.—This, the largest river in British Columbia (over 1,000 miles in length), has been important from a fishery standpoint ever since salmon canning was taken up commercially.

The Hudson Bay Co., the first to prepare salmon for commercial purposes, bought the fish from the Indians and pickled them in barrels for export, mainly to the Hawaiian Islands and Asia.

Howay,^b in his work on "British Columbia," after describing briefly the fishing operations carried on by the Hudson Bay Co. in the Fraser River, has the following to say with respect to the develop-

^a The author is indebted to Henry Doyle, of Vancouver, British Columbia, for practically all of the historical data relating to the canning industry of British Columbia, and hereby expresses his deep appreciation for this and many other courtesies.

^b British Columbia, from the earliest Times to the Present. By F. W. Howay. 4 vols., illus. Vancouver, 1914.

ment of the commercial salmon fisheries and the preparation of the catch by salting and canning on the part of the independents who succeeded the company:

SALMON CANNING INDUSTRY.

No sketch of our history could be called complete without containing some reference to the origin and development, during the early stages, at any rate, of the industry of salmon canning.

By its charter the Hudson Bay Co. was granted "the fishing of all sorts of fish, whales, sturgeons, and all other royal fishes in the seas, bays, inlets, and rivers, within the premise (that is within the undefined area surrounding Hudson Bay), and the fish taken therein." Though no similar grant was contained in the exclusive license of trade with the Indians west of the Rocky Mountains, which was the only title the company had in this region, yet it claimed and exercised a monopoly of the salmon fishing on the Fraser River.

Reference has already been made to the salmon fishery carried on by the company at San Juan Island. In August, 1829, at Fort Langley (the name of this place has since been changed to Derby) 7,544 salmon were obtained from the natives at a cost of £13 17s. 2d. in goods. The trade increased; in 1835 and for many years thereafter 3,000 or 4,000 barrels of salt salmon were exported, principally to the Hawaiian Islands. With the revocation of the license in 1858 this claim of monopoly fell.

Capt. William Spring, in 1863, began salting and curing salmon at Beechy Bay. In the following year Mr Annandale, with whom Mr. Alexander Ewen was associated, opened a salmon saltery on Fraser River. This venture was almost a complete failure owing to the attempt to use the Scotch trap nets instead of drift nets. The former were found utterly unsuited to the conditions on Fraser River. When this enterprise failed, Mr. Ewen introduced drift nets and carried on an extensive business in salted salmon with the Hawaiian Islands and Australia.

The first attempt, on the Fraser River, to preserve salmon in hermetically sealed cans was made in 1867 by James Symes. This was not a commercial effort, but a mere experimental test to ascertain the possibility. A few cases were prepared, filled, and cooked by boiling on an ordinary kitchen stove. The result was most encouraging. The product was shown at the agricultural exhibition held in New Westminster in October, 1867, and was pronounced excellent, the directors making special mention of it.

About the same year Donald McLean established another salmon-curing establishment at New Westminster. Besides salted salmon, he put up pickled salmon, salmon boiled and preserved in vinegar, and smoked and kippered salmon.

The canning of salmon as a business was first undertaken on the Fraser by Alexander Loggie & Co. The persons interested were Alexander Loggie, Alexander Ewen, James Wise, and David S. Hennessy. Mr. Wise was an experienced fisherman; Messrs. Loggie and Hennessy had had experience in the canneries of New Brunswick. In June, 1870, these persons built, in connection with a salmon saltery, the first salmon cannery in British Columbia. It was located at Annieville, about 3 miles below New Westminster. The cannery was a very primitive affair; the cylinders upon which the cans were shaped were of wood covered with sheet iron; the trays were small wooden contrivances holding about three dozen one-pound cans. There was practically no machinery; the operations were almost entirely by hand. The fish after being put into the cans was preserved by boiling in large wooden vats. Great difficulty was experienced in thoroughly cooking the fish, the boiling point of ordinary water not proving sufficient; to overcome this, salt was added to the water, and by this means the temperature was raised to 230°. The room in which the cooking was performed was, in temperature like a Turkish bathroom; no windows or doors were allowed to be opened, except of necessity, under the mistaken idea that the cold currents of air would injure the product.

Capt. Stamp, who has been frequently mentioned in the foregoing pages, also entered the business at the same time. His cannery was located at Sapperton, New Westminster. He did not attempt to manufacture his cans, but obtained his supply from Mr. Deas, a tinsmith of Victoria.

About 1873, Loggie & Co. removed their cannery to New Westminster, where in the meantime Messrs. Lane, Pike, and Nelson had established themselves in the same business. These latter persons conceived the plan of canning the salmon whole; the sockeyes, being of an almost uniform size, lent themselves readily to this attempt. It was, however, a failure, as owing to the great vacuum in the cans, they became much distorted.

In 1872 Holbrook & Co. purchased a small cannery which had been started at Sapperton by Capt. Stamp some time before, and operated it for a few years.

In 1876 there were three canneries running, consisting of Holbrook & Co., Ewen & Co., and the British Columbia Canning Co. (Deas Island).

The following year this was increased by English & Co. and Finlayson & Lane, the latter quitting after one season, being succeeded in 1878 by Lane, Pike & Nelson. King & Co., the British Columbia cannery (Annieville), and the Delta cannery also commenced operations the latter year.

In 1879 Holbrook & Co., and Lane, Pike & Nelson dropped out, and Haigh & Sons (succeeded in 1884 by the Bon Accord Packing Co.) commenced operations.

King & Co. were burned out in 1880, and Adair & Co., afterwards known as the Wellington Packing Co., commenced. A year later Laidlaw & Co. commenced operations.

In 1882 the British Union Packing Co., afterwards known as the Harlock Packing Co., commenced packing salmon. The British-American cannery and J. H. Todd & Sons (Richmond cannery) also began operations.

Joseph Spratt started a floating cannery, known as "Spratt's Ark," in 1883; he retired at the end of two years. E. A. Wadhams also began operations in 1883. In 1887 the Holly cannery was built on Lulu Island opposite Deas Island. The high water of June, 1894, partially destroyed it and the site was abandoned.

No more additional plants were built until Hobson & Co. started in 1889. The Canoe Pass Canning Co. also started the same year, as did J. H. Todd & Sons with their Beaver cannery.

The Anglo British Columbia Packing Co. was formed in 1891, taking over the canneries formerly operated by the British Columbia Packing Co. (old Annieville plant), E. A. Wadhams, British-American Packing Co., Canoe Pass Canning Co., Dun'an & Batchelor (Britannia cannery), and English & Co. (Phoenix cannery).

In 1892 the Terra Nova Canning Co. began operations, and the next year the Lulu Island Canning Co., Steveston Canning Co., Pacific Coast Packing Co., Canadian Pacific Packing Co., Short & Squair, and Butimar & Dawson (at Steveston) all commenced operation.

In 1894 the Gulf of Georgia Canning Co., Dinsmore Island Canning Co., Sea Island Packing Co., and the Fishermen's Packing Co. all built and began to operate canneries.

The Alliance Canning Co., Atlas Canning Co., Boutilier & Co., and the Star Canning Co. commenced operations in 1895.

There was considerable development in 1896, when the Anglo-American Canning Co., Fraser River Industrial Co., Hume & Co., Provincial Canning Co., Westham Island Packing Co., Westminster Packing Co., and the Vancouver Packing Co. all started canning.

In 1897 the Premier Canning Co., Sinclair Canning Co., Western Fisheries, Cleve Canning Co., Welsh Bros., Currie, McWilliams & Fowler, Butimar & Dawson (at Canoe Pass), Colonial Canning Co., and the Fraser Canning Co. all began operating.

The English Bay cannery was added to the list in 1898, but the Sinclair Canning Co. and Western Fisheries plants were both de-

stroyed by fire at New Westminster and not rebuilt. The plant of the Steveston Canning Co. was absorbed that year by the Federation Brand Salmon Canning Co. and the cannery renamed the "Lighthouse" cannery.

In 1899 the Greenwood Canning Co., Scottish Canadian Canning Co., St. Mungo Canning Co., Wurzburg & Co., and Acme Canning Co. all began active operations, while in 1900 the Great Northern Canning Co. was the only addition to the list. In 1900 the United Canneries (Ltd.) was formed to take over the Gulf of Georgia, English Bay, and Scottish Canadian plants, and the Canadian Canning Co. this year also absorbed the Star, Fraser, and Vancouver canneries. In 1901 the National Packing Co. built at Eagle Harbor.

Like the other canning sections, British Columbia suffered in 1901 from an oversupply of canned salmon, due to the large number of plants which had been erected and which were producing more salmon than market could be found for. At this juncture the British Columbia Packers Association was formed. It embraced 29 out of the 48 plants on the Fraser River and 12 of those situated in Northern British Columbia waters, including the following plants: Ewen & Co., Delta, Harlock, Wellington, Lulu Island, Terra Nova, Pacific Coast, Canadian Pacific, Short & Squair (Imperial cannery), Brunswick canneries at Steveston and Canoe Pass, Dinsmore Island, Sea Island, Fisherman's Packing Co., Reliance cannery, Atlas cannery, Boutilliar & Co., Hume & Co., Anglo-American, Provincial, Westham Island, Westminster Packing Co., Premier, Cleve, Welsh Bros., Currie, McWilliams & Fowler, Colonial, Greenwood, Wurzburg & Co., and the Acme Canning Co. In 1914 the corporation style was changed to the British Columbia Fishing & Packing Co. (Ltd.).

In 1902 the Fraser River Industrial cannery was sold to C. S. Windsor; in 1905 this plant was sold by Mr. Windsor to Peter Birrell.

In 1905 the Burrard Canning Co., Steveston Canning Co., Butimar & Dawson, Unique cannery, and the Vancouver Fish & Canning Co. were all built and operated. The latter was burned in the middle of the season. The same year the Great Northern cannery was purchased by McPherson & Wilkinson.

In 1906 the Great West Packing Co. cannery was built at Steveston; the Nye Canning Co. operated for part of the season on False Creek in Vancouver, and the Capital City Canning Co. built a plant at Victoria. The same year the Lighthouse cannery was leased for the season by the Royal Packing Co.; while in the following year the Unique cannery was dismantled.

In 1909 the Gulf of Georgia cannery was sold to M. Desbrisay & Co.; Peter Birrell sold the Industrial cannery to the Glen Rosa Canning Co., who have since operated it; the Lighthouse cannery was leased for the season by Kildala Packing Co.; the Gosse-Millerd Packing Co. purchased the Steveston Canning Co.'s plant; while the following year the Lighthouse cannery was leased for the season by Lee Coy.

In 1912 the Lighthouse cannery was sold to C. S. Windsor and associates. The Scottish-Canadian cannery was also sold to C. S. Windsor and associates, by whom it was operated under the name of the Scottish-Canadian Canning Co. until 1914.

In 1913 the Great Northern cannery was leased for the season to the English Fisheries (Ltd.), while in the following year the Gosse-Millerd Packing Co. bought the Vancouver and Fraser canneries from the receiver of the Canadian Canning Co. The Jervis Inlet Canning Co. acquired the Lighthouse cannery the same year.

The Scottish-Canadian cannery was acquired in 1915 by the Graham Co., while the Great Northern cannery was sold to the Defiance Packing Co.

In 1916 a new cannery was built at Liverpool, South Westminster, by the Liverpool Canning Co.

In 1917 the Gosse-Millerd Packing Co. purchased the Star cannery which had been lying idle since 1913; the Booth Fisheries Co. leased the Scottish-Canadian cannery for the season. They held an option to purchase same, but did not exercise it, and the plant has since been closed down. The Cliff-Lowman Packing Co. acquired the Lighthouse cannery from the Jervis Inlet Canning Co.

In 1918 the Canadian Fishing Co. built at Vancouver, and while their plant is not on the Fraser River it is classed in that area, as its pack will be largely secured from Fraser River fish.

Early in the spring of 1919 fire destroyed the Star, Steveston, and Lighthouse canneries, none of which have been rebuilt.

Skeena River.—The first cannery to be built on the Skeena River was in 1877, when a man named Neill built one at Inverness. In 1878 the Windsor Canning Co., consisting of Henry Saunders, W. H. Dempster, and John Wilson, of Victoria, established a cannery at Aberdeen.

There were no additions until in 1883, when the Balmoral cannery the British-American, and Robert Cunningham canneries were started.

In 1889 the North Pacific was started and in 1890 the Standard. In 1891 the Anglo-British Columbia Packing Co. bought the British-American cannery and the North Pacific Canning Co. cannery. In 1892 the Claxton, and in 1895 the Carlisle, canneries were built. In 1899 the Claxton cannery was purchased by the Wallace Bros. Packing Co. The Peter Herman (afterwards the Skeena River Commercial Co.) and Turnbull canneries were built in 1900. The last named operated only four seasons.

In 1902 the British Columbia Packers Association acquired the Balmoral, Cunningham, and Standard canneries.

In 1903 the Cassiar cannery was built. The next year the Alexandria Packing Co. was started. It was later acquired by the British Columbia Packers Association, as was also the Dominion cannery, which was built in 1906.

The Carlisle cannery was sold in 1906 to the Kildala Packing Co.

In 1911 the Wallace Fisheries (Ltd.) purchased the Claxton cannery from the Wallace Bros. Packing Co., while in 1913 the Canadian Fish & Cold Storage Co. built a cannery at Tucks Inlet, where their supply of salmon is obtained from the Skeena fishermen.

In 1916 the Gosse-Millerd Packing Co. built their Sunnyside plant. In 1918 the Northern-British Columbia Fisheries (Ltd.) purchased the Skeena River Commercial Co.'s plant at Port Essington, and also erected a new cannery at Port Edward.

Rivers Inlet.—The first cannery to be built and operated on Rivers Inlet was in 1881 by Shotbolt & Draney, afterwards the British

Columbia Canning Co. The Wannuck cannery was built in 1884, the Good Hope in 1895, the Brunswick in 1896, the Wadhams and the Vancouver in 1897.

There were no changes until 1902, when the British Columbia Packers Association acquired the Wadhams, Brunswick, Wannuck, and Vancouver, the two latter being dismantled and the two former enlarged correspondingly.

In 1906 the Beaver cannery was built by J. H. Todd & Sons, the Kildalla cannery by the Kildalla Packing Co., and the Strathcona cannery by Bain & Wilson, the latter afterwards being acquired by the Wallace Fisheries (Ltd.).

In 1911 the Strathcona Packing Co.'s plant was purchased by Wallace Fisheries (Ltd.). In 1917 the Provincial Canning Co. built a plant, and in 1918 the McTavish Canning Co. also built one.

Nass River.—The first cannery to be built on the Nass River was by Henry Croasdale in 1881, and it operated for four years. The Douglas Packing Co. built a cannery here in 1882 and operated it for two years. Both were then shut down owing to the fact that the locations were too far up the river for steamers to move the packs. In 1888 the plants were dismantled and removed to Nass Harbor and Mill Bay, respectively. In 1889 the Cascade Packing Co. commenced operations, but the plant was dismantled in 1893.

In 1903 the Pacific Northern cannery was built near the mouth of Observatory Inlet, and in 1905 it was purchased by John Wallace, who moved it to Arrandale. In the latter year the Port Nelson Canning & Salting Co. started. In 1908 the Mill Bay cannery was purchased by the Kincolith Packing Co. In 1911 the Arrandale and Port Nelson canneries were bought by the Anglo British Columbia Packing Co., and in the following year the Nass Harbor cannery was bought by the British Columbia Packers Association.

The Wales Island cannery, which became Canadian property under the Alaska boundary award, was in 1911 purchased by M. Desbrisay & Co., by whom it has since been continuously operated.

In 1916 the Kincolith Packing Co.'s Mill Bay plant was purchased by the Kincolith Fisheries (Ltd.), while in 1918 the Northern British Columbia Fisheries (Ltd.) purchased the Mill Bay cannery from the Kincolith Fisheries (Ltd.) and built a new plant at Kumeon. The Western Salmon Packing Co. also built a new plant at Summerville the same year.

Queen Charlotte Islands.—In 1912 the British Columbia Fisheries (Ltd.), a concern promoted by Sir George Doughty, M. P., of Grimsby, England, built a cannery at Aliford Bay, Skidegate Inlet, and operated same for two seasons. The British Columbia Fisheries (Ltd.) then went into insolvency, and the plant remained idle until 1916, when it operated under lease to the Western Salmon Packing Co. In 1917 the cannery was purchased by the Maritime Fisheries (Ltd.), the present owners.

The Wallace Fisheries (Ltd.), built at Naden Harbor in 1912, and operated that and the following seasons. The cannery was not in commission during 1914 or 1915, but ran in the years 1916 to 1918, inclusive. It was found that Masset Inlet would be a more suitable location, and in 1919 the plant removed from Naden Harbor to a new site on the shores of the Inlet.

A cannery was built at Lockeport in 1918 by the Lockeport Canning Co. The same year the Western Salmon Packing Co. (Ltd.) built a plant at Lagoon Bay.

Miscellaneous places.—A cannery was built at Metlakatla in 1882 by Rev. John Duncan for the Metlakatla Indians, fish being obtained from Skeena River. The plant was dismantled in 1886.

John Rood built the first cannery on Smiths Inlet, in Quachela Lagoon, in 1883. It was closed in 1884, and the plant moved to Wannuck, Rivers Inlet, to which place also the Smiths Inlet fish were subsequently transported for packing purposes. In 1902 the Wm. Hickey Canning Co. built a new plant on Smiths Inlet, selling same in 1912 to the Wallace Fisheries (Ltd.). The Western Packers (Ltd.) also built at Marguerite Bay in 1917.

A cannery was built at Lowe Inlet in 1890 by the Lowe Inlet Canning Co. It was sold to the British Columbia Packers Association in 1902.

In 1890 a cannery was built at Gardiner Canal by a man named Price and his associates. It ran until 1893, when it was dismantled and closed.

Robert Draney built at Namu in 1893, selling out in 1912 to the Draney Fisheries (Ltd.), who in turn sold out to the Northern British Columbia Fisheries (Ltd.) in 1918.

Robert Draney built the Kimsquit cannery in 1901, and in 1907 the Kildalla Packing Co. built the Manitou cannery. The latter is still operating, but in 1912 the Draney Fisheries (Ltd.) purchased the Kimsquit cannery, and in 1918 sold it again to the Northern British Columbia Fisheries (Ltd.).

In 1900 the Bella Coola cannery was built by John Clayton and sold by him in 1902 to the British Columbia Packers Association, who have operated it ever since. In 1917 a new cannery was built by the Tallheo Fisheries (Ltd.) and sold by them in 1918 to the Northern British Columbia Fisheries (Ltd.).

Toms, Morris & Fraser built at China Hat in 1900 and sold to the British Columbia Packers Association in 1902. The latter dismantled and closed the plant in the fall of that year.

A cannery was built at Warke Island in 1911 by John Wallace, principally for packing Gardiner Canal fish. Plant was purchased in 1917 by the Western Packers (Ltd.), who have since operated it.

A cannery was built at Bella Bella in 1912 by the East Bella Bella Canning Co. It was sold in 1915 to the Gosse-Millerd Packing Co., who have since operated it.

The cannery built at Alert Bay in 1881 by S. A. Spencer was purchased in 1902 by the British Columbia Packers Association, who have since operated same.

Cannery was built at Clayoquot in 1895 by Earle & Magneson. It was purchased by the Clayoquot Sound Canning Co. in 1902, by whom it has since been operated.

A cannery was erected at Bute Inlet in 1890 by C. S. Windsor and George Hobson, but only operated the one season.

The West Coast Packing Co. was built and operated at Nootka Sound in 1896, but only secured 112 cases. The plant was dismantled and abandoned. In 1917 a new plant was erected by the Nootka Packing Co., who have since operated steadily.

Dawson & Buttimer built at Alberni Canal in 1903. They sold out to the Wallace Fisheries (Ltd.) in 1911, and the latter have operated steadily ever since.

Pidcock Bros. built a small cannery at Quathiaski Cove in 1904. They operated it that and the following year and then sold to T. E. Atkins in 1907. This plant was destroyed by fire in 1909, and the following year the Quathiaski Canning Co. built a new plant, which has operated steadily since.

A small cannery was built at Pender Harbor in 1906 by P. H. Alder. It operated for two seasons and was then closed down and dismantled.

J. H. Todd & Sons and the Capital City Canning Co. both built at Victoria in 1905 (the former at Esquimalt). Messrs. Todd & Son still operate, but the Capital City Canning Co. plant was closed and dismantled in 1914.

Capt. R. E. Gosse built at Knight Inlet in 1907 at Sargeants Passage, but moved the plant to Glendale Cove in 1910, and at the close of that season sold the cannery to the Anglo British Columbia Packing Co., who have since operated it.

The Wallace Fisheries (Ltd.) built a cannery at Quatsino Sound in 1911, but dismantled it in 1914.

The Goletas Fish Co. built at Shushartis Bay in 1914, and after operating for three seasons sold the plant in 1917 to the Western Packers (Ltd.), the present owners.

The Gilford Fish Co. built a cannery at Kingcombe Inlet in 1914. After operating it that season they sold to the Preston Packing Co., the present owners.

The Jervis Inlet Canning Co. built a cannery at Jervis Inlet in 1912, operating it that and the following season. In the fall of 1913 it was destroyed by fire. In 1917 the C. L. Packing Co. erected a new plant at Green Bay, Jervis Inlet.

The Nanaimo Canning Co. started at Nanaimo in 1913 and operated until 1916, in which year the plant was acquired by the Nanaimo Cannery & Packers (Ltd.).

The Quathiaski Canning Co. was built at Blind Cove in 1916; the Gulf Island Fish Co., at Lasqueti Island, in 1916; and the Sidney Canning Co., at Sidney, in 1916.

The Redonda Island Canning & Cold Storage Co. built a cannery at Redonda Island in 1917, while the Lummi Bay Packing Co. built a cannery at Nitnat in 1917.

In 1918 the Defiance Packing Co. built a cannery at Port Renfrew, while in 1919 the Gosse-Millerd Packing Co. built one at San Mateo.

SALMON FISHING IN THE HEADWATERS.

Considerable salmon fishing is carried on in the headwaters of certain of the larger rivers of the coast, of which no account appears in the data of the commercial fisheries. This is due to the fact that the fishing is usually of a desultory character, the fisheries are few in number and scattered widely, and while the catch in the aggregate is considerable it does not amount to much in any one spot.

The Columbia River is a typical example of such a stream. Commercial fishing is usually considered as ending at Celilo, about 150 miles from the mouth. As a matter of fact, salmon fishing for market

or for home use is carried on to a considerable extent along the main river and also on the Snake and the Yakima, tributaries of the Columbia. In nearly all cases hook and line and spears are used alone, but on the Snake River, near Lewiston, in Idaho, are several rather important haul-seine fisheries. Fishing is carried on at these places in the spring for steelhead trout and in the fall for chinook and silver salmon and steelhead trout. As many as 25 salmon have been taken at one time. While this may seem a small number to one habituated to the large catches farther down the river, in the aggregate it amounts to a considerable quantity.

Considerable local fishing is carried on along the various Oregon streams above the sections usually fished by commercial fishermen. Most of this is done by ranchers living along the streams, and while by far the greater part is for home consumption a small proportion is sold.

On the Yukon River and its tributaries considerable salmon fishing is prosecuted. Much of this is done by natives for the use of themselves and their dogs, but at places white fishermen operate for a portion of the year and sell their catches in near-by settlements or at the mining camps. No effort has ever been made to secure statistics of the extent of this fishery.

APPARATUS AND METHODS OF THE FISHERIES.

GILL NETS.

The gill net is the oldest and most popular form of apparatus in use in the salmon fisheries of the Pacific coast. There are two kinds, drift and set, these names clearly expressing the difference between them. Fine flax or linen twine is generally used in their manufacture, although in some places cotton twine is employed, and it has usually 12 threads and is laid slack. They are hung in the ordinary manner—to a rope with cork floats to support the upper portion of the gear, and to a line with lead sinkers attached, which keeps the net vertical in the water and all its meshes properly distended. The nets are tanned, usually several times each season.

Drift nets vary greatly in length and depth, depending upon the width of the fishing channels, the depth of water, etc. On the Sacramento River they average about 300 fathoms in length, are 45 meshes deep, and have a stretch mesh of from $7\frac{1}{2}$ to $9\frac{1}{2}$ inches. On the coastal rivers of Oregon these nets average about 125 fathoms in length, and are about 36 meshes in depth, the mesh varying with the species of salmon sought. On the Columbia River the nets average about 250 fathoms in length and have a stretch mesh for chinooks of 9 to $9\frac{1}{2}$ inches. On the Willamette River, the principal tributary of the Columbia, they average about 75 fathoms in length, with meshes of 8 and $9\frac{1}{2}$ inches. On Willapa Harbor drift gill nets run from 100 to 250 fathoms in length, are 30 meshes deep, with stretch meshes of 7 and $8\frac{1}{2}$ inches. On Grays Harbor they average 100 fathoms in length, the chinook nets run from 24 to 45 meshes in depth, with a stretch mesh of 9 inches, while the silver or coho nets are 35 meshes in depth, with a stretch mesh of 7 inches. In northern British Columbia the nets average 150 fathoms in length with a stretch mesh of $5\frac{1}{2}$ inches. In the Puget Sound region the nets

average 300 fathoms in length, with meshes suitable for the particular species sought. In Alaskan waters the nets vary greatly in length and depth, depending upon the places where fished.

Drift gill netting is prosecuted chiefly in the estuaries of the rivers in and near the channels. If the water is clear the nets are set only at night, but should the water be muddy or discolored with glacial silt, fishing can be carried on either night or day. Night fishing is most common in the States, while day fishing is most common in Alaska. When fishing in rivers, it is necessary to work in a straight stretch of water of fairly uniform depth and free from snags or sharp ledges, these being called "reaches."

In setting the net the boat puller rows slowly across the stream while the other man pays out the apparatus, to the first end of which a buoy has been attached. When about two-thirds of the gear is out, the boat is turned downstream at nearly right angles to her former course, so that the net, when set, approximates the shape of the letter L. The net is laid out at nearly right angles or diagonally to the river's course, so that it will intercept the salmon that are running in, and is usually put out about an hour before high-water slack and taken in about an hour after the turn of the tide. In Alaska the fishermen usually fish on both the high and low slack. The nets are allowed to drift for the time specified, the fishermen drifting along at one end, then the net is hauled into the boat over a wooden roller fixed in the stern, and the fish, which have become gilled in the meshes, are removed, stunned or killed by a blow on the head, and thrown into the bottom of the boat.

Set gill nets are made in the same way as drift nets, in many instances being fragments of the latter, and are usually operated in the upper reaches of the rivers. They vary in length from 10 to 100 fathoms, from 35 to 65 meshes in depth, and have the same sizes of meshes as the drift nets, the size varying, of course, with the species sought for. Sometimes these nets are staked, sometimes anchored, while occasionally only one end is tied to the shore or a stake set in the water.

On the flats off the mouth of the Stikine River, in southeast Alaska, a combination of the drift and set method is followed. A double set of stakes, about 6 feet apart, are set out from the shore for a distance of several hundred yards. An hour or two before slack water the fishermen pay out the net parallel to the line of stakes and about 50 feet from them. The tide drifts the net down until it is caught against the stakes, which retain it until slack water, when the fisherman takes it up and repeats from the opposite direction on the next turn of the tide.

HAUL SEINES.

On the Columbia River, where this form of apparatus plays a prominent part in the fisheries, the nets vary in length from 100 to 400 fathoms; the shallowest end is from 35 to 40 meshes deep, but it rapidly increases in width and is from 120 to 140 meshes deep at the other wing. The "bunt," or bag, in the central part of the net is about 50 fathoms long. These nets are usually hauled on the numerous sand bars which are a very noticeable feature of the river at low tide. Buildings are erected on piles on these sand flats, in which the

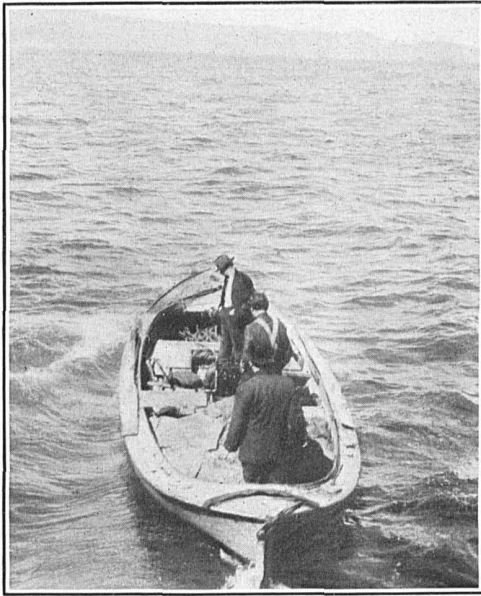


FIG. 8.—COLUMBIA RIVER POWER GILL NET BOAT.

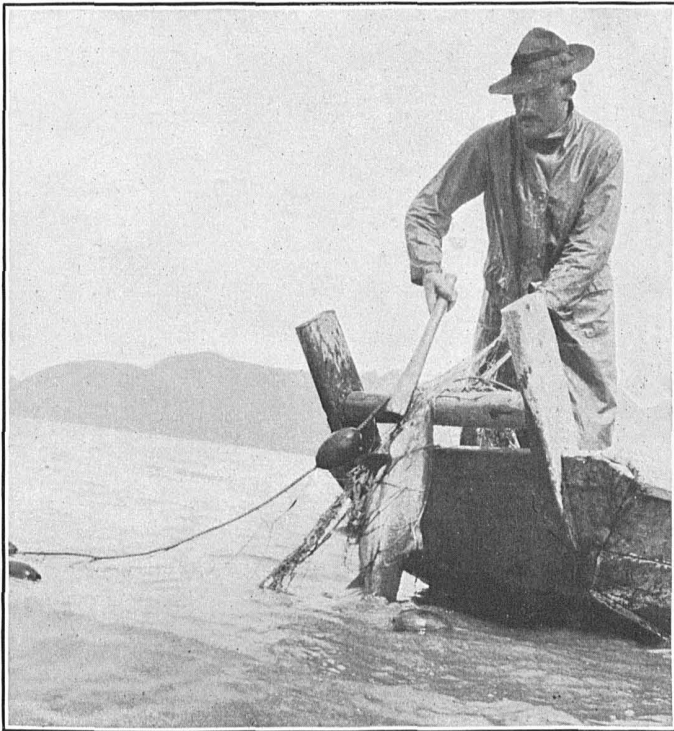


FIG. 9.—REMOVING THE SALMON FROM A GILL NET.

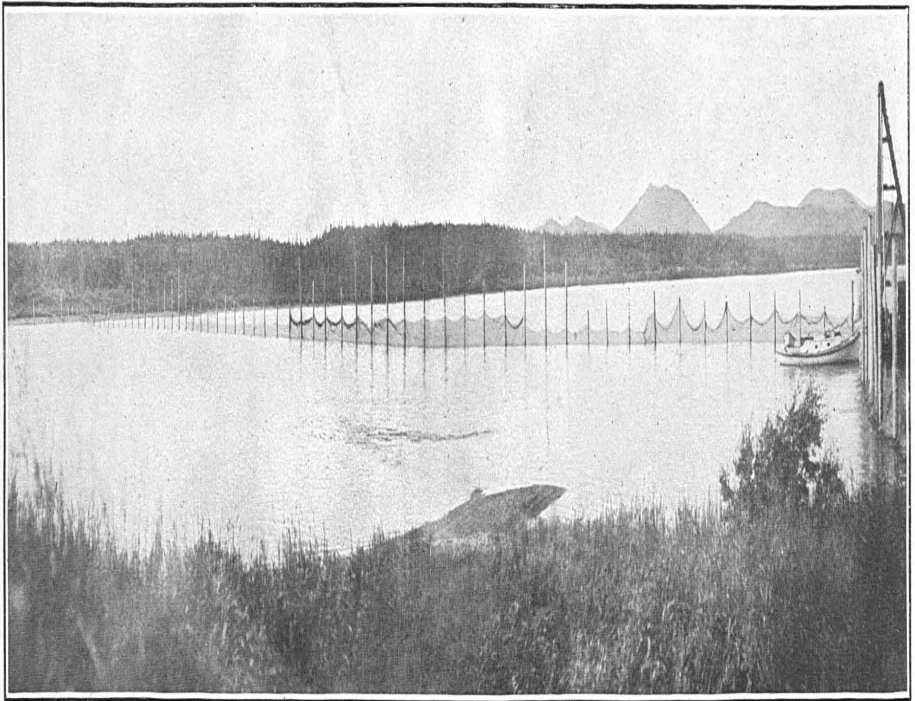


FIG. 10.—SALMON RACK ACROSS WOOD RIVER, ALASKA.

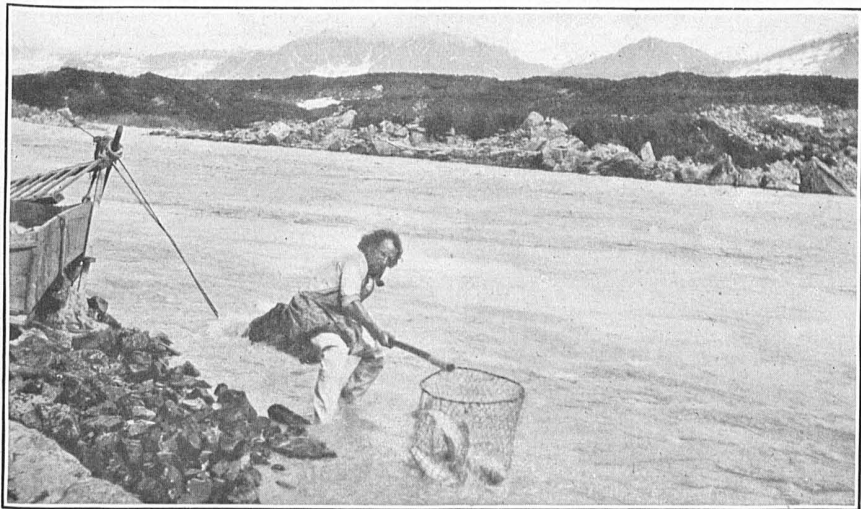


FIG. 11.—DIPPING SALMON FROM THE COPPER RIVER, ALASKA.

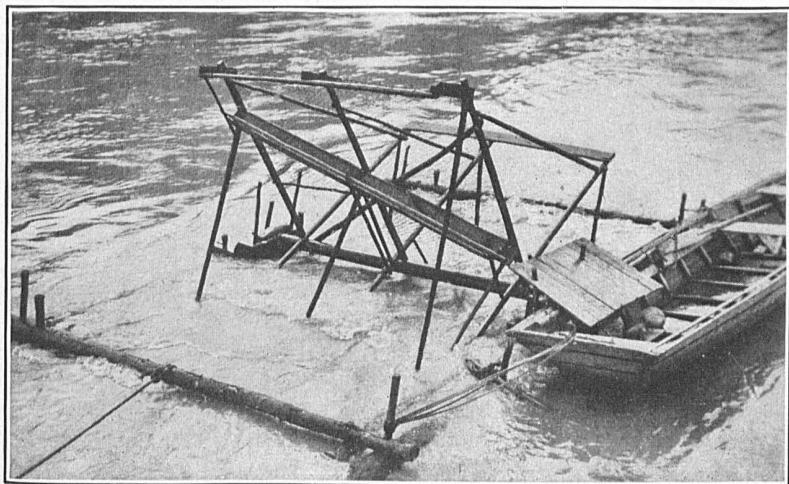


FIG. 12.—FISH WHEEL, YUKON RIVER, ALASKA.



FIG. 13.—A SCOW LOAD OF SALMON.



FIG. 14.—PURSE SEINE CREW DELIVERING FISH TO CANNERY TENDER.

men and horses take refuge at high tide, when the bars are covered with water. Operations begin as soon as the beach or bar uncovers, so that the men can wade about. The net is placed in a large seine boat, with the shore end attached to a dory. At the signal the seine boat is headed offshore, while the dory heads toward the bar. As the seine boat circles around against the current the net is paid out in the shape of a semicircle. The dory men hurry to the bar with the shore end of the net, the idea being to get that in as soon as possible in order to prevent the escape of the salmon in that direction. As soon as this has been accomplished, the outer shore line is brought to the bar, when several horses are hitched to the line and begin to haul in the net, care being taken by the men to work it against the current as much as practicable, and to get it in as speedily as they can in order to prevent the escape of salmon either by jumping over the cork line or finding some outlet below the footrope or lead line.

The only other place on the coast where haul seines are important is at Karluk, on Kodiak Island, in Alaska. Here the seines are hauled upon the narrow gravel spit dividing the lagoon from the strait, and practically the same method is followed as in the Columbia River.

DIVER NETS.

These are in use in the Columbia River, mainly throughout the middle and upper portions of the river. They vary from 100 to 200 fathoms in length and are used almost exclusively for chinook salmon. In construction they somewhat resemble a trammel net. Two nets are attached together side by side. The outer one, or the one toward the oncoming fish, has a larger mesh than the other, so that if the fish manages to pass through the first, it will be caught in the smaller meshes of the second.

DIP NETS.

These consist of an iron hoop secured to the end of a stout pole with a bag-shaped net fastened to the hoop. They are generally used at the cascades on the rivers, small platforms being erected upon which the operator stands while fishing. Indians formerly used them to a large extent, but, owing to the steady decline in the number of Indians, and the appropriation of favorable spots by the whites for other forms of apparatus, they are but little used now.

SQUAW NETS.

This type is virtually a set net. It consists of an oblong sheet of gill netting, about 12 feet long and 8 feet deep, its lower edge weighted to keep it down, and its upper edge attached to a pole that floats at the surface, and is held by a line or lines to another projecting pole which is securely fastened to the shore, so that it will not swing around with the strain of the swift current on the net. A single block is attached to the pole, and through this passes a rope, thus making a tackle for the more convenient manipulation of the net. The dip-net fishermen of the Columbia River use this net, which derives its name from the fact that it used to be commonly operated by Indian squaws for taking salmon. But few are now in use, for the same reasons as given for the decline in the use of dip nets.

PURSE SEINES.

This form of apparatus is in quite general use in Puget Sound and southeast Alaska, and has proved highly effective in these deep, swift waters. These seines are about 200 fathoms long, 25 fathoms in the bunt, and 20 fathoms in the wings, all with a $3\frac{1}{4}$ -inch stretch mesh. The foot line is heavily leaded and the bridles are about 10 feet long. The purse line is made of $1\frac{1}{2}$ -inch hemp. The rings through which the purse line is rove measure about 5 inches in diameter and are made of galvanized iron.

Purse seining for salmon in Puget Sound and waters north of same is one of the most important methods in use in the fisheries. In the type of vessel used in this fishery there has probably been greater improvement than in any other branch of the fisheries of the coast. In the early days row scows were in use, but now vessels with power are used.

In 1903 the first gasoline-powered purse seine boat appeared on the Pacific coast salmon fishing grounds in Puget Sound. The vessel was named the *Pioneer* and she was equipped with a 5-horsepower engine. The first season she easily demonstrated her vast superiority over the other purse seiners in the quickness with which she could reach a school of fish after it was sighted and in surrounding it with her seine. The next year there were a few more built or equipped, and the number has steadily increased until at the present time practically all except a few in southeast Alaska are equipped with motor engines.

The first power seine boats were only about 30 feet in length and had small power. As they were few in numbers, there was virtually no competition, and high power and speed were not a necessity. As the boats increased in numbers, however, competition became keener, and the first types of boats with their small power were quickly thrown into the shade by the newer types, which averaged between 45 and 55 feet in length, with 45 to 75 horsepower engines.

When motive power was introduced in the vessels, it was natural that the fishermen should soon introduce winches for the purpose of hauling in the nets, as the whole work could then be done by the one engine.

The purse seine vessels are built with rounded sterns. On an elevated section of the stern is set a movable platform on a pivot. The after end of this platform has a long roller. The purse seine is stowed on this platform, the head rope with corks on one side and the foot line on the other, so that there will be no tangling when the seine is paid out.

When the lookout sights a school of fish, the seiner is run down close to it and a rowboat launched. One man takes his place in this with the rope from one end of the seine and acts as a pivot, while the seiner circles around the school, the crew paying out the seine as she moves along. When it is all out, the vessel runs alongside the rowboat and takes aboard the other rope. Attaching this and the rope from the other end to the power winch, the circle around the fish is rapidly narrowed, and the slack of the seine as it comes in is stowed back on the platform. Around the bottom of the seine and through galvanized-iron rings about 5 inches in diameter runs the purse line. As this is hauled into the boat, the open space at

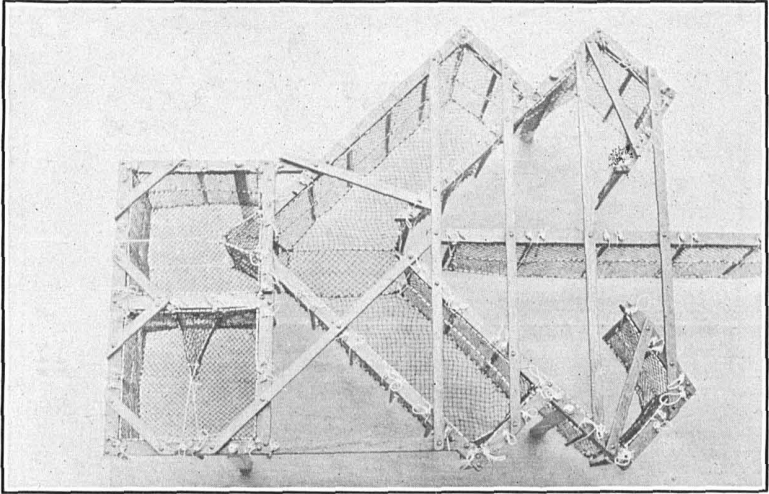


FIG. 15.—FLOATING TRAP.

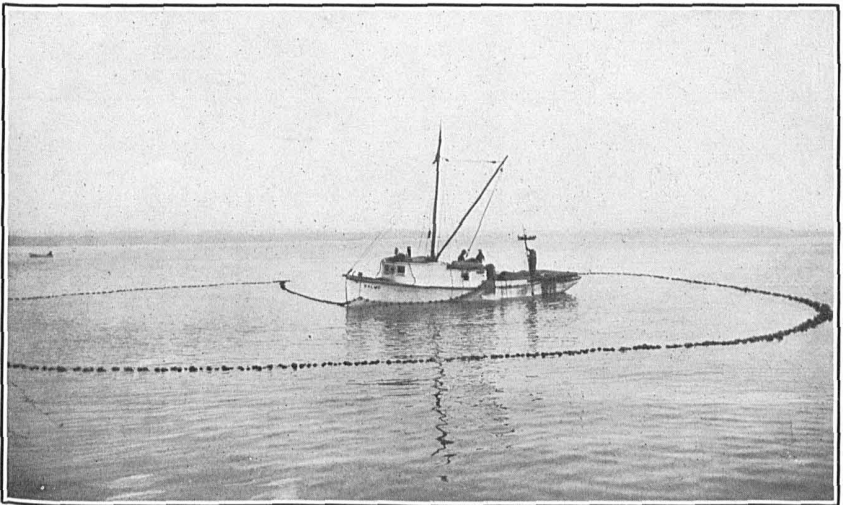


FIG. 16.—PURSE SEINER HAULING IN NET.

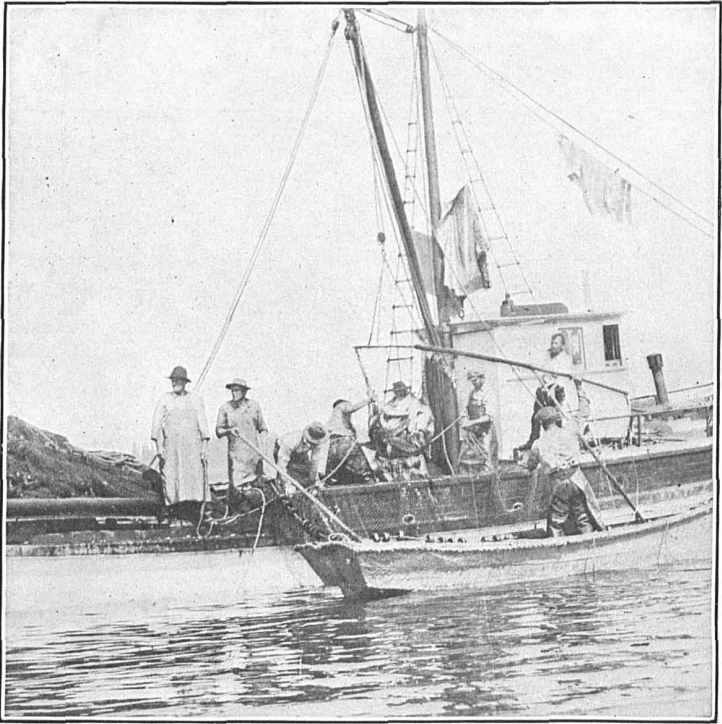


FIG. 17.—DIPPING SALMON FROM A PURSE SEINE.

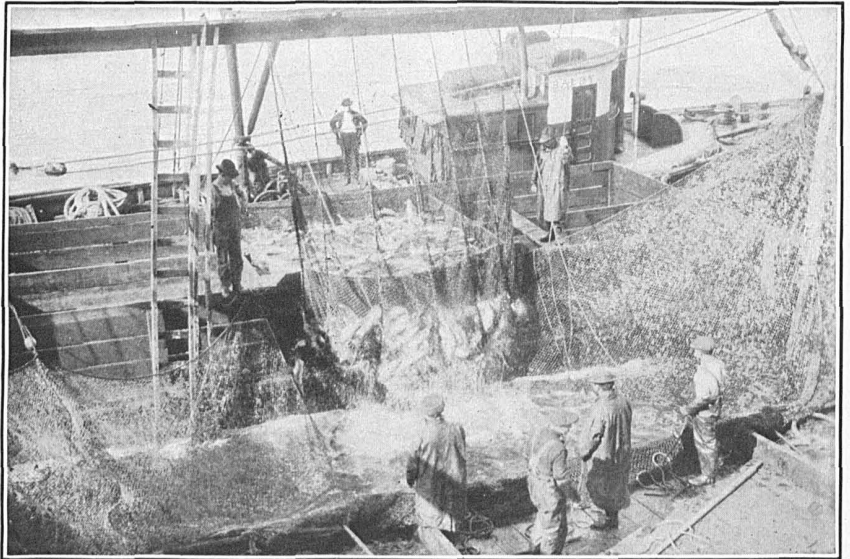


FIG. 18.—BRAILING SALMON FROM A TRAP.

the bottom is rapidly closed up just as a handbag would be through the drawing together of the pursing string at the top. During this operation the nonpower purse seiners have a man standing alongside the rail who throws a pole into the center in order to drive the fish away from the open section. He is so skillful in this work that almost invariably the pole comes back to his hand as the pressure of the waters forces it up again. When the bottom has been pursed up the fishermen hauling by hand can move more leisurely, but with the power winches in use the hauling in of the net is a comparatively easy matter, and the pole thrower is dispensed with.

When all the fish are in the bunt and the latter alongside, the fish are generally dipped out by means of a dip net balanced on the end of a tackle. A fisherman lowers it into the seine, scoops up a load of salmon, and as the net is hauled up guides it over the vessel, and then trips it and dumps the fish into the hold.

The Puget Sound purse seiners meet the salmon off the entrance to the Strait of San Juan de Fuca and follow the sockeyes till they have passed out of American waters, what are known as the Salmon Banks, off the lower end of San Juan Island, being the principal rendezvous during the run of sockeyes. After this run is over they go up the Sound and fish for dogs and cohos, and later go to the head of the Sound and fish for dogs, cohos, chinooks, and steel-head trout. In southeast Alaska they follow the fish all over the bays, straits, and sounds of that section. Purse seines are used in a few other places, but the fishery is secondary to those with other forms of apparatus.

This style of fishing is said to have been introduced on Puget Sound by the Chinese in 1886.

TRAPS OR POUND NETS.

A trap is stationary and consists of webbing, or part webbing and part wire netting, held in place and position by driven piles. This piling usually is held together above water by a continuous line of wood stringers, also used to fasten webbing to or to walk on if necessary.

In building, the "lead" is first constructed. This runs at right angles, or very nearly so, to the shore, and consists of a straight line of stakes, to which wire or net webbing is hung from top of high water, or a little higher, to the bottom, making a straight, solid wall.

At a little distance inshore of the outer end of the lead begin what are called the "hearts." These are V-shaped and turned toward the lead, beginning at a distance of 30 to 40 feet on either side of same and running in the same general direction, the "big heart" or outer heart first, the inner heart, supplementing the first, being smaller, and the end of the outer heart leading into it. Some traps have only one heart. The narrow end of the inner heart leads into the "pot" and forms what is known as the "tunnel." The tunnel ends in a long and narrow opening, running up and down the long way, and is held in position by ropes and rods. Below this is what is known as the "apron," a sheet of web stretched from the bottom of the heart upward to the pot, in order to lead the fish into the tunnel when swimming low in the water, and to obviate the necessity of

building the pot clear to the bottom, which would be expensive, as the pots of the traps are usually in quite deep water. If the trap is intended to catch the fish coming from only one direction, the lead generally runs to and is attached to one side of the entrance to the outer heart on the side opposite to that from which the fish are expected.

Some traps have "jiggers" (a hook-shaped extension of the outer heart) on each side, and sometimes on only one side, which help to turn the fish in the required direction.

The "pot" is built out beyond the inner heart and immediately adjoining same. It is a square compartment, with web walls and bottom connected in the shape of a large square sack, fastened to piling on all sides. This pot is hauled up and down by means of ropes and tackles, either by hand or, as is most popular, by steam.

The "spiller" is another square compartment adjoining either end of the pot (sometimes there are two spillers, one at each end), and is simply a container for fish. A small tunnel leads the fish from the pot into the spiller, whence the fishermen lift them out. This is accomplished by closing the tunnel from the pot, after which the ropes holding the front of the spiller are loosened and the net wall allowed to drop almost to the level of the water. A steam or gasoline tug then pushes a scow alongside the spiller and takes position on the outside of this scow. From the deck of the tug a derrick is rigged with a running line from the steam capstan through the block at the top of the derrick. This line is attached to the far end of a net apron, called a "brailer," which is heavily weighted by having chains along each side and leaded crossways at several places. A small boat is run inside the spiller, and the men in this draw the brailer across the barge and let it sink in the spiller. The fish soon gather over it, when the steam capstan quickly reels it in, the net folding over as drawn in from its far side and spilling the fish out on the scow. Men on the scow pick out and throw overboard the undesirable fish. The apron is then drawn back across the pot and the operation repeated so long as any fish remain. In this manner a trap with many tons of salmon in it is quickly emptied.

Traps, like nearly all other fixed fishing appliances, are built on the theory that salmon, like most other fishes, have a tendency to follow a given course in the water, whether a natural shore line or an artificial obstruction resembling one; also that the fish very seldom turns in its own wake. The trap has taken advantage of these natural tendencies of the fish, and is arranged so that, although the salmon may turn, he will continually be led by the wall of net toward and into the trap.

If a trap is located in a place where fish play and where an eddy exists, and the fish run one way with the incoming tide and the opposite with the outgoing, it will fish from both directions; if located where the fish simply pass by, as for instance, on a point or reef, it will fish from one side only.

A variation of the trap, to be used in places where piles can not be driven, is the floating trap. An experimental trap of this variety was used at Uganuk, on Kodiak Island, Alaska, as early as 1896. Its use was abandoned in 1897, not to be resumed until some years later. A number of floating traps (of the type invented by J. R. Heckman, of Ketchikan, Alaska) have been and are being used in

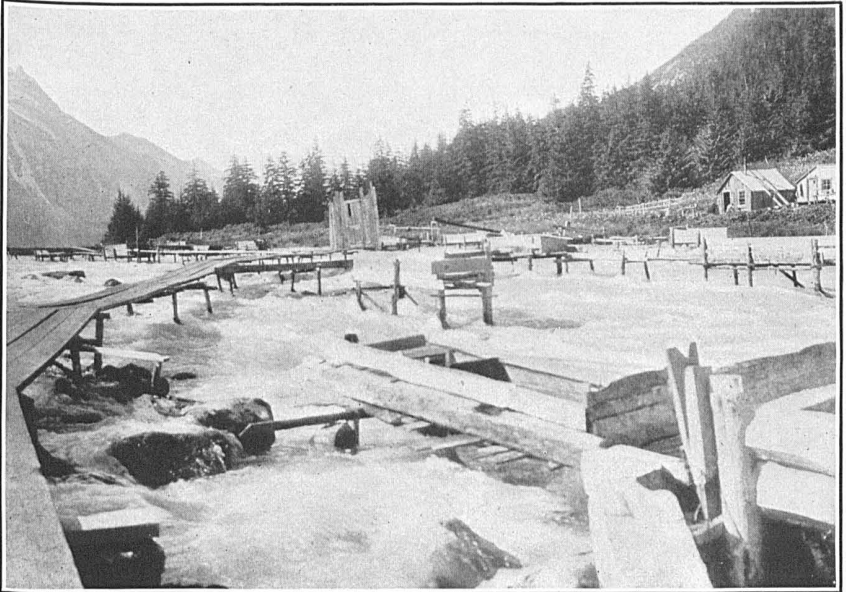


FIG. 19.—RACKS AND RUNWAYS FROM WHICH INDIANS GAFF SALMON, CHILKOOT RIVER, ALASKA.

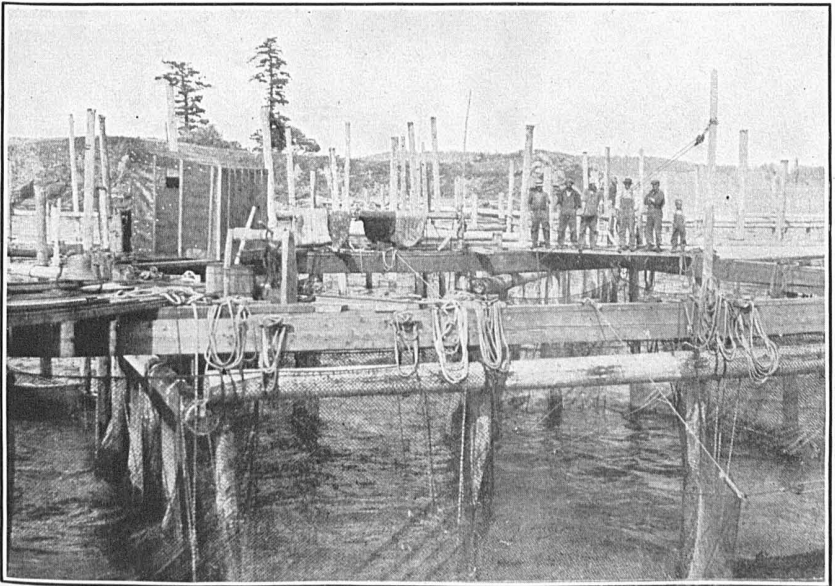


FIG. 20.—THE POT AND SPILLER OF A SALMON TRAP.

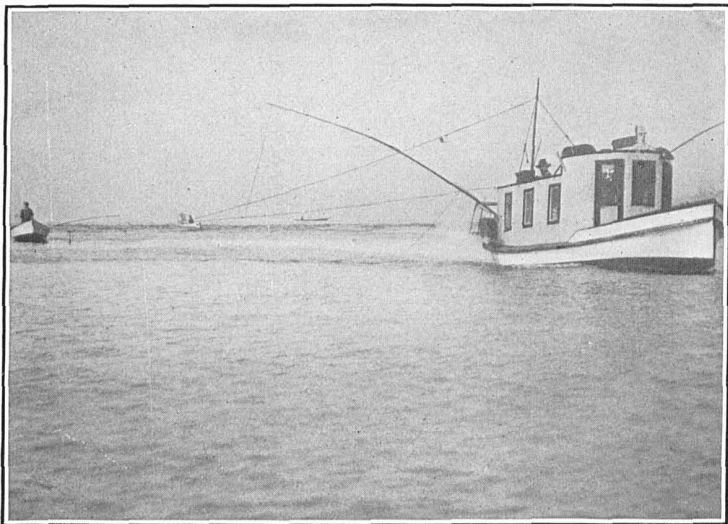


FIG. 21.—TROLLING FOR SALMON ON PUGET SOUND WITH POWER BOATS.



FIG. 22.—PUGET SOUND PURSE SEINE BOATS AT RICHARDSON, WASH.

southeast Alaska, the first having been installed in 1907. The design of this trap follows the shape of an ordinary Puget Sound driven trap. It is constructed of logs, 20 to 26 inches at the butt, bolted and braced together in one solid frame. Suspended from this frame through the logs are 2½-inch pipes extending down in the water 30 feet. Halfway down these pipes and also on the extreme lower ends are eyebolts, to which the web is drawn down and fastened. Thus the web is kept in place as well as if the pipes were driven piles. The lead is also a continuation of large piles or logs bolted firmly together with similarly suspended pipes and webbing.

The so-called wooden traps on the Columbia River are essentially weirs, being a modification of the brush weirs or traps used by the Indians for the capture of salmon long before the advent of the white men. They are built on shore, of piling and planks, the latter arranged like slats with spaces between. The bowl, or pot, is provided with a movable trapdoor that can be opened during the closed season and on Sundays, so that the fish can pass through and run upstream. These weirs, after being built, are launched into the river, placed in proper position near the shore, and then ballasted so that they sink to the bottom.

According to Collins,^a "pound nets were introduced on the Columbia River in 1879. In May of that year O. P. Graham, formerly of Green Bay, Wis., built a pound net on the river similar to those used on the Great Lakes. The success of this venture led to the employment of more apparatus of this kind, and many fishermen went West to participate in the fishery."

The first trap on Puget Sound, it is said, was built by John Waller, about 1880, off Cannery Point, at the southeastern corner of Point Roberts.

According to Collins,^b H. B. Kirby, who had previously fished on the Great Lakes, set a pound net in Puget Sound about 1883, but it was a complete failure. This was set off Point Roberts, near where the Waller trap was set. On March 15, 1888, he again set a pound net, which he had designed to meet the new conditions, at Birch Bay Head, in the Gulf of Georgia. It proved a complete success, and was the forerunner of the present large number which are set annually in these waters.

In Alaska the first trap was set in Cook Inlet about 1885. British Columbia refused to permit the use of pound nets in its waters until 1904, when their use was allowed within certain limited regions.

Some of these traps, especially on Puget Sound, have proved extremely valuable. The years 1898 and 1899 covered practically the high-water mark, as several desirable locations changed hands in those years at prices ranging from \$20,000 to \$90,000 for single traps, the original expense of which did not exceed \$5,000. But few have brought such high prices since, however, owing to the decline in the run of salmon, and at the present time but few of them would fetch much at a sale.

The location of sites for these nets is regulated by law in Oregon, Washington, and British Columbia, but in Alaska the procedure is

^a Report on the Fisheries of the Pacific Coast of the United States. By J. W. Collins. Report, U. S. Commissioner of Fish and Fisheries, 1888-89, p. 210. Washington, 1892.

^b Collins: *Op. cit.*, p. 267.

not well defined and has proved rather confusing to strangers. Some acquire the shore line by mineral location or by the use of scrip, while still others have merely a squatter's right.

Under the existing fish-trap laws applicable to Alaska, a fish trap may be operated anywhere along the coast of Alaska, 300 yards from the mouth of any salmon stream, and along the shore of all rivers—excepting those emptying into Cook Inlet, the streams on Afognak Island, and in Wood River—where the same are at least 500 feet wide.

A clear water distance of 600 yards laterally and 100 yards endwise must be maintained between all traps. At the present time there is no law regulating the length of leads, the maximum depth of water in which the pot may be driven, or the use or occupancy of the trap sites.

It has been decided by the highest courts within the past year that title to the upland conveys no title to the trap owner who may be in front. The tidelands of Alaska are not of sufficient commercial importance as yet to enter into this controversy. At the present time there is no tideland law applicable to Alaska affecting the upland owners or the trap-site locators.

At the present time the canner who is on the ground first with piles and a driver can assert his right to any unoccupied trap site regardless of who fished it the previous season. This, however, is the exception rather than the rule. As a general proposition the cannery respect the rights of rivals in the same fishing region, and a trap location once recognized as that of a certain individual or company is rarely jumped so long as the original locator cares to maintain a trap on it.

Within the bounds of the forest reserve no land can be acquired except by lease, which may be secured from the United States forestry agent, Ketchikan, Alaska.

INDIAN TRAPS.

The natives, especially in Alaska, have various ingenious methods of catching salmon. In the Bering Sea rivers they catch them by means of wickerwork traps, made somewhat after the general style of a fyke net. These are composed of a series of cylindrical and conical baskets, fitting into each other, with a small opening in the end connecting one with the other and the series terminating in a tube with a removable bottom, through which the captive fish are extracted. Some of the baskets are from 15 to 25 feet in length and are secured with stakes driven into the river bottom, while the leader, composed of square sections of wickerwork, is held in place by stakes.

During the summer of 1910 the author found and destroyed an ingenious native trap set in Tamgas stream, Annette Island, southeast Alaska. This stream is a short and narrow one, draining a lake, about midway of which are a succession of cascades. In the narrowest part of the latter, and in the part up which the fish swim, a rack had been constructed of poles driven into the bottom and covered with wire netting, so as almost wholly to prevent salmon from passing up. Just below, and running parallel to the rack and at right angles to the shore, was placed a box flume with a flaring mouth at the outer end. At the shore end the flume turned sharply

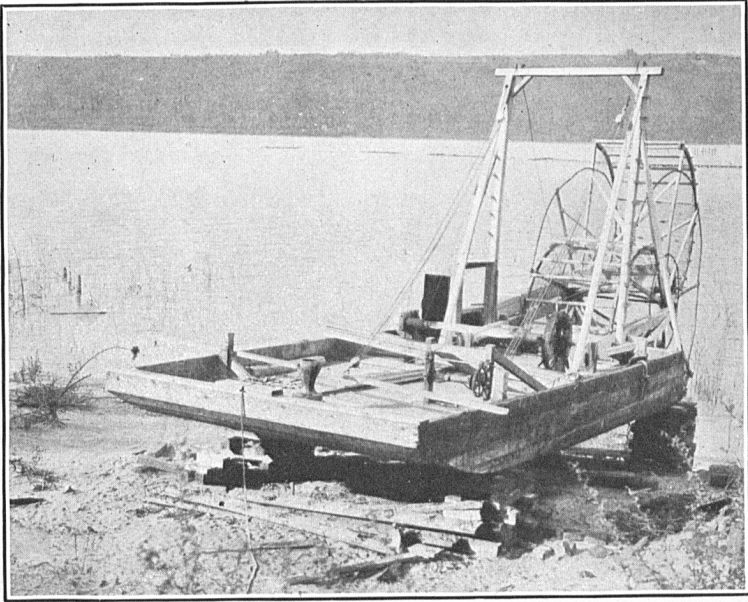


FIG. 23.—A COLUMBIA RIVER SCOW FISH WHEEL.

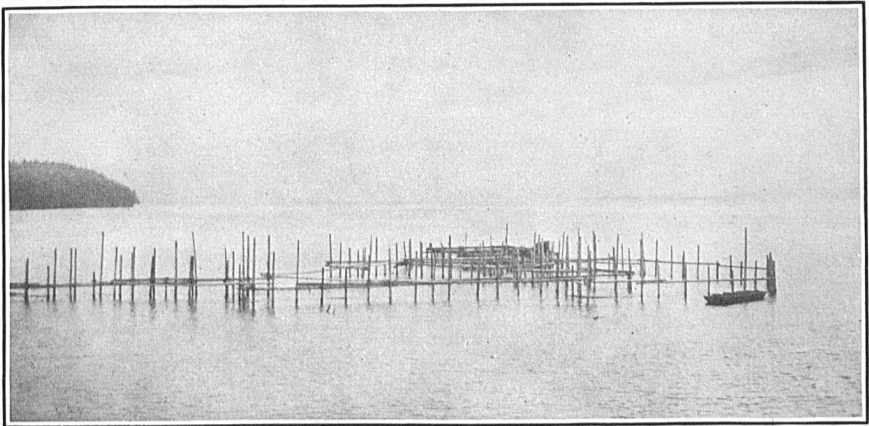


FIG. 24.—PUGET SOUND SALMON TRAP.

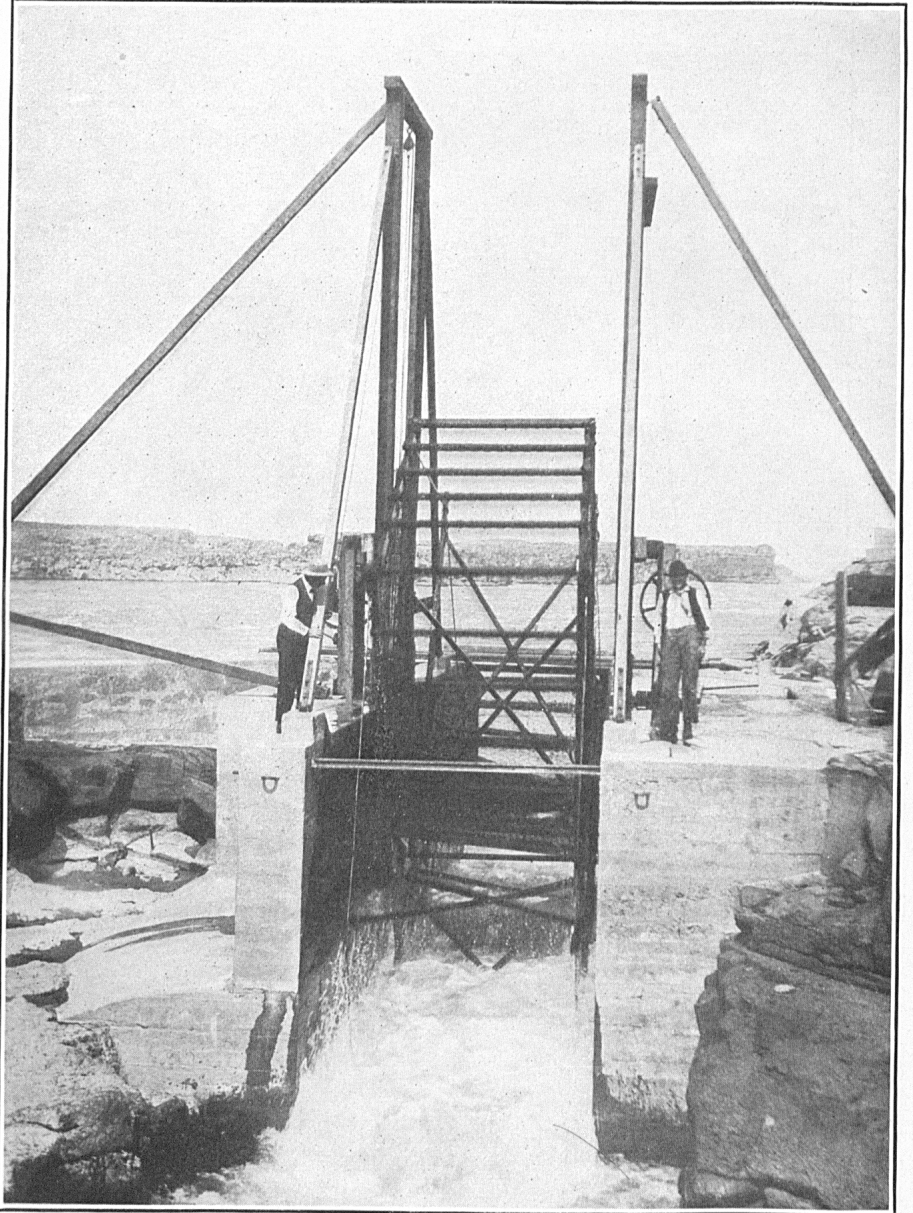


FIG. 25.—A COLUMBIA RIVER STATIONARY FISH WHEEL.

at right angles and discharged into a square box with slat bottom and covered over with boughs. The fish in ascending the stream would be stopped by the rack and in swimming around many of them would be carried by the current into and down the flume, eventually landing in the receiving box alongside the shore.

WHEELS.

Fish wheels are of two kinds, the floating or scow wheel, which can be moved from point to point if need be, and the shore wheel, which is a fixed apparatus. They operate in exactly the same manner, however. The stationary wheel is located along the shore in a place where experience has shown that the salmon pass. Here an abutment is built of wood and stone, high enough to protect it from an ordinary rise in the river. To this is attached the necessary framework for holding the wheel. The latter is composed of three large scoop-shaped dip nets made of galvanized-iron wire netting with a mesh of $3\frac{1}{2}$ to 4 inches. These nets are the buckets of the wheel and they are so arranged on a horizontal axis that the wheel is kept in constant motion by the current, and thus picks up any fish which come within its sweep. The nets are fixed at such an angle that as they revolve their contents fall into a box chute through which the fish slide into a large bin on the shore. The wheels range in size from 9 to 32 feet in diameter and from 5 to 15 feet in width, and cost from \$1,500 to \$8,000, the average being about \$4,000. A number of them have long leaders of piling running out into the river, which aid in leading the salmon into the range of the wheel.

The scow wheel consists of a large square-ended scow that is usually decked at one end and open at the other. Several stanchions, some 8 to 10 feet high, support a framework upon which an awning is spread to protect the fish from the sun's rays and the crew from the elements. To one end of the scow are fastened two upright posts, which are guyed by wooden supports, while projecting from the same end is the framework which supports the wheel, the latter being constructed in the same way as the stationary wheel, but on a smaller scale. In operation the scow is anchored with the wheel end pointing downstream, and as the wheel is revolved by the current, the fish caught fall from the net into a box chute, through which they slide into the scow. As stationary wheels can be used only at certain stages of water, the scow wheel is a necessary substitute to be used at such times as the former can not be operated, or in places where it is not feasible to build a stationary wheel.

The above forms of wheels are used exclusively on the Columbia River.

An ingenious device is used by some of the wheel operators on the Columbia River in getting their catch to the canneries, a few miles farther down the river. The salmon are tied together in bunches, which are attached to air-tight casks and sent down the stream. At the canneries small balconies have been constructed at the water end of the building. A man armed with a pair of field glasses is stationed here, and as soon as he sights one of these casks he notifies a boatman who goes out and tows in the cask and salmon. About 800 pounds of salmon are attached to a keg, and a tag showing the wheel from which shipped, is tied to the fish.

In 1908 the first fish wheel to be located in the coastal waters of Alaska was operated in the Taku River, in southeast Alaska. The wheel was set between two 4-foot scows, stationed parallel to each other, and each 40 feet in length. The wheel had two dips, each 22 feet in width and hung with netting. It could be moved from place to place, the same as the scow wheels on the Columbia River. It was operated throughout the king and red salmon runs, but caught almost no salmon, and was not set in the succeeding years.

For many years the natives of the interior of Alaska have been resorting to the banks of the Yukon and Kuskokwim Rivers and their tributaries in order to secure a sufficient supply of salmon to sustain them through the succeeding winter. The favorite apparatus of these natives at present is a type of fish wheel introduced by the whites about 1905. An oblong framework of timbers is constructed in the water and moored to the bank by ropes. A wheel, composed of two or three dips, is placed in this, the axle resting upon the framework. The current catches each dip in turn, thus causing the wheel to revolve, and the dip is of such shape that the salmon caught roll off it into a trough, down which they slide into a boat moored between the wheel and the shore or into a box fixed to the supporting framework on the side. Although crude in construction, these wheels are very effective and a large number of them are set each season.

The Columbia River fish wheel is a patented device. It was first used by the patentees, S. W. Williams & Bro., in 1879, and for several years they retained a monopoly in its use. A number are now operating on the river. The device was not new even when patented, as a similar "fishing machine," as it is called, had been in use prior to this time and is still used by white fishermen on the Roanoke River in North Carolina.

REEF NETS.

When the whites first visited the Northwest they found the natives employing a number of ingenious devices for catching salmon, and one of the most effective of these was the reef net. J. A. Kerr, Esq.,^a who has been engaged in the salmon fisheries of Puget Sound for a number of years, has written the following very interesting account of this native fishery:

The aborigines the world over have developed ingenuity solely along the lines of their necessities. The coast Indians of Alaska evolved the bidarky and the ingenious implements for taking the seal, the walrus, and the whale. The Siwash of Puget Sound developed a seaworthy dugout and appliances for taking salmon that marks the acme of Indian invention.

When Vancouver explored the waters of the Sound he found over 500 Indians encamped at Chiltenum, now Point Roberts. He relates in his log of the voyage that these Indians were engaged "in fishing for salmon with crude nets made of the bark of young willow." He described the racks upon the contiguous upland used by the Indians in curing the fish.

When Gov. Stevens negotiated the treaty with the Indians of the lower Sound at Point Elliott, now Mukilteo, in 1855, I was informed by Col. Shaw, the interpreter, that over 7,000 Indians attended, the session lasting for five days.

The Government sought to have the Indians confined to reservations, and the disposition of their ancient fisheries was a matter of great solicitude on their part. Salmon was the principal article of their diet.

After protracted discussion the sixth clause of the treaty was made to provide that "the right to take fish at their usual and accustomed fishing grounds, together with the right to erect and maintain racks upon the contiguous upland for curing and drying the same, is hereby forever guaranteed to said Indians."

^a The Siwash Reef Net. By J. A. Kerr. Pacific Fisherman Yearbook, 1917, p. 60.

There were two of those ancient fisheries on the lower Sound—Point Roberts Reef and Village Point.

The original reef net of the Indians, as described by the first white settlers and by the Indians themselves, was constructed as follows:

The natives peeled the bark from the willow and with it spun a twine and tied a net about 25 feet in width and 40 feet in length, with a mesh substantially of the dimensions and shape of that used in the now familiar pound net.

They then went into the swamps and cut cedar withes. After heating rocks and placing them in pools of water they steamed these withes, after which they twisted them into substantial ropes.

Their reef net operations were confined to the shoal waters over the reefs. The reef net locations were of great value to the Indians, and were considered as property and handed down from father to son. As a rule the Indian families controlling these locations owned an inner and outer location. The reef at Point Roberts is over 1 mile in length.

Reef net fishing was confined to the flood tide. At the beginning of the flood the outer location was used, after the middle of the flood the nets were shifted to the inner locations.

The Indians assembled at the reefs in advance of the salmon run and prepared their appliances.

They first secured heavy boulders or blocks of sandstone from Chuckanut to be used as anchors. They then procured for each net two logs about the length of their canoes. To each end of these logs they tied one of their ropes, about 100 feet in length, the other end of which was fastened to the stone anchor. These logs were anchored over the top of the reef and about 20 feet apart. From the forward end of these logs there was run out at an angle of 45° other ropes to a distance of 50 feet, the outward end fastened to a buoy. To these ropes were fastened stalks of kelp, the ends weighted to the bottom with stones. Thus was constructed a lead operating to concentrate the approaching school of fish between the logs. Then from the front end of these logs there was dropped forward and to the bottom two ropes, from one of these ropes to the other, at intervals of 2 or 3 feet, were fastened cords of willow twine. This appliance was called by the Indians a ladder.

Now in operating the net itself two canoes were lashed on the inside of the logs. Three Indians occupied one canoe and four the other. The net was then suspended between the canoes. The Indians in the forward end of the canoes held the ropes fastened to the bottom of the net, those in the back end held the ropes fastened to the top of the net. The tide running against the net caused it to bag, or purse. The fourth Indian in one of the canoes was generally an elderly man and was called the watcher. He discovered the school of salmon as they were carried into the net and at his signal the Indians at the front of the canoes pulled the lower edge of the net, which was kept within 4 feet of the surface, above the water. The Indians at the middle of the canoe reached down and caught the sides of the net, lifting the sides above the surface. These Indians pulled against each other, the long ropes by which the logs were moored giving enough to allow the canoes to be pulled alongside each other. The fish were then dumped into one of the canoes, after which the net was loosened and lowered, and the boats fell back to their original position again. With these appliances the Indians would take up to 3,000 salmon on a single run of the tide.

This Indian appliance affords not only an interesting illustration of native ingenuity, but as a matter of fact was the forerunner of the pound net. John Waller, a Welshman, was one of the earliest settlers at Point Roberts. He observed the operations of the reef net and in the early 60's constructed at Point Roberts the first pound net ever driven on the Pacific coast. The leads duplicated that of the Indians, while he impounded the salmon by means of the tunnel leading into a web pot, instead of lifting them as impounded.

The reef net marks the humble Siwash as an inventor of some skill, and as a benefactor of some importance, and the apparatus would be in use to-day were it not for the large number of people required to operate it.

At one time this was a favorite device of the Puget Sound natives for catching sockeye salmon. Owing to the large number of men required to work them, and the fact that they can be worked only at certain stages of tide and in favorable weather, these nets gradually have been supplanted by other devices. In 1909 but five were used, and these were operated off the shores of San Juan, Henry, Steuart, and Lummi Islands, and in the vicinity of Point Roberts. Practically none are used at present.

TROLLING.

Each year the catching of salmon by trolling becomes of increasing importance commercially. Although begun a number of years ago the industry never attained prominence until the mild curers created such a persistent and profitable demand for king, or chinook, salmon that the fishermen, who had previously restricted their operations mainly to the use of nets during the annual spawning runs, which last but a small portion of the year, began to follow up the fish both before and after the spawning run and soon discovered that they were to be found in certain regions throughout nearly every month in the year.

Trolling has several advantages from the fisherman's point of view over seine, gill net, and trap fishing. To engage in it, one does not need any very expensive gear, a boat, hooks, and lines being all that are required. Then, there are no licenses to pay and no seasons to observe in many sections, as the fishing is done in many instances beyond the jurisdiction of State waters.

The fishermen comprise all nationalities. While the majority of them are professionals, men of all walks of life are to be found engaging in the business, some on account of their health, others because of reverses in business or lack of work, while still others engage in it from pure love of the outdoor life.

The Monterey Bay (Calif.) trollers use 48 cotton line generally. A few inches below the main lead an additional line is added, with a small sinker on it. This gives two lines and hooks, and as the main line has but the one lead, and that above the junction with the branch line, it floats somewhat above the latter, which is weighted down with a sinker. The main stem is about 20 fathoms in length, while the branch lines are about 5 fathoms each. These lines cost about \$3.50 each. No spoon is used, but bait almost invariably. A few fishermen use a spread of stout steel wire, 4 feet long, with 5 or 6 feet of line on each end of the spread, two lines and hooks.

On the upper Sacramento River (mainly at Redding and Keswick) some fishing is done with hand lines. A small catch was made here in 1908, but none were so caught in 1909.

Even as early as 1895 trolling was carried on in the Siuslaw River, Oreg., for chinook and silver salmon.

About 1912 the fishermen living along the lower Columbia River discovered that salmon could be taken by trolling off the bar. A number of them went into the business regularly, while their numbers were greatly swelled by the addition of many of the net fishermen during the regular closed seasons on the river, these not applying to trollers. Some idea of the growth of this fishery off the Columbia River bar may be gained when it is stated that in September, 1915, about 500 boats were engaged in it. It is reported that in 1919 over 1,000 boats were engaged in trolling here.

At Oregon City and other places on the Willamette River a number of chinook salmon are caught by means of trolling each year, mainly by sportsmen. A spoon is quite generally employed in place of bait. The fishermen claim that the salmon are not feeding at this time, as their stomachs are shriveled up.

For a number of years the Indians living at the reservation on Neah Bay, Wash., have annually caught large numbers of silver and

chinook salmon in the Strait of Juan de Fuca. A large number of white fishermen also engage in this fishery at the present time in the same waters, while others troll for the same species, but more particularly silvers, in parts of Puget Sound proper. The ordinary trolling line, with a spoon instead of bait, is used.

Many of the trollers use power boats, and in this event four and sometimes six lines are used. One and sometimes two short poles are run out from each side of the boat (when two are used on a side, one is shorter than the other), the butt being dropped into a chock. Two lines are generally trailed from the stern. At the end of each pole is a very short line with a small tin can attached. A few pebbles are in the can, and as the launch moves slowly through the water with all her lines set, the troller knows when he has a bite by the rattling of the pebbles in the can. Each of the lines attached to a pole is also connected with the boat by a short line from the side to a point on the line about 20 feet from the tip of the latter. When a fish is hooked, the fisherman merely pulls in the line by means of the short piece and then can haul the fish in hand over hand.

The most remarkable trolling region is in southeast Alaska. For some years the Indians here had been catching king salmon for their own use during the spring months, and about the middle of January, 1905, king salmon were noticed in large numbers in the vicinity of Ketchikan. Observing the Indians catching these, several white fishermen decided to engage in the pursuit, shipping the product fresh to Puget Sound ports. They met with such success that 271,644 pounds, valued at \$15,600, were shipped. The next year several of the mild-cure dealers established plants in this region, thus furnishing a convenient and profitable market for the catch, and as a result the fishery has grown until in 1915 2,170,400 pounds of king salmon and 54,400 pounds of coho salmon were caught and marketed. The length of the fishing season has also lengthened until now the business is prosecuted vigorously during about seven months in the year, and in a desultory manner for two or three months more, only the severe winter weather preventing operations the rest of the year.

In southeast Alaska the fishermen generally use either the Hendryx Seattle trout-bait spoon No. 5 or the Hendryx Puget Sound No. 8. The former comes in nickel or brass or nickel and brass, the full nickel preferred. The Siwash hook No. 9/0, known as the Victoria hook in British Columbia, is in quite general use. As a rule, but one hook is used, and this hangs from a ring attached to a swivel just above the spoon, while the point of the hook comes a little below the bottom of the spoon. Occasionally double or treble hooks are used. Some fishermen use bait, and when this is done the herring, the bait almost universally employed, is so hooked through the body as, when placed in the water, to stretch out almost straight and face forward as in life.

There are a large number of power-boat trollers in this region. These trollers generally use one pole on a side and one at the stern. The rowboat trollers use but one line, which is attached to a thwart in the boat, handy to their reach when rowing, and trailing out from the stern of the boat.

The trollers usually have temporary camps where they congregate while the fish are to be found in that section, moving on to some more favorable spot when the fish begin to get scarce.

Reports from the trollers of southeast Alaska prove that all species of salmon will take the hook at some time or other in the salt waters of this region, an examination of their stomachs generally showing that they are either feeding or in a condition to feed.

A small commercial fishery is carried on in this region for coho salmon, mainly in August and September, in the neighborhood of Turnabout Island, in Frederick Sound. A Stewart spoon with two hooks on one ring is used, baited with herring in such a way that the fish is straightened out and faced toward the spoon. The sportsmen of Ketchikan also fish with rod and reel for this species in the neighborhood of Gravina Island, using a Hendryx spoon (kidney bait No. 6), which is silvery in color on one side and red on the other. Although much smaller than the king, the coho salmon is more gamey.

During the latter part of March the Gulf of Georgia, in British Columbia, is invaded by large schools of young coho salmon, locally called "bluebacks." They evidently come in from the sea by way of the Straits of Fuca, as their presence is at first apparent in the lower gulf, especially among the reefs and islands off Gabriola Pass. On their arrival these fish are only about a couple of pounds weight, but increase in size very rapidly, with correspondingly voracious appetites. They are to be found in the gulf throughout the spring and summer. By May the fish generally average close to three pounds each when dressed, while in July they are between four and six pounds in weight.

A number of fishermen with power and row boats engage in this fishery, the fish being either sold to the fresh markets or to the canneries.

Trolling lines and spoon baits of one form or another are used. In fishing from power boats the outer lines are attached to fish poles 15 to 18 feet long, rigged out on either side. Those poles are usually hinged at the foot of a short mast and lowered outboard by a halyard running through a block at the masthead, with the additional brace of a forward guy, which, with the drag of the lines aft, holds them in position. It has been customary to use from five to seven lines from each launch, the two outer lines leading from the ends of the poles; the next pair are attached to intermediate tips fastened halfway out on the main pole, while inboard lines are attached to smaller upright rods on either quarter.

The outer trolls are brought within reach (the poles being practically fixtures) by means of a short piece attached to each fishing line 15 or 20 feet from the point where it is fastened to the pole and leading inboard.

Recently, however, the Dominion authorities have decreed that a troller shall not use more than three lines from a boat when trolling for salmon. Should a man be alone in the boat three lines will keep him very busy if the fish are biting at all well.

Spoons are generally used. All shapes are employed, from the ordinary Siwash patterns to wobblers; brass or silver wobblers, of Nos. 4 and 5 sizes, are largely used by the fishermen. Spinners of 2 to 3 inches long are also popular. Copper, copper and silver, and brass

spinners of the Siwash and Victoria patterns are very effective, while red beads, feathered hooks, or a piece of silvery salmon skin placed on the hook as an additional bait often add to the attraction of a spoon.

Quite generally the fishermen use single hooks on their spoons. Various lengths of line are used, but on the average about 60 feet for outside lines and 40 for inside are used. As fish can be landed much quicker with a short line, the fishermen generally shorten their lines to 20 or 30 feet when the fish are biting rapidly. Quite heavy lines are used from the pole to the sinker; from there extends a length of light line, and then a piece of wire, to which the spoon is attached. The sinker, which is usually between 2 and 3 pounds in weight when fishing from a power boat and about 1 pound when a rowboat is employed, is attached to the line about 18 feet from the spoon.

The best fishing times are in the early morning and evening, without regard to tidal conditions. The low slack water is always favorable to good fishing.

These fish are delicate flavored, but do not keep well, it being necessary to rush them to market if they are to be sold in a first-class condition.

Considerable numbers of these fish are taken by both American and Canadian fishermen on Swiftsure Banks, off Cape Flattery. As complaint had been made in 1914 that these fish were immature and were unfit for canning because of their appearance after being out of the water some hours, H. T. Graves, acting commissioner of agriculture for the State of Washington, which department is concerned with the wholesomeness of food products, made a thorough investigation of their fitness for food. In a letter to the Pacific Fisherman, Seattle, Wash., and published in that journal under date of August, 1914, he states, among other things, the following:

The question, therefore, for us to determine was to ascertain their value as a food product. The condition of these fish arriving at the various canneries was carefully noted; samples were selected for bacteriological analysis.

The fish when first taken from the water are very soft when compared with the other salmon. After they have been out of the water 12 hours the fish easily separates from the bony structures, and in the course of ordinary handling in the time which elapses between the hour of taking from the water until they are offered for packing at Sound canneries, which is anywhere from 12 to 48 hours, they become badly broken up and present a rather ugly and distasteful appearance, to say the least.

We found that many different methods of handling were being experimented with by the fisherman and by Puget Sound canneries, but without any noticeable effect. While from a physical observation one would imagine these fish as received at the Sound canneries to be unwholesome, a bacteriological examination by Dr. E. P. Fick, State bacteriologist, indicated that putrefaction was not present, although some of the specimens did contain a rather high bacteria count.

BOW AND ARROW.

On the Tanana River, a tributary of the Yukon River, in Alaska, the Indians hunt salmon in birch-bark canoes with bow and arrow. As the canoe is paddled along and the Indian sees the dorsal fin of the salmon cutting the surface of the muddy water he shoots it. The tip of the arrow fits into a socket, and when struck the tip, which when loose is attached to the stock by a long string, comes out of the socket and the arrow floats, easily locating the fish for the fisherman.

SPEAR AND GAFF.

Spears of varying shapes and styles have been in use by the Indians from time immemorial and are still employed on many rivers in which salmon run. With the exception of the Chilkoot and Chilkat Rivers of Alaska, practically all of the catch secured in this manner is consumed by the fishermen and their families. In the Chilkoot River the Indians have built numerous racks in the stream and on the banks, upon which they stand and hook the fish out with a gaff attached to a pole. The catch is sold to the cannery located on Chilkoot Inlet.

SPORT FISHING FOR SALMON.

The number of sportsmen who improve the opportunity presented by the appearance of feeding springs and cohos is increasing yearly, and in time this promises to far excel the sport salmon fishing of the Atlantic coast.

On Puget Sound and lower British Columbia waters the anglers generally use ordinary trout fishing rods and tackle, with preferably a short trolling tip on the rod when out for coho. Small spinners of silver or copper, of about an inch in length, or else the small double Tacoma spoons, are very good. A strong gut leader or trace of fine piano wire is frequently used, as the fish's teeth would cut through an ordinary line. Where iron wire is used the salt water rusts it rapidly, and unless the precaution is taken to dry off the wire and oil it after using it can not be used for more than a couple of days. Sinkers of an ounce or two in weight are generally employed with fine line.

Many of the small spoons on the market have very cheap hooks, and these are apt to straighten out or break with the strain of a large fish. Hooks of the best steel will, however, stand up to this strain.

One of the favorite spots for anglers is at the falls on the Willamette River at Oregon City, Oreg. Another is on the Clackamas, a tributary which debouches into the Willamette near here. When the spring run of salmon appears in April, hundreds of anglers, many of them from far distant points, appear to participate in the sport during this month and in May. Many noted sportsmen have fished for salmon at these spots. Among them was Rudyard Kipling,^o and his experiences were woven into a classic short story.

The fishing ground is spread over a mile's length of the river, from Clackamas rapids to the deadline at the falls. It is not an uncommon sight to see 500 boats, each containing from one to six fishermen and fisherwomen, dotting the river on favorable days during the season.

Two methods of fishing are followed. The most popular is to anchor at the head of the Clackamas rapids or in swift water near the falls and allow the rush of water to spin the trolling hook. In the longer lengths of quieter water the sportsmen troll in slow motor boats or rowboats.

An inexperienced boatman is apt to find fishing in the rapids or near the falls somewhat dangerous, as the swift water may overturn his craft and carry him to his death before help can reach him.

There is a fishway in the dam, so that the fish can pass up this and into the river above the dam. No fishing is allowed closer than 100

^o It was in 1889 that Kipling fished here, and his story was reprinted in *The American Angler*, Vol. II, No. 2, December, 1917, pp. 415-420.

feet of the mouth of this ladder. Up to 1915 there was a second deadline, 600 feet from the falls, beyond which no commercial fisherman could operate nets, but the Oregon Legislature in that year closed the Willamette to all net fishermen from the Clackamas rapids to the falls.

The salmon in the spring run on the Willamette will average about 25 pounds each, but examples weighing 50 pounds and over are not uncommon.

In 1914 the Salmon Club of Oregon was formed of anglers who desired to encourage the use of light tackle in the taking of large game fish, in place of the extremely heavy tackle heretofore used. The following rules were adopted:

The rods used may be made of any material except solid bamboo cane. They must not be less than 5 feet in length and weigh not over 6 ounces.

The line must not be heavier than the standard nine-thread linen line.

Any style of reel or spoon may be used and the wire leader must not exceed 3 feet in length.

The angler must reel in his fish, bring it to gaff unaided, and must do the gaffing himself. If a rod is broken at any time during the struggle with the fish it will disqualify the catch.

As a reward of merit the club awards bronze buttons to all anglers taking, on light tackle, salmon weighing 20 pounds or over; for a fish weighing over 30 pounds a silver button is given, and for any salmon over 40 pounds the lucky angler receives a gold button. Numerous additional prizes are also given by public-spirited citizens.

The season for light tackle on the Willamette River and all other inland streams of Oregon has been fixed by the club from January 1 to July 1.

In 1915 the first angler to win a gold button on the Willamette River did so on April 18, when he took a 42½-pound salmon. On the same day this same angler also won a silver button for a 32½-pound fish and a bronze button for a 26-pound fish.

DANGERS TO THE INDUSTRY.

Man is undoubtedly the greatest present menace to the perpetuation of the great salmon fisheries of the Pacific coast. When the enormous number of fishermen engaged and the immense quantity of gear employed is considered, one sometimes wonders how any of the fish, in certain streams at least, escape. High water or low water, either of which will prevent certain forms of apparatus from fishing to any extent while such conditions prevail, storms which impede fishing, and the hundred and one small things which in the aggregate are of considerable importance, however, all aid in assisting the salmon in dodging the apparatus and reaching the spawning beds in safety, while, unless the stream is completely blocked by a tight barricade, an indeterminate number of salmon will escape all the pitfalls man and animals may set for them.

In some sections an almost idolatrous faith in the efficacy of artificial culture of fish for replenishing the ravages of man and animals is manifested, and nothing has done more harm than the prevalence of such an idea.

While it is an exceedingly difficult thing to prove, the concensus of opinion is that artificial culture does considerable good, yet the very fact that this can not be conclusively proven ought to be a warning to all concerned not to put blind faith in it alone.

When salmon are stripped by man, the eggs fertilized and retained in hatcheries until the young are born, and then planted as soon as the yolk sac has been absorbed, it is manifest that the only saving over the natural method is in reducing the loss in the egg stage. We know that many eggs, after being deposited naturally on the spawning beds, are devoured by other fishes, while sudden freshets and occasional droughts also claim their toll of eggs. It is highly probable, although we have no positive data on this point, that these losses far exceed those experienced in artificial salmon culture, and whatever this difference is it represents the extent to which salmon hatcheries should be credited as preservers of the industry.

In the opinion of the author, the best way in which to conserve the fisheries of the coast is by enacting and enforcing laws under which a certain proportion of the runs will be enabled to reach the spawning beds and perform the final and most important function of their lives unmolested. If this is done, there can be no question of the perpetuation of the industry, and if it is then supplemented by the work of hatcheries, which would reduce the loss in the egg stage, assurance on this point would be made doubly sure.

If unrestricted fishing is to prevail, however, with a dependence upon hatcheries alone to repair the ravages of man, the industry will suffer seriously, for, from the very nature of things, less and less fish will annually escape through the fishing zone, resulting in a continually lessening quantity of eggs being obtained at the hatcheries, and finally the latter will have to close down from sheer lack of material upon which to work.

Should eggs be brought to the hatchery from other streams, it would merely be "robbing Peter to pay Paul," and in the end the same result would follow in those streams.

Fortunately these matters are becoming increasingly plain to the people of the various States, provinces, and territories concerned, and, while a few selfish persons in each are seeking solely their own enrichment by any means possible, the greater number of those interested in fishing operations want to see the industry perpetuated and are willing to do almost anything that will work to this end.

The rapid increase, during recent years, of salmon trolling and purse seining on the feeding banks off the mouth of the Columbia River and outside the Strait of Juan de Fuca and elsewhere on the coast has resulted in the taking of large quantities of small and immature salmon, and alarm is now felt lest the runs of chinooks and cohos be seriously depleted. Several thousands of large and small boats are being operated on these grounds from five to eight months of the year, and while, when prices were comparatively low, but few of these immature fish were marketed, the high prices which have prevailed during the last four years have caused such an intensity of fishing that many thousands are now caught each season.

Investigations^a by experts off the mouth of the Columbia in 1918 show that a large proportion of the chinook salmon caught by trolling are 2 and 3 years old. These are generally sold to the canners, who separate them into two groups, those under 5 pounds and those over. Those under 5 pounds are called "graylings" by the fishermen, but a mere glance at them is sufficient to establish their real identity. The

^a The Taking of Immature Salmon in the Waters of the State of Washington. By E. Victor Smith State of Washington, Dept. of Fisheries. 44 pp., 8 pls. 1920.

reports of one cannery during the period from May 11 to May 29 showed there had been received 4,061 pounds of these fish, none of which weighed 5 pounds. From May 30 to June 12 this same cannery received 548 of these fish having a total weight of 1,483 pounds. As the owner of this cannery was decidedly opposed to the purchase of these fish, and only bought them because his regular fishermen would have gone to other cannerymen with their full-sized fish had he not taken the immature ones, it is probable that the cannerymen who were not opposed to the practice received a greater proportion of immature fish than he.

An idea of the smallness of these immature salmon may be gained when it is stated that the average weight of sexually mature chinook salmon running into the Columbia River is about 22 pounds.

These small chinooks are said to produce a very inferior quality of canned goods, being rated as second and third grade. The meat is of an ashy color, poor in fat content, and insipid in taste.

Off the Strait of Juan de Fuca the same condition of affairs existed as off the Columbia River, with the added complication that many immature cohos were also captured.

The immature feeding coho deteriorates when taken from the water even more rapidly than does the immature feeding chinook. Within 24 hours of being taken from the water the abdomens may be broken open, the ribs protrude freely, and the flesh begins to deteriorate. It was early found that it was impossible, except through the exercise of extraordinary precautions, to get these fish to the up-sound canneries before it was too late, so that of recent years only canneries situated adjacent to the banks were enabled to use them.

The sale of young salmon in the fresh fish markets of Seattle and other Puget Sound cities has been common for years. They are marketed usually as "salmon trout."

It is an economic crime to catch and kill these immature salmon, as but little money is obtained for them, while if they were allowed to attain maturity they would increase in weight, in the case of the chinook nearly 1,000 per cent on the average and in the case of the coho about 100 per cent in four or five months time.

Another bad feature of trolling operations off the mouth of the Columbia River is that trollers, because they operated outside the 3-mile limit, were exempted from the observance of the regular closed season, operative in the river from August 25 to September 10. As a result of this, fishing was carried on continuously throughout the run; most of the gill netters who had to stop fishing in the river put their nets ashore and went outside and engaged in trolling, while canneries on the river bought and canned all the fish brought in. In 1917 the Washington Legislature enacted a law prohibiting possession within the State during the closed season, except for personal use, of salmon caught beyond the 3-mile limit outside the Columbia River. The State court, on trial, held this to be unconstitutional as being an interference with interstate and foreign commerce.

Oregon also adopted the same law as Washington, and on trial this was upheld as constitutional on October 3, 1919, by the Oregon circuit court. However, the law will be of no value if valid in only one State, as if enforced there the fishermen will sell their catches in the other State.

It is quite plain that the salmon runs entering the Columbia River and the Strait of Juan de Fuca can not long continue to exist under this terrific drain upon the immature and mature fish. In the latter section the sockeyes and humpbacks are rapidly being exterminated, and it is probable that the chinooks and cohos, the especial victims in this attack, will soon show signs of exhaustion.

The State authorities appear to be helpless in these matters, but an enactment by the Federal Government could be maintained, as the principle has been applied to fishery matters elsewhere, notably the spring mackerel closed season for five years and the sponge law relating to the landing of undersized sponges taken from the grounds off the Florida coast.

Next to the fishing operations of man, the gravest danger to the salmon fisheries of the Pacific coast lies in the pollution of the rivers which the salmon ascend for spawning purposes. The salmon, both old and young, require pure cold water, and the immense runs which have annually ascended the streams for many years are doubtless due to the fact that such conditions have prevailed in them. The large increase in the population of the coast States within recent years, with the resulting increase of mills and factories, has greatly increased the amount of sewage from cities and towns and the waste of the manufacturing plants. Many of the latter have also constructed dams without adequate fishways, and these also wreak great havoc to the industry by cutting the fish off from the upper reaches of the rivers upon which constructed.

The emptying of sewage into streams ought to be made a crime. It is an exceedingly crude method of dealing with it, and, instead of disposing of the filth, merely transfers it from one place to another, making the water unfit for use at points farther downstream and spreading diseases and death amongst not only the finny but also human users of it.

In the present condition of sanitary science it is a comparatively easy matter to dispose of this filth by modern septic devices, and a number of cities are now disposing of their sewage in this manner.

The irrigation ditch, a comparatively new product on this coast, while of great benefit in developing the arid lands in certain sections, as at present operated is a considerable menace to the salmon fisheries. But few ditches have screens at their head, and as a result many thousands of young salmon slowly making their way to the ocean home pass into and down these to an early doom. Every owner of such a ditch should be compelled to place at its head a screen with fine enough mesh to prevent absolutely the passage through the same of even the tiniest baby salmon.

Next to man and his methods the trout is undoubtedly one of the greatest enemies of the salmon. The Dolly Varden follow the salmon from the sea to the spawning beds, and when the eggs are extruded devour countless thousands of them. Many and many a time the writer has seen on the spawning beds female red salmon swimming around with a cloud of trout spread out behind like a fan, following her every movement, eagerly waiting for the moment when the eggs shall appear.

In the summer, when the young are heading for the sea, the trout are lying in wait for them and again take their toll of countless thousands.

Much is said by certain people of the ravages amongst the salmon of certain animals, as the seal, sea lion, bear, eagle, kingfisher, crane, duck, loon, and hawk. While in the aggregate the ravages of these animals are considerable, they are not a drop in the bucket as compared with the direct or indirect ravages of man and his agencies.

FISHING SEASON IN ALASKA.

There is much interest manifested in the beginning and end of the salmon-fishing season for the more important waters of the various regions of Alaska. The following table, extracted from United States Bureau of Fisheries Document No. 838, "Alaska Fisheries and Fur Industries in 1916," pages 48 and 49, gives dates taken from the statistical reports made by the canning companies. The earliest one reported by any company doing much fishing has been accepted as an opening date, while the closing date was determined by taking the day nearest to which major operations ceased.

FISHING SEASON IN THE CANNING INDUSTRY FOR SALMON CAUGHT IN CERTAIN IMPORTANT WATERS IN ALASKA IN 1916.

Locality.	Coho.		Chum.	
	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—
Southeast Alaska:				
Chatham Strait.....	June 1	Sept. 27	June 1	Sept. 30
Prince of Wales Island, west side.....	June 15	Sept. 23	July 1	do....
Cordova Bay.....	do....	do....	do....	do....
Clarence Strait—				
Southern section.....	June 10	Sept. 29	June 27	Sept. 29
Northern section.....	July 20	Sept. 30	Aug. 13	Oct. 17
Behm Canal.....	June 15	Oct. 20	June 15	Oct. 20
Revilagtedo Channel.....	June 27	Sept. 29	June 27	Sept. 29
Stephens Passage.....	July 4	Oct. 4	June 22	Oct. 3
Peril and Sumner Straits.....	June 24	Sept. 27	July 1	Sept. 30
Frederick Sound.....	June 22	Sept. 21	Sept. 14	Sept. 23
Icy Strait and Cross Sound.....	June 15	Sept. 20	May 29	Sept. 27
Lynn Canal.....	July 7	Oct. 1	July 7	Oct. 1
Baranof Island, west side.....	July 4	Sept. 20	June 20	Sept. 20
Chichagof Island, west side.....	Aug. 15	Sept. 15	Aug. 5	Sept. 15
Portland Canal.....	Aug. 16	Sept. 9	July 8	Sept. 3
Ipiugania Bay.....	June 8	do....	do....	do....
Yakutat Bay and vicinity.....	Aug. 25	Sept. 28	do....	do....
Central Alaska:				
Bering River.....	do....	do....	do....	do....
Martin River.....	do....	do....	do....	do....
Copper River Delta.....	May 12	Sept. 24	May 12	Sept. 24
Copper River, lake and canyon.....	May 31	Sept. 16	May 31	Sept. 16
Controller Bay.....	Aug. 24	Sept. 25	do....	do....
Cook Inlet.....	July 2	Aug. 27	June 24	Aug. 23
Prince William Sound—				
Eastern section.....	July 1	Sept. 30	June 23	Sept. 24
Western section.....	do....	do....	July 7	Aug. 4
Afognak streams—				
Western part.....	do....	do....	do....	do....
Eastern part.....	Aug. 15	Oct. 20	do....	do....
Karluk.....	June 3	Oct. 2	June 3	Oct. 2
Red River.....	do....	do....	June 8	July 21
Uganik.....	Aug. 15	Oct. 10	do....	do....
Olga Bay.....	June 8	Sept. 1	June 8	Sept. 1
Chignik Bay.....	June 28	Sept. 9	June 12	Sept. 8
Ikatan Bay.....	May 22	July 25	May 22	July 25
Cold Bay, Thin Point, and King Cove.....	June 23	Aug. 15	June 28	Aug. 15
Morzhovoi Bay.....	June 9	Aug. 11	June 9	Aug. 11
Favlof Bay.....	do....	do....	do....	do....
Western Alaska:				
Kvichak Bay.....	June 11	Aug. 1	June 11	Aug. 1
Naknek, Ugaguk, and Ugashik Rivers.....	do....	do....	June 21	July 31
Nushagak Bay.....	June 11	Aug. 4	June 11	Aug. 4
Nushagak River.....	June 24	Aug. 6	June 23	Aug. 6
Port Moller.....	June 7	Aug. 9	July 7	Aug. 9
Nelson Lagoon.....	do....	do....	July 1	Aug. 7
Kotzebue Sound.....	July 20	Sept. 1	do....	do....

FISHING SEASON IN THE CANNING INDUSTRY FOR SALMON CAUGHT IN CERTAIN IMPORTANT WATERS IN ALASKA IN 1916—Continued.

Locality.	Humpback.		King.		Red.	
	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—
Southeast Alaska:						
Chatham Strait.....	June 1	Sept. 30	June 1	Sept. 22	June 1	Sept. 12
Prince of Wales Island, west side.....	July 1	do.			June 15	Sept. 23
Cordova Bay.....	June 15	do.			do.	Do.
Clarence Strait—						
Southern section.....	June 27	Aug. 16			June 8	Sept. 29
Northern section.....	Aug. 13	Oct. 17	June 27	Aug. 30	July 13	Sept. 7
Behm Canal.....	June 15	Oct. 17			June 15	Oct. 16
Revillefjorde Channel.....	June 27	Sept. 29	June 16	July 16	June 27	Sept. 29
Stephens Passage.....	June 22	Sept. 21	May 9	July 12	June 21	Oct. 3
Perl and Sumner Straits.....	June 21	Sept. 30			June 27	Sept. 9
Frederick Sound.....					June 22	Sept. 21
Icy Strait and Cross Sound.....	June 1	Sept. 27	May 21	July 15	May 21	Sept. 15
Lynn Canal.....	July 7	Aug. 24			June 24	Oct. 1
Baranof Island, west side.....	June 20	Sept. 20			June 8	Sept. 20
Chichagof Island, west side.....	Aug. 1	Sept. 15			Aug. 1	Sept. 1
Portland Canal.....	July 8	Sept. 3			July 8	Aug. 18
Iphigonia Bay.....	June 8	Sept. 9			June 8	Sept. 9
Yakutat Bay and vicinity.....	July 15	Aug. 10	June 2	Aug. 4	June 2	Aug. 4
Central Alaska:						
Bering River.....			June 22	June 28	June 6	Aug. 7
Martin River.....			May 12	July 9	June 12	July 9
Copper River Delta.....	May 12	Sept. 24	do.	do.	May 12	Aug. 15
Copper River, lake and canyon.....	May 31	Sept. 16	May 31	Sept. 16	May 31	Sept. 16
Controller Bay.....	July 23	Aug. 8			May 27	Aug. 15
Cook Inlet.....	June 27	Aug. 27	May 27	Aug. 27	May 30	Aug. 27
Prince William Sound—						
Eastern section.....	June 28	Sept. 24			June 20	Sept. 24
Western section.....	July 9	Aug. 1			June 17	July 23
Afognak streams—						
Western part.....	June 20	Aug. 15			May 15	July 31
Eastern part.....	July 15	Sept. 18			June 1	Oct. 20
Karluk.....	June 3	Oct. 2	June 3	Oct. 2	June 3	Oct. 2
Red River.....	June 8	July 21			June 8	July 21
Uganik.....	June 5	Oct. 10			June 5	July 27
Olga Bay.....	June 8	Sept. 1	June 8	Sept. 1	June 8	Sept. 1
Chignik Bay.....	June 12	Aug. 31	June 12	Aug. 31	June 12	Sept. 9
Iktan Bay.....	May 22	July 25	May 22	July 25	May 22	July 25
Cold Bay, Thin Point, and King Cove.....	June 28	Aug. 15			June 28	Aug. 15
Morzhovoi Bay.....	June 9	Aug. 11	June 9	Aug. 11	June 9	Aug. 11
Pavlof Bay.....	Aug. 7	Aug. 15				
Western Alaska:						
Kvichak Bay.....	June 11	Aug. 1	June 11	Aug. 1	June 11	Aug. 1
Naknek, Ugnuk, and Ugashik Rivers.....	June 15	Aug. 1	June 21	July 31	June 21	July 31
Nushagak Bay.....	June 11	Aug. 4	June 11	Aug. 4	June 11	Aug. 4
Nushagak River.....	June 17	Aug. 6	June 8	July 28	June 13	Aug. 6
Port Moller.....	June 7	Aug. 9	June 7	Aug. 9	June 7	Aug. 9
Nelson Lagoon.....			do.	July 21	do.	Aug. 7
Kotzebue Sound.....						

FISHERMEN AND OTHER EMPLOYEES.

FISHERMEN.

White men do the greater part of the fishing for salmon, many nationalities being represented, but Scandinavians and Italians predominate almost everywhere. A number of Greeks are to be found fishing in the Sacramento, while Slavonians do most of the purse seining on Puget Sound. The native-born American is not often found actually engaged in fishing, but frequently is the owner of the gear or has a responsible position in the packing plants.

A number of Indians participate in the fisheries of Alaska and a few fish in Washington. The only Chinese engaged in fishing are in Monterey Bay. A number of Japanese also fish in this bay, which is the only place in American territory where they fish for salmon. A considerable number of Japanese engage in fishing in Canadian waters.

In many places on the coast, particularly in Alaska, fishing is a hazardous occupation. In Alaska most of it is done in the bays, sounds, and straits, where storms are frequent, and the annual loss of life is heavy. The records of the Alaska Fishermen's Union show for its members the following losses of life by drowning: 1905, 10 men; 1906, 5 men; 1907, 10 men; 1908, 17 men; and 1909, 17 men.

The fishermen early saw the advantages of organization, and nearly every river now has a union which is subordinate to the general organization. One of the most typical of these is the Alaska Fishermen's Union, which has active jurisdiction over all sections of Alaska except a portion of southeast Alaska. This organization enters into contracts with the salmon canneries and salteries, by which the rates of wages, duties, etc., of the fishermen are fixed in advance for a certain period—three years—up until 1918, when an agreement was made for only one year. The same was true in 1919. As a result of this mutual agreement upon terms but little trouble is experienced with the fishermen, who generally conform scrupulously to the terms of the contract, and strikes and bickerings, which were very common some years ago, are now almost entirely absent.

CANNERY LABOR.

NATIONALITIES.

In the early days canning was a haphazard business and workmen came and went as common laborers do in the wheat fields of the West. As the business increased in importance and the need of skilled labor became imperative, men were put to certain work and kept at it from season to season, with the result that in a few years a corps of highly skilled workers had been evolved, and this had much to do with the rapid extension of the industry.

For many years Chinese formed the greater part of the cannery employees, the superintendent, foreman, clerks, machinists, and watchmen alone being white. No other laborers have ever been found to do the work as well or with as little trouble as the Chinese. In times of heavy runs, when the cannery would have to operate almost day and night in order to take advantage of what might be the last run for the season of the sometimes erratic salmon, the Chinese were always willing, even eager, to do their utmost to fill the cans, and, if fed with the especial food they insisted upon having and due regard was had to certain racial susceptibilities, the cannery man could almost invariably depend upon the Chinese doing their utmost.

The Chinese-exclusion law cut off the supply of Chinese, and as the years went by and their ranks became decimated by death, disease, and the return of many to China, the contractors were compelled to fill up the rapidly depleting crews with Japanese, Filipinos, Mexicans, Porto Ricans, etc., with the result that to-day in many canneries special quarters have to be provided for certain of the races—more particularly the Chinese and Japanese—in order to prevent racial hatred from engendering brawls and disturbances.

In Alaska the Japanese now compose about one-half of the cannery employees. While a few cannery men express themselves as well pleased with this class of labor, the majority find it troublesome.

In Alaska and at a few places in the States Indians are employed in the canneries. In Alaska more would be employed if they could be secured. They make fair work people, but are rather unreliable about remaining through the season.

CHINESE CONTRACT SYSTEM.

Cannery labor is supplied largely through the contract system. In the large cities along the coast are agencies, mainly owned by Chinese, which make a specialty of furnishing labor for canning. In the agreement between the canning company and the contractor the company guarantees to pack a certain number of cases during the coming season, and the latter agrees to do all the work from the time the fish are delivered on the wharf until they are ready to ship at the end of the season for a certain fixed sum per case. Should the cannery pack more than the guaranteed number, which it usually does if possible, the excess has to be paid for at the rate per case already agreed upon, while if the pack for any reason should fall below the contract amount, the company must pay for the shortage the same as though they had been packed. The company transports the Chinese to the field of work and carries them to the home port at the end of the season. It provides them with a bunk house and furnishes fuel, water, and salt. The contractor sends along with each crew a "boss," who has charge of the crew and furnishes their food, the company transporting this free.

While this contract system met with favor from some of the cannery men because it relieved them from the annoyance and trouble involved in hiring, working, and feeding their cannery gangs, others, and these the most farsighted, from the early days of the industry viewed it with suspicion and distrust and in a few instances refused to have anything to do with it. While the plan apparently met with no objection from the Chinese when they were the only ones engaged in the work, as soon as other races began to be employed disputes became common, and it is probable that to-day it is the most unpopular feature of the industry from the common workers' standpoint, and mainly because of the abuses which have grown up in connection with it.

Since the beginning of the present century there has been a steady expansion of the salmon-canning industry, with a consequent heavy demand for cannery labor. As a result of the operation of the Chinese-exclusion act during this period the number of Chinese available has been steadily declining; in fact, most of the Chinese now employed are mainly men well along in life, as the few comprised in the rising generation do not wish to follow in their fathers' footsteps. As a result the oriental gang now comprises many nationalities.

The great increase in the number of canneries during the period noted, with the resulting demand for labor, led to the introduction of other nationalities, more notably the Japanese, into the ranks of the Chinese contractors. Many of these operated with very little or no capital and when a bad season occurred they usually passed their losses, in whole or in part, onto their workers, usually by absconding, and when the latter attempted to come back onto the owner of the plant the latter successfully pleaded the fact that he had made a contract with the contractor to do the work at a certain fixed sum

per case, that the stipulated price had been paid him, and if he failed to settle with the men it was no concern of the canner.

The contractor, under his agreement with the canner, has the right to feed his employees from the time they leave the home port until they return, and this is a most prolific source of profit and graft to him and of trouble to the canner. When the workers comprise orientals alone, the food question rarely troubles as then rice, which is the staple food and is also as a rule quite cheap, meets with the approval of all. But since the gangs now comprise almost as many nonorientals as there are orientals, and the former find it impossible to exist, let alone thrive, on rice, much trouble results when the contractor furnishes them with an undue proportion of the latter in the daily menu. As a result of this condition of affairs, some of the more far-seeing companies now compel the contractor to furnish each nationality with food to which they are accustomed and in sufficient quantities. Eternal vigilance is required in this matter, however, as the wily oriental is always seeking an opportunity to increase his profits by cutting the quantity of food to the minimum and by forcing as much rice as possible upon the employees. Innumerable strikes in the canneries can be traced directly to dissatisfaction with the quantity, kind, and quality of food furnished to the men by the contractor's agent; and the resulting losses, which are sometimes very large, as the strikes generally occur when the cannery has plenty of fish, fall upon the cannery men.

Nearly all of the workers are ignorant men; in most cases they have but little knowledge of English, the language in which the contract is printed, and as no paternal Government watches over them to see that they understand thoroughly the terms of the contract and that it is fulfilled on the part of the employer, as is done in the case of the sailors and fishermen, some of them discover at the end of the season that their pay does not come up to the glowing promises of the agent who recruited them and also frequently discover that there are various fines provided for in the contract, which, while they do not work an injustice when the contractor is honest, yet in the hands of an unscrupulous and grasping contractor, frequently operate to the financial disadvantage of the worker.

Some of the dishonest contractors have developed other methods for fleecing their employees. Sometimes they will furnish to their contract workers, either directly or through some concern in which they have financial interests or which will pay them a commission, an outfit comprising clothing, blankets, shoes, etc., at a price two or three hundred times its real value. The worst feature of many of these outfits is that they are woefully inadequate for use in the climate to which the cannery ship is bound. Some unscrupulous contractors also sell goods to the workers at extortionate prices while at the cannery. The latter is usually not permitted by the canners, who generally operate a store of their own where the men can as a rule obtain goods as cheap as they can be bought in either San Francisco or Seattle.

Orientals are inveterate gamblers, and there are usually several sharpers with each cannery gang, generally with the connivance of the contractor's agent—although it is usually an impossibility to prove this legally—and they inveigle the green hands into all sorts of gambling games, and in this manner frequently succeed in winning

all or part of their season's wages. That those in charge of the gang are well aware of what is going on is patent when it is stated that the men are not paid off until they return to the home port at the end of the season, and that no considerable claim on the wages due a worker can be paid unless the contractor or his agent knows what it is for. Sometimes when dealing with a canner who is insistent upon seeing justice done to the members of the oriental gang, and the number of these is increasing rapidly, an effort is made to camouflage these gambling debts by charging them up on the books as clothing or goods furnished the worker.

As a result of these evils, a number of the cannerymen have discontinued the practice of making Chinese contracts and deal directly with their men. When this is done, it is but rare to hear of a strike due to food supplied, as the cannerymen, when the matter is put directly up to them, realize that the only way in which they can expect adequate work from their employees is by seeing that they are given the proper kind and quantity of food and that they operate under decent working and living conditions.

A few of the cannerymen who still retain the old system endeavor to eradicate so far as possible the evils of it by a close supervision over the food supplied the men and by having a representative present at the season's pay-off in order to see that no attempt is made to cheat the men out of their wages. Unfortunately, however, some of them feel that they have done their full duty when they have made a contract with someone, no matter what his financial responsibility may be, and have paid him the agreed upon sum at the end of the season, doubtless feeling that the rest is the concern alone of the men.

In a very few instances the members of the oriental gang are still shoved into inadequate and insanitary quarters aboard ships, and at the canneries are housed in quarters which are a disgrace to any modern packing plant, but, fortunately, these conditions, as stated, prevail now with but comparatively few of the companies. The old "China" house, in which was housed the whole oriental gang like rabbits in a warren, has been largely superseded by cottages, each housing from 8 to 16 men, and these are numerous enough to permit of the various nationalities flocking by themselves. Bathing facilities, with hot and cold water, are fairly common, and opportunities for washing clothing are frequent.

FISHERIES OF BOUNDARY WATERS.

Waters which form the boundaries between States or between nations, and in which fishing is carried on by the citizens of both, have almost always proved bones of contention, and the Pacific coast has been no exception to the rule.

WASHINGTON AND OREGON.

The Columbia River, which forms the boundary between Oregon and Washington, affords a typical example of the evils which can result from a division of responsibility between two States. For many years each State enacted laws regulating the fisheries of the river with very slight regard usually to laws already in force in the other State. As a result of this the fishermen transferred their

residence for license purposes from State to State as the laws of one or the other best suited their particular purposes.

The fishermen and packers also were in apparently irreconcilable conflict as to the proper means to be taken to conserve the fisheries, and each session of the legislatures saw strong lobbies present to work for certain selfish ends, while the few earnest men who had the real welfare of the fisheries of the river at heart had difficulty in making the slightest headway against the influence of these lobbies.

To further complicate the matter, in 1894 Oregon claimed that, under the provisions of the enabling act admitting it as a State, it had jurisdiction to the Washington shore, and proceeded to arrest Washington men who were fishing in what was the open season according to Washington law but the closed season under Oregon law.

In June, 1908, the voters of the State of Oregon had presented for their consideration two bills radically affecting the waters of Columbia River. One proposed closing the river east of the mouth of the Sandy River against all fishing of any kind except with hook and line, and was originated by gill-net fishermen of the lower river for the purpose of eliminating fish wheels in the upper waters. This bill was the first presented to the people, and when it appeared the upriver men retaliated by presenting a bill affecting the lower river to such an extent that it practically prohibited the net fishermen from operating.

Very much to the surprise of all concerned both bills were passed and became laws on July 1, to take effect, as provided, on August 25 and September 10, respectively. The Oregon master fish warden proceeded to enforce both laws, arresting all violators on both sides of the river, irrespective of whether or not they were operating under a Washington or Oregon license, and incidentally did the fisheries a great service by bringing prominently before the public the anomalous condition of affairs which was occasioned by the archaic system under which the fisheries of the Columbia were governed. The State of Washington appealed to the United States courts, which, after argument, issued an injunction preventing the warden from enforcing the laws so far as the Washington fishermen were concerned.

In the meantime the attention of the General Government had been drawn to the apparently irreconcilable conflict between the two States, and fearing that in the *mêlée* the interests of the fisheries would be lost sight of, President Roosevelt, in a message to Congress, after reciting briefly the lack of harmony in jurisdiction by the States, recommended that the General Government take over the control of the fisheries of the Columbia, as well as other interstate rivers.

This had the effect of bringing matters to a head, and negotiations were soon in progress looking to the preparation of a treaty between the two States by which uniform laws would be adopted, and thus each State have concurrent jurisdiction to the opposite shore of the river. The legislatures each appointed a committee of eight members to confer and frame joint legislation. The two committees met in Seattle, Wash., early in 1909, and agreed upon the following recommendations:

- First. A spring closed season from March 1 to May 1.
- Second. A fall closed season from August 25 to September 10.
- Third. A Sunday closed season from 8 p. m. Saturday of each week to 6 p. m. the Sunday following between the 1st day of May and the 25th day of August.

Fourth. We suggest the mutual recognition by each State of the licenses issued to floating gear by the other State.

Fifth. That the State of Oregon repeal chapter 89 of the session laws of Oregon for the year 1907, relative to the operation of purse seines and other like gear on the Columbia River.

Sixth. We recommend the enactment of similar laws in both States carrying an appropriation of at least \$2,500 in each State and providing for the destruction of seals and sea lions and the granting of a bounty on the same, to be \$2.50 for seals and \$5 for sea lions.

Seventh. We recommend the repeal of both the fish bills passed under the provisions of the initiative and referendum in June, 1907, by the people of the State of Oregon, said bills being designated on the ballot as 318, 319 and 332, 333.

The recommendations were enacted into law by both States, and at the same time the State of Washington in its bill also prohibited fishing for salmon within 3 miles of the mouth of the Columbia between March 1 and May 1 and between August 25 and September 10, or salmon fishing on tributaries of the Columbia, except the Snake, between June 1 and September 15; and also prohibited fishing for salmon by any means save by hook and line in the Kalama, Lewis, Wind, Little White Salmon, Wenatchee, Methow, and Spokane Rivers and in the Columbia River 1 mile below the mouth of any of the rivers named. The agreement was subjected to a rather severe strain, however, when it was discovered that the Oregon Legislature had failed to provide the same closed periods for the tributaries that were enacted for the Columbia, thus leaving the Willamette, Clackamas, Lewis and Clark, and Youngs Rivers and Spikanon Creek open to fishing for 15 days in March and 15 days in April, while the Columbia was closed. The cry of bad faith was at once raised by the Washington fishermen, and for a short time it appeared that the agreement would be broken at the very beginning. The Oregon Board of Fish Commissioners took the matter up, however, and by order closed these streams to all fishing during the times of closed season on the Columbia, and thus restored peace once more.

This agreement continued in force until 1915, when the legislature of each State prepared for a thorough revision of its fishery code. In order to make this revision more effective, committees from both legislatures were appointed and held joint meetings in Portland, where they mutually agreed upon laws covering the fisheries of the Columbia River, and in order to make this agreement more binding the following chapter was inserted in the codes finally adopted:

All laws and regulations now existing, or which may be necessary for regulating, protecting, or preserving fish in the waters of the Columbia River, over which the States of Oregon and Washington have concurrent jurisdiction, or any other waters within either of said States, which would affect said concurrent jurisdiction, shall be made, changed, altered, and amended in whole or in part only with the mutual consent and approbation of both States.

As such an agreement between two States requires the approval of Congress, a bill ratifying the same was introduced in Congress on December 16, 1915, but was not finally ratified until April 1, 1918.

While the compact was pending in Congress, the Washington legislature at its 1917 session made several changes in the existing fisheries law and contended they were effective because the compact agreement was not ratified by Congress until 1918, which then did not take recognition of the new regulations. When the matter came officially before the superior court of Pacific County, Wash., in 1919, the court held that the compact was valid, thus nullifying

laws passed by the State of Washington affecting the Columbia River since 1915, and if this decision stands in the higher courts of both States all laws passed by either legislature since 1915, affecting the Columbia River fisheries, will fail unless they happen to be the same in both States.

WASHINGTON AND BRITISH COLUMBIA.

The conditions which prevail in Puget Sound adjacent to the boundary between Washington and British Columbia have also been the cause of serious anxiety to those interested in the perpetuation of the salmon fisheries. The great schools of sockeye salmon which are on their way from the ocean to the spawning beds in the Fraser River pass through this section, and it is here that the greater part of the fishing is done. The Province of British Columbia and the State of Washington are vitally interested in the preservation of these fish, but, unfortunately, they seem unable to agree upon any definite policy with regard to their conservation, although it would appear to the unprejudiced observer that it ought to be possible to find some common ground upon which they could agree.

This condition of affairs on Puget Sound and similar conditions in other boundary waters led the General Government to take up the matter, and on April 11, 1908, a convention was concluded between this country and Great Britain for the protection and preservation of the food fishes in international boundary waters of the United States and Canada. Both Governments appointed international commissioners—Dr. David Starr Jordan for the United States and S. T. Bastedo (who was succeeded later by Prof. Edward Ernest Prince) for Canada—whose duty it was to investigate conditions prevailing in these waters and to recommend a system of uniform and common international regulations. After an exhaustive investigation the commissioners submitted recommendations, which included the following affecting the boundary waters dividing the State of Washington and the Province of British Columbia, those waters being defined as the Strait of Juan de Fuca, and those parts of Washington Sound, the Gulf of Georgia, and Puget Sound lying between the parallels of 48° 10' and 49° 20':

GENERAL REGULATIONS.

3. *Disposition of prohibited catch.*—In case any fish is unintentionally captured contrary to the prohibitions or restrictions contained in any of the following regulations, such fish shall, if possible, be immediately returned alive and uninjured to the water.

4. *Dynamite, poisonous substances, etc.*—No person shall place or use quicklime, dynamite, explosive, or poisonous substances, or electric device in treaty waters for the purpose of capturing or killing fish.

5. *Pollution of waters.*—No person shall place or pass, or allow to pass, into treaty waters any substance offensive to fishers, injurious to fish life, or destructive to fish fry or to the food of fish fry, unless permitted so to do under any law passed by the legislative authority having jurisdiction.

No person shall deposit dead fish, fish offal, or gurry in treaty waters, or on ice formed thereon, except in gurry grounds established by the duly constituted authorities.

6. *Capture of fishes for propagation or for scientific purposes.*—Nothing contained in these regulations shall prohibit or interfere with the taking of any fishes at any time for propagation or hatchery purposes, and obtaining at any time or by any method specimens of fishes for scientific purposes under authority granted for Canadian treaty waters by the duly constituted authorities in Canada and for United States treaty waters by the duly constituted authorities in the United States.

12. *Capture of immature salmon prohibited.*—No salmon or steelhead of less than pounds in weight shall be fished for, killed, or captured in treaty waters.

13. *Salmon weirs, etc., above tidal limits prohibited.*—No salmon and no steelhead shall be fished for, killed, or captured by means of a net of any sort, any weir or any fish wheel, above tidal limits in any river in treaty waters.

14. *Close season for sturgeon.*—During the term of four years next following the date of the promulgation of these regulations no sturgeon shall be fished for, killed, or captured in treaty waters.

15. *Capture of fish for fertilizer or oil prohibited.*—Fishes useful for human food shall not be fished for, killed, or captured in treaty waters for use in the manufacture of fertilizer, or of oil other than oil for food or medicinal purposes.

16. *Naked hooks and spears prohibited.*—No spear, grappling hook, or naked hook, and no artificial bait with more than three hooks, or more than one burr of three hooks attached thereto, shall be used for the capture of fish in treaty waters. This regulation shall not prohibit the use of a gaff in hook-and-line fishing.

17. *Torching prohibited.*—No torch, flambeau, or other artificial light shall be used as a lure for fish in treaty waters.

The following regulations relate specifically to the waters named:

STRAIT OF JUAN DE FUCA AND ADJACENT WATERS.

The following regulations (62 to 66, inclusive) shall apply to the Strait of Juan de Fuca, those parts of Washington Sound, the Gulf of Georgia, and Puget Sound lying between the parallels of 48° 10' and 49° 20' north latitude:

62. *Close season for salmon.*—From August 25 to September 15 in each year, both days inclusive, no salmon or steelhead shall be fished for, killed, or captured for commercial purposes in these treaty waters; provided, however, that in the waters to the westward of a line drawn southward from Gonzales Point to the shore of the State of Washington silver salmon, or coho salmon, may be fished for, killed, or captured from September 1 to September 15 in each year, both days inclusive.

63. *Weekly close season for salmon and steelhead.*—From 6 o'clock Saturday morning to 6 o'clock on the Monday morning next succeeding, no salmon or steelhead shall be fished for, killed, or captured in these treaty waters.

It is, however, provided that in the waters to the westward of a line drawn southward from Gonzales Point to the shore of the State of Washington the weekly close season shall begin 12 hours earlier, and shall end 12 hours earlier.

64. *Construction of pound nets.*—All pound nets or other stationary appliances for the capture of salmon or steelhead shall be so constructed that no fish whatever shall be taken during the weekly close season. The erection or addition to the pound net of a jigger is prohibited.

65. *Location of pound nets.*—All pound nets shall be limited to a length of 2,500 feet, with an end passageway of at least 600 feet between one pound net and the next in a linear series, such distance being measured in continuation of the line of direction of the leader of such net, and a lateral passageway of at least 2,400 feet between one pound net and the next.

On and after January 1, 1911, the mesh in pound nets shall be 4 inches in extension in the leader and not less than 3 inches in other parts of the net.

66. *Nets other than pound nets.*—No purse net shall be used within 3 miles of the mouth of any river and no seine within 1 mile of the mouth of any river in these treaty waters.

No gill net of more than 900 feet in length or of a greater depth than 60 meshes shall be used in these treaty waters.

The effort to enact these regulations into law by our Congress met with decided objections not only on the part of the Puget Sound operators, but also from operators in other waters affected, with the result that the bill was shelved and never acted upon finally. After waiting a while to see if any action would be taken by our Government, Canada finally repealed the act in which it had accepted the regulations.

DECREASE IN SOCKEYE SALMON RUN.

In 1913 the matter of the Frazer River-Puget Sound sockeye salmon run came prominently to the fore through a rock slide in Hell Gate

Canyon, on the Fraser River, caused by blasting operations of a construction gang building a railroad through there. This slide, it was asserted, cut off the greater part of the run to the upper river, and, it was feared, would have a very serious effect on future runs. By the time the run of 1914 arrived the greater part of the débris had been removed from the canyon, and the fish, it was alleged, could once more pass up. Reports of persons who visited these spawning grounds in 1913 and subsequent years were to the effect that but few spawners, as compared with earlier years, were to be found on them.

That the subsequent decrease in the runs was not to be attributed solely to the rock slide in Hell Gate canyon is plainly evident by a glance at the pack figures in this area before and subsequent to 1913. The following statement shows the combined sockeye packs of the American and Canadian packers operating on the run going to the Fraser River:

	Cases.		Cases.
1909.....	a 1,590,555	1915.....	155,714
1910.....	384,869	1916.....	105,870
1911.....	189,767	1917.....	a 559,732
1912.....	307,775	1918.....	70,420
1913.....	a 2,401,488	1919.....	98,409
1914.....	534,484		

Aside from the damage caused to the "big year" run by the rock slide, there can be only one explanation of such a progressive decline in the pack, and that is excessive fishing. The fishermen of both countries are to blame for this. On the American side traps, purse seines, and, in a slight degree, gill nets, have taken a heavy toll of the fish as they passed through our waters. After some had safely run this gantlet they met thousands of gill nets operated by Canadian fishermen in and around the mouth of the Fraser River and in the lower reaches of same, and it is a wonder that any of the schools ever got to the spawning beds. Several abortive attempts have been made by the authorities of Canada and British Columbia on the one side and the State of Washington on the other to arrive at some equitable method for protecting this sockeye run. The former especially have professed an earnest desire to do something along this line, and there is no reason to doubt their sincerity. On the American side a few people, and among these a few of the more intelligent canners, pleaded for the enactment of laws that would adequately protect the salmon, but they were overborne by the great bulk of the packers and fishermen who, disregarding all the warnings and teachings of experience, insisted upon going ruthlessly forward with the slaughter, and when reproached with their shortsightedness clamored for the establishment of more salmon hatcheries, as though the latter could accomplish the miracle of increasing the supply of fry from a steadily decreasing supply of eggs.

That this wanton destruction of one of our greatest natural resources should have been permitted to continue unchecked by the people of Washington and British Columbia is a most surprising thing, and indicates either a most remarkable ignorance of the condition, which should have been patent to everybody, or a criminal apathy.

* The big year, which comes every fourth year.

AMERICAN-CANADIAN FISHERIES CONFERENCE.

In 1917 a joint commission, known as the American-Canadian Fisheries Conference, was appointed to take evidence and see if it were possible to compose the fishery disputes which had affected the good relations of the two countries for over 150 years. The commission was composed, for America, of William C. Redfield, Secretary of Commerce; Edwin F. Sweet, assistant Secretary of Commerce; and Dr. Hugh M. Smith, Commissioner of Fisheries; and for Canada, of J. Douglas Hazen, Chief Justice of New Brunswick, who had been for six years Minister of Marine and Fisheries for Canada; George G. Desbarats, deputy Minister Naval Service; and William A. Found, Superintendent of Fisheries.

Hearings were held on the Atlantic coast in 1917 and on the Pacific coast in 1918, and in 1919 the commission agreed upon and presented to their respective Governments several treaties concerning these matters, the only one of special interest here being the treaty covering the sockeye fisheries of the Fraser River-Puget Sound, which was signed on September 2, 1919. Owing to its importance this treaty is reproduced entire below:

CONVENTION FOR THE PROTECTION, PRESERVATION, AND PROPAGATION OF SALMON.

The United States of America, and His Majesty George V, of the United Kingdom of Great Britain and Ireland, and of the British Dominions beyond the Seas, King, Emperor of India, equally recognizing the desirability of uniform and effective measures for the protection, preservation, and propagation of the salmon fisheries in the waters contiguous to the United States and the Dominion of Canada, and in the Fraser River System, have resolved to conclude a convention for this purpose, and have named as their Plenipotentiaries:

The President of the United States of America, the Honorable Robert Lansing, Secretary of State of the United States of America, and

His Britannic Majesty, the Honorable Ronald Lindsay, his charge d'affaires at Washington, and the Honorable Sir John Douglas Hazen, a Knight Commander of the Most Distinguished Order of St. Michael and St. George, Chief Justice of New Brunswick, and a member of his Privy Council for Canada.

Who, having exhibited their full powers, found to be in due form, have agreed to and signed the following articles:

ARTICLE I.

The times, seasons, and methods of sockeye-salmon fishing in the waters specified in Article III of this Convention, and the nets, engines, gear, apparatus, and appliances which may be used therein, shall be limited to those which are specified in the regulations appended hereto, and/or which may be specified in revised, modified, or substituted regulations provided for in Article VI and promulgated in accordance with the terms of Article II.

ARTICLE II.

The High Contracting Parties engage to put into operation and enforce by legislative and executive action, with as little delay as possible, the provisions of this convention and said regulations, and the date when the said regulations shall be put into operation, shall be fixed by concurrent proclamations of the President of the United States and of the Governor General of the Dominion of Canada in Council. Each of the High Contracting Parties may, by appropriate legislation, provide for the trial, conviction, and punishment within its jurisdiction of any person found there who has contravened any of the provisions of this convention, and/or said regulations within the jurisdiction of the other High Contracting Party, and who has not been punished for such offence within the latter jurisdiction.

ARTICLE III.

It is agreed that the provisions of this convention and of said regulations shall apply to the waters included within the following boundaries:

Beginning at Carmanagh Lighthouse on the southwest coast of Vancouver Island, thence in a straight line to a point three marine miles due west astronomic from Tatoosh Lighthouse, Washington, thence to said Tatoosh Lighthouse, thence to the nearest point of Cape Flattery, thence following the southerly shore of Juan de Fuca Strait to Point Wilson, on Quimper Peninsula, thence in a straight line to Point Partridge on Whidbey Island, thence following the western shore of the said Whidbey Island, to the entrance to Deception Pass, thence across said entrance to the southern side of Reservation Bay, on Fidalgo Island, thence following the western and northern shore line of the said Fidalgo Island to Swinomish Slough, crossing the said Swinomish Slough in line with the track of the Great Northern Railway, thence northerly following the shore line of the mainland to Point Grey at the southern entrance to Burrard Inlet, British Columbia, thence in a straight line to the southern end of Gabriola Island, thence to the southern side of the entrance to Boat Harbor, Vancouver Island, thence following the eastern and southern shores of the said Vancouver Island to the starting point at Carmanagh Lighthouse, as shown on the United States Coast and Geodetic Survey Chart No. 6300, as corrected to July 20, 1918, and also the Fraser River and its tributaries.

The High Contracting Parties engage to have prepared, as soon as practicable, charts of the waters described in this article, with the international boundary line indicated thereon; and to establish such buoys and marks for the purposes of this convention as may be recommended by the commission referred to in Article IV.

ARTICLE IV.

The High Contracting Parties agree to appoint, within two months after the exchange of ratifications of this convention, a commission to be known as the International Fisheries Commission, consisting of four persons, two to be named by each party. This commission shall continue to exist so long as this convention shall be in force. Each party shall have the power to fill, and shall fill, from time to time, any vacancy which may occur in its representation on the commission. Each party shall pay its own commissioners, and any joint expenses shall be paid by the two High Contracting Parties in equal moieties.

ARTICLE V.

The International Fisheries Commission shall conduct investigations into the life history of the salmon, hatchery methods, spawning-ground conditions, and other related matters, and shall observe the operation of the said regulations appended hereto, and shall recommend to their respective Governments any modifications of, additions to, or substitutions for the appended regulations which may be found desirable.

ARTICLE VI.

The regulations appended to this convention shall remain in force for a period of eight years from the date of their promulgation, as provided in Article II, and thereafter until one year from the date when either of the High Contracting Parties shall give notice to the other of its desire for their revision, or until the termination of this convention, whichever shall first occur. Immediately upon such notice being given, the International Fisheries Commission shall proceed to make a revision of said regulations, which revised regulations shall be incorporated in a special agreement between the High Contracting Parties. It is understood that such special agreement shall on the part of the United States be made by the President of the United States, by and with the advice and consent of the Senate thereof. Such special agreement shall be binding only when confirmed by the two Governments by an exchange of notes. Such special agreement shall be promulgated as provided in Article II hereof, and shall remain in force for a period of five years and thereafter until one year from the date when a further notice of revision is given as above provided in this article, or until the termination of this convention, whichever shall first occur.

It shall, however, at any time, be in the power of the High Contracting Parties by special agreement upon the recommendation of the International Fisheries Commission, to make modifications of, additions to, or substitutions for any of the regulations in force, and (or) to make the provisions of this convention, and any regulations pro-

mulgated in accordance with the terms thereof, operative in the waters specified in Article III of this convention, as to any or all of the other species of salmon, including steelhead. It is understood that such special agreement shall on the part of the United States be made by the President of the United States, by and with the advice and consent of the Senate thereof. Such special agreement shall be binding only when confirmed by the two Governments by an exchange of notes. Such special agreement shall be promulgated as provided in Article II hereof.

ARTICLE VII.

This convention shall remain in force for a period of fifteen years, and thereafter until two years from the date when either of the High Contracting Parties shall give notice to the other of its desire to terminate this convention.

ARTICLE VIII.

The present convention shall be duly ratified by the President of the United States, by and with the advice and consent of the Senate thereof, and by His Britannic Majesty, and the ratifications shall be exchanged at Washington as soon as practicable. IN FAITH WHEREOF, the respective plenipotentiaries have signed the present convention in duplicate and thereunto affixed their seals.

Done at the City of Washington this second day of September, in the year one thousand nine hundred and nineteen.

ROBERT LANSING, (Seal)
R. C. LINDSAY, (Seal)
J. D. HAZEN. (Seal)

APPENDIX.

INTERNATIONAL REGULATIONS FOR THE PROTECTION AND PRESERVATION OF THE SOCKEYE SALMON FISHERIES OF THE FRASER RIVER SYSTEM.

SECTION 1.

The following regulations shall apply to the waters described in Article III of the convention of September 2, 1919, between the United States and Great Britain, to which these regulations are appended, to-wit:

(Here is inserted the description of the waters affected, as already set forth in Article III above.)

SECTION 2.

DEFINITIONS.

"Drift net" shall mean a floating gill net that is neither anchored nor staked, but that floats freely with the tide or current.

"Trap net" shall include a pound net.

"Commission" shall mean the International Fisheries Commission appointed under the convention to which these regulations are appended.

"Treaty waters" shall mean all waters described in Article III of the convention to which these regulations are appended.

SECTION 3.

(a) Fishing for sockeye salmon in the treaty waters within the territorial limits of the State of Washington, shall not be permissible except under license from such state, and in the treaty waters of Canada except under license under the provisions of the fisheries act of Canada.

(b) No greater number of licenses for any class of fishing appliance shall be authorized in any year in the treaty waters within the territorial limits of the State of Washington than were issued for such class for the season of 1918, up to August 31st, inclusive thereof, and in the treaty waters of Canada the number of gill nets that may be licensed in any year shall not exceed 1,800.

(c) No license shall be granted to any person or partnership in the State of Washington unless such person or each member of such partnership shall be an American citizen, resident in said State, and no license shall be granted to any joint-stock company or corporation in said State, unless the officers, directors and the holders of a majority of the stock thereof, are American citizens, or unless it is authorized to do business in the said State; and no license shall be granted to any person, company or firm in the Province of British Columbia unless such person is a British subject

resident in the said Province, or unless such company or firm is a Canadian company or firm, or is authorized by the Provincial Government to do business in the said Province of British Columbia.

(d) No one other than a British subject who owns or leases land on either side of the Fraser River above New Westminster Bridge, and who actually permanently resides on, and is cultivating such land, shall be eligible for a license to fish for sockeye salmon between New Westminster Bridge and Mission Bridge, but fishing under such license shall not be carried on below New Westminster Bridge.

SECTION 4.

The use of nets other than drift nets, purse seines, and trap nets shall not be permitted in treaty waters for the capture of sockeye salmon.

SECTION 5.

No net fishing or fishing of any kind, other than with hook and line, except for hatchery purposes, or scientific purposes, shall be permissible in the Fraser River above the down river side of Mission Bridge.

SECTION 6.

During the years 1920 to 1927, both years inclusive, no one shall fish for, catch or kill any salmon from the 20th day of July to the 31st day of July in each year, both days inclusive; and during this close time, no nets or appliances of any kind that will capture salmon may be used in these treaty waters; *Provided, however,* That salmon fishing for hatchery or scientific purposes may be authorized during this period.

SECTION 7.

The weekly close time for salmon fishing shall be from six o'clock a. m. Saturday, to six o'clock p. m. Sunday, in Canadian waters, excepting in that portion of the Fraser River between New Westminster Bridge and Mission Bridge, where the weekly close time shall be from six o'clock a. m. Saturday to six o'clock p. m. on the following Monday, and in the treaty waters of the United States from Friday at four o'clock p. m. to Sunday at four o'clock a. m. and during this close time no salmon fishing of any kind other than for hatchery or scientific purposes shall be permissible, and during the full period of each weekly close time or annual close season, each trap net shall be closed by an apron across the outer entrance to the heart of the trap, which apron shall extend from the surface to the bottom of the water and shall be securely connected to the piles on either side of the heart of the trap net, fastened by rings not more than two feet apart on taut wires stretched from the top to the bottom of the piles, and such apron, or the appliance by which it is raised and lowered, shall be provided with a signal or flag, which shall disclose whether the trap net is closed, and which shall be of the form and character approved by the commission: *Provided,* that in addition to the foregoing requirement, such trap net shall be equipped with a V-shaped opening, to the satisfaction of the commission, and in the lead of such trap net next to the entrance to the heart and immediately adjacent to the apron, of at least ten feet in width at the top and extending below the surface at least four feet below low water, which V-shaped opening shall remain open and unobstructed during the full period of each weekly close time or annual close season. For the purposes of assuring full compliance with this regulation, the owner or operator of each trap net shall constantly maintain during the weekly and annual close time a watchman, whose duty it shall be to cause each trap net to be kept closed and the lead to be kept open, as above provided.

SECTION 8.

All salmon trap nets shall be limited to a total length of twenty-five hundred feet, with an end passageway of at least six hundred feet between one trap net and the next in linear series, such distances being measured in continuation of the line of direction of the leader of such trap net, but in no instance shall more than two-thirds of the width of any passageway at any point be closed by trap nets. There shall also be a lateral distance of at least twenty-four hundred feet between one trap net and the next.

SECTION 9.

A salmon purse seine shall not exceed nineteen hundred linear feet in length, including the lead and attachment, measured on the cork line when wet.

SECTION 10.

(a) No purse seine shall be cast or placed in the water for fishing purposes within twenty-four hundred feet of any trap net.

(b) The use of purse seines for the capture of sockeye salmon shall be confined to the treaty waters southward and westward of a straight line drawn from the lighthouse on Trial Island, British Columbia, to the northwest point of Whidbey Island, State of Washington.

SECTION 11.

A salmon drift net shall not exceed nine hundred linear feet in length, and the vertical breadth thereof shall not exceed sixty meshes, and the size of the mesh shall not be less than five and three-fourths inches, extension measure, when in use.

Had such a treaty been adopted and rigidly enforced 10 or 12 years ago, it might have had a beneficial effect on the Fraser River-Puget Sound sockeye run, but the destruction of the run has progressed to such an alarming extent during the past 7 years that only a total cessation of all fishing for sockeyes in this section for a term of years could have the slightest beneficial effect. The proposed regulations provide that "during the years 1920 to 1927, both years inclusive, no one shall fish for, catch, or kill any salmon from the 20th day of July to the 31st day of July in each year, both days inclusive; and during this close time no nets or appliances of any kind that will capture salmon may be used in these treaty waters * * *." This closed period runs concurrently on both sides of the line, and while it would have but a very slight effect if the salmon were able to reach the spawning grounds in this short period, it certainly can have none if the Canadian gill netters are enabled to start fishing just about the time the salmon have reached the mouth of the Fraser.

The only hope of rehabilitating the sockeye run—and some well-informed observers have grave doubts whether anything will ever accomplish this desirable result—is to close the waters of Puget Sound through which the sockeyes pass and the Fraser River during the months of July and August or such other period as may be necessary to protect the sockeyes from the time they appear off the capes until they have passed beyond the fishermen on the Fraser River to all salmon fishing for a period of 8 or 12 years. As the sockeyes are 4-year fish—i. e., are born and live in fresh water for about a year, then go to sea, and are not observed again until they return in the fourth year after birth (a small proportion live to 5 years, and a vastly smaller proportion to 6 years), spawn on the breeding grounds of the Fraser and then die—a closed period of less than 4 years could have no appreciable effect, as it would not be a complete cycle in the animal's life, while 8 or 12 years, representing two or three cycles of their life, might possibly have a beneficial effect, although the experiences of the past show clearly that it is much easier to destroy a school of fish than it is to restore a much depleted one.

DECREASE IN HUMPBACK SALMON CATCH.

Another unfortunate condition has developed as a result of excessive fishing in Puget Sound of recent years, and that is the heavy decline in the catch of humpback salmon. These fish are caught in the same apparatus as used for sockeyes.

For many years the humpbacks came in countless numbers, and the fishermen were able to sell but a small part of the catch. Despite

this, they persisted in catching them and many thousands were killed and thrown away during the years when the run appeared in the sound. This ruthless and senseless slaughter finally had its natural result, and about four years ago a heavy decline was observed in the catch of that year, and this decline has steadily increased since, with the result that to-day there are grave doubts as to whether the run can be preserved even in its impaired condition. The only hope is that the prohibition of all salmon fishing during the months of July and August may be adopted, which would prevent fishing for either sockeyes or humpbacks, both of which run during these months.

PACKS BY CANADIAN AND AMERICAN CANNERS.

Many people on both sides of the boundary line have been under the impression that the American fishermen on Puget Sound have been by far the greatest offenders in so far as the quantity of sockeye salmon taken has been concerned, but a table ^a prepared by Mr. J. P. Babcock, assistant to the Commissioner of Fisheries of British Columbia, does not bear this out. Previous to 1891 most of the fishing was done by British Columbia fishermen. The table follows:

Year.	Canadian waters.	American waters.	Total.	Year.	Canadian waters.	American waters.	Total.
	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>		<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>
1891.....	176,954	5,538	182,492	1907.....	62,617	96,974	159,591
1892.....	79,715	2,954	82,669	1908.....	74,574	155,218	229,792
1893.....	457,797	47,852	505,649	1909.....	585,435	1,005,120	1,590,555
1894.....	363,967	41,791	405,758	1910.....	150,432	234,437	384,869
1895.....	395,984	65,143	461,127	1911.....	62,817	126,950	189,767
1896.....	356,984	72,979	429,963	1912.....	123,879	183,896	307,775
1897.....	860,459	312,048	1,172,507	1913.....	736,661	1,664,827	2,401,488
1898.....	258,101	252,000	508,101	1914.....	198,183	336,251	534,434
1899.....	480,485	499,646	980,131	1915.....	91,130	64,584	155,714
1900.....	229,800	228,704	458,504	1916.....	27,394	78,476	105,870
1901.....	928,669	1,105,996	2,033,765	1917.....	148,164	411,538	559,702
1902.....	293,477	339,556	633,033	1918.....	19,697	50,723	70,420
1903.....	204,809	167,211	372,020	1919.....	34,063	64,346	98,409
1904.....	72,688	123,419	196,107				
1905.....	837,489	847,122	1,684,611	Total..	8,493,431	8,766,640	17,260,071
1906.....	183,007	182,241	365,248				

METHODS OF PREPARING SALMON.

CANNING.

EARLY DAYS OF THE INDUSTRY.

In the salmon industry canning is and has been almost from the time of the discovery of a feasible method of so preserving the fish, the principal branch. The first canning of salmon on the Pacific coast was on the Sacramento River in 1864, when G. W. and William Hume and Andrew S. Hapgood, operating under the firm name of Hapgood, Hume & Co., started the work on a scow at Washington, Yolo County, Calif. The Hume brothers, who came from Maine originally, had been fishing for salmon in the Sacramento River for some years before the idea of canning the fish had entered their minds, while Mr. Hapgood had previously been engaged in canning lobsters in Maine, and was induced by the Humes to participate in

^a Fraser River Salmon Situation: A Reclamation Project. By John Pease Babcock. Appendix V, Report, British Columbia Commissioner of Fisheries for the year ending Dec. 31, 1919, p. 3. Victoria, British Columbia, 1920.

order that they might have the benefit of his knowledge of canning methods. The late R. D. Hume, who worked in the original cannery and later became one of the best-known canners on the coast, thus describes the plant and the methods employed:⁶

Before the arrival of Mr. Hapgood (from Maine) the Hume brothers had purchased a large scow, on which they proposed to do the canning of salmon, and had added an extension to the cabin 18 by 24 feet in area, to be used as a can-making shop. This had a shed on the side next to the river for holding any cans that might be made in advance of the packing season. A few days after the arrival of Mr. Hapgood (Mar. 23, 1864), the tools and machinery were packed and put in position. Mr. Hapgood made some stovepipe and two or three sheet-iron fire pots, and in a short time was ready for can making. The following list of tools and machinery will show how primitive our facilities were as compared with present methods: 1 screw hand press, 1 set cast-iron top dies, 1 set cast-iron bottom dies, 1 pair squaring shears, 1 pair rotary shears, 1 pair bench shears, 1 pair hand shears or snips, 1 pair 24-inch rolls, 1 anvil (weight 50 pounds), 1 forging hammer, 1 tinner's hammer, 1 set punches for making stovepipe, 1 rivet set, 1 grooving set, 2 iron slabs grooved on one side to mold strips of solder, 1 iron clamp to hold bodies of cans while soldering the seams, 1 triangular piece of cast iron about three-eighths of an inch in thickness and 6 inches in length, with a wooden handle attached to the apex, also used for holding can bodies in place while being seamed.

The process of canning was as follows: The bodies of the cans were first cut to proper size by the squaring shears, a line was then scribed with a gauge about three-sixteenths of an inch from one edge, and they were next formed into cylindrical shape by the rolls. They were then taken to the soldering bench and one edge lapped by the other until the edge met the line that had been scribed and fastened there by being soldered a small part of the length to hold them in place for the further purpose of seaming. They were then placed either in the iron clamp, which had a piece of wood attached to its underside, and held firmly, the clamp being closed by the operation of a treadle, or were slipped on a piece of wood, which was bolted to the bench, while being held in place by the triangular hand seamer, which was pressed down on the lap of the seam by the left hand of the operator. When this had been done a piece of solder, which had been prepared by shaking in a can together with rosin, was placed on the seam and melted and rubbed lengthwise of the seam. After cooling the bodies were ready for the end or bottom, which operation was brought about by first cutting out circular blanks with the rotary shears, and then placing them in the cast-iron die and bringing the handle of the screw press around with a swing with force enough to form up the end or bottom. In this operation there were many difficulties, as the ends or bottoms would many times stick to the upper part of the die and refuse to come off, and finger nails were pretty short in those days. To get the ends out of the lower part of the die was not so bad, as a wooden plunger operated by a treadle knocked them out, but sometimes they were in pretty bad shape. When the bottoms or ends were ready they were slipped on the bodies and the edge of the bottom rolled about in a pan of powdered rosin until the seam was well dusted. A piece of solder similar in size and preparation as used for the side seam was placed in the can. They were then placed on the smooth side of the cast-iron slabs, and the operator, with a hot soldering copper shaped to fit the circle of the can, melted the solder and by turning the can rapidly soldered the full circumference. The output of this can factory was very imperfect, as at least one-half of the seams burst, owing to the lack of experience of the manager or want of good judgment.

When the can making was well underway Mr. Hapgood then turned his attention to getting the apparatus for canning on board the house-boat. This in the cooking department consisted of a kettle made of boiler iron about 36 inches in diameter and 5 feet in depth, set in a brick furnace and fired from underneath. Alongside was a round-bottom, cast-iron pot holding about 60 gallons of water and heated in the same manner. These kettles, with a dozen coolers or circular sheet-iron pans with ropes attached and with holes cut in the bottoms for drainage, a set of 5-inch blocks and tackle, with a sheet-iron fire pot and a scratch awl, completed the bathroom outfit. The can filling and soldering room was furnished with a table through the center, where cutting the salmon in pieces to suit and the filling of the cans was done. On each side of the room there was a bench running the full length, on the end of one of which the cans were placed to receive the pickle, which was used at that time instead of the small quantity of salt that is placed in the cans during the operations of these later days.

⁶The First Salmon Cannery. By R. D. Hume. *Pacific Fisherman*, Vol. II, No. 1, January, 1904, pp. 19-21.

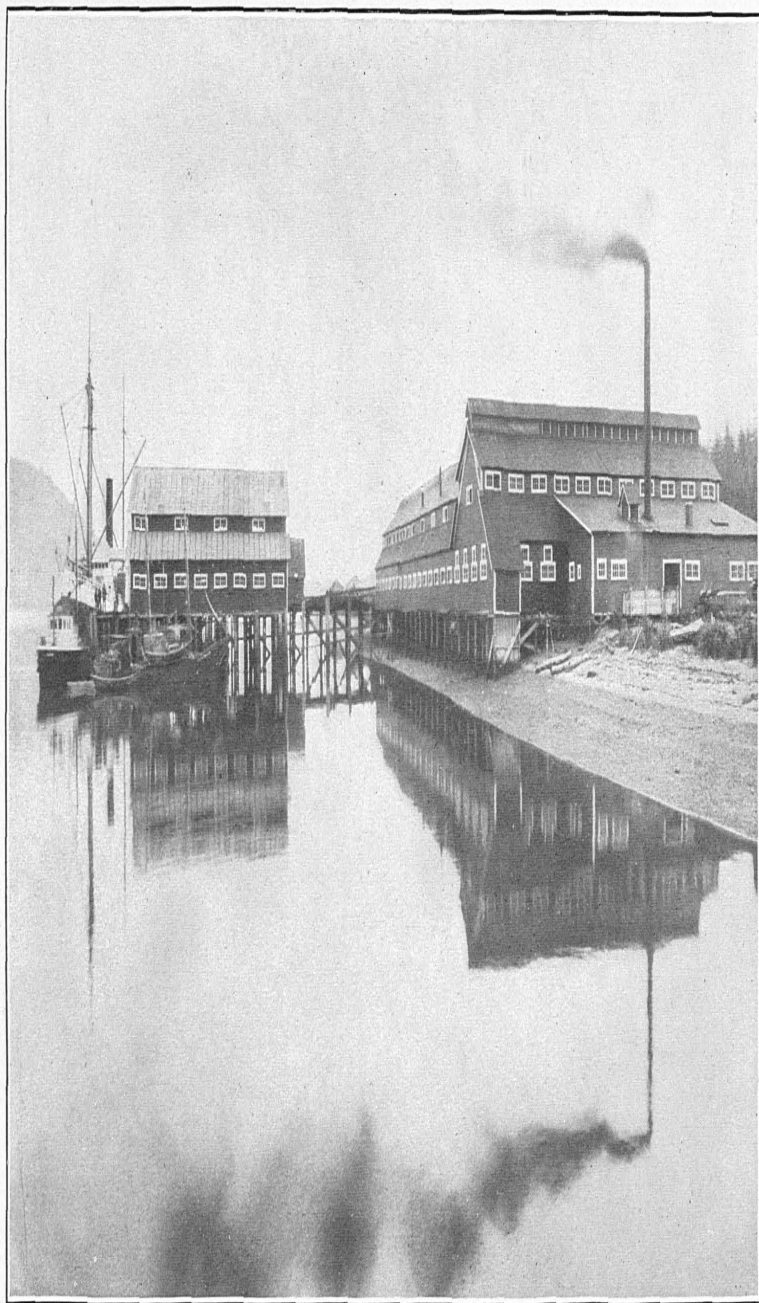


FIG. 26.—SALMON CANNERY AT HOONAH, ALASKA.



FIG. 27.—SALMON CANNERY AT SANTA ANA, ALASKA.

After the salmon had been cleaned by removing the entrails and washing them outside the covered portion of the scow, they were brought inside and placed on the table, and a man with a butcher knife in one hand and a stick in the other, which had a mark showing the length of the pieces desired, cut gashes in the side of the salmon as a guide and then cut the fish into sections corresponding to the length of the mark on the stick. He then proceeded to cut the sections in pieces to suit the cans. Then three or four operators placed the salmons in the cans and shoved them along the table to where a boy wiped the top edge and passed them along to two others who placed tops which fitted inside of the rim. The cans were then taken in wooden trays to the bench opposite the starting point, which was fitted with four sheet-iron pots, and at the one nearest the entrance to the house on the scow a man put a soldering flux on the top edge, which was made by adding zinc to muriatic acid, and then with a pointed soldering copper and a stick of solder melted the solder until a small portion could be drawn around the groove formed by the edge of the can and the bevel of the top. From there the cans were taken to the other parts of the bench, where two men finished soldering the head in, and then taken to the third man, who soldered, or, as it was called, buttoned, the end of the seam lap. The cooking department or bathroom, as it was called, was separated from the filling and soldering room by a partition. The cans were shoved through a hole in the partition.

At this time the process was a secret. Mr. Hapgood did the cooking and all the work done inside, no one but a member of the firm being allowed to go in. This privacy was continued until the firm moved to the Columbia River, and the labor becoming too arduous for Mr. Hapgood to perform alone, a boy by the name of Charlie Taylor was taken in as an assistant. * * *

But to return to the original proposition: When the filled cans had been soldered and entered the bathroom they were put in the coolers and lowered into the cast-iron pot, one cooler of cans being cooked at a time. The cooler was lowered into the boiling fresh water until the cans were submerged to within 1 inch of the top ends and left to cook for one hour; then they were hoisted out and the vent holes in the center of the top soldered up, after which they were dumped into the boiler-iron kettle, which held a solution of salt and water of density sufficient to produce, when boiling, a heat of 228° to 230° F. They were cooked in this solution for one hour and then taken out of the kettle with an iron scoop shaped like a dip net, with a wooden handle about 6 feet in length. They were dumped into a tank of water on the other side of the partition which separated the bathroom from the packing room through an opening in the partition, receiving many a bump and bruise in the operation. Then they were washed with soap and rag to remove the dirt and grease, each can being handled separately. When this was done they were piled on the floor of the packing room and in a few days were painted with a mixture of red lead, turpentine, and linseed oil, for at that time buyers would have no canned salmon, no matter how good the quality, unless the cans were painted red.

When packs of 10,000 to 15,000 cases were made in a season only the absolutely essential machinery was used, the rest of the work, such as cutting and cleaning the fish and placing them in the cans, being done by hand. When larger canneries were constructed, especially in Alaska, where labor is expensive and difficult to obtain, the greater part of the workmen having to be brought up from the States, machinery to do as much as possible of the work became absolutely essential. The inventive genius of the country came to the rescue and one by one machines for cutting, sliming, and cleaning the fish, filling the cans, putting the tops on, and washing them were invented and put into use, while automatic weighing machines were produced and extensive improvements and alterations were made in the machines previously in use. There are to-day many large manufacturing establishments which devote all or the greater part of their facilities to furnishing machinery and supplies to this giant branch of the salmon industry.

When salmon canning was in its infancy, a pack of from 150 to 200 cases was considered a good day's work. Now it is not an uncommon occurrence for a cannery to turn out from 2,500 to 4,000 cases in one day, and there are a number which have even greater capacity.

The usual method of figuring the capacity of a salmon cannery is by the number of lines or units employed. The machinery arranged so that the fish pass through all the operations from filling to double seaming is known as a line, and the capacity is based upon the number of these lines in use in the plant.

During the height of the salmon run, a cannery is an exceedingly busy and interesting place, and a description of the methods used at the present time will show the giant strides the industry has made since the days of Hapgood, Hume & Co.

HANDLING THE SALMON.

At convenient spots near the fishing grounds large scows and lighters are anchored and the fishing crews deliver their catches aboard these, the tallyman on each scow keeping a record and giving the crew a receipt. Men fishing near the cannery deliver their catch alongside. Steamers and launches are used to tow out empty scows and bring in those filled. In the old days the fish were pitched by hand into bins on the wharves, but this laborious method has been superseded by the use of an elevator, which extends from a short distance above the top of the wharf to the water's edge, provision being made for raising or lowering the lower end according to the stage of the tide. This elevator is slanting, and is made of an endless chain operating in a shallow trough. About every 2 feet there is attached to the chain a crosspiece of wood. At the top of the elevator are chutes which deliver the fish at various convenient spots on the cutting-room floor.

A recent invention, which is rapidly coming into use, is the unloading scow. This is a scow divided by kid boards into compartments. On the side is an opening which, when not in use, is closed by planks dropped into grooves. The filled scow is run alongside an elevator with a flaring mouth box at the lower end. A chute is placed between the scow, opposite the door, and the elevator, the door opened, and the fish allowed to slide by gravity into the box, then up the elevator to the fish floor. As one compartment is emptied another is attacked by removing the partition boards, and so on until the scow is empty. Should the fish stick, a hose with running water is run a foot or more down into the pile, which loosens the fish and causes them to move freely. By the use of these scows the fish are unloaded in a very short time, with but little labor, and are not marked by pew holes, as under the old method.

If the salmon have been in the scows for from 20 to 24 hours they are used as soon as possible after being delivered at the cannery; otherwise that length of time is usually allowed to elapse, the cannermen claiming that if not allowed to shrink the fish will be in such condition that when packed much juice will be formed, and lightweight cans will be produced. The danger of canning fish that are too fresh, however, is of minor importance as compared with the tendency in the other direction.

Before dressing the fish a stream of water is kept playing over them in order to remove the dirt and slime, after which men with pews separate the different species into piles.

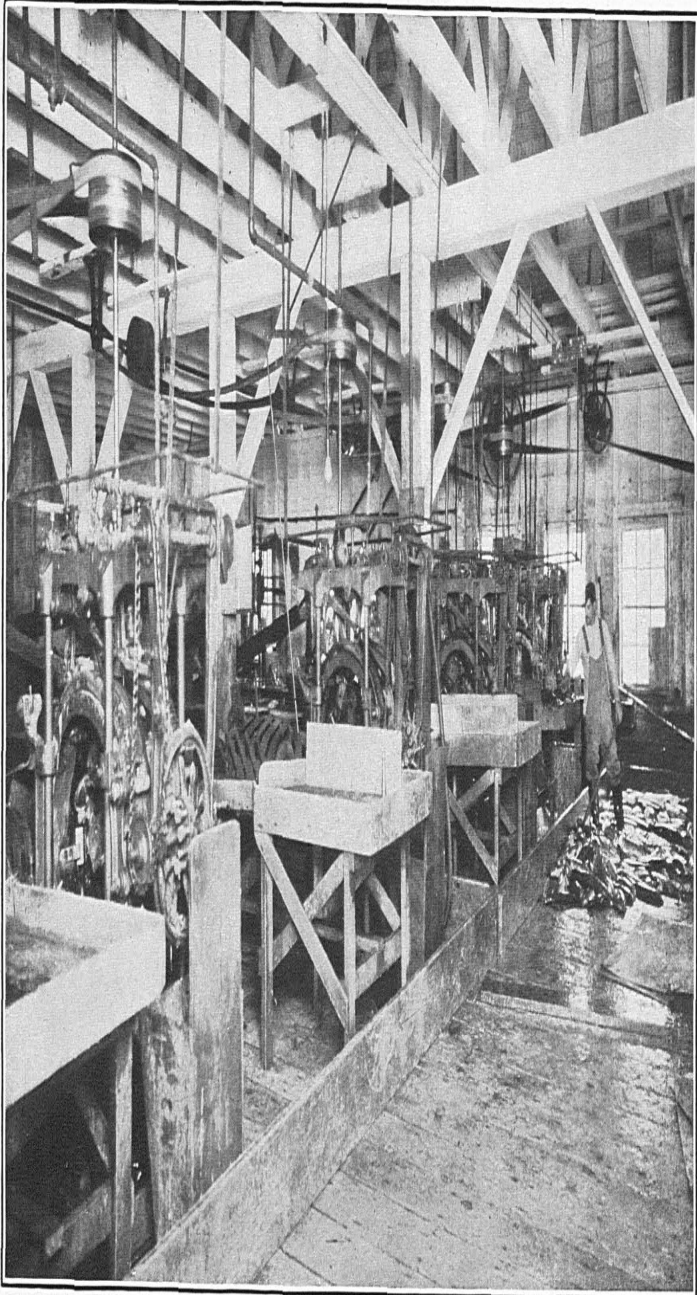


FIG. 28.—A BATTERY OF "IRON CHINKS."



FIG. 29.—CUTTING SALMON INTO PIECES OF A SIZE TO FIT THE CAN.

DRESSING.

A number of the small canneries still use the old hand method of dressing the fish, and in such places the selection of the butchering or dressing gangs is of prime importance. Two men constitute a "butcher's gang," and the number of these gangs is dependent upon the output of the plant. Boys place the fish, with the head out, upon the cutting tables. One man cuts off the heads, and is followed by another who removes the fins, tails, and viscera. The offal is thrown into a chute, whence it passes into the water under the cannery or into a scow moored underneath, while the dressed fish is transferred to a tank of water, to be scaled, washed, and scraped. It is then passed to another tank of water, where it receives a second washing, scraping, and final brushing with a whisklike broom, which removes any offal, blood, and scales that were overlooked in the first washing, after which it is removed to large bins on either side of the cutting machine.

The most useful cannery inventions in recent years have been of machines for doing the work of the dressing gangs. The one commonly known as the "Iron Chink," now in general use in canneries where such machines are employed, was first used in 1903 at Fairhaven (now Bellingham), Wash. It removes the head, tail, and fins and opens and thoroughly cleans the fish ready to cut into pieces for the cans. By the use of these machines the dressing gang is almost entirely done away with, dispensing with 15 to 20 men. This same machine is now so arranged that the fish after dressing are also "slimed," i. e., the thick mucus covering the skin removed, and the inside of the fish cleaned.

CUTTING.

The usual method of cutting the salmon is by a machine. This is generally a large wooden cylindrical carrier, elliptical in shape, thus having a larger carrying capacity. Ledges or rests on the outside the length of the carrier are wide enough to hold the fish, and are slit in cross section through the ledges and outer casing to receive the gang knives. The latter are circular, fixed on an axle at the proper distances apart, and revolve at the highest point reached by the carrier and independently of the latter. The carrier and gang knives are set in motion, each revolving on its own shaft. As a rest on the carrier comes to a horizontal position, men stationed at the fish bins lay a fish on each ledge as it passes. Thence it is conveyed to the revolving gang knives and, after being divided, passes through on the downward course, sliding off the rest into the filling chute. The knives in these machines are so arranged as to cut the fish transversely in sections the exact length of the cans to be filled.

The rotary cutter shunts the tail pieces to one side, and these are carried by means of a chute to baskets. The tail pieces are generally canned separately. As the tail portion is much smaller, with less meat, it can not be placed in the cans with the middle and head sections without detracting from their value, but if packed under a distinct and separate label, as is now done, there is no reason why the tails should not supply the demand for a cheap grade of fish.

In some of the smaller canneries, especially in those packing flat cans, the gang knives are worked by hand. In this case, the knives are not circular, but elongated or semicircular in shape, tapering at

the outer ends. They are mounted on an axle having a large iron lever at one end, and when this lever is raised the ends of the gang knives are thrown up and back. The fish is then placed in position under them and the lever pulled forward, the knives, with a scimitar-like movement, dividing the fish.

The original method of cutting was by means of a long knife wielded by a Chinaman who stood at a regular butcher's block. Although his strokes were incredibly quick, the rotary cutting machine is a vast improvement over the old way.

SALTING.

Every can of salmon is seasoned with one-fourth of an ounce of salt, which, to insure uniformity, is added by mechanical means. A table is used, in the top of which are holes equal distances apart. On the underside of the top is a sheet-iron plate, with an equal number of holes, which slides in a groove at the sides, and is worked either by a hand or foot lever. Just below is an open space large enough to accommodate a tray holding 36 or 48 cans. A workman stands in front of the table and slides a tray of cans into the open space. He then throws a quantity of salt upon the table and immediately scrapes this off with a thin piece of wood, each hole being filled in the operation, and the salt being prevented from falling through by the iron plate underneath. The lever is then pressed, the iron plate moves forward until the holes in it are directly under the holes in the table top, when the salt drops through into the cans. This operation can be repeated four or five times in a minute. Most canneries now use a small salter attached to the filling machine and this deposits the required amount in the can as it is passing by on its way to be filled.

FILLING THE CANS.

Most canneries now use filling machines for all sizes of cans, although a few, more particularly those packing flat and odd-sized cans, still fill by hand.

The filling machine consists of a chute with a belt to which are attached wire racks about 4 inches apart, set at an angle to prevent the salt from spilling out, into which the salted cans are fed from the floor above and pass into the machine. At the same time the divided sections of salmon pass down another chute into the mouth of what looks like a hand coffee mill. They pass through here down a smaller chute and are forced by two dogs into a receptacle through which the plunger, or filler, passes. Here the plunger comes opposite the open mouth of the empty can, which when it reaches this point is caught by a clasp or hook and held in front of the plunger, which is immediately thrust forward through a chamber filled with salmon, cutting the fish longitudinally and at the same time filling the can. The next movement forces the can out upon a table. When running at full speed, one of these machines will fill about 80 cans a minute.

On being released by the clamp and rolling upon the table they are righted by a workman and pushed onto an endless belt, upon which they pass into the weighing machine. If of the proper weight, they pass through this machine, but if below the required weight the cans are shunted to one side, where workers add the quantity of fish needed, a supply of small bits being kept at hand for this pur-

pose. Generally the cans overrun in weight, frequently as much as 2 or 3 ounces. Occasionally a can is weighed on a small balance scales in order to see that the machine is in perfect adjustment.

After passing the weighing machine any bones and scraps of flesh which may be sticking up out of the can are clipped away by workers armed with scissors.

In the hand method the fillers stand on each side of a long table with a trough running down the middle from end to end. This is filled with the cut pieces of salmon, and the fillers, usually women and children, put large pieces into the cans at first and then smaller pieces to occupy the vacant spaces.

From the weighing machine the cans pass to the clinching machine, which attaches the top of the can loosely to the body in such a way that it allows the air in the can to escape, yet prevents the fish from coming in direct contact with the steam of the exhaust box. Also the water resulting from the condensation of steam, which accumulates in the exhaust box, is kept from entering the can and thus bleaching the flesh.

In many plants the cans are washed by jets of water or steam directed against them in a closed box as they are passing from the clincher to the exhaust box.

The cans then pass into a steam exhauster, consisting in one type of a box about 30 feet in length, in which are three endless-chain belts running side by side. Under and over each belt are steam coils, and under each of the lower coils are single pipes, which through small holes throw jets of live steam upon the coils, creating an intense heat. The cans pass along the first belt, are then transferred to the second belt, on which they return to the entrance of the box, whence they pass to the third belt, and continuing along this to the end pass out to the double seamer, the whole operation occupying from 5 to 15 minutes, preferably 15. One style of exhauster has 10 ovals formed by the pipe, and the cans pass along these from side to side of the exhauster until discharged at the far end. Another type is formed of a long tube through which the cans pass and are heated by perforated steam pipes. Upright exhausters, in which the cans travel along a spiral, are also in use. By this means the contents of the can are heated and the greater part of the air exhausted, which is the object of the first cooking in the retort under the method formerly in general use. In Alaska, where 1-pound tall cans form the bulk of the pack, the cans are exhausted at a temperature from 206° to 212° F., 210° being the favorite.

A recent invention, which the inventor claims will do away with the steam exhaust box, and thus save a large amount of valuable floor space in the canning "line," is the power vacuum pump, known as vacuum exhausting machine, by means of which air is exhausted from the cans, accomplishing the same purpose as the steam exhaust box. Some of these machines have been in active use for several seasons, with most satisfactory results.

Leaving the exhauster the cans pass to the double seamer, which fastens the cover on tightly with a double seam or crimp. It should be stated that no solder is used in attaching the top on the can, the curled flanges of the cover being coated around the outer edge with cement or other sealing fluid to take its place. Solder, however, is used in joining the side seam of the can, this being done when the can

is manufactured. The cans then leave the machine on an endless conveyer, pass through a machine which washes the outside of the cans, and thence to the men who transfer them to the coolers, which are immediately placed upon the trucks and run into the retort for the one cooking they are to receive. By the use of these cans the soldering machine used in the old-style method is done away with. It also does away with the first cooking and the subsequent venting and soldering, a saving both in labor and time consumed.

COOKING.

The processing time varies in each district and sometimes for each species. In Alaska 1-pound tall reds, cohos, chums, and pinks are generally cooked from 90 to 120 minutes, at 12 to 18 pounds pressure and at a temperature of 242° to 248° F. One-pound flats and half-pound cans are generally cooked about 10 minutes less time. Owing to their larger bones, king salmon are generally cooked from 10 to 20 minutes longer than the other species; steelhead trout also.

On Puget Sound 1-pound tall sockeyes, cohos, and pinks are generally cooked for 90 minutes at a pressure of 10 pounds and at a temperature of 240° F. Halves and 1-pound flats are generally cooked at the same temperature but for only 80 minutes. Chum tallies are generally cooked for 105 minutes at a pressure of 10 pounds and at a temperature of 240°; while spring or king salmon are cooked for 120 minutes at a pressure of 10 pounds and at a temperature of 240°.

It is the custom at all canneries, no matter what the system, to allow about 5 minutes at the beginning of the cooking to work up the required heat of the retort, and when cooking is completed there is a like period for reducing the temperature and pressure before opening the doors. The cooking times given above are exclusive of the two 5-minute periods noted here.

It should be distinctly understood that the processing times noted are only approximate. The condition of the fish, the weather—whether hot or cold, rainy or dry—etc., all must be taken into account. The canner can not go far astray, however, if he keeps generally within the narrow margins noted above. In the early days much secrecy and mystery was thrown about the cooking, and the work was carried on in a separate room, known as the "bathroom," under lock and key. The first cooking was done in common tubs. The early retorts were made of wood. Later, round iron kettles were substituted, nearly one-half consisting of cover, and round crates were used for holding the cans. At the present time only rectangular horizontal iron or steel retorts are used, and access to these is had by means of miniature railroad tracks.

For many years cannery men believed that the double cooking of salmon was absolutely necessary, but in 1898 F. A. Seufert, at his cannery on the Columbia River, at Seuferts, Oreg., a short distance above The Dalles, discarded this idea, and has since used a one-cooking method. By the new process the cans are tested for leaks after the center hole in the top is soldered up, as before, and are left in the retort 70 minutes at 245° F. and 12 pounds steam pressure. According to its originator, this method saves more than one-half the labor in the bathroom, saves nearly one-half the labor in washing the cans after cooking, and also better retains the color of the fish.

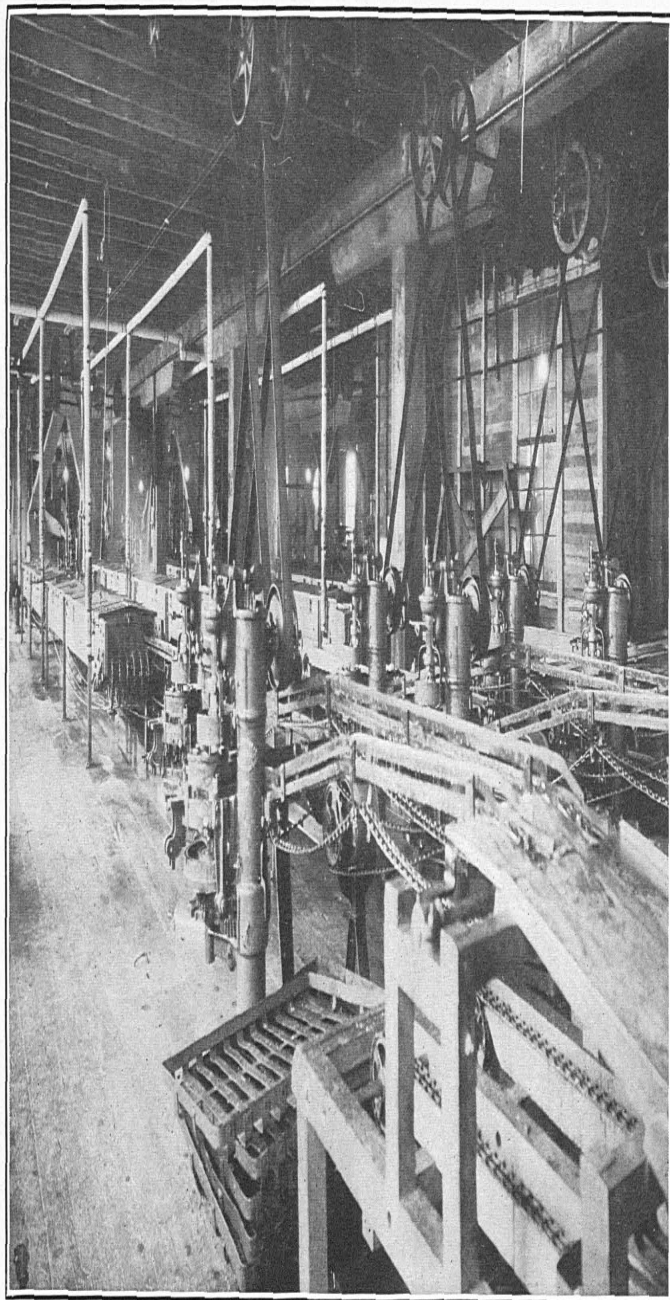


FIG. 30.—EXHAUST BOXES AND THE DOUBLE SEAMERS.



FIG. 31.—COOKING THE SALMON IN RETORTS.

REPAIRING CANS.

Imperfect cans which are discovered after cooking and are repaired at once and whose contents are recooked are still very good, the only difficulty being that by blowing or venting them a second time they lose weight. The above goods usually go in with the regular pack of their kind and are not classed as regular "do-overs." The latter were generally defective cans, which, owing to pressure of other work, could not be repaired until considerable time had elapsed, by which time decomposition had set in. The cans which can not be repaired immediately are now thrown onto the cannery dump.

On coming from the retort the coolers are lowered into a bath of lye, or, as in some canneries, the cans are run through such a bath on an endless belt, which, with the aid of a slight rinsing and a few rubs with a brush over the top, removes from the can all the grease and other material. The belt then passes them into another bath where the lye is washed off in hot fresh water. The cans then go to the cooling room, where a stream of water is played upon them, or during rainy weather are placed out of doors upon the wharf, and there allowed to cool, in order to stop the heat inside the can from continuing to cook the fish. In some canneries the lye bath before cooling is dispensed with, as the earlier washings are supposed to have cleaned the cans.

The top and bottom of the cans contract in cooling, and for several hours a sharp popping noise is heard. Here, as in nearly every process through which they pass, the cans are again tested, this time by tapping the tops with a small piece of iron about 6 inches long, or, sometimes, a 12-penny nail. The sound conveys to the ear of the tester an unmistakable meaning as to the condition of the can, and the faulty cans that escape notice during the other tests are almost invariably found in this one.

LACQUERING.

A common custom in the salmon-canning industry, but one that is not common in the canning of vegetables, fruits, etc., is that of lacquering the cans. This idea of protecting the can on the outside has been followed from the very beginning, for two reasons: (1) That the English market which, at that time especially, absorbed the greater part of these goods insisted on their shipments being finished in this way, and (2) from the fact, as these canners speedily found out, that if they did not protect their cans in some way enormous losses through rust would ensue.

The first experiment of this nature was to paint the cans by hand with red paint, treating each singly. Next a composition of logwood extract and alcohol was tried, which, however, did not produce satisfactory results for a very plain reason—the can was dyed instead of being lacquered. The next attempt was to varnish the cans with a japan varnish reduced with alcohol, but this was found to dry too slowly for speedy handling. After extended experimentation the quick-drying brown lacquer of the present time was evolved, which carries asphaltum in the form of an asphalt varnish as its base, this being supplanted in some cases by gilsonite. This lacquer can be procured in either a heavy or light body, is generally reduced with ben-

zene or gasoline, and is applied according to the requirements of the market, which in some localities demands a heavy coating and in others a much lighter finish, the latter giving a rich golden brown color. Some experiments have also been made in using brighter colored lacquers for this work. Several of these, made to give a bright golden, copper, or other color, are extremely attractive in appearance, while at the same time protecting the tin against rust quite as well as the brown.

The industry soon outgrew the hand method of lacquering, and the process which for a number of years was universal in the trade and is still used by some canneries succeeded it. For this there are a number of rectangular box vats about 40 by 80 inches and 18 inches in depth, the number varying with the capacity of the cannery. These are usually lined with galvanized metal and provided with a grid-iron-shaped iron frame, hung from a windlass or other tackle for lifting or lowering from top to bottom of the vat. The cans are loaded on this gridiron, being placed in an inclined position to allow the draining of the lacquer, and are lowered in the vat sufficiently to submerge them in the lacquer with which the vat is charged to a depth of 7 to 10 inches. The loaded gridiron is then raised to the top of the vat and the cans allowed to drain and dry before piling. This method, while being more effective in regard to the volume of work, was still of necessity a very slow and tedious operation. In damp or rainy weather, especially when it is not possible to open warehouse doors and windows, the gas arising from a number of these vats makes effective drying almost impossible.

Another principal objection to this method of lacquering, which applied also to all earlier attempts, was the impossibility of obtaining an even coat of lacquer when the can was allowed to dry in any stationary position. There was also a large waste by evaporation.

Notwithstanding repeated efforts at invention, however, it was not until 1901 that an effective machine for handling this difficult work was put on the market. The apparatus now in use by a number of canneries receives the cans on a revolving wheel fitted with rests for holding them while passing through the lacquer bath. From here they roll upon an endless chain which revolves the cans as they pass through a long box in which a hot blast dries them before they reach the end of the machine. The rotating or rolling motion given to the can after the lacquer bath, preventing the lacquer from draining to and consequently accumulating on any part of its surface, also has the effect of distributing the lacquer evenly and results in a clean and neatly finished can. The air blast facilitates the work of drying to such an extent that it requires only about two minutes after being deposited on the drying bed of the machine for the cans to be ready for handling, while the quantity of cans which can be handled in a day is vastly greater than by the old method.

A few flat and oval cans are not lacquered, but are protected from rust by wrapping in tissue paper, over which the label is placed.

Several of the largest operators have stopped lacquering the sides of the cans, depending upon the label to protect this portion from rust. Enameled ends are used, and, as these are bought from can makers, these operators are thus enabled to get away entirely from the dangers of lacquering.

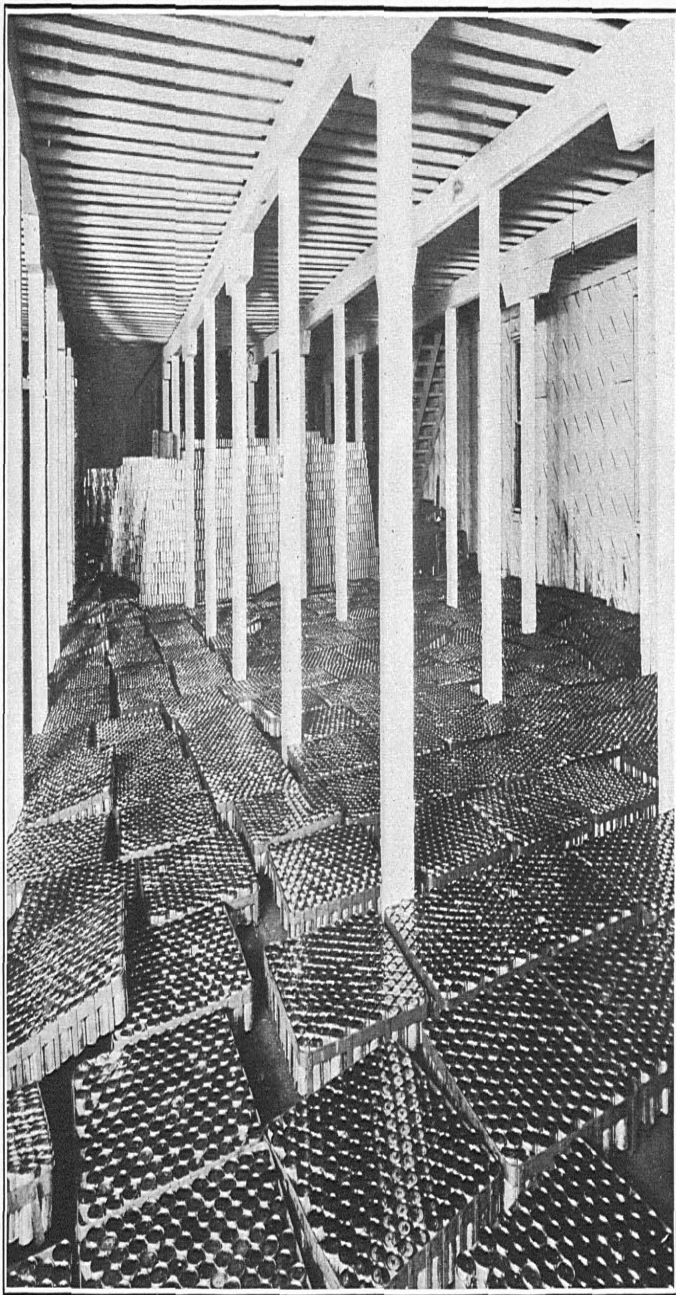


FIG. 32.—COOKED SALMON CANS COOLING.

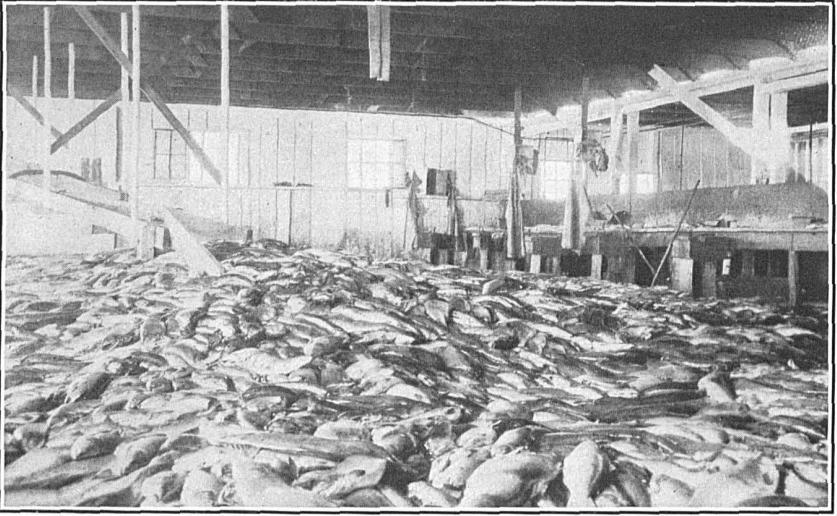


FIG. 33.—SALMON ON THE FLOOR OF THE FISH HOUSE.



FIG. 34.—SALMON CAN-LABELING MACHINE.

LABELING.

While machines have been made for this purpose, and some of them are in use, the work is usually done by hand. A number of men or women seat themselves about 4 feet apart in front of the pile of cans. Each man has in front of him a package of several hundred labels, and by bunching them on a slant so that successive margins protrude beyond each preceding, he can apply paste to the entire number with one stroke of the brush. A can is placed on the label, is quickly rolled, and the label is on much quicker than one can tell it. Each man places to his right the cans he labels, forming a pile of length and width equal to his unlabeled pile, and when the entire lot has been labeled it has been shifted only about 4 feet. Cans of fancy brands of salmon put up on the Columbia River and in the Puget Sound region are wrapped in colored tissue paper before the label is put on. Cartons similar to those used by the sardine packers would make good containers for fancy brands and would be much cheaper than the present method.

Some of the canners now have their labels lithographed directly on the tin, and the whole covered with a transparent lacquer.

Several attempts have been made to popularize salmon packed in glass and porcelain jars, and while these have met with some favor, it was not sufficient to warrant a continuance of the practice for any length of time. But few are being so packed at the present time.

BRANDS.

A very important feature of the canning industry is the selection of appropriate brands or labels for the various grades of salmon. Each company has a number of these, which it has acquired either by designing them or by absorbing another company which owned them. A well-known brand has a value in itself and sometimes is a very important asset. A company will sometimes market a considerable part of its product in one section, and here, where the consumer has become familiar with the brand and pleased with the contents of the can, he will ask for and accept no other, despite the fact that the latter might be, and probably is, the equal of the product he has been using.

For many years but few salmon canners appreciated the value of a can label, and it has taken some bitter experiences to drive home to the rest that a properly designed label placed upon good goods and the owner protected in its use by the law has real value, just as much as boats, nets, buildings, machinery, or the thousand and one material things required to carry on the business.

A free trade definition of a label would be that it is an artistic representation or intellectual production, stamped directly upon an article of manufacture, or upon a slip or piece of paper or other material, to be attached in any manner to manufactured articles, to bottles, boxes, and packages containing them, to indicate the contents of the package, the name of the manufacturer, or the place of manufacture, the quality and quantity of the goods, directions for use, etc.

Labels are subject to the copyright law and should be registered before use or publication. If not registered, there is no protection in law against infringement. The continued use of a label, however,

will give the person so using a certain proprietary right in it, which can be enforced in a court of equity and may be defended by injunctions, which will generally be granted. Such proceedings are expensive, annoying to a busy man, and at best will protect one only after at least a certain amount of damage has been done, and it is far safer to avoid this by registering the label at the time of issue, which will give one the further advantage in that a description of the character and quality of the article labeled can be set forth, which will, to a certain extent at least, be protected with the label.

The commercial value of a label and name is represented by the more or less general demand for the goods protected by it. In the canned-salmon industry, as in that of other food-packing industries, certain labels, through the good quality of the goods marketed under them and the publicity created for them, have become of very considerable value to the owners. A case in point is the label Royal Crown, owned by the late R. D. Hume. This was one of the earliest brands marketed in England, and some years later a certain Liverpool firm of salmon handlers paid Mr. Hume the sum of \$10,000 for the exclusive right to its use in England.

In designing a label there are several things which should be borne in mind. It should bear an easily remembered name and design; a name difficult of pronunciation should be avoided at all costs. For many years glaring red labels have been popular, but the success met with by those using more subdued and artistic designs and coloring indicates that the public appreciate them more than they do the older and coarser types. The design should be as simple as possible, as experience has demonstrated that a simple form—so simple that it can be fully understood by a mere glance—will gain by regular repetition, while a more complicated design will lose in this process.

A good many now in the business still remember the small label that was used on salmon cans before 1870. Labels about 3 by 5 inches in size, printed in one color, on white or colored newspaper, served merely the purpose of distinguishing cans, telling contents and manufacturer, and were without commercial value. About the year 1870 a few cannerymen commenced to import from the East and Europe full-sized labels, i. e., labels that went all around the can. These were called by some "Pennington" labels, as a firm of that name supplied quite a number of them.

For some years they were used for the best grades only. They were printed in four and five colors, the design showing invariably a number of panels of different shapes and sizes. The lettering was not always plain and sometimes even intentionally irregular and puzzling. The colors were placed side by side, in boldest contrast, without any attempt to harmonize them.

It was soon discovered that the highly colored panels, while striking, lost all effect when massed on the retailer's shelves, and the different brands looked so much alike that the individual designs could not well be remembered by the customer, the only really distinctive feature being the name, and that was generally printed so small and indistinct that it could not be readily seen at a distance.

To remedy these defects, the designers soon reduced the number of panels and subdivisions, increasing meanwhile the size of the remaining ones and filling them with distinctive designs, still colored as simply as before, with no attempt at blending of colors. The back-

ground, at first perfectly plain, commenced to show patterns more or less complicated, and at times quite pretentious, so as to take away from the design proper.

Gradually the panel design disappeared. In place of it some showed one continuous picture on the label, which was very unsatisfactory and soon disappeared, as only a fraction of the picture could be seen at one time. Others had two subdivisions, one showing the name of the brand with its illustrations, occasionally used as a trade-mark, the other showing the article packed in the can, both named and illustrated. Unfortunately, these subdivisions were so large that the roundness of the can prevented one from seeing the picture as a whole, but this was soon remedied by making the subdivisions narrower and filling in between with directions, weight of contents, etc.

From this point on the general plan of labels underwent few changes except that the work, both of the artist and pressman, improved wonderfully, some of the labels now designed and printed being real works of art.

Up to a few years ago one of the most serious evils in the trade was the use of misleading and lying brands. The high-grade product would almost invariably be correctly and fully branded, but "chums" and "pinks" were usually branded as "Fresh salmon," "Ch ice salmon," etc., which would deceive all persons but those well acquainted with the industry. "Do-overs," and very poor fish, were usually marketed under a brand which bore the name of a fictitious company or of no company at all.

The passage of State laws of varying degrees of efficiency governing the branding of salmon helped slightly to remedy this condition of affairs, but it was not until the pure food and drugs act, approved June 30, 1906, was put into force by the Government that any radical improvement was noticeable. At the present time but few misleading brands are in use.

BOXING OR CASING.

A case of salmon generally contains 48 one-pound cans or their equivalent, i. e., 24 two-pound cans or 96 half-pound cans. Some canneries pack their half-pound cans in cases of 48. These cases are usually made of wood and cost from 9 to 11 cents each knocked down.

CAN MAKING.

Some of the canneries in the coast States and Alaska purchase their cans ready-made, but the usual method is to purchase the sheet tin and make up the cans in the canneries. This is especially necessary in Alaska, as it would be impossible to find room on the cannery ships for such a bulk as they would make in addition to the other supplies necessary. Furthermore, the making of cans provides work for a large part of the crew, otherwise unemployed while the rest are getting ready the other necessary paraphernalia. The work is done by machinery and occupies several weeks' time.

Of recent years the objection to the great amount of space occupied by the cans when shipped by freight has been overcome by making the body of the can, pressing it flat, and shipping it in this compact shape along with the ends. At the cannery is a machine for rimming the flattened body into a round shape once more, when the end can be put on with the regular double seamer.

CANNING SMOKED SALMON.

A number of ventures in the line of canning smoked salmon have been made on this coast, but most of the pioneers were not content or able to invest the amount of capital needed and wait the time required to create a demand for such products, and soon quit.

One of the leading British Columbia packers, H. Bell-Irving & Co., some years ago put up in cans some pink salmon which had been treated to an artificial smoke in a vat, and these are said to have made a favorable impression in Australia. Another canner operating on the Fraser River smoked pink salmon, and then, cutting them to the proper length, packed them dry in half-pound cans.

In 1908 the Columbia Canning Co. put up at its cannery on Chilkoot Inlet, Alaska, some smoked salmon which had been shaved into thin strips like dried beef. These, called "Flaxamo," were packed in oil and were very good, especially in making sandwiches.

In 1915 two companies began in Seattle the smoking, slicing, and canning of coho and king salmon. These were put up in oblong flat cans of various sizes, similar to sardine cans, 2½, 4½, and 7½ ounces, respectively, while for a special trade a 7½-pound can was also packed. These fish were cut quite thin, about 40 to 50 slices to the pound, and were packed in hermetically sealed cans with cottonseed oil. The fish were all hard smoked before slicing and canning.

The same companies are also putting up kippered salmon in cans.

Salmon loaf, made by mixing salmon with flour and various other ingredients, thus producing a paste, is also being canned by several packers.

A straight salmon paste, made solely from the flesh of the salmon, and mixed with oil and spices, is being manufactured by one of the leading packers.

HOME CANNING.

At a number of places along the coast it has become the custom for the thrifty housewives to do a little home canning of salmon for winter use when the fish are abundant and cheap, and they find canning salmon as easy as canning vegetables and fruit. The fish are dressed, skinned, and the backbone removed. It is then cut into transverse strips of a size to fit either a pint or a quart glass jar, whichever is to be used. The jars are then filled with the pieces, salted to taste, the rubber ring put on, after which the can cover is put on loosely so that the steam may escape. Strips of thin wood are placed at the bottom of a kettle or wash boiler and the cans set down on them. Enough cold water is then poured into the kettle to bring it up to within about 2 inches of the top of the cans. The kettle is then put on the stove and, after it comes to a boil, note is made of the time, and the cans are cooked from one and one-half to three hours. There seems to be a great variation in the time of cooking on the part of the operators. Some even cook only one hour, but these generally use a preservaline. About three hours seems to be the best time, as the bones are then quite soft. At the end of the cooking period the tops are tightened, the kettle removed from the stove, and the water and cans allowed to cool in the kettle.

Portable retorts and hand doubleseamers are now available for household use, and as a result many are using tin cans as containers. A recent improvement on the doubleseamer permits of the use of a tin container three times, thus materially reducing the heavy expense for cans.

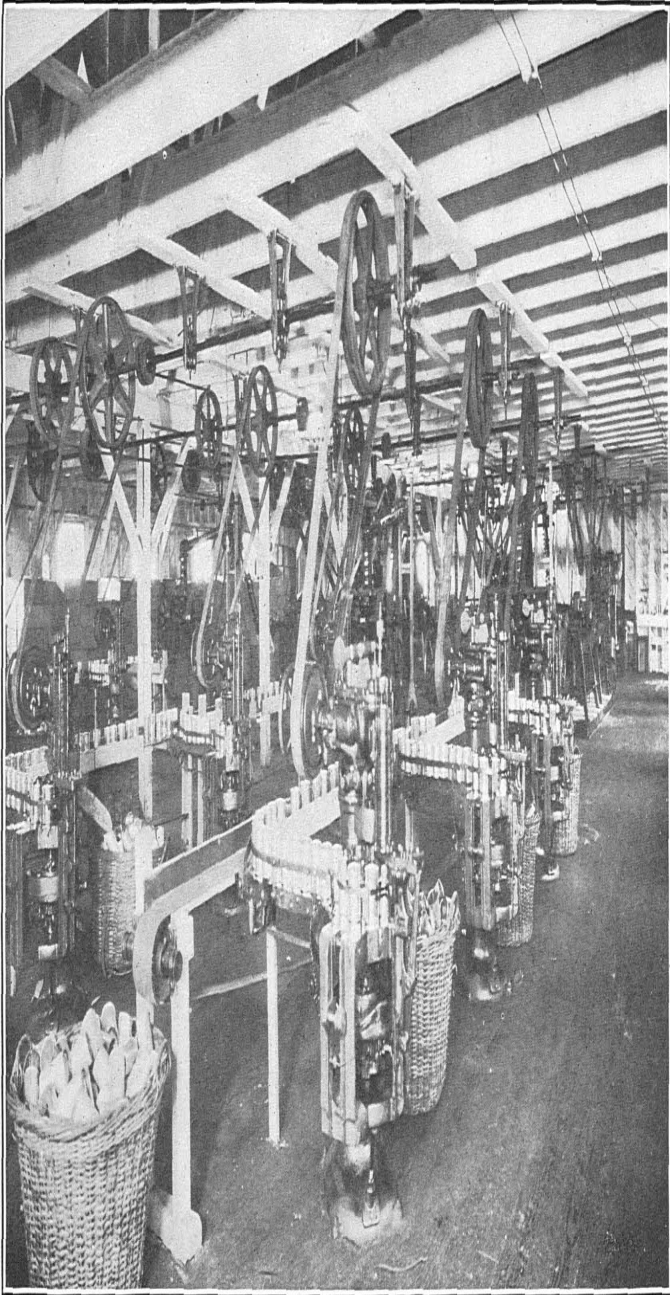


FIG. 35.—MAKING SALMON CANS.

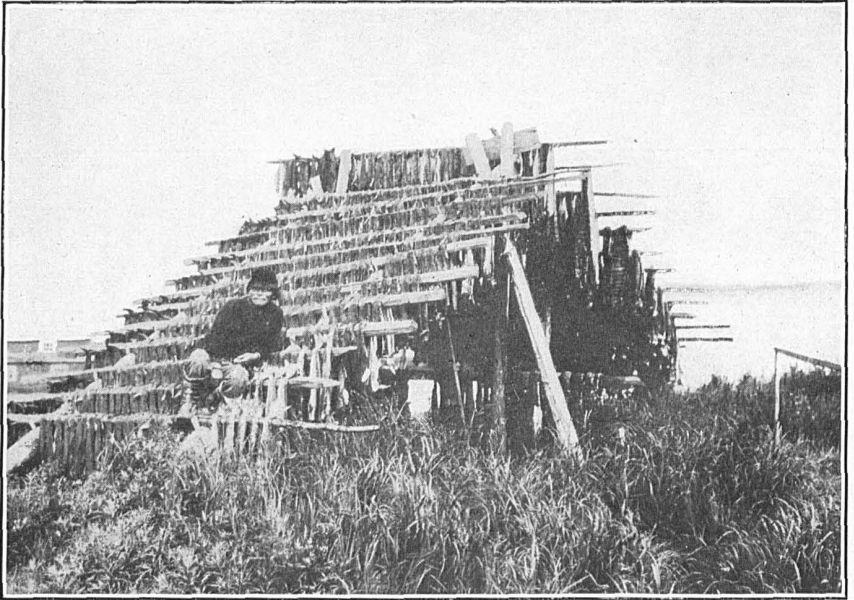


FIG. 36.—AN INDIAN SALMON DRYING RACK, BERING SEA, ALASKA.



FIG. 37.—THE BARONOVICH SALMON SALTERY; THE OLDEST SALTERY IN ALASKA.

INSPECTION OF PLANTS PACKING CANNED SALMON.

For some years there has been a desire on the part of a majority of the salmon canners for some form of inspection of the plants and of the pack made. The widespread suspicion that the salmon pack of 1918 was considerably below standard, which suspicion resulted in heavy monetary loss to the packers, gave a great impetus to this desire. The National Canners' Association, an organization composed of the majority of the canners of the United States, a few years before, at the request of the sardine canners of Maine, organized them into the sardine section of the association, and by an assessment of a small sum per case raised sufficient funds to provide an inspection service to see that the plants were put into and kept in a satisfactory sanitary condition and also to inspect the goods packed and, if they were up to the standards fixed in advance, to affix to the cans suitable certificates attesting this.

At its annual convention in 1919 the association decided to extend a similar service to any other section willing to assess itself to pay the necessary expense. In explanation of its plan the association issued the following circular shortly after the convention had adjourned:

1. This service is installed by the National Canners' Association, with which a direct contract is made by each canner.

2. It runs for a term of three years and is applied in States or local territories where similar conditions are to be met.

3. The cost of the inspection is paid by the canners in the territory named through an assessment which, in the past, has been collected by the can companies with which each canner deals. This cost is added to the can invoice, and is remitted by the can companies to the treasurer of the National Canners' Association each month.

4. In order to meet the preliminary expenses of the inspection before the regular fund becomes available, each canner who signs a contract will pay into the treasury of the National Canners' Association, within 30 days after signing the contract, an assessment of one-half cent per case on his pack of 1918, on the commodities to be inspected. Should the total sum raised during the season be greater than the expenses of inspection during the season, a refund of all or a portion of the one-half cent per case will be made after a small sum is reserved to maintain a consistent surplus.

5. The treasurer of the National Canners' Association distributes this money to the local sections where the money is to be spent.

6. The National Canners' Association has no profit in this inspection—its only requirement being that each canner under inspection is a member of the association, and pays the membership and general dues.

7. A director or supervisor of inspection is appointed by the National Canners' Association who in turn appoints his assistants. The salaries of the director or supervisor and his assistants are fixed by the National Canners' Association which works in harmony with the judgment of the advisory board. The director or supervisor must be a man of superior ability, preferably one with scientific training. He must also be a good executive.

8. The director or supervisor acts in conjunction with the advisory board which may consist of five, seven, or nine members. This advisory board is elected by the canners in the States or Territories covered. The duties of this board are what its name implies, "advisors." In point of actual experience, it is found this advisory board is able to settle all practical disputes and misunderstandings which may arise under this method of inspection. There is always a final appeal to the executive committee of the National Canners' Association.

9. The National Canners' Association does not promise or guarantee to issue certificates of inspection, but in territories where inspection has existed, the certificates have been issued on products which merit the same. It should be distinctly understood, however, that this does not form any part of the contract.

10. The cost in territories where inspection has been applied has been one and one-quarter to two cents per case. It is impossible to advise in advance definitely what the cost will be, as the local conditions differ. It should be borne in mind that there must always be a sufficient number of inspectors to protect the inspection, and

if canners are widely scattered, this, as a matter of course, will increase the number numerically—not in proportion to the pack.

11. The inspection covers sanitation in plants, quarters for employees, and sanitation of the product. It is also proposed, as the work progresses, to apply inspection to the character of the raw product, and grading of the same. This grading on staples will be worked out on recommendation from the advisory board, which will be harmonized so as to give a uniform grade to each product through the entire country.

12. In localities where inspection has been installed, local laboratories purchased and financed by the funds for inspection, have been found most useful. These laboratories furnish prompt facilities for canners for testing their product and working out manufacturing problems which come up during the activities of the canning season. These laboratories are established and work in harmony with the research laboratories of the National Canners' Association, Washington, D. C.

13. This inspection can well be made the basis of a consistent publicity advertising campaign, should the industry adopt it generally, in time to guarantee its working satisfactorily during the canning season of 1919. The present plan, however, does not include this publicity campaign, as this is a matter which must necessarily be passed upon later by the canners themselves.

14. Copy of contract with each canner is herewith inclosed, or information.

On February 17, 1919, the matter of adopting this inspection system was submitted to the salmon canners of the Pacific coast and accepted by a large majority. A chief inspector and a number of assistants were appointed, who carried on a sanitary inspection of the various canneries during the following summer. It is the intention ultimately to extend this inspection to the pack itself.

INVESTIGATION OF CANNED SALMON INDUSTRY.

In 1917 and 1918 an investigation of the canned salmon industry was made by the Federal Trade Commission and many valuable statistical data were gathered and published.^a

The following table shows, with other data, the average number of fish per case of each grade packed in the different geographical sections.

NUMBER OF FISH CANNED AND PURCHASED, NUMBER OF CASES PACKED, AND AVERAGE NUMBER OF FISH PER CASE. ^b

1916.

District.	Grade of fish.	Number of companies reporting.	Number of fish canned.	Number of fish purchased.	Percentage of fish canned which were purchased.	Number of cases packed.	Average number of fish per case.
West Alaska.....	Kings.....	7	111,381	27,175	24.39	26,003	4.28
Central Alaska.....	do.....	6	25,483	11,602	45.52	5,884	4.35
Southeast Alaska.....	do.....	20	148,288	136,597	92.12	34,344	4.31
Puget Sound.....	do.....	15	180,580	80,574	44.62	25,606	7.05
Columbia River.....	do.....	9	865,392	842,127	97.31	265,376	3.26
Outside rivers ^c	do.....	7	60,656	60,143	99.15	18,607	3.23
Totals and averages.....		64	1,391,778	1,158,218	83.66	375,790	3.73
West Alaska.....	Reds.....	8	16,664,413	1,017,042	6.13	1,223,950	13.52
Central Alaska.....	do.....	6	1,387,647	547,261	39.43	118,891	11.67
Southeast Alaska.....	do.....	29	1,609,978	784,503	48.70	123,767	13.00
Puget Sound.....	do.....	17	2,593,240	168,584	6.50	198,205	13.04
Columbia River.....	do.....	8	775,382	439,900	56.73	67,334	11.52
Outside rivers ^c	do.....	1	59,352	59,352	100.00	4,645	12.78
Totals and averages.....		69	22,990,012	3,016,642	13.28	1,736,792	13.24

^a Report of the Federal Trade Commission on Canned Foods. Canned salmon. December, 1918. 83 pp. Washington, 1919.

^b Report of the Federal Trade Commission: Op. cit., pp. 15, 16.

^c Coastal streams in Washington, Oregon, and California.

PACIFIC SALMON FISHERIES.

NUMBER OF FISH CANNED AND PURCHASED, NUMBER OF CASES PACKED, AND AVERAGE NUMBER OF FISH PER CASE—Continued.

1916.

District.	Grade of fish.	Number of companies reporting.	Number of fish canned.	Number of fish purchased.	Percentage of fish canned which were purchased.	Number of cases packed.	Average number of fish per case.
West Alaska.....	Medium reds..	4	394,048	46,619	11.83	86,078	10.92
Central Alaska.....	do.	6	305,246	131,998	43.22	37,275	8.19
Southeast Alaska.....	do.	29	1,018,014	505,937	49.67	117,422	8.69
Puget Sound.....	do.	17	1,099,374	677,485	61.62	110,658	9.93
Columbia River.....	do.	10	348,597	310,216	89.50	42,782	8.10
Outside rivers.....	do.	8	349,053	349,348	100.00	34,937	9.99
Totals and averages.....		74	3,512,332	2,331,819	66.38	379,152	9.26
West Alaska.....	Pinks.....	3	4,153,353	540,248	13.00	214,482	19.36
Central Alaska.....	do.	6	4,102,775	1,821,558	44.39	212,109	19.33
Southeast Alaska.....	do.	27	12,266,379	4,772,123	38.89	879,853	13.93
Puget Sound.....	do.	8	1,800,875	607	.....	70,979	25.37
Totals and averages.....		44	22,323,382	7,134,541	31.90	1,377,583	16.19
West Alaska.....	Churns.....	7	1,144,595	289,063	25.31	97,528	11.74
Central Alaska.....	do.	6	331,423	160,465	48.41	37,870	8.75
Southeast Alaska.....	do.	28	3,661,176	2,296,478	62.72	344,213	10.63
Puget Sound.....	do.	15	2,981,678	1,887,278	63.29	387,373	7.70
Columbia River.....	do.	8	374,370	358,255	95.69	62,043	6.34
Outside rivers.....	do.	5	110,809	106,973	96.53	16,896	6.56
Totals and averages.....		69	8,604,051	5,009,112	59.26	945,923	9.10
Columbia River.....	Steelheads.....	7	103,774	102,117	98.40	16,991	6.10
Totals and averages.....		7	103,774	102,117	98.40	16,991	6.10

1917.

West Alaska.....	Kings.....	8	107,590	18,407	17.10	21,398	5.03
Central Alaska.....	do.	9	34,158	19,872	58.19	6,675	5.11
Southeast Alaska.....	do.	22	283,643	202,693	71.46	45,674	6.21
Puget Sound.....	do.	18	209,360	105,731	50.54	53,485	3.91
Columbia River.....	do.	10	959,846	648,063	6.99	275,291	3.51
Outside rivers.....	do.	9	45,378	43,468	95.75	12,940	2.30
Totals and averages.....		76	1,639,975	1,033,234	63.00	413,463	3.96
West Alaska.....	Reds.....	9	21,449,913	1,192,000	5.56	1,433,780	14.90
Central Alaska.....	do.	9	2,271,939	974,653	42.89	189,921	11.96
Southeast Alaska.....	do.	33	1,964,993	1,074,658	54.55	158,582	12.03
Puget Sound.....	do.	27	4,731,861	1,233,489	26.00	372,467	12.73
Columbia River.....	do.	7	1,213,887	688,637	56.72	98,076	12.36
Outside rivers.....	do.	2	21,868	21,868	100.00	1,769	12.36
Totals and averages.....		87	31,654,511	5,185,305	16.40	2,254,505	14.13
West Alaska.....	Medium reds..	3	145,837	18,385	12.60	13,406	10.87
Central Alaska.....	do.	9	238,572	141,424	59.29	30,430	7.84
Southeast Alaska.....	do.	33	1,033,339	419,046	40.55	98,324	10.51
Puget Sound.....	do.	27	813,269	501,887	73.90	91,991	8.84
Columbia River.....	do.	10	728,221	587,879	80.72	47,861	15.11
Outside rivers.....	do.	10	394,779	376,224	95.29	34,417	11.48
Totals and averages.....		92	3,340,017	2,044,815	61.05	316,429	10.58
West Alaska.....	Pinks.....	2	3,958,391	1,175,748	29.70	219,508	18.03
Central Alaska.....	do.	10	5,221,887	2,172,476	41.62	324,230	16.11
Southeast Alaska.....	do.	33	24,166,834	10,473,748	43.30	1,362,187	17.26
Puget Sound.....	do.	26	11,805,693	6,361,891	53.80	858,396	13.68
Columbia River.....	do.	1	77,081	14,635	18.98	4,761	16.21
Outside rivers.....	do.	1	62,892	62,892	100.00	4,222	14.89
Totals and averages.....		73	45,292,778	20,261,300	44.90	2,778,304	16.29
West Alaska.....	Churns.....	9	527,982	194,962	36.92	64,215	9.74
Central Alaska.....	do.	33	728,514	418,419	57.43	79,208	9.20
Southeast Alaska.....	do.	26	4,087,578	2,554,968	62.49	480,895	8.50
Puget Sound.....	do.	27	2,547,467	1,832,350	72.71	249,390	10.22
Columbia River.....	do.	8	277,856	125,456	44.42	28,025	9.89
Outside rivers.....	do.	7	86,736	84,413	95.12	11,655	7.61
Totals and averages.....		119	8,258,103	5,228,548	63.31	903,448	9.14
Puget Sound.....	Steelheads.....	1	33	33	100.00	5	6.60
Columbia River.....	do.	10	138,421	145,581	105.01	22,234	6.71
Outside Rivers.....	do.	1	787	787	100.00	126	6.24
Totals and averages.....		12	139,241	146,401	105.00	22,365	6.22

• Coastal streams in Washington, Oregon, and California.

The following table shows the relative importance of different species within each district. In 1916 the red or sockeye salmon was the most abundant, but in 1917 the humpback had usurped this place by a small margin.

RELATIVE IMPORTANCE OF DIFFERENT SPECIES WITHIN EACH DISTRICT.^a

[Per cent which each species is of total pack by districts.]

District.	King or chinook.	Red or sockeye.	Medium red.	Pinks or hump-back.	Chum.	Steel-head.	Total, all grades.
1916.							
West Alaska.....	1.6	85.4	1.6	2.6	8.8	.....	100
Central Alaska.....	2.0	53.7	5.1	32.9	6.3	.....	100
Southeast Alaska.....	.8	11.8	8.1	57.7	21.6	.....	100
Puget Sound.....	5.5	11.4	21.4	.2	61.4	0.1	100
Columbia River.....	69.9	1.1	11.2	.1	13.5	4.2	100
Outside rivers.....	40.0	5.4	29.7	3.0	21.8	.1	100
Per cent of total.....	8.6	36.8	8.3	26.6	19.4	.3	100
1917.							
West Alaska.....	1.2	95.1	.3	.2	3.2	.....	100
Central Alaska.....	1.9	72.2	3.6	13.3	9.0	.....	100
Southeast Alaska.....	.9	6.5	4.5	65.3	22.8	.....	100
Puget Sound.....	3.1	21.1	6.4	51.7	17.7	.....	100
Columbia River.....	71.2	1.5	13.6	.1	9.9	3.7	100
Outside rivers.....	39.9	2.8	32.9	9.2	15.0	.2	100
Per cent of total.....	6.9	34.2	5.1	38.3	15.3	.2	100

^a Report of the Federal Trade Commission: Op. cit., p. 33.

The following table shows the relative importance of districts in the production of each species in 1916 and 1917. Southeast Alaska leads in each year, with 35.1 and 38.1 per cent, respectively. Western Alaska was second in 1916, but was forced down to third place by Puget Sound in 1917. In 1916 Central Alaska produced 21 per cent of the humpback pack, but in 1917 this was reduced to 4.1 per cent. Puget Sound advanced from 0.1 per cent of the humpback pack in 1916 to 30.7 per cent in 1917. Humpbacks run in this district only every other year.

RELATIVE IMPORTANCE OF DISTRICTS IN PRODUCTION OF EACH SPECIES.^a

[Per cent of total amount of each species packed in various districts.]

District.	King or chinook.	Red or sockeye.	Medium red.	Pinks or hump-back.	Chum.	Steel-head.	Total, all grades.
1916.							
West Alaska.....	4.9	59.9	4.9	2.5	11.8	.....	25.9
Central Alaska.....	4.0	24.8	10.5	21.0	5.5	.....	17.0
Southeast Alaska.....	3.3	11.2	34.4	76.0	39.1	.....	35.1
Puget Sound.....	6.9	3.4	28.1	.1	34.4	0.6	10.8
Columbia River.....	66.9	.3	11.2	.1	5.8	98.5	8.2
Outside rivers.....	14.0	.4	10.9	.3	3.4	.9	3.0
Total.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1917.							
West Alaska.....	3.4	53.5	1.3	.1	4.0	.....	19.1
Central Alaska.....	3.3	24.9	8.2	4.1	6.9	.....	11.8
Southeast Alaska.....	4.9	7.2	32.8	64.6	57.0	.....	38.1
Puget Sound.....	10.3	14.0	28.0	30.7	26.1	.....	22.6
Columbia River.....	66.7	.2	17.1	.0	4.1	98.4	8.4
Outside rivers.....	11.4	.2	12.6	.5	1.9	1.6	2.0
Total.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0

^a Report of the Federal Trade Commission: Op. cit., p. 34.

MILD CURING.

The beginning of the business of mild-curing salmon, or "sweet pickling," as it is sometimes called, is of comparatively recent date.

In 1889 a German dealer came to the Columbia River and tried to interest some of the cannery men in the business. J. O. Hanthorn, M. J. Kinney, and J. W. Cook were persuaded to prepare some, and the plant of the Northwest Cold Storage Co., at Portland, was used to keep the fish at a low temperature during repacking and preparation for shipment. These fish were shipped to Germany, but the shippers received no financial returns, word coming back that the fish were not satisfactory.

Owing to this lack of success from the first effort, no further attempt was made until 1894, when Mueller & Loring, of Chicago, put up a carload of mild-cured salmon at Kalama, Wash., and shipped it to Germany. In 1896 Charles Rucklés and Wallace Bros., of Kalama, packed several carloads for the German market. It was not until 1898 that the business was permanently established on the Columbia, the Trescott Packing Co. and S. Schmidt & Sons putting up plants at Warrenton and Astoria, respectively.

In 1900 the Trescott Packing Co. began packing the spring and fall runs, and the Sacramento River Packers' Association packed the fall run, on the Sacramento River, the business being carried on here every year since.

In 1901 the Sacramento River Packers' Association began at Monterey the mild curing of the spring salmon that were taken with hook and line in the open ocean.

S. Elmore & Co. started the industry in 1902 at Tillamook, and the business began on Puget Sound in 1901, when the San Juan Fishing & Packing Co. and the Seattle Fish Co. took it up. The Pacific Cold Storage Co. began the next year at Anacortes.

Prior to 1906 several of the Alaska cannery men put up each season a few tierces of mild-cured salmon, but it was not until this time that the industry really began as such. In that year J. Lindenberger (Inc.) started packing at Ketchikan, Alaska. The following year several other plants were started, and in 1910 almost all of the king salmon taken in southeast Alaska were mild cured. The same is true to-day.

For mild curing the fresh fish must be given greater care in handling than is the case with any other process. Care must be exercised to see that the flesh of the fish is not bruised or broken, and in order to make sure of this the handlers usually pack several fish in one box, with cracked ice over and around them if the weather is warm. As soon as a box is filled, it is put in the hold, where the boxes are stacked one upon another, but prevent more weight than is represented inside one box coming upon any one fish.

In dressing, the head is removed, care being taken to leave as much of the bony structure of the head as possible to assist in holding the side of the hooks when it is being smoked later on; the fish is then split down the belly to the vent, the entrails removed, when a cut is made on either side of the blood clot in the back, and the fish passed to the "washer," who holds the fish on its back in a slot on the table under a spray of water, and removes the membrane of skin which covers the inside of the backbone and inside of which a good

deal of thick blood lies, by means of a large spoon or some similar form of scraper. A knife should not be employed. Some curers do not remove the fins at this stage, while others do.

The body is then scored along the sides with a small knife, care being used to cut the skin only: this allows the salt to penetrate more freely and thus assist the process of cure. A specially prepared eccentric wheel is sometimes used for this purpose, which makes a series of small cuts varying from half an inch at the tail to $1\frac{1}{2}$ inches long at the shoulder, and from 2 to 3 inches apart.

The fish is now ready for the splitter, who turns it on its back with the open belly toward him and forces the shoulder down on a sharp-pointed nail, so the fish will not slip during the operation. A crosscut is first made across the root of the tail to the bone, but no deeper. Then the knife is entered at the vent, immediately above the bone, and a cut, which should go no farther back than the middle of the backbone, is drawn down to the crosscut already made. Then raising the lug with his left hand, the splitter enters the knife at the shoulder above the bone, and with one sweep from head to tail, separates the entire side. This is the more easily done if the fins have been previously removed. If the work is perfect, there will be no flesh left on the bone, but a line of fat will show down the center of the side. This improves the appearance of the fish and adds to its value.

In order to remove the bone from the remaining half of the fish, the splitter inserts the knife under the bone, about the vent, and draws down toward the tail, but care must be taken, as before, not to go farther back than the spine. The splitter now takes the fish off the nail, holding it by the lug, his left thumb resting on the upper, or inside of the fish, and his fingers on the lower, or skin side. The tail is now pointing away from the splitter, who enters his knife carefully under the backbone, and with one dextrous outward sweep separates the bone from the fish right down to the root of the tail. When abreast of the crosscut, however, he turns the knife sharply downward, and cuts off the fish the same as on the other side. As with the first half, no flesh should be left adhering to the bone, and the line of fat should show down the center. In other words, the two sides should be exactly alike.

The sides are dipped into cold water in the dress tank, and are then laid, skin side down, on the table with the thin or belly edge toward the front. A man then removes any blood remaining in the veins on the inside of the fish, by pressing it away from him toward the back of the fish, either with his fingers or with a spoon. If the blood is not squeezed out in this way the salt will harden it during the process of curing, and the flesh will become dark in color. The sides are then dipped in a tank of weak brine and crushed ice to give them a final wash, but should on no account be left to soak in the brine. Upon removal, they are again scraped to insure the removal of all the blood from the veins.

Great care must be used in handling the newly split sides, as they are very tender and may be easily broken or bruised. In lifting them by the lug or collar bone, the curer should have his fingers to the inside and his thumb to the outer or skin side; otherwise the skin may be broken.

The sides are then taken to the salter, who lays them, skin side down, on a salting table, on which has been dumped a quantity of dairy salt, and gently rubs the flesh with the salt, lifts it up with only such salt as will adhere to it, and places it in the tierce.

The tierces in which the salmon sides are packed are stout casks made of fir or spruce, bound with six strong galvanized hoops. They contain about 800 pounds of fish, but when full of pickle the gross weight of cask and content is between 1,100 and 1,200 pounds. A plug hole is bored in the head of the tierce.

Two or three handfuls of salt are thrown over the bottom of the tierce, then a layer of salmon sides, skin down, and two or three handfuls of salt are sprinkled over them. In packing two sides of fish, crossed head and tail are packed close to opposite sides of the tierce, the back or thick part of each side being placed close up against the side of the tierce. Other sides of fish are packed from the sides toward the center of the tierce, napes and tails alternately, the back of each side being drawn halfway up and resting on the side already laid. When complete, the layer should be perfectly level, and this depends a good deal on how the last or center piece is laid. Salt is sprinkled between each layer in the manner and quantity noted above and the process continued until the tierce is full. The tiers should be crossed in packing. The top layer should be placed with the skin up and have extra salt put on. From 85 to 100 pounds of salt are used to 800 pounds of fish.

The tierce is then headed up, after which pickle is poured in until the tierce is quite full. This pickle may be made with the same salt as is used for rousing and sprinkling the fish. Perfectly clear water should be provided and broken ice should be added in liberal quantities, if the weather is warm. Before using, the pickle should be strained through a fine sieve or a clean cloth, to remove froth and sediment. A centigrade saltmeter is used by most mild curers. The pickle is made to a strength of at least 90°, but it usually weakens to about 70° during the first 10 days of cure, whereas after repacking it should not readily come below 85°, and it should retain that strength for a long time.

When tierces have been filled with pickle they are rolled inside a cold-storage room, with a temperature of 35 to 38° F., where they may be tiered two tiers high. Very little variation in the temperature is allowable, as it would start the oil or fat in the flesh, allowing it to escape into the brine.

Unless the tierces are kept quite full of pickle the sides of fish are apt to be broken when the cask is rolled about. The tierces must be examined frequently to see that they are full of brine, as there are always small leaks, while the staves absorb more or less moisture. Furthermore, if the tierces were allowed to leak, ugly yellow spots would show on the parts of the fish that were left dry. Thus it is of the utmost importance, both during the two or three weeks allowed for pining and also after repacking, to see that they are kept full of pickle. Several gallons of pickle may be absorbed by each cask during the first two or three weeks of cure.

The actual shrinkage during the two or three weeks in which the fish lie in the first packing may be reckoned at 30 per cent. Fat, well-conditioned fish, especially those which are caught in the ocean, shrink less, but poor fish, especially those caught when well on their

way to the spawning grounds, shrink more—sometimes up to 35 per cent.

After holding the fish in storage for at least 20 and not more than 90 days they are taken out of the tierces. Each side of fish should be lifted out carefully, as described above, and sponged with a large sponge until all salt and slime are entirely removed, leaving only a clean, red side of fish. Either pure ice water or ice pickle may be used for this washing, but it will depend entirely on the quality and condition of the fish. Soft, poor fish would require pickle, but good firm fish may be washed in clean ice water.

The sides are then weighed and graded accordingly, 6 to 8 pounds, 8 to 10 pounds, and so on, being the grades. Sides of 11 pounds and over are called *large* fish, and "L" is marked on the side of the tierce. Some curers grade their sides from 9 to 11 pounds and class them as *medium* and mark them "M;" smaller sides are termed *small* and are marked "S."

After the sides have been graded they should be counted and repacked, the defective sides, such as thin-bellied, torn or broken, being put by themselves. Fish which are considered perfect are called No. 1; those which do not come up to that standard are termed No. 2, and are marked accordingly; while fish that have any taint of sourness are marked "T." In repacking, the sides of fish should be replaced as nearly as possible in their original position, those curved in shape being placed against the sides of the cask and straight pieces laid in the center of the tier. No salt is used in repacking, but as soon as the tierce is filled, the head put in, and the air test applied it is laid on its bilge and filled up with ice-cold pickle made to a strength of 90° salometer (90 per cent saturation) that can be made from fresh or salt water, whichever is handiest and cleanest, half-ground salt being used. There will be about 830 pounds of fish on an average in the tierce after repacking, and some 14 gallons of pickle may be required to fill the cask up. They are then put back into cold storage and pickled at the bilge daily for at least a week. If kept for any length of time, they would, of course, have to be tested, regularly—a tap with a hammer would do—and any leakage promptly rectified. If properly cured, the fish should keep in good condition for months in cold storage, provided the casks are sound and kept full of pickle.

On the head of each tierce are put the following marks: Initials of packer or packers; initials of place where packed; number of tierce (consecutive); number of sides in tierce, the tare, and the gross weight (weight of pickle not counted); quality of fish (I, II, or T); and size of fish (L, M, or S).

If of first quality, no mark is necessary, but second-quality and tainted fish have to be noted.

In the early days of the industry different preparations, which included salicylic and boracic acids, were used to help preserve the fish. This caused much complaint from the Germans, and finally their Government subjected our product to a rigid inspection, with most salutary results, as now it is one of the purest and best products put up on this coast, the use of acids being done away with entirely.

The king salmon is almost invariably the species mild cured, being the only one large enough to answer the requirements of the trade. In 1907 a Ketchikan (Alaska) packer put up a quantity of coho, dog, and humpback salmon, but he found so much difficulty in disposing

of the product that he abandoned further efforts in this line. A few cohos are put up each year.

The principal consumers of the mild-cured salmon are the smokers, who take them from the tierce, wash and soak them for a few minutes, and then have a practically fresh fish to smoke, and not, as in the days when hard-pickled salmon were used, one that had lost most of its oil and flavor through the excessive amount of salt needed to preserve it.

The greater part of the product put up on this coast goes to Europe, Germany being the principal consumer, but considerable quantities are sold in Norway, Sweden, and other countries, while the smokers of the cities east of the Rocky Mountains use large quantities every year.

In Germany, the principal market for mild-cured salmon, nearly all of the fish are smoked. One of the most popular ways of using the smoked salmon is in the making of sandwiches, and probably the greater portion of these are used in the beer halls and the automatic restaurants in that country.

PICKLING.

The earliest method of preserving salmon on the coast was by pickling. At times this industry attained to large proportions, but during the last 10 years it has been declining, largely because the canners are able to pay more for the raw fish than the salters. All species of salmon are pickled, but the most popular is the red salmon.

In dressing salmon for pickling the head is removed, the fish split along the back, the cut ending with a downward curve on the tail. The viscera and two-thirds of the backbone are removed, and the blood, gurry, and black stomach membrane scraped away. The fish are then thoroughly scrubbed and washed in cold water. They are next placed in pickling butts with about 15 pounds of half-ground salt to every 100 pounds of fish. The fish should be laid in a tier, flesh side up, and the salt well sprinkled over it, repeating until the tank is full. Several boards are then laid across the fish and these are weighted down with large stones in order to keep the fish submerged in the pickle which will form. The fish remain here about one week, the brine being held at about 90°. They are then removed, rubbed clean with a scrub brush, and repacked in market barrels, one sack of salt being used to every three barrels of 200 pounds each. About 40 to 52 red salmon, 25 to 35 coho salmon, 70 to 80 humpback salmon, 10 to 14 king salmon, and 25 to 30 dog salmon are required in packing a barrel of pickled salmon.

A few salteries also pack "bellies." This product is merely the belly of the fish, which is the fattest portion, and as most of the packers throw away the rest of the fish, thus causing a very large waste of choice food, this method has come under the ban of the law in some of the coast States and in Alaska. As a result, but few "bellies" are packed now, and most of these only when some economic use is made of the remainder. Humpback salmon furnish the major part of the "belly" pack.

In preparing salmon bellies, the operator first cuts off the two pectoral fins, and then removes the head, care being taken to follow the curve of the body until the backbone is reached, which should

then be severed straight across. With the smaller salmon the fish is then turned on its back, and the operator inserts his knife in the body just above the backbone and cuts down through the body, the knife coming out just in front of the vent. If properly done, the cut will come close to the upper wall of the stomach. With large king salmon it is sometimes necessary to make the cut first on one side, then turn the fish over and make the cut on the other side. The belly is then laid flat on the cutting table and the membrane at one end cut so the belly will lie flat. The bellies are then washed and salted the same as hard-salted salmon.

When bellies are cut, the backs are saved and either dried in the open air, without salt, or else pickled.

With large kings, the operator, after the belly has been cut out, scrapes the inside of the remainder of the carcass. The knife is then inserted under the backbone at the end nearest the tail, and it is cut away with as little flesh as possible adhering to it. The blood is then scraped off, the fish thoroughly washed, and then salted the same as the whole fish.

Some of the old-time fishermen save parts of the salmon heads as food. In this event, the head is split lengthwise clear to the bony covering which protects the top of the head. The gill rakers are then removed from each side of the split head, leaving the nutritious parts intact. The cleaned heads are then salted down the same as whole salmon.

DRY SALTING.

During the progress of the Russian-Japanese War the preparation of dry-salted dog salmon became an important industry, but as soon as the Japanese fishermen resumed their former occupations the demand fell off so much that the industry was virtually abandoned in the United States, although a number of Japanese continue it in British Columbia. The fish, after being dressed, were packed in boxes, in salt, these boxes holding about 560 pounds of fish, and were shipped in this condition to Japan.

At a number of places in Alaska the bellies of red and coho salmon are cut out and salted, after which the backs are dried in the sun and, thus cured, are used for fox food at the numerous fox ranches. This product is called "ukalu."

SMOKING.

The smoking of salmon is virtually a continuation of the pickling, as the fish must be pickled before being smoked, the main purpose of the pickling being to preserve them until the time arrives for smoking, which may be weeks or months after the fish are caught. For smoking the salmon are taken out of the barrel and soaked until as much of the salt as possible is removed. They are then put into the smokehouse and subjected to the heat and smoke of a fairly hot fire for about two days in order that they may be thoroughly dried and hardened. Exposure to a smoldering fire (alder wood is a favorite fuel) for about three days completes the process.

For shipment smoked salmon are packed in wooden boxes, oil paper being placed between the fish.

In the manufacture of smoked salmon, the mild-cured product is most in demand. The necessary quantity of sides is taken from the

cold-storage and placed in large tanks filled with fresh water. In these they are soaked over night, the water being changed several times, depending upon the salinity of the fish, the variation of which depends upon the length of time the product has been held in storage, those held longest absorbing the most salt.

After soaking, the sides are taken from the tanks, piled on tables, and allowed to drain as much as possible. They are then taken one at a time, laid flesh side down, and a bacon hanger, which is made of wire and has six or more points bent at right angles to the frame, terminating at the top in a hook, is pressed firmly into the flesh on the skin side and at the upper end of the side. They are then hung upon a round stick, which latter is then set in position in the smokehouse, each end resting upon supports on the side. The fish are placed so that no two of them will touch. When the smokehouse is full, a small fire of any nonresinous wood is then built underneath to dry them, the ventilator in the top being left open so the moist air can escape. The fires should not be allowed to become too hot; the object is to give the fish smoke rather than heat, as in the latter case they would become partially cooked. For a mild cure, for ready consumption, from 8 to 10 hours, according to the condition of the fish, should be sufficient. If immediate sale should not be possible the fish must be kept in a cold-storage room with a temperature of about 24° F.

In sections where the products move more slowly into consumption, a harder smoking is wanted. In this event, they are held over the fire until dried, which would depend upon climatic conditions, but probably around two days. After the fish have dried sufficiently, the fire is smothered with sawdust, which produces a dense smoke, giving the sides their color. During the latter period the ventilator is partly closed, but must be watched to prevent the fish from sweating.

When thoroughly smoked the sides are removed from the smokehouse, taken off the hanger, and each side wrapped in paper, then packed in wooden boxes holding each 30 pounds.

Kippered salmon.—On the Pacific coast practically all of the kippered salmon is prepared from frozen white-meated king salmon, which on account of the color of the flesh is not in much demand. It is, however, fully the equal, in both flavor and food value, of the red-meated kings. It is not absolutely essential that the fish be first frozen, as the fresh fish may be kippered after dressing, but the latter is always a little soft when so prepared, owing to an excess of moisture, which is largely removed in freezing. Fresh salmon is available only part of the year, so it is found most convenient to freeze and store the stock and work it up when needed throughout the year.

Before freezing, the fish have been dressed, so when thawed in cold-running water, it is only necessary to split and cut them into pieces of a pound or less, these being about 6 inches long, or perhaps 3 inches broad, depending upon the part of the fish the piece is taken from, and place them in a tank of strong brine to season for several hours. They are then dipped in a harmless vegetable coloring, similar to that used by the butchers for coloring sausage: this gives the outside of the product a red color, a concession to popular prejudice.

From the coloring tank, the pieces are placed on a tray with wood frame and bottom of one-half inch square meshed wire; care is taken that the pieces do not touch each other.

The tray is then slipped into a rack which will hold a number of these, placed one above the other, and this rack is then run on a track into the smokehouse.

A medium fire is then kindled which dries and slightly smokes the pieces from 16 to 18 hours.

When they reach a proper stage the fire is enlarged, but great care must be exercised in order to prevent their being overheated, and this is done by means of the damper at the bottom of the smokehouse and the ventilator at the top. The fish are baked in this manner from 25 to 35 minutes, the thermometer showing from 250 to 275° of heat.

When the cooking is completed the cars are pulled out and the fish allowed to cool, after which each piece is wrapped in a square of parchment paper and packed in a box or basket which holds 10 pounds.

The product is quite perishable, and if it can not be used at once, when of course it is at its best, must be placed in cold storage. The packer endeavors to turn out daily only the amount he can market that day.

Beleke.—A smoked product, known locally as "beleke," is put up at Kodiak, Alaska, from red and coho salmons. Steelhead trout are the best for this purpose, but are not often utilized owing to their scarcity in this region. In preparing "beleke" only the backs of the fish are used, the belly part being cut out and pickled separately. The backs are divided into three grades, according to size, viz, "small," "medium," and "large." They are first put into a brine, the "large" being put in first, followed by the "medium" and "small" at intervals of one hour each, so that all will be cured at about the same time. The coho backs, being the largest, are kept in the brine from 19 to 20 hours, while the red salmon backs, which are smaller, remain in the brine only about 16 hours. After being thoroughly salted the backs are removed from the brine and rinsed in fresh water, then hung in the air for about 24 hours to dry and to allow a thin skin to form on the outside. They are then hung in the smokehouse, in the presenece of a little fire of cottonwood or alder. On dry days the gable windows are thrown open and the wind allowed to pass through while the smoking is going on. The smoking must be done slowly, two weeks being devoted to it.

There is a good demand for this product locally, the fish selling for from 15 to 20 cents a pair, but little effort has been made to extend its sale outside of central Alaska.

FREEZING.

The process of preserving fish by freezing was first introduced in 1888. Previous to this the comparatively ancient method of packing with ice, or in rare instances letting the fish freeze naturally during the winter months, was followed. Packing with ice is in quite general use to-day for shipments of fish which are to be preserved for short periods of time. Cooling with ice never results in a temperature lower than 32° F., which, of course, does not freeze the fish.

The freezing of salmon and steelhead trout began on the Sacramento and Columbia Rivers in the late eighties. It was taken up in a small way on Puget Sound in 1892. That year Wallace Bros. and Ainsworth & Dunn froze a small lot, the work being done for them by the Seattle Ice Co. (now the Ice Delivery Co.), and the venture was so successful that the next year nearly all of the wholesale dealers on the Sound took up the business. The Crescent Creamery, of Tacoma, also engaged in the business for the fish dealers for a year or two shortly thereafter. In 1902 the British Columbia Packers' Association bought a large cold-storage plant at New Westminster, British Columbia, at that time the only large and modern plant in the Province, and began the active freezing of fish. Since then a number of excellent plants have been built and operated. In Alaska the preparing of frozen salmon began in 1902. The San Juan Fishing & Packing Co., soon to be succeeded by the Pacific Cold Storage Co., put up a cannery and cold-storage plant at Taku Harbor, in southeast Alaska, in 1901, though it did not operate the cold-storage portion until 1902. The Taku Harbor Canning & Cold Storage Co. later on succeeded to the ownership and operation of this plant. This is the only plant which was operated in Alaska until the New England Fish Co. erected in 1909 a large plant at Ketchikan for the freezing of halibut primarily, but considerable quantities of salmon have been frozen also.

In 1911 the schooner *Metha Nelson* was fitted up as a floating freezer by the Alaska Packers Association and sent to Kodiak Island. As the vessel arrived in San Francisco shortly before the State's closed season on salmon began, and it was a difficult matter to dispose of the catch before then, the business was abandoned.

In 1912 J. Lindenberger (Inc.) opened a freezing plant at Craig, on Fish Egg Island, Alaska, while the ship *William H. Smith* was outfitted as a floating cannery and freezer by the Weiding & Independent Fisheries Co., at Saginaw Bay, Alaska. The latter operated only one season.

The year 1913 saw quite a development in the industry. The Columbia & Northern Fishing & Packing Co., at Wrangell, the Juneau Cold Storage Co., at Juneau, the Booth Fisheries Co., at Sitka, and the floating cold-storage ship *Glory of the Seas*, by the Glacier Fish Co., at Idaho Inlet, were all started this year.

In 1914 the Ketchikan Cold Storage Co. opened a freezer for the general commercial freezing of fish.

In 1917 the San Juan Fishing & Packing Co. built and operated a cold-storage plant at Seward.

In 1918 Henry Goemaere operated for the first time a plant at Washington Bay; while the National Independent Fisheries Co. and the Trout Fisheries Co. froze salmon at Ketchikan. All the other freezers operated as usual, the only change being the purchase by Libby, McNeill & Libby of the cold-storage plant and cannery of the Taku Harbor Canning & Cold Storage Co. at Taku Harbor.

The freezing of salmon is almost invariably carried on in connection with other methods of handling and preserving, and the purpose is usually to secure the fish when numerous and cheap, freeze them, and then hold them until the runs are over and the fish are once more in good demand at high prices. The business proved so profitable,

however, that the dealers began to look for wider markets for their product. Europe, more especially Germany, was prospected and a profitable market soon developed, with the result that to-day frozen Pacific salmon can be secured in nearly every town of any size in western Europe, while large quantities are marketed all over our own country.

There are four important features in packing and using frozen salmon: (1) To get fresh fish; (2) to keep them cold (about 15° above zero) after they are frozen; (3) to keep a coat of ice on them; and (4) to allow them to thaw slowly in cold water or in the air before cooking.

In selecting salmon for freezing, only the finest and freshest of each species are used. The current belief that freezing destroys the flavor of the fish is erroneous, the flavor depending entirely upon the condition before freezing, and the quicker they are frozen after being caught the better will the natural flavor of the fish be preserved. Frozen salmon are just as wholesome as fresh, and their chemical constituents are almost identical. The danger lies in the temptation to freeze the fish after decomposition has set in, but, fortunately, this is now very rarely practiced in the salmon industry.

The coho, or silver, and the chum, or dog, salmon are the choicest of the salmons for freezing. The other species, except the red, or sockeye, which is too oily and rarely frozen, are also frozen in varying quantities. The steelhead trout, which is ranked by the Pacific coast dealers among the salmon, is considered the choicest fish of all for freezing.

Some of the most modern plants in the country are on this coast. These have numerous freezers, generally, in which a temperature of from 25° to 30° F. below zero can be maintained if desired, although a temperature of more than 10° below zero is rarely ever required. All freezing is by direct expansion and each freezer is piped with about 2 feet of 1½-inch pipe per cubic foot of freezing space. The bunkers in the freezers are in pairs, generally nine pipes wide, spaced 10 inches apart. This leaves about a 3½-foot passage through the center of each freezer opposite the swing doors. The salmon are laid on metal sheets, which are placed on the tiers of pipes.

After freezing the salmon are passed through openings in the rear of the freezers into the glazing room, which has a temperature of about 20° F., where they are dipped into water, and when removed are covered with a thin glaze of ice, which may be thickened by repeated dippings. This is an extra precaution to exclude the air from the fish.

After being thoroughly frozen and glazed, each fish is covered first with a parchment, like rolls of butter, and then with a piece of heavy brown paper. They are then packed in boxes holding about 250 pounds each, placed in cold-storage cars and shipped.

The method of freezing fish in brine is now under serious consideration by a number of fishermen and dealers. A brine freezer may be of small capacity and carried on a fishing boat or it may be a freezer of large capacity at some central point convenient for receiving the catches. In this method a strong brine solution, cooled by circulation through crushed ice, is used for freezing the fish. By this method large fish may be frozen in from 1 to 3 hours, a great saving in time as compared with the method at present in use.

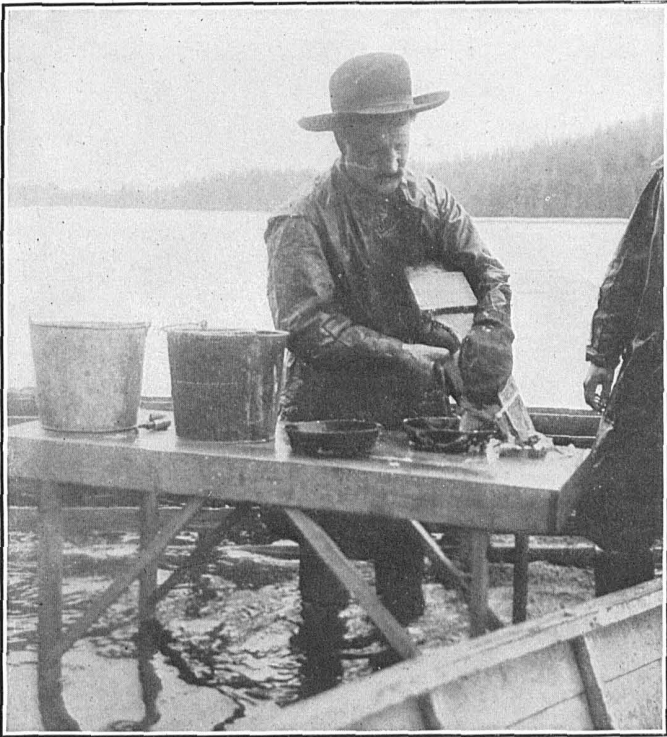


FIG. 40.—STRIPPING SALMON WITH AID OF STRAIT JACKET.



FIG. 41.—CHEHALIS HATCHERY, WASHINGTON FISH AND GAME COMMISSION, SHOWING RACKS TO PREVENT SALMON FROM GOING UPSTREAM, AND PEN FOR HOLDING SPAWNING FISH.

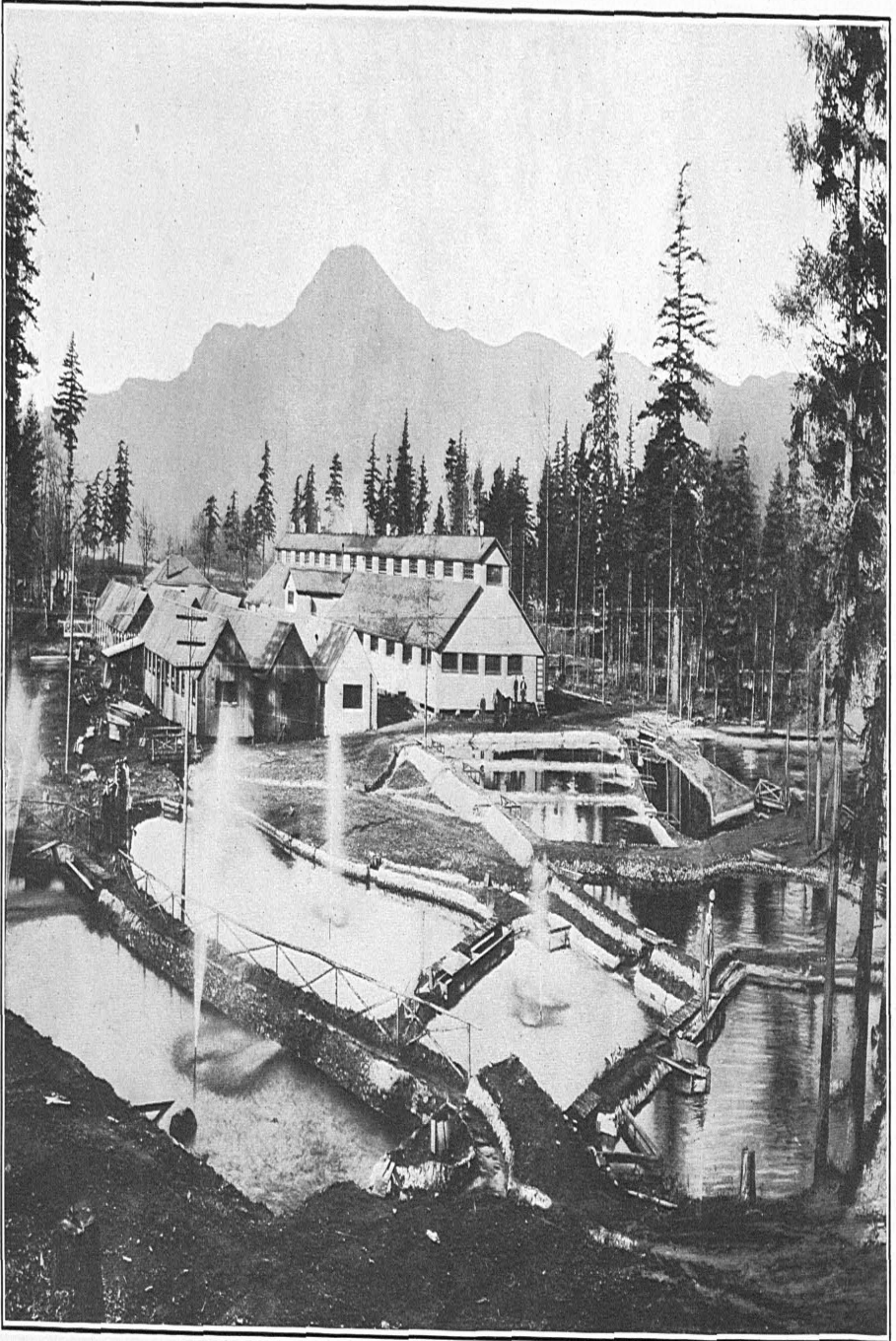


FIG. 42.—BONNEVILLE SALMON HATCHERY OF THE OREGON FISH AND GAME COMMISSION, SHOWING REARING PONDS.

UTILIZING SALMON EGGS AND MELT.

Every year immense quantities of salmon eggs are thrown away in the fisheries of the west coast, though there is but little doubt that, if properly prepared, a market could in time be found for this now waste part of the fish. In France there is a good market for a product known as "rogue," which is the spawn of cod, haddock, hake, and pollock, salted in casks, and which is used as bait in the sardine fisheries. Salmon spawn is the choicest and most successful bait used on this coast, and if properly prepared would undoubtedly answer the purpose as well as the regular "rogue" if not better, owing to its oiliness and attractive color. The roes should be soaked for some days in old brine and then packed in strong casks holding about 25 gallons each. It might also prove to be a good bait for tolling mackerel on the Atlantic coast.

In 1910 a considerable quantity of salmon roe was prepared in Siberia and sold in competition with caviar, which is prepared from sturgeon eggs. The product met with favor in Europe and now large quantities are prepared each season.

In this country Miss Ida Tuholski, of San Francisco, who had been engaged in the preparation of sturgeon caviar for some years, put up a number of sample lots of salmon caviar which are fully the equal of the best sturgeon caviar. Capital has been chary, however, about engaging in the business, although undoubtedly it will be an important industry some day.

For making caviar the eggs should be as fresh as possible, and in order to make sure of this the salmon are taken alive, if possible, shortly after coming from the water, killed and bled, the belly opened up and the roe taken out. This work can best be done on work and living scows anchored close to the fishing camps. The roe is placed upon a stand, the top of which is formed of a small-meshed galvanized-iron wire screen. On the underside is arranged a zinc-lined trough. The operator gently rubs the mass of eggs back and forth over the screen, the mesh of which is just large enough to let the eggs drop through, and, as they are separated from the membrane by the rubbing, they fall through into the trough and are thence drawn off into tubs by means of a sliding door at the end of the trough.

After all the roe has been separated the tub is removed and a certain proportion of salt (the sturgeon caviar makers employ the best Luneburg, Germany, salt in this work, while some of the Siberian makers of salmon caviar use No. 2 Berkshire salt from England) is added to the roe, after which the mass is mixed with the hands. The most delicate part of the whole operation is in the manner of mixing. No direct rule can be given for doing this portion of the work, as the condition of the roe regulates the time consumed and the manner of handling. It requires practical experience to become proficient, but this should be an easy matter for one used to handling salted products. The sturgeon caviar makers use about 11 pounds of salt in preparing a keg of caviar.

After the salt has been added the mass of eggs first dries up, but in a few minutes the strength of the salt draws from the eggs their watery constituents and a copious brine is formed, which can be poured off when the tub becomes too full. In Siberia the caviar

makers put the eggs into a brine solution of 19 to 22 per cent Baumé strength immediately after they come from the trough. The salted eggs are then poured into very fine-meshed sieves which hold about 10 pounds each. In the caviar house are arranged long, sloping boards with narrow strips nailed on each side. On these the sieves are placed and left here from 8 to 20 hours in order to thoroughly drain.

The Siberian caviar makers hasten the operation by putting the eggs into a brine solution as noted above, leave them there for from 25 to 45 minutes, then place them in bags and subject them to heavy pressure, after which they are packed. While this method occupies less time, it is not thought the resulting product is as good as that prepared by the slower method outlined above.

The eggs are then transferred to small casks (holding about 135 pounds). The sturgeon caviar makers use oak or pine casks, but some of the Siberian makers say that oak casks turn the salmon caviar black. The casks are steamed before use in order to prevent any possible leakage. It is especially necessary that the kegs or barrels used be air-tight, as otherwise the product will spoil. Barrels such as used in packing salt salmon are rarely ever tight enough to hold caviar. The casks are covered and allowed to stand until the gas escapes and the eggs settle. The vacant space caused by the settling is then filled, the cask headed up and put in a cool place until ready for shipment.

The Siberian salmon caviar makers use a small quantity of "preservative" in each keg for the purpose of aiding in preserving them, as cold-storage facilities are quite primitive as yet in that country, and it is the addition of this powder which forms the mysterious part to the uninitiated. No preservative would be needed in Alaska, however, as the kegs could be shipped in cold storage along with the mild-cured salmon.

Several establishments are putting up these eggs in jars and hermetically sealed cans for use as bait in sport fishing.

In 1916 one of the companies operating in Alaska put up some salmon melt in cans. No difficulty was experienced in canning this product and it met with considerable favor from those who tried it, but nothing has been done with it since.

MISCELLANEOUS PRODUCTS.

A few years ago a company on the Columbia River put up what was known as "fish pudding." In preparing this the salmon was ground fine, mixed with milk and eggs, and then packed in tin cans. The preparation was soon abandoned.

In 1903 one of the Point Roberts canneries packed a new product which was called "salmon paste." For this the fish was ground up, cooked, seasoned with spices, etc., and made into fish balls, a very palatable dish when warmed over.

In 1905 a Seattle concern began the manufacture of wienerwurst sausages from halibut and salmon.

The Indians in the Bristol Bay region of Alaska occasionally dress the skins of salmon and make of them leather for the tops of boots, also bags and other small articles.

A product, which was first made in Norway, is prepared by means of an invention which quickly dries and pulverizes the flesh of fresh

fish. The resulting powder, called "fish flour," is easy to transport from one place to another and has great nutritive value. It is probable that the tailpieces of the fish, which are at present thrown away, and the cheaper grades of salmon might be prepared in this way and thus furnish another market for salmon.

MEAL, FERTILIZER, AND OIL.

As early as 1888 there was a small plant at Astoria, Oreg., where the refuse of the canneries was utilized for the manufacture of oil and fertilizer. In that year 8,000 gallons of oil (chiefly from salmon heads) and 90 tons of fertilizer were prepared. The oil was worth 22½ cents per gallon and the fertilizer had a market value of \$20 per ton. Most of the refuse was dumped into the river, however. In 1898 a similar plant was established in the Puget Sound district of Washington. At present the plants of the Robinson Fisheries Co. at Anacortes; the Pacific American Fisheries at Eliza Island, near Bellingham; the Wannewetsch Reducing Co., at Blaine; and the Japanese-American Fertilizer Co. on Lummi Island, all on Puget Sound, operate quite largely on the offal from the Sound salmon canneries.

In 1882 the Alaska Oil & Guano Co. established a fertilizer plant at Killisnoo, Alaska, for the extraction of oil and fertilizer from herring, and has operated the plant continuously ever since. In some years large quantities of whole salmon have been handled at this plant, and the resulting product was found to sell as well as that from herring.

In Alaska the Fish Cannery By-Products (Ltd.), in 1914 built a large plant at Ward Cove, near Ketchikan, where salmon offal is used in the preparation of fertilizer, meal, and oil. The company is now experimenting in the preparation of various chemical products from the raw material.

Probably the most serious evil in the salmon industry to-day is the enormous wastage which annually occurs. About one-fourth of the total weight of each fish handled at the various packing plants is thrown away. With the exception of the tailpiece, which is discarded at some canneries owing to the excessive amount of bone which would be in the product if canned, this waste material could not be utilized as food, comprising as it does the head, viscera, fins, and tail. When not conveniently near the very few fertilizer plants at present in operation this product is either allowed to pass through chutes into the water under the cannery, or is dumped into scows and towed to the ocean or the deeper waters of the sounds, and there thrown overboard. This procedure is not only exceedingly wasteful, but is also far from beneficial to the waters where deposited.

The great desideratum in the salmon fisheries of the Pacific coast at the present time is the invention of a small odorless fertilizer plant, costing not more than \$2,500 or \$3,000, which can be installed at the various salmon canneries and salteries. The offal from the cannery could there be utilized and the product obtained would doubtless net a fair return on such an investment, while at the same time the present (in the aggregate) enormous waste would be stopped, and the waters adjacent to the canneries rendered far more agreeable to the fishes as well as to the people on shore. It is absolutely essen-

tial that the plant shall be odorless, as the smell of the ordinary fertilizer establishment would be very offensive to persons visiting the cannery and would not enhance the demand for canned salmon. At the present time the cheapest plant available costs about \$10,000, and very few canneries can afford to invest this sum of money in the disposal of their own offal alone.

A great impetus has been given to the industry during the last two years, owing to the big demand which has come from the farmers and poultrymen for fish meal or scrap, which, after it has been mixed with other ingredients, can be fed to cattle, hogs, and poultry. Experiments carried out at various agricultural experiment stations, both here and in Europe, show conclusively that this class of food increases the appetite of the animal, and consequently the weight, while it does not affect the flavor of the flesh of the animals.

SHIPPING FRESH SALMON DIRECT TO CONSUMER.

An important new feature in the salmon industry is the shipping of individual salmon direct to consumers by express, or, for certain short distances, by parcel post, for a certain fixed sum, which includes the fish itself and the cost of delivering same to the buyer.

This business began in Tacoma, Wash., in 1914, and those who originated it advertised throughout the country that they would ship a fresh salmon to any express office in the United States (except Southern Express), express prepaid, for \$1.25, weight 7 to 8 pounds. In 1915 the cost, delivered east of the Mississippi River, was raised to \$1.50 each, the old rate of \$1.25 still being in force for shipments west of the Mississippi River. The price has since been increased to \$2.50 for any place in the United States. The number of shippers has increased very much, and the business is now carried on from a number of places in Washington, Oregon, and California.

In shipping an individual fish, it is packed in a box containing 20 pounds of cracked ice. These boxes are collected by the express companies and are generally sent out in their own regular cars attached to trains leaving in the evening. About every 15 to 20 hours the box is opened and from 5 to 7 pounds, depending upon the weather, of cracked ice added to the box to make up the loss through melting.

As the Post Office Department will not accept packages in which ice is used for preserving fish, the use of the parcel post for shipments of individual fish is limited to the first postal zone (up to 50 miles from the initial point), except in winter, when the postmasters are authorized, in their discretion, to accept shipments for the second zone (50 to 100 miles from the initial point). In making fresh-fish shipments by parcel post, frozen fish are generally used.

Most of the orders come from the Middle West, where fresh fish are not abundant, but orders are received from all sections of the country.

The success met with in shipping fresh salmon led to a considerable expansion of the industry, with the result that now one can obtain not only a fresh salmon, but also may purchase salt, smoked, and kippered salmon, salt codfish, and fresh halibut, smelt, crabs, and other sea food in their season.

NUTRITIVE QUALITIES OF SALMON.

More and more attention is being paid by the consuming public to the nutritive qualities of the food products offered them, and this is especially true as regards fishery products.

The proper functions of food are two-fold, first, to furnish protein for building and repairing the body, and second, to supply energy for heat and muscular work. Foods which supply an abundance of both at a reasonable price are of the greatest importance from an economical standpoint.

ANALYSES OF CANNED AND FRESH PACIFIC SALMON.

Despite the great prominence of the salmon industry, but little time has been devoted to it by the chemist.

Prof. W. O. Atwater was the first American investigator to devote any portion of his energies to the analysis of Pacific salmon. In "Principles of Nutrition and Nutritive Value of Food" (Farmers Bulletin No. 142, United States Department of Agriculture, 1901), he gives the following analysis of canned Pacific coast salmon:

Water, 63.5 per cent; protein, 21.8 per cent; fat, 12.1 per cent; ash, 2.6 per cent; fuel value per pound, 915 calories.^a

C. F. Langworthy, in "Fish as Food" (Farmers Bulletin No. 85, United States Department of Agriculture, 1898), gives the following analyses of fresh and canned Pacific coast salmon:

Fresh salmon, California (sections): Refuse (bone, skin, etc.), 5.2 per cent; water, 60.3 per cent; protein, 16.5 per cent; fat, 17 per cent; mineral matter, 1 per cent; total nutrients, 34.5 per cent; fuel value per pound, 1,025 calories.

Canned salmon: Refuse (bone, skin, etc.), 3.9 per cent; salt, 1 per cent; water, 59.3 per cent; protein, 19.3 per cent; fat, 15.3 per cent; mineral, 1.2 per cent; total nutrients, 35.8 per cent; fuel value per pound, 1,005 calories.

Dr. Harvey W. Wiley gives the following as the composition of a Pacific coast salmon (species not given):^b

Fresh—Water, 63.61 per cent; protein, 17.46 per cent; fat, 17.87 per cent; ash, 1.06 per cent. Dry—Protein, 52.31 per cent; fat, 49.05 per cent; ash, 2.92 per cent.

On page 137 of the same work Dr. Wiley gives the following as the mean of three samples of Pacific coast canned salmon:

Composition of canned salmon.—Mean of three samples. Water-free substance: Protein, 53.52 per cent; fat, 40.52 per cent; ash, 6.24 per cent.

Prof. Knisely,^c of the Oregon State Agricultural College at Corvallis, Oreg., analyzed canned salmon packed at the Funter Bay (Alaska) cannery of the Thlinket Packing Co., with the following results:

Species.	Molsture.	Protein.	Fat.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.
Sockeye or red	64.74	24.19	9.11	2.06
Coho or medium red	68.22	26.56	3.61	1.66
Humpback or pink	69.43	24.00	4.86	1.68
Keta or chum	67.08	25.06	6.59	1.26

^a The unit used to show the fuel value is the "calorie," which is the amount of heat required to raise the temperature of about 1 pound of water 4° F.

^b Foods and their Adulteration, etc., p. 135. By Harvey W. Wiley. 8°, Philadelphia, 1907.

^c Pacific Fisherman, Vol. VI, No. 1, January, 1908, p. 21.

H. M. Loomis, formerly chief of the Seattle food and drug inspection laboratory, Bureau of Chemistry, United States Department of Agriculture, reports as follows on analyses of both canned and fresh Pacific salmon made at this laboratory.^a

CANNED SALMON (1911 PACK.)^c

Sample.	Water.	Ethyl ether extract. ^b	Protein (Nx6.25).	Total ash.	NaCl. ^e	Ammoniacal nitrogen.	
						Richardson method.	Alcohol vapor method.
No. 1. Puget Sound sockeye.....	<i>Per cent.</i> 62.44	<i>Per cent.</i> 15.17	<i>Per cent.</i> 20.25	<i>Per cent.</i> 2.50	<i>Per cent.</i> 0.79	<i>Per cent.</i> 0.0403	<i>Per cent.</i> 0.0348
No. 2. Puget Sound sockeye.....	61.84	13.74	21.77	2.73	1.10	.0437	.0410
No. 3. Alaska medium red.....	69.97	7.81	20.40	2.58	1.09	.04965	.....
No. 4. Alaska chum.....	73.48	2.88	21.33	2.57	.83	.0563	.0557
No. 5. Alaska pink or hump back.....	74.12	4.75	19.75	1.98	.50	.0404	.....
No. 6. Alaska red.....	70.88	5.26	21.79	2.35	.64	.0455	.....

FRESH SALMON (CAUGHT MAY 7, 1912), EDIBLE PORTIONS.

	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Puget Sound sockeye.....	67.48	8.86	22.24	1.36	.....	0.0121
Puget Sound steelhead or salmon trout.....	67.89	9.39	21.80	1.35	.....	.0218

^a Each sample is average of two or more cans. All samples, except No. 2, are old form 1-pound tall cans. No. 2 is ½-pound flat cans.

^b Represents the fat.

^c Represents the salt.

ANALYSES OF CANNED SALMON BY SOUTH DAKOTA AUTHORITIES.

In 1916 the South Dakota Food and Drug Department analyzed a considerable number of samples of canned salmon for the purpose of determining, if possible, whether inferior grades of the fish were substituted for the better grades, and for the further purpose of discovering some means of identifying the different types of salmon by chemical analysis.

Thirty-three samples of commercial canned salmon, including 30 different brands, were analyzed. Thirteen of these were labeled as belonging to the sockeye class, five to the coho, six to the humpback, and one to the chum. Five samples were not labeled as to variety. One sample was labeled "Salmon Steaks" and two samples were labeled "Fresh Alaska." The last eight samples, because they were not labeled to show the common name of the fish contained in the can, were in violation of the F. I. D. No. 105 referred to above.

All of the cans but one were labeled to show the net weight of fish in the can. Sixteen per cent of them contained less than the declared amount of contents, but the greatest shortage was but 3.1 per cent of the declared weight, while the greatest excess in weight was 18.7 per cent of the declared weight. The weight is usually stated considerably under the actual amount of the contents.

The amount of liquid in the cans is an important factor to consider in computing the value of the contents. The free liquor in the cans examined varied widely from 3.95 per cent in sample number 15-209, labeled salmon steaks, to 26.54 per cent in sample number 15-63, which was not labeled as to variety. As a rule, the largest amount of free liquor is found in the lower priced grades, but there are exceptions, notably number 15-70, which contained 24.14 per cent of free liquor.

It will be noticed from the results given in the table that the amount of total moisture varies inversely as the amount of fat (called ether extract in the table). That is, salmon containing an excessive amount of moisture contains little fat, but those samples which contain the lower amounts of moisture contain the largest amounts of fat. The protein content seems to be fairly constant in all samples, the average amount

^a Salmon Canning Industry of North America. By H. M. Loomis. Original communications, Eighth International Congress of Applied Chemistry, Washington and New York, Sept. 4 to 13, 1912, Vol. XVIII, pp. 239-245. The Rumford Press, Concord, N. H.

being 19.34 per cent, while the minimum found is 15.66 per cent and the maximum 22.45 per cent. The total phosphoric acid varies from 4.2 per cent to 9.8 per cent, the average being 6.6 per cent.

As would be expected, the samples containing the larger proportions of fat liberate the larger quantities of heat units, or calories, per pound, and it will be noted that the price is not in all cases an accurate measure of value, some of the higher priced varieties being in reality much lower in actual cost, when their food value is taken into consideration, than some of the cheaper varieties.^a

The table below has been condensed from that shown in the report. The brand, name of the jobber, and the data about these samples, where the species is not shown on the label, have been eliminated, as they were not essential to our purpose. All of the other data have been reproduced exactly as they appeared in the original report. Not a single one of the samples apparently bore the packer's label, all being jobber's labels.

Laboratory No.	Variety.	Total	Ether	Protein.	Ash.	
		moisture.	extract.		Soluble.	Insoluble.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
15-56	Red.....	52.32	17.68	19.50	2.15	0.81
15-210	Fancy sockeye.....	59.29	16.83	18.28	1.63	.88
15-209	Salmon steaks.....	60.46	17.96	17.31	1.47	.33
15-60	Fancy red.....	60.46	15.40	18.22	1.33	2.89
15-72	Sockeye.....	60.89	15.19	19.16	.81	.78
15-65	do.....	60.95	15.94	18.56	1.60	1.11
15-59	Red sockeye.....	61.60	15.48	16.89	1.99	.67
15-64	do.....	62.18	13.10	19.13	1.45	.65
15-204	Red Alaska.....	65.44	10.57	20.31	2.15	.61
15-58	Coho salmon.....	65.65	9.82	17.32	1.61	1.33
15-220	Red Alaska.....	66.12	8.63	21.22	1.72	.62
15-64	Coho salmon.....	67.18	9.59	17.60	1.18	1.70
15-222	Pink salmon.....	69.53	6.62	20.48	1.85	.78
15-219	Red salmon.....	69.87	6.36	20.38	2.24	.67
15-207	Pink salmon.....	70.45	7.28	17.66	1.53	.90
15-221	Chum.....	70.52	4.57	19.73	.80	.72
15-205	Red salmon.....	70.86	4.04	21.11	1.60	1.13
15-70	do.....	71.45	4.47	20.75	2.15	1.60
15-61	Pink salmon.....	71.64	4.35	18.31	1.58	1.01
15-208	Gorbouscha ^b	78.17	5.33	17.35	1.27	.45
15-206	Alaska salmon ^c	73.30	2.43	21.22	1.46	.98
15-214	do.....	73.78	3.98	18.31	1.62	.54
15-57	Pink Alaska.....	74.03	8.90	15.66	1.50	1.02

Laboratory No.	Variety.	Phosphoric acid. ^d		Sodium chloride.	Calories per lb.	Price per lb.
		Soluble.	Insoluble.			
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Number.</i>	<i>Value.</i>
15-56	Red.....	4.2	3.5	1.45	1,116	\$0.31
15-210	Fancy sockeye.....	4.2	4.0	.81	1,050	.30
15-209	Salmon steaks.....	3.7	1.5	.51	1,080	.36
15-60	Fancy red.....	2.8	3.8	.68	900	.29
15-72	Sockeye.....	3.1	3.7	.14	1,125	.25
15-65	do.....	2.2	5.3	.68	1,020	.29
15-59	Red sockeye.....	3.6	2.6	1.10	965	.....
15-64	do.....	3.2	3.5	.60	910	.30
15-204	Red Alaska.....	4.0	2.3	1.15	825	.....
15-58	Coho salmon.....	2.5	5.7	1.02	730	.25
15-220	Red Alaska.....	1.9	2.8	.82	760	.....
15-64	Coho salmon.....	2.4	5.9	.53	730	.21
15-222	Pink salmon.....	1.8	3.6	.90	690	.....
15-219	Red salmon.....	2.0	2.7	1.26	545	.....
15-207	Pink salmon.....	3.4	4.1	.74	635	.15
15-221	Chum.....	1.0	4.1	Trace.	565	.....
15-205	Red salmon.....	3.3	3.2	.65	580	.30
15-70	do.....	2.7	3.1	1.17	575	.39
15-61	Pink salmon.....	2.4	4.7	.84	525	.15
15-208	Gorbouscha ^b	2.9	2.1	.46	550	.....
15-206	Alaska salmon ^c	2.7	4.4	.66	500	.15
15-214	do.....	1.7	2.5	.75	510	.15
15-57	Pink Alaska.....	2.0	4.5	.85	455	.25

^a Bulletin, South Dakota Food and Drug Department, Vol. IV, Nos: 2 and 3, October-December, 1916, pp. 8-11.

^b Probably pink salmon (author).

^c Probably chum salmon (author).

^d Mgm. of P₂O₅ per gram.

ANALYSIS OF SALTED SALMON.

Falkenburg & Co., of Seattle, have recently made an analysis of the food value of salted salmon, as follows:^a

Regarding the salmon recently inspected and analyzed for you by ourselves with the following results:

Protein.....	21.97 per cent.
Fat.....	4.34 per cent.
Salt.....	19.08 per cent.
Ash.....	.84 per cent.
Moisture.....	54.35 per cent.
Calories per pound.....	592

If this salmon were freshened, as is the custom in preparing it for the table, removing all but about 2 per cent of the salt, the fish would then have the following analysis:

Protein.....	27.13 per cent.
Fat.....	5.36 per cent.
Salt.....	2.47 per cent.
Moisture.....	65.11 per cent.
Ash.....	1.03 per cent.
Calories per pound.....	734

Bulletin No. 28 of the United States Department of Agriculture, "Chemical Composition of American Food Products" gives on page 51 the food value of the average canned salmon as purchased as follows:

Refuse.....	14.2 per cent.
Protein.....	19.5 per cent.
Fat.....	7.5 per cent.
Ash.....	2.0 per cent.
Moisture.....	56.8 per cent.
Calories per pound.....	680

STATISTICS OF THE SALMON OUTPUT.

SALMON CATCH IN 1918.

The following tables show the total catch, by species, of salmon and steelhead trout on the Pacific coast of North America in 1918, and the catch, by apparatus and species, for each geographic section of Alaska and Washington in 1918:

SUMMARY, BY SECTION AND SPECIES, OF PACIFIC COAST SALMON CATCH IN 1918.

Section.	Pounds.	Section.	Pounds.
Alaska:		Washington—Continued.	
Coho, or medium red.....	17,470,086	Steelhead.....	1,440,733
Chum, or keta.....	113,286,544	Sockeye, or red.....	4,127,280
Humpback, or pink.....	193,265,448	Total.....	49,600,847
King, or spring.....	16,010,764	Oregon: Salmon ^b	34,551,253
Red, or sockeye.....	176,690,325	California: Salmon ^b	13,026,076
Total.....	516,723,167	British Columbia: Salmon ^b	152,992,500
Washington:		Grand total.....	766,902,843
Coho, or medium red.....	12,621,704		
Chum, or keta.....	10,153,240		
Humpback, or pink.....	353,568		
King, or spring.....	20,907,322		

^a Pacific Fisherman, Seattle, Wash., Vol. XVII, No. 4, April, 1919, p. 76.

^b Species not given separately.

^c Estimated.

SALMON CATCH IN 1918, BY APPARATUS AND SPECIES, FOR EACH GEOGRAPHIC SECTION OF ALASKA.^a

Apparatus and species.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
Seines:	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Coho, or silver.....	2,239,596	546,966	23,454	2,810,016
Chum, or keta.....	42,507,872	15,239,240	1,744,448	59,491,560
Humpback, or pink.....	53,774,192	19,615,380	443,504	73,833,076
King, or spring.....	368,830	32,296	119,658	521,784
Red, or sockeye.....	3,979,215	9,528,400	4,492,510	18,000,125
Total.....	102,889,705	44,962,282	6,823,574	154,665,561
Gill nets:				
Coho, or silver.....	1,495,494	2,757,504	763,164	5,016,162
Chum, or keta.....	1,539,760	2,199,696	5,459,944	9,249,400
Humpback, or pink.....	305,540	118,388	885,992	1,309,920
King, or spring.....	460,570	1,983,190	2,040,808	4,484,568
Red, or sockeye.....	2,583,605	8,688,790	117,100,100	128,372,495
Total.....	6,494,969	16,747,568	126,250,008	148,492,545
Pound nets:				
Coho, or silver.....	4,198,356	2,030,592	60,000	6,288,948
Chum, or keta.....	29,164,536	11,276,288	1,681,560	42,121,384
Humpback, or pink.....	96,348,688	19,941,668	1,722,468	118,012,824
King, or spring.....	696,674	614,822	217,844	1,529,440
Red, or sockeye.....	7,113,930	20,191,895	1,892,915	29,198,740
Total.....	137,522,184	54,054,365	5,574,787	197,151,336
Lines:				
Coho, or silver.....	1,802,370			1,802,370
Chum, or keta.....	236,000			236,000
Humpback, or pink.....	37,076			37,076
King, or spring.....	8,177,818			8,177,818
Red, or sockeye.....	105,640			105,640
Total.....	10,358,804			10,358,804
Dip nets:				
Coho, or silver.....		51,018		51,018
King, or spring.....		195,580		195,580
Red, or sockeye.....		1,013,425		1,013,425
Total.....		1,260,023		1,260,023
Wheels:				
Coho, or silver.....			1,501,572	1,501,572
Chum, or keta.....			2,188,200	2,188,200
Humpback, or pink.....			12,552	12,552
King, or spring.....			1,102,674	1,102,674
Total.....			4,801,898	4,804,898
Total:				
Coho, or silver.....	9,735,816	5,380,080	2,348,190	17,470,086
Chum, or keta.....	73,498,168	28,714,224	11,074,162	113,286,544
Humpback, or pink.....	150,525,496	39,075,436	3,084,516	193,265,448
King, or spring.....	9,703,892	2,825,988	3,480,884	16,010,764
Red, or sockeye.....	13,782,290	39,422,510	123,485,525	176,690,325
Grand total.....	257,246,682	116,024,238	143,453,267	516,723,167

^a Figured from data in "Alaska Fisheries and Fur Industries in 1918," pp. 42, 43. By Ward T. Bower. U. S. Bureau of Fisheries Document No. 872, Appendix VII, Report U. S. Commissioner of Fisheries, 1918. Washington, 1919. In changing from number of fish to pounds the species were figured on the following basis: Coho, 6 pounds; chum, 8 pounds; humpback, 4 pounds; king, 22 pounds; and red, 5 pounds.

SALMON CATCH IN 1918, BY APPARATUS AND SPECIES FOR EACH GEOGRAPHIC DISTRICT OF WASHINGTON.

Apparatus and species.	Puget Sound.	Grays Harbor.	Willapa Harbor.	Columbia River.	Total.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Selnes, drag:					
Coho, or silver	148,080			41,898	189,984
Chum, or keta	478,304			5,600	483,904
Chinook, or spring	21,208			470,448	491,656
Humpback, or pink	92			908	1,000
Sockeye, or red	385			67,845	68,230
Steelhead				158,568	158,568
Total	648,075			745,267	1,393,342
Selnes, purse:					
Coho, or silver	3,083,838			145,908	3,229,746
Chum, or keta	6,398,664				6,398,664
Chinook, or spring	325,182			952,116	1,277,298
Humpback, or pink	12,388			1,540	13,928
Sockeye, or red	225,365			935	226,300
Steelhead	95,320			27,840	123,160
Total	10,140,757			1,128,339	11,269,096
Pound, or trap, nets:					
Coho, or silver	4,219,038	55,272	253,404	577,398	5,105,112
Chum, or keta	1,390,256	22,920	132,528	93,496	1,639,200
Chinook, or spring	8,392,098	50,764	180,438	2,109,294	10,782,634
Humpback, or pink	240,724			688	241,412
Sockeye, or red	2,479,560			90,355	2,569,906
Steelhead	95,864	56	112	432,016	528,048
Total	16,817,530	129,002	566,532	3,303,247	20,816,311
Gill nets:					
Coho, or silver	1,072,860	423,570	102,162	310,698	1,909,290
Chum, or keta	749,104	102,256	40,640	282,336	1,154,336
Chinook, or spring	856,812	415,866	133,408	4,783,284	6,189,370
Humpback, or pink	6,072			12,320	18,392
Sockeye, or red	88,260	4,125	15	534,115	628,515
Steelhead	19,824	4,120	344	396,824	420,912
Total	2,792,732	949,937	276,569	6,299,577	10,318,815
Set nets:					
Coho, or silver	586,776	327,780	133,508	11,340	1,059,404
Chum, or keta	211,568	95,936	130,888	13,024	451,416
Chinook, or spring	332,662	168,652	28,930	103,004	633,248
Humpback, or pink	2,216	644		26,072	28,932
Sockeye, or red	770	1,630	470	105,975	108,845
Steelhead	66,528	26,832	4,552	62,256	160,168
Total	1,200,520	621,474	298,348	321,671	2,442,013
Reef nets:					
Coho, or silver	75,804				75,804
Chum, or keta	7,312				7,312
Chinook, or spring	33,330				33,330
Humpback, or pink	49,792				49,792
Sockeye, or red	10,180				10,180
Total	176,418				176,418
Fish wheels:					
Coho, or silver				66	66
Chinook, or spring				212,410	212,410
Sockeye, or red				508,915	508,915
Steelhead				53,408	53,408
Total				774,799	774,799
Bag nets:					
Coho, or silver	300				300
Chum, or keta	16,400				16,400
Chinook, or spring	66			2,750	2,816
Steelhead				808	808
Total	16,766			3,558	20,324

SALMON CATCH IN 1918, BY APPARATUS AND SPECIES FOR EACH GEOGRAPHIC DISTRICT OF WASHINGTON—Continued.

Apparatus and species.	Puget Sound.	Grays Harbor.	Willapa Harbor.	Columbia River.	Total.
Hooks and lines:	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Coho, or silver.....	638,436	34,170	3,036	376,356	1,051,998
Chum, or keta.....	960	888		160	2,008
Chinook, or spring.....	391,312	8,160	1,184	933,904	1,334,560
Humpback, or pink.....	112				112
Sockeye, or red.....	2,645			5,745	8,390
Steelhead.....	64			1,597	1,661
Total.....	1,033,529	43,218	4,220	1,317,762	2,398,729
Total:					
Coho, or silver.....	9,825,138	840,792	492,110	1,463,664	12,621,704
Chum, or keta.....	9,252,668	222,000	304,056	374,616	10,163,240
Chinook, or spring.....	10,352,670	643,432	344,010	9,667,210	20,907,322
Humpback, or pink.....	311,396	644		41,528	353,568
Sockeye, or red.....	2,807,155	5,755	485	1,313,885	4,127,280
Steelhead.....	277,400	31,008	5,008	1,133,317	1,446,733
Grand total.....	32,826,327	1,743,631	1,145,669	13,894,220	49,609,847

BRISTOL BAY WATERS SALMON CATCH, 1913 TO 1917.

Broadly speaking, about one-third of the yield of salmon from Alaskan waters comes from the important Bristol Bay region. The following table shows the catches made in the more important waters fished in the Bristol Bay district in the period of five years from 1913 to 1917:

SALMON CATCH, BY STREAMS, IN BRISTOL BAY REGION, 1913 TO 1917.*

Species and stream.	1913	1914	1915	1916	1917	Total.
Red salmon:	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>
Nushagak.....	5,236,008	6,174,097	5,676,457	3,592,574	5,679,818	26,368,954
Igushik.....	173,925	263,718	223,405	223,343	167,421	1,076,813
Kvichak-Naknok.....	13,691,050	12,584,809	7,156,488	11,551,086	15,762,582	60,746,015
Ugagak.....	902,728	897,767	1,216,252	1,578,862	1,856,600	6,462,209
Ugashik.....	577,615	254,718	609,076	647,422	1,047,111	3,035,940
Total.....	20,581,326	20,165,107	14,786,678	17,693,287	24,513,532	97,669,830
King salmon:						
Nushagak.....	67,622	89,599	116,261	81,591	73,889	428,932
Igushik.....	34	94	106	330	477	1,041
Kvichak-Naknek.....	5,648	10,657	29,392	20,934	18,155	82,786
Ugagak.....	254	406	510	365	143	1,677
Ugashik.....	691	1,209	1,739	1,904	531	6,074
Total.....	74,249	101,964	148,028	105,124	91,145	520,510
Coho salmon:						
Nushagak.....	66,640	81,434	117,172	293,210	62,260	620,716
Kvichak-Naknok.....	2	17,462	13,271	288	3	31,026
Ugagak.....	165	165				330
Total.....	66,807	99,061	130,443	293,498	62,263	652,072
Pink and chum salmon:						
Nushagak.....	683,201	932,477	444,146	1,813,566	303,437	4,181,827
Igushik.....				738	183	921
Kvichak-Naknek.....	13,940	173,831	232,082	304,117	83,019	806,989
Ugagak.....	7,450	7,450	12,004	7,500	5,726	40,130
Ugashik.....	14,704	14,613	18,212	49,196	879	97,604
Total.....	719,295	1,128,371	706,444	2,180,117	393,244	5,127,471
Grand total.....	21,441,677	21,524,503	15,771,593	20,172,026	25,060,184	103,969,968

* From "Alaska Fisheries and Fur Industries in 1917," p. 32. By Ward T. Bower and Henry D. Aller. Appendix II, Report, U. S. Commissioner of Fisheries, 1917. Washington, 1918.

PACK OF CANNED SALMON IN 1919.

The following table shows, by species, grades, and sizes, the pack of canned salmon for the Pacific coast of North America in 1919:

PACK OF CANNED SALMON ON THE PACIFIC COAST IN 1919.^a

Species, grades, and sizes.	Alaska.	Puget Sound.	Hoh River.	Queets River.	Quinalt River.	Grays Harbor.	Willapa Harbor.	Columbia River.
Coho, silver, or medium red:	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>
1/2-pound flat.....	10,087	15,640		175		2,548		14,387
1-pound flat.....	10,357	32,936				2,167		27,471
1-pound tall.....	209,694	162,307	233	850	775	7,499	2,927	48,870
Total.....	230,138	210,883	233	1,025	775	12,214	2,927	90,728
Chinook or king, red:								
Fancy—								
1/2-pound flat.....								143,558
1-pound flat.....	8,323							130,056
1-pound tall.....	20,259							38,749
Standard—								
1/2-pound flat.....	7,422	21,685		450		1,454		24,279
1-pound flat.....	2,961	8,398				506		25,038
1-pound tall.....	112,788	35,874			165	2,410	1,152	30,445
Total.....	151,733	65,957		450	165	4,370	1,152	392,125
Chinook or king, white:								
1/2-pound flat.....		172						
1-pound tall.....		2,413						
Total.....		2,585						
Chum or keta:								
1/2-pound flat.....	3,846	3,403				6		3,018
1-pound flat.....		3,242				2,739		2,129
1-pound tall.....	1,344,616	618,896	332	50	650	25,967	9,125	70,346
Total.....	1,348,462	625,541	332	50	650	28,712	9,125	75,493
Humpback or pink:								
1/2-pound flat.....	27,776	17,379						
1-pound flat.....	7,548	41,674						
1-pound tall.....	1,622,110	362,262	18					
Total.....	1,657,434	421,215	18					
Snakeeye or red:								
1/2-pound flat.....	116,205	43,556		100	1,144			7,268
1-pound flat.....	109,933	13,688						
1-pound tall.....	978,205	7,102						
Total.....	1,204,343	64,346		100	1,144			7,268
Steelhead trout:								
1/2-pound flat.....								7,212
1-pound flat.....		5,099						5,890
1-pound tall.....	91							1,306
Total.....	91	5,099						14,414
Grand total.....	4,592,201	1,295,626	583	1,625	2,734	45,296	13,204	580,028

^a Reduced to a common basis of forty-eight 1-pound cans to the case.

PACK OF CANNED SALMON ON THE PACIFIC COAST IN 1919—Continued.

Species, grades, and sizes.	Nehalem River.	Tillamook Bay.	Nes-tugga River.	Alsea Bay and River.	Siletz River.	Sius-law River.	Umpqua River.	Coquille River.
Coho, silver, or medium red:	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>
½-pound flat.....	4,000	300	1,658	300	200	3,760	7,500	1,364
1-pound flat.....	100	525	424	5,892	3,760	7,500	3,646	
1-pound tall.....	8,124	3,150	2,400	2,607	5,892	3,760	7,500	5,010
Total.....	8,124	7,150	2,400	2,607	5,892	3,760	7,500	5,010
Chinook or king, red:								
Standard—								
½-pound flat.....	1,000	1,500	1,157	500				1,027
1-pound flat.....	100	100	100	19				
1-pound tall.....	500	500	300	1,255	874			
Total.....	500	1,500	1,900	2,612	1,393			1,027
Chum or keta:								
½-pound flat.....		3,150	50	50				
1-pound tall.....	1,183	1,200	400	485	472			45
Total.....	1,183	4,350	450	535	472			45
Grand total.....	9,807	13,000	4,760	5,654	7,757	3,760	7,500	6,082

Species, grades, and sizes.	Rogue River.	Smith River.	Klamath River.	Sacramento River.	Noyo River.	Monte-rey Bay.	British Colum-bia.	Total.
Coho, silver, or medium red:	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>
½-pound flat.....	227		625				92,890	144,201
1-pound flat.....	444		520				5,201	79,921
1-pound tall.....							101,902	569,053
Total.....	671		1,145				199,993	793,175
Chinook or king, red:								
Fancy—								
½-pound flat.....	4,000							147,558
1-pound flat.....	3,000							141,379
1-pound tall.....	1,580							60,588
Standard—								
½-pound flat.....	4,710	4,271	1,870	4,500	45,726		121,551	
1-pound flat.....	3,947	95	4,421	401	3,000	2,892	51,878	
1-pound tall.....				708	2,000	33,638	222,649	
Total.....	17,237	4,366	6,291	1,169	7,500	2,000	82,256	745,603
Chinook or king, white:								
½-pound flat.....							4,010	4,188
1-pound flat.....							346	346
1-pound tall.....							13,933	16,346
Total.....							18,295	20,880
Chum or keta:								
½-pound flat.....							49,257	62,780
1-pound flat.....							11,984	20,094
1-pound tall.....							310,794	2,284,561
Total.....							372,035	2,367,435
Humpback or pink:								
½-pound flat.....							127,435	172,590
1-pound flat.....							14,839	63,901
1-pound tall.....							204,305	2,188,765
Total.....							346,639	2,425,306
Sockeye or red:								
½-pound flat.....							293,720	461,993
1-pound flat.....							13,339	136,960
1-pound tall.....							69,945	1,045,252
1-pound oval.....							1,941	1,941
1-pound oval.....							500	500
Total.....							369,445	1,646,646
Steelhead trout:								
½-pound flat.....			145				3,586	10,943
1-pound flat.....			150				116	11,261
1-pound tall.....							791	2,188
Total.....			295				4,493	24,392
Grand total.....	17,908	4,366	7,731	1,169	7,500	2,000	1,383,156	8,023,437

CANNING INDUSTRY, 1864 TO 1919.

SUMMARY OF CANNING INDUSTRY.

From the beginning of the canning of salmon on this coast it has been the most important branch of the industry, and the following table shows in condensed form the number of cases packed in each year on the Pacific coast of North America from the beginning of the industry in 1864 to 1919, both inclusive.

As British Columbia is a Province of the Dominion of Canada it does not come strictly within the scope of this report, but in order to show the pack of canned salmon on the North American shores of the Pacific Ocean, which would be incomplete without that of the Province, it has been included also.

PACK OF CANNED SALMON ON THE PACIFIC COAST, BY YEARS AND WATERS.

Year.	Puget Sound.	Coastal streams of Washington.	Grays Harbor.	Willapa Harbor.	Columbia River.	Coastal streams of Oregon.	Smith River, Calif.
	Cases.	Cases.	Cases.	Cases.	Cases.	Cases.	Cases.
1866					4,000		
1867					18,000		
1868					28,000		
1869					100,000		
1870					150,000		
1871					200,000		
1872					250,000		
1873					250,000		
1874					350,000		
1875					375,000		
1876					450,000		
1877	5,500				380,000	7,804	
1878	238		5,420		460,000	26,934	4,277
1879	1,300				480,000	8,571	
1880	5,100				530,000	7,772	7,540
1881	8,500				550,000	12,320	
1882	7,900				541,300	19,198	
1883	1,540				629,400	23,156	
1884	5,540				620,000	27,876	
1885	12,000		8,200		653,800	33,410	5,530
1886	47,000		18,700	13,600	448,500	77,547	1,550
1887	22,000				356,000	73,996	
1888	21,975		37,000	22,500	372,477	62,843	2,347
1889	11,674				309,885	98,800	
1890	8,000				435,774	47,009	
1891	20,529		500	8,000	398,053	24,500	
1892	26,420		16,500	14,500	487,338	83,600	
1893	89,774		22,000	16,195	415,876	62,778	2,000
1894	95,400		21,400	15,100	490,100	54,815	2,000
1895	179,968		11,449	22,600	634,696	77,878	2,250
1896	195,664		21,274	24,941	481,697	91,880	
1897	494,028		13,300	29,600	582,721	68,083	
1898	400,200		12,100	21,420	487,044	83,209	
1899	919,611		24,240	21,314	332,774	82,041	
1900	489,460		30,800	26,300	368,772	12,237	
1901	1,380,580		41,500	34,000	390,183	68,018	
1902	581,659		31,500	39,462	317,143	44,236	
1903	478,488			5,890	339,577	54,801	
1904	291,458		27,559	26,400	395,104	98,874	
1905	1,018,641		22,050	14,950	397,273	89,065	
1906	430,622		22,000	14,440	394,898	107,332	
1907	698,080		14,000	18,352	324,171	79,712	
1908	448,765		14,000	20,457	277,710	83,994	
1909	1,678,737		21,436	12,024	274,196	58,169	
1910	567,883		55,480	11,508	391,415	104,617	
1911	1,551,028	18,431	75,941	25,497	553,331	138,146	
1912	416,119	19,914	47,287	23,148	286,026	84,074	
1913	2,583,463	13,124	19,895	12,050	286,479	38,492	
1914	817,354	21,469	32,434	16,837	454,621	106,617	3,000
1915	1,269,206	31,735	40,992	12,842	558,534	80,499	3,033
1916	1,052,917	15,777	60,336	18,553	547,801	81,924	2,505
1917	1,990,258	13,324	42,696	8,379	553,346	84,475	6,300
1918	622,732	13,732	35,972	8,827	591,381	92,241	4,653
1919	1,295,626	4,942	45,296	13,204	580,028	76,218	4,366
Total	22,192,871	152,438	893,257	572,950	21,370,293	2,750,999	51,281

PACK OF CANNED SALMON ON THE PACIFIC COAST, BY YEARS AND WATERS—CON.

Year.	Klamath River, Calif.	Eel River, Calif.	Noyo River, Calif.	Sacramento River.	Alaska.	British Columbia.	Total.
	Cases.	Cases.	Cases.	Cases.	Cases.	Cases.	Cases.
1864				2,000			2,000
1865				2,000			2,000
1866							4,000
1867							18,000
1868							28,000
1869							100,000
1870							160,000
1871							200,000
1872							260,000
1873							250,000
1874				2,600			362,500
1875				3,000			378,000
1876				10,000		7,247	467,247
1877		8,500		21,600		58,387	481,691
1878		10,500		34,017	8,159	89,940	639,491
1879				13,865	12,530	61,093	577,349
1880		0,250		62,000	0,639	61,849	687,010
1881				181,200	8,977	169,576	930,573
1882				200,000	21,745	240,461	1,030,592
1883		16,000		123,000	48,337	163,438	1,008,881
1884		8,200		81,450	64,886	123,706	937,118
1885		5,750		90,000	83,416	108,517	896,642
1886		12,500		39,900	142,005	162,904	922,176
1887				36,500	206,077	204,088	899,256
1888	4,400			68,076	412,115	184,040	1,217,792
1889				67,200	719,196	417,211	1,614,066
1890				26,065	682,691	411,257	1,609,896
1891				10,353	801,400	314,511	1,578,746
1892	1,047			2,281	474,717	248,721	1,365,180
1893	1,600			23,336	643,654	610,202	1,877,415
1894	1,700			28,463	686,440	492,232	1,887,650
1895	1,000			26,185	626,580	587,692	2,169,848
1896				18,387	968,707	617,782	2,413,312
1897				38,543	909,078	1,027,188	3,133,134
1898				29,731	965,097	492,651	2,492,252
1899	1,600			32,680	1,078,146	766,619	3,267,826
1900				39,804	1,648,139	606,640	3,091,542
1901				17,600	2,016,804	1,247,212	5,186,407
1902	2,500			14,043	2,836,824	627,161	4,194,568
1903				8,200	2,246,210	473,674	3,606,900
1904	3,400			14,407	1,953,766	465,894	3,276,882
1905				2,780	1,894,616	1,167,460	4,606,726
1906					2,219,044	626,460	3,817,776
1907					2,169,878	647,469	3,848,677
1908					2,618,048	642,689	4,005,672
1909	5,033				2,396,477	967,920	5,418,692
1910	8,016	0,000			2,413,054	762,201	4,320,174
1911	7,604	8,400		4,142	2,823,817	948,966	6,165,302
1912	18,000	11,000			4,064,641	996,676	5,961,786
1913	6,376				3,739,185	1,363,901	8,035,915
1914	11,000			17,315	4,066,663	1,111,039	6,648,329
1915	12,000			6,179	4,600,293	1,138,881	7,649,694
1916	8,884			c 19,445	4,900,627	996,066	7,703,894
1917	8,030			d 11,443	6,947,286	1,567,485	10,223,092
1918	10,200		2,000	4,036	6,605,836	1,618,167	9,607,766
1919	7,731		7,500	43,169	4,692,201	1,393,166	8,023,487
Total.....	122,221	92,100	9,500	1,419,534	74,891,284	26,763,668	161,188,291

a Reduced to a common basis of forty-eight 1-pound cans to the case.
 b Includes 950 cases packed at Monterey.
 c Includes 12,809 cases packed at Monterey.
 d Includes 2,000 cases packed at Monterey.

CANNING INDUSTRY, BY SPECIES AND WATERS.

The tables which follow show separately, by waters and as far as possible by species, the salmon canned on the Pacific coast from the beginning of the industry until 1919. It is only within recent years that the published statistics have shown the pack of the different species separately. In the early years of canning the chinook, or quinnat, salmon was used exclusively, the other species not being utilized until the chinook had begun to decrease in abundance, or a demand

had arisen for a cheaper product. There is a very great difference in the selling value of the highest and lowest grades, and it is necessary to have complete statistical data now in order intelligently to comprehend the trend of the industry. While every effort has been made to make these tables complete, there are, unfortunately, some gaps which it was found impossible to fill. Such ellipses indicate that either the canneries did not operate or that no data were available for such periods.

Although there are only five species of salmon found on the Pacific coast, each bears several common names which are in general use in one or more of the many fishing districts. Trade names of each species as known in each district follow:

Districts.	1	2	3	4	5
Alaska.....	Red.....	King.....	Coho. Medium Red. Silver.	Plnk.....	Chum.
British Columbia.	Sockeye.....	Spring	Coho.	Humpback.....	Keta.
Puget Sound.....	do.....	Tyee Spring	do.....	do.....	Chum.
Columbia River.....	Blueback.....	Chinook	Silverside.....	(None packed).....	Do.
Outside rivers.....	Quinnat.....	Quinnat.....	do.....	do.....	Do.

PACK OF CANNED SALMON ON PUGET SOUND IN SPECIFIED YEARS.

Year.	Can-neries oper-ated.	Chinook.		Sockeye.		Medium red or silver.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1877.....	1					5,000	.....
1878.....	1					238	.....
1879.....	1					1,300	\$5,000
1880.....	1						.....
1881.....	1						.....
1882.....	1						.....
1883.....	1						.....
1884.....	1						.....
1885.....	4						.....
1889.....	2	240	\$1,200			7,480	37,400
1890.....	1	1,000	5,000			3,000	15,000
1891.....	2	382	2,101	5,538	\$24,921	5,809	19,308
1892.....	2	86	473	2,954	11,816	7,236	24,503
1893.....	3	1,200	6,480	47,852	103,371	11,812	59,000
1894.....	3			41,781	188,014	22,418	89,672
1895.....	7	1,542	7,325	65,143	278,108	50,805	154,218
1896.....	11	13,495	67,475	72,879	350,299	82,040	294,448
1897.....	12	9,500	39,045	312,048	1,248,182	91,900	282,133
1898.....	18	11,200	50,624	252,000	1,058,400	98,600	335,240
1899.....	19	24,364	103,180	499,648	2,368,334	111,387	418,178
1900.....	19	22,350	134,100	229,800	1,149,000	128,200	512,800
1901.....				1,220,000			
1902.....	21	30,049	150,245	372,301	2,047,655	85,817	429,085
1903.....	22	14,600	72,500	167,211	1,003,200	103,450	413,800
1904.....	13	14,441	69,352	109,264	653,871	118,127	447,851
1905.....	24	1,804	9,922	825,453	4,952,718	79,335	337,174
1906.....	16	8,139	48,834	178,748	1,251,236	94,497	472,485
1907.....	14	1,814	10,326	93,122	608,416	119,472	476,288
1908.....	11	95,210	668,470	170,951	1,196,657	128,922	644,922
1909.....	24	13,019	72,604	1,097,904	6,183,300	143,133	630,440
1910.....	15	10,064	60,324	248,014	1,673,095	162,755	895,153
1911.....	21	21,823	172,582	127,769	1,168,145	256,123	1,711,178
1912.....	21	20,252	101,706	184,680	1,060,173	149,727	761,200
1913.....	32	1,234	5,247	1,673,099	10,871,178	61,019	235,372
1914.....	22	27,140	179,532	339,787	2,751,832	158,933	715,995
1915.....	40	28,406	145,555	64,584	676,789	180,783	902,335
1916.....	32	45,072	270,432	90,886	817,790	208,967	1,044,835
1917.....	45	70,918	638,292	454,336	4,543,360	115,890	926,890
1918.....	33	62,821	568,585	52,587	736,225	235,705	2,004,258
1919.....	35	68,542	856,775	64,346	1,029,536	210,883	2,529,996

* Includes 1,892 cases packed with reds brought from Alaska.

PACK OF CANNED SALMON ON PUGET SOUND IN SPECIFIED YEARS—Continued.

Year.	Can-neries oper-ated.	Chum.		Pink.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1877	1			500		5,500	
1878	1					238	
1879	1					1,300	\$5,600
1880	1					5,100	
1881	1					8,500	
1882	1					7,900	
1883	1					1,500	
1884	1					5,500	
1885						12,000	
1886						17,000	
1887						22,000	
1888	4					21,975	126,356
1889	2	1,145	\$3,435	2,809	\$7,584	11,074	49,619
1890	1	4,000	12,000			8,000	32,000
1891	2	3,093	10,825	5,647	15,246	20,529	72,461
1892	2	16,180	56,630			26,426	93,419
1893	3	11,390	31,295	17,530	47,331	89,774	247,637
1894	3	22,152	60,916	9,049	24,432	95,400	363,036
1895	7	38,785	94,741	23,633	62,556	179,968	591,948
1896	11	26,550	73,013			195,664	755,235
1897	12	23,310	64,103	67,268	171,804	494,026	1,805,505
1898	18	38,400	105,600			400,200	1,549,864
1899	19	81,481	86,427	252,733	734,241	919,611	3,710,358
1900	19	89,100	245,025			469,450	1,940,925
1901						1,380,590	
1902	21	93,492	467,460			581,659	3,094,445
1903	22	12,001	30,002	181,320	407,984	478,488	1,927,646
1904	13	49,858	124,254			291,488	1,295,328
1905	24	41,057	102,643	70,992	212,970	1,018,041	5,616,433
1906	16	149,218	708,781			430,602	2,481,336
1907	14	50,249	180,847	433,423	1,300,209	698,080	2,042,146
1908	11	47,607	142,821	6,075	18,225	448,765	2,069,095
1909	24	53,688	128,916	370,993	902,342	1,678,737	7,917,608
1910	15	146,942	514,297	108	388	567,883	3,143,256
1911	21	98,321	391,123	1,046,992	4,302,344	1,551,028	7,745,372
1912	21	60,760	184,193	700	2,185	416,119	2,079,457
1913	32	56,225	124,970	791,880	2,092,401	2,583,403	13,329,108
1914	22	290,477	903,075	1,017	4,015	817,354	4,555,049
1915	40	411,724	1,165,474	583,649	1,795,285	1,269,206	4,676,415
1916	32	504,184	2,031,088	143,804	575,210	1,052,917	4,739,458
1917	45	218,977	1,270,947	1,130,103	6,780,978	1,990,258	14,159,583
1918	33	264,922	1,069,069	42,946	162,807	322,732	5,017,823
1919	35	525,541	3,363,462	421,215	3,369,720	1,295,020	11,149,489

^a Includes 14 cases of steelheads, valued at \$34. The totals also include large quantities of salmon brought to the sound canneries from other waters, principally in British Columbia, and packed here, those when prepared for market comprising approximately 141,917 cases of humpbacks or pinks, valued at \$66,952; 136,310 cases of chums, valued at \$538,837, and 53,135 cases of silvers, valued at \$87,185; a grand total of 331,368 cases and \$1,183,074.

^b Includes 4 cases of steelheads, valued at \$36.

^c Includes 5,099 cases of steelheads from sound waters.

PACK OF CANNED SALMON ON SOLEDUCK RIVER, WASH., IN SPECIFIED YEARS.^a

Year.	Can-neries oper-ated.	Chinook.		Sockeye.		Silverside.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1912	1	414	\$2,484	15	\$156	940	\$4,324
1913	1	206	1,442			1,040	3,536
1914	1	237	1,185			1,439	5,574
1915	1	388	1,940			1,320	6,072

Year.	Can-neries oper-ated.	Pink. ^b		Chum.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1912	1	103	\$268	76	\$182	1,548	\$7,414
1913	1			28	61	1,274	5,039
1914	1	189	567	103	291	1,968	7,617
1915	1	826	2,478	192	538	2,726	11,028

^a None packed since 1915.

^b These are virtually all light-colored chinooks.

PACK OF CANNED SALMON ON HOH RIVER, WASH., IN SPECIFIED YEARS.

Year.	Canneries operated.	Chinook.		Silver-side.		Chum.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
1917.....	1	372	\$3,348	204	\$1,665	110	\$715	686	\$5,728
1918.....	1	60	540	294	2,499	17	108	371	3,147
1919.....	1	18	216	233	2,796	332	2,125	583	5,137

PACK OF CANNED SALMON ON QUETS RIVER, WASH., IN SPECIFIED YEARS.

Year.	Canneries operated.	Chinook.		Sockeye.		Silver-side.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1912.....	1	750	\$4,500	200	\$2,080	2,500	\$11,500
1913.....	1	1,082	7,574	220	1,848	1,680	5,712
1914.....	1	1,176	6,876	200	2,134	1,800	6,960
1915.....	1		9,036	1,612	9,072		
1916.....	1	1,506	8,417			617	3,085
1917.....	1	713	6,417			1,196	9,769
1918.....	1	381	3,429	20	280	1,138	9,673
1919.....	1	450	5,400	100	1,600	1,025	12,300

Year.	Canneries operated.	Chum.		Steelhead.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1912.....	1	1,000	\$2,400			4,450	\$20,480
1913.....	1	670	1,461	600	\$3,300	4,252	19,895
1914.....	1	1,020	2,887	500	2,750	4,695	20,612
1915.....	1					1,512	9,072
1916.....	1	416	1,245			2,538	18,366
1917.....	1	47	306	129	1,161	2,085	17,643
1918.....	1			87	870	1,626	14,262
1919.....	1	50	320			1,625	19,620

* 68 cases of these were smoked.

PACK OF CANNED SALMON ON QUINULT RIVER, WASH., IN SPECIFIED YEARS.

Year.	Canneries operated.	Chinook.		Sockeye.		Silver-side.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1911a.....	1	5,000	\$35,000	2,031	\$16,000	6,000	\$42,000
1912.....	2			4,500	40,500	3,916	18,014
1913.....	1			492	4,133	7,106	24,160
1914.....	2	51	255	12,074	120,740	1,623	6,281
1915.....	2	1,144	6,864	22,972	239,989	1,888	6,807
1916.....	2	1,365	8,190	10,815	92,835	1,093	5,465
1917.....	2	309	2,781	4,608	55,296	2,609	21,289
1918.....	2	1,497	13,473	2,470	30,869	6,086	51,731
1919.....	2	186	2,063	1,144	18,304	775	9,800

Year.	Canneries operated.	Chum.		Total.	
		Cases.	Value.	Cases.	Value.
1911a.....	1	5,400	\$27,000	18,431	\$120,000
1912.....	2	5,500	13,200	13,916	71,714
1913.....	1			7,598	28,233
1914.....	2	1,048	2,968	14,796	130,242
1915.....	2	1,963	5,580	27,497	259,240
1916.....	2	466	1,398	13,239	107,888
1917.....	2	1,821	11,836	10,553	98,488
1918.....	2	1,682	10,874	11,735	100,947
1919.....	2	650	4,160	2,734	38,827

a Previous to this date the fish were transported to the Aberdeen and Hoquiam canneries and prepared there.

b Includes 1,206 cases of humpbacks, valued at \$7,236.

PACIFIC SALMON FISHERIES.

PACK OF CANNED SALMON ON GRAYS HARBOR IN SPECIFIED YEARS.

Year.	Can-neries oper-ated.	Chinook.		Silverside.		Chum.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
1878.....	1							5,420	\$29,268
1879.....	1								
1885.....								8,200	
1886.....								18,700	
1889.....	4							37,000	212,750
1891.....	1			500	\$1,500			500	1,500
1892.....	1	4,500	\$15,390	9,000	30,780	3,000	\$9,415	16,500	55,585
1893.....	1	4,500	22,500	12,000	48,000	5,500	14,850	22,000	85,350
1894.....	1	12,300	61,500	4,100	16,400	5,000	13,500	21,400	91,400
1895.....	1	56	202	8,678	28,403	2,617	6,922	11,449	35,527
1896.....	2	7,816	36,806	9,278	29,089	4,180	11,495	21,274	67,990
1897.....	1	3,100	11,741	8,300	23,481	1,900	5,000	13,300	40,222
1898.....	2	5,100	23,052	4,800	16,320	2,200	6,050	12,100	45,422
1899.....	1	5,000	21,250	15,740	59,025	3,500	8,750	24,240	89,025
1900.....	2	6,700	33,500	12,900	61,600	11,200	30,800	30,800	115,900
1901.....								41,500	
1902.....	1	4,000	20,000	10,000	45,000	17,500	70,000	31,500	135,000
1904.....	2	4,339	20,163	14,904	61,854	8,316	21,022	27,559	93,039
1905.....	2	2,050	9,225	18,000	62,000	7,000	18,200	22,050	79,425
1906.....	2	2,500	10,000	11,500	48,900	8,000	21,500	22,000	75,400
1907.....	1	1,000	7,000	9,500	47,500	3,500	11,500	14,000	65,000
1908.....	1	1,000	7,000	9,500	47,500	3,500	11,500	14,000	65,000
1909.....	1	5,721	20,819	9,019	38,146	5,047	11,608	21,436	79,624
1910.....	3	15,495	90,718	21,788	108,840	13,867	48,534	65,540	272,017
1911.....	4	16,773	110,411	28,991	202,937	31,177	155,885	75,941	469,233
1912.....	5	9,090	54,360	26,162	120,345	12,065	28,956	47,287	203,661
1913.....	4	1,253	8,771	5,723	19,458	12,919	28,163	19,895	55,592
1914.....	4	11,899	59,495	9,156	35,434	11,379	32,203	32,434	127,434
1915.....	4	4,219	20,089	14,036	61,707	22,379	63,678	40,992	140,472
1916.....	5	12,470	74,403	11,580	67,898	32,560	117,744	60,336	265,229
1917.....	5	12,124	109,118	9,559	51,246	10,910	70,915	42,695	261,715
1918.....	6	8,751	99,912	21,994	201,705	5,247	37,915	35,972	338,582
1919.....	6	4,370	54,026	12,214	140,608	28,712	133,757	46,295	384,991

- a Includes 1,649 cases, valued at \$9,051, packed with sockeyes brought from Puget Sound.
- b Includes 4,350 cases of "quinault" or sockeye, salmon, valued at \$23,925.
- c Includes 6,780 cases of humpbacks.
- d Includes 3,796 cases of humpbacks, valued at \$15,184.
- e Includes 10,073 cases of humpbacks, valued at \$60,438.

PACK OF CANNED SALMON ON WILLAPA HARBOR IN SPECIFIED YEARS.

Year.	Can-neries oper-ated.	Chinook or black.		Silverside.		Chum.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
1880.....								13,600	
1887.....	4							22,500	\$129,375
1888.....	3							8,000	24,000
1891.....	1			8,000	\$24,000			14,500	48,785
1892.....	1	3,000	\$10,260	9,000	30,780	2,500	\$7,745	16,195	58,910
1893.....	1	1,700	9,180	7,895	31,580	6,800	18,150	15,100	55,080
1894.....	1	2,700	14,580	5,600	22,400	6,800	18,700	22,600	77,552
1895.....	2	4,636	23,180	13,047	41,150	4,917	13,222	24,941	82,201
1896.....	2	4,651	22,755	11,940	38,208	8,450	21,238	29,600	97,088
1897.....	1	8,100	33,291	14,600	44,822	6,900	18,975	21,420	75,963
1898.....	2	5,865	26,610	9,809	33,351	5,745	15,802	13,720	79,176
1899.....	3	6,650	25,425	10,675	40,031	4,889	13,720	20,300	102,900
1900.....	3	6,700	33,500	12,400	49,600	7,200	19,800	34,000	167,308
1902.....	2	5,826	29,136	9,125	41,075	24,528	97,112	5,890	27,855
1903.....	1	2,300	13,800	2,390	10,755	1,200	3,300	38,700	79,140
1904.....	2	3,000	12,000	7,400	28,440	16,000	58,000	14,050	53,125
1905.....	2	4,650	20,925	4,300	17,200	6,000	15,000	14,440	50,620
1906.....	2	4,000	18,000	5,340	21,380	5,100	18,260	13,352	54,532
1907.....	2	3,630	15,354	9,228	38,682	624	2,496	20,457	81,086
1908.....	2	4,017	20,685	5,923	23,692	10,817	36,809	12,024	36,391
1909.....	1	1,455	5,889	4,822	17,359	5,747	13,163	11,508	63,208
1910.....	1	2,923	15,077	5,096	25,480	3,489	27,711	25,497	157,515
1911.....	2	5,717	40,019	9,298	65,086	10,482	52,410	28,148	108,156
1912.....	3	6,123	30,738	8,030	36,938	5,533	22,879	3,111	10,577
1913.....	2	67	469	7,179	27,749	6,734	19,077	16,837	61,256
1914.....	3	2,924	14,431	4,008	18,437	5,686	15,921	12,842	53,738
1915.....	2	5,115	30,690	3,365	16,825	10,073	36,262	18,553	63,777
1916.....	2	1,720	18,920	2,143	19,287	4,516	30,708	8,379	68,915
1917.....	2	921	10,131	5,249	50,890	2,657	18,599	8,827	79,120
1918.....	2	1,152	13,824	2,927	35,124	9,125	58,400	13,204	107,348

- e Includes 4,462 cases of humpbacks, valued at \$11,501.

PACK OF CANNED SALMON ON THE COLUMBIA RIVER FROM THE INCEPTION OF THE INDUSTRY TO 1919.

Year.	Canneries operated.	Chinook.		Blueback.		Silverside.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1866	1	4,000	\$64,000				
1867	1	18,000	288,000				
1868	2	28,000	392,000				
1869		100,000	1,350,000				
1870		150,000	1,800,000				
1871		200,000	2,100,000				
1872		250,000	2,325,000				
1873		250,000	2,250,000				
1874	13	350,000	2,625,000				
1875	13	375,000	2,250,000				
1876	17	450,000	2,475,000				
1877		380,000	2,052,000				
1878	30	460,000	2,300,000				
1879	30	480,000	2,640,000				
1880	35	530,000	2,650,000				
1881	35	550,000	2,475,000				
1882		541,300	2,600,000				
1883		629,400	3,147,000				
1884		620,000	2,915,000				
1885		553,800	2,500,000				
1886		448,500	2,135,000				
1887		356,000	2,124,000				
1888	28	372,477	2,327,981				
1889	21	286,697	1,600,182	17,797	\$101,051		
1890	21	335,604	1,946,087	57,345	290,069		
1891	22	353,907	2,038,566	15,482	284,242		
1892	24	344,267	1,996,388	66,547	372,909	4,176	\$20,890
1893	24	288,773	1,559,374	30,469	152,295	29,107	116,428
1894	24	351,106	1,895,976	43,814	224,430	42,758	171,032
1895	24	444,909	2,428,668	18,015	86,523	99,601	329,683
1896	24	370,943	1,840,511	16,983	81,518	44,103	141,145
1897	22	432,763	1,804,221	12,972	51,888	80,860	197,762
1898	23	329,566	1,490,394	66,670	300,015	65,431	222,465
1899	17	265,824	1,458,175	23,969	134,723	29,608	112,056
1900	16	282,392	1,821,258	18,162	92,184	44,925	202,163
1902	14	270,580	1,428,743	17,037	86,465	10,532	44,732
1903	16	301,762	1,610,614	8,383	42,867	12,181	49,899
1904	20	320,378	1,944,690	12,911	78,048	31,254	118,357
1905	19	327,106	1,962,636	7,768	46,608	26,826	114,011
1906	19	311,384	1,868,007	7,816	54,712	41,446	124,338
1907	19	258,433		6,504		31,757	
1908	14	210,096		8,551		31,452	
1909	15	182,131	1,203,546	27,908	214,561	42,178	186,070
1910	15	244,285	1,832,137	6,234	34,287	68,922	363,688
1911	15	405,862	2,204,185	5,988	47,904	79,416	549,478
1912	15	220,317	1,988,526	8,210	35,384	31,842	177,248
1913	15	192,116	1,664,670	11,152	93,677	40,969	176,412
1914	17	289,464	2,573,502	35,311	376,924	69,769	380,666
1915	19	406,486	3,694,361	5,459	56,707	33,330	173,234
1916	20	395,166	3,572,203	3,790	27,288	52,064	335,114
1917	20	403,637	5,023,529	7,968	111,552	64,299	700,680
1918	20	400,952	5,222,983	37,833	605,328	98,145	1,072,843
1919	21	392,125	5,031,207	7,268	73,116	90,728	1,052,767

* Of these, 2,346 cases, valued at \$23,203 were packed with sockeyes brought from Puget Sound.

PACK OF CANNED SALMON ON THE COLUMBIA RIVER FROM THE INCEPTION OF THE INDUSTRY TO 1919—Continued.

Year.	Canneries operated.	Chum.		Steelhead trout.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1866.....	1					4,000	\$64,000
1867.....	1					18,000	288,000
1868.....	2					28,000	392,000
1869.....						100,000	1,350,000
1870.....						160,000	1,800,000
1871.....						200,000	2,100,000
1872.....						250,000	2,325,000
1873.....						250,000	2,250,000
1874.....	13					350,000	2,625,000
1875.....	13					375,000	2,250,000
1876.....						450,000	2,475,000
1877.....						380,000	2,052,000
1878.....	30					460,000	2,300,000
1879.....	30					480,000	2,640,000
1880.....	29					530,000	2,650,000
1881.....	35					550,000	2,475,000
1882.....						541,300	2,600,000
1883.....						629,400	3,147,000
1884.....						620,000	2,915,000
1885.....						553,800	2,600,000
1886.....	30					448,500	2,135,000
1887.....						356,000	2,124,000
1888.....	28					372,477	2,327,881
1889.....	21			25,391	\$108,587	399,895	1,809,829
1890.....	21			42,925	171,300	435,774	2,407,456
1891.....	22			29,564	118,156	398,933	2,440,964
1892.....	24			72,348	288,892	487,338	2,679,069
1893.....	24	2,311	\$6,933	65,226	260,904	415,876	2,095,934
1894.....	24			52,422	209,688	490,100	2,501,126
1895.....	24	22,493	62,591	49,678	203,542	634,696	3,110,997
1896.....	24			49,663	198,652	481,697	2,261,826
1897.....	22			46,146	165,440	552,721	2,219,311
1898.....	23			26,277	60,352	487,944	2,073,226
1899.....	17	11,379	33,836	11,994	39,188	332,772	1,777,975
1900.....	16	17,696	63,706	20,597	102,985	358,772	2,282,296
1901.....						390,183	1,942,660
1902.....	14	10,401	41,604	8,593	42,965	317,143	1,644,509
1903.....	16	10,000	37,500	7,261	36,255	339,577	1,777,105
1904.....	20	20,693	52,691	9,868	48,892	395,104	2,242,678
1905.....	19	25,751	65,206	9,822	40,110	397,273	2,237,571
1906.....	19	27,802	69,505	6,500	32,500	394,898	2,149,062
1907.....	19	22,556		5,921		324,171	1,763,490
1908.....	14	16,884		10,726		277,719	1,380,709
1909.....	15	24,542	57,115	17,382	99,796	274,196	1,760,220
1910.....	15	66,538	232,883	5,430	31,203	391,415	2,544,128
1911.....	15	53,471	203,188	8,594	47,399	553,331	3,052,194
1912.....	15	18,699	46,590	6,953	22,109	286,026	2,319,356
1913.....	15	13,303	29,486	8,939	49,142	266,479	2,012,387
1914.....	17	49,285	305,541	10,792	59,358	454,621	3,695,989
1915.....	19	86,530	251,632	26,723	129,358	558,534	4,305,292
1916.....	20	77,766	307,483	18,999	118,987	547,891	4,361,299
1917.....	20	53,659	386,596	23,783	292,583	553,346	6,514,940
1918.....	20	29,846	215,669	24,605	350,071	591,381	7,466,894
1919.....	21	75,493	441,989	14,414	144,140	580,029	6,743,219

^a Includes 55 cases of humpbacks, valued at \$132, packed with humpbacks brought from Puget Sound.
^b Includes 56 cases of humpbacks, valued at \$224.

PACK OF CANNED SALMON ON THE COLUMBIA RIVER, BY STATES, 1916-1919.

States and species.	1916		1917		1918		1919	
	Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
Washington:								
Blueback.....	1,377	\$12,389	2,801	\$33,612	19,450	\$245,070	2,329	\$18,632
Chinook.....	179,083	1,074,495	146,140	1,763,680	145,511	1,715,874	130,185	1,671,007
Chum.....	46,012	165,643	14,539	93,050	12,173	85,211	39,279	235,674
Humpback.....	^b 56	224						
Silverside.....	26,788	133,940	15,989	183,874	35,746	343,162	34,927	349,270
Steelhead.....	14,348	89,091	6,053	66,583	8,699	104,388	7,148	71,480
Total.....	267,664	1,472,782	185,522	2,130,799	221,579	2,493,705	213,868	2,340,063
Oregon:								
Blueback.....	2,413	14,899	5,167	77,940	18,383	360,258	4,939	54,484
Chinook.....	216,083	2,497,708	257,497	3,269,849	255,441	3,507,109	261,940	3,303,200
Chum.....	31,754	141,840	39,120	293,546	17,673	130,456	36,214	236,316
Silverside.....	25,296	201,174	48,316	519,806	62,309	729,681	55,801	703,497
Steelhead.....	4,651	32,896	17,730	225,955	16,906	246,683	7,266	72,680
Total.....	280,197	2,888,517	367,824	4,364,096	369,802	4,073,189	366,160	4,397,156
Grand total....	547,861	4,361,299	553,346	6,514,895	591,381	7,466,894	580,028	6,743,219

^a Includes 106,328 cases spring chinooks, valued at \$1,382,264; 21,740 cases fall chinooks, valued at \$273,924; and 2,117 cases light-colored chinooks, valued at \$14,819.

^b Fish brought in from Puget Sound.

PACK OF CANNED SALMON ON NEHALEM RIVER, OREG., IN SPECIFIED YEARS.

Year.	Can-neries oper-ated.	Chinook.		Silverside.		Chum.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
1887.....	1							5,000	\$30,000
1889.....								6,000	32,000
1890.....								9,000	45,500
1891.....	1							3,500	14,000
1892.....	1			10,000	\$40,000			10,000	40,000
1893.....	1	1,692	\$6,768	5,031	20,124			6,723	26,892
1894.....	1	1,627	6,508	4,866	19,464			6,493	25,972
1895.....	1	1,762	7,008	5,152	16,486			6,904	28,494
1896.....	1	2,828	8,484	5,213	15,654			8,046	24,138
1897.....	2	3,364	10,162	8,366	26,098			11,750	35,250
1898.....	1	3,808	9,891	5,700	19,380			9,508	29,271
1899.....	1	1,384	5,536	7,405	26,658	1,288	\$3,664	10,077	36,058
1900.....	1								
1901.....	1	268	1,189	3,273	13,092	2,609	7,206	6,210	21,437
1902.....	1	271	1,431	3,169	13,468	2,670	10,280	6,010	25,179
1903.....	1	686	3,670	4,615	19,614			5,301	22,284
1904.....	1	500	2,500	5,000	20,000	6,000	12,000	11,600	34,500
1905.....	1	2,700	16,200	2,900	12,325	6,000	15,000	11,600	43,525
1906.....	1	3,987	23,922	4,976	14,928	2,057	5,143	11,020	42,993
1907.....	1	4,000	28,000	6,600	19,800	2,000	6,000	12,600	53,800
1908.....	1	5,000	35,000	6,100	18,300	2,016	6,048	13,118	59,348
1909.....	1	1,986	10,542	4,564	20,253	909	2,991	7,448	32,886
1910.....	1	3,500	24,500	5,400	29,700	1,500	4,500	10,400	68,700
1911.....	2	5,821	46,568	14,878	81,829	3,439	13,048	24,138	141,446
1912.....	2			13,331	73,321	1,671	3,927	14,902	77,248
1913.....	1	300	1,500	764	3,056	5	11	1,069	4,567
1914.....	2	4,841	33,837	11,800	63,720	1,668	4,150	18,309	101,777
1915.....	2	400	2,400	5,400	24,840	2,260	6,328	8,060	33,568
1916.....	2	2,700	21,666	8,474	17,370	833	2,499	7,007	41,525
1917.....	2	783	7,047	851	6,908	472	3,804	2,106	17,159
1918.....	2	1,685	18,535	9,200	83,320	519	3,833	11,404	110,488
1919.....	2	500	6,250	8,124	97,488	1,183	7,571	9,807	111,309

PACIFIC SALMON FISHERIES.

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PACK OF CANNED SALMON ON TILLAMOOK BAY, OREG., IN SPECIFIED YEARS.

Year.	Can-neries oper-ated.	Chinook.		Siverside.		Chum.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
1884								4,500	
1885								9,800	
1886	2							37,000	
1887	2							21,000	\$115,500
1888	2							14,533	84,140
1889								9,500	82,250
1890								14,009	79,049
1891	1								
1892	1			18,000	\$72,000			18,000	72,000
1893	1	497	\$1,988	4,000	16,000	6,919	\$17,297	11,416	35,285
1894	1	700	2,800	7,763	31,052	700	1,760	9,163	35,602
1895	1			6,514	20,845	7,001	19,253	13,515	40,098
1896	1	2,200	6,600	4,860	14,580			7,060	21,180
1897	1	2,000	6,000	9,000	27,000			11,000	33,000
1898	1	5,000	13,000	10,342	35,162			15,342	48,162
1899	1	2,180	8,720	3,889	14,036	5,121	15,363	11,190	38,119
1900	1								
1901	1	848	4,240	2,133	9,598	3,901	10,728	6,882	24,566
1902	1	215	1,135	2,287	9,720	4,093	10,372	6,595	27,227
1903	1			2,727	11,590	2,620	10,480	5,347	22,070
1904	1			4,400	17,600	6,500	13,000	10,900	30,600
1905	1	1,100	6,600	1,700	7,050	8,800	22,000	11,600	36,250
1906	1	1,870	11,220	2,364	7,092	1,270	3,175	5,504	21,487
1907	1	2,000	14,000	3,410	10,230	2,314	6,942	7,724	31,172
1908	1	2,300	18,100	6,000	21,000	4,000	12,000	12,300	49,100
1909	1	2,615	15,663	5,029	21,809	3,712	8,538	11,356	46,010
1910	1	2,900	20,300	4,500	24,750	2,000	6,000	9,400	51,050
1911	2	8,433	67,464	12,063	69,647	5,277	20,053	28,373	157,164
1912	2	3,811	28,677	6,418	32,069	4,550	11,375	14,779	70,142
1913	1	2,600	16,600	1,000	4,000	1,000	2,200	4,600	21,800
1914	2	4,784	33,138	4,131	22,307	6,707	16,891	15,572	73,312
1915	3	5,675	34,300	4,549	29,925	9,099	25,477	19,323	79,702
1916	3	9,465	75,720	4,333	21,665	7,830	22,580	21,328	119,975
1917	3	8,822	79,398	5,522	44,176	6,941	48,587	21,285	172,161
1918	1	107	1,177	3,481	33,228	1,567	10,969	5,135	45,372
1919	2	1,500	18,750	7,150	85,800	4,350	27,840	13,000	132,390

PACK OF CANNED SALMON ON NESTUGGA RIVER, OREG., IN SPECIFIED YEARS.

Year.	Can-neries oper-ated.	Chinook.		Siverside.		Chum.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
1887	1							4,300	\$23,650
1888	1							5,000	28,750
1889								6,700	36,850
1891	1								
1899	1	1,109	\$4,436	3,034	\$10,922	513	\$1,539	4,656	16,897
1900	1								
1901	1	279	1,116	3,553	13,323	396	1,089	4,228	15,528
1905	1	3,000	18,000	1,000	4,250	400	1,000	4,400	23,250
1906	1	2,622	15,732	2,468	7,404	165	413	5,255	23,549
1907	1	2,100	14,700	3,540	10,620	150	450	5,790	25,770
1908	1	2,000	14,000	3,000	10,500	100	300	5,100	24,800
1910	1	2,000	14,000	3,300	18,150	140	420	5,440	32,570
1911	1	3,562	28,496	7,124	39,182	641	2,436	11,327	70,114
1912	1	3,090	18,540	6,180	30,900	708	1,770	9,978	51,210
1913	1	126	756	243	972			369	1,728
1914	1	3,542	24,794	5,730	30,942	265	662	9,537	56,308
1915	1	200	1,300	3,930	18,078	800	2,240	4,930	21,618
1916	1	2,400	19,200	4,056	20,280	200	600	6,656	40,800
1917	1	2,000	18,000	3,800	30,400	260	1,820	6,080	50,220
1918	1	3,000	33,000	3,206	39,778	215	1,505	6,421	65,283
1919	1	1,900	23,750	2,400	28,800	450	2,880	4,750	55,430

PACK OF CANNED SALMON ON SILETZ RIVER, OREG., IN SPECIFIED YEARS.

Year.	Can-neries oper-ated.	Chinook.		Silverside.		Chum.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
1896	1	2,500	\$7,500	1,900	\$5,700			4,400	\$13,200
1897	1	3,510	10,530	5,015	15,045			8,525	25,575
1898	1	3,200	8,360	4,330	14,722			7,530	23,082
1899	1	2,200	9,900	2,319	8,696	200	\$550	4,719	19,146
1900	1								
1901	1	876	4,380	3,740	16,830	360	1,260	4,976	22,470
1902	1	600	3,183	1,917	8,147	500	2,000	3,017	13,315
1904	1	1,000	6,000	3,300	13,200	1,000	2,000	5,300	20,200
1905	1	1,500	9,000	1,709	7,225	900	2,250	4,100	18,475
1906	1	2,635	18,810	3,192	9,578	187	418	5,994	25,804
1907	1	2,333	16,331	4,300	12,900	200	600	6,833	29,831
1908	1	2,100	14,700	4,700	16,450	300	900	7,100	32,050
1910	1	2,200	15,400	4,600	23,300	250	750	7,050	41,450
1911	1	3,584	28,672	7,164	39,402	237	901	10,985	68,975
1912	1	3,277	19,662	6,554	32,770	283	707	10,114	53,139
1913	1	15	75	354	1,416	17	37	386	1,526
1914	1	3,356	23,492	6,712	36,245	196	490	10,264	60,227
1915	1	100	600	3,000	13,800	100	280	3,200	14,680
1916	1	1,000	8,000	3,000	15,000	210	630	4,210	23,630
1917	1	1,800	16,200	3,400	28,200	222	1,654	5,422	45,954
1918	2	4,301	47,344	7,789	74,774	384	2,688	12,477	124,806
1919	2	1,393	17,413	5,892	70,704	472	3,021	7,757	91,188

PACK OF CANNED SALMON ON YAQUINA BAY AND RIVER, OREG., IN SPECIFIED YEARS.^a

Year.	Can-neries oper-ated.	Chlnook.		Silverside.		Chum.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
1887	2								
1888	3							5,088	\$29,256
1889								5,000	27,500
1891	1								
1896	1	1,714	\$5,142	615	\$1,845			2,329	6,987
1898	1	170	442	1,530	5,202			1,700	5,644
1899	2	316	1,422	3,234	12,127	1,300	\$3,575	4,850	17,124
1900	1								
1901	1	96	480	2,848	12,816	549	1,647	3,493	14,943
1903	1			1,238	5,262	315	787	1,553	6,049
1904	1	50	200	2,600	8,840	450	1,080	3,100	10,120
1905	1	200	1,200	2,050	8,613	62	155	2,312	9,968
1906	1	500	3,000	3,100	9,280	60	150	3,660	12,460
1907	1	834	5,838	1,000	3,000	49	147	1,883	8,985
1908	1			4,000	14,000			4,000	14,000
1909	1			1,139	4,556	33	76	1,172	4,632
1910	1			2,669	13,345			2,669	13,345
1911	1			1,009	5,549	51	289	1,060	5,838

^a Cannery not operated from 1912 to 1916, both years inclusive. In 1917 it was consolidated with Waldport cannery owned by same party.

PACK OF CANNED SALMON ON ALSEA RIVER AND BAY, OREG., IN SPECIFIED YEARS.

Year.	Can-neries oper-ated.	Chinook.		Silverside.		Chum.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
1886.	1								
1887.	2							11,180	\$64,285
1888.	3							9,620	55,316
1889.								10,000	55,000
1891.	1								
1892.	1			3,600	\$14,400			3,600	14,400
1893.	1	1,260	\$6,300	3,240	12,960			4,500	19,260
1894.	1	440	2,200	4,160	16,640			4,600	18,840
1895.	1	1,700	6,375	3,280	11,808			4,980	18,183
1896.	1	3,500	10,500	3,400	10,200			6,900	20,700
1897.	1	1,800	5,400	3,200	9,600			5,000	15,000
1898.	1	4,296	11,170	2,170	7,378			6,466	18,548
1899.	1	2,150	9,138	5,010	19,038			7,160	28,176
1900.	1								
1901.	1	695	3,475	4,629	18,790	891	\$3,118	6,215	25,383
1902.	1	701	3,702	4,530	19,253	670	2,680	5,901	25,635
1903.	1	1,031	5,516	4,242	18,029	44	88	5,317	23,633
1904.	1	1,000	5,000	6,500	26,000	300	600	7,800	31,600
1905.	1	2,500	15,000	1,800	7,650	700	1,750	5,000	24,400
1906.	1	3,702	22,212	3,843	11,529			7,545	33,741
1907.	1	800	5,600	5,100	15,300	350	1,050	6,250	21,950
1908.	1	1,200	8,400	6,000	21,000	400	1,200	7,600	30,600
1909.	1	1,119	6,714	5,488	24,027	80	184	6,065	30,925
1910.	1	2,500	17,500	5,900	31,950	100	300	8,500	49,750
1911.	2	4,161	33,288	9,329	51,309	688	2,014	14,178	87,211
1912.	2	3,721	22,388	8,288	41,430	524	1,310	12,541	65,128
1913.	2	1,607	8,035	4,304	17,216	160	352	6,071	25,673
1914.	2	4,546	31,822	6,728	36,331	73	183	11,347	68,336
1915.	2	1,668	10,763	6,966	32,044	178	498	8,812	43,305
1916.	2	2,624	20,992	3,864	19,320	292	876	6,780	41,188
1917.	2	2,727	24,543	6,621	52,068	418	2,926	9,766	80,437
1918.	2	2,000	22,000	7,215	69,264	312	2,178	10,068	99,934
1919.	2	2,512	31,400	2,607	31,200	535	3,718	5,654	66,313

• Includes 541 cases of bluebacks, valued at \$6,492.

PACK OF CANNED SALMON ON THE SIUSLAW RIVER, OREG., IN SPECIFIED YEARS.

Year.	Can-neries oper-ated.	Chinook.		Silverside.		Chum.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
1878.	2							10,300	\$55,620
1879.	2								
1886.	1							1,500	
1888.	3							11,960	68,770
1889.	1							12,000	66,000
1891.	2								
1892.	2			18,000	\$72,000			18,000	72,000
1893.	2	1,471	\$7,355	11,830	47,320			13,301	54,675
1894.	2	1,871	9,355	14,987	59,948			16,858	69,303
1895.	2	1,637	6,139	10,465	35,274			12,102	41,413
1896.	1	2,700	8,100	9,000	27,000			11,700	35,100
1897.	1	1,100	3,300	3,900	11,700			5,000	15,000
1898.	1	850	2,210	10,000	34,000			10,850	36,210
1899.	1	1,162	4,648	7,323	26,363	115	\$345	8,600	31,356
1900.	2								
1901.	1	1,736	8,675	7,488	29,952			9,223	35,627
1902.	1	1,298	6,800	4,320	18,260			5,608	25,060
1903.	1	1,519	8,127	6,842	29,079			8,361	37,206
1904.	1	500	2,500	6,500	26,000			7,000	28,500
1905.	1								
1906.	2	4,500	27,000	15,000	45,000	1,500	3,750	21,000	75,750
1907.	1			16,773	47,319			15,773	47,310
1908.	1			8,600	30,100			8,600	30,100
1909.	2	632	3,792	7,436	32,956			8,068	36,748
1910.	2	856	5,992	12,800	70,400	8,502	25,506	22,158	101,898
1911.	2	1,120	8,960	10,266	56,463	5,000	19,000	16,388	84,423
1912.	2			6,108	30,540			6,108	30,540
1913.	a			4,281	17,124			4,281	17,124
1914.	1			9,266	50,036			9,266	50,036
1915.	1			1,755	8,073			1,755	8,073
1916.	1	875	7,000	3,021	15,105			3,896	22,105
1917.	1			350	2,800			350	2,800
1918.	1			3,000	28,800			3,000	28,800
1919.	1			3,760	43,120			3,760	43,120

• The two canneries combined and operated one plant.

PACK OF CANNED SALMON ON THE UMPQUA RIVER, OREG., IN SPECIFIED YEARS.^a

Year.	Can-neries oper-ated.	Chinook.		Silverside.		Chum.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
1878	2							8,100	\$43,740
1879	2								
1884	2							3,700	
1885	1							10,500	
1886	1							18,600	
1887	1							4,000	22,000
1888	1							9,000	51,750
1889	1							12,000	66,000
1891	1								
1892	1			10,000	\$40,000			10,000	40,000
1893	1	809	\$4,045	3,204	12,816			4,013	16,861
1894	1	235	1,175	6,875	27,500			7,110	28,675
1895	1	992	3,720	7,697	28,863			8,689	32,583
1896	1	1,300	3,900	8,000	24,000			9,300	27,900
1899	2	925	3,860	7,576	27,008	115	\$345	8,616	31,211
1900	2								
1903	1	23	123	6,733	23,615			6,756	28,738
1904	1	500	2,500	9,500	38,000	500	1,000	10,500	41,500
1905	1	6,100	36,600	10,500	44,625			16,600	81,225
1906	1	1,143	6,858	5,613	16,839			6,756	23,697
1909	1	500	3,000	7,763	31,012			8,263	34,012
1910	1	2,000	14,000	11,000	60,500			13,000	74,500
1911	1	300	2,400	6,118	33,649			6,418	36,049
1912	1	30	210	3,759	18,795			3,789	19,005
1914	1	1,000	8,000	2,000	10,000			3,000	18,000
1915	2			5,100	23,460			5,100	23,460
1916	2			2,900	14,500			2,900	14,500
1917	1			5,368	42,928	47	329	5,415	43,257
1918	1	1,703	18,793	3,409	32,726	1	7	5,113	51,466
1919	1			7,500	90,000			7,500	90,000

^a No canning done in 1913.

PACK OF CANNED SALMON ON COOS BAY AND RIVER, OREG., IN SPECIFIED YEARS.

Year.	Can-neries oper-ated.	Chinook.		Silverside.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1887	2					11,300	\$62,150
1888	1					5,500	31,625
1889	1					7,000	38,500
1891	2		3				
1893	1			3,125	\$12,500	3,125	12,500
1894	1	163	\$815	8,428	33,712	8,591	34,527
1895	1	5,110	19,163	2,332	8,934	7,442	28,097
1896	1	13,000	39,000	2,000	6,000	15,000	45,000
1897	1	6,200	18,600	2,200	6,600	8,400	25,200
1898	2	3,142	8,169	7,180	24,412	10,322	32,581
1898	2	1,273	5,092	5,174	18,626	6,447	23,718
1900	2						
1901	1	1,215	6,075	4,082	16,328	5,297	22,403
1902	1	412	2,175	2,640	11,220	3,052	13,395
1904	1	2,033	7,725	7,200	24,490	9,233	32,205
1906	1	2,043	12,258	1,755	5,265	3,798	17,523
1909	1	275	1,475	3,959	17,927	4,234	19,402
1910	1	500	3,500	5,500	30,250	6,000	33,750
1911	2	2,630	21,040	7,260	39,930	9,890	60,970
1912	2	1,457	10,199	3,989	19,945	5,446	30,144
1913	2			7,383	29,532	7,383	29,532
1914	1			9,300	50,220	9,300	50,220
1915	1			3,500	16,100	3,500	16,100
1916	1			2,485	12,426	2,485	12,426
1917	1						
1918	1			3,800	36,480	3,800	36,480

PACK OF CANNED SALMON ON COQUILLE RIVER, OREG., IN SPECIFIED YEARS.

Year.	Canneries operated.	Chinook		Silverside.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1883	1					7,000	
1884	1					7,300	
1885	1					3,800	
1886	2					8,300	
1887	3						
1888	2					11,000	\$83,250
1889						8,600	47,300
1891	1						
1892	1			5,000	\$20,000	5,000	20,000
1893	1			6,500	26,000	6,500	26,000
1894	a 1			2,000	8,000	2,000	8,000
1895	2	760	\$2,887	8,724	32,616	9,484	35,502
1896	2	1,225	3,675	7,800	23,400	9,025	27,075
1898	2	641	1,407	7,485	26,499	8,026	28,906
1899	2	950	3,800	7,550	28,500	8,500	32,300
1900	1	2,636	18,189	9,601	38,404	12,237	51,584
1901	1	133	665	6,096	20,384	5,229	21,049
1902	1	286	1,510	5,877	24,927	6,163	26,437
1903	1	331	1,771	9,635	36,911	9,016	38,682
1904	2	600	2,400	19,686	64,744	14,286	57,144
1905	2	2,100	12,600	11,343	48,208	13,443	60,808
1906	2	321	4,926	17,979	53,637	18,800	58,863
1907	2	306	2,142	13,220	39,660	13,526	41,802
1908	2			19,174	67,109	19,174	67,109
1909	2	250	1,255	9,818	42,687	10,068	43,942
1910	2	420	2,940	16,637	91,604	17,057	94,444
1911	2	715	5,720	16,676	91,718	17,391	97,438
1912	2	377	2,639	6,040	30,200	6,417	32,839
1913	2			8,910	35,640	8,910	35,640
1914	2			12,097	65,324	12,097	65,324
1915	2	1,079	6,474	5,131	25,515	6,210	31,989
1916	2	869	6,952	2,652	13,260	3,521	20,212
1917	2	694	6,216	8,005	64,040	b 8,708	70,335
1918	2	1,318	14,498	10,096	96,922	c 11,650	113,129
1919	2	1,027	12,837	6,010	60,120	d 6,082	72,957

a Burned.
 b Includes 7 cases of chums, valued at \$49.
 c Includes 217 cases of chums, valued at \$1,519, and 19 cases of steelheads, valued at \$190.
 d Includes 45 cases of chums.

PACK OF CANNED SALMON ON ROGUE RIVER, OREG., IN SPECIFIED YEARS.^a

Year.	Canneries operated.	Chinook.		Silverside.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1877	1					7,804	
1878	1					8,534	
1879	1					8,571	
1880	1					7,772	
1881	1					12,320	
1882	1					19,186	
1883	1					16,156	
1884	1					12,376	
1885	1					9,310	
1886	1					12,147	
1887	1					17,216	
1888	1					21,062	\$121,107
1889	1					22,000	132,000
1890	1					24,000	120,000
1891	1					21,000	105,000
1892	1	10,000	\$59,000			19,000	95,000
1893	b 1	3,200	16,000	9,000	\$36,000	3,200	16,000
1895	1	10,377	41,508	4,385	15,347	14,762	56,855
1896	1	16,000	75,000	3,000	9,000	18,000	84,000
1897	1	16,355	61,420	3,653	10,959	19,008	72,379
1898	1	12,964	51,550	501	1,303	13,465	52,853
1899	1	5,481	30,145	1,745	6,980	7,226	37,125
1900	1						

a Shut down in 1911 and 1912 through the closing of the river to all fishing.
 b Burned down during season. Not opened the next year.

PACK OF CANNED SALMON ON ROGUE RIVER, OREG., IN SPECIFIED YEARS—Contd.

Year.	Canneries operated.	Chinook.		Siverside.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1901.....	1	2,681	\$13,405	4,184	\$17,736	6,865	\$31,141
1902.....	1	3,799	20,058	4,091	17,387	7,890	37,445
1903.....	1	8,418	45,036	4,792	20,366	13,210	65,402
1904.....	1	16,000	84,000	3,255	11,392	19,255	75,392
1905.....	1	18,500	111,000	1,500	6,375	20,000	117,375
1906.....	1	12,000	72,000	6,000	18,000	18,000	90,000
1907.....	1	7,537	56,528	1,796	8,980	9,333	65,508
1908.....	1	4,354	32,855	2,650	13,250	7,004	46,905
1909.....	1	186	1,300	699	2,777	885	4,277
1910.....	1	232	1,788	2,711	16,266	2,943	18,082
1913.....	1	3,020	27,180	2,403	11,857	5,423	39,017
1914.....	1	6,938	62,060	987	5,453	7,925	67,513
1915.....	2	19,094	135,301	515	2,369	19,609	137,670
1916.....	2	22,640	181,120	501	2,505	23,141	183,625
1917.....	2	24,707	271,777	660	5,280	25,367	277,057
1918.....	2	20,469	225,159	2,704	24,336	23,173	249,495
1919.....	3	17,237	215,463	671	8,052	17,908	223,516

PACK OF CANNED SALMON ON SMITH RIVER, CALIF., IN SPECIFIED YEARS.

Year.	Canneries operated.	Quinnat.		Siverside.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1878.....	1	4,277	\$23,096	.....	.....	4,277	\$23,096
1880.....	1	7,500	41,250	.....	.....	7,500	41,250
1884.....	1	5,500	33,000	.....	.....	5,500	33,000
1885.....	1	1,550	9,300	.....	.....	1,550	9,300
1888.....	1	2,347	14,082	.....	.....	2,347	14,082
1893.....	1	1,500	7,500	500	\$1,500	2,000	9,000
1894.....	1	1,500	7,500	500	1,500	2,000	9,000
1895.....	1	2,250	9,990	.....	.....	2,250	9,990
1914.....	1	.....	.....	3,000	18,000	3,000	18,000
1915.....	1	1,965	13,685	1,078	6,220	3,033	19,905
1916.....	1	1,515	12,120	990	4,950	2,505	17,070
1917.....	1	6,300	69,300	.....	.....	6,300	69,300
1918.....	1	4,041	44,451	612	5,508	4,653	49,959
1919.....	1	4,366	56,768	.....	.....	4,366	56,768

PACK OF CANNED SALMON ON KLAMATH RIVER, CALIF., IN SPECIFIED YEARS.

Year.	Canneries operated.	Quinnat.		Siverside.		Total.	
		Cases.	Value.	Cases.	Value.	Cases.	Value.
1888.....	1	4,400	\$26,400	.....	.....	4,400	\$26,400
1892.....	1	1,047	4,188	.....	.....	1,047	4,188
1893.....	1	1,600	6,400	.....	.....	1,600	6,400
1894.....	1	1,700	6,800	.....	.....	1,700	6,800
1895.....	1	1,200	5,321	400	\$1,500	1,600	6,821
1899.....	1	1,600	8,800	.....	.....	1,600	8,800
1902.....	1	2,500	13,500	.....	.....	2,500	13,500
1904.....	1	3,400	20,800	.....	.....	3,400	20,800
1909.....	1	5,633	33,000	.....	.....	5,633	33,000
1910.....	1	8,016	52,000	.....	.....	8,016	52,000
1911.....	1	7,400	46,000	204	816	7,604	46,816
1912.....	2	18,000	117,000	.....	.....	18,000	117,000
1913.....	2	6,376	40,500	.....	.....	6,376	40,500
1914.....	1	7,500	48,500	3,500	14,000	11,000	62,500
1915.....	1	10,400	72,800	2,500	13,000	12,900	85,800
1916.....	1	6,484	51,872	2,400	12,000	8,884	63,872
1917.....	1	5,130	56,430	2,900	23,200	8,030	79,630
1918.....	1	8,555	61,105	4,292	38,628	^a 10,200	102,557
1919.....	1	6,291	81,783	1,145	18,740	^b 7,731	95,523

^a Includes 353 cases of steelheads, valued at \$2,824.^b Includes 295 cases of steelheads.

PACK OF CANNED SALMON ON EEL RIVER, CALIF., IN SPECIFIED YEARS.^a

Year.	Canneries operated.	Quinnat.		Year.	Canneries operated.	Quinnat.	
		Cases.	Value.			Cases.	Value.
1877.....	1	8,500	\$51,000	1885.....	1	5,760	.....
1878.....	1	10,500	56,700	1886.....	1	12,500	\$75,000
1880.....	1	6,250	.....	1910.....	1	6,000	42,000
1883.....	1	15,000	.....	1911.....	1	8,400	52,500
1884.....	1	8,200	.....	1912.....	1	11,000	71,500

^a Shut down since 1912.

PACK OF CANNED SALMON ON NOYO RIVER, CALIF., IN SPECIFIED YEARS.

Year.	Canneries operated.	Quinnat.	
		Cases.	Value.
1918.....	1	2,000	\$22,000
1919.....	1	7,500	97,500

PACK OF CANNED SALMON ON THE SACRAMENTO RIVER IN SPECIFIED YEARS.

Year.	Canneries operated.	Quinnat.		Year.	Canneries operated.	Quinnat.	
		Cases.	Value.			Cases.	Value.
1864.....	1	2,000	.....	1893.....	3	23,336	.....
1866.....	1	2,000	.....	1894.....	2	28,463	.....
1874.....	.....	2,500	.....	1895.....	3	25,185	\$111,821
1875.....	.....	3,000	.....	1896.....	.....	13,387	.....
1876.....	2	10,000	.....	1897.....	.....	38,543	.....
1877.....	.....	21,500	.....	1898.....	.....	29,731	.....
1878.....	6	34,017	\$183,692	1899.....	.....	32,580	150,688
1879.....	4	13,855	59,577	1900.....	.....	39,304	.....
1880.....	9	82,000	.....	1901.....	.....	17,500	.....
1881.....	20	181,200	.....	1902.....	.....	14,043	.....
1882.....	19	200,000	.....	1903.....	.....	8,200	.....
1883.....	21	123,000	.....	1904.....	2	14,407	66,936
1884.....	.....	81,460	.....	1905.....	1	2,780	.....
1885.....	6	90,000	.....	1911.....	1	4,142	28,994
1886.....	9	39,300	.....	1913.....	1	950	6,650
1887.....	.....	36,500	.....	1914.....	2	17,315	95,232
1888.....	6	68,075	423,750	1915.....	2	5,229	35,463
1889.....	3	57,300	.....	1916.....	1	6,229	53,088
1890.....	.....	25,005	.....	1917.....	3	9,443	94,430
1891.....	.....	10,353	.....	1918.....	2	4,036	44,386
1892.....	.....	2,281	.....	1919.....	2	1,169	15,197

PACK OF CANNED SALMON AT MONTEREY BAY IN SPECIFIED YEARS.

Year.	Canneries operated.	Quinnat.		Year.	Canneries operated.	Quinnat.	
		Cases.	Value.			Cases.	Value.
1915.....	1	950	\$7,300	1918.....	.....	.....	.....
1916.....	1	12,809	102,472	1919.....	1	2,000	\$26,000
1917.....	1	2,000	20,000	.....	.....	.....	.....

PACK OF CANNED SALMON IN ALASKA, BY DISTRICTS, SINCE THE INCEPTION OF THE INDUSTRY.

Year.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	Canneries operated.	Pack.	Canneries operated.	Pack.	Canneries operated.	Pack.	Canneries operated.	Pack.
		<i>Cases.</i>		<i>Cases.</i>		<i>Cases.</i>		<i>Cases.</i>
1878.....	2	8,159					2	8,159
1879.....	2	12,530					2	12,530
1880.....	1	6,539					1	6,539
1881.....	1	8,977					1	8,977
1882.....	1	11,501	2	10,244			3	21,745
1883.....	4	20,040	2	28,287			6	48,327
1884.....	4	22,180	2	42,297	1	a 400	7	64,886
1885.....	3	16,728	2	52,687	1	14,000	6	83,415
1886.....	4	18,660	2	74,588	3	48,822	9	142,065
1887.....	5	31,462	2	102,515	3	72,700	10	206,677
1888.....	6	81,128	6	241,101	4	89,886	16	412,115
1889.....	12	141,760	21	461,451	4	118,985	37	719,196
1890.....	12	142,901	19	421,300	4	118,890	35	682,591
1891.....	11	156,615	14	511,367	5	133,418	30	801,400
1892.....	7	115,722	6	295,496	2	63,499	15	474,717
1893.....	8	136,033	11	399,815	3	107,730	22	643,654
1894.....	7	145,444	10	435,052	4	108,544	21	686,440
1895.....	9	262,381	12	327,919	6	150,135	28	626,580
1896.....	9	271,887	13	485,990	8	218,336	29	966,707
1897.....	9	271,887	13	382,899	7	254,312	29	909,078
1898.....	9	251,385	14	395,009	7	318,768	30	945,097
1899.....	9	310,219	14	350,095	9	411,832	32	1,078,146
1900.....	16	456,639	14	492,223	12	590,277	42	1,548,139
1901.....	21	735,449	18	562,142	21	719,213	55	2,016,804
1902.....	26	906,676	12	583,690	26	1,046,458	64	2,536,824
1903.....	21	642,305	12	417,175	27	1,180,730	60	2,246,210
1904.....	12	569,003	11	499,485	32	885,268	55	1,953,756
1905.....	13	433,607	9	371,755	25	1,089,154	47	1,894,516
1906.....	20	767,285	8	478,024	19	978,735	47	2,219,044
1907.....	22	887,503	8	522,836	18	759,534	48	2,169,873
1908.....	23	1,022,723	8	425,721	19	1,169,604	50	2,618,048
1909.....	19	852,870	8	391,054	18	1,161,553	45	2,395,477
1910.....	23	1,086,399	10	432,617	19	914,138	52	2,413,054
1911.....	32	1,690,868	11	499,743	21	743,206	64	2,923,817
1912.....	51	2,033,648	14	625,062	22	1,895,931	87	4,064,641
1913.....	42	1,782,898	14	447,249	23	1,609,038	79	3,739,185
1914.....	44	1,776,076	14	658,791	23	1,621,787	81	4,056,653
1915.....	46	2,549,212	17	632,646	24	1,318,233	87	4,500,298
1916.....	54	2,214,280	19	1,075,913	27	1,610,434	100	4,900,627
1917.....	62	3,294,845	27	1,017,206	29	1,835,235	118	5,947,286
1918.....	76	3,375,445	29	1,391,951	30	1,838,439	135	6,605,835
1919.....	75	3,108,364	30	775,557	28	708,280	133	4,592,201
Total.....		32,373,930		17,320,059		25,107,295		74,801,284

a Experimental pack.

PACK OF CANNED SALMON IN ALASKA FROM 1898 TO 1919, BY SPECIES.

Year.	Coho, or silver.		Chum, or keta.		Humpback, or pink.	
	Cases.	Value.	Cases.	Value.	Cases.	Value.
1898	54,711		5,184		109,399	
1899	39,402		1,031		149,159	
1900	50,984		30,012		232,022	
1901	65,609		47,464		641,427	
1902	82,723		159,849		549,602	
1903	120,506		35,052		355,799	
1904	85,741		21,178		299,333	
1905	67,394	\$215,875	41,972	\$113,056	168,597	\$498,194
1906	109,141	382,109	254,812	730,235	348,297	1,040,951
1907	85,180	337,384	184,173	547,757	581,978	1,799,280
1908	98,932	274,089	218,513	554,197	644,133	1,733,379
1909	56,558	231,029	120,712	274,110	484,873	1,114,839
1910	114,026	559,868	254,218	773,409	554,322	1,784,055
1911	133,908	792,647	323,795	1,199,583	1,005,278	3,972,706
1912	196,198	741,377	664,633	1,684,180	1,280,138	3,296,698
1913	75,779	261,654	290,918	2,643,948	1,372,881	3,550,587
1914	157,063	690,086	603,859	2,240,765	986,049	3,519,116
1915	124,268	536,124	470,946	1,243,321	1,876,516	5,217,203
1916	261,900	1,390,491	724,115	2,420,600	1,737,793	6,330,185
1917	193,231	1,682,745	906,747	5,672,047	2,296,976	14,794,002
1918	218,958	2,004,979	1,364,960	8,582,872	2,438,954	16,068,466
1919	230,138	2,761,656	1,348,462	8,630,157	1,657,434	13,259,472

Year.	King, or spring.		Red, or sockeye.		Total.	
	Cases.	Value.	Cases.	Value.	Cases.	Value.
1898	12,862		782,941		965,097	
1899	23,400		864,254		1,078,146	
1900	37,715		1,197,406		1,548,139	
1901	43,069		1,319,335		2,010,804	
1902	59,104		1,685,546		2,536,824	
1903	47,609		1,687,244		2,246,210	
1904	41,950		1,505,548		1,953,758	
1905	42,125	\$141,999	1,574,428	\$5,335,547	1,894,516	\$6,304,671
1906	80,834	116,222	1,475,960	5,620,875	2,210,044	7,896,392
1907	43,424	181,718	1,295,113	5,915,227	2,189,873	8,781,360
1908	23,792	99,867	1,662,678	7,524,251	2,618,048	10,185,783
1909	48,034	207,624	1,705,302	7,610,550	2,895,477	9,438,152
1910	40,221	214,802	1,450,267	7,774,390	2,413,054	11,086,322
1911	45,518	295,088	1,315,318	8,363,233	2,823,817	14,593,237
1912	48,317	243,331	1,900,355	10,426,481	4,054,641	16,291,917
1913	34,370	139,053	1,965,237	8,036,362	3,739,185	13,531,604
1914	48,039	241,105	2,201,643	12,289,617	4,060,653	18,920,589
1915	88,251	408,266	1,932,312	11,248,101	4,500,293	18,653,015
1916	65,873	353,420	2,110,937	12,765,733	4,900,627	23,209,429
1917	61,951	644,447	2,488,381	23,610,789	5,947,286	46,304,090
1918	49,226	485,205	2,533,737	23,920,347	6,805,885	51,041,949
1919	151,733	1,820,798	1,204,343	16,656,459	4,592,201	42,128,540

* Includes 91 cases of steelheads; value not given.

OUTPUT ^a OF CANNED SALMON IN ALASKA, 1912 TO 1918. ^b

Product.	1912	1913	1914	1915	1916	1917	1918	Total.
Coho, or silver:	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>
1-pound flat.....	2,719	3,587	4,579	2,050	13,145	30,412	26,238	82,730
1-pound flat.....	17	286	285	2,333	8,191	362	12,786	24,245
1-pound tall.....	163,462	71,928	152,199	119,880	240,573	162,457	179,934	1,090,431
Total.....	166,198	75,779	157,063	124,268	261,909	193,231	218,958	1,197,406
Chum, or keta:								
1-pound flat.....	2,795	985	373	.....	1,423	26,760	3,559	35,895
1-pound flat.....	.....	2,619	5,568	817	.....	2,530	2,996	14,030
1-pound tall.....	661,838	287,314	657,918	479,629	722,692	877,457	1,358,405	5,045,253
Total.....	664,633	290,918	663,859	479,946	724,115	906,747	1,364,960	5,095,178
Humpback, or pink:								
1-pound flat.....	13,712	20,822	2,103	4,325	41,491	91,403	63,557	237,413
1-pound flat.....	.....	3,258	9,286	3,508	14,796	6,014	20,216	57,077
1-pound tall.....	1,266,426	1,348,801	974,660	1,867,683	1,681,606	2,199,559	2,355,182	11,693,817
Total.....	1,280,138	1,372,881	986,049	1,875,516	1,737,793	2,296,976	2,438,954	11,988,307
King, or spring:								
1-pound flat.....	5,151	1,585	3,143	2,404	2,617	12,973	6,000	33,873
1-pound flat.....	.....	.....	4,804	3,755	3,804	5,133	5,287	22,783
1-pound tall.....	38,166	32,785	40,092	82,092	59,452	43,645	37,959	334,391
Total.....	43,317	34,370	48,039	88,261	65,873	61,951	49,226	391,027
Red, or sockeye:								
1-pound flat.....	28,024	29,041	53,825	52,033	81,565	124,309	137,008	506,805
1-pound flat.....	16,242	11,735	64,671	112,847	86,395	89,612	151,864	533,366
1-pound tall.....	1,856,089	1,924,461	2,083,147	1,785,139	1,938,971	2,274,460	2,244,865	14,085,132
1½-pound nominals.....	.....	.....	.....	2,293	.....	.....	.....	2,293
2-pound nominals.....	.....	.....	.....	.....	6,006	.....	.....	6,006
Total.....	1,900,355	1,965,237	2,201,643	1,932,312	2,110,937	2,488,381	2,533,737	15,132,602
Grand total.....	4,054,641	3,739,185	4,056,653	4,500,293	4,900,627	5,947,286	6,605,835	33,804,520

AVERAGE ANNUAL PRICE PER CASE OF FORTY-EIGHT 1-POUND CANS OF ALASKA SALMON, 1908 TO 1918. ^b

Product.	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918
Coho, or silver.....	\$3.98	\$4.07	\$4.89	\$5.67	\$4.44	\$3.45	\$4.39	\$4.31	\$5.34	\$8.76	\$9.15
Chum, or keta.....	2.53	2.28	3.04	3.72	2.37	2.21	3.37	2.59	3.34	6.14	6.27
Humpback, or pink...	2.69	2.40	3.16	3.94	2.55	2.58	3.50	2.78	3.64	6.44	6.58
King, or spring.....	4.20	4.32	5.34	6.43	5.37	4.04	5.01	4.63	5.36	10.40	9.85
Red, or sockeye.....	4.52	4.53	5.30	6.33	5.45	4.54	5.58	5.82	6.04	9.48	9.44

^a The number of cases shown has been put upon the common basis of forty-eight 1-pound cans per case.
^b From "Alaska Fisheries and Fur Industries in 1918," p. 49, by Ward T. Bower. Appendix VII, Report, U. S. Commissioner of Fisheries, 1918. Washington, 1919.

PACK OF CANNED SALMON IN BRITISH COLUMBIA SINCE THE INCEPTION OF THE INDUSTRY, BY WATERS.

Year.	Canneries operated.	Fraser River.	Skeena River.	Rivers Inlet.	Naas River.	Outlying districts.	Total.
		Cases.	Cases.	Cases.	Cases.	Cases.	Cases.
1876	2	7,247					7,247
1877	5	55,387	3,000				58,387
1878	8	81,446	3,600				85,046
1879	9	50,490	10,603				61,093
1880	9	42,155	19,694				61,849
1881	11	142,516	21,680			5,500	169,576
1882	16	199,704	24,522	5,935	6,500	4,900	240,461
1883	20	105,701	31,157	10,789	9,400	6,430	153,437
1884	14	34,037	53,793	20,393	8,500	7,000	122,706
1885	9	89,617	12,900			6,000	108,517
1886	16	99,177	37,587	15,000		1,200	152,964
1887	20	130,088	58,592	11,203		4,200	204,083
1888	21	76,616	70,108	20,000	12,318	5,000	184,040
1889	28	310,122	58,405	21,722	19,800	7,162	417,211
1890	33	244,352	91,645	33,500	24,700	17,960	411,257
1891	38	177,989	77,057	86,500	11,058	11,907	314,511
1892	36	98,491	90,750	14,955	29,100	18,425	248,721
1893	44	474,237	59,021	35,418	15,680	25,848	610,202
1894	42	363,566	61,005	40,161	20,000	7,500	492,232
1895	49	432,920	69,356	58,575	20,541	6,300	587,692
1896	56	375,344	97,863	107,473	14,649	22,453	617,782
1897	65	879,776	61,310	40,090	20,000	26,007	1,027,183
1898	67	264,225	80,102	105,362	20,000	22,862	492,551
1899	68	527,396	112,562	76,428	19,442	29,691	785,519
1900	69	331,371	135,424	74,196	20,200	46,349	606,540
1901	78	998,913	125,845	66,794	15,904	40,856	1,247,212
1902	69	327,197	155,936	70,298	23,212	50,518	627,161
1903	61	237,125	98,609	69,390	12,100	56,390	473,674
1904	61	128,903	164,869	94,292	19,085	68,746	465,894
1905	54	877,136	114,086	83,122	32,725	60,392	1,167,460
1906	59	240,486	162,430	122,578	32,534	71,142	629,460
1907	42	163,116	159,255	94,064	31,832	99,102	547,459
1908	50	89,184	200,177	78,090	46,908	122,330	547,689
1909	86	567,203	140,739	91,014	40,990	127,974	907,920
1910	58	223,148	222,035	126,398	39,720	147,900	762,201
1911	59	301,344	254,410	101,068	65,684	226,461	948,965
1912	57	173,921	254,258	137,697	71,162	359,538	996,576
1913	78	732,059	164,055	68,098	53,423	330,288	1,353,901
1914	63	328,390	237,634	109,052	94,890	341,073	1,111,039
1915	63	289,199	279,161	146,838	104,289	313,894	1,133,381
1916	73	106,440	223,158	85,383	126,686	453,398	995,065
1917	90	377,988	292,219	95,302	119,495	672,481	1,557,485
1918	83	206,003	374,216	103,155	143,908	789,876	1,616,157
1919	74	158,718	398,877	80,367	97,512	657,682	1,393,166
Total		12,119,943	5,367,525	2,550,675	1,440,047	5,276,373	26,763,563

NUMBER OF SALMON CANNERIES OPERATED IN VARIOUS SECTIONS OF BRITISH COLUMBIA IN RECENT YEARS.

Year.	Fraser River.	Naas River.	Skeena River.	Rivers Inlet.	Outlying districts.	Total.
1910	23	4	12	7	12	58
1911	22	4	12	7	14	59
1912	18	4	12	7	16	57
1913	36	4	13	7	18	78
1914	21	5	13	7	17	63
1915	22	5	13	7	16	63
1916	23	5	14	8	23	73
1917	29	6	14	9	32	90
1918	16	7	15	9	36	83
1919	11	7	15	9	32	74

PACK, BY DISTRICTS AND SPECIES, OF CANNED SALMON IN BRITISH COLUMBIA FROM 1903 ^a TO 1919.

Districts and species.	1903	1904	1905	1906	1907	1908
Fraser River district:	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>
Chums.....		1,066				
Cohos.....	25,728	45,667	30,836	34,413	35,766	24,198
Pinks.....	4,504		3,304	15,543	63,530	415
Sockeyes.....	204,809	72,688	837,489	183,007	69,815	63,120
Springs, red.....	2,084	9,482	5,507	6,503	3,448	1,427
Springs, white.....				1,020	557	18
Total.....	237,125	128,903	877,136	240,486	163,116	89,184
Skeena River district:						
Chums.....		35,329				
Cohos.....	9,648	5,515	7,247	16,897	15,247	10,085
Pinks.....	20,045		7,523	38,991	25,217	45,404
Sockeyes.....	50,968	93,404	84,717	86,394	108,413	139,846
Springs, red.....	18,008	20,621	14,598	20,138	10,378	13,374
Springs, white.....						468
Total.....	98,669	154,869	114,085	162,420	159,255	209,177
Rivers Inlet district:						
Chums.....		61				
Cohos.....	219	358		66	5,040	9,505
Pinks.....	180				700	479
Sockeyes.....	68,119	93,862	82,771	122,631	87,874	64,652
Springs, red.....	872	11	351	181	450	454
Total.....	69,390	94,292	83,122	122,878	94,064	75,090
Naas River district:						
Chums.....		31				
Cohos.....	2,187	1,697	3,083	5,997	6,093	8,348
Pinks.....			1,840	3,450	5,957	6,612
Sockeyes.....	8,438	15,000	24,402	22,166	17,813	27,584
Springs, red.....	1,475	2,357	3,340	858	1,288	3,263
Springs, white.....				63		
Steelheads.....					681	1,101
Total.....	12,100	19,085	32,725	32,534	31,832	46,908
Outlying districts:						
Chums.....		1,155				
Cohos.....	14,136	13,114	3,292	11,759	25,754	29,781
Pinks.....	2,653		1,303	10,321	23,300	23,538
Sockeyes.....	36,383	48,272	51,234	45,481	40,159	59,815
Springs, red.....	3,218	6,204	4,563	3,581	7,595	6,915
Springs, white.....					2,382	2,245
Steelheads.....					2	36
Total.....	56,390	68,745	60,392	71,142	99,192	122,330
TOTAL BY SPECIES.						
Chums.....		37,642				
Cohos.....	51,818	66,351	44,458	69,132	87,900	81,917
Pinks.....	27,382		13,970	69,305	61,874	67,648
Sockeyes.....	368,717	323,226	1,080,673	469,879	314,074	355,023
Springs, red.....	25,667	38,675	28,369	31,261	23,159	25,433
Springs, white.....				1,083	2,939	2,731
Steelheads.....					683	1,137
Grand total.....	473,674	465,894	1,167,460	629,460	547,469	542,089

^a In 1901 in the Fraser River district 920,313 cases of sockeyes were packed, and in 1902 sockeyes were packed as follows: 293,477 cases in Fraser River district, 117,677 cases in Skeena River district, 68,819 cases in Rivers Inlet district, 20,953 cases in Naas River district, and 30,510 cases in outlying districts.

^b Pinks and chums combined.

PACK, BY DISTRICTS AND SPECIES, OF CANNED SALMON IN BRITISH COLUMBIA FROM 1903 TO 1919—Continued.

District and species.	1909	1910	1911	1912	1913	1914
Fraser River district:	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>
Chums.....		52,177	47,237	12,961	22,220	74,726
Cohos.....	21,540	27,855	39,740	28,574	11,648	38,639
Pinks.....	1,987	128	142,101	574	9,973	6,057
Sockeyes.....	542,248	133,045	58,487	108,784	684,596	185,483
Springs, red.....	1,428	1,018	7,028	14,655	3,573	9,485
Springs, white.....		8,925	0,751	8,373	49	14,000
Total.....	567,203	223,148	301,344	173,921	732,059	328,390
Skeena River district:						
Chums.....			70	504		8,329
Cohos.....	12,249	11,531	23,376	39,628	18,647	16,378
Pinks.....	28,120	13,473	81,956	97,588	66,045	71,021
Sockeyes.....	87,001	187,246	131,006	92,498	52,927	130,166
Springs, red.....	11,727	9,546	15,514	19,532	23,250	11,529
Springs, white.....	742	239	2,428	4,501	3,186	211
Steelheads.....				207		
Total.....	140,739	222,035	254,410	254,258	164,055	237,634
Rivers Inlet district:						
Chums.....			288	3,845		5,023
Cohos.....	1,400	2,075	6,287	11,010	3,660	7,789
Pinks.....		19	5,411	8,899	2,097	5,784
Sockeyes.....	89,027	126,921	88,763	112,884	61,745	89,890
Springs, red.....	587	383	317	681	594	566
Springs, white.....				468		
Total.....	91,014	129,398	101,066	137,697	68,096	109,052
Naas River district:						
Chums.....		351	5,189	3,245	2,967	25,569
Cohos.....	6,818	6,285	7,842	12,468	8,172	9,276
Pinks.....	3,589	895	11,467	12,476	20,539	25,333
Sockeyes.....	28,246	30,810	37,327	36,037	23,574	31,327
Springs, red.....	2,280	1,228	3,434	5,710	2,999	2,660
Springs, white.....	57	11	325	1,226	152	725
Steelheads.....		140	100			
Total.....	40,990	39,720	65,684	71,162	53,423	94,890
Outlying districts:						
Chums.....		5,834	39,167	37,770	52,758	70,827
Cohos.....	19,911	26,636	42,457	73,422	32,695	48,119
Pinks.....	12,848	20,098	64,312	126,296	94,233	112,145
Sockeyes.....	93,019	87,893	67,866	94,559	149,336	99,830
Springs, red.....	2,196	7,138	12,458	21,967	7,017	8,668
Springs, white.....		301	201	3,524	260	1,484
Total.....	127,074	147,900	226,461	350,538	336,268	341,073
TOTAL BY SPECIES.						
Chums.....		58,362	91,951	58,325	77,965	184,474
Cohos.....	61,918	74,382	119,702	165,102	69,822	120,201
Pinks.....	46,544	34,613	305,247	247,743	192,887	220,340
Sockeyes.....	840,441	585,915	383,509	444,762	972,178	536,696
Springs, red.....	18,218	19,313	38,751	62,345	37,433	32,908
Springs, white.....	799	9,476	9,705	18,092	3,616	16,420
Steelheads.....		140	100	207		
Grand total.....	987,920	762,201	948,965	996,576	1,353,901	1,111,039

* Pinks and chums combined.

PACK, BY DISTRICTS AND SPECIES, OF CANNED SALMON IN BRITISH COLUMBIA FROM
1903 TO 1919—Continued.

District and species.	1915	1916	1917	1918	1919
Fraser River district:	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>
Chums.....	18,539	30,184	59,973	86,215	15,718
Cohos.....	34,114	27,876	30,735	43,871	54,866
Pinks.....	128,555	840	134,442	18,388	39,363
Sockeyes.....	89,040	27,394	123,614	16,849	29,628
Springs, red.....	15,388	11,096	10,197	15,192	15,223
Springs, white.....	3,532	9,217	18,916	24,853	3,592
Steelheads.....	31	33	111	635	328
Total.....	289,190	106,440	377,988	206,003	158,718
Skeena River district:					
Chums.....	5,769	17,121	21,516	22,573	31,457
Cohos.....	32,190	47,409	38,456	38,759	36,550
Pinks.....	107,578	73,029	148,319	161,727	117,303
Sockeyes.....	116,553	60,923	65,790	123,322	184,945
Springs, red.....	15,069	18,372	13,586	16,013	23,285
Springs, white.....	204	2,561	2,699	6,828	2,656
Steelheads.....	1,798	3,743	1,883	4,994	2,672
Total.....	279,161	223,158	292,219	374,216	398,877
Rivers Inlet district:					
Chums.....	5,387	20,144	16,101	6,729	7,089
Cohos.....	7,115	15,314	9,124	12,074	9,038
Pinks.....	2,964	3,567	8,065	29,542	6,538
Sockeyes.....	130,350	44,936	61,195	53,701	56,258
Springs, red.....	1,022	1,033	715	957	1,201
Springs, white.....		389	102	452	2
Steelheads.....					
Total.....	146,838	85,383	95,302	103,155	80,367
Naas River district:					
Chums.....	11,076	11,200	24,938	40,368	24,041
Cohos.....	15,171	19,139	22,180	17,061	10,900
Pinks.....	34,879	69,593	44,588	59,206	29,949
Sockeyes.....	39,349	31,411	22,188	21,816	28,259
Springs, red.....	3,053	3,061	3,170	2,332	2,993
Springs, white.....	648	784	1,326	1,820	581
Steelheads.....	113	1,498	1,125	1,305	789
Total.....	104,289	126,686	119,495	143,908	97,512
Outlying districts:					
Chums.....	41,229	161,552	352,745	341,730	293,730
Cohos.....	58,366	77,181	64,814	87,359	88,630
Pinks.....	93,376	145,615	161,365	258,882	153,486
Sockeyes.....	106,750	50,125	07,091	61,071	70,355
Springs, red.....	17,232	17,699	20,932	31,041	39,554
Springs, white.....	1,986	2,544	4,093	7,806	11,225
Steelheads.....	985	712	901	926	702
Total.....	313,894	453,398	672,481	788,875	657,682
TOTAL BY SPECIES.					
Chums.....	82,000	240,201	475,273	497,615	372,035
Cohos.....	146,956	186,719	165,309	199,124	199,993
Pinks.....	367,352	280,644	496,759	527,745	346,039
Sockeyes.....	476,042	214,780	339,848	276,459	369,445
Springs, red.....	51,734	51,281	48,630	65,535	82,256
Springs, white.....	6,370	15,495	27,646	41,819	18,295
Steelheads.....	2,927	5,986	4,020	7,860	4,493
Grand total.....	1,133,381	995,065	1,557,485	1,616,157	1,393,156

MARKET PRICES FOR CANNED SALMON.

The manner of fixing the selling price at which the canner is willing to dispose of his canned product varies slightly in certain regions. In May or June, when the spring-packing season has sufficiently advanced so that a line can be gotten on the probable pack of chinook, the highest priced of the pack, the Columbia River canners agree upon a price, this usually being high or low, as the pack is small or large.

Since the Alaska Packers Association was formed, through a combination of a number of canneries operating in the Territory of Alaska, it has packed annually in recent years about one-fourth of the salmon canned. It also owns several canneries on Puget Sound, thus being quite a factor in that region also.

In the early days of the association the custom grew up amongst the smaller packers of Alaska and Puget Sound of waiting until the association fixed the prices on its own pack, when the others would generally fall into line with the same prices for their packs. This custom is still in vogue. At no time has it ever been compulsory on the part of any packer to adopt the same prices as the association. In fact, it has sometimes been the case that, while the small packer publicly quoted the association's opening prices, yet in secret he was shading it by 2½ to 5 cents per dozen on certain grades. In recent years this has frequently been the case and the big packers, who adhered to the opening prices, have had to sit idly by and watch their small competitors underselling them and getting the bulk of the business until they had finally disposed of their goods, when, necessarily, they would have to drop out of the market until the next season.

Occasionally the other packers do not like a certain quotation of the association and make one more nearly in consonance with their own views. This happened in 1913, when the association quoted 60 cents for chums, while the Puget Sound canners quoted 55 cents for this grade, and in 1915 when the association quoted 65 cents for chums and the Puget Sound interests 70 cents for the same grade, thus showing clearly the independence of the smaller packers.

Owing to a peculiar feature of the salmon marketing business, more depends upon the opening prices than appears on the surface to the uninitiated.

Shortly after the first of the year buyers throughout the world begin to take stock of their salmon supplies and shortly thereafter begin placing their "future" orders. These cover the quantity required of each grade, and when the buyer orders through a broker the orders are placed subject to a contract similar to the following:

The undersigned hereby authorizes _____ to book the number of cases of canned salmon specified below; said booking to be filed with packers for delivery from _____ (naming year) pack, subject to buyers' approval of opening prices when named; *the option being granted buyers of confirming the total number of cases specified below; confirming a smaller quantity, or declining any confirmation.*

_____ furthermore agrees that buyers shall have the option of increasing quantities listed below, when he names opening prices for his packers, contingent upon his ability to secure at that time an increased allotment from his packers. In event _____ secures an increased allotment from his packers insufficient to meet all increases requested by his patrons, he will distribute such increase as he can secure among the dealers who have filed conditional contracts with him, according to the date order that said contracts have been received in his office.

Under this form of contract the packer is expected to be ready to fulfill the terms of same, except in case of a short pack, when the orders are generally prorated; i. e., all orders are proportionately reduced until they come within the compass of the pack. Should the buyer dislike the opening price he has the privilege of canceling the order. While this latter privilege may not, at first glance, look just to the packer, yet it is doubtful if any buyer would place a "futuro" order unless he was assured of a chance to cancel it should he feel that too high a sum was fixed in the opening prices.

Some canneries contract to sell their entire output to one buyer, and the price fixed is usually the opening prices for the year in question. In such cases the buyer and seller are both compelled to abide by the price, no matter how unjust one or the other may consider it.

The association does not announce its opening prices until late in August or early in September, when the greater part of the packing is over with and a good line on the total pack has been obtained, and it speaks well for the discernment of the officials of the association that their judgment as to prices should meet with the general approval as often as it does.

AMERICAN OPENING PRICES.

Below are shown the yearly opening prices on the various grades and sizes from 1890 to 1919. The most interesting part of this is the increase shown in the value of high-grade salmon. Columbia River chinook was quoted at \$1.05 for 1-pound talls in 1897, and it gradually advances until in 1919 it is quoted at \$3.15. Alaska red 1-pound talls in 1897 sold for 90 cents, the lowest during the period in question, advancing, with occasional recessions, until in 1919 it reached high-water mark of \$3.25. In 1897 Puget Sound 1-pound tall sockeye sold for 80 cents, 10 cents below Alaska red. In 1898 it sold for 20 cents less than reds. In 1902 it sold for \$1 as compared with 95 cents for Alaska red, and from that time on brought a higher price, being quoted at \$3.15 in 1919 as compared with \$2.35 for Alaska red. No sockeye 1-pound talls were packed in 1919.

Medium red or coho does not figure in the opening prices until 1908, when Puget Sound coho sold for 5 cents a dozen more than Alaska coho. Very shortly thereafter, however, both were classed together and sold for the same price. This grade has not had the wide fluctuations of the others, due mainly to the generally small pack made annually.

Pink salmon has been the football of the salmon market ever since the pack became of sufficient size to become a feature in it. The size of the pack has been steadily increasing, as the fish became better known, and while the price obtained has been excellent in certain years (in 1911 it sold at \$1 per dozen, the highest point reached up to that time, usually the price has been low. In 1897 it was quoted at 65 cents. In 1915 the opening price was 75 cents, but as a matter of fact a large part of the pack really sold for 65 cents. The lowest point it reached was in 1903, when it was quoted at 50 cents a dozen. As a result of the demand created by the war pink salmon opened at 90 cents in 1916, \$1.65 in 1917 and 1918, and \$2.25 in 1919. The market collapsed under the last-named price, however, and is now (1920) not more than one-half of it.

It is only of recent years that chum salmon has become a factor in the market. Although sold for some time before then, chum salmon appears first in the regular opening prices in 1908, when it was quoted at 70 cents a dozen. In 1913 it was quoted at 55 cents while the opening price in 1915 was 70 cents on Puget Sound and 65 cents at San Francisco. During the war the opening prices on chums were materially increased, being 85 cents in 1916, \$1.60 in 1917, \$1.75 in 1918, and \$2.15 in 1919. As in the case of chums the market collapsed under the 1919 price, and some sales under \$1 were made in 1920.

The pack of Alaska and Puget Sound kings or springs has always been small, and while they have always been quoted at \$1 per dozen or better (in 1919 they were quoted at \$3.12½) they have always been slow sellers. It is extremely improbable that the canned pack will increase much in the future, as this fish is the best for mild curing, and as the mild curers are able to offer better prices for the raw fish than the canneries, they will always get the fish when desired.

AMERICAN OPENING PRICES PER DOZEN CANS SINCE 1890.

1890 to 1902.

Year and species.	Talls.	Year and species.	Talls.	Year and species.	Talls.
1890.					
Columbia River chinook	\$1.40	Columbia River chinook	\$1.32½	Columbia River chinook	\$1.25
Alaska red	1.20	Alaska red	1.15	Alaska red	1.10
Alaska pink	.75	Alaska pink	.80	Puget Sound sockeye	1.10
1891.					
Columbia River chinook	1.35	1896.		1900.	
Alaska red	1.20	Columbia River chinook	1.25	Columbia River chinook	1.60
Alaska pink	.75	Alaska red	1.10	Alaska red	1.25
1892.					
Columbia River chinook	1.35	Alaska pink	.75	Puget Sound sockeye	1.10
Alaska red	1.15	1897.			
Alaska pink	.75	Columbia River chinook	1.05	Alaska pink	.75
1893.					
Columbia River chinook	1.32½	Alaska red	.95	1901.	
Alaska red	1.17½	Puget Sound sockeye	.80	Columbia River chinook	1.50
Alaska pink	.65	Alaska pink	.65	Alaska red	1.25
1894.					
Columbia River chinook	1.35	1898.			
Alaska red	1.10	Columbia River chinook	1.05	Columbia River chinook	1.35
Alaska pink	.60	Alaska red	.97½	Alaska red	1.00
1903 to 1919.					
Columbia River chinook	1.20	Puget Sound sockeye	.80	Puget Sound sockeye	1.00
1902.					
Columbia River chinook	1.35	Alaska pink	.65	Alaska pink	.65

Year and species.	Talls.	Flats.	Halves.	Year and species.	Talls.	Flats.	Halves.
1903.							
Puget Sound sockeye	\$1.50	\$1.60	\$0.90	Columbia River chinook	\$1.45	\$1.55	\$0.90
Columbia River chinook	1.35	1.45	.85	Puget Sound sockeye	1.35	1.50	4.00
Alaska red	1.30			Alaska red	1.00		
Alaska pink	.50			Alaska pink	.70		
1904.							
1905.							
Columbia River chinook	1.45	1.15	.90	Columbia River chinook	1.50	1.60	1.00
Puget Sound sockeye	1.55	1.65	.95	Puget Sound sockeye	1.45	1.60	1.00
Alaska red	1.30			Alaska red	.95		
Alaska pink	.70			Alaska pink	.75		

AMERICAN OPENING PRICES PER DOZEN CANS SINCE 1890—Continued.

1903 to 1919—Continued.

Year and species.	Tails.	Flats.	Halves.	Year and species.	Tails.	Flats.	Halves.
1907.				1913			
Columbia River chinook.....	\$1.65	\$1.75	\$1.05	Pink.....	\$0.65	\$0.80	\$0.55
Puget Sound sockeye.....	1.60	1.75	1.10	Chum.....	a.55	.70	.50
Alaska red.....	1.15			1914.			
Alaska pink.....	.80			Chinook.....	1.95	2.10	1.25
1908.				Sockeye.....	1.95	2.15	1.35
Columbia River chinook.....	1.65	1.75	1.05	Alaska red.....	1.45	1.80	1.10
Puget Sound sockeye.....	1.60	1.75	1.05	Medium red.....	1.15	1.35	.82½
Puget Sound pink.....	.75	.80		Alaska king.....	1.40		1.10
Puget Sound coho.....	1.05	1.15	.75	Pink.....	.90	1.00	.70
Alaska red.....	1.15			Keta, or chum.....	.85	.95	.65
Alaska king.....	1.05			1915.			
Alaska coho.....	1.00			Chinook.....	1.90	2.00	1.25
Alaska pink.....	.70			Sockeye.....	1.95	2.15	1.35
Alaska chum.....	.70			Alaska red.....	1.50	1.85	1.15
1909.				Medium red.....	1.15	1.30	.75
Columbia River chinook,				Alaska king.....	1.25		
fancy.....	1.65	1.75	1.05	Pink.....	.75	.85	.57½
Puget Sound sockeye.....	1.35	1.50	1.00	Keta, or chum.....	b.70	.80	.52½
Alaska red.....	1.15	1.35	.85	1916. ^c			
Alaska king.....	1.10			Chinook.....	1.90	2.00	1.25
Alaska coho.....	1.05	1.20	.70	Sockeye.....	2.05	2.25	1.40
Alaska pink.....	.90			Alaska red.....	1.50	1.75	1.20
Alaska chum.....	.57½			Medium red.....	1.30	1.45	.90
1910.				Alaska king.....	1.35		
Columbia River chinook,				Pink.....	.90	1.10	.75
fancy.....	1.75	1.90	1.10	Chum.....	.85		.67½
Puget Sound sockeye.....	1.65	1.80	1.10	1917.			
Alaska red.....	1.35	1.50	1.00	Chinook.....	2.90	3.00	1.75
Alaska king.....	1.35			Sockeye.....	2.90	3.00	1.75
Alaska pink.....	.80			Alaska red.....	2.35	2.60	1.65
Alaska chum.....	.77½			Medium red.....	2.00	2.15	1.35
Medium red and coho.....	1.25	1.40	.80	Alaska king.....	2.25		
1911.				Pink.....	1.65	1.80	1.15
Columbia River chinook,				Chum.....	1.60	1.75	
fancy.....	1.95	2.00	1.30	1918. ^d			
Puget Sound sockeye.....	1.95	2.00	1.30	Chinook:			
Alaska red.....	1.60	1.75	1.12½	Fancy.....	3.15	3.25	2.00
Alaska medium red.....	1.45	1.65	1.00	Standard.....	2.75	2.85	1.75
Alaska king.....	1.80	2.00	1.12½	Bluebacks.....	3.15	3.25	2.00
Pink.....	1.00	1.15	.80	Sockeye.....	2.35	2.50	1.65
Chum.....	.95	1.05	.75	Alaska red:			
1912.				Medium red:			
Chinook.....	1.95	2.00	1.25	Alaska.....	2.25	2.40	1.60
Sockeye.....	1.95	2.00	1.30	Puget Sound, etc.....	2.40	2.50	1.60
Alaska red.....	1.40	1.60	1.15	Pink.....	1.65	1.80	1.15
Alaska medium red.....	1.15	1.25	.80	Chum:			
Alaska king.....	1.40	1.60	1.15	Alaska.....	1.60	1.75	1.10
Pink.....	.65	.65	.50	Puget Sound, etc.....	1.75	1.85	1.10
Chum.....	.62½		.50	Steelhead.....	3.00	3.10	1.90
1913.				1919.			
Chinook.....	1.95	2.00	1.25	Chinook.....	3.15	3.25	2.00
Sockeye.....	1.60	1.65	1.05	Sockeye.....			2.50
Alaska red.....	1.15	1.35	.95	Alaska red.....	3.35	3.50	2.25
Alaska medium red.....	.85	1.00	.70	Tips and tails.....	3.10		
Alaska king.....	1.00	1.15	.90	Alaska king.....	3.12½		
				Medium red.....	3.00	3.15	2.00
				Pink.....	2.25	2.40	1.40
				Chum.....	2.15	2.30	1.25

^a The opening price in San Francisco was 60 cents.

^b The opening price in San Francisco was 65 cents.

^c The Kelley-Clarke prices differed from these in the following particulars: Red tails, \$1.60; red halves, \$1.25; medium red tails, \$1.35; medium red flats, \$1.50; medium red halves, \$1.00; pink tails, \$1.00; Chum tails, 95c.; and King tails, \$1.40.

^d Maximum prices set by U. S. Food Administration.

^e Pack of 1-pound tails and 1-pound flats taken for British Government at these prices.

^f No price named by Alaska Packers Association or Deming & Gould Co.

^g Alaska Packers Association and Northwestern Fisheries Co. quoted \$3.25; others reduced to conform.

^h Quoted by Alaska Packers Association only.

ⁱ Alaska Packers Association quoted \$2.10.

BRITISH COLUMBIA OPENING PRICES.

The packers of British Columbia and the United States both sell a considerable portion of their high-grade salmon abroad, and the competition thus engendered compels a fairly close conformity in prices. On salmon sold in the domestic markets, however, the competition is not so keen; hence there is room for a considerable diversity of opinion as to values. Unlike the United States, there is a very small market in Canada for chum salmon, and it has only been in recent years that opening prices have been fixed on this grade.

BRITISH COLUMBIA OPENING PRICES SINCE 1902.*

[Prices are for full cases.]

Year and species.	Talls.	Flats.	Halves.	Year and species.	Talls.	Flats.	Halves.
1902.				1911.			
Sockeye.....	\$4.75	\$4.90		Pink.....	\$4.00	\$4.25	\$5.50
Red spring.....	4.00			Chum.....	3.75		
Coho.....	3.75			1912.			
Pink.....	2.50	2.50		Sockeye.....	9.00	9.25	10.75
1903.				Red spring.....	7.75		9.25
Sockeye.....	4.65			Coho.....	7.25	7.25	7.50
Red spring.....	4.00			Pink.....	3.00	3.00	4.50
Coho.....	3.75			Chum.....	2.75		
Pink.....	2.60	2.50		1913.			
1904.				Sockeye.....	6.00	6.25	7.75
Sockeye.....	5.75	6.25		Red spring.....	5.75	5.75	
Red spring.....	5.25			Coho.....	4.25	4.50	
Coho.....	4.25			Pink.....	2.60	2.50	
Pink.....	2.75			1914.			
1905.				Sockeye.....	7.50	8.75	9.25
Sockeye.....	5.00	5.30		Red spring.....	6.75		
Red spring.....	4.50	5.00		Coho.....	4.75		5.50
Coho.....	4.00			Pink.....	3.50		
Pink.....	2.60			1915.			
1906.				Sockeye.....	8.25	8.25	10.25
Sockeye.....	5.50			Red spring.....	6.75		
Red spring.....	5.25			Coho.....	4.50	5.00	
Coho.....	4.50	4.75		Pink.....	3.25	3.50	4.75
Pink.....		3.00		Chum.....	2.75		
1907.				1916.			
Sockeye.....	5.50			Sockeye.....	9.00		11.00
Red spring.....	5.50	5.50		Red spring.....	8.00		9.50
Coho.....	4.50	4.50		Coho.....	6.50		9.00
Pink.....	3.00	3.00		Pink.....	3.75		5.25
1908.				Chum.....	3.00	4.00	
Sockeye.....	6.10			1917.			
Red spring.....	5.75	5.75		Sockeye.....	13.00		16.00
Coho.....	4.75	5.00		Red spring.....		12.00	13.00
Pink.....	3.25	3.25		Coho.....	10.00	11.00	12.50
1909.				Pink.....	8.00		9.25
Sockeye.....	5.25		\$6.75	Chum.....	6.85		
Red spring.....	5.10	5.60		1918.			
Coho.....	4.25			Sockeye.....	14.50	15.00	16.00
Pink.....	2.75			Red spring.....	13.00	13.25	14.00
1910.				Coho.....	11.50	12.00	13.00
Sockeye.....	6.50	7.00	8.25	Pink.....	8.50	8.75	10.00
Red spring.....	5.75	6.00		Chum.....	6.75		7.75
Coho.....	5.00	5.50	6.50	1919.			
Pink.....	3.25			Sockeye.....	16.00	16.50	17.50
1911.				Red spring.....			16.00
Sockeye.....	7.75	8.00	10.00	Coho.....	12.00	12.50	13.50
Red spring.....	6.50			Pink.....		9.00	10.00
Coho.....	6.00	6.25	7.50	Chum.....	6.75		

* These opening prices have been furnished by H. Boll-Ingving & Co. (Ltd.), of Vancouver, British Columbia, Canada, well known packers and haulders of canned salmon.

PICKLING INDUSTRY.

The salmon-pickling industry was so overshadowed by its giant brother, the canning industry, that statistical data, except for Alaska, were found in extremely fragmentary shape, and only that portion is shown relating to Alaska from the time of annexation to and including 1919.

PACK OF SALTED SALMON IN ALASKA, 1868 TO 1919.

Year.	Salmon.		Salmon bellies.		Dry-salted salmon.	
	Barrels.	Value.	Barrels.	Value.	Pounds.	Value.
1868.....	2,000	\$16,000				
1869.....	1,700	13,600				
1870.....	1,800	14,400				
1871.....	700	6,300				
1872.....	1,000	9,000				
1873.....	900	7,200				
1874.....	1,400	11,200				
1875.....	1,200	9,600				
1876.....	1,800	14,400				
1877.....	1,950	15,700				
1878.....	2,100	16,800				
1879.....	3,500	28,000				
1880.....	3,700	29,600	300	\$3,300		
1881.....	1,760	15,840				
1882.....	5,890	53,010				
1883.....	7,251	65,259				
1884.....	6,106	54,954				
1885.....	3,230	29,070				
1886.....	4,861	43,749				
1887.....	3,978	35,802				
1888.....	9,600	85,500				
1889.....	6,457	58,013				
1890.....	18,039	162,351				
1891.....	8,913	71,304				
1892.....	17,374	140,057	53	815		
1893.....	24,065	120,083				
1894.....	32,011	178,060				
1895.....	14,234	85,404				
1896.....	9,314	65,198	150	1,200		
1897.....	15,848	110,936	2,846	28,460		
1898.....	22,670	181,360	580	5,800		
1899.....	22,382	167,865	235	2,350		
1900.....	31,852	238,890	2,353	23,530	511,400	\$10,228
1901.....	24,477	171,339	652	3,816		
1902.....	30,384	212,088	328	2,052		
1903.....	27,921	223,368	3,667	32,973	300,000	5,500
1904.....	13,674	89,209	208	1,950	966,812	16,180
1905.....	19,071	143,811	1,360	11,355	7,280,234	115,643
1906.....	17,283	126,194	1,338	13,644	1,107,680	16,969
1907.....	22,307	203,127	2,065	37,422	107,580	1,505
1908.....	34,337	293,377	4,736	59,330	20,800	416
1909.....	28,915	183,400	1,970	25,358	71,600	1,038
1910.....	12,779	111,634	1,628	19,007	22,178	554
1911.....	8,483	102,477	1,337	15,561	33,285	1,340
1912.....	34,602	305,928	37	606		
1913.....	37,881	272,726	451	6,523	21,282	1,235
1914.....	25,954	247,195	408	5,467	12,200	810
1915.....	12,058	157,457	571	13,610		
1916.....	17,259	205,706	475	6,961	44,552	2,408
1917.....	36,185	584,962	225	6,535	371,600	33,044
1918.....	56,837	1,078,456	53	1,425		
1919.....	8,110	105,447			212,244	17,601
Total.....	767,927	7,058,006	28,924	328,950	11,083,447	224,471

ALASKA PICKLED-SALMON PACK, 1906 TO 1918, BY SPECIES, QUANTITY,^a AND VALUE.

Species.	1906		1907		1908		1909		1910	
	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.
Whole salmon:										
Coho.....	539	\$5,642	1,665	\$16,406	692	\$5,648	318	\$2,485	160	\$1,504
Chum.....	231	1,550	233	1,521	122	707	35	190		
Humpback.....	2,446	13,852	4,248	29,374	2,346	17,935	1,557	9,405	330	1,998
King.....	1,007	8,058	964	10,684	660	6,813	441	3,798	352	3,399
Red.....	13,060	97,092	15,197	145,142	30,517	262,274	28,508	167,298	11,931	104,649
Total.....	17,283	126,194	22,307	203,127	34,337	293,377	28,859	183,176	12,773	111,550
Bellies:										
Coho.....			101	2,696	229	3,535	255	3,843	126	1,135
Chum.....	30	150			117	699			70	770
Humpback.....	1,273	13,188	1,800	21,080	2,447	28,140	738	7,438	616	6,135
King.....	22	185	84	1,002	48	720	36	175	6	128
Red.....	13	121	890	12,644	1,805	26,236	942	13,902	808	10,839
Total.....	1,338	13,644	2,965	37,422	4,736	59,330	1,970	26,358	1,626	19,007
Backs, etc.:										
Humpback.....							56	224		
King.....									2	24
Red.....									4	60
Total.....							56	224	6	84
Grand total.....	18,621	139,838	25,272	240,549	39,073	352,707	30,885	208,768	14,405	130,641

Species.	1911		1912		1913		1914	
	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.
Whole salmon:								
Coho.....	223	\$2,149	1,165	\$9,595	1,000	\$6,452	365	\$2,767
Chum.....	133	666	93	652	100	778	53	293
Humpback.....	1,122	11,238	4,236	28,304	2,724	18,181	482	2,954
King.....	600	8,095	225	2,442	135	1,410	269	2,588
Red.....	6,239	79,578	28,883	264,965	33,916	245,905	24,785	238,593
Total.....	8,317	101,726	34,602	305,928	37,881	272,726	25,954	247,195
Bellies:								
Coho.....	38	489			54	946	67	962
Chum.....	7	77			67	941	18	180
Humpback.....	676	5,122	37	606	324	4,546	229	2,620
King.....	2	30					2	13
Red.....	614	9,843			6	90	92	1,672
Total.....	1,337	15,561	37	606	451	6,523	408	5,467
Backs, etc.:								
Humpback.....	150	600						
King.....	1	15						
Red.....	15	136						
Total.....	166	751						
Grand total.....	9,820	118,038	34,639	306,534	38,332	279,249	26,362	262,662

^a Barrels hold 200 pounds of fish; when of a different size they have been reduced to conform to this weight.

ALASKA PICKLED-SALMON PACK, 1906 TO 1918, BY SPECIES, QUANTITY, AND VALUE—
Continued.

Species.	1915		1916		1917		1918	
	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.
Whole salmon:								
Coho.....	1,763	\$19,393	2,076	\$22,287	1,798	\$29,631	2,501	\$47,152
Chum.....	325	2,925	495	4,057	1,722	21,899	6,080	84,878
Humpback.....	662	5,958	503	3,624	5,576	73,557	11,973	182,490
King.....	377	4,147	630	7,956	359	6,550	297	7,645
Red.....	8,931	125,034	13,549	167,762	26,710	463,019	35,977	756,191
Total.....	12,058	157,457	17,259	205,706	36,165	584,962	56,828	1,078,556
Bellies:								
Coho.....			27	500	11	326	10	180
Chum.....			285	3,556	73	1,362		
Humpback.....	133	2,660	61	882	110	2,885	26	650
King.....			2	23	7	150		
Red.....	438	10,950	100	2,000	24	812	17	595
Total.....	571	13,610	475	6,961	225	5,535	53	1,425
Backs, etc: Coho.....							9	100
Grand total....	12,629	171,067	17,734	212,667	36,390	590,497	56,890	1,079,981

PACK OF SALTED SALMON IN ALASKA IN 1919.^a

Products. ^b	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.
Coho, or silver.....	706	\$13,206	204	\$3,024	292	\$5,918	1,202	\$22,148
Chum, or keta.....	70	2,080	27	135	41	555	138	2,770
Humpback, or pink.....	26	280	50	700	46	548	121	1,508
King, or spring.....	241	4,542	8	232	618	16,207	867	21,041
Red, or sockeye.....	12	355	587	12,380	5,183	135,245	5,782	147,980
Total.....	1,055	20,443	876	16,471	6,179	158,533	8,110	195,447

^a From "Alaska Fisheries and Fur Industries in 1919," p. 50. By Ward T. Bower. Appendix IX, Report, U. S. Commissioner of Fisheries, 1919. Washington, 1920.
^b Each barrel holds 200 pounds of fish.

MILD-CURING INDUSTRY.

The beginning of this industry on the Pacific coast is of comparatively recent date, and the following table is complete, with the possible exception of a few tierces, which may not have been reported for the coastal rivers of Oregon:

TERCES OF MILD-CURED SALMON PACKED ON PACIFIC COAST FROM 1897 TO 1919.*

Year.	Alaska.	British Columbia.	Puget Sound, Wash.	Grays Harbor, Wash.	Willapa Harbor, Wash.	Columbia River (both sides).	Coastal rivers, Oreg.	Eel River, Calif.	Sacramento River, Calif.	Monterey Bay, Calif.	Total.
1897.....						400					400
1898.....	70					700					770
1899.....	180			375		1,250					1,765
1900.....						1,275					2,225
1901.....	67		600			3,000			850		6,767
1902.....	67		425			4,213	188		3,100	504	7,722
1903.....	8		824			6,725			3,600	354	11,511
1904.....	34		1,250			9,088		200	4,719	248	15,539
1905.....	1,129	1,175	3,000			9,805	415		2,979	319	17,873
1906.....	1,520	1,957				8,000	740	175	2,177	510	18,085
1907.....	1,378	1,993	2,080	20	100	6,070	740	140	4,102	582	17,464
1908.....	2,292	1,060				4,960			3,243	252	10,893
1909.....	3,357	1,600	2,109	75	29	5,340	560	80	5,111	911	18,267
1910.....	3,184	1,688	2,435	67		7,922	1,395		5,616	75	22,408
1911.....	5,245	1,965	2,745	100	30	8,185	1,247	110	2,011	160	19,717
1912.....	7,443	1,489	3,018	357	40	5,824	3,082	100	3,274		22,424
1913.....	4,091	3,180	3,923	260	50	5,748	2,381		4,789	550	28,282
1914.....	2,986	3,182	1,934			5,205	457		1,829	1,478	18,174
1915.....	4,898	1,119	2,235			4,078	583	8	1,830	942	13,306
1916.....	3,583	1,848	1,785			4,658	194		1,069	1,089	15,070
1917.....	3,948	429	1,083			1,804	275		1,608	300	8,749
1918.....	5,376	1,173	2,423			1,804	275	455	1,913	286	10,483
1919.....						3,328	148	1,328	2,355	1,055	17,184
Total.....	51,069	23,467	32,887	1,244	249	109,660	12,158	2,689	57,781	9,564	300,668

* The net weight of fish in a tierce is about 800 pounds. King, chinook, or spring salmon were used almost exclusively. From most places the data are complete from the time of the inception of the industry, but from a few minor places the data are somewhat fragmentary.
 † Includes Fort Bragg, on Noyo River.

YUKON TERRITORY, CANADA.

Some salmon fishing is carried on in that section of the upper Yukon River which lies in Yukon Territory, Dominion of Canada. The species taken are principally king and dog, and these are sold mainly in a fresh condition. The following table shows the quantity taken and the value of same in certain years:

CATCH OF SALMON IN YUKON TERRITORY, CANADA, IN SPECIFIED YEARS.

Year.	Salmon.		Year.	Salmon.	
	Pounds.	Value.		Pounds.	Value.
1903.....	70,000	\$5,600	1914.....	188,600	\$18,860
1909.....	185,674	17,566	1915.....	187,000	15,700
1910.....	169,900	16,889	1916.....	143,500	14,350
1911.....	229,000	22,900	1917.....		
1912.....	224,100	22,410	1918.....		
1913.....	182,000	18,200	1919.....		

TRADE WITH OUTLYING POSSESSIONS.

As a result of the war with Spain the United States in 1898 acquired possession of Porto Rico, Guam, and the Philippine Islands, while in the same year Hawaii became a part of this country at its own request, and in 1900 two islands of the Samoan group were acquired by a partition agreement with Great Britain and Germany. The trade with the Philippine Islands is shown to date in the tables

of exports and imports to foreign countries, but the trade with the other possessions has been eliminated from these tables and shown separately ever since their annexation to the United States.

HAWAII.

The islands constituting this Territory, owing to their reciprocity treaty with this country for a number of years before annexation, purchased their supplies of salmon from the United States almost exclusively. In recent years the Territory has imported the following quantities of salmon from the mainland:

Year ending June 30—	Canned salmon.		All other salmon, fresh or cured.	Year ending June 30—	Canned salmon.		All other salmon, fresh or cured.
	Pounds.	Value.			Pounds.	Value.	
1907.....	1, 126, 217	\$89, 286	<i>Value.</i> \$64, 232	1914.....	1, 418, 941	\$97, 532	<i>Value.</i> (a)
1908.....	905, 029	89, 025	87, 143	1915.....	1, 005, 849	90, 705	(a)
1909.....	1, 440, 410	121, 718	73, 848	1916.....	1, 582, 528	132, 597	(a)
1910.....	1, 381, 398	113, 528	72, 194	1917.....	1, 463, 528	145, 531	(a)
1911.....	1, 231, 264	119, 572	76, 572	1918.....	1, 168, 528	174, 777	(a)
1912.....	1, 850, 567	194, 385	57, 495	1919.....	979, 895	169, 577	(a)
1913.....	1, 841, 874	173, 202	(a)				

(a) Not shown separately.

PORTO RICO.

Of recent years the following shipments of domestic salmon have been made to this island:

Year ending June 30—	Canned salmon.		All other salmon, fresh or cured.	Year ending June 30—	Canned salmon.		All other salmon, fresh or cured.
	Pounds.	Value.			Pounds.	Value.	
1907.....	604, 627	\$53, 916	<i>Value.</i> \$2, 893	1914.....	416, 414	\$41, 726	<i>Value.</i> (a)
1908.....	512, 038	48, 195	1, 428	1915.....	588, 889	56, 527	(a)
1909.....	381, 171	34, 777	3, 810	1916.....	800, 873	60, 453	(a)
1910.....	511, 055	43, 494	6, 243	1917.....	831, 360	70, 427	(a)
1911.....	357, 382	30, 699	3, 868	1918.....	378, 266	52, 737	(a)
1912.....	710, 721	65, 354	1, 208	1919.....	468, 501	68, 532	(a)
1913.....	666, 602	60, 811	(a)				

(a) Not shown separately.

PHILIPPINE ISLANDS.

Of recent years the following shipments of domestic salmon have been made to these islands:

Year ending June 30—	Canned salmon.		All other salmon, fresh or cured.	Year ending June 30—	Canned salmon.		All other salmon, fresh or cured.
	Pounds.	Value.			Pounds.	Value.	
1909.....	1, 126, 470	\$74, 792	<i>Value.</i> \$712	1915.....	4, 159, 590	\$288, 548	<i>Value.</i> (a)
1910.....	5, 425, 404	398, 904	2, 089	1916.....	5, 640, 858	356, 306	(a)
1911.....	3, 069, 118	225, 885	3, 642	1917.....	4, 202, 574	351, 633	(a)
1912.....	5, 096, 810	422, 001	2, 437	1918.....	5, 558, 796	618, 697	(a)
1913.....	10, 122, 820	591, 128	(a)	1919.....	3, 880, 425	431, 616	(a)
1914.....	5, 034, 252	266, 369	(a)				

(a) Not shown separately.

ALASKA.

It seems like "carrying coals to Newcastle" to ship canned salmon to Alaska, from which Territory more than half the canned salmon of the world is produced, and yet a small business is done each year in this line, most of the product going to the mining camps and towns somewhat removed from the fishing sections.

The table below shows the shipments of such fish in recent years. After 1914 the shipments were lumped together with all other kinds of fish and thus prevented the listing of salmon separately.

Year ending June 30—	Canned salmon.		All other salmon, fresh or cured.	Year ending June 30—	Canned salmon.		All other salmon, fresh or cured.
	Pounds.	Value.			Pounds.	Value.	
1909.....	67,132	\$7,123	<i>Value.</i> \$3,966	1912.....	134,320	\$15,022	<i>Value.</i> \$4,218
1910.....	67,658	7,204	3,538	1913.....	43,346	5,074	(a)
1911.....	38,265	4,613	1,061	1914.....	42,945	5,278	(a)

a Not shown separately.

GUAM.

Since annexation, this country and Japan have been competing for the trade of this island, which, in earlier years, Japan controlled quite largely. During the last two years shown in the statement, however, the United States has secured the advantage. The table below shows the extent of the trade, which is made up almost entirely of salted or pickled salmon, only 900 pounds of fresh salmon, valued at \$92, having been shipped by this country to Guam in 1908. Since 1909 all the fishery products imported have been lumped under one heading and it has been impossible to distinguish the salmon from the other species.

Year and country.	Pickled salmon.		Year and country.	Pickled salmon.	
	Pounds.	Value.		Pounds.	Value.
1905.			1908.		
United States.....	1,415	\$71	United States.....	7,406	\$623
Japan.....	10,526	1,221	Japan.....	6,130	465
1907.			1909.		
United States.....	13,004	1,086	United States.....	10,779	740
Japan.....	19,882	1,601	Japan.....	4,295	344

TUTUILA, SAMOA.

The customs statistics lump the imports of fish under one general heading, thus making it impossible to show separately the imports of salmon.

FOREIGN TRADE IN SALMON.

As we do not consume all of the salmon produced by our fisheries, it is necessary to find a foreign market for the surplus each season, but, as canned salmon has become one of the staples of the world, there

is not much difficulty in this respect, especially since our only competitors are Canada, Siberia, and Japan. The two last named have not yet become important factors in the canned-salmon market, though they will as their fishing operations are extended. There is more competition in the pickled, fresh, and frozen markets, several European and Asiatic countries being large producers of these goods, as is Canada also, for a considerable proportion of which she is compelled to find an outside market.

The World War greatly disturbed the usual course of our foreign trade. Because of the need for foodstuffs a tremendous demand arose in Europe for our salmon, resulting in a decided increase in the quantities shipped there and, for a while, in a reduction of our exports in other directions. In time, however, the markets adjusted themselves to the changed conditions of trade.

EXPORTS OF DOMESTIC CANNED SALMON.

From the beginning of the industry a considerable proportion of the salmon canned has been exported, especially of the higher grades. In Europe the chief customer is Great Britain, followed closely in the closing years of the war by Italy. Great Britain does not, however, consume this quantity, for a considerable part of her importations are reexported. On the North American Continent and adjacent islands the best customers are Mexico, Cuba, Panama, and the British West Indies, in the order named. The heavy shipments to Canada since 1916 are mainly in transit shipments to Europe by Canadian steamship lines as our lines were overburdened with war shipments. In South America, Chile, Peru, Argentina, and Ecuador were the leading markets in 1918. In Asia, Hongkong and China import canned salmon, although neither buys great quantities. The islands of the Pacific and Indian Oceans are large consumers. British Australasia took 7,811,387 pounds, valued at \$1,407,561 in 1918, and other good customers were the British East Indies and British, French, and German Oceania. In Africa the British and Portuguese possessions are the largest importers.

The movements of these products are naturally often influenced favorably or adversely as the tariffs of the various countries in which they are marketed are raised or lowered.

Some countries maintain excessively high tariffs, among these being Brazil, 30 cents per pound; Colombia, 8½ cents; Mexico, 4 cents; Guatemala, 6½ cents; Paraguay, 7 cents; Uruguay, 6 cents; Austria-Hungary, 8 cents, and Germany, 7 cents. Norway levies 6 cents a pound duty, but this is undoubtedly to protect her own salmon industry.

In but few of the tariff acts is canned salmon distinguished by name, being usually classed as "preserved fish," and as these are usually luxuries in many countries they bear an extra high duty as a result.

In addition to these high duties in some countries, especially in South America, there are various other charges, fees, etc., which materially enhance the value of the goods before they reach the consumer. C. H. Clarke, of the salmon brokerage firm of Kelley-Clarke Co., of Seattle, Wash., has published and published a statement ^a

^a Pacific Fisherman, Vol. 13, No. 5, p. 11, 1915.

showing the comparative charges on 100 cases each of red Alaska and pink canned salmon from the time they leave Seattle up to the time they reach the hands of wholesalers in South America. This shows that the f. o. b. Seattle value of the red salmon was \$500 and of the pink salmon \$280. By the time these goods reached the hands of the Rio de Janeiro wholesalers the red salmon were worth \$1,900.07, while the pink salmon were worth \$1,677.87. At Montevideo, Uruguay, the red salmon were worth \$1,436.01 and the pink salmon \$1,213.81. The table is so interesting and instructive that it is reproduced entire herewith.

COMPARATIVE CHARGES ON 100 CASES EACH OF RED ALASKA AND PINK CANNED SALMON FROM SEATTLE, WASH., TO HANDS OF WHOLESALERS IN SOUTH AMERICA.

	Argentina (Buenos Aires).		Brazil (Rio de Janeiro).		Chile (Valparaiso).		Ecuador (Guayaquil)	
	Red.	Pink.	Red.	Pink.	Red.	Pink.	Red.	Pink.
F. o. b. Seattle value.....	\$500.00	\$280.00	\$500.00	\$280.00	\$500.00	\$280.00	\$500.00	\$280.00
Strapping.....	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Freight.....	104.75	104.75	114.50	114.50	48.00	46.00	46.00	45.00
Marine insurance, 5 per cent f. p. a.....	6.10	3.90	6.20	4.00	6.50	3.25	5.50	3.25
C. i. f. value.....	615.85	393.65	625.70	403.50	650.50	328.25	650.50	328.25
Consular fees in United States.....	2.00	2.00	3.25	3.25	5.25	4.25	22.35	14.00
Customs duty.....	519.58	519.58	1,133.78	1,138.78	160.40	160.40	346.37	234.37
Analysis.....	2.12	2.12	6.47	6.47	.....	5.35	.....	.....
Storage in customhouse.....	2.41	2.41	33.90	33.90	.....	.....	.....	.....
Handling in customhouse.....	7.24	7.24	.....	.....	2.51	2.51	.....	.....
Stamps and entry blanks.....	1.49	1.49	.....	.....	1.43	1.43	.....	.....
Statistics.....	.....	.....	10	10	.....	.....	.....	.....
Internal-revenue tax.....	.....	.....	7.77	7.77	.....	.....	.....	.....
Port tax.....	.....	.....	57.20	57.20	.....	.....	.....	.....
Customs brokerage.....	12.74	12.74	.....	.....	7.15	7.15	.....	.....
Wharfage, lighterage, cartage.....	7.64	7.64	26.90	26.90	3.65	3.65	19.30	19.30
Value ex customhouse.....	1,171.05	948.85	1,900.07	1,677.87	736.30	513.05	937.62	706.92

	Paraguay (Asuncion).		Peru (Callao).		Uruguay (Montevideo).		Venezuela (La Guayra).	
	Red.	Pink.	Red.	Pink.	Red.	Pink.	Red.	Pink.
F. o. b. Seattle value.....	\$500.00	\$280.00	\$500.00	\$280.00	\$500.00	\$280.00	\$500.00	\$280.00
Strapping.....	5.00	5.00	.....	.....	5.00	5.00	5.00	5.00
Freight.....	134.75	134.75	37.50	37.50	104.75	104.75	54.00	54.00
Marine insurance, 5 per cent f. p. a.....	9.60	6.30	5.40	3.20	6.10	3.90	5.60	3.40
C. i. f. value.....	649.85	426.05	542.90	320.70	615.85	393.65	586.20	343.00
Consular fees in United States.....	2.00	2.00	5.75	3.45	1.05	1.05	12.85	12.85
Customs duty.....	308.25	308.25	275.80	275.80	779.30	779.30	238.90	238.06
Analysis.....	.....	.....	.....	.....	.....	.....	.....	.....
Storage in customhouse.....	.....	.....	.....	.....	.....	.....	.....	.....
Handling in customhouse.....	.....	.....	.....	.....	16.15	16.15	.....	.....
Stamps and entry blanks.....	.....	.....	58	58	1.55	1.55	1.35	97
Statistics.....	37	37	.....	.....	.....	.....	.....	.....
Internal-revenue tax.....	.....	.....	.....	.....	.....	.....	.....	.....
Port tax.....	.....	.....	.....	.....	.....	.....	.....	.....
Customs brokerage.....	.....	.....	4.86	4.86	15.50	15.50	5.00	2.80
Wharfage, lighterage, cartage.....	6.33	6.33	16.69	15.09	6.61	6.61	12.82	12.82
Value ex customhouse.....	966.30	743.00	846.04	621.14	1,436.01	1,213.81	836.18	611.40

The following table shows in summarized form the yearly exports of domestic canned salmon and the countries to which exported for the years 1900 to 1915, inclusive, and in detailed form for the years 1916 to 1918, inclusive:

EXPORTS, BY COUNTRIES RECEIVING, OF DOMESTIC CANNED SALMON.

SUMMARY, 1900-1915.^a

Country receiving.	1900		1901		1902		1903	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Europe.....	18,941,109	\$1,881,725	31,877,663	\$3,234,862	30,683,551	\$2,625,284	35,410,768	\$3,125,197
North America.....	1,051,808	98,064	2,443,561	297,440	2,780,844	242,029	4,285,406	378,665
South America.....	1,868,225	192,918	1,577,013	160,862	1,291,908	107,907	1,756,214	121,918
Asia.....	654,126	67,941	853,434	86,571	1,597,346	120,674	1,759,294	134,783
Oceania.....	3,882,646	390,466	3,681,276	367,533	8,179,161	670,741	5,511,514	444,505
Africa.....	684,456	62,534	856,553	83,003	2,640,214	224,767	1,630,138	145,733

Country receiving.	1904		1905		1906	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Europe.....	33,591,896	\$3,508,818	21,071,263	\$1,877,600	32,061,402	\$2,753,643
North America.....	2,446,023	204,363	1,565,733	132,134	2,069,357	171,946
South America.....	2,057,859	147,333	1,708,828	134,941	3,490,603	249,052
Asia.....	12,995,768	930,054	3,994,862	280,704	779,415	60,173
Oceania.....	3,898,606	341,849	5,257,446	467,928	6,340,346	509,257
Africa.....	936,126	92,181	1,468,383	142,253	1,194,291	103,872

Country receiving.	1907		1908		1909	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Europe.....	7,756,780	\$791,436	13,321,086	\$1,205,375	23,028,476	\$2,207,194
North America.....	3,052,658	261,138	2,654,175	242,879	2,209,405	198,043
South America.....	5,659,690	414,774	5,571,000	410,743	1,461,662	123,502
Asia.....	1,419,391	105,364	1,004,571	86,908	1,386,702	119,582
Oceania.....	6,719,157	552,205	5,131,554	439,917	7,383,494	705,201
Africa.....	610,429	58,132	643,659	52,696	647,370	62,911

Country receiving.	1910		1911		1912	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Europe.....	44,765,898	\$4,712,182	22,134,328	\$2,408,708	19,545,720	\$2,183,982
North America.....	2,224,516	191,551	1,979,950	190,037	3,411,176	332,692
South America.....	3,183,812	226,197	3,006,927	206,903	6,756,440	609,393
Asia.....	1,596,775	133,516	1,489,282	145,721	1,702,428	160,119
Oceania.....	11,568,824	998,219	9,699,624	901,540	11,220,515	1,255,149
Africa.....	510,871	52,593	290,688	30,633	787,479	79,238

Country receiving.	1913		1914		1915	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Europe.....	25,408,154	\$2,705,254	62,862,328	\$6,028,170	63,760,758	\$7,110,728
North America.....	4,271,710	370,823	6,907,615	611,545	4,328,246	370,444
South America.....	4,134,771	292,367	3,472,438	233,675	1,301,962	107,783
Asia.....	3,593,538	254,209	2,875,995	180,402	1,135,793	97,662
Oceania.....	17,419,390	1,441,270	12,089,093	1,017,994	12,100,414	1,309,376
Africa.....	463,403	39,417	353,541	29,507	818,943	76,450

^a Detailed statistics for 1900 to 1915, inclusive, may be found in "Pacific Salmon Fisheries," by John N. Cobb, Appendix III, Report, U. S. Commissioner of Fisheries, 1916, pp. 187-194. Washington, 1917.

EXPORTS, BY COUNTRIES RECEIVING, OF DOMESTIC CANNED SALMON—Continued.

DETAILS, 1916 TO 1918.

Country receiving.	1916		1917		1918	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
EUROPE.						
Belgium.....			1, 115, 792	\$8, 546	18, 000	\$2, 525
Denmark.....	366, 948	\$29, 255	89, 405	0, 050		
France.....	3, 447, 022	377, 597	985, 582	153, 927	7, 937, 490	1, 187, 737
Gibraltar.....					1, 158, 864	187, 157
Greece.....	70, 560	6, 059	190, 736	14, 486	173, 400	24, 035
Iceland, and Faroe Islands.....	136	16	2, 820	297	98	16
Italy.....	34, 184	3, 170	4, 169, 250	436, 576	13, 540, 046	1, 752, 163
Malta, Goro, etc.....	9, 120	702	5, 520	525		
Netherlands.....	21, 868	2, 865	20, 450	2, 709		
Norway.....	41, 280	4, 383	54, 440	6, 164		
Portugal.....	20	2	60	7	794	178
Russia in Europe.....			240	18		
Serbia and Monten. gro.....	170	17				
Spain.....	4, 995	382	37, 481	3, 369	1, 315	274
Sweden.....	60, 122	6, 666	14, 100	1, 800		
United Kingdom:						
England.....	100, 030, 707	11, 105, 506	74, 941, 109	8, 536, 248	46, 415, 026	7, 447, 399
Scotland.....	1, 067, 590	111, 381	1, 131, 832	139, 718	848, 295	120, 652
Ireland.....					900	220
NORTH AMERICA.						
Bermuda.....	89, 599	8, 741	93, 523	22, 066	87, 832	16, 028
British Honduras.....	32, 021	3, 228	30, 057	3, 072	25, 178	3, 410
Canada.....	7, 994, 185	877, 055	0, 158, 079	838, 734	12, 184, 077	1, 765, 690
Central American States:						
Costa Rica.....	118, 002	8, 878	95, 435	8, 065	10, 750	1, 643
Guatemala.....	58, 528	4, 084	45, 484	4, 708	19, 028	2, 584
Honduras.....	37, 695	3, 651	28, 188	3, 080	10, 536	1, 612
Nicaragua.....	36, 844	3, 064	50, 719	6, 029	33, 421	5, 115
Panama.....	633, 845	57, 042	454, 084	50, 793	306, 765	49, 031
Salvador.....	21, 404	1, 826	18, 368	2, 134	6, 691	1, 144
Mexico.....	1, 611, 929	132, 406	3, 707, 225	342, 564	1, 800, 185	246, 830
Miquelon, Langley, etc.....	957	100	3, 026	377	60	8
Newfoundland and Labrador.....	700	37	2, 640	286		8
West Indies:						
British—						
Barbados.....	60, 361	5, 787	73, 610	8, 043	97, 722	18, 121
Jamaica.....	228, 973	19, 017	180, 065	18, 347	86, 603	14, 170
Trinidad and Tobago.....	26, 080	26, 080	134, 832	18, 230	372, >20	61, 443
Other British.....	75, 578	7, 097	103, 004	12, 001	32, 116	5, 760
Cuba.....	927, 129	87, 479	1, 619, 236	149, 492	1, 632, 073	210, 167
Danish.....	11, 582	1, 063	34, 598	4, 100	23, 629	4, 633
Dutch.....	21, 599	2, 122	24, 673	2, 782	8, 370	1, 683
French.....	4, 772	477	4, 770	543	548	80
Haiti.....	3, 586	361	4, 297	486	1, 793	349
Santo Domingo.....	85, 722	7, 048	231, 413	22, 869	100, 417	14, 148
SOUTH AMERICA.						
Argentina.....	273, 000	23, 429	191, 618	19, 043	353, 103	61, 428
Bolivia.....	14, 579	1, 466	122, 092	11, 724	211, 978	24, 478
Brazil.....	40, 732	3, 921	64, 657	7, 599	187, 615	26, 246
Chile.....	2, 812, 537	192, 681	1, 452, 165	121, 019	2, 304, 499	330, 244
Colombia.....	136, 254	11, 614	126, 861	22, 675	76, 477	11, 479
Ecuador.....	245, 149	16, 009	276, 654	25, 302	216, 466	28, 360
Guiana—						
British.....	184, 654	18, 249	196, 261	26, 637	161, 719	27, 749
Dutch.....	87, 398	3, 048	39, 050	3, 588	35, 143	5, 832
French.....	29, 128	2, 371	17, 909	1, 910	29, 560	3, 825
Peru.....	523, 580	36, 361	434, 329	37, 447	1, 150, 276	188, 794
Uruguay.....	23, 464	1, 841	5, 258	590	6, 836	1, 509
Venezuela.....	195, 618	19, 234	297, 125	28, 168	181, 236	26, 834
ASIA.						
Aden.....	27, 716	2, 817			2, 832	472
China.....			42, 017	6, 177	68, 949	18, 872
China, leased territory:						
Japanese.....	96	16	192	32	144	30
Chosen.....	1, 632	172	2, 620	466	1, 062	207

* From Pacific Fisherman Yearbook for 1919, p. 93. † Customs returns are for the fiscal year ending June 30 of the year noted.

EXPORTS, BY COUNTRIES RECEIVING, OF DOMESTIC CANNED SALMON—Continued.

DETAILS, 1916 TO 1918—Continued.

Country receiving.	1916		1917		1918	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
ASIA—continued.						
East Indies:						
British—						
British India.....	1,117,839	\$91,767	601,935	\$62,264	1,349,057	\$222,947
Straits Settlements.....	1,215,214	71,585	106,896	9,081	232,755	34,465
Other British.....	166,144	12,787	101,280	10,355	41,818	6,944
Dutch.....	727,006	81,121	374,832	42,693	405,328	66,240
French.....	4,712	615	6,816	1,340	240	69
Hongkong.....	47,658	5,170	74,585	9,570	86,203	14,678
Japan.....	1,346	141	2,604	340	4,590	883
Persia.....	24,960	1,892	9,600	800		
Russia in Asia.....	46	4				
Siam.....	1,392	219	2,880	533	6,048	1,012
OCEANIA.						
British:						
Australia and Tasmania...	11,035,294	1,204,354	6,990,835	865,865	7,397,009	1,337,231
New Zealand.....	216,292	24,684	96,912	10,332	240,240	45,409
Other British.....	30,878	2,923	141,735	14,749	174,138	24,921
French.....	290,854	29,201	248,415	32,643	186,574	31,160
German.....	448,890	29,434	357,386	37,172	285,605	39,071
Philippine Islands.....	5,640,858	356,366	4,202,574	351,633	5,558,796	618,697
AFRICA.						
British Africa:						
West.....	100,310	7,880	613,545	62,925	480,414	72,960
South.....	620,555	56,255	1,421,021	157,863	1,293,714	161,423
East.....			25,608	2,543	57,275	8,638
Belgian Congo.....			1,750	331	2,293	463
Canary Islands.....	10,480	1,071	7,200	432	836	115
Egypt.....	105,800	9,534			261,673	42,335
French Africa.....			2,250	235	20,288	4,256
Italian Africa.....	110	10				
Liberia.....	3,624	366	2,810	258	9,448	1,409
Portuguese Africa.....	27,508	3,231	135,580	13,291	52,298	7,207
Spanish Africa.....	9,700	911	138,580	13,291	8,845	1,175
Total.....	152,943,962	15,032,497	117,962,807	12,963,425	110,060,480	16,570,834
RECAPITULATION.						
Europe.....	114,163,722	11,648,003	82,758,877	9,390,858	70,092,226	10,692,246
North America.....	12,322,259	1,056,904	16,196,177	1,565,409	16,840,112	2,413,649
South America.....	4,563,993	332,024	3,314,969	305,964	4,899,692	706,757
Asia.....	3,336,665	268,306	1,326,163	142,641	2,199,024	361,322
Oceania.....	17,659,036	1,646,962	12,037,857	1,312,394	13,842,382	2,096,439
Africa.....	808,298	80,298	2,328,764	246,159	2,187,064	300,371

In 1918 the practice of publishing customs figures for the calendar year instead of the fiscal year, as had prevailed previously, was inaugurated. The following tables show the exports of canned salmon, by countries, for the calendar years 1918 and 1919:

EXPORTS, BY COUNTRIES RECEIVING, OF CANNED SALMON, CALENDAR YEARS 1918 AND 1919.

Country receiving.	1918		1919	
	Pounds.	Value.	Pounds.	Value.
EUROPE.				
Austria-Hungary			157,396	\$38,394
Azores, and Madeira Islands.....			432	71
Belgium	18,072	\$2,539	5,179,022	970,696
Denmark			1,082,434	181,178
Finland			68,000	13,010
France	11,458,346	1,270,875	15,947,105	2,525,449
Germany			833,793	147,783
Gibraltar.....	273,540	44,593	370,890	85,890
Greece			2,722,686	471,555
Iceland, and Faroe Islands.....			12,025	2,557
Italy	19,654,983	2,785,844	36,925,190	4,801,911
Malta, Gozo, etc.....			1,892	262
Netherlands.....			231,710	46,356
Norway			441,776	87,668
Portugal.....	662	193	200	38
Rumania.....			9,720	1,538
Russia in Europe.....			19,600	2,795
Serbia, Montenegro, and Albania.....				96
Spain			79,457	16,253
Sweden	164	40	88,012	17,158
Switzerland.....			12,184	2,414
Turkey in Europe.....			100,040	17,072
United Kingdom:				
England.....	43,515,880	6,742,494	66,524,438	12,788,932
Scotland.....	154,495	22,072	1,460,082	219,951
Ireland.....	1,320	286	1,459,360	197,677
NORTH AMERICA.				
Bermuda.....	35,144	6,288	53,429	6,940
British Honduras.....	8,560	1,181	68,194	9,409
Canada.....	4,077,186	620,195	9,587,861	1,467,611
Central American States:				
Costa Rica.....	5,310	818	98,155	16,049
Guatemala.....	10,492	1,374	74,407	12,599
Honduras.....	3,459	488	50,936	8,693
Nicaragua.....	11,586	1,866	125,179	21,095
Panama.....	172,296	30,485	141,733	25,441
Salvador.....	4,290	741	20,783	5,173
Mexico.....	347,384	54,709	4,917,709	703,262
Miquelon, Langley, etc.....			3,090	751
Newfoundland and Labrador.....			108	21
West Indies:				
British—				
Barbados.....	33,074	6,305	65,114	12,947
Jamaica.....	77,002	12,225	367,119	51,537
Trinidad and Tobago.....	153,207	24,023	143,094	27,023
Other British.....	10,148	1,933	37,935	7,717
Cuba.....	428,208	60,432	1,846,913	238,858
Dominican Republic.....	50,887	7,973	238,502	36,503
Dutch.....	3,209	701	17,678	4,603
French.....	184	24	10,456	2,422
Haiti.....	1,038	190	6,199	1,393
Virgin Islands of United States.....	20,059	4,221	22,408	4,447
SOUTH AMERICA.				
Argentina.....	255,950	51,437	403,010	76,052
Bolivia.....	94,076	8,765	84,559	13,087
Brazil.....	101,529	21,625	31,113	7,273
Chile.....	1,316,148	195,478	1,331,484	214,284
Colombia.....	31,816	5,493	275,050	47,078
Ecuador.....	40,358	5,895	368,939	55,947
Guiana:				
British.....	38,595	7,785	122,715	25,974
Dutch.....	13,789	2,380	68,581	14,336
French.....	5,456	778	36,662	7,007
Paraguay.....			240	55
Peru.....	290,837	41,262	1,180,989	185,839
Uruguay.....	6,240	1,441	47,412	9,932
Venezuela.....	129,457	19,907	383,120	63,321
ASIA.				
Aden.....	2,400	894	2,880	480
China.....	41,980	8,579	90,232	19,088

EXPORTS, BY COUNTRIES RECEIVING, OF CANNED SALMON, CALENDAR YEARS 1918 AND 1919—Continued.

Country receiving.	1918		1919	
	Pounds.	Value.	Pounds.	Value.
ASIA—continued.				
China, leased territory: Japanese.....	48	\$10	168	\$43
Chosen.....	42	8	5,274	1,246
East Indies:				
British—				
British India.....	367,273	67,256	984,672	193,089
Straits Settlements.....	111,440	16,021	223,168	42,403
Other British.....	26,896	4,485	61,814	13,402
Dutch.....	124,502	17,622	427,298	71,132
French.....	240	69	2,412	692
Hongkong.....	41,424	7,839	116,912	22,628
Japan.....	25,968	3,259	12,038	1,940
Russia in Asia.....			192	52
Siam.....	4,800	760	2,122	558
Turkey in Asia.....			20,504	3,646
OCEANIA.				
British:				
Australia.....	1,149,888	215,715	5,777,713	1,293,194
New Zealand.....	26,592	4,835	61,533	13,919
Other British.....	47,674	9,872	93,423	16,115
French.....	116,535	19,203	225,429	42,308
German.....	153,840	20,394	80,377	12,966
Philippine Islands.....	5,291,182	579,410	2,371,736	279,408
AFRICA.				
Abyssinia.....			92	18
Belgian Kongo.....	2,354	477	14,990	3,251
British Africa:				
West.....	192,376	33,051	976,463	172,258
South.....	121,990	18,255	1,269,317	294,633
East.....	34,260	6,098	5,996	1,417
Canary Islands.....			59,790	8,025
Egypt.....	261,673	42,335	939,595	133,358
French Africa.....	17,136	3,572	32,989	7,208
German Africa.....			50,465	9,332
Liberia.....	2,633	539	8,218	1,781
Madagascar.....			48	8
Morocco.....			5,688	932
Portuguese Africa.....	2,788	485	31,868	6,839
Spanish Africa.....			36,266	7,009
Total.....	91,101,734	13,149,307	169,750,672	28,644,706

The following table shows in summarized form the customs districts from which canned salmon was exported for the years 1900 to 1915, inclusive, and in detailed form for the years 1916 to 1919, inclusive. Up to 1910 about two-thirds of the total exports have gone from the port of San Francisco, while about one-fifth of the total passed through the port of Puget Sound, Wash. In 1910 the exports from Puget Sound exceeded those from San Francisco. In 1918, however, San Francisco assumed first place once more. The only other port through which any considerable quantity is shipped is New York City. It is usual now to load the salmon on steamers and sailing vessels at San Francisco and the Puget Sound cities to go direct to Europe.

EXPORTS, BY CUSTOMS DISTRICTS, OF CANNED SALMON.

SUMMARY, 1900 TO 1915.*

Customs district from which exported.	1900		1901		1902		1903	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Atlantic ports....	3,820,656	\$370,302	8,834,322	\$947,729	4,538,073	\$427,335	5,734,469	\$611,868
Gulf ports.....	38,688	3,430	55,425	5,426	50,116	4,966	54,016	5,086
Mexican border ports.....	30,264	2,861	20,140	2,082	188,346	15,498	130,363	11,741
Pacific ports.....	23,168,445	2,314,541	32,337,112	3,270,524	42,367,217	3,539,231	44,391,379	3,716,926
Northern border and Lake ports.....	24,137	2,514	42,501	4,510	39,362	4,373	43,107	5,171

Customs district from which exported.	1904		1905		1906	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Atlantic ports.....	2,133,121	\$214,332	2,693,503	\$267,283	3,277,571	\$318,321
Gulf ports.....	72,792	6,455	97,561	8,426	127,255	10,910
Mexican border ports.....	355,248	24,183	289,439	23,148	455,413	36,130
Pacific ports.....	53,362,492	4,979,565	31,957,252	2,734,269	41,906,406	3,469,472
Northern border and Lake ports.....	625	63	28,800	2,364	177,769	13,110

Customs district from which exported.	1907		1908		1909	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Atlantic ports.....	2,314,535	\$227,779	2,334,663	\$227,113	4,043,807	\$409,933
Gulf ports.....	165,060	14,450	206,120	19,245	107,018	8,954
Mexican border ports.....	570,343	47,776	723,689	65,119	219,128	21,574
Pacific ports.....	22,160,349	1,892,398	24,961,173	2,126,995	31,705,144	2,971,884
Northern border and Lake ports.....	7,828	646	400	46	42,012	3,991

Customs district from which exported.	1910		1911		1912	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Atlantic ports.....	3,003,430	306,122	1,564,485	\$166,971	2,506,989	\$257,792
Gulf ports.....	118,559	9,554	169,359	15,194	109,045	12,029
Mexican border ports.....	264,717	21,503	213,226	20,393	415,269	38,455
Pacific ports.....	60,460,190	5,074,196	36,663,729	3,834,584	40,391,058	4,312,116
Northern border and Lake ports.....	33,800	2,883	.....	.....	1,405	171

Customs district from which exported.	1913		1914		1915	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
New York.....	1,635,881	\$189,959	2,404,220	\$207,924	5,316,456	\$512,549
New Orleans.....	.....	.....	182,717	19,787	261,709	28,682
El Paso.....	.....	.....	120,140	9,045	176,390	12,348
San Francisco.....	31,687,774	3,277,841	38,844,912	3,600,636	35,321,068	4,209,914
Oregon.....	634,000	83,000	124,512	9,391	671,462	64,517
Washington.....	19,827,745	1,434,461	45,876,703	4,138,449	41,064,868	4,183,410
All other districts.....	1,215,566	118,089	197,716	14,061	634,183	60,963

* Detailed statistics for 1900 to 1915, inclusive, may be found in "Pacific Salmon Fisheries," by John N. Cobb, Appendix III, Report U. S. Commissioner of Fisheries, 1916, pp. 194-198. Washington, 1917.

EXPORTS, BY CUSTOMS DISTRICTS, OF CANNED SALMON—Continued.

DETAILS, 1916 TO 1918.

Customs district from which exported.	1916		1917		1918	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Georgia.....			156,000	\$37,052	96	\$24
Maine and New Hampshire.....	2,583,306	\$274,432	1,186,871	160,399	3,336	621
Maryland.....	517,800	47,603	1,884,672	165,537	1,208,142	149,080
Massachusetts.....	1,314,778	130,701	2,447,156	279,184	789,629	159,052
New York.....	24,257,388	2,330,629	23,993,032	2,607,602	49,034,077	7,690,025
Philadelphia.....	111,573	8,680	2,445,373	237,540	302,740	40,431
Porto Rico.....	8,813	578	3,060	384	6,106	839
Virginia.....	2,689,040	211,848	5,969,268	551,269	489,242	82,563
Florida.....	4,252	350	9,971	672	7,262	1,623
Galveston.....	3,211	159	30,996	3,467	10,457,201	2,124,530
Mobile.....	7,635	851	7,055	686	6,505	838
New Orleans.....	1,125,031	109,238	8,003,488	967,410	1,720,839	223,676
Sabine.....	4,867	428	8,244	1,233	5,411	1,325
Arizona.....	134,358	10,263	170,372	15,005	97,046	12,228
Eagle Pass.....	37,922	3,496	95,077	7,783		
El Paso.....	117,715	8,876	196,331	15,878	105,630	12,547
San Antonio.....					401,640	47,445
Laredo.....	252,826	16,637	367,324	33,159		
Alaska.....	87,371	6,319	3,094,290	267,489	5,396,783	691,837
Hawaii.....	78	15	137,328	15,959	56,044	8,196
Oregon.....	657,121	60,257	303,888	36,105		
San Francisco.....	53,221,608	5,846,811	32,390,683	3,910,592	18,278,622	3,163,508
Southern California.....	33,455	2,463	36,153	3,768	30,008	4,327
Washington.....	60,620,904	5,461,097	30,649,747	2,084,487	13,783,070	1,874,726
Buffalo.....	850	107	5,437	722	250	25
Dakota.....			66,825	5,906	2,630	437
Duluth and Superior.....			171	39	15	1
Michigan.....	1,949,086	207,808	3,354,350	427,810	1,814,899	284,746
Montana and Idaho.....	3,339,969	283,727	987,925	166,323	1,248	422
St. Lawrence.....			100	28	61,990	5,011
Vermont.....	12,000	1,124	68,530	8,957	18	2
Total.....	152,943,962	15,032,497	117,962,807	12,963,425	110,060,480	16,570,894

In 1918 was inaugurated the practice of publishing customs figures for calendar years instead of, as previously, for the fiscal year ending June 30. The following tables show the exports of canned salmon by customs districts for the calendar years 1918 and 1919:

EXPORTS, BY CUSTOMS DISTRICTS, OF CANNED SALMON, CALENDAR YEARS 1918 AND 1919.

Customs district from which exported.	1918		1919	
	Pounds.	Value.	Pounds.	Value.
Georgia.....	99	\$25		
Maine and New Hampshire.....	98	24	130,964	\$27,831
Maryland.....	1,705,877	220,669	2,385,585	411,895
Massachusetts.....	517,456	84,118	331,296	58,267
New York.....	46,490,264	7,500,562	85,463,019	13,677,432
Philadelphia.....	305,414	42,261	2,593,197	322,858
Porto Rico.....	1,711	394	7,468	1,262
Virginia.....	303,650	44,586	1,203,496	211,701
Florida.....			171,653	20,678
Galveston.....	15,169,801	1,942,094	11,156,255	1,857,799
Mobile.....	3,567,735	482,945	1,654,115	219,879
New Orleans.....	542,161	80,586	10,060,979	1,612,503
Sabine.....	3,033	833	16,439	3,354
Arizona.....	30,063	4,319	118,946	17,726
El Paso.....	21,290	2,891	320,836	41,491
San Antonio.....	46,914	7,373	855,588	116,612
Alaska.....	72	12	1,694,478	188,038
Hawaii.....	48,428	7,052	49,232	7,718
Oregon.....			244,600	56,080

EXPORTS, BY CUSTOMS DISTRICTS, OF CANNED SALMON, CALENDAR YEARS 1918 AND 1919—Continued.

Customs district from which exported.	1918		1919	
	Pounds.	Value.	Pounds.	Value.
San Francisco.....	4,490,375	\$749,095	19,596,548	\$4,359,336
Southern California.....	34,045	5,159	125,793	21,856
Washington.....	16,422,108	1,764,105	27,911,740	4,930,335
Buffalo.....	501	75	863,795	140,569
Dakota.....	2,541	437	90,206	19,841
Duluth and Superior.....			13,460	2,996
Michigan.....	1,345,300	200,873	1,087,458	199,026
Montana and Idaho.....			1,527,576	281,707
St. Lawrence.....	52,800	8,819	163,063	26,108
Vermont.....			42,889	8,144
Total.....	91,101,734	13,149,307	169,750,672	28,644,706

EXPORTS OF DOMESTIC FRESH AND CURED SALMON.

The following table shows in summarized form the value of the exports of fresh and cured salmon, by countries to which exported, for the period 1900 to 1915, inclusive, and in detailed form for the years 1916 to 1919, inclusive. As with the canned salmon, the greater part of these exports go to European countries, Germany, under ordinary conditions, taking by far the largest quantity. A small portion of this is salmon caught in Atlantic waters.

EXPORTS, BY COUNTRIES RECEIVING, OF DOMESTIC PICKLED, FRESH, ETC., SALMON.

SUMMARY, FISCAL YEARS 1900 TO 1915.^a

Country receiving.	1900	1901	1902	1903	1904	1905
Europe.....	\$340,643	\$344,368	\$496,637	\$760,197	\$1,094,050	\$1,748,039
North America.....	87,964	60,416	132,704	67,225	36,408	25,809
South America.....	1,702	901	3,083	1,690	1,822	3,438
Asia.....	3,324	15,037	25,843	5,393	1,382	30,170
Oceania.....	101,388	5,982	35,863	34,835	28,083	25,085
Africa.....	265	24	325	12	864	114

Country receiving.	1906	1907	1908	1909	1910
Europe.....	\$1,776,086	\$1,794,885	\$1,687,535	\$1,225,948	\$1,468,015
North America.....	36,948	23,204	27,263	28,383	29,688
South America.....	2,600	2,351	517	1,365	5,242
Asia.....	92,881	19,384	3,962	3,640	848
Oceania.....	18,914	38,721	28,767	28,935	28,079
Africa.....	60	198		289	1,268

Country receiving.	1911	1912	1913	1914	1915
Europe.....	\$1,511,184	\$1,587,973	\$2,055,109	\$2,074,499	\$1,375,123
North America.....	24,880	20,350	34,741	66,087	20,836
South America.....	384	142	3,409	933	618
Asia.....	3,933	107	1,398	2,428	1,362
Oceania.....	32,334	21,575	25,699	31,380	27,420
Africa.....	424	4	2,210	32	

^a Detailed statistics for 1900 to 1915, inclusive, may be found in "Pacific Salmon Fisheries," by John N. Cobb, Appendix III, Report, U. S. Commissioner of Fisheries, 1916, pp. 198-201. Washington, 1917.

EXPORTS, BY COUNTRIES RECEIVING, OF DOMESTIC PICKLED, FRESH, ETC., SALMON—
Continued.

DETAILS, FISCAL YEARS 1916 TO 1918.

Country receiving.	1916	1917	1918
EUROPE.			
Denmark.....	\$193,124	\$33,874	
France.....	2		\$3,900
Greece.....	2,898	1,844	
Iceland, and Faroe Islands.....	365	1,237	
Italy.....		6,418	10
Netherlands.....	10,961	4,614	
Norway.....	194,868	134,676	
Spain.....	316		
Sweden.....	145,613	27,346	
United Kingdom—England.....	147,955	155,089	130,747
NORTH AMERICA.			
Bermuda.....	688	1,002	600
British Honduras.....	115	1	6
Canada.....	12,872	79,676	55,976
Central American States:			
Costa Rica.....	169	14	
Guatemala.....	75	61	18
Honduras.....	149	112	5
Nicaragua.....	249	97	81
Panama.....	6,364	2,973	2,308
Salvador.....	117	76	3
Mexico.....	9,909	3,388	3,186
Newfoundland and Labrador.....	15		
West Indies:			
British—			
Barbados.....	944	564	12
Jamaica.....	2,689	806	122
Trinidad and Tobago.....	102	1,635	
Other British.....	1,352	801	26
Cuba.....	6,563	2,274	2,578
Danish.....	257	902	379
Dominican Republic.....	967	1,875	448
Dutch.....	674	382	52
French.....	61	65	
Haiti.....	625	435	290
SOUTH AMERICA.			
Argentina.....	111	140	9
Bolivia.....	87	129	36
Brazil.....	424	537	112
Chile.....	735	39	243
Colombia.....	1,164	435	809
Ecuador.....	263	45	31
Gulana:			
British.....	940	158	
Dutch.....	380	817	6
French.....	407	230	25
Portu.....	929	742	
Uruguay.....	95		
Venezuela.....	2,998	779	362
ASIA.			
China.....	23	111	95
China, leased territory—Japanese.....		100	
Chosan.....	7		4
East Indies:			
British—			
British India.....	102	22	22
Straits Settlements.....			50
Other British.....	9		
Dutch.....	1,735		438
French.....		35	
Hongkong.....	43	9	
Japan.....	22	56	286
Russia in Asia.....	243		
OCEANIA.			
British:			
Australia.....	31,815	21,058	155
New Zealand.....	81	23	
Other British.....	61	86	73
French.....	1,285	1,039	235
German.....	442	1,062	1,363
Philippine Islands.....	252	1,071	135

EXPORTS, BY COUNTRIES RECEIVING, OF DOMESTIC PICKLED, FRESH, ETC., SALMON—
Continued.

DETAILS, FISCAL YEARS 1916 TO 1918—Continued.

Country receiving.	1916	1917	1918
AFRICA.			
British Africa:			
West.....		\$376	\$152
South.....	\$1,642	877	
(Canary Islands.....	87	1,140	
Egypt.....		479	
Iberia.....	6		
Portuguese Africa.....	1,251	47	
Spanish Africa.....	701		
Total.....	790,198	492,879	205,446
RECAPITULATION.			
Europe.....	696,102	364,098	134,657
North America.....	45,756	97,139	66,089
South America.....	8,533	4,051	1,092
Asia.....	2,184	333	895
Oceania.....	33,936	24,339	1,961
Africa.....	3,687	2,919	152

DOMESTIC PICKLED SALMON, CALENDAR YEARS 1918 AND 1919.^a

Country receiving.	1918		1919	
	Barrels. ^b	Value.	Barrels. ^b	Value.
EUROPE.				
Azores, and Madeira Islands.....			2	\$62
Belgium.....			1	85
Denmark.....			10,044	466,359
Germany.....			2,307	41,538
Greece.....			109	3,879
Netherlands.....			270	15,995
Norway.....			2,514	123,069
Spain.....			1	29
Sweden.....			2,178	106,010
United Kingdom:				
England.....	419	\$17,800	2,210	124,152
Scotland.....			101	2,830
NORTH AMERICA.				
Bermuda.....			37	662
British Honduras.....			1	20
Canada.....	66	1,300	273	5,031
Central American States:				
Costa Rica.....			3	66
Guatemala.....	5	138	5	199
Honduras.....	1	6		
Nicaragua.....			3	50
Panama.....	31	817	28	846
Mexico.....	5	104	2	38
West Indies:				
British:				
Barbados.....	7	176	301	11,380
Jamaica.....	1	17	18	390
Trinidad and Tobago.....	6	115	659	18,148
Other British.....	3	59	9	243
Cuba.....	17	452	31	1,008
Danish.....	18	350		
Dominican Republic.....	64	1,180	35	1,004
Dutch.....	2	20	13	213
French.....	2	46	19	547
Haiti.....	24	497	20	652
Virgin Islands of United States.....			20	454

^a Included in "All others" in previous years.

^b Barrel holds 200 pounds of fish.

EXPORTS, BY COUNTRIES RECEIVING, OF DOMESTIC PICKLED, FRESH, ETC., SALMON—
Continued.

DOMESTIC PICKLED SALMON, CALENDAR YEARS 1918 AND 1919—Continued.

Country receiving.	1918		1919	
	Barrels.	Value.	Barrels.	Value.
SOUTH AMERICA.				
Colombia.....	1	\$20	2	\$36
Guiana:				
British.....	14	369	10	270
Dutch.....	15	385	101	2,726
French.....	35	865	35	1,186
Peru.....			3	72
Venezuela.....	2	42	1	50
ASIA.				
China.....	9	210	3	86
Japan.....			68	1,864
OCEANIA.				
British:				
Australia.....	1,058	23,704	736	16,292
New Zealand.....	1	28		
Other British.....	2	35	3	70
French.....	44	937	29	692
German.....	75	1,645	19	413
Philippine Islands.....	3	63		
AFRICA.				
British South Africa.....			1	32
Liberia.....	2	20	7	69
Total.....	1,922	51,401	22,256	947,694
RECAPITULATION.				
Europe.....	419	17,800	19,737	882,958
North America.....	242	5,277	1,476	40,878
South America.....	67	1,682	152	4,340
Asia.....	9	210	96	1,950
Oceania.....	1,183	26,412	787	17,467
Africa.....	2	20	8	101

The following table gives a summary, by customs districts, of the exports of domestic fresh and cured salmon from 1900 to 1915, inclusive, and a detailed statement of the same for the years 1916 to 1919, inclusive. The greater part of the shipments pass through the New York City customs district.

EXPORTS, BY CUSTOMS DISTRICTS, OF DOMESTIC PICKLED, FRESH, ETC., SALMON.

SUMMARY, FISCAL YEARS 1900 TO 1915.*

Customs district from which exported.	1900	1901	1902	1903	1904	1905
Atlantic ports.....	\$346,924	\$380,890	\$503,439	\$767,397	\$1,103,034	\$1,787,832
Gulf ports.....		5	143	30	124	159
Mexican border ports.....	1,192	585	1,857	1,227	1,180	997
Pacific ports.....	185,644	92,698	183,177	99,018	55,167	66,772
Northern border and Lake ports.....	1,516	2,610	819	1,680	3,004	6,895

Customs district from which exported.	1906	1907	1908	1909	1910	1911	1912
Atlantic ports.....	\$1,781,478	\$1,797,411	\$1,590,778	\$1,230,542	\$1,479,656	\$1,514,599	\$1,586,319
Gulf ports.....	14	276	7,225	40	74	1,542	.....
Mexican border ports.....	788	424	167	25	202	18	202
Pacific ports.....	139,606	73,927	44,313	50,834	50,521	46,167	33,190
Northern border and Lake ports.....	5,580	6,705	5,560	7,110	2,187	10,813	10,440

Customs district from which exported.	1913	1914	1915	Customs district from which exported.	1913	1914	1915
New York.....	\$2,060,068	\$2,067,366	\$1,377,840	San Francisco....	\$26,030	\$29,880	\$28,777
Alaska.....	20,995	16,932	6,630	All other districts	8,119	21,418	9,592
Puget Sound.....	7,354	59,713	2,020				

DETAILS, FISCAL YEARS 1916 TO 1918.

Customs district from which exported.	1916	1917	1918
Maine and New Hampshire.....	\$16	\$22,480	\$37
Massachusetts.....	2,925	14,764	32,002
New York.....	732,782	360,348	106,636
Porto Rico.....	47	635	57
Florida.....	60	.....	210
Mobile.....	48	5	5
New Orleans.....	610	166	408
Sabine.....	33	.....	950
Arizona.....	1,736	374	501
Eagle Pass.....	.....	454	.....
El Paso.....	.....	276	24
San Antonio.....	.....	.....	1,123
Laredo.....	16	100	.....
Alaska.....	5,203	29,348	14,539
Hawaii.....	16	16	7
San Francisco.....	33,648	23,804	6,907
Southern California.....	80	255	191
Washington.....	1,155	4,779	19,825
Buffalo.....	394	2,938	6,450
Dakota.....	706	2,233	1,942
Duluth and Superior.....	13	42	1,251
Michigan.....	8,845	12,695	11,910
Montana and Idaho.....	.....	5,667	49
St. Lawrence.....	1,800	7,167	1,258
Vermont.....	565	4,433	174
Total.....	790,198	492,879	205,446

* A more detailed statement for 1900 to 1912 may be found in "Pacific Salmon Fisheries," by John N. Cobb, Appendix III, Report U. S. Commissioner of Fisheries, 1916, pp. 202-203. Washington, 1917.

EXPORTS, BY CUSTOMS DISTRICTS, OF DOMESTIC PICKLED, FRESH, ETC., SALMON—
Continued.

DOMESTIC PICKLED SALMON, CALENDAR YEARS 1918 AND 1919.

Customs district from which exported.	1918		1919	
	Barrels.	Value.	Barrels.	Value.
Maine and New Hampshire			120	\$2,220
Massachusetts			2	65
New York	657	\$23,346	21,041	919,375
Porto Rico	1	23		
Philadelphia			44	5,500
New Orleans			7	163
Alaska	40	770	4	100
San Francisco	1,185	26,443	797	17,724
Southern California	3	58	2	36
Washington	20	458	100	2,017
Dakota	6	91	125	2,112
Duluth and Superior	2	60		
Michigan	3	53	4	168
Montana and Idaho			1	34
St. Lawrence	3	60	9	180
Total	1,922	51,401	22,256	947,694

EXPORTS, BY COUNTRIES RECEIVING, OF ALL OTHER SALMON, CALENDAR YEAR 1919.

Country receiving.	Value.	Country receiving.	Value.
Belgium	\$1,230	Virgin Islands of United States	\$241
Denmark	75,095	Bolivia	2
France	6,444	Brazil	2,194
Iceland and Faroe Islands	200	Chile	190
Netherlands	617	Colombia	182
Norway	43,840	Dutch Guiana	238
Spain	16	French Guiana	135
Sweden	2,430	Peru	10
United Kingdom—England	251,730	Venezuela	49
Bermuda	25	China	286
Canada	421,498	British Straits Settlements	29
Guatemala	96	Other British East Indies	3
Honduras	5	Dutch East Indies	749
Nicaragua	21	French East Indies	5
Panama	646	Japan	6,214
Salvador	28	Russia in Asia	67
Mexico	13,884	Siam	3
Barbados	4,000	Australia	4,840
Jamaica	108	French Oceania	184
Trinidad and Tobago	16	German Oceania	36
Other British West Indies	15	Philippine Islands	1,513
Cuba	1,643	British West Africa	381
Dominican Republic	525	French Africa	450
Dutch West Indies	110	Total	842,464
French West Indies	255		
Haiti	38		

EXPORTS, BY CUSTOMS DISTRICTS, OF ALL OTHER SALMON, CALENDAR YEAR 1919.

Customs district.	Value.	Customs district.	Value.
Maine and New Hampshire	\$72,305	Southern California	\$315
Massachusetts	18,986	Washington	13,861
New York	218,204	Buffalo	5,964
Philadelphia	44,623	Dakota	4,250
Porto Rico	199	Duluth and Superior	44
Florida	4	Michigan	13,561
New Orleans	4,049	Montana and Idaho	12,283
Sabine	29	Ohio	123
Arizona	65	St. Lawrence	29,252
El Paso	6	Vermont	2,831
San Antonio	13,365	Total	842,464
Alaska	347,068		
San Francisco	41,046		

IMPORTS OF FRESH SALMON.

For some years it was the custom of the canneries on Puget Sound, when fish were scarce on the American side and abundant on the Canadian side, to import fresh salmon to fill out the domestic supply and the Canadian canneries would do the same when the conditions were reversed. In 1904 the Canadian Government prohibited the export of fresh sockeye salmon to Puget Sound for packing purposes, and in 1910 an effort was made to have Congress retaliate by enacting a similar law for this side of the line, but the bill failed of passage.

The table below shows the yearly imports of fresh salmon from British Columbia:

IMPORTS OF FRESH SALMON FROM BRITISH COLUMBIA, CANADA, FOR A SERIES OF YEARS.^a

Year.	Pounds.	Value.	Year.	Pounds.	Value.	Year.	Pounds.	Value.
1890.....	4,860	\$241	1897.....	93,454	\$2,681	1904.....	40,610	\$1,025
1891.....	4,950	170	1898.....	11,580	278	1905.....	1,015	35
1892.....	6,288	301	1899.....	58,002	4,101	1906.....	3,457,738	64,408
1893.....	64,811	3,639	1900.....	19,404	855	1907.....	113,224	4,131
1894.....	3,872	219	1901.....	27,072	2,050	1908.....	8,880	795
1895.....	14,000	1,403	1902.....	22,353	739	1909.....	41,073	2,346
1896.....	11,799	419	1903.....	6,860	343	1910.....	198,251	10,116

^a After 1909 all imports of fresh salmon are listed under "Fish, fresh."

After 1911 the imports of fresh salmon from both coasts of Canada and from Newfoundland were lumped together, and are shown in the table below. Fully nine-tenths, if not more, of this salmon came from the Province of British Columbia in Canada, and the greater part of this was canned in the canneries on Puget Sound, Wash.

Fiscal year ending June 30—	Pounds.	Value.	Fiscal year ending June 30—	Pounds.	Value.	Fiscal year ending June 30—	Pounds.	Value.
1911.....	1,122,286	\$114,123	1914.....	3,282,828	\$245,791	1917.....	19,769,600	\$599,442
1912.....	1,620,687	135,416	1915.....	10,676,296	383,697	1918.....	14,408,294	957,169
1913.....	2,089,781	180,513	1916.....	24,026,481	601,115	1919.....	15,571,451	928,552

The following table shows, by customs districts, the imports of fresh salmon during the calendar year 1918:

IMPORTS, BY CUSTOMS DISTRICTS, OF FRESH SALMON, CALENDAR YEAR 1918.

Customs district.	Pounds.	Value.	Customs district.	Pounds.	Value.
Maine and New Hampshire.....	449,244	\$32,721	Dakota.....	632,772	\$56,472
Massachusetts.....	4,965	318	Duluth and Superior.....	18,100	1,728
New York.....	12,400	3,536	St. Lawrence.....	247,833	26,918
Philadelphia.....	4,500	495	Vermont.....	336,806	37,216
Washington.....	11,479,858	421,713			
Buffalo.....	20	2	Total.....	13,085,998	631,119

During the calendar year 1919, imports of fresh salmon amounted to 752,480 pounds, valued at \$101,121, and during the calendar year 1920, to 676,359 pounds, valued at \$125,863.

IMPORTS OF CURED SALMON.

Below are shown the imports into this country of foreign-cured salmon, the product of the Pacific salmon fisheries, from 1886 to 1909, inclusive.

IMPORTS OF FOREIGN PICKLED PACIFIC SALMON, 1886 TO 1909.^a

Year.	British Columbia.		Japan.		Hongkong.		Russia, Asiatic.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1886.....	5,600	\$224							5,600	\$224
1887.....	200	4							200	4
1888.....	86,000	4,031							86,000	4,031
1889.....	18,200	860							18,200	860
1890.....	600	36							600	36
1891.....	200	5							200	5
1893.....	5,478	201							5,478	201
1894.....	149,410	17,592			1,200	\$29	11,875	\$298	162,485	17,919
1895.....	6,550	250			600	13			7,150	263
1896.....	6,530	474							6,530	474
1897.....	6,890	156							6,890	156
1898.....	4,145	188			30	2	9,870	286	14,045	456
1899.....	15,875	1,554							16,032	1,560
1900.....	162,558	11,061	900	\$41					163,158	11,102
1901.....	165,243	11,225							165,243	11,225
1902.....	175,411	13,794	606	28					176,017	13,822
1903.....	161,549	11,756	380	18					161,909	11,774
1904.....	282,210	23,319	1,400	52					283,610	23,371
1905.....	282,027	25,584	3,015	132					285,042	25,717
1906.....	35,475	1,730	5,510	175					40,985	1,905
1907.....	6,393	322	680	31					7,073	353
1908.....	13,230	631	4,185	174					17,415	805
1909.....	30,710	1,523	3,537	148					34,247	1,671
1910.....	111,645	5,505								

^a After 1909 all imports of salmon, pickled or salted, are included under "All other cured or preserved."

^b Includes 137 pounds, valued at \$3, from China.

Since 1910 all imports of pickled salmon have been lumped together and it has been impossible to distinguish the imports of Pacific salmon from those imported from Atlantic districts. The table below shows the total imports, almost all of which comprise salmon from the Province of British Columbia in the Dominion of Canada.

Fiscal year ending June 30—	Pounds.	Value.	Fiscal year ending June 30—	Pounds.	Value.	Fiscal year ending June 30—	Pounds.	Value.
1911.....	695,878	\$62,769	1914.....	1,114,927	\$84,503	1917.....	945,394	\$81,776
1912.....	417,938	33,901	1915.....	1,162,341	104,451	1918.....	739,769	74,042
1913.....	344,580	28,650	1916.....	1,010,844	70,837	1919.....	859,276	117,352

EXPORTS OF CANADIAN CANNED SALMON.

EXPORTS OF CANNED SALMON FROM CANADA, 1916-1919.

[Fiscal year ended Mar. 31.]

Destination.	1916	1917	1918	1919
	Pounds.	Pounds.	Pounds.	Pounds.
Australia.....	4,789,094	3,365,149	2,230,742	3,760,194
Barbados.....				1,642
Bermuda.....	11,480	10,934	9,182	25,884
Bolivia.....		9,600		120,000
British Guiana.....		48		96
British India.....	298,200	101,344	2,400	55,950
British South Africa.....	52,800			48,000
British West Indies.....	28,643	116,112	48,238	
Chile.....		14,400		614,016
China.....	11,976	1,440	101	2,540
Cuba.....				1,048,800
Dutch East Indies.....	343,682	319,344	47,768	28,800
Ecuador.....				2,400
Fiji.....	628,752	860,400	786,616	354,198
France.....	3,908,461	5,621,100	13,629,569	2,869,658
French Oceania.....		14,400	48,000	
Greenland, Iceland, etc.....			200	
Hongkong.....	18,240		7,800	15,550
Italy.....		60	3,109,694	5,464,070
Jamaica.....				676
Japan.....				192
Newfoundland.....			120	48,000
New Zealand.....	1,388,050	1,339,282	1,689,652	1,623,496
Other British East Indies.....				36,000
Other British Oceania.....	91,056	105,360	6,000	12,000
Other British West Indies.....				8,646
Panama.....		4,700		
Peru.....		21,600		
Russia in Europe.....				48,600
Siam.....	14,400	124,848		24,096
St. Pierre and Miquelon.....	2,394	1,361	1,869	4,784
Straits Settlements.....	2,064,736	1,060,018	292,800	412,810
Switzerland.....	192			
Trinidad and Tobago.....				240
United Kingdom.....	35,225,051	34,772,879	21,117,314	29,285,108
United States.....	18,725	567,758	893,639	1,936,753
Total.....	49,142,882	48,332,127	43,777,154	47,813,697

SALMON CULTURE.^a

The artificial culture of salmon on the Pacific coast has developed into a large and constantly expanding industry. The United States Bureau of Fisheries operates a number of large and well-equipped hatcheries, while the State governments of California, Oregon, and Washington, the Dominion of Canada and the Province of British Columbia, and certain private companies have built and maintain a large number of hatcheries, some of these being among the largest in the world.

OBTAINING THE SPAWNING FISH.

The eggs used for artificial propagation are obtained from salmon taken on their way upstream to the natural spawning grounds. In order to arrest the ascent of the fish a rack is usually built across the stream. Where this is not feasible a trap is sometimes constructed for the purpose of catching the fish. Sometimes the racks have slat traps attached in which some fish are caught.

^a Since this revision was completed there has appeared an excellent work on this subject, entitled "Artificial Propagation of the Salmon of the Pacific Coast," revised and enlarged by Henry O'Malley. Appendix II, Report, U. S. Commissioner of Fisheries, 1919, 32 pp., 9 pls. Washington, 1920.

A number of methods have been employed for taking the fish as they are grouped below the rack and seeking for an opening, but the most practicable has been found to be by means of drag or haul seines swept across the area just below the rack. When the pocket or bunt is brought close to shore the workmen pick out the ripe fish and turn the others back to remain until they reach this stage. The ripe fish are placed in pens or live boxes made for this purpose, the males and females being kept separate. These live boxes are usually on the under side of a floating platform, and are accessible through hinged covers set in the plank flooring. Projecting beyond this platform is usually another, upon which the actual work of stripping the fish and caring for the pens is performed.

At a few places where the fish are caught before they have reached the ripe stage, notably Karluk, the fish are placed in a pound or corral and held until they become ripe. This method is resorted to only in case of necessity.

The surest sign of ripeness in a female is the separation of the eggs in the ovaries, but the experienced spawn taker can, from the general appearance of the fish, usually tell whether she is ripe or not, according to Bower: ^a

An interesting experiment was conducted at the Afognak station last season [1910] to determine the degree of ripeness producing the best quality of eggs. The loss on the lot taken from females which were dead ripe—eggs flowing very freely—was less than 1 per cent, while with another lot, where the females were ordinarily ripe upon testing in the usual manner, the loss was about 5 per cent. This shows the need of caution in having fish fully ripe before stripping, if the highest degree of efficiency is to be expected.

TAKING THE EGGS.

As the eggs of the females confined in pens are likely to be injured within the fish, stripping is usually done every day.

When ready for spawn taking, one man lifts a female from the live box by means of a small dip net, while another man lifts out a male in the same manner. They are held suspended in the net until their violent struggles are over, when it is easy to handle them.

For many years, and even yet at many hatcheries, the method of taking salmon spawn has been by pressing the eggs out by steady downward pressure on the belly of the fish. The milt from the male is obtained in the same way.

Where the force is large and the fish rather small the quickest way is for one to hold the fish in one hand and press out the eggs or milt with the other. When the fish are large, or the working force is small, a strait-jacket is used. This is a sort of trough made about the average length of the salmon and hollowed out to fit its general shape. A permanent cleat is set across the lower end, while at the upper end is a strip with a buckle. The fish is slid into the trough, the tail going below the cleat, where it is securely held, and the head buckled in at the upper end with the strap. In this condition the fish is unable to do any harm by its struggles and the eggs can be pressed out at leisure.

^a Fish Culture in Alaska, by Ward T. Bower. In Alaska Fisheries and Fur Industries in 1911, by B. W. Evermann. U. S. Bureau of Fisheries Document No. 766, p. 70. Washington, 1912.

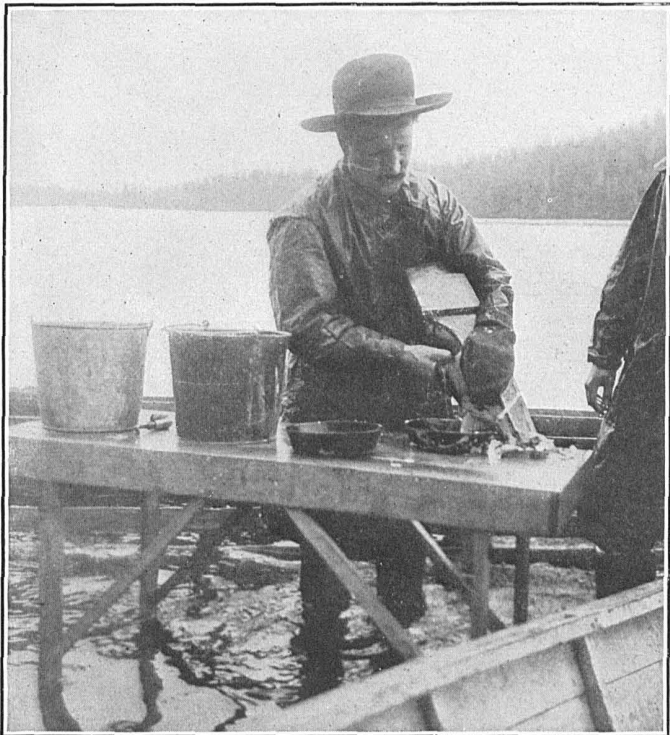


FIG. 40.—STRIPPING SALMON WITH AID OF STRAIT JACKET.



FIG. 41.—CHEHALIS HATCHERY, WASHINGTON FISH AND GAME COMMISSION, SHOWING RACKS TO PREVENT SALMON FROM GOING UPSTREAM, AND PEN FOR HOLDING SPAWNING FISH.

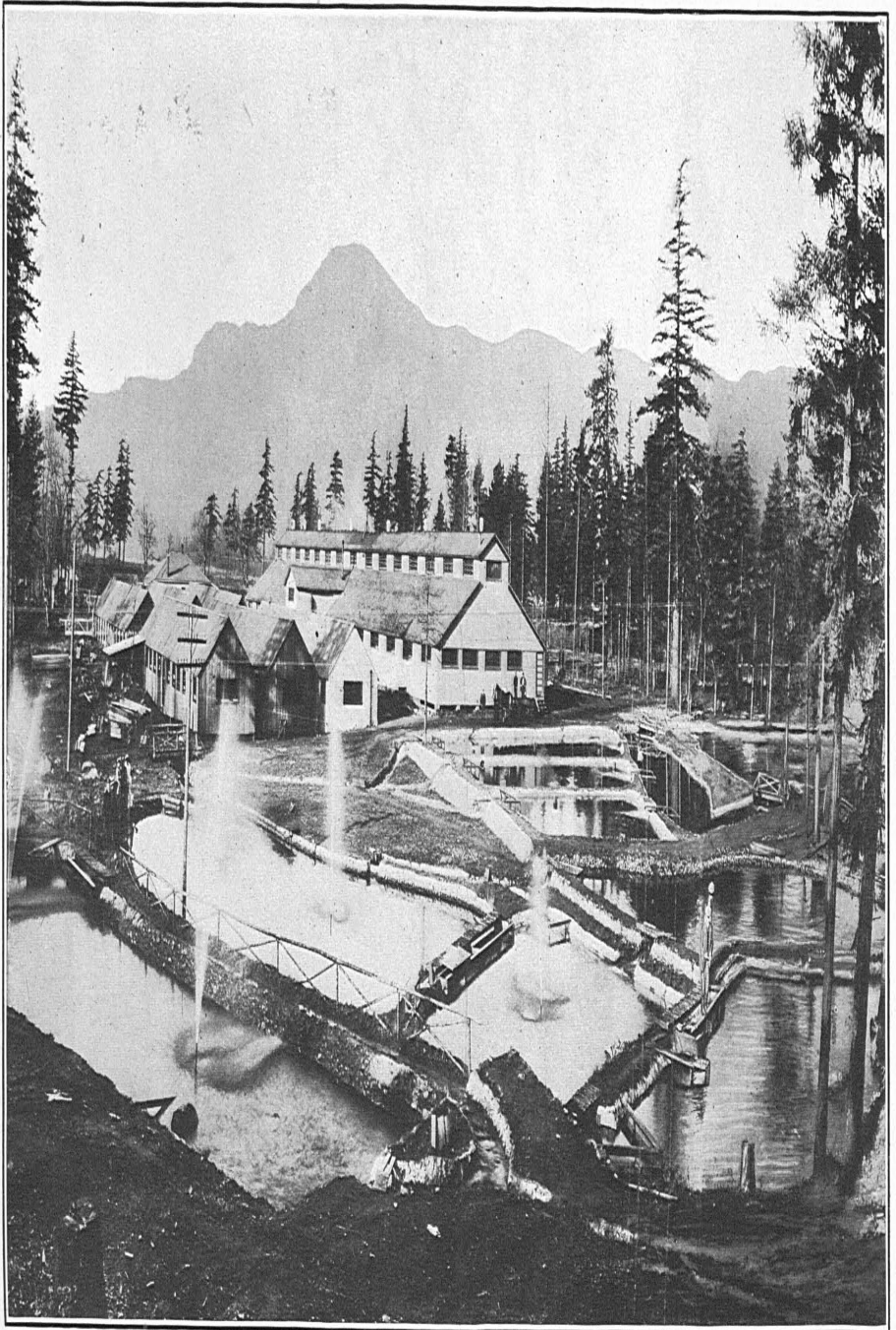


FIG. 42.—BONNEVILLE SALMON HATCHERY OF THE OREGON FISH AND GAME COMMISSION, SHOWING REARING PONDS.

A more modern method in use at many hatcheries, which has been well described by Mr. Bower,^a is as follows:

The long-followed process of taking Pacific salmon eggs by hand expression has been superseded in the last few years by the method of incision, a method discovered and developed by the late Cloudsley Rutter in connection with his study of the life history of the salmon of the Sacramento River. This consists simply of making a cut in the abdominal walls from the throat or near the pectoral fins to the vent, the fish just previously having been killed by a blow on the back of the head. When making the cut the knife is either shielded by a guard or is so held between the thumb and forefinger as to allow not more than half an inch of the blade to project, thus precluding the possibility of injuring any of the eggs. Immediately following the incision the eggs flow in a mass into the spawning pan beneath. The operator's fingers are inserted into the abdominal cavity gently to assist in removing any eggs that may be enfolded in the organs or that may merely adhere to the walls of the cavity. Fertilization is accomplished in the usual manner.

Care must be exercised not to tear loose from the ovaries any eggs that do not come freely when the organs are moved from side to side by the fingers. Eggs thus torn loose are immature, and if taken it becomes necessary to eliminate them subsequently in the hatchery. It is preferable also to have the fish either in a vertical position or with the head considerably higher than the tail, that gravity may assist the flow of eggs.

It was at first thought necessary—and the practice still obtains at some stations—to bleed the fish either by cutting off the head or tail before making the incision. Experimentation, however, has conclusively demonstrated that no advantage results from this procedure, as the few drops of blood that may occasionally fall into a pan of eggs result in no harm. The extra labor involved in bleeding may therefore be dispensed with entirely.

When taken by the method of incision the eggs are of greatly improved quality; there is no straining or rupture of good eggs as is inevitably the result when heavy hand pressure is exerted; no unripe eggs are torn from the ovaries; and at the same time there is no waste of good eggs left enfolded in the organs, as is certain to be the case in stripping by hand. The improvement in quality is from 5 to 10 per cent and the saving in labor, too, is of noteworthy consideration.

The taking of Pacific salmon eggs by incision marks so distinct an advance in fish culture that it is no longer permissible to continue the obsolete method of stripping by hand.

FERTILIZING THE EGGS.^b

In impregnating the eggs the main object is to bring the milt and the eggs together as quickly as possible after they have left the fish. By some persons a little water is considered desirable to give greater activity to the milt, but if left more than a minute in the water there is a decided loss of fertilizing power. The eggs do not suffer so quickly from immersion in water. The absorbing property which they possess when they first leave the parent fish, and which attracts to the micropyle the spermatozoa, lasts several minutes, but it is not prudent to leave the eggs in the water a moment longer than is necessary before adding the milt.

The addition of the water is not essential to a good impregnation; in some instances better results are secured without the use of water and, after all, if the main object is secured, of bringing the milt and the eggs together with the slightest possible delay after they leave the fish, it makes very little difference whether water is used or not. The milt retains its fertilizing power several days when kept from air and water, and impregnation can be effected between fishes widely separated by merely forwarding the milt properly sealed. At Baird impregnation by the dry method, which has always been followed there, has resulted in the fertilization of about 90 per cent of the eggs so treated.

The Russian or dry method of impregnating eggs consists simply in taking both the eggs and the milt in a moist pan. It may be urged as an objection to this method that the eggs will be injured by striking against the pan, but it is a fact that although the same eggs would be destroyed by the concussion a week later, or even 24 hours later, they do not suffer in the least from it at the moment of extrusion from the fish.

It was at one time considered an important question whether the eggs or milt should be taken first, but with the dry method it makes no difference, as, either way, both eggs and milt remain operative long enough for all practical purposes of impregnation.

^a Fish Culture in Alaska, by Ward T. Bower. In *Alaska Fisheries and Fur Industries in 1911*, by B. W. Evermann. U. S. Bureau of Fisheries Document No. 769, pp. 80, 81. Washington, 1912.

^b A Manual of Fish-culture, Based on the Methods of the U. S. Commission of Fish and Fisheries, revised edition, pp. 10-12. Washington, 1900.

Various methods of treating the eggs in the pan after impregnation has taken place have been tried. Some operators leave the eggs in the pans as first taken with the milt for two or three minutes and then add water, after which they are left to stand in the pan until they separate, when they are washed clean, taken to the hatching house, and placed in the troughs. Others pour the contents of the several pans—eggs, milt, and all—into a large can after the eggs become impregnated, and when the eggs separate the contents of the can are poured into the hatching troughs, trusting to the current in the troughs to wash the milt from the eggs. At Baird water is poured on the eggs a few moments after they become impregnated, after which they are left perfectly quiet until they separate, which, in water of the temperature of the McCloud River in September, 52° to 53°, takes about an hour. The pans, in the meanwhile, are put in a trough filled with river water to keep them from becoming too warm. After the eggs separate they are carefully washed and are carried in buckets to the hatching house, where they are measured and placed in the hatching trays.

Mr. Bower^a has the following to say as to the loss by concussion and the proper method of preventing same:

Coincident with the absorptive period in salmon eggs is an adhesive stage varying with the temperature from one to two hours, when the eggs are exceedingly sensitive. This is the so-called period of water hardening. Under no circumstances should the eggs be handled during this stage, nor should they be subjected to the slightest concussion. Repeated tests have demonstrated conclusively that even allowing the buckets containing the eggs to stand on the same platform where spawning operations are being carried on results in considerable loss.

To guard against this, the buckets should either stand on the bottom of the stream or else on a platform in every way independent of and having absolutely no connection with the main platform. To some this may seem like a small and irrelevant consideration, but strict observance is certain to reduce the loss by at least 2 or 3 per cent. During the process of water hardening the buckets should be partly submerged to properly regulate the temperature.

Due caution must be observed not to move the eggs until water hardening is complete. After a little experience the operator can readily tell, upon carefully inserting the hand and finding the eggs free and hard and no longer soft and velvety, even toward the bottom of the bucket, that they may be moved to the hatchery without fear of loss.

HATCHING APPARATUS AND METHODS.^b

The hatching apparatus generally employed on this coast is pretty much of the same pattern and is described as follows:^c

The hatching apparatus generally employed on the Pacific coast in salmon propagation consists of a combination of troughs and baskets. The troughs in common use are the so-called "Williamson troughs," which are 16 feet long, 12 or 16 inches wide, and 6½ inches deep. The troughs are arranged in pairs, and usually two or three pairs are placed end to end on different levels. The fall of water in each trough is 1½ inches. The troughs are divided by double partitions of wood or metal into compartments just enough longer than the baskets to enable the latter to be raised and lowered and to be tilted slightly. The essential feature of these troughs is that at the lower end of each compartment a partition, extending entirely across the trough, reaches from the bottom almost to the top, and another similar partition at the upper end of the compartment reaches from the top almost to the bottom of the trough, each set of partitions being about an inch apart. The water is consequently forced to flow under the upper partition and over the lower partition, and to do this it must necessarily ascend through the tray of eggs. The troughs are provided with canvas covers stretched upon light frames and made sunlight proof by saturation with asphaltum varnish, and their interiors are thickly coated with asphaltum.

The egg receptacles are wire trays or baskets about 12 inches wide, 24 inches long, and deep enough to project an inch or two above the water, which is 5 or 6 inches deep in the troughs in which they are placed. Into each of these baskets 2 gallons of salmon eggs, equivalent to about 30,000, are poured at a time. The eggs suffer no

^a Fish Culture in Alaska, by Ward T. Bower. In *Alaska Fisheries and Fur Industries in 1911*, by B. W. Evermann. U. S. Bureau of Fisheries Document No. 766, pp. 81, 82. Washington, 1912.

^b At some of the Alaska hatcheries quite large baskets, some holding as many as 103,000 red salmon eggs are used.

^c A Manual of Fish-culture, Based on the Methods of the U. S. Commission of Fish and Fisheries, revised edition, pp. 12, 13. Washington, 1900.

injury whatever from being packed together in this manner, the water being supplied in a way that forces it through the eggs, partially supporting and circulating through them. The meshes are too small to permit the eggs to pass through, although the fry are able to do so.

The advantages of this apparatus and method are:

(1) The top of the tray or basket is out of the water and always entirely dry; consequently in handling it the hands are kept dry.

(2) By tilting one end of the tray up or down a little or by lifting it entirely and settling it gently back again in its place the bad eggs will be forced to the top; thus a feather is not required in picking over the eggs and the injuries very often inflicted with it are avoided.

(3) The top of the tray being above water, the eggs can never run over the top nor escape in any way, which is a great advantage over the shallow form of tray.

(4) There is economy of space; 30,000 to 40,000 eggs can be placed in each basket, provided a sufficient quantity of water is available. Two troughs 16 feet long and 1 foot wide will by this method carry about 500,000 salmon eggs. The deep trays may be filled at least half full of eggs, and thus 10 times as many eggs can be hatched in the same space and with the same supply of water as by the old method. A good but gentle circulation is continually maintained through the eggs.

(5) The deep-tray system is admirably adapted to getting rid of mud that has collected on the eggs, for all sediment accumulating about them can be easily removed by gently moving the tray up and down a few times in the water; but if the deposit of mud on the troughs becomes so excessive as to be unmanageable, a false bottom of wire cloth or perforated zinc can be placed in the troughs at a suitable distance above their real bottom, leaving a space of about 1 or 1½ inches between the wire cloth and the trough bottom. By this means the mud that comes into the trough will sift down into the space below the wire cloth entirely out of the way of the fish, the movements of the fish themselves helping very much to produce this result. Should the accumulation of mud in the space below the false bottom of the trough become too great, it can easily be sluiced out in various ways.

When quinnat salmon eggs are simply to be matured for shipment, hatching trays with one-fourth or one-fifth inch square mesh will answer the purpose, but when the eggs are to be hatched in them, every alternate strand of wire running lengthwise, or, better still, every second and third thread, should be left out in order to form an oblong mesh through which the newly hatched fry, after separating themselves from the unhatched eggs, can escape from the hatching trays into the trough below.

At Baird eggs kept in water averaging about 54° F. hatch in 35 days. The allowance of 5 days' difference in the time of hatching for each degree of change in the water temperature is approximately correct.

For the first few days the eggs of the quinnat salmon are very hardy, and at this time they should be thoroughly picked over and the dead ones removed as far as possible before the delicate stage during the formation of the spinal column comes on, so that during that critical period they may be left in perfect quiet. As soon as the spinal column and the head show plainly, the eggs are hardy enough to ship, but when there is time enough it is better to wait a day or two until the eye-spot is distinctly visible, after which time the eggs will stand handling and may be safely shipped if properly packed.

HANDLING EGGS IN HATCHERY.^a

At some of the Bureau's stations where salmon eggs are handled it was the custom until a few years ago to "bury" the eggs or leave them undisturbed (aside from picking once the day after spawning) for two or three weeks after putting them in the baskets. The result was that they were in some instances literally buried under and in such a mass of mud and sediment that many eggs were killed. Discontinuance of the practice resulted in a very appreciable improvement.

When the water is so turbid as to cause a heavy deposit of sediment, it is better to go over the eggs occasionally, even through the critical stages of development, or until the line of the fish is well formed. Of course the eggs must be handled with utmost caution at all times, but owing to their extreme sensitiveness during the two or three days following the closing of the blastopore and until a perceptible curve shows in the tail, they should be left entirely untouched. It soon becomes easy to determine the stage of an egg's development by holding it up to the light between the thumb and forefinger. In the absence of cautious and skilled operatives and unless the water is roily for an extended period, it is undoubtedly better to let the eggs

^a Fish Culture in Alaska, by Ward T. Bower. In Alaska Fisheries and Fur Industries in 1911. U. S. Bureau of Fisheries Document No. 766, pp. 81, 82. Washington, 1912.

remain undisturbed until the curvature of the tail is visible to the unaided eye. The accumulation of a moderate coating of sediment which readily washes off is not injurious. In a few instances it has become necessary to handle the eggs during the tender stage to arrest the spread of fungus, but where the water supply is reasonably well adapted to fish-cultural purposes such a course is rarely if ever necessary.

REMOVAL OF DEAD EGGS BY THE USE OF SALT SOLUTION.

Among the most noteworthy advances in the fish-cultural methods during the last few years has been the use of salt as an aid in the removal of dead eggs. The development of this process has extended over a period of several years, but it is more during the last year or so through the efforts of L. E. Baldridge, of the Yes Bay station, that it has reached a high degree of efficiency.

Compared with the time-honored process of picking by hand, there are marked advantages in using the salt solution, and chief among these is the great saving of labor. It is estimated that if the eggs happen to be of not more than mediocre quality it would take at least 20 pickers to remove as many dead eggs as could two men using the salt solution. Moreover, the operation is much more thoroughly performed in the latter process than is possible in picking by hand.

Another advantage of using the solution is that it is possible thoroughly to clean the eggs. This greatly reduces any loss through contamination and infection resulting from the decomposition and fungous growths which inevitably follow the long-continued presence of dead eggs that in the hand-picking method frequently escape attention. Even when utmost care is taken to pick out all dead eggs, fungous masses will occasionally appear. This condition is rarely observed when the salt solution has been used, and it undoubtedly means that in the aggregate many eggs are saved. Still another point in favor of the solution, it is generally believed, is that it acts as a tonic or stimulant to the good eggs while at the same time as a deterrent to the growth of fungus. Again, in picking by hand there is apt to be loss by movement of the eggs during delicate stages of development; and the oft-repeated insertion of egg tweezers, which are bound to touch other eggs, undoubtedly at times results in injury.

Recent experience has demonstrated that the solution may be applied effectively to eggs freshly taken as well as those in more advanced stages of development.

The principle of the salt bath is simply that the specific gravity of the good eggs is greater than that of the bad eggs, hence upon being placed in the salt solution the good eggs sink and the bad remain afloat and are easily removed. It is vitally essential to the success of the undertaking that the solution be of the proper strength, and it is for this reason that the beginner is apt to become discouraged. If the solution is too weak all the eggs, both good and bad, will sink, while if it is too strong all will remain afloat. The margin of the proper density is so narrow that in the operation it is necessary every few minutes to strengthen the solution by adding more salt or brine, otherwise the small amount of fresh water which adheres to a basket of eggs as it is lifted from the hatching trough into the solution will affect unfavorably the results when treating succeeding baskets. Experience and careful observation, however, will soon make it possible for the operator accurately to judge when to add a bit of the stock solution. It is a convenience, of course, to have a salinometer at hand when preparing the solution. It is commonly the practice as an aid in preparing the solution to test it occasionally with a few eggs.

Highly successful results in using the solution with red salmon eggs have been attained at the Yes Bay station, and a detailed description is accordingly given of the methods pursued at that place.

The chief item of equipment consists of a water-tight wooden tank 4 feet long, 2½ feet wide, and 10 inches deep for holding the solution in which the eggs are immersed. Before each basket is immersed it is necessary that the surface of the solution be perfectly quiet, for any ripple or current will tend to disturb the buoyant effect of the solution upon the eggs. Therefore it was found of great convenience last winter to use a floating frame made of half-inch material 6 inches wide fastened together vertically and at right angles, thus forming open squares about 6 inches either way. After each basket of eggs is lifted from the salt bath this frame is placed in the solution to stop all motion of the water, being pushed down until it is almost submerged and held firmly against the side of the tank for a few seconds. Upon being carefully withdrawn the solution is quiet and the next basket of eggs may be immersed without further delay.

Another piece of equipment is a feather fan with which gently to push the floating dead eggs away from over the submerged basket into which the good eggs have settled. Unless the dead eggs are quickly moved they too will sink. A feather fan made by

fastening eagle feathers to a thin strip 8 inches long by 1½ inches wide works much more satisfactorily for this purpose than a wing. An ordinary hand scaffold net about 12 by 14 inches in size for removing dead eggs from the tank, a dipper, and a bucket complete the outfit. Wood and metal surfaces in all equipment should be well coated with asphaltum or some similar preparation.

At Yes Bay as soon as five or ten million eggs are far enough advanced to stand light concussion the baskets are lifted out of the troughs and the eggs are stirred thoroughly with the hand, which causes practically all of the unfertile or empty eggs to turn white. As soon as the line of the fish shows plainly when held up to the light and there is a distinct curvature to the tail, the eggs are sufficiently well advanced in development to stand stirring. After this process the baskets are returned to the troughs and allowed to remain three days, for when first turned the unfertile eggs are about as heavy as the good eggs and consequently would sink if the salt solution were applied at once.

On the fourth day after stirring, everything being in readiness, five or six baskets are removed from a trough and set on top to drain. After a few moments a basket is grasped at each end and is lowered into the tank containing the solution until the liquid comes through the eggs. A light shake is then given to level up the eggs in the basket. Next, slowly and very gently, the basket is lowered until the brine comes almost to its rim and is held perfectly still for a moment. All the eggs in the basket will rise, but soon the good eggs will begin to sink, and presently, if it is a basket of poor eggs, the surface will be completely covered with bad eggs. Now, without the slightest jar, the basket is lowered far enough below the surface to permit an egg to float over the rim. The bad eggs will immediately start toward the edges of the tank. After a few seconds the basket is gently lowered until it rests upon the bottom. The remaining dead eggs are then brushed away from over the basket by means of quick, short, and light strokes of the feather fan, long, sweeping strokes are to be carefully avoided. One end of the basket is then gently raised until it is above the surface of the brine and the basket is drawn toward the end of the tank and out from under the floating dead eggs. At the same time the fan is used with the other hand to aid in moving any of these floating eggs to one side. The fan is then dropped and the lower end of the basket is grasped and the whole is quickly raised out of the solution. The basket is set at an angle on the tank for a moment to drain and is then carried to the hatching trough. The attendant lifts out another basket to drain along with the four or five others originally removed and returns to the tank of brine with the basket that has been draining the longest.

While this is being done the other operator skims the dead eggs off the surface of the brine and places the frame described above in the tank for a moment to stop all motion of the solution. After five or six baskets have been treated, any eggs that have settled to the bottom of the tank are removed, as they absorb and weaken the brine. It is necessary, as earlier mentioned, to add a little fresh brine after handling each basket. The eggs should be as clean as possible, as the solution will not be effective when it contains much sediment. A 1-inch hole with plug in one corner of the tank is convenient for drawing off any deposit of this character. Should failure occur in treating a basket of eggs, as, for example, if by sudden jar they are all caused to sink, or if the brine is too weak or too strong, the basket must be put back in the hatching trough, as it will not respond to treatment again the same day.

At Yes Bay last winter a large portion of the 72,000,000 eggs were thoroughly cleaned up at one handling. Two men ran as many as 10,000,000 eggs through the salt bath in a single day. It is customary on the day after treating the eggs to have them gone over so that if any dead eggs remain they may be picked out by hand. This, however, requires very little time, as but few dead eggs are found. No alarm need be felt if the eggs seem to shrink as a result of the immersion, for they will soon resume their normal size upon being replaced in fresh water.

The use of the salt solution has been extended lately to the handling of lake trout eggs in Michigan and Minnesota, and there appears to be no reason why it is not equally well adapted to the eggs of other salmonoids. Certainly its many advantages commend further experimentation in this direction.

The eggs of the salmon hatch very gradually at first, only a small proportion coming out the first day, but the number increases daily until the climax is reached, when large numbers of young burst their shells in a single day. As at this time the vast number of discarded shells are apt to clog up the guard screens at the outlets of the troughs, great care and vigilance is necessary to prevent this by thoroughly cleansing them frequently.

The hatched fish easily slip through the oblong mesh in the bottom of the trays into the space below. They should be assisted in doing this by gently raising and lowering the tray at intervals, care being taken not to raise them out of the water.

After they are all hatched out and in the bottom of the troughs about the only danger to guard against is that of suffocation. They frequently crowd together in heaps and dig down under one another until some of them die for want of running water, which is less than an inch away from them. The best remedy is to thin them out.

John Pease Babcock, Assistant to the Commissioner of Fisheries of the Province of British Columbia, in 1910 advanced a novel suggestion that freshly fertilized eggs buried immediately under sand and gravel would produce strong healthy fry at less cost than under existing hatching methods, and that fry so produced are stronger and more capable of resisting the attacks of their active enemies. The interesting account of his experiments is reproduced entire:^a

In writing of the propagation of salmon and trout, some authorities state that considerable loss is occasioned in natural propagation by many of the eggs becoming embedded in sand and gravel; that all the eggs so embedded are lost.

Observation and experiment in the propagation of Pacific salmon and trout for a considerable period lead me to advance the theory that in natural propagation only those eggs which become embedded beneath several inches of sand and gravel produce alevins which live to attain the fry stage; and that those eggs which are not covered by several inches of sand and gravel are either consumed by active aquatic enemies or destroyed by vegetable molds, commonly termed "fungus."

My experiments have demonstrated that the burial of freshly fertilized eggs of the *nerka* and other Pacific salmon does not smother them; that eggs so treated not only live but hatch; and that if they are covered to a sufficient depth the alevins produced survive and possess the instinct and power to work their way gradually to the surface; that if buried beneath 5 or 6 inches of sand and gravel such eggs will hatch, and the young will work their way up through the sand and gravel to the surface, and that by the time they emerge, have absorbed their sacs and are then exempt from the attacks of vegetable molds.

Eggs buried under 1 or 2 inches of sand and gravel produce alevins that work their way up to the surface before the sac is absorbed, and upon reaching the surface are subject to attack by vegetable molds, and a very large percentage are thus destroyed, as well as by the more developed forms of aquatic life.

Eggs buried to a depth of 3 inches produce alevins that work their way to the surface so gradually that by the time they reach the surface their sacs are so nearly absorbed that many, but not all, resist the effects of fungus. Alevins from eggs buried beneath less than 4 inches of sand are liable to reach the surface while the sac is so thinly covered that few, if any, survive the effects of fungous growth.

The spawning beds of Pacific coast streams from California to Alaska (to which my observations have been confined), where the salmon spawn in numbers are, during and after the spawning period, covered with more or less vegetable molds. These molds are particularly common in the beds of streams where great numbers of salmon have spawned and died. Every experienced fish culturist knows that most waters carry great numbers of spores of fungi, and how difficult it is to prevent eggs and alevins from being attacked and injured by their growth. I believe that in natural propagation fungous growths destroy more salmon eggs and alevins than all other causes combined. The vegetable molds of Pacific streams are not active beneath the surface of the beds of streams. Salmon eggs cast therein, if even thinly covered with sand, are not injured by them. These molds do not affect the fry that have nearly or entirely absorbed their sacs, but they are deadly if permitted to attach themselves to either the eggs or the alevins.

^a Some Experiments in the Burial of Salmon Eggs—Suggesting a New Method of Hatching Salmon and Trout. By John Pease Babcock. Transactions, American Fisheries Society, 1910, pp. 393-395. Washington, 1911.

This method has been carried out on a considerable scale by A. Robertson, a Dominion of Canada hatchery superintendent located on the Fraser River, and the results published in "Hatching Salmon Fry in Gravel," *Pacific Fisherman*, Seattle, Wash., Vol. 17, No. 6, June, 1919, p. 38, illus.

My experiments along this line lead me to express the opinion that by the burial of freshly fertilized salmon eggs under 6 or 7 inches of sand and gravel strong healthy fry can be produced at less cost than under existing hatching methods, and that fry so produced are stronger and more capable of resisting the attacks of their active enemies.

I trust that this short statement of my experiments in the burial of salmon eggs may be deemed of sufficient economic importance to stimulate fish culturists generally in experimenting along similar lines. Those who do will perhaps experience some difficulty at first in the covering of a large number of eggs. Experimenters will find that after preparing suitable beds of sand and small gravel the eggs can be evenly laid and held until covered, if the surface of the bed is first thickly indented with cells a little deeper than the eggs. This can be readily accomplished by stamping the bed with a board covered with projections or pegs of suitable size.

My experiments suggest that in the near future most of the buildings and hatching apparatus now used in the propagation of salmon and trout will be dispensed with; that after the eggs have been expressed and fertilized, instead of being placed in wire baskets in hatcheries, they will be buried beneath the sand and gravel of the beds of natural or prepared streams, and that with the exception of watchmen to protect them, little or no other labor will be required:

FEEDING AND PLANTING THE FRY.

For some time the fry remain at the bottom of the trough, but when the yolk sac is nearly absorbed they rise from the bottom and begin swimming. As a rule the fry are planted about the time the yolk sac is absorbed, thus obviating the necessity for feeding them. Some experts advise planting young red salmon when the umbilical sac is about two-thirds absorbed, which is the time when the fish begin to swim up freely. With the temperatures prevailing at the Alaska hatcheries, this means that the fry must be held at least four or five weeks after hatching.

PACKING EGGS FOR SHIPMENT.

In packing salmon eggs for shipment it is the custom at the Bureau of Fisheries' hatcheries to use a packing box made of one-half inch pine, 2 feet square and 1 foot deep.^a

At the bottom is placed a thick layer of moss, then a layer of mosquito netting, then a layer of eggs, then mosquito netting again, then successive layers of moss, netting, eggs, netting, and so on to the middle of the box. Here a firm wooden partition is fastened in and the packing renewed above in the same manner as below. The cover is then laid on the top, and when two boxes are ready they are placed in a wooden crate, made large enough to allow a space of 3 inches on all sides of the boxes. This space is filled with hay to protect the eggs against changes of temperature, and, the cover being put on the eggs, they are ready to ship. In the middle of the crate an open space about 4 inches in depth is left, between the two boxes of eggs, for ice. As soon as the crates arrive at the railway station this space, as well as the top of the crate is filled in with ice. Recent experiments show that salmon eggs can be packed and safely transported to considerable distances when they are first taken.

REARING SALMON FRY.

For many years it was the custom to plant the fry as soon as they had absorbed the yolk sac, a period of about 30 days. A few thousands were sometimes raised to the fingerling, yearling, or adult stage, more as a curiosity than anything else. No particular difficulty was experienced in raising these fish, but the expense entailed in feeding them for a prolonged period, and the impossibility of doing so unless large ponds were constructed at great expense for the pur-

^a A Manual of Fish-culture, Based on the Methods of the United States Commission of Fish and Fisheries, revised edition, p. 14. Washington, 1917.

pose of holding them during the feeding period, prevented the general adoption of the rearing system.

For some years certain fish culturists and others had contended that the planting of fry just after they had absorbed the umbilical sac was an economic mistake, claiming that at this age they were weak and comparatively sluggish in their movements, and would fall easy prey to their numerous fish, bird, and other enemies. The late Robert D. Hume, who built and operated a hatchery on the lower Rogue River, also one on the upper Rogue River, which the United States Bureau of Fisheries operated for some years, was one of the first to take up the rearing of salmon fry on any scale.

In time these objections bore weight, and a few years ago the construction of ponds in which fry could be held and fed until they had reached a size which would insure them at least an even chance for their lives was undertaken all along the coast except in British Columbia, with the result that to-day there is a pond capacity for about one-half of the total capacity of the various hatcheries.

Most of the nursery ponds have been constructed near the hatcheries and usually comprise oblong trenches dug in the earth and walled with cement and stone.

In Oregon the State authorities found that the best results in pond rearing were obtained by using creek or natural ponds, which were made by placing dams across the small streams in the vicinity of the hatcheries. When first taken from the hatching troughs the fry are placed in the artificial ponds until the danger from spring freshets in the small streams is over. They are then transferred to the natural ponds, where the continual flow of fresh water, and the logs, rocks, etc., which provide shade and shelter, afford more natural conditions, and in which the natural food of the fry supplements the artificial food provided by man.

A big advantage in connection with the use of natural ponds is the comparatively small expense involved in providing for them as compared with the large expense involved in the construction of cement ponds.

The young fry show when they are ready to feed by darting to one side or the other when small particles of food are dropped in the water and float past them. For the first few weeks they should be fed regularly and as often as six times a day, and the earlier in the day the feeding begins and the later it continues at night the better. Two hours after feeding they will be found to be ravenously hungry, and as they grow much faster for frequent feeding great care should be taken to see that they are well fed. If not fed sufficiently they will bite at one another and cause more or less mortality among themselves.

FOOD.

In feeding salmon fry almost every conceivable food has been utilized. By universal consent liver is conceded to be the best food for the fry, as it can be ground finer than other foods and the blood which it contains is highly nutritious. At many places, however, it is impossible to secure liver, while its cost when available is generally prohibitive.

The food used is generally that most available and which experience has shown that the fry like and upon which they thrive.

In Oregon ^a it has been found that the extremely young fry thrived on a mixture of ground dried salmon and mush (composed of middlings and other wheat products). Milk curds from near-by creameries also proved satisfactory. The older fish are fed on ground smelt, lampreys, spent salmon, both dried and salted, and offal from the canneries, some loose and some packed in 1-gallon cans. An excellent food is broken-up ice-cream cones. This latter food also has the advantage of not sinking to the bottom and thus polluting the water; and because it floats at the surface the surplus can be lifted out with a dip net.

SALMON SOLD AFTER STRIPPING.

For many years it was the custom after the eggs had been stripped from the salmon to either give the carcasses to the Indians or to bury them. In 1917, under stress of the great demand for fish caused by the war, L. H. Darwin, fish and game commissioner of Washington, after an analysis by chemists had shown that the flesh was wholesome food, offered for sale, at a low rate, these spawned-out fish. The offer was accepted by several of the cities of the State, some of which established municipal markets at which these salmon, as well as other food products, were offered for sale at prices ruling lower than those in the commercial markets. It is probable that the economic utilization of these salmon will be permanent, and will prove a source of considerable profit to the States which sell them.

SALMON HATCHERIES ON THE PACIFIC COAST.

Below is shown a list of the salmon and steelhead-trout hatcheries operated on the Pacific coast during the year 1919:

U. S. BUREAU OF FISHERIES.	STATE OF CALIFORNIA.
Alaska:	Sisson.
Afognak.	Brookdale.
Yes Bay.	Price Creek.
California:	Ukiah.
Baird.	STATE OF OREGON.
Battle Creek.	Wallowa River.
Hornbrook.	McKenzie River.
Mill Creek.	Salmon River.
Oregon:	Bonnevile.
Clackamas.	Santiam River (eyeing station).
Applegate.	Klaskanine.
Snake River.	Willamette River (eyeing station).
Rogue River.	Eagle Creek.
Upper Clackamas.	Snake River (Idaho).
Washington:	Tillamook.
Baker Lake.	Yaquina.
Birdsview.	Siuslaw.
Brinnon.	Umpqua.
Darrington.	South Coos.
Duckabush.	Coquille.
Illabott Creek.	Alesia.
Quilcene.	Rogue River.
Big White Salmon.	
Little White Salmon.	

^a Rearing and Feeding Salmon Fry in Oregon. By R. E. Clanton. Transactions, Pacific Fisheries Society, 1914, p. 91-94. Seattle, 1915.

STATE OF WASHINGTON.

Chambers Creek.
 Chehalis.
 Chehalis No. 2.
 Chinook.
 Dungeness.
 Ellwah.
 Green River.
 Green River No. 2.
 Naseel River.
 Nisqually.
 Nooksack.
 Nooksack River, Middle Fork.
 Nooksack River, South Fork.
 North River.
 Pilchuck.
 Puyallup River.
 Samish.
 Skagit River.
 Skokomish.
 Skykomish.
 Snohomish.
 Stillaguamish.
 Kalama.
 Lewis River.
 Pateros-Methow.
 Tahuya (eyeing station).
 Wenatchee.
 Tilton River.
 Wind River.
 Hump Tulips.
 Willapa.
 Willapa No. 2:

DOMINION OF CANADA.

Granite Creek.
 Pemberton.
 Harrison Lake.
 Stuart Lake.
 Skeena River.
 Babine Lake.
 Rivers Inlet.
 Fraser River.
 Anderson Lake.
 Kennedy Lake.
 Cowichan Lake.

PROVINCE OF BRITISH COLUMBIA.

Seton Lake.

BRITISH COLUMBIA PACKERS ASSOCIATION.

Nimkish Lake.

ALASKA (PRIVATE HATCHERIES).

Alaska Packers Association:
 Fortmann.
 Northwestern Fisheries Co.:
 Quadra.
 Hetta.
 North Pacific Trading & Packing Co.:
 Klawak.

GENERAL STATISTICS.

Distribution of fry, etc.—In the next table is shown by years and species the distribution in Pacific coast waters of fry, fingerlings, yearlings, and adults from 1873, when the first hatchery began operation, to 1919, inclusive. The figures on fingerlings, yearlings, and adults are not as complete as could be wished, this being due to certain of the State fish commissions not separating them from the fry in the published results.

The table shows the enormous total of 7,990,416,264 fry and 275,093,097 fingerlings, yearlings, and adults as having been deposited in local waters since the inception of the work on this coast. Of these nearly one-half were sockeye, or red salmon, followed by chinook, or spring, coho, or silver, dog, steelhead trout, and humpback salmon in the order named.

This table does not show the large number of eggs, fry, etc., shipped from the coast hatcheries to other sections of the country and to various foreign countries. These appear in the tables shown under the various States, Provinces, and Territories.



FIG. 43.—UNITED STATES SALMON HATCHERY, YES BAY, ALASKA.

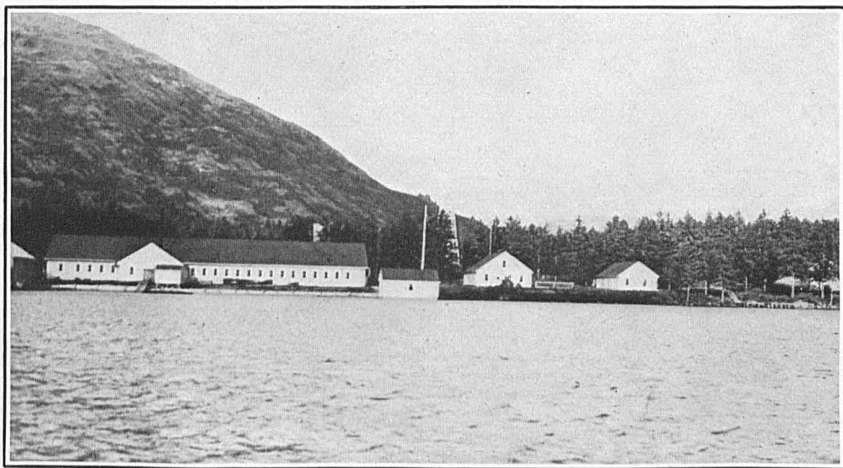


FIG. 44.—UNITED STATES SALMON HATCHERY, AFOGNAK, ALASKA.

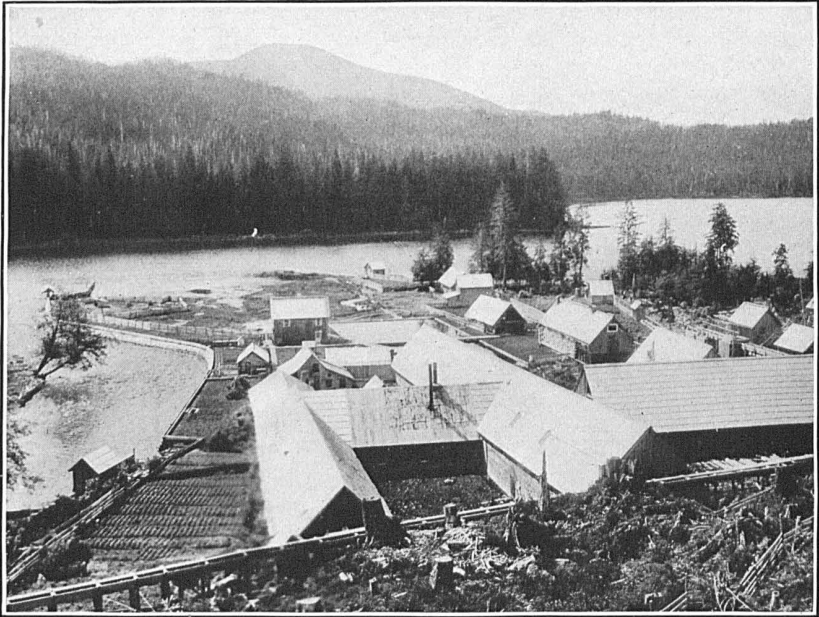


FIG. 45.—ALASKA PACKERS ASSOCIATION FORTMANN HATCHERY, NAHA STREAM, ALASKA; THE LARGEST HATCHERY IN THE WORLD.

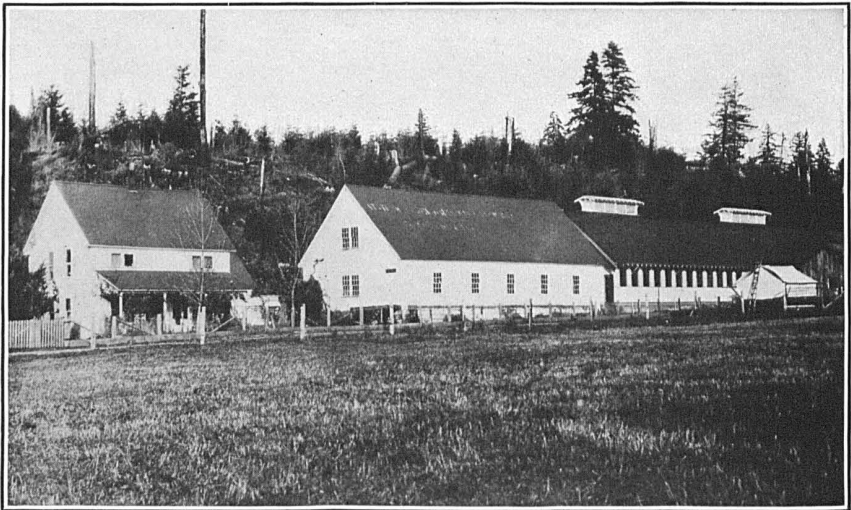


FIG. 46.—CHEHALIS HATCHERY, WASHINGTON FISH AND GAME COMMISSION, SATSOP, WASH.

DISTRIBUTION OF SALMON IN THE PACIFIC COASTAL STREAMS OF NORTH AMERICA, IN SPECIFIED YEARS.

Year.	Chinook, king, or spring.		Coho, or silver.		Chum.		Humpback, or pink.	
	Fry.	Fingerlings, yearlings, and adults.	Fry.	Fingerlings, yearlings, and adults.	Fry.	Fingerlings, yearlings, and adults.	Fry.	Fingerlings, yearlings, and adults.
1873	520,000							
1874	850,000							
1875	2,250,000							
1876	2,000,000							
1877	2,550,000							
1878	2,582,620							
1879	5,376,500							
1880	4,059,290							
1881	4,974,790							
1882	3,991,750							
1884	600,000							
1886	150,000							
1887	200,000							
1888	2,590,000							
1889	8,168,000							
1890	5,250,475							
1891	9,269,000							
1892	4,299,000	25,000						
1893	10,825,950							
1894	8,427,900		280,000					
1895	8,458,000		910,000	580,000				
1896	25,581,033	807,150						
1897	31,146,093		298,137					
1898	73,684,076							
1899	56,773,851		189,000					
1900	33,974,064		13,925,104		10,301,760			
1901	36,563,138	1,068	20,047,935		16,476,280			
1902	73,852,120		41,436,123		9,937,390			
1903	75,553,389		34,460,201		10,012,390			
1904	161,530,963		23,894,026				521,797	
1905	143,714,117		30,743,492					
1906	167,745,494	122,980	47,356,449	300	3,268,800		969,090	
1907	124,578,390		44,426,380		6,120,000		4,224,255	
1908	135,447,179	2,165,797	54,108,557		4,342,350		31,920,662	
1909	88,188,707	16,949	50,648,674		7,805,000		10,000	
1910	97,361,532	225	45,863,952		8,607,500		2,251,340	
1911	80,570,265	11,700	52,869,759		13,435,750		460,150	
1912	101,810,615	1,405,880	66,087,446	116,300	4,684,950		34,205,460	
1913	112,008,886		79,313,839		35,792,440		1,888	
1914	133,271,477	2,571,711	67,682,576		16,623,984		39,685,814	
1915	149,666,221	9,875,745	92,926,831		63,088,372		7,867,484	
1916	151,640,595	26,070,128	56,647,147	5,543,712	63,390,798	1,000,000	15,842,627	2,015,000
1917	96,975,725	27,060,581	17,828,235	4,663,560	26,133,925	7,014,580	4,953,000	7,449,030
1918	133,102,069	22,384,610	55,697,111	10,148,815	82,020,140		22,159,186	4,736,000
1919	67,908,011	58,007,670	32,207,426	3,286,580	26,772,025	4,524,560	5,426,000	369,958
Total.	2,438,054,687	150,527,774	929,848,490	24,319,287	408,815,854	12,539,140	170,499,653	15,469,988

DISTRIBUTION OF SALMON IN THE PACIFIC COASTAL STREAMS OF NORTH AMERICA, IN SPECIFIED YEARS—Continued.

Year.	Sockeye, red, or blueback.		Steelhead trout.		Total.	
	Fry.	Fingerlings, yearlings, and adults.	Fry.	Fingerlings, yearlings, and adults.	Fry.	Fingerlings, yearlings, and adults.
1873.....					520,000	
1874.....					850,000	
1875.....					2,250,000	
1876.....					2,000,000	
1877.....					2,550,000	
1878.....					2,582,620	
1879.....					5,376,500	
1880.....					4,059,290	
1881.....					4,974,790	
1882.....					3,991,750	
1884.....					600,000	
1885.....	1,800,000				1,800,000	
1886.....	2,625,000				2,625,000	
1887.....	4,414,000				4,414,000	
1888.....	5,807,000				5,807,000	
1889.....	4,419,000				4,419,000	
1890.....	6,640,000				6,640,000	
1891.....	3,803,800				3,803,800	
1892.....	6,000,000				6,000,000	25,000
1893.....	6,274,000				6,274,000	
1894.....	8,504,000		353,500		8,857,500	
1895.....	11,081,000				11,081,000	560,000
1896.....	15,868,000		107,808		15,975,808	807,150
1897.....	18,374,440		282,000		18,656,440	
1898.....	20,916,000		650,000		21,566,000	
1899.....	15,761,000		8,625		15,769,625	
1900.....	29,590,000		2,061,500		31,651,500	
1901.....	19,901,253		1,709,328		21,610,581	1,008
1902.....	72,679,000		3,243,948		75,922,948	
1903.....	89,398,789		4,509,641	37,033	93,945,463	37,033
1904.....	70,710,200		4,207,920		74,918,120	
1905.....	119,963,200		3,805,676		123,768,876	
1906.....	232,037,442		6,725,965	24,383	238,787,790	147,663
1907.....	224,018,450		5,629,493		229,647,943	
1908.....	230,528,455		5,837,671		236,366,126	2,105,797
1909.....	239,251,146		8,193,778		247,444,924	16,949
1910.....	396,215,795		11,368,446		407,584,241	225
1911.....	257,463,497		14,995,717		272,459,214	11,700
1912.....	324,325,768		12,710,382	177,790	337,213,940	1,690,960
1913.....	242,146,099		16,654,906		258,801,005	
1914.....	261,305,781		11,719,558		273,025,339	2,571,711
1915.....	198,910,010	8,369,830	22,942,909		229,222,749	18,245,676
1916.....	256,582,879	15,232,732	15,952,138	3,480,092	291,267,841	54,301,684
1917.....	215,853,504	12,305,953	15,241,720	1,837,950	244,239,127	60,381,654
1918.....	155,043,461	12,705,285	18,480,440	3,520,420	187,749,606	53,495,130
1919.....	62,397,320	14,299,960	17,755,206	135,500	94,487,986	80,624,228
Total.....	3,835,069,259	62,973,760	208,128,321	9,263,168	4,115,434,408	275,093,097

Output of United States Bureau of Fisheries hatcheries.—The next table shows by years and species the combined output of the various hatcheries of the United States Bureau of Fisheries on this coast. The greater part of the egg output was to various State hatcheries on the Pacific coast, more particularly those belonging to the State of California. The total figures show that since the Bureau began operations on this coast it has distributed 1,173,825,343 eggs, 2,063,076,832 fry, and 281,317,294 fingerlings, yearlings, and adults.

OUTPUT OF PACIFIC COAST SALMON HATCHERIES OWNED BY THE U. S. BUREAU OF FISHERIES, 1872 TO 1919.

Year.	Chinook, king, or spring.			Coho, or silver.		
	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
1872.....	30,000					
1873.....	1,400,000					
1874.....	4,155,000					
1875.....	6,250,000	1,750,000				
1876.....	5,065,000	1,500,000				
1877.....	4,983,000	2,000,000				
1878.....	7,810,000	2,500,000				
1879.....	4,250,000	2,300,000				
1880.....	3,800,000	2,000,000				
1881.....	4,300,000	3,100,000				
1882.....		3,991,750				
1883.....		776,125				
1889.....	3,450,000	6,000,000				
1890.....	2,554,000	2,890,475				
1891.....	3,688,000	5,678,525				
1892.....	2,902,000	1,647,900				
1893.....	5,530,000	5,290,100				
1894.....	7,500,000	651,500			280,000	
1895.....	3,899,000	600,000			690,000	550,000
1896.....	2,798,500	3,547,850	557,150			
1897.....	18,232,590	9,828,095			298,137	
1898.....	30,605,000	39,950,698				
1899.....	32,018,000	9,369,366				
1900.....	7,411,000	14,287,264			140,824	
1901.....	11,615,036	7,987,107	1,068		302,041	
1902.....	19,446,410	29,340,308			424,530	
1903.....	10,160,177	23,845,956	250	680,800	81,812	
1904.....	75,217,354	35,006,988			3,984,645	
1905.....	96,055,765	21,620,292		107,000	9,321,513	
1906.....	115,048,145	20,797,543	123,118	296,000	6,445,574	300
1907.....	78,587,705	17,567,022		760,000	3,636,952	
1908.....	68,520,550	24,999,185	2,165,797	296,000	13,420,714	57,932
1909.....	38,859,285	20,177,286	16,949	272,000	9,470,925	
1910.....	33,306,709	15,682,064	225	275,000	10,888,025	
1911.....	37,314,514	16,659,684	211,700	2,391,900	6,210,296	
1912.....	36,837,550	31,040,893	1,405,860	62,000	12,955,824	
1913.....	58,296,873	33,414,423		202,000	13,952,963	
1914.....	61,632,645	48,895,607	5,582,796	96,840	24,619,456	27,258
1915.....	25,751,005	53,612,056	9,604,985	111,200	24,018,365	287,662
1916.....	20,622,340	57,870,714	22,982,655	198,500	8,124,334	1,469,507
1917.....	7,191,200	16,404,404	27,858,026		4,403,700	4,662,960
1918.....	15,074,900	6,028,918	63,176,244		980,300	10,504,115
1919.....	12,782,500	399,002	34,088,150		7,544,020	1,291,730
Total.....	967,351,733	601,720,170	187,775,573	5,681,420	162,200,940	18,841,464

Year.	Chum.		Humpback, or pink.			Sockeye, red, or blueback.		
	Fry.	Fingerlings, yearlings, and adults.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
1900.....								10,683,000
1901.....								3,834,463
1902.....								3,371,000
1903.....								3,731,789
1904.....				176,597				3,855,000
1905.....								7,819,281
1906.....			2,000	969,990		880,000		10,000
1907.....								9,923,680
1908.....			502,000	6,764,762		75,000		58,835,055
1909.....				10,000		100,000		69,883,305
1910.....				1,731,740				93,408,496
1911.....	911,650		100,000	460,150				146,081,595
1912.....	2,495,000		3,271,740	2,566,325	2,000,000		100,490,900	91,422,273
1913.....	19,479,000			1,880	2,000,000		78,724,900	
1914.....	8,672,735		13,280,000	37,648,422	6,020,000		53,071,574	
1915.....	35,504,707		14,500,000	7,153,500	119,480	155,000	46,282,691	8,416,405
1916.....	21,500,944	1,000,000	7,000,000	6,106,400	2,915,000	3,100,000	90,988,566	2,666,308
1917.....	14,403,300	7,014,580		165,000	7,499,030	2,000,000	84,152,825	2,145,953
1918.....	9,892,145			2,132,831	8,736,000	18,000,000	67,591,200	12,705,285
1919.....	4,544,000	4,524,560	10,082,000	5,426,500	389,958	101,981,000	48,393,000	25,959,960
Total.....	117,403,481	12,539,140	48,697,740	71,314,097	14,643,823	136,311,000	1,072,544,583	52,033,411

Operations suspended from 1884 to 1888, both inclusive.

OUTPUT OF PACIFIC COAST SALMON HATCHERIES OWNED BY THE U. S. BUREAU OF FISHERIES, 1872 TO 1919—Continued.

Year.	Steelhead trout.			Total.		
	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
1872.....				30,000		
1873.....				1,400,000		
1874.....				4,155,000	850,000	
1875.....				6,250,000	1,760,000	
1876.....				5,065,000	1,500,000	
1877.....				4,983,000	2,000,000	
1878.....				7,810,000	2,500,000	
1879.....				4,250,000	2,300,000	
1880.....				3,800,000	2,000,000	
1881.....				4,800,000	3,100,000	
1882.....					3,991,750	
1883.....					776,125	
1889 ^a				3,450,000	6,000,000	
1890.....				2,554,000	2,890,475	
1891.....				3,688,000	5,078,525	
1892.....				2,902,000	1,647,900	
1893.....				5,530,000	5,290,100	
1894.....	75,000	368,500		7,575,000	1,240,000	
1895.....		852,500	332,000	3,699,000	2,042,500	892,000
1896.....	175,000	107,808		2,973,500	3,655,658	557,150
1897.....	50,000	257,000		18,282,690	10,383,232	
1898.....	60,000	650,000		30,665,000	40,600,098	
1899.....	159,000	12,125		32,777,000	9,378,491	
1900.....	415,000	125,000		7,826,000	25,242,088	
1901.....	246,000	65,850	25,000	11,861,036	12,189,451	26,668
1902.....	481,000	130,250		19,927,410	33,266,088	
1903.....	480,000	702,700	285,848	17,320,977	28,362,257	286,098
1904.....	225,000	93,205	11,090	75,442,354	43,116,435	11,090
1905.....	464,400	537,205		96,627,165	39,298,291	10,000
1906.....	358,000	1,834,485	40,383	117,127,325	39,971,272	173,301
1907.....	250,000	1,190,305		79,697,705	81,229,404	
1908.....	487,725	1,089,598		69,881,275	116,155,562	2,223,729
1909.....	483,725	1,670,371		39,714,990	124,737,078	16,949
1910.....	300,000	3,511,226		38,881,709	177,894,650	225
1911.....	690,000	3,826,439		40,466,414	128,559,119	211,700
1912.....	905,000	4,289,415	294,090	43,066,290	144,769,730	1,699,950
1913.....	1,330,000	4,272,225		61,628,873	149,850,391	
1914.....	729,000	4,022,438		51,137,485	176,930,232	5,734,409
1915.....	877,000	5,282,973	1,048,817	41,994,205	171,584,282	19,456,849
1916.....	1,490,000	841,800	3,676,305	32,410,840	185,432,553	34,710,275
1917.....	3,237,600	2,013,510	1,891,450	12,428,800	121,542,739	51,071,099
1918.....	1,070,000	103,000	6,854,785	37,144,900	86,728,394	96,976,429
1919.....	775,000		1,148,000	125,600,600	66,296,622	67,382,358
Total.....	15,783,450	87,769,726	15,607,768	1,173,825,343	2,062,952,997	281,441,179

^a Operations suspended from 1884 to 1888, both inclusive.

ACCLIMATIZING PACIFIC SALMON IN OTHER WATERS.

For many years efforts have been made by the United States Bureau of Fisheries and various State fish commissions to introduce Pacific coast salmon in eastern waters. In the early history of fish culture chinook fry were planted in almost every imaginable stream along the Atlantic seaboard, in various streams in the Mississippi Valley, and also in tributaries of the Great Lakes. In most cases, owing to the unsuitability of the water, the experiment was doomed to failure from the start. In the case of a few streams where results might have been obtained, the plantings were at long intervals and the fish were too small to protect themselves, while no effort was made by the State authorities to protect them.

The most successful results with plants of chinook salmon have been obtained in Lake Sunapee, N. H., where it is now a not uncommon thing for anglers to catch chinook with rod and reel.

In 1912 about 10,000 chinook fingerlings from Columbia River eggs furnished by the United States Bureau of Fisheries were planted by the Massachusetts Fish Commission in Lake Quinsigamond, and during July, 1914, about 20 months after they were hatched, over 600 salmon, according to a member of the commission, were caught, ranging from 1½ to 5 pounds each.

Other plants have been made since in Lake Quinsigamond and other lakes and ponds, with fairly satisfactory results, and the ultimate outcome of the experiment is awaited with much interest.

The most successful effort in this line was initiated by the United States Bureau of Fisheries in the fall of 1913, when it transferred from its hatcheries on the Pacific coast to those in Maine 13,240,000 humpback-salmon eggs. These were followed by a second shipment of 7,022,000 eggs in the fall of 1914, a third shipment of about 7,000,000 eggs in the fall of 1915, and others each year since. These eggs were hatched out and the fry planted in various selected New England streams where the conditions seemed favorable.

Early in August, 1915, a female humpback salmon 22½ inches long and weighing 4 pounds 3 ounces was taken at the Bangor water-works in the Penobscot River. Shortly after a male fish of about the same size was taken in this river at Orland Dam. A little later agents of the Bureau captured 20 alive near Bangor, and about 3,000 eggs were obtained and fertilized.

In Dennys River, in Maine, during the period between August 15 and September 24, local fishermen caught a number. Since then they have been running regularly each season into certain of these streams.

The chinook salmon has also been acclimatized in the waters of New Zealand. They were first introduced in 1900, and eggs were imported for six years in succession. A considerable annual run now enters those rivers in which the salmon were planted.

In 1908 the United States Bureau of Fisheries initiated an effort to establish a run of sockeye salmon in Grandy Creek, a stream in the immediate vicinity of the Birdsvew (Wash.) hatchery of the Bureau, and one which had not been visited by this species. The first fish, numbering 64,000, were planted in the creek in 1908. Four years afterwards, in September, 1912, the first sockeye salmon entered the hatchery trap in Grandy Creek, and from them 222,000 eggs were secured. In 1916 the water in the creek was too low to permit the ascent of salmon until September 26, when its level was slightly raised by local rains, and a few fish immediately entered it and were taken in the hatchery trap. The eggs secured from the small number available amounted to 24,500. The 1920 run is being awaited with much interest.

In 1916 L. H. Darwin, commissioner of fish and game for the State of Washington, began an experiment looking to the stocking, with sockeye salmon, of the Samish River, a stream debouching in Puget Sound, and in which this species had not hitherto been found. The parent fish were obtained from traps and transported alive in crates to the Samish State hatchery, where they were held until ripe and then stripped and fertilized. After hatching, the fry were planted in the stream. A few returned in 1920.

CALIFORNIA.

HISTORY.

The first fish-cultural station on the Pacific coast was located on McCloud River, a stream of the Sierra Nevada Mountains emptying into Pit River, a tributary to the Sacramento, 323 miles nearly due north of San Francisco. The site on the west bank of the river, about 3 miles above the mouth, was chosen after investigation of a number of places on the Sacramento, by Livingston Stone, one of America's pioneer fish culturists, and the station was named Baird, in honor of the then Commissioner of Fisheries, Prof. Spencer F. Baird. Although the season had nearly passed when the station was sufficiently advanced to handle eggs, 50,000 eggs were secured, and while 20,000 were lost, owing to the excessive heat, the remaining 30,000 were shipped east, all of which were eventually lost but 7,000 fry, which were planted in the Susquehanna River, in Pennsylvania.

The main object of the hatchery the first few years was to secure eggs to ship to the East for the purpose of introducing Pacific salmon in the waters of that section. The commission early made an agreement with the State of California, however, under which the latter at first paid part of the expense, and the commission hatched and planted a portion of the take in the McCloud River. Later, part of the eggs were turned over to the State, which hatched and planted the salmon in local waters.

In 1881 the station buildings were washed away in a freshet, but were immediately rebuilt. From 1884 to 1887, both inclusive, all operations were suspended.

In 1889 a hatchery was established at Fort Gaston, on the Army reservation in the Hoopa Indian Reservation in Humboldt County, but it was not put into operation until 1890. As the reservation was abolished on July 1, 1892, the commission took complete charge of the plant, and in 1893 established a tributary station on Redwood Creek. The same year Korbels station was established about one-half mile above Korbels, on Mad River, in Humboldt County. Owing to the lack of money this station was closed in the fiscal year 1896, but was reopened during the fiscal year 1897.

That same year the commission erected, on ground owned by the State, a hatchery at Battle Creek, in Tehama County, and also took charge of and operated the hatchery erected at this place by the State fish commission the previous year. Under the terms of an agreement the commission was to deliver to the State as many eyed spawn as the latter could hatch at Sisson, its own station.

Owing to their inaccessibility, the Fort Gaston hatchery and its substations were abandoned in 1898. The same year an experimental station was established at Olema, Bear Valley, in Marin County, whence eggs were transferred from Baird station, hatched out here, and planted in Olema Creek in order to see if they could not be domesticated here, where they had not been found previously.

During the fiscal year 1902 a substation was established on Mill Creek, a stream which has its source in the foothills of the Sierra Mountains, in the northeastern part of Tehama County, and empties into the Sacramento River from the east about a mile above the town of Tehama. The eggs are retained here until eyed and then shipped to other hatcheries.

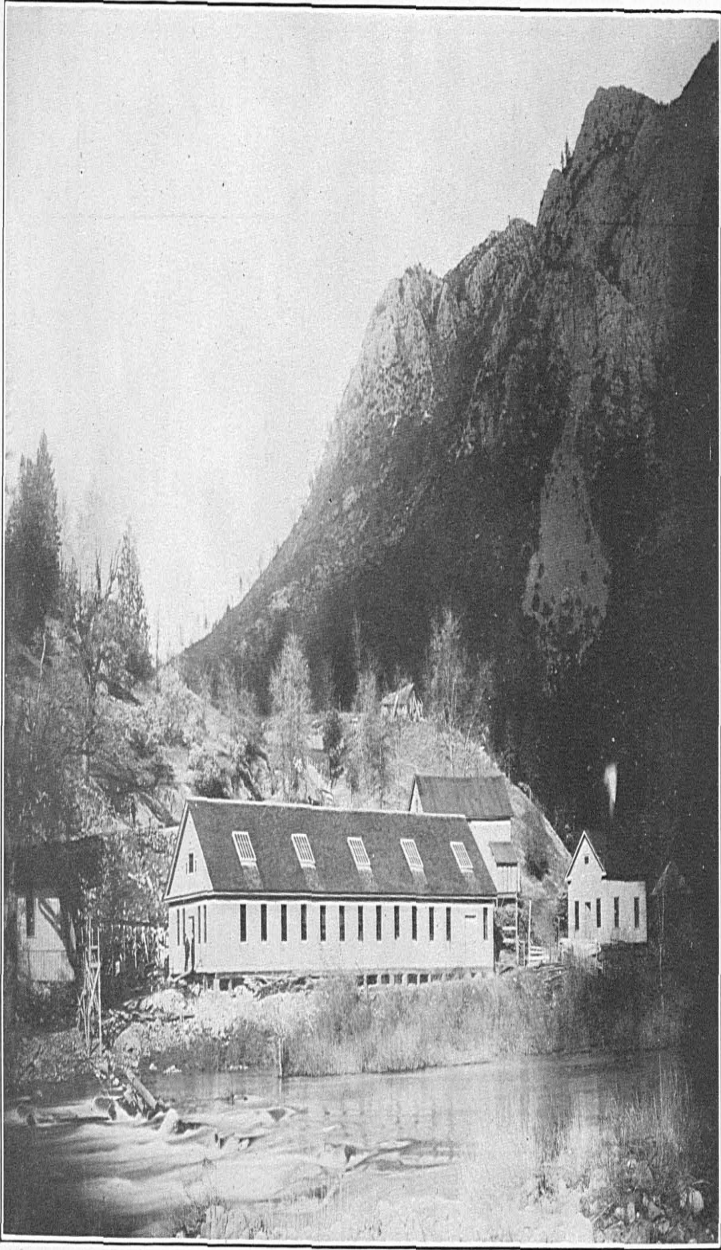


FIG. 47.—UNITED STATES BUREAU OF FISHERIES HATCHERY AT BAIRD, CALIF.; THE FIRST FISH-CULTURAL STATION ON THE PACIFIC COAST.

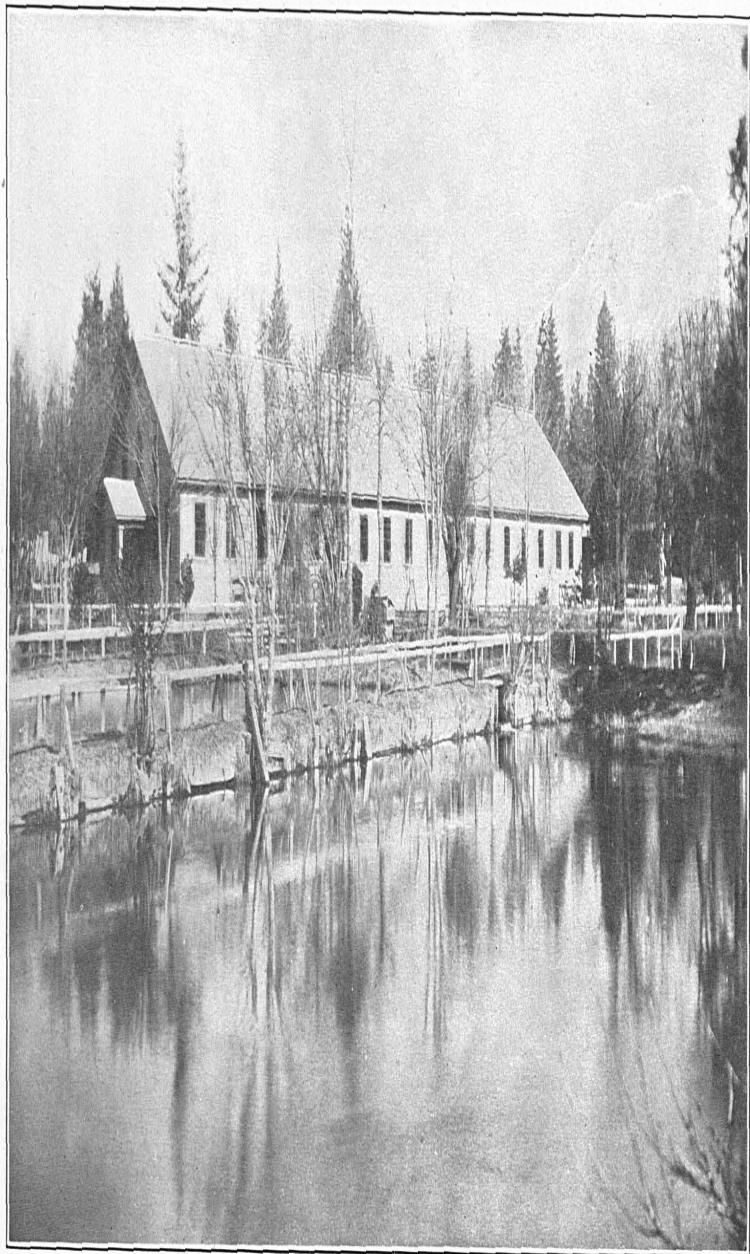


FIG. 48.—MOUNT SHASTA HATCHERY OF THE CALIFORNIA FISH AND GAME COMMISSION, AT SISSON, CALIF.

As stated above, the State aided the work of the United States Fish Commission in a financial way and also by hatching and distributing the eggs turned over to its care. In 1885 the State legislature passed a bill authorizing the establishment of a hatchery of its own, and the same year such a station was built upon Hat Creek about 2½ miles above its junction with Pitt River, a tributary of the Sacramento River. As the work of the first few seasons developed that the location was unsuitable, the hatchery was removed in 1888 to Sisson, in Siskiyou County. It is now known as the Mount Shasta hatchery. The work of this hatchery was to handle the eggs turned over to it by the United States Fish Commission. It was almost doubled in size in 1917.

In 1895 another hatchery was built by the State near the mouth of Battle Creek, a tributary of the Sacramento River. In 1896 and 1897 this hatchery was operated jointly by the State and the United States Fish Commission while awaiting the appropriation of money by the commission to purchase it from the State.

In the fall of 1897 a hatchery was established by the State at Grizzly Bluff, on Price Creek, a tributary of Eel River, in Humboldt County, and in 1902 this hatchery made the first plant in the State of steelhead trout fry. In 1916 it was moved to a point on Eel River near Fort Seward.

Santa Cruz County has had a hatchery at Brookdale for a number of years. In 1911 it was leased to the State and operated by the latter during the seasons of 1911 and 1912. In 1913 the State gave up the lease and entered into a contract to purchase the eggs produced from this hatchery. The price agreed upon was that the State commission was to pay \$1.50 per thousand for the eyed steelhead eggs, up to the number of 2,000,000, and \$1 per thousand for all eggs up to 3,000,000, provided that the eggs were collected and eyed by a skilled fish culturist and would pass inspection before they were accepted. In 1916 the State leased the plant for a term of years.

A hatchery was established by the United States Bureau of Fisheries at Hornbrook, on Klamath River, in 1913. At first this hatchery was devoted to rainbow-trout work, but later the collection and distribution of silver and chinook salmon was taken up.

During the fall of 1911 the State established an experimental station at Sacramento in order to carry on a series of experiments to determine whether the eggs of the quinnat salmon could be successfully hatched and the fry reared near the city of Sacramento. Of the fish hatched at this station 50,000 were marked.

Nearly all of the fry that were liberated in the Sacramento River were floated in a screen cage by boat into the middle of the stream and there released. N. B. Scofield took 500 in a floating box down the river, where they were held and fed for several weeks in brackish and salt water. They were apparently not affected by the changes in the salinity of the water.

Experiments were carried on until the summer of 1913, when they were abandoned due to the killing of the embryos by the mineral substances in the water used at the station.

During the fiscal year 1912 the Mill Creek hatchery of the United States Bureau of Fisheries was operated by the California Commission.

Some years ago the town of Ukiah, Mendocino County, established a hatchery 1 mile from the town, and on Russian River.

For some years it was operated as a trout station, but eventually became an important steelhead hatchery. It was not operated in 1913. In 1914 the State Fish Commission collected steelhead eggs at the Eel River dam of the Snow Mountain Water & Power Co., and having secured permission from the town of Ukiah, hatched them out in its hatchery.

As the Hornbrook hatchery on Klamath River was on private property, the United States Bureau of Fisheries in 1915 removed the buildings from the old location on the south side to property owned by the Government on the north side of the river.

In 1915 new hatchery buildings were erected at the Mill Creek hatchery.

OUTPUT.

The following tables show separately the quantity of salmon eggs, fry, fingerlings, yearlings, and adults distributed by the United States Bureau of Fisheries and by the State since the inception of the work. The large quantity of eggs shown by the Bureau represents largely the eggs supplied to the State, which hatched and distributed them, and eggs sent to other States and to foreign countries.

OUTPUT OF HATCHERIES IN CALIFORNIA OWNED BY THE UNITED STATES BUREAU OF FISHERIES.

Year ending June 30— ^a	Chinook.			Silver.		
	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
1872.....	30,000					
1873.....	1,400,000					
1874.....	4,155,000	850,000				
1875.....	6,250,000	1,750,000				
1876.....	5,085,000	1,500,000				
1877.....	4,983,000	2,000,000				
1878.....	7,810,000	2,500,000				
1879.....	4,250,000	2,300,000				
1880.....	3,800,000	2,000,000				
1881.....	4,300,000	3,100,000				
1882.....		3,991,750				
1883.....		778,125				
1889 ^b	3,450,000	1,500,000				
1890.....	1,554,000	84,000				
1891.....	2,988,000	777,000				
1892.....	2,902,000	315,500				
1893.....	3,530,000	1,190,100				
1894.....	7,500,000	438,500			280,000	
1895.....	3,676,000	500,000			690,000	
1896.....	6,170,800	715,700				560,000
1897.....	18,232,590	3,056,701				
1898.....	30,405,000	16,643,300			298,137	
1899.....	27,665,000	3,275,110				
1900.....	2,925,000	3,533,950				
1901.....	3,834,038	889,570				
1902.....	17,580,410	2,115,560				
1903.....	11,275,777	1,618,066				
1904.....	64,598,354	2,350,130				
1905.....	96,025,765	7,561,380				
1906.....	107,905,945	3,496,267				
1907.....	73,376,315	2,512,250	138			
1908.....	64,990,550	4,780,855				
1909.....	32,278,265	3,590,078				
1910.....	30,539,467	2,286,257				
1911.....	33,364,514	3,666,061		2,289,900		
1912.....	20,697,550	7,243,325				
1913.....	17,092,873	2,195,100		100,000	17,320	
1914.....	25,373,645	5,598,349	3,849,991	95,840	2,536,460	
1915.....	20,716,005	5,015,400	8,086,139		971,740	
1916.....	19,622,340	9,940,950	11,938,224		2,169,050	
1917.....	7,027,300	800,000	14,628,300		50,000	
1918.....	14,421,900		10,689,400			11,000
1919.....	11,802,500		10,287,800			
Total.....	825,864,901	117,457,334	59,479,992	2,485,740	7,012,707	797,162

^a The calendar year was used up to 1889.^b The hatchery was closed from 1884 to 1888.

OUTPUT OF HATCHERIES IN CALIFORNIA OWNED BY THE UNITED STATES BUREAU OF FISHERIES—Continued.

Year ending June 30 — ^a	Steelhead trout.			Total.		
	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
1872.....				30,000		
1873.....				1,400,000		
1874.....				4,155,000	850,000	
1875.....				6,250,000	1,750,000	
1876.....				5,065,000	1,500,000	
1877.....				4,983,000	2,000,000	
1878.....				7,810,000	2,500,000	
1879.....				4,250,000	2,300,000	
1880.....				3,800,000	2,000,000	
1881.....				4,300,000	3,100,000	
1882.....					3,991,750	
1883.....					776,125	
1889 ^b				3,450,000	1,500,000	
1890.....				1,554,000	84,000	
1891.....				2,988,000	777,000	
1892.....				2,902,000	315,500	
1893.....				3,530,000	1,190,100	
1894.....	75,000	308,500		7,575,000	1,027,000	
1895.....		852,500	332,000	3,676,000	2,042,500	892,000
1896.....	175,000	107,808		6,345,800	823,508	
1897.....	50,000	257,000		18,282,500	3,611,838	
1898.....	60,000	650,000		30,665,000	16,203,300	
1899.....				27,665,000	3,275,110	
1900.....				2,925,000	3,533,950	
1901.....				3,934,036	889,570	
1902.....				17,580,410	2,115,580	
1903.....				11,275,777	1,618,066	
1904.....				64,508,354	2,350,130	
1905.....				96,025,765	7,561,380	
1906.....				107,905,945	3,496,267	138
1907.....				73,376,315	2,512,250	
1908.....				64,090,550	4,780,855	
1909.....				32,278,285	3,590,078	
1910.....				30,539,467	2,286,257	
1911.....				35,654,414	3,066,061	
1912.....				20,697,550	7,243,325	
1913.....				17,192,673	2,212,420	
1914.....				25,469,485	8,134,809	3,849,991
1915.....				20,716,005	5,987,140	8,312,301
1916.....				10,622,340	12,110,000	11,638,224
1917.....				7,027,300	850,000	14,639,300
1918.....				14,421,900		10,689,400
1919.....				11,802,500		10,287,800
Total.....	360,000	2,175,808	332,000	828,710,641	123,645,849	60,609,154

^a The calendar year was used up to 1889.

^b The hatchery was closed from 1884 to 1888.

OUTPUT OF HATCHERIES OWNED BY THE STATE OF CALIFORNIA.

Year.	Chinook.		Silver fry.	Steelhead fry.	Total.	
	Eggs.	Fry. ^a			Eggs.	Fry.
1873.....		520,000				520,000
1874.....		850,000				850,000
1875.....	^b 250,000	2,250,000			250,000	2,250,000
1876.....		2,000,000				2,000,000
1877.....		2,200,000				2,200,000
1878.....		2,500,000				2,500,000
1879.....		2,300,000				2,300,000
1880.....		2,225,000				2,225,000
1881.....		2,420,000				2,420,000
1882.....		3,991,750				3,991,750
1884.....		600,000				600,000
1886.....		150,000				150,000
1887.....		200,000				200,000
1888.....		1,290,000				1,290,000
1889.....		2,168,000				2,168,000
1890.....		1,320,000				1,320,000
1891.....		2,798,000				2,798,000
1892.....		2,651,000				2,651,000
1893.....		3,941,650				3,941,650
1894.....		7,776,400				7,776,400
1895.....		3,435,000				3,435,000
1896.....		15,283,183				15,283,183
1897.....		18,123,000				18,123,000
1898.....		31,476,388				31,476,388
1899.....		21,234,000				21,234,000
1900.....		2,536,000				2,536,000
1901.....		3,239,000				3,239,000
1902.....		16,852,040		301,000		17,153,040
1903.....		20,040,487		120,000		20,160,487
1904.....		63,632,000		80,000		63,712,000
1905.....		87,000,000		108,000		87,108,000
1906.....		105,815,920		243,000		106,058,920
1907.....		71,267,000		352,000		71,619,000
1908.....		60,619,000		170,000		60,789,000
1909.....		28,000,000		517,000		28,517,000
1910.....		28,469,745		637,800		29,107,545
1911.....		29,657,283	2,060,910	1,858,100		33,576,273
1912.....		18,909,445		2,177,958		21,087,403
1913.....		16,277,227	25,000	1,983,500		18,285,727
1914.....		25,290,615	12,500	3,171,083		28,474,198
1915.....		33,313,150	1,417,000	8,582,500		43,312,650
1916.....		19,339,738		5,213,170		24,552,908
1917.....		6,853,000		6,699,420		13,552,420
1918.....		14,439,000		4,483,000		18,922,000
1919.....		11,970,000	178,000	4,950,000		17,098,000
Total.....	250,000	797,224,001	3,693,410	41,657,531	250,000	842,574,942

^a The greater part of the output of chinook fry was from eggs supplied by the U. S. Bureau of Fisheries hatcheries in California.

^b All were lost.

DISTRIBUTION.

The following table shows, by streams and species, the distribution in California of the salmon eggs, fry, fingerlings, yearlings, and adults, from the hatcheries of the United States Bureau of Fisheries and the State. This far from represents the work of the hatcheries, as large quantities of eggs were sent to other States and foreign countries.

DISTRIBUTION OF SALMON IN THE WATERS OF CALIFORNIA.

Year.	Klamath River and tributaries.				Redwood Creek and tributaries.			
	Chinook.		Silver.		Chinook fry.	Silver.		Steel-head fry.
	Fry.	Yearlings.	Fry.	Yearlings and adults.		Fry.	Yearlings and adults.	
1890	90,000							
1891	30,000				25,000			
1892	147,600	25,000			142,500			
1893	487,200				170,000			
1895			300,000	180,000		140,000	400,000	
1896					65,700			107,808
1897					280,250	124,750		202,000
1898	16,000				1,260,000			650,000
1903	40,000							
1911			2,060,910					
1913			17,320					
1914	2,155,100		2,548,960					
1915	5,820,000		1,098,000					
1916	7,733,135		2,189,050					
1917	1,728,000	388,000	50,000	11,000				
1918	3,675,000							
1919	1,148,000		178,000					
Total...	23,070,035	383,000	8,422,240	171,000	1,943,460	264,750	400,000	959,808

Year.	Mad River and North Fork.			Eel River.		Russian River.	Skaggs Springs.	Marin County creeks.
	Chinook fry.	Silver fry.	Steel-head fry.	Chinook fry.	Steel-head fry.	Chinook fry.		
1881						15,000	15,000	
1894		280,000	308,500					
1895		470,000						
1897	145,385	173,387	60,000					635,000
1898				7,867,388				1,970,000
1899				8,202,000				900,000
1900				885,000				
1902				2,069,500	301,000			
1903				5,257,947	120,000			
1904				5,200,000	90,000			
1905				8,100,000				
1906				9,285,920	243,000			
1907				7,570,000	352,000	25,000		25,000
1908				6,154,000				
1909				5,500,000	349,000			
1910				5,909,745	334,800			
1912	100,000			3,103,660				
1913	100,000			1,386,500				
1914	225,000			3,723,000				
1915	350,000			2,618,150				
1917	400,000			91,000				
1918	250,000			844,000				
1919	250,000			682,000				
Total...	1,820,365	923,387	368,500	84,479,810	1,789,800	40,000	15,000	3,530,000

DISTRIBUTION OF SALMON IN THE WATERS OF CALIFORNIA—Continued.

Year.	Sacramento River and tributaries.					San Francisco Bay streams.	Smith River.	Santa Ynez River.	Monterey Bay and tributaries.			
	Chinook.			Silver fry.	Steel-head fry.					Chinook fry.		
	Eggs.	Fry.	Yearlings, fingerlings, and adults.									
1873.....	20,000	520,000										
1874.....		850,000										
1875.....	a 250,000	2,000,000										
1876.....		2,000,000										
1877.....		2,200,000										
1878.....		2,500,000										
1879.....		2,500,000										
1880.....		2,225,000										
1881.....		b 2,300,500				20,000			30,000			
1882.....	80,300	3,991,750										
1883.....		600,000										
1884.....		150,000										
1885.....		200,000										
1886.....		1,290,000										
1887.....		3,668,000										
1888.....		1,404,000										
1889.....		3,520,000										
1890.....		2,676,500										
1891.....		4,474,750										
1892.....		8,214,900			45,000							
1893.....		3,935,000										
1894.....		15,683,183	250,000									
1895.....		19,264,086										
1896.....		33,998,300										
1897.....	85,200	16,307,110										
1898.....		5,184,950										
1899.....		4,128,670										
1900.....		15,888,100										
1901.....		16,359,606										
1902.....		60,782,130										
1903.....		94,581,380										
1904.....		100,038,552			108,000							
1905.....		66,200,250				135,000			900,000			
1906.....		59,245,855				170,000			1,200,000			
1907.....		26,090,000				168,000			800,000			
1908.....		24,786,257				303,000						
1909.....		33,323,324										
1910.....		22,949,110										
1911.....		16,691,167				294,660						
1912.....		24,637,884	838,900				100,000					
1913.....		28,688,000	9,053,635	1,194,762				42,000				
1914.....		26,800,604	5,538,224				300,000	25,000				
1915.....		5,875,000	14,260,300					25,000				
1916.....		9,470,000	10,686,400				100,000	25,000				
1917.....		9,840,000	10,287,000					25,000				
1918.....												
1919.....												
Total....	435,500	788,832,798	50,917,465	1,194,762	929,000	314,660	500,000	142,000	2,830,000			

a All were lost.

b Includes 15,000 chinook fry planted in San Gregorio River and 15,000 chinook fry planted in Pescadero Creek.

c Includes the following plants in Santa Barbara county streams: Bear Creek, 4,000; Maguilito Creek, 2,000; and Salispuedes Creek, 2,000.

DISTRIBUTION OF SALMON IN THE WATERS OF CALIFORNIA—Continued.

Year.	Mon- terey Bay and tribu- tar- ies.	Ven- tura River.	Truckee River.	Total.					
	Silver fry.	Chinook fry.	Eggs.	Chinook.			Silver.		Steel- head fry. ^b
				Fry.	Year- lings, finger- lings, and adults. ^c	Fry.	Adults and year- lings.		
1873				20,000	520,000				
1874					850,000				
1875			250,000	250,000	2,250,000				
1876					2,000,000				
1877					2,200,000				
1878					2,500,000				
1879					2,300,000				
1880					2,225,000				
1881			10,000		2,390,600				
1882				80,300	3,091,750				
1883					600,000				
1884					150,000				
1885					200,000				
1886					1,290,000				
1887					3,665,000				
1888					1,495,000				
1889					3,575,000				
1890					2,968,600	25,000			
1891					5,131,950				
1892					8,214,900		280,000		358,500
1893					3,935,000		910,000	560,000	
1894					15,748,853	250,000			107,808
1895					20,324,701		298,137		282,000
1896					45,101,688				650,000
1897					25,409,110				
1898				85,200	6,069,950				
1899					4,128,570				
1900					18,967,600				301,000
1901					21,657,653				120,000
1902					65,982,130				90,000
1903					102,661,380				108,000
1904					110,204,472				243,000
1905	80,000				75,029,250		80,000		487,000
1906	80,000				66,199,855		80,000		170,000
1907	654,000				31,690,000		42,000		518,200
1908					30,756,002				637,800
1909					33,323,324		2,060,910		1,858,100
1910					20,152,770				2,177,968
1911	25,000				18,472,327		42,320		1,583,500
1912					30,940,964	838,906	2,548,960		3,171,083
1913		25,000			37,543,150	9,053,635	2,363,702		8,582,500
1914	71,000	25,000			34,853,739	5,538,224	2,169,050		5,213,170
1915		25,000			8,144,000	14,628,300	50,000	11,000	6,699,420
1916		25,000			14,389,000	10,689,400			
1917		25,000			11,970,000	10,287,000	178,000		4,950,000
1918		25,000							
1919		25,000							
Total	310,000	125,000	260,000	435,500	908,003,118	51,810,465	11,103,139	571,000	38,684,089

^a Of recent years it has been impossible to show the total number of yearlings, fingerlings, and adults planted, as the State reports do not distinguish them from the fry. Those shown in 1914-1919 were reared by the U. S. Bureau of Fisheries.

^b After 1911 the practice of showing waters in which steelheads were planted was abandoned as the number of streams was becoming unwieldy.

^c Includes 1,200 steelhead fry, which in "Total" column are included under "Steelhead fry."

OREGON.

HATCHERIES ON COASTAL STREAMS.

Rogue River.—In 1877 R. D. Hume, who had been packing salmon on this river for some years, erected a hatchery at Ellensburg. In 1888 the Oregon Legislature appropriated a sum of money for the enlargement and support of this hatchery, Mr. Hume to retain complete control. As the location is on tidewater, it is necessary to catch the parent fish and hold them until they are ready to spawn, and in order to do this Mr. Hume had an excavation 32 by 62 feet and 11 feet deep made in the bank of the river. This was lined with concrete 1 foot thick, which, when filled with water, made a pond 30 by 60 feet and 10 feet deep. Over the entire pond he constructed a building which could be closed up so as virtually to exclude the light. It is supposed that retaining the fish in a dark place aids in keeping them in good physical condition until ready to spawn. After the death of Mr. Hume in 1908 this hatchery was taken over and operated by the State.

In 1897 Mr. Hume built and equipped a hatchery on the upper Rogue River at the mouth of Elk Creek, about 26 miles from the town of Central Point, in Jackson County, and, in pursuance of an understanding with the United States Fish Commission, the latter operated then and still continues to operate this plant.

In 1900 the Government established an auxiliary station for the collection of steelhead trout eggs on Elk Creek, about 10 miles above the main station. In 1905 a substation was operated at Grants Pass, while during the fiscal year 1908 and in subsequent years substations were operated at Findley Eddy, on the Rogue River, Illinois River, and Applegate Creek, tributaries of the Rogue.

Many of the eggs gathered at the upper Rogue River stations were shipped to Mr. Hume's hatchery, on the lower river, and there hatched out and planted.

Coquille River.—The State formerly had a hatchery on this river, but it was abandoned during the winter of 1902-3. In the winter of 1904-5 a substation was established on one of the tributaries of the Coquille River, about 6 miles from the South Coos River hatchery, and was used in hatching eggs brought to it from the latter place. A station was built on the north fork of the Coquille River in 1910.

Coos River.—A hatchery was built by the State in 1900 on the South Coos River, about 20 miles from the town of Marshfield.

Umpqua River.—In 1900 the State built a hatchery on the north fork of the Umpqua River, near the town of Glide and about 24 miles east of Roseburg. In 1901 a station was established farther up the north fork, at the mouth of Steamboat Creek. After working here two years the station was moved a couple of miles farther up the stream. In 1907 work was resumed again at the original station near Glide, as winter freshets had seriously damaged the upper station. A permanent station was built in 1910.

Siuslaw River.—In 1893 the State erected a hatchery on Knowles Creek, a tributary of the Siuslaw River, about 20 miles above the mouth of the river. It was turned over to the United States Fish Commission to operate, but no fish came up to the hatchery because the fishermen lower down stretched their nets entirely across the river.

In 1897 and 1898 the United States Fish Commission operated a hatchery owned by a Mr. McGuire and located close to Mapleton, about 2 miles below the head of tidewater.

In 1902 the State established an experimental station at the Bailey place, near Meadow post office. In 1907 a permanent station was established by the State on Land Creek fork of the Siuslaw River.

Alsea River.—In 1902 the State established a station on the Willis Vidito place, near the town of Alsea. In 1907 an experimental station was established on this river at the mouth of Rock Creek, about 14 miles above the head of tidewater. In 1910 an experimental station was established between Alsea and tidewater.

Yaquina River.—In 1902 the State established a hatching station on the Big Elk River, a tributary of Yaquina River, about 3 miles above its confluence with the main river. This station was made permanent the next year.

Tillamook Bay.—In 1902 the State established a station on Wilson River, a tributary of Tillamook Bay, and about 8 miles above tidewater. In 1906 the station was removed to the Trask River, a tributary of Tillamook Bay.

DISTRIBUTION.

The following table shows the distribution of fry and fingerlings in the coastal streams of the State by the Government and the State:

DISTRIBUTION OF SALMON IN THE COASTAL STREAMS OF OREGON.

Year ending June 30—	Tillamook Bay and tributaries.			Yaquina River.			Alsea River.		
	Chinook fry.	Silver-side fry.	Steel-head fry.	Chinook fry.	Silver-side fry.	Steel-head fry.	Chinook fry.	Silver-side fry.	Steel head fry.
1898	19,994								
1901				218,500					
1903	251,875			557,700			67,750		
1904	799,300			3,144,380	985,220				
1905				1,407,470	3,009,075	780,500	1,000,000	1,000,000	
1906				816,608	4,178,000	1,033,150	806,938	1,785,351	
1907	312,700	2,648,000		1,919,508	1,955,793	376,245			
1908	2,124,000	1,629,000		2,193,043	909,855		199,700	812,300	
1909		4,896,000	569,890	485,500	1,006,309				
1910	624,800	3,506,990	2,309,770	324,038	28,815				
1911	1,818,245	1,080,000	1,196,000	582,785	2,637,580	621,015	495,950	30,300	
1912	646,300	1,578,131	761,000	148,992	1,554,802	7,145	287,645	997,455	
1913	1,747,630	422,886	848,229	727,567	3,288,650		87,935	424,925	
1914	487,692	1,112,392	660,588						
1915	2,835,428		213,900						
1916	1,982,724	130,130					646,431		
1917	2,148,430	183,800	495,090				1,373,100	1,649,830	1,495,316
1918	1,442,400	534,600					869,370	1,107,483	
1919	705,656	2,097,442	384,370				1,151,730	1,872,473	1,753,104
Total.	17,940,074	19,819,371	7,438,637	12,521,091	19,553,869	2,818,055	6,986,539	9,680,117	3,248,419

• All fingerlings.

DISTRIBUTION OF SALMON IN THE COASTAL STREAMS OF OREGON—Continued:

Yearending June 30—	Sluslaw River.			Umpqua River.		Coos Bay and tributaries.		
	Chinook fry.	Silver- side fry.	Steel- head fry.	Chinook fry.	Steel- head fry.	Chinook fry.	Silver- side fry.	Steel- head fry.
1897.....	180,000							
1898.....	440,275							
1899.....	2,700,000							
1901.....	213,500			730,000		235,000		
1902.....	112,000	214,800		1,136,000		2,416,350		
1903.....	389,239			1,596,213				
1904.....	822,667			1,399,860		4,079,274		
1905.....	435,162	311,900		2,654,925		3,877,172		
1906.....	1,826,531	1,296,732	397,355	4,903,700		2,744,000		
1907.....	608,949	1,030,486		4,685,900		4,014,400		
1908.....	729,130	1,127,293		2,378,853		3,000,000		
1909.....	191,267	1,092,540	98,243	4,089,848		2,084,500	1,032,000	222,000
1910.....	273,352	25,239		5,686,273		1,883,738		
1911.....	594,702	20,693	227,580	2,541,238	263,990	2,374,200		
1912.....	715,758	504,429	72,067	1,053,516		1,767,170	2,317,370	
1913.....	256,028	627,312	106,717	905,704	181,085	1,281,120	962,528	
1914.....	1,062,546	476,273	17,735	1,882,985	80,000	1,331,217	2,973,390	
1915.....	1,472,410		257,850	1,333,171		1,212,805	1,551,845	192,625
1916.....	972,395			1,216,518		92,236,229	92,492,217	
1917.....	984,945	153,662		918,622	65,200	2,370,000	1,089,500	
1918.....	529,904	147,475		1,402,700		1,208,840	1,193,960	
1919.....	743,057			3,259,258		1,932,210	2,416,680	
Total.....	16,252,717	7,028,884	1,177,577	43,777,282	620,281	39,848,225	16,029,290	414,625

Year ending June 30—	Coquille River.		Rogue River and tributaries.			
	Chnook fry.	Silverside fry.	Chnook.		Silverside fry.	Steelhead fry.
			Fry.	Yearlings, finger- lings, and adults.		
1877.....			50,000			
1898.....			1,910,045			
1900.....			2,156,945			
1901.....		235,000	2,967,058		128,000	65,850
1902.....			4,750,763		424,530	20,260
1903.....	3,084,577		3,480,300		680,800	
1904.....	1,000,000		9,023,428			8,078
1905.....	2,210,000		4,758,638		1,250,432	531,000
1906.....	2,978,700		47,600	75,000		12,625
1907.....	2,840,000		5,880,290		1,275,000	105,300
1908.....	2,450,000	228,600	6,597,027	170,051	158,000	937,680
1909.....		1,185,800	771,710		643,000	878,847
1910.....			1,430,292			89,850
1911.....	500,000	980,770	1,364,248		501,081	2,592,065
1912.....	196,855	1,672,850	9,574,340		2,355,885	b 1,313,890
1913.....	496,680	962,528	4,169,150		8,198,346	2,795,075
1914.....	491,580	1,331,910	3,752,483		c 7,832,000	1,376,308
1915.....	495,333	1,305,815	4,747,623	9,309	d 2,336,359	d 3,908,099
1916.....	a 1,465,321	a 1,451,858	2,515,500	2,517,892	e 198,103	f 3,083,092
1917.....	1,100,500	674,293	171,500	1,758,800	g 399,700	h 561,955
1918.....	1,219,628	1,098,650		900,750	366,500	2,810,700
1919.....	1,491,210	1,469,440		1,032,950	592,150	807,000
Total.....	22,255,384	12,420,514	70,118,855	6,464,752	22,439,886	21,898,859

a All fingerlings.

b Includes 177,790 fingerlings, yearlings, and adults.

c Includes 860,963 fingerlings, yearlings, and adults.

d Includes 27,258 fingerlings.

e Includes 9,153 fingerlings.

f Includes 2,583,092 fingerlings; all were planted by U. S. Bureau of Fisheries.

g Includes 6,000 fingerlings.

h Includes 128,600 fingerlings.

DISTRIBUTION OF SALMON IN THE COASTAL STREAMS OF OREGON—Continued.

Year ending June 30—	Total.				Grand total, all species.
	Chinook.			Steelhead fry.	
	Fry.	Yearlings, fingerlings, and adults.	Silverside fry.		
1877	50,000				50,000
1897	180,000				180,000
1898	2,370,314				2,370,314
1899	2,700,000				2,700,000
1900	2,156,945				2,156,945
1901	4,594,058		128,000	65,850	4,787,908
1902	8,415,113		639,330	20,250	9,074,693
1903	9,427,654		680,800		10,108,454
1904	20,288,809		985,220	8,073	21,282,102
1905	16,343,382				16,343,382
1906	14,123,977	75,000	5,571,407	1,311,500	22,075,884
1907	20,261,747		7,260,083	1,443,130	29,964,960
1908	19,671,753	170,051	7,009,279	481,545	27,752,571
1909	7,626,825		4,863,048	937,680	13,427,553
1910	10,022,483		9,855,649	1,768,780	21,646,912
1911	10,271,366		3,561,094	2,899,620	16,732,080
1912	14,390,576		5,250,394	4,931,256	24,572,226
1913	9,668,714		10,980,722	2,154,132	22,803,572
1914	9,008,603		9,887,175	3,931,106	22,826,884
1915	12,094,770	9,309	13,725,965	2,134,631	28,964,675
1916	2,515,500	11,037,710	5,253,819	4,573,074	23,380,103
1917	9,062,097	1,758,800	4,272,308	3,063,092	18,156,097
1918	6,672,842	900,750	4,150,785	2,617,560	14,342,937
1919	9,283,111	1,032,950	4,448,668	2,810,700	17,575,429
Total	221,180,649	14,984,870	100,971,931	37,616,453	380,763,903

The following tables show separately the total output of the hatcheries in Oregon owned by the United States Bureau of Fisheries and of those owned by the State:

OUTPUT OF HATCHERIES IN OREGON OWNED BY THE U. S. BUREAU OF FISHERIES.

Year ending June 30—	Chinook.			Silverside.		
	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
1889		4,500,000				
1890	1,000,000	2,776,475				
1891	700,000	4,901,525				
1892		1,232,400				
1893		4,100,000				
1894		213,000				
1895	23,000					
1896		2,832,150	657,150			
1897		4,922,634				
1898		16,915,612				
1899		4,300,200				
1900	27,000	4,126,367				
1901	1,800,000	1,669,857			146,824	
1902	1,100,000	1,669,857	1,068		123,000	
1903	1,865,000	11,687,061			424,530	
1904	4,884,400	5,453,880	250	680,800		
1905	8,113,000	15,270,675				
1906	30,000	9,822,688			1,250,432	
1907	28,200	2,454,371	122,980			800
1908	1,661,390	8,542,104				
1909	2,045,000	7,844,827	627,856		158,000	57,932
1910	8,631,000	5,021,655	2,763		1,799,915	
1911	3,953,992	4,220,197	225			
1912	600,000	5,689,168	200,000		1,659,681	
1913	8,000,000	12,887,840	750,765		2,355,885	
1914	21,491,000	11,291,023			3,198,346	
1915	1,075,000	12,156,818	602,300		8,441,642	27,218
1916	37,000	10,434,617	531,351	76,200	2,373,559	
1917	1,000,000	9,916,900	3,556,161	196,000	488,950	9,153
1918	163,900	634,500	7,364,500		393,700	92,100
1919	3,000	3,843,700	11,284,150		8,000	385,300
1919	20,000		5,325,450			594,350
Total	58,152,882	189,608,972	30,927,669	953,000	22,827,464	1,166,393

a All but 17,000 of these were from eggs received from the California stations.

b All raised from eggs received from the California stations.

OUTPUT OF HATCHERIES IN OREGON OWNED BY THE U. S. BUREAU OF FISHERIES—
Continued.

Year ending June 30—	Steelhead trout.			Total.		
	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
1889					4,500,000	
1890				1,000,000	2,778,475	
1891				700,000	4,901,525	
1892					1,332,400	
1893					4,100,000	
1894					213,000	
1895				23,000		
1896					2,832,150	557,150
1897					4,922,634	
1898					16,915,512	
1899	159,000	12,125		186,000	4,312,325	
1900	415,000	99,000		2,215,000	4,372,191	
1901	246,000	65,850	25,000	1,346,000	1,863,707	26,068
1902	481,000	20,250		2,347,000	12,031,841	
1903	400,000	262,700	62,033	5,965,200	5,716,560	62,283
1904		23,205	11,090	3,113,000	15,283,890	11,090
1905	50,000	534,000		80,000	11,607,068	
1906	10,000	1,264,485	40,383	38,200	3,748,856	163,663
1907	50,000	105,300		1,711,390	8,647,404	
1908	283,725	952,680		2,308,725	8,955,507	685,788
1909	51,468	1,374,308		3,582,468	8,195,878	2,763
1910		2,074,188		3,953,992	6,294,885	225
1911		2,914,789		600,000	10,280,638	200,000
1912		2,005,100	294,090	8,000,000	17,198,825	1,044,855
1913		2,785,075		21,491,000	17,284,444	
1914		2,230,008		1,075,000	22,828,468	629,558
1915	752,000	3,254,275	910,652	865,200	16,062,351	1,442,003
1916	450,000	600,000	2,785,805	1,648,000	10,905,850	6,351,119
1917	2,687,600	34,500	467,450	2,851,500	1,062,700	7,924,050
1918	750,000		3,372,165	753,000	3,851,700	15,041,615
1919	525,000		843,000	545,000		6,762,800
Total.....	7,290,793	20,561,838	8,611,668	66,396,675	232,988,274	40,905,630

OUTPUT OF HATCHERIES OWNED BY THE STATE OF OREGON.

Year	Chinook fry.	Silverside fry.	Steelhead trout fry.	Sockeye fry.	Total.
1877	50,000				50,000
1878	79,620				79,620
1879	1,876,500				1,876,500
1880	1,834,290				1,834,290
1881	2,554,290				2,554,290
1882	1,300,000				1,300,000
1889	4,500,000				4,500,000
1890	990,000				990,000
1891	a 792,000				792,000
1895	2,500,000				2,500,000
1896	2,500,000				2,500,000
1899	2,700,000				2,700,000
1900	2,500,000				2,700,000
1901	7,562,000		200,000		7,807,000
1902	11,220,550	7,957,000	245,000		19,433,577
1903	18,502,072	3,288,600	300,850		22,091,522
1904	b 48,730,791	8,974,185	143,849		52,848,825
1905	16,393,249	5,509,085	1,495,733		23,398,069
1906	c 27,404,596	7,503,655	1,859,690		36,767,947
1907	d 25,156,732	6,446,628	376,245		31,979,605
1908	e 21,209,394	5,359,709			26,569,103
1909	f 20,108,990	9,212,649	1,403,129		30,724,768

a Eggs from which hatched obtained from U. S. Bureau of Fisheries.

b 6,826,540 eggs obtained from U. S. Bureau of Fisheries.

c 7,714,000 eggs obtained from U. S. Bureau of Fisheries.

d 3,550,000 eggs obtained from U. S. Bureau of Fisheries.

e 3,020,000 eggs obtained from U. S. Bureau of Fisheries.

f 6,581,000 eggs obtained from U. S. Bureau of Fisheries.

OUTPUT OF HATCHERIES OWNED BY THE STATE OF OREGON—Continued.

Year.	Chinook fry.	Silverside fry.	Steelhead trout fry.	Sockeye fry.	Total.
1910.....	24,189,365	3,631,827	2,364,120	.....	30,185,312
1911.....	19,782,229	4,749,319	4,018,598	c 1,488,327	30,018,473
1912.....	18,077,971	9,580,497	1,358,742	e 1,857,825	30,975,035
1913.....	20,023,208	9,879,666	1,130,031	f 1,837,134	39,570,099
1914.....	21,945,746	5,393,965	753,233	e 1,978,140	33,576,084
1915.....	27,532,188	2,917,480	4,783,208	.....	35,242,836
1916.....	27,120,254	4,215,705	3,180,709	k 2,399,000	36,915,668
1917.....	27,615,600	4,183,000	4,804,743	e 1,526,024	38,129,367
1918.....	28,109,125	4,656,207	1,633,580	k 2,731,823	37,030,735
1919.....	33,732,431	9,140,769	4,004,754	m 3,199,800	50,077,754
Total.....	475,153,231	107,999,926	34,333,549	17,218,073	634,704,779

- a 6,465,300 eggs obtained from U. S. Bureau of Fisheries.
- b 3,950,000 eggs obtained from U. S. Bureau of Fisheries.
- c 1,500,000 eggs obtained from U. S. Bureau of Fisheries.
- d 8,000,000 eggs obtained from U. S. Bureau of Fisheries.
- e 2,000,000 eggs obtained from U. S. Bureau of Fisheries.
- f 2,491,000 eggs obtained from U. S. Bureau of Fisheries.
- g 1,000,000 eggs obtained from U. S. Bureau of Fisheries.
- h Eggs from which hatched obtained from U. S. Bureau of Fisheries.
- i All but 490,000 were fingerlings.
- j All but 41,500 were fingerlings.
- k 3,000,000 eggs obtained from U. S. Bureau of Fisheries.
- l Most of the output comprised of fish 4 to 9 months old.
- m 3,174,900 from eggs obtained from Alaska, and 25,000 from dwarf sockeye eggs obtained from Montana.

COLUMBIA RIVER AND TRIBUTARIES.

The first fish-cultural work upon the Columbia River and in Oregon was at Clackamas, on the Clackamas River, a tributary of the Willamette River, which empties into the Columbia River about 180 miles from its mouth.

This hatchery was built in 1876 by the Oregon & Washington Fish Propagating Co., which operated it until 1880. In 1887 the State provided for and there was appointed a State fish commission. Almost the first work of the commission was to spend \$12,000 appropriated by the legislature to put in repair and operate this hatchery. On July 1, 1888, it was informally turned over to the United States Commission of Fish and Fisheries, which paid over the purchase price, took formal possession in the following winter, and has operated it ever since, with the exception of several years when the building of dams stopped the progress of salmon to the hatchery. During this period a temporary station for the collection of eggs was established on Sandy River, about 15 miles away, and on Salmon River, a tributary of Sandy River, both tributaries of the Columbia River. Some eggs were also brought in from the California hatcheries and hatched at the Clackamas station. In 1901 the hatchery was moved about 4 miles down the river and has since been operated as both a rearing and a collecting station. In 1901 the State established another hatchery on the Clackamas River about 30 miles below the main station and between the north and south forks. In 1904 all were turned over to the United States. In 1915 the hatchery was moved again. In 1907 an experimental station for the collection of eggs of the early variety of chinook salmon was established by the State of Oregon on the Clackamas River below the Portland Railway, Light & Power Co.'s dam at Cazadero, but this was later operated by the United States Bureau of Fisheries. The building of a dam having cut off this station, another was established in 1913 at a point 30 miles distant from Portland.

In 1889 the State established a hatchery in the cannery of F. M. Warren, at Warrendale, in Multnomah County, on the Columbia River, which was operated in that year and in 1890.

In 1895 some of the Oregon salmon packers combined and organized the Columbia River Packers' Propagating Co., which established a hatchery on the upper Clackamas River at the junction of the Warm Springs and the Clackamas and operated it in 1895 and 1896. The Government operated it in 1897 and 1898, after which it was turned over to the State and moved to the opposite side of the river.

In 1898 the collection of steelhead-trout eggs was first undertaken on the northwest coast by the State of Oregon on Salmon River, a tributary of the Columbia River, and met with fair success. In March, 1899, the Government sent a party to the falls of the Willamette River, near Oregon City, to collect steelhead eggs, and also operated for this purpose at its substation on the Salmon River, but the latter effort met with failure, as the rack was washed away. This station was turned over to the State on June 15, 1899.

In 1901 the State of Oregon did some experimental work at Swan Falls, on Snake River, the boundary for a considerable distance between Oregon and Idaho. During the winter and early spring of 1902 the State also worked Tucannon River, which is a tributary of Snake River, for steelhead, but met with poor success. Snake River was worked again in 1902 at the foot of Morton Island, which is situated 2 miles above Ontario, in Malheur County. Title to the necessary property was secured from the War Department in 1903 and permanent buildings were erected. It was closed for some years and finally abandoned in 1911.

In 1901 the State of Oregon established an experimental hatchery in Wallowa County, on the Grande Ronde River, at the mouth of a small tributary called the Wenaha River, which enters the main stream about 50 miles from its mouth. A permanent station was established in the canyon about $1\frac{1}{2}$ miles below the Wallowa bridge on the Wallowa River, a tributary of the Grande Ronde River, in 1903.

In 1902 the State of Oregon erected a permanent plant on Salmon River at its junction with Boulder Creek. This plant was closed in 1911.

In the same year the State established an experimental station on the McKenzie River, a tributary of the Willamette River, about one-half mile above Vida post office. This experimental work was resumed in 1905 at a point 2 miles below Gate Creek. The hatchery was permanently established at a spot about 30 miles from Eugene and near the town of Leaburg a year or two later.

In 1903 a hatchery was built by the State of Oregon on the Snake River near the town of Ontario, in eastern Oregon.

In 1906 an experimental station was established by the State on Breitenbush Creek, a short distance above its junction with the Santiam River, a tributary of the Willamette River, but the plant was destroyed, very shortly after its establishment, by a forest fire. An experimental station was reestablished here in 1909, but a heavy freshet raised the river so high that the penned fish escaped around the rack.

In 1909 the State of Oregon built at Bonneville, on Tanner Creek, a tributary of the Columbia River, a large central hatchery capable of handling 60,000,000 eggs, it being the intention of the State to hatch at this plant the eggs collected at other stations.

In the same year a temporary hatchery was located on the Santiam River by the State of Oregon.

During 1910 the State of Oregon received 1,500,000 red salmon eggs from the Yes Bay (Alaska) hatchery of the United States Bureau of Fisheries, and yearly since they have received a consignment from the same source, as will be noted in the statistical tables. These were hatched out in the Bonneville hatchery and planted in the Columbia River.

The State of Oregon built a hatchery on the Klaskanine River, a tributary of Youngs River, near Olney, in Clatsop County, in 1911. In the same year an eyeing station for spring chinooks was opened by the State on the Willamette River, near Lowell.

The first entrance of Washington (then a Territory) into fish-cultural operations was in 1879, when the State fish commissioner paid the Oregon & Washington Fish Propagating Co., which was operating the hatchery on the Clackamas River, \$2,000 for salmon fry deposited in that river. In 1893 the State legislature established a hatchery fund which was to be supplied by licenses from certain lines of the fishery business. In 1895 its first hatchery in the Columbia River Basin was built on the Kalama River, about 4 miles distant from its junction with the Columbia, and in Cowlitz County. Shortly after this hatchery was built it was discovered that it was above where the salmon spawned, and a second hatchery was built $1\frac{1}{2}$ miles below the first named, as the rugged mountainous character of the country made transportation between the two sites difficult. Of recent years a road has been constructed along the river bank, and it is probable that the upper buildings will be abandoned entirely.

Another station for the collection and eyeing of eggs was established on the Chinook River, a small stream which empties into Baker Bay near the mouth of the Columbia.

During the fiscal year 1897 the United States Fish Commission established a station on Little White Salmon River, a stream which empties into the Columbia, on the Washington side, about 14 miles above the Cascades. During the fiscal year 1901 an auxiliary station was operated on Big White Salmon River, while fishing was carried on in Eagle and Tanner Creeks, in Oregon, the eggs obtained from these creeks being brought to the Little White Salmon hatchery.

In 1899 the State of Washington built and operated hatcheries on the Wenatchee River, a tributary of the Columbia River, about $1\frac{1}{2}$ miles from Chiwaukum Station on the Great Northern Railway, and on Wind River, a tributary of the Columbia, about 1 mile from the junction.

In 1900 Washington State hatcheries were established in the Columbia River Basin as follows: White River hatchery, which was built on Coos Creek, which empties into a tributary of the White River, the location being about $2\frac{1}{2}$ miles from where the Green River joins the White River; Methow River hatchery, built on the Methow River at the point where it is joined by the Twisp, about 22 miles from the Columbia River; Colville River hatchery, built

on the north bank of Colville River, about 1½ miles from its mouth, and about 1 mile from Kettle Falls; Klickitat River hatchery, located on the east bank of the Klickitat River, about 6 miles from its mouth; and one on the Little Spokane River, about 10 miles from its mouth and about 9 miles north of the city of Spokane. The Klickitat River hatchery never was operated, while most of the others were operated intermittently.

In 1906 a hatchery was established by the State of Washington on the Lewis River, some distance above the town of Woodland. In 1919 this hatchery was operated by the United States Bureau of Fisheries.

In 1909 the State of Washington established a hatchery near Pateros, on the Methow River, a tributary of the Columbia River, and on the Tilton.

In 1915 Clarke County, Wash., built a hatchery on the east side of Cold Creek, about 2 miles from the town of Vancouver.

A temporary station was established by the State of Washington on Wenatchee Lake, near Leavenworth, in 1915.

The following table shows the plants of salmon and steelhead trout in the Columbia River and its tributaries by the Bureau of Fisheries and the States of Oregon and Washington:

PLANTS OF SALMON IN THE COLUMBIA RIVER AND TRIBUTARIES SINCE 1877.

Year ending June 30—	Sockeye.		Chinook.		Silveride.	
	Fry.	Yearlings, fingerlings, and adults.	Fry.	Yearlings, fingerlings, and adults.	Fry.	Yearlings, fingerlings, and adults.
1877.....			300,000			
1878.....			79,620			
1879.....			3,076,500			
1880.....			1,834,290			
1881.....			2,554,290			
1888.....			1,300,000			
1889.....			4,500,000			
1890.....			3,756,475			
1891.....			5,094,000			
1892.....			1,332,400			
1893.....			4,100,000			
1894.....			213,000			
1895.....			c2,523,000			
1896.....			9,832,150	557,150		
1897.....			10,641,394			
1898.....			26,212,074			
1899.....			19,979,241			
1900.....			22,510,869		7,175,824	
1901.....			24,977,310	1,668	5,569,750	
1902.....			44,328,085		17,545,724	
1903.....			40,174,318		8,721,720	
1904.....			71,694,587		8,422,085	
1905.....			17,107,217		1,354,610	
1906.....			b36,324,805	47,980	828,472	300
1907.....			23,171,235		2,657,349	
1908.....			32,856,262	1,995,746	1,705,543	
1909.....			33,081,994	16,949	2,439,415	
1910.....			37,743,777	225	8,374,733	
1911.....	1,488,327		28,791,095	11,700	d1,808,900	
1912.....	1,957,825		49,335,065	1,405,860	1,243,660	
1913.....	1,937,134		70,211,177		4,591,500	
1914.....	1,978,140		481,985,039	1,732,805	636,900	
1915.....			81,504,641	812,801	608,747	
1916.....	4,478,362	1,526,024	85,037,035	8,686,789	873,852	
1917.....	1,528,094		47,187,410	9,922,569	1,381,915	86,100
1918.....	2,731,823		64,929,898	10,383,400	2,763,832	18,800
1919.....	3,199,800	939,960	22,571,500	46,382,420	4,205,864	2,200
Total.....	10,297,435	2,465,984	1,014,082,348	81,958,362	78,400,425	107,403

c Includes 23,000 eggs.
b Includes 48,200 eggs.

e Includes 100,000 eggs.
d Includes 1,000,000 eggs.

PLANTS OF SALMON IN THE COLUMBIA RIVER AND TRIBUTARIES SINCE 1877—Contd.

Year ending June 30—	Steelhead trout.		Chum.		Total.	
	Fry.	Yearlings, fingerlings, and adults.	Fry.	Yearlings, fingerlings, and adults.	Fry.	Yearlings, fingerlings, and adults.
1877					300,000	
1878					79,620	
1879					3,076,500	
1880					1,834,290	
1881					2,554,290	
1882					1,300,000	
1889					4,500,000	
1890					3,756,475	
1891					5,094,000	
1892					1,332,400	
1893					4,100,000	
1894					213,000	
1895					2,523,000	
1896					0,832,150	557,150
1897					10,641,394	
1898					26,212,074	
1899	8,625				19,987,866	
1900	299,000				29,985,093	
1901	245,000				30,782,060	1,608
1902	266,327				62,130,138	
1903	563,550	37,033			49,459,583	37,033
1904	158,981				80,275,658	
1905	a768,235				19,230,062	
1906	b1,745,111	24,383			38,898,388	72,663
1907	26,640				25,855,224	
1908	15,000				34,576,805	1,995,746
1909	a1,058,657				36,580,066	16,949
1910	c2,063,688				43,182,198	225
1911	1,982,331		420,730		33,901,383	11,700
1912	1,387,600	116,300	105,020		54,030,070	1,522,160
1913	40,000		105,800		76,885,611	
1914	d932,700		591,038		86,134,417	1,732,805
1915	4,128,833		8,299,372		94,541,793	812,801
1916	1,459,907	6,000	16,448,199		108,517,145	10,218,813
1917	4,074,330	338,850	5,332,125	248,050	59,501,804	10,595,869
1918	4,274,330		8,881,640		84,581,523	10,402,200
1919	4,663,820	135,500	210,600	460,800	34,851,584	47,920,880
Total . . .	30,151,725	658,066	40,396,324	708,850	1,182,328,257	85,898,662

a Includes 50,000 eggs.
b Includes 58,000 eggs.

c Includes 25,000 eggs.
d Includes 79,000 eggs.

WASHINGTON.

Willapa River.—In 1899 Washington established a hatchery on Trap Creek, a tributary of the Willapa River, situated about 200 yards from the creek's mouth.

In 1916 local residents along the North River, a tributary of Willapa Harbor, contributed the funds to build a salmon hatchery, and this was constructed and put into operation the same year.

In 1917 a salmon hatchery was built and put into operation at Raymond. It is designated as Willapa Hatchery No. 2.

In 1918 some fishermen and public-spirited citizens of this section contributed the money for the building of a State hatchery on the Nasel River, a tributary of Willapa Harbor.

Chehalis River.—The construction of a hatchery on the Chehalis River, about 4 miles above the city of Montesano, was begun by the State in October, 1897, but owing to bad weather and extreme high water was not completed until late in 1898. The hatchery was a failure until 1902 when a fair season was had, as was again true in 1903. It was not operated in 1904. Since the State began taking

eggs from the Satsop River, a tributary of the Chehalis, it has been possible to fill the hatchery each season.

In 1909 the site where eggs had been gathered on the Satsop River was purchased, and a new hatchery was erected there. It has three concrete rearing ponds and is fully equipped for the taking of spawn and the hatching out and caring for 5,000,000 fry. This plant was first operated in the fall of 1909.

Work was begun in September, 1914, by the United States Bureau of Fisheries on a hatching station on Lake Quinault, Wash., and a take of eggs was made the same year.

In lieu of installing fishways in their dams in the Humptulips River and tributaries, in the Grays Harbor section, two timber firms agreed to furnish the money needed to build a hatchery on Stevens Creek, west of Humptulips, and the same was constructed and put into operation in October of 1914. The plant is now the property of the State.

In 1917 a hatchery was built by the State on Chehalis River near Dryad, with money contributed by two lumber companies in lieu of building fishway over a dam.

Puget Sound and tributaries.—In 1896 the State established a hatchery on Baker Lake, which is the head of Baker River, a tributary of the Skagit River, and this was the first establishment for the hatching of sockeye salmon. In July, 1899, it was sold to the United States Fish Commission. In 1901 steelhead trout eggs were collected on Phinney Creek, about 5 miles from the town of Birdsvie, and some 30 miles from Baker Lake. In 1901 an auxiliary station was opened at Birdsvie, on Skagit River, and steelhead trout eggs were collected on Phinney and Grandy Creeks and brought to Baker Lake to be hatched.

In 1898 a private hatchery (the necessary money being raised by subscription among the residents of Fairhaven, now Bellingham, and vicinity) was built near Lake Samish, a few miles from Fairhaven.

In 1899 a hatchery was built by the State on Kendall Creek, a tributary of the Nooksack River, about 300 yards from same, and about 2 miles from the railway station of Kendall. Except in 1903, this hatchery has since been operated continuously. An eyeing station was built in 1907 on the south fork of the Nooksack River, about 1 mile from Acme. This hatchery is now used as a reserve station.

In the same year the State built a hatchery on the Skokomish River, about 4 miles from its mouth. An eyeing station was also erected on the north fork of the same river. The main station was not operated in 1904 and only on a small scale in 1903 and 1905.

The State in 1889 built a hatchery on Friday Creek, a tributary of the Samish River, situated about 1 mile from the mouth of the creek.

The following State hatcheries were first operated in 1900: Snohomish hatchery, built on the west bank of Skykomish River, a few miles from its mouth; Nisqually River hatchery, built on Muck Creek, about one-half mile from the Nisqually River, and about 4 miles from the town of Roy, in Pierce County; and the Stillaguamish hatchery, located on the Stillaguamish River, about 4 miles from the town of Arlington, in Snohomish County. The latter has since been moved to Jim Creek, a tributary of the south branch of the Stillaguamish River. It is merely used as an eyeing station now.

The Startup hatchery, located near Startup, on the Skykomish River, was formerly used as a collecting station for the Snohomish hatchery. It is still used for this purpose, but also retains and hatches a considerable quantity of spawn. The station is about 4 miles from the Snohomish hatchery. In 1918 it was rebuilt and now bears the name of Skykomish hatchery.

In 1900 the State established a fisheries experimental station at Keyport Landing, on the east arm of Port Orchard Bay, with Pearson as the nearest post office. The work of the station was devoted to salmon and oysters until it was abandoned a few years later.

The State established a hatchery on the Dungeness River, about 7 miles from the town of Dungeness, in Clallam County, in 1901. In 1906 it constructed a hatchery on a small tributary of the Skagit River, between Hamilton and Lyman. This was destroyed in 1917 by floods. The station built on Sauk River, a tributary of the Skagit, has been operated only occasionally since the Skagit hatchery was built.

The White River hatchery was constructed on Suice Creek, a tributary of Green River, some years ago. During the summer of 1909 a new hatchery was built at this station, the old one being too small to accommodate the amount of spawn that could be taken. The new hatchery is located on the east side of Suice Creek near the county road. The building contains 140 hatching troughs. The plant has a pond system, where the fry are kept and fed until they are able to shift for themselves.

During the summer of 1911 the city of Tacoma constructed a large concrete dam in the Green River, about 4 miles west of Eagle Gorge. As this dam prevented the salmon from reaching the spawning beds, the State established an eyeing station the same year just below the dam. In 1913 the name was changed to Green River hatchery, to conform to the name of the main stream.

In 1912 the United States Bureau of Fisheries completed the Quilcene and Duckabush hatcheries. Both are on small tributaries entering the west side of Hoods Canal, an arm of Puget Sound.

In 1913 a new station was operated by the Bureau on the Dusewallips River, a tributary of Hoods Canal, Puget Sound, near Brinnon. Two new field stations—on Elwell River, a tributary of the Skykomish River, near Sultan, and on Sauk River, a tributary of the Skagit River, near Darrington—were also put into operation the same year. The Sauk River had been worked by the State at one time.

In 1913 the Middle Fork Nooksak eyeing station was transformed into a hatchery. In the same year the eyeing station on the south fork was moved farther up the river.

In 1914 stations were established by the United States Bureau of Fisheries on Day Creek and Illabot Creek, tributaries of the Skagit River, while a substation was opened on Hamahama River at Eldon, distant about 9 miles up Hood Canal from the mouth of the Duckabush River.

On May 23, 1914, the Baker Lake hatchery building was destroyed by fire. In addition to the building and equipment, 1,305,820 silver fry and 823,097 sockeye fry were destroyed. The station was rebuilt but was burned down again in 1919. It has since been rebuilt.

In 1915 the State built a hatchery on the Pilchuck River, a tributary of the Skykomish River, near Granite Falls.

In lieu of building a fishway in its dam on the Elwha River, near Port Angeles, the Olympic Power Co. furnished the funds needed to build a hatchery below the dam, and this was opened by the State in 1915.

In 1916 the city of Tacoma furnished funds to build a hatchery in lieu of a fish ladder over the Nisqually power plant dam, and the hatchery was constructed by the State at Chambers Prairie and opened in 1916. It is known as the Chambers Creek hatchery.

In 1917 a new hatchery was established by the State at Orting, on the Puyallup River, while in 1918 an eyeing station was established at Tahuya, on Hood's Canal, near the Skokomish hatchery.

In 1919 the Nisqually hatchery was destroyed by floods.

The following tables show the total output of the salmon hatcheries in the State of Washington owned by the United States Bureau of Fisheries and the hatcheries owned by the State itself:

OUTPUT OF THE SALMON HATCHERIES IN WASHINGTON OWNED BY THE U. S. BUREAU OF FISHERIES.

Year ending June 30--	Chinook.			Sockeye, or blueback.			Silver, or coho.		
	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
1897		1,548,760							
1898		7,301,886							
1899	4,926,000	1,791,056							
1900	2,688,000	6,628,947			10,683,000				
1901	6,581,000	5,427,680			3,834,453			174,041	
1902		16,637,687			3,371,000				
1903		16,774,030			3,731,789				81,812
1904	7,506,000	17,386,183			3,855,000				3,984,645
1905		4,236,276			7,819,281	10,000	107,000		8,071,081
1906	7,714,000	14,846,905		880,000	3,285,130	9,500	239,180		6,445,574
1907	3,550,000	6,512,738			4,224,255		760,000		3,636,952
1908	1,485,000	12,372,503	1,537,941	75,000	8,514,305		298,000		13,262,714
1909	3,650,000	11,665,553	14,186	100,000	5,430,628		272,000		7,681,110
1910	3,813,250	9,176,610			4,551,825		275,000		10,888,025
1911	3,350,000	7,307,456	11,700		5,496,000		102,000		4,550,615
1912	8,020,000	10,959,728	655,095		4,692,573		52,000		10,599,939
1913	19,713,000	19,933,300			5,751,700	120,000	102,000		10,754,617
1914	4,584,000	31,140,440	1,130,505	50,000	2,583,469				13,591,354
1915	4,998,000	28,162,139	987,495	165,000	10,820,441	46,575	35,000		20,673,056
1916		38,012,864	7,488,270		15,737,420	2,666,308	2,500		5,466,334
1917		14,969,904	5,885,226		11,861,825	2,145,953			3,960,000
1918	3,150,000	2,185,218	41,202,604		3,625,000	12,705,285			972,300
1919	960,000	389,002	18,474,900		1,000,000	15,799,960			7,544,020
Total.	86,686,250	294,653,864	77,368,012	1,260,000	120,872,092	33,503,581	2,242,080	132,318,169	16,877,909

OUTPUT OF THE SALMON HATCHERIES IN WASHINGTON OWNED BY THE U. S. BUREAU OF FISHERIES—Continued.

Year ending June 30—	Humpback.			Steelhead trout.		
	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
1900					26,000	
1902					110,000	
1903				80,000	440,000	223,815
1904		176,597		255,000	70,000	
1905				414,400	3,205	
1906	2,000	969,990		348,000	540,000	
1907				200,000	941,505	
1908	502,000	6,764,762		224,000	136,916	
1909				220,000	717,691	
1910		1,388,000		300,000	1,437,038	
1911		96,000		660,000	911,650	
1912		2,566,325		905,000	2,284,315	
1913		1,880		1,330,000	1,477,150	
1914	13,280,000	21,114,023	4,355	729,000	1,792,430	
1915		6,929,500		125,000	2,008,698	137,665
1916	7,000,000	6,100,400	2,915,000	1,040,000	341,600	891,000
1917		165,000	7,449,030	550,000	1,979,010	1,424,000
1918		2,132,831	3,730,000	320,000	103,000	3,482,620
1919		2,354,500	369,958	250,000		305,000
Total	20,764,000	50,745,808	14,474,343	7,950,400	15,320,208	6,464,100

Year ending June 30—	Chum.		Total.		
	Fry.	Fingerlings, yearlings, and adults.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
1897				1,848,760	
1898				7,391,886	
1899			4,926,000	1,791,058	
1900			2,686,000	17,335,047	
1901			6,581,000	9,433,174	
1902				19,118,687	
1903			80,000	21,027,631	223,815
1904			7,761,000	25,472,425	
1905			521,400	20,129,843	10,000
1906			9,183,180	26,087,699	9,500
1907			4,510,000	15,316,450	
1908			2,582,000	41,051,200	1,537,941
1909			4,242,000	25,374,980	14,186
1910			4,388,250	27,423,498	
1911	69,000		4,112,000	18,430,720	11,700
1912	2,405,000		8,077,000	33,697,880	655,095
1913	19,479,000		21,145,000	57,397,647	
1914	8,672,735		18,623,000	78,694,451	1,254,860
1915	35,504,707		5,313,000	114,098,541	1,213,235
1916	21,500,944	1,000,000	8,042,500	87,165,562	10,420,932
1917	14,403,300	7,014,580	550,000	47,339,039	28,458,649
1918	9,892,145		3,470,000	18,910,494	71,245,414
1919	4,544,000	4,524,560	1,210,000	15,831,622	40,171,788
Total	116,560,831	12,539,140	118,903,330	730,470,992	161,227,085

OUTPUT OF THE SALMON HATCHERIES OWNED BY THE STATE OF WASHINGTON.^a

Year ending June 30—	Chinook fry.	Chum fry.	Hump-back fry.	Silver, or coho, fry.	Sockeye, or blue-back, fry.	Steelhead-trout fry.	Total.
1896	4,500,000						4,500,000
1897	4,050,000						9,550,000
1898	4,275,000						9,675,000
1899	5,251,500				5,500,000		9,751,500
1900	12,251,500			189,000	5,400,000		8,784,000
1901	12,275,400	10,301,750		13,779,280		1,738,560	38,088,200
1902	14,766,822	16,478,280		19,747,894		1,398,476	49,900,850
1903	14,283,499	9,937,390		32,964,593		2,481,371	60,150,178
1904	13,261,184	9,937,390		28,659,079		3,134,078	56,014,044
1905	7,101,180		295,200	15,725,196		2,868,868	38,150,448
1906	10,943,550	3,268,800		12,226,294		2,433,635	21,761,109
1907	8,897,670	6,120,000		28,900,380		2,769,784	45,888,514
1908	18,647,600	4,342,350	2,655,900	28,668,600		3,575,943	47,282,213
1909	17,440,950	8,218,000		29,273,202		4,578,075	59,497,127
1910	21,168,350	8,607,500	519,600	24,543,200		4,080,450	54,282,600
1911	16,458,502	13,326,750		30,894,100		4,855,000	66,044,550
1912	23,380,516	4,684,950	370,785	33,097,750		5,163,180	68,046,182
1913	30,542,928	14,711,400		37,164,125		4,832,067	70,432,443
1914	35,529,709	7,842,266		50,263,290		9,089,256	104,606,868
1915 b	39,784,092	27,458,665	1,532,737	33,494,380	49,792	3,601,514	82,050,398
1916 c	48,239,092	41,890,354	5,78,504	60,169,474	62,631	3,457,130	131,510,496
1917 e	34,228,979	15,086,648	5,902,227	38,877,396	607,979	9,984,852	145,501,900
1918 f	83,176,074	71,750,001	5,842,775	6,842,775	908,455		55,966,887
1919 f	45,773,506	22,228,025	6,086,256	45,650,003	6,571,770	10,250,532	223,494,236
Total	529,570,203	296,190,529	17,941,209	586,365,698	19,646,147	89,284,213	1,538,997,999

^a As the printed reports of the State before 1913 in many instances report as the output the number of eggs gathered, it has been necessary in such cases to make an arbitrary reduction from these figures, in order to allow for the loss in the egg stage. In addition to figures in table, in 1916, 13,424,362; in 1918, 6,745,823, and in 1919, 12,351,780 dwarf sockeyes were hatched and planted in waters of the State.

^b A considerable proportion of the fry was fed in rearing ponds for some time before planting.

^c 29,900 eggs were distributed in addition.

^d Year ends Nov. 30, 1916.

^e Period from Nov. 30, 1916, to Mar. 31, 1917.

^f Year ending Mar. 31.

^g In addition 6,000,000 eggs were furnished by the U. S. Bureau of Fisheries.

The following table shows the plantings made in waters of Washington other than the Columbia River by the United States Bureau of Fisheries and the State of Washington:

PLANTS OF SALMON IN THE WATERS OF WASHINGTON OTHER THAN THE COLUMBIA RIVER.

Year ending June 30—	Puget Sound and tributaries.					
	Chinook.		Sockeye.		Silver, or coho.	
	Fry.	Yearlings, fingerlings, or adults.	Fry.	Yearlings, fingerlings, or adults.	Fry.	Yearlings, fingerlings, or adults.
1897			5,500,000			
1898			5,400,000			
1899	7,470,000			189,000		
1900			10,683,000	6,749,280		
1901	300,000		3,834,453	14,360,185		
1902	2,141,322		3,371,000	23,161,009		
1903	2,113,850		3,731,789	21,507,771		
1904	1,865,933		3,855,000	14,071,845		
1905	2,590,738			16,441,375		
1906	4,819,290		3,573,130	9,500	29,755,574	14,840
1907	3,907,598				26,980,552	
1908	8,356,709		8,514,305		37,613,468	
1909	9,647,288		5,430,626		28,622,310	
1910	11,681,060		4,554,825		36,837,125	
1911	4,984,482		5,496,000		29,941,865	
1912	4,846,254		4,692,573		39,758,614	
1913	7,561,328		5,751,700		56,128,207	
1914	7,392,820		2,683,261	120,000	42,215,911	
1915	15,222,734		7,371,056		74,565,147	
1916	22,022,439	802,795	1,897,420	520	42,696,932	1,455,490
1917	26,890,383	750,812	1,520,280	2,093,000	6,227,775	4,560,460
1918	35,318,306	411,060	7,696,750	9,319,275	26,249,710	6,845,115
1919	22,244,102	195,900	645,520	8,622,000	12,285,222	2,864,980
Total	201,176,702	2,160,367	96,202,688	20,164,295	589,306,935	15,740,885

^c Includes 50,000 eggs.

^d All fingerlings.

PLANTS OF SALMON IN THE WATERS OF WASHINGTON OTHER THAN THE COLUMBIA RIVER—Continued.

Year ending June 30—	Puget Sound and tributaries.					
	Humpback.		Chum.		Steelhead.	
	Fry.	Yearlings, fingerlings, or adults.	Fry.	Yearlings, fingerlings, or adults.	Fry.	Yearlings, fingerlings, or adults.
1900.....			10,301,760		1,572,560	
1901.....			16,478,280		1,398,476	
1902.....			9,937,390		2,501,371	
1903.....			9,937,390		3,107,891	218,200
1904.....	471,797				3,518,476	
1905.....					a 1,320,940	
1906.....	969,990		1,800,000		3,162,174	15,000
1907.....	4,224,255		5,220,000		3,994,308	
1908.....	9,420,662		2,278,350		4,566,491	
1909.....			6,048,000		b 4,499,141	
1910.....	1,887,800		7,748,500		6,292,338	
1911.....	96,000		12,074,000		4,841,330	
1912.....	5,432,110		3,526,170		c 6,732,805	1,000
1913.....	1,888		31,408,960		9,731,400	
1914.....	22,647,060	d 4,355	15,635,048		4,444,271	
1915.....	7,508,004		51,832,080		5,102,555	
1916.....	12,006,827	2,918,000	41,541,949	1,000,000	5,102,594	891,000
1917.....	165,000	7,449,030	12,955,800	6,766,530	1,979,010	1,420,600
1918.....	8,219,086	4,736,000	52,874,752		4,851,092	3,520,420
1919.....	2,354,000	369,958	21,480,325	4,063,760	3,152,452	
Total.....	75,403,079	15,477,343	312,798,782	11,830,290	81,763,647	6,068,120

Year ending June 30—	Quinnault Lake and River.						
	Chinook.		Sockeye.		Silverside.		Steelhead fry.
	Fry.	Yearlings, fingerlings, or adults.	Fry.	Yearlings, fingerlings, or adults.	Fry.	Yearlings, fingerlings, or adults.	
1915.....	10,913		3,558,591		198,966		10,598
1916.....	29,600	4,810	13,840,000	2,665,788	96,650	4,864	
1917.....	160,000		11,150,000	52,953	1,910,000		
1918.....	220,000		2,500,000	3,386,010	200,000	3,303,700	
1919.....	100,000	109,400	1,000,000	4,738,000	600,000	419,400	
Total.....	529,513	114,210	32,048,591	10,842,751	3,005,616	3,727,964	10,598

Year ending June 30—	Chehalis River.				Willapa River.			
	Chinook.	Silver, or coho.	Chum.	Steelhead.	Chinook.	Silver, or coho.	Chum.	Steelhead.
1899.....	1,215,000							
1900.....	2,355,300				881,000			190,000
1901.....	1,909,800				653,400			
1903.....					2,163,019	1,800,000		500,000
1904.....	900,000				819,504	204,878		420,390
1906.....					630,000	1,800,000		288,000
1906.....		2,563,380	1,408,800		529,650	2,160,000		171,550
1907.....		2,250,000	900,000		393,660	2,250,000		526,800
1908.....	163,000	3,275,000	2,004,000		678,000	654,500		148,500
1909.....	148,000	1,500,000	1,757,000		322,200	504,000		399,000
1910.....	403,000	4,577,000	359,000		455,200	04,000		
1911.....	111,150	4,041,900	900,960	937,500	724,350	2,467,900		300,000
1912.....	118,750	3,575,700	1,052,760	93,752	748,600	3,111,750		303,823
1913.....	119,700	1,690,200	3,177,680	412,500	729,600	1,386,000		382,600
1914.....	189,000	2,977,260	2,977,800	701,118	3,247,845	1,785,580		248,565
1915.....	73,327	4,790,474	1,230,000	551,302	302,461	581,730	1,581,750	105,440
1916.....	854,170	6,811,315	4,218,930	638,733	2,670,105	108,550	1,181,720	
1917.....	495,350	120,000	2,690,000		2,178,185	595,000		
1918.....	2,978,288	12,276,990	17,725,949	967,975	5,411,725	1,809,901	2,359,805	771,600
1919.....	279,200	6,017,655	4,763,000	1,847,400	1,460,206	372,500	318,100	197,060
Total.....	12,263,045	53,766,874	43,205,379	6,150,280	24,908,810	21,046,287	5,441,375	4,952,920

a Includes 14,400 eggs.
b Includes 100,000 eggs.

c Includes 25,000 eggs.
d All fingerlings.

PLANTS OF SALMON IN THE WATERS OF WASHINGTON OTHER THAN THE COLUMBIA RIVER—Continued.

Year ending June 30—	Total by species.						Grand total.
	Chinook.	Sockeye.	Silver, or coho.	Hump-back.	Chum.	Steelhead.	
1878.....	* 3,000						3,000
1897.....		5,500,000					5,500,000
1898.....		5,400,000					5,400,000
1899.....	8,685,000		189,000				8,874,000
1900.....	3,236,300	10,683,000	6,749,280				32,732,000
1901.....	2,863,200	3,834,453	14,360,185				36,834,594
1902.....	2,141,322	3,371,000	23,161,069				41,202,152
1903.....	4,276,869	3,731,789	23,307,771		9,037,390	2,591,371	45,079,910
1904.....	3,585,437	3,855,000	14,276,721	471,797	9,637,390	3,638,866	28,127,821
1905.....	3,220,738		18,241,375			1,617,940	23,080,053
1906.....	5,348,940	3,582,630	34,493,704	989,090	3,268,800	3,348,724	51,012,878
1907.....	4,301,258		31,460,552	4,224,255	6,120,000	4,490,808	50,596,873
1908.....	9,198,309	8,514,305	41,542,966	9,420,662	4,342,350	4,714,991	77,733,583
1909.....	10,117,488	5,430,628	30,926,310		7,805,000	4,898,141	59,177,665
1910.....	12,539,280	4,554,825	38,478,125	1,887,600	8,607,500	6,292,338	72,359,648
1911.....	5,829,982	5,496,000	36,441,665	96,000	12,975,020	6,078,830	69,917,497
1912.....	5,513,604	4,692,573	46,476,064	5,432,110	4,578,930	7,131,382	73,824,683
1913.....	8,410,628	5,761,700	59,204,407	1,888	34,586,640	10,526,400	118,481,663
1914.....	10,779,171	2,803,281	46,976,751	22,651,416	6,032,346	5,393,944	104,636,888
1915.....	15,618,445	10,929,647	80,076,317	7,508,000	64,663,800	5,592,895	174,389,108
1916.....	26,283,919	18,403,728	51,178,801	14,923,627	47,942,599	6,632,299	165,359,972
1917.....	30,474,530	14,816,233	13,413,235	7,614,030	22,312,330	3,399,510	92,029,868
1918.....	44,339,439	22,902,035	53,684,416	12,955,086	72,760,506	10,111,087	216,752,569
1919.....	24,388,808	15,005,520	22,559,757	2,723,958	30,625,185	5,196,912	100,500,140
Total.....	241,155,647	159,258,325	687,193,661	90,880,422	373,275,826	98,943,565	1,650,707,346

* These were brought from the Clackamas (Oreg.) station and planted in some unnamed lake.

BRITISH COLUMBIA.

Fraser River.—The first hatchery established by the Dominion of Canada on the Pacific coast was erected in 1884 at what is now Bon Accord, a point on the lower river some 4 miles above New Westminster, and on the opposite shore. The next built was in 1901 on Granite Creek, Shuswap Lake, which discharges into the Fraser through the South Thompson River, the lake being about 280 miles from New Westminster. In 1904 another hatchery was established on Harrison Lake on the Lillooet River, first large tributary of the Fraser on the north side; also one about 4 miles east of the lower extremities of Pemberton Meadows, at the junction of Owl Creek and the Birkenhead River, 4 miles above its confluence with the eastern branch of the Lillooet River, which in turn discharges into Lillooet Lake. In 1907 a hatchery was built on Stuart Lake, near the headwaters of the Fraser.

In 1914 the Bon Accord hatchery had to be abandoned, due to the laying out of a town site around it, and the equipment was transferred to Queen's Park, New Westminster.

The Province of British Columbia owns Seton Lake hatchery, which was established in 1903 on Lake Creek, on the north side, about half a mile from the outlet of Seton Lake, and it has been operated continuously ever since. Seton Lake is a part of the Fraser River chain and is some 300 miles above the mouth of the river. Lake Creek, the outlet of Seton Lake, empties into the Cayoosh Creek, a tributary of the Fraser, 45 miles north of the latter's junction with the Thompson, and 1 mile south of the town of Lillooet.

In 1916 a subsidiary station was built by the Dominion on Cultus Lake to accommodate the surplus eggs which could not be handled in the Harrison and Pemberton hatcheries.

In 1913, the year of the quadriennially big run of sockeye salmon on the Fraser River, the contractors who were building the new Canadian Northern Railway, in blasting their way along the banks of the river, threw the rock and other débris into the stream until in the narrow part of the canyon south of North Bend at Whites Creek, Hells Gate, China Bar, and Scuzzy Rapids, all within a few miles of each other, the débris formed great sloping banks extending out into the stream at these points, and entirely changed the direction of the currents, and, of course, the velocity of the water. At best the salmon had a hard time getting through there, but the added obstructions rendered it practically impossible.

At a rather late hour the authorities woke up to the menace this work was to the run of salmon, and the dumping of débris into the river in such a manner as to obstruct their ascent was stopped.

How to clear the stream once more was now the problem, and this was seriously complicated by a slide of rock which took place in Hells Gate in February, 1914, which narrowed the channel of the stream considerably.

In March, 1914, the Dominion Marine and Fisheries Department contracted with a private concern to remove the obstructions, and this was done from Scuzzy Rapids, China Bar, and Whites Creek within a short period of time, but a couple of seasons' work were required to clear up Hells Gate so as to permit of passage for the fish. Some people claim that the fish still find it difficult to pass these obstructions.

Rivers Inlet.—A hatchery was established by the Dominion on McTavish Creek, one of the tributaries of Oweekayno Lake, about 20 miles up Rivers Inlet, in 1905, and has been operated ever since.

Skeena River.—In 1902 the Dominion established a hatchery on Lakelse Lake, in the Skeena River Basin, about 65 miles up the river from Port Essington. In 1919 a modern hatchery was commenced to replace the old one that was put out of commission by floods in 1917. In 1907 another was constructed on Babine Lake, the source of the Skeena River.

Vancouver Island.—In 1902 S. A. Spencer, of the Alert Bay cannery (now belonging to the British Columbia Packers' Association), in return for certain special fishery privileges granted by the Dominion, established a hatchery on the Nimpkish River, which is located on the northeast shore of Vancouver Island. The hatchery was burned down in 1903, but was immediately rebuilt. Since its establishment it has been operated by the Dominion.

In 1910 the Dominion put three new hatcheries into operation, all on Vancouver Island. They were located on Anderson Lake, Kennedy Lake, and Cowichan Lake, respectively. The two former are used for sockeyes and the latter for king and coho salmon and steelhead and other varieties of trout.

In 1915-16 the Draney Fisheries (Ltd.), operated a hatchery on a lake near by and hatched out 560,000 fry from eggs obtained from Rivers Inlet.

The following table shows the plantings made in the waters of British Columbia from the Dominion and provincial hatcheries:

PLANTS OF SALMON FRY MADE IN THE WATERS OF BRITISH COLUMBIA.

Year.	Fraser River. ^a						Total.
	Chum.	Coho, or silver.	Spring, or king.	Hump-back.	Sockeye.	Steelhead trout.	
1885					1,800,000		1,800,000
1886					2,625,000		2,625,000
1887					4,414,000		4,414,000
1888					5,807,000		5,807,000
1889					4,419,000		4,419,000
1890					6,640,000		6,640,000
1891					3,603,800		3,603,800
1892					6,000,000		6,000,000
1893					5,674,000		5,674,000
1894					6,300,000		6,300,000
1895					6,390,000		6,390,000
1896					10,393,000		10,393,000
1897					6,925,000		6,925,000
1898					6,850,000		6,850,000
1899					4,742,000		4,742,000
1900					6,200,000		6,200,000
1902 ^b		90,000			16,808,000	75,000	15,973,000
1903	75,000	1,750,000	22,000		12,521,000		14,378,000
1904		210,000		50,000	13,729,200	12,000	14,001,200
1905		5,576,100	4,381,400		9,244,300		19,201,800
1906		4,774,000	1,791,500		100,479,000	4,000	107,048,500
1907		3,219,200	1,814,900		38,965,900		42,000,000
1908		5,890,000	2,815,000	22,500,000	51,855,200		83,060,200
1909		7,375,400	5,772,400		41,909,500		55,057,300
1910		450,000	6,300,000		105,312,500		112,062,500
1911		5,318,800	2,129,500		24,146,300		31,594,600
1912		3,899,500	5,962,500	28,773,350	34,183,850		72,819,200
1913	1,100,000	1,995,600	4,533,550		41,082,700		48,091,850
1914		1,522,000	50,000	500,000	92,308,000		94,380,000
1915	125,000	2,198,000	2,614,700		27,496,000		32,431,700
1916		1,652,000	2,640,000	^c 3,834,000	467,201,000		75,227,000
1917 ^e	5,255,000	1,971,900	1,645,200	4,788,000	27,903,600		41,564,700
1918 ^e	378,000	1,729,800	2,783,000	13,940,100	37,153,350		55,964,250
1919	383,000	1,800,625	2,291,200	40,000	742,071,825	30,000	46,016,650
Total.....	7,317,000	51,420,925	47,428,850	74,425,450	868,137,025	121,000	1,048,848,250

Year.	Skeena River.			Rivers Inlet.			Nimipkish River.
	Hump-back.	Sockeye.	Total.	Spring, or king.	Sockeye.	Total.	Sockeye.
1903		3,450,000	3,450,000				1,636,000
1904		4,000,000	4,000,000				2,496,000
1905		3,787,900	3,787,900				2,860,000
1906		3,784,450	3,784,450		8,000,000	8,000,000	4,873,400
1907		4,125,750	4,125,750		8,440,000	8,440,000	4,870,000
1908		8,946,950	8,946,950	4,706,000	8,694,000	13,300,000	4,800,000
1909		11,882,400	11,882,400		13,300,000	13,300,000	4,500,000
1910		11,521,700	11,521,700		12,750,000	12,750,000	5,055,000
1911		12,558,470	12,558,470		11,436,000	11,436,000	6,414,000
1912		12,367,500	12,367,500		11,791,000	11,791,000	5,114,500
1913		11,430,430	11,430,430		10,981,000	10,981,000	4,981,000
1914		11,843,200	11,843,200		12,397,000	12,397,000	5,063,000
1915	16,000	11,899,613	11,915,613		12,712,000	12,712,000	4,880,000
1916		11,202,257	11,202,257		12,594,100	12,594,100	4,980,000
1917		12,105,000	12,105,000		13,305,600	13,305,600	
1918		8,190,000	8,190,000		2,721,600	2,721,600	
1919		8,096,000	8,096,000		2,938,800	2,908,800	4,874,000
Total.....	16,000	151,169,620	151,185,620	4,706,000	141,931,100	146,637,100	67,370,900

^a Some of the reports from the provincial hatchery at Seton Lake show merely the take of eggs; it has been necessary to make an arbitrary reduction in order to show the loss of eggs and fry before planting.

^b No plants made in 1901.

^c 3,549,000 were eggs.

^d 3,242,000 were eggs.

^e All were given as eggs, and an arbitrary reduction was made in order to show the loss in eggs and fry before planting.

^f 500,000 were eggs; of the eggs from which the total plantings were made, 8,096,000 were obtained from the Skeena River.

^g Includes 80,000 coho fry.

PLANTS OF SALMON FRY MADE IN THE WATERS OF BRITISH COLUMBIA—Continued.

Year.	Vancouver Island.					Total.
	Chum.	Coho, or silver.	Spring, or king.	Sockeye.	Steelhead trout.	
1911.....	40,000	4,550,000	425,000	7,862,000	145,200	13,022,200
1912.....		3,487,500	456,000	13,620,750	37,200	17,601,450
1913.....		3,180,000	712,500	15,031,750	173,900	19,098,150
1914.....		2,252,000	701,000	15,314,500	87,200	18,364,700
1915.....		2,229,220	250,000	15,911,000	55,000	18,445,220
1916.....		1,689,828	576,400	7,966,000	38,600	10,270,828
1917.....		1,426,860	1,209,600	2,802,000		5,468,460
1918.....		2,200,410	418,950	4,527,338		7,146,698
1919.....		2,152,194	a 431,760	b 4,589,250	c 33,798	7,207,002
Total.....	40,000	23,168,010	5,181,810	87,684,588	570,898	116,645,306

Year.	Total by species.						Grand total.
	Chum.	Coho, or silver.	Spring, or king.	Hump-back.	Sockeye.	Steelhead trout.	
1885.....					1,800,000		1,800,000
1886.....					2,625,000		2,625,000
1887.....					4,411,000		4,411,000
1888.....					5,807,000		5,807,000
1889.....					4,419,000		4,419,000
1890.....					6,640,000		6,640,000
1891.....					3,603,800		3,603,800
1892.....					6,000,000		6,000,000
1893.....					5,674,000		5,674,000
1894.....					6,300,000		6,300,000
1895.....					6,390,000		6,390,000
1896.....					10,395,000		10,395,000
1897.....					5,925,000		5,925,000
1898.....					5,850,000		5,850,000
1899.....					4,742,000		4,742,000
1900.....					6,200,000		6,200,000
1901.....		90,000			15,808,000	75,000	16,973,000
1902.....	75,000	1,750,000	22,000		17,607,000		19,454,000
1903.....		210,000		50,000	20,225,200	12,000	20,497,200
1904.....		5,576,100	4,381,400		15,802,200		25,819,700
1905.....		4,774,000	1,701,500		117,136,850	4,000	123,706,350
1906.....		3,219,200	1,814,900		54,401,650		59,435,750
1907.....		5,890,000	7,521,000	22,500,000	74,196,150		110,107,150
1908.....		7,376,400	5,772,400		71,591,900		84,739,700
1909.....		460,000	6,300,000		184,639,200		141,389,200
1910.....	40,000	9,868,800	2,554,500		62,414,770	145,200	75,023,270
1911.....		7,387,000	6,418,500	28,773,350	77,077,000	37,200	119,693,650
1912.....		5,175,000	5,246,050		83,486,830	173,900	95,182,430
1913.....	1,100,000	3,774,000	761,000	500,000	139,915,700	87,200	142,027,900
1914.....		4,425,220	2,805,300	16,000	72,898,613	55,000	80,385,133
1915.....	125,000	8,341,828	8,116,400	3,834,000	103,943,357	38,600	114,274,183
1916.....		5,266,000	3,398,760	2,854,800	4,788,000	56,176,200	72,473,760
1917.....		378,000	3,930,210	3,181,950	13,940,100	62,582,288	74,022,548
1918.....		383,000	3,962,819	2,722,960	40,000	62,539,875	69,702,452
Total.....	7,367,000	74,588,935	57,314,000	74,441,450	1,310,299,233	691,898	1,468,190,276

a Includes 24,361 fingerlings.

b Includes 205,700 advanced fry and 20,000 fingerlings.

c Includes 5,357 fingerlings.

ALASKA.

In 1891 several of the canneries operating at Karluk, on Kodiak Island, combined forces and built a hatchery on the lagoon at that place. As the cannery men were at swords' points in regard to their fishing rights on the spit, in 1892 the hatchery was closed. In May, 1896, the Alaska Packers Association broke ground for a hatchery at the eastern end of the lagoon, near the outlet of Karluk River, a short distance from where the hatchery was located in 1891, and operated it until 1916, when it was abandoned as a hatchery.

In 1892 Capt. John C. Callbreath, manager of the Point Ellis cannery on Kuiu Island, operated a small hatchery on the left bank of Kutlakoo stream. It was a very primitive place, and an exceptionally high tide destroyed the whole plant in September. It was never rebuilt.

Capt. Callbreath, however, after seeing to the operation of the hatchery, had returned to Wrangell during the summer, where his attention was again attracted to hatchery work, and in the fall of 1892 he built a small hatchery on Jadjeska stream, Etolin Island, about 200 yards from its mouth. The stream is about one-half mile in length and is the outlet of a small lake. Finding the location unsuitable, Capt. Callbreath removed the hatchery in 1893 to the northern side of the lake, about three-eighths of a mile from the head of the outlet, where it still stands. The owner's intention was to build up a stream which had a small natural run of red salmon until it had a large run, with the hope that the Government would then give him the exclusive right to take these fish from the stream for commercial purposes. The experiment was kept up until the end of the season of 1905, when Capt. Callbreath's failing eyesight compelled the cessation of the actual hatching. Until 1910 a man was stationed on the stream during the run of spawning fish for the purpose of lifting them over the dam, so that they could reach the spawning beds at the head of the lake, and the project was abandoned entirely shortly thereafter. The owner's expectation of a big run as a result of hatching operations was never realized.

In 1896 the Baranof Packing Co., which operated a cannery on Redfish Bay, on the western coast of Baranof Island, built a small hatchery on the lake at the head of Redfish stream. The following winter was so cold that not only the flume but the whole cataract froze solid, and as the hatchery was thus left without water the eggs were put into the lake and left to their fate and the hatchery closed down permanently.

In 1897 the North Pacific Trading & Packing Co., at Klawak, Prince of Wales Island, established a hatchery near the head of Klawak stream, close to Klawak Lake. In 1898 the plant was moved to the mouth of a small stream entering the lake about halfway up the western shore. This hatchery was operated continuously until the end of 1917, since when it has been shut down. In 1909 the North Alaska Salmon Co. acquired a half interest in it, which it relinquished to the original owners a few years later.

The Pacific Steam Whaling Co. in 1898 erected a small hatchery on Hetta Lake, on the west side of Prince of Wales Island, which was operated until the close of the hatching season of 1903-4, when the Pacific Packing & Navigation Co., successor to the original owner, went into the hands of a receiver. In 1907 it was reopened by the Northwestern Fisheries Co., which had acquired the interests of the old company, and has been operated each season since, with the exception of 1919.

Up to 1900 the work of hatching salmon was entirely voluntary on the part of the packers. On May 2 of that year the following regulation was promulgated at the Treasury Department, which at that time had control of the Alaska salmon-inspection service:

7. Each person, company, or corporation taking salmon in Alaskan waters shall establish and conduct, at or near the fisheries operated by him or them, a suitable

artificial propagating plant or hatchery, and shall produce yearly and place in the natural spawning waters of each fishery so operated red-salmon fry in such numbers as shall be equal to at least four times the number of mature fish taken from the said fisheries by or for him or them during the preceding fishing season. The management and operation of such hatcheries shall be subject to such rules and regulations as may hereafter be prescribed by the Secretary of the Treasury. They shall be open for inspection by the authorized official of this department; annual reports shall be made, giving full particulars of the number of male and female salmon stripped, the number of eggs treated, the number and percentage of fish hatched, and all other conditions of interest; and there shall be made a sworn yearly statement of the number of fry planted and the exact location where said planting was done.

On January 24, 1902, this regulation was amended so as to require the planting of "red-salmon fry in such numbers as shall be equal to at least ten times the number of salmon of all varieties taken from the said fisheries."

Although the regulation was mandatory, but few of the packers obeyed it, some because no suitable place was to be found within a reasonable distance of their plants, others because the establishment and operation of such a hatchery would cost more than their returns from the industry justified, and others because of lack of knowledge required in hatchery work. The greater number of them absolutely ignored it, and as a result those who conformed to the regulation were placed under a heavy financial handicap. The injustice of this arrangement was patent on its face, and in 1906, when a comprehensive revision of the law was made by Congress, provision was made for reimbursing in the future those cannery men who operated salmon hatcheries. The section covering this point reads as follows:

SEC. 2. That the catch and pack of salmon made in Alaska by the owners of private salmon hatcheries operated in Alaska shall be exempt from all license fees and taxation of every nature at the rate of ten cases of canned salmon to every one thousand red or king salmon fry liberated, upon the following conditions:

That the Secretary of Commerce and Labor may from time to time, and on the application of the hatchery owner shall, within a reasonable time thereafter, cause such private hatcheries to be inspected for the purpose of determining the character of their operations, efficiency, and productiveness, and if he approve the same shall cause notice of such approval to be filed in the office of the clerk or deputy clerk of the United States district court of the division of the District of Alaska wherein any such hatchery is located, and shall also notify the owners of such hatchery of the action taken by him. The owner, agent, officer, or superintendent of any hatchery the effectiveness and productiveness of which has been approved as above provided shall, between the thirtieth day of June and the thirty-first day of December of each year, make proof of the number of salmon fry liberated during the twelve months immediately preceding the thirtieth day of June by a written statement under oath. Such proof shall be filed in the office of the clerk or deputy clerk of the United States district court of the division of the District of Alaska wherein such hatchery is located, and when so filed shall entitle the respective hatchery owners to the exemption as herein provided; and a false oath as to the number of salmon fry liberated shall be deemed perjury and subject the offender to all the pains and penalties thereof. Duplicates of such statements shall also be filed with the Secretary of Commerce and Labor.

It shall be the duty of such clerk or deputy clerk in whose office the approval and proof heretofore provided for are filed to forthwith issue to the hatchery owner, causing such proofs to be filed, certificates which shall not be transferable and of such denominations as said owner may request (no certificate to cover fewer than one thousand fry), covering in the aggregate the number of fry so proved to have been liberated; and such certificates may be used at any time by the person, company, corporation, or association to whom issued for the payment pro tanto of any license fees or taxes upon or against or on account of any catch or pack of salmon made by them in Alaska; and it shall be the duty of all public officials charged with the duty of collecting or receiving such license fees or taxes to accept such certificates in lieu of money in payment of all license fees or taxes upon or against the pack of canned salmon at the ratio of one thousand fry for each ten cases of salmon. No hatchery owner shall obtain the rebates from the output of any hatchery to which he might

otherwise be entitled under this act unless the efficiency of said hatchery has first been approved by the Secretary of Commerce and Labor in the manner herein provided for.

Of recent years so much objection has been raised to the system of hatchery rebates that the matter of the Federal Government taking over all private hatcheries in Alaska, at a fair valuation, and operating same, is being favorably considered.

In 1901 the Pacific Steam Whaling Co. established two small hatcheries—one on Nagel Stream, which enters the northern side of Quadra Lake, on the mainland of southeast Alaska, and one on a stream entering Freshwater Lake Bay, Chatham Strait. Both were closed down in 1904 when the company failed. In 1908 the Northwestern Fisheries Co., which had acquired the Quadra plant, removed it to a small stream entering the head of the lake and has operated it ever since.

In 1901 the Alaska Packers Association erected a hatchery on Heckman Lake, the third of a series of lakes on Naha Stream, Revillagigedo Island, and about 8 miles from Loring, where the association has a cannery. This, known as Fortmann hatchery, is without question the largest and costliest salmon hatchery in the world, having a capacity of 110,000,000 eggs, and the association is entitled to great credit for the public spirit it has shown and the work it has done, entirely without remuneration until 1906, in building and operating not only this hatchery but also the one at Karluk.

The Union Packing Co., at Kell Bay, on Kuiu Island, and F. C. Barnes, at Lake Bay, on Prince of Wales Island, in 1902 built and operated small hatcheries, both of which were abandoned after one season's work.

Up to 1905 the work of hatching salmon in Alaska was confined to the salmon cannery men. In that year, however, the United States Bureau of Fisheries erected a hatchery on Yes Lake, which empties through a short stream into Yes Bay, on Cleveland Peninsula. In 1907 the Bureau constructed another hatchery, on Afognak Lake, near Litnik Bay, Afognak Island.

The eruption of Katmai volcano, on the Alaska Peninsula, June 6, 1912, covered the island of Afognak with volcanic ash and sand to an average depth of 9 inches. It is estimated that 20,000 salmon perished at the head of Litnik Lake, while thousands were driven back into the ocean. As a result of these conditions the work at the Afognak station was much hampered and curtailed. Even as late as 1915 work at this station was still being hampered by the volcanic ash and sand which fell in 1912.

In 1913 collecting stations were established at Eagle Harbor and Uganak Lake, on Kodiak Island. In 1915 another was established at Seal Bay, on Afognak Island.

In 1913 a collecting station was established on Ketchikan Creek, but, owing to the objections of the citizens of the town against the taking away of the eggs, the station was abandoned in 1915.

The following tables show the eggs and fry distributed by the Government and privately owned hatcheries in Alaska:

OUTPUT OF THE SALMON HATCHERIES IN ALASKA OWNED BY THE U. S. BUREAU OF FISHERIES, 1906 TO 1919.

Year ending June 30—	McDonald Lake or Yes Bay hatchery.							
	Red, or sockeye.		Coho, or silver fry.	Steel-head fry.	Humpback.		Total.	
	Eggs.	Fry.			Eggs.	Fry.	Eggs.	Fry.
1906.....		6,038,550						6,638,550
1907.....		54,610,800		143,500				54,754,300
1908.....		61,369,000						61,369,000
1909.....		48,663,000	9,000					48,662,000
1910.....		69,879,000						69,879,000
1911.....		68,239,900			100,000		100,000	68,239,900
1912.....		68,335,000						68,335,000
1913.....		60,422,100						60,422,100
1914.....	2,000,000	42,726,400				4,500,000	2,000,000	47,226,400
1915.....		37,445,000			2,000,000		2,000,000	37,445,000
1916.....	18,100,000	652,317,500					18,100,000	670,417,500
1917.....	2,000,000	51,175,000					2,000,000	53,175,000
1918.....		32,539,200						32,539,200
1919.....	447,300,000	432,650,000			1,365,000	930,000	48,665,000	922,584,450
Total....	69,400,000	687,001,050	9,900	143,500	3,465,000	5,430,000	72,865,000	692,584,450

Year ending June 30—	Afognak hatchery.							
	Red, or sockeye.		Coho, or silver fry.	Humpback.		Total.		
	Eggs.	Fry.		Eggs.	Fry.	Eggs.	Fry.	
1909.....		39,325,870			10,000			39,335,870
1910.....		71,847,170			863,740			72,010,910
1911.....		23,755,000			364,150			27,119,150
1912.....		18,394,700			8,271,740		3,271,740	18,394,700
1913.....		12,551,100						12,551,100
1914.....	3,970,000	7,761,705	50,000		12,034,399	3,970,000		19,846,104
1915.....		76,387,080			12,500,000	9,843,480	12,500,000	6,730,560
1916.....		22,933,640						22,933,640
1917.....		21,116,000						21,116,000
1918.....	18,000,000	31,427,000					18,000,000	31,427,000
1919.....	454,081,000	24,903,000			8,697,000	2,142,000	63,378,000	27,045,000
Total.....	76,651,000	283,202,265	50,000	24,463,740	15,257,789	101,119,740	298,510,034	

a Includes 2,925,000 fingerlings, yearlings, or adults.
 b Includes 19,402,500 fingerlings.
 c Includes 1,575,000 fingerlings.
 d 1,089,900 sockeye eggs were shipped to the Little White Salmon hatchery, and 3,440,100 to the Oregon Fish Commission.
 e Includes 6,000,000 fingerlings.
 f Includes 5,444,830 fingerlings, yearlings, or adults.
 g Includes 119,480 fingerlings, yearlings, or adults.
 h Includes 11,100,440 fingerlings. Of the eggs from which these fry and fingerlings were hatched 15,000 came from Yes Bay hatchery.
 i Includes 10,180,000 fingerlings.
 j 5,100,000 of these eggs were shipped to the Bureau's Quinalt (Wash.) hatchery, and 20,700,000 to the Province of British Columbia.
 k 5,760,000 of these eggs were shipped to the Bureau's Puget Sound hatcheries.

OUTPUT OF THE SALMON HATCHERIES IN ALASKA OWNED BY THE U. S. BUREAU OF FISHERIES, 1906 TO 1919—Continued.

Year ending June 30—	Total, by species, both hatcheries.						Grand total.	
	Red, or sockeye.		Coho, or silver fry.	Steel-head fry.	Humpback.			
	Eggs.	Fry.			Eggs.	Fry.	Eggs.	Fry.
1906.		6,638,550						6,638,550
1907.		54,610,800		143,500				54,754,300
1908.		61,369,000						61,369,000
1909.		87,978,870	9,900			10,000		87,988,770
1910.		141,520,770						141,520,770
1911.		94,994,400			100,000	303,740		141,894,510
1912.		86,729,700			3,271,740	364,150	100,000	95,359,050
1913.		72,673,200					3,271,740	86,729,700
1914.		50,488,105	50,000					72,673,200
1915.	5,970,000	54,832,080			14,500,000	16,534,390	5,970,000	67,072,504
1916.	3,100,000	75,251,140				3,343,480	14,500,000	84,175,560
1917.	2,000,000	72,291,000					43,100,000	75,251,140
1918.	18,000,000	63,966,200					2,000,000	72,291,000
1919.	101,981,000	57,553,000			10,062,000	3,072,000	18,000,000	63,966,200
Total...	131,051,000	970,203,315	59,900	143,500	27,933,740	20,687,769	158,984,740	991,094,484

a Includes 8,369,830 fingerlings, yearlings, or adults.

b Includes 119,490 fingerlings, yearlings, or adults.

c Includes 8,489,310 fingerlings, yearlings, or adults.

d 15,000,000 of the red salmon eggs shown under Yes Bay were transferred to Afognak, hatched out there and the fry counted under the "Fry" column of that hatchery.

TAKE OF EGGS, AND OUTPUT OF PRIVATE SALMON HATCHERIES OF ALASKA, 1893 TO 1919.

[Unless otherwise stated in footnotes, all of the fry liberated were red salmon.]

Year ending June 30—	Callbreath's hatchery.		Karluk hatchery.		Klawak hatchery.	
	Eggs.	Fry.	Eggs.	Fry.	Eggs.	Fry.
1893.	900,000	600,000				
1894.	3,000,000	2,204,000				
1895.	6,300,000	5,291,000				
1896.	6,200,000	5,475,000				
1897.	4,400,000	4,390,000	3,238,000	2,556,440		
1898.	3,400,000	2,526,000	8,454,000	6,340,000	2,023,000	800,000
1899.	3,000,000	2,050,000	4,491,000	3,360,000	3,600,000	3,000,000
1900.	3,400,000	2,335,000	10,496,900	7,872,000	3,600,000	a 1,000,000
1901.	(b)		19,334,000	15,566,800	(c)	
1902.	6,000,000	5,500,000	32,800,000	28,700,000	3,500,000	2,800,000
1903.	6,000,000	5,000,000	23,400,000	17,555,000	8,500,000	1,500,000
1904.	6,000,000	5,000,000	28,113,000	22,000,000	3,000,000	1,700,000
1905.	6,050,000	5,250,000	45,500,000	33,670,000	2,800,000	2,000,000
1906.	7,700,000	6,500,000	36,933,000	28,230,412	2,800,000	2,300,000
1907.	(d)	(d)	38,679,200	26,846,000	3,600,000	1,187,000
1908.	(e)	(e)	47,608,200	48,655,000	3,500,000	2,776,000
1909.	(f)	(f)	40,320,000	37,105,000	3,500,000	2,500,000
1910.	(g)	(g)	45,228,000	40,620,000	5,800,000	6,300,000
1911.	(h)	(h)	49,620,000	37,722,000	6,786,500	6,200,000
1912.	(i)	(i)	41,026,800	37,495,100	5,600,000	3,530,000
1913.	(j)	(j)	45,600,000	41,803,155	8,835,000	3,875,000
1914.	(j)	(j)	34,629,160	31,546,080	3,645,000	3,465,000
1915.	(j)	(j)	30,240,000	27,704,000	8,816,000	3,853,000
1916.	(j)	(j)	41,135,000	23,948,000	4,180,000	4,020,000
1917.	(j)	(j)	h 1,016,000	(j)	8,180,000	7,822,000
1918.	(j)	(j)	(j)	(j)	(j)	(j)
1919.	(j)	(j)	(j)	(j)	(j)	(j)
Total.....	62,350,000	52,121,000	628,086,260	524,309,987	77,245,500	59,928,000

a Many eggs frozen.

b No run of fish.

c Hatchery was not used, the eggs being hatched out in the lake.

d No report.

e Fish coming in to spawn were lifted over the dam.

f Not operated.

g A collection of 7,400,000 humpback eggs was made for Afognak, and these appear in the report of that hatchery.

h These eggs were turned over to the Afognak hatchery and the hatchery shut down.

i A considerable portion of these are coho eggs.

TAKE OF EGGS, AND OUTPUT OF PRIVATE SALMON HATCHERIES OF ALASKA, 1893 TO 1919—Continued.

Year ending June 30—	Hetta hatchery.		Quadra Bay hatchery.		Freshwater Bay hatchery.	
	Eggs.	Fry.	Eggs.	Fry.	Eggs.	Fry.
1899.....	2,800,000	2,600,000				
1900.....	2,000,000	1,500,000				
1901.....	1,800,000	a 500,000				
1902.....	2,500,000	1,700,000	4,500,000	3,500,000	1,500,000	1,000,000
1903.....	4,800,000	4,000,000	5,500,000	4,000,000	(b)	(b)
1904.....	5,127,500	3,750,000	800,000	c 400,000	(d)	(d)
1905.....	(e)	(e)	(e)	(e)	(e)	(e)
1906.....	(e)	(e)	(e)	(e)	(e)	(e)
1907.....	(e)	(e)	(e)	(e)	(e)	(e)
1908.....	8,000,000	6,125,000	(e)	(e)	(e)	(e)
1909.....	8,400,000	8,134,000	3,325,000	3,025,750	(e)	(e)
1910.....	10,313,000	9,000,000	10,883,000	9,850,000	(e)	(e)
1911.....	9,141,000	8,552,500	11,200,000	10,350,000	(e)	(e)
1912.....	2,585,000	2,342,000	11,000,000	10,166,000	(e)	(e)
1913.....	3,780,000	3,592,000	10,000,000	8,127,000	(e)	(e)
1914.....	4,052,000	3,590,500	18,400,000	17,054,000	(e)	(e)
1915.....	7,438,500	7,142,500	21,300,000	20,300,000	(e)	(e)
1916.....	7,408,000	7,092,000	8,114,000	7,598,000	(e)	(e)
1917.....	3,247,000	3,120,000	16,125,000	15,003,000	(e)	(e)
1918.....	4,826,000	4,537,000	13,600,000	12,990,000	(e)	(e)
1919.....	(e)	(e)	20,400,000	19,852,000	(e)	(e)
Total.....	88,248,000	77,327,500	154,927,000	142,215,750	1,500,000	1,000,000

Year ending June 30—	Fortmann hatchery.		Kell Bay hatchery.		Total.	
	Eggs.	Fry.	Eggs.	Fry.	Eggs.	Fry.
1893.....					600,000	600,000
1894.....					3,000,000	2,204,000
1895.....					6,300,000	5,291,000
1896.....					6,200,000	5,475,000
1897.....					7,036,000	6,946,440
1898.....					13,877,000	9,666,000
1899.....					13,891,000	11,019,000
1900.....					19,406,000	12,707,000
1901.....					21,134,000	16,069,800
1902.....	11,460,000	10,300,000			62,260,000	63,500,000
1903.....	40,050,000	29,005,000	2,500,000	2,000,000	85,750,000	63,060,000
1904.....	22,203,000	13,780,000	(e)	(e)	65,043,500	46,630,000
1905.....	65,010,000	63,181,000	(e)	(e)	119,360,000	104,101,000
1906.....	68,715,000	67,643,000	(e)	(e)	116,148,000	104,679,412
1907.....	105,450,000	80,973,000	(e)	(e)	147,729,200	119,006,000
1908.....	41,280,000	33,920,000	(e)	(e)	100,588,200	80,476,000
1909.....	24,465,000	22,785,000	(e)	(e)	80,010,000	74,249,750
1910.....	53,340,000	50,725,000	(e)	(e)	125,544,000	115,495,000
1911.....	34,920,000	30,245,000	(e)	(e)	111,873,500	93,069,500
1912.....	107,520,000	100,335,000	(e)	(e)	167,731,800	163,888,100
1913.....	23,160,000	20,800,000	(e)	(e)	88,376,000	77,997,155
1914.....	9,480,000	8,700,000	(e)	(e)	70,236,160	64,355,580
1915.....	22,500,000	20,820,000	(e)	(e)	85,294,500	79,619,500
1916.....	26,520,000	25,615,000	(e)	(e)	87,357,000	83,273,000
1917.....	62,580,000	57,405,000	(e)	(e)	91,128,000	83,350,000
1918.....	4,240,000	4,980,000	(e)	(e)	22,696,000	25,557,000
1919.....	f 23,280,000	15,205,000	(e)	(e)	43,680,000	35,057,000
Total.....	746,173,000	659,417,000	2,500,000	2,000,000	1,761,009,760	1,518,319,237

- a Many eggs frozen
- b No run of fish.
- c Hatchery was not used, the eggs being hatched in the lake.
- d No report.
- e Not operated.
- f Includes 30,000 coho eggs taken and 27,000 fry liberated.
- g Includes 600,000 humpback eggs taken and 560,000 fry liberated.
- h Includes 2,400,000 humpback eggs taken.
- i Includes 1,845,000 humpback fry planted.
- j Includes 3,660,000 humpback eggs.

THE SALMON FISHERIES OF SIBERIA.

As on the Alaska coast, the aborigines of Siberia must have learned early of the excellent food qualities of the salmon which each year frequented the rivers of that country for spawning purposes, and

not only ate them fresh but also dried large quantities for winter use for themselves and their dogs.

Owing to the inaccessibility of the Siberian coast, due mainly to the lack of transportation facilities for many years and the decided objection of the Russian Government to travelers roaming over the country, partly because of the presence of political and criminal convicts and partly because of a fear that they might learn too much of its resources, there has been but little written, especially with regard to its fishery resources, about this remote section of the Russian Empire, and what little has been published is usually filled with inaccuracies, due, doubtless, in many instances to the fact that the writer generally had to get most of his information at second and third hand and was also unfamiliar with fishery subjects.

Most of the data given below were obtained directly from persons living in Siberia or Japan, most of whom are engaged in the fishing industry of Siberia, or from Americans who have on various occasions visited the country in order to view its fishing possibilities at first hand.

SPECIES OF SALMON.

All five species of salmon are to be found along the Siberian coast, and the schools appear to run about the same as they do on the American side. Although we have very little authentic data relating to their movements, these are doubtless similar to the runs on the Alaska coast, where climatic and other conditions are very similar. Nearly all streams from the Arctic Ocean to north China seem to have runs of one or more species. The steelhead does not appear to be an inhabitant of the Asian coast.

The fishing carried on by the Russians has usually been along the rivers of the mainland, principally in the Amur and on Sakhalin Island.

From very early times Japanese fishermen have frequented the Siberian coast and Sakhalin Island (the southern portion of which they at one time owned, exchanging it to Russia for the Kurile Islands in 1875 and again acquiring it in 1905, as a result of the Russian-Japanese war), being drawn here mainly by the rich stores of salmon which could be secured easily and quickly, and were so necessary to eke out the vast quantity needed to supply such a fish-eating nation as Japan.

FISHING DISTRICTS.

The Priamur fishing district is subdivided into several districts as follows:

Nikolaevsk district.—This district comprises the whole lower part of the Amur River from the village Zimmermanovka down to the mouth of the river, about 300 miles; the River Amgun, 200 miles; the Amur estuary, about 150 miles on the mainland and about 130 miles on the coast of Sakhalin Island, and about 865 miles of the coast line on the southwestern shore of the Okhotsk Sea. In 1913 there were 139 fishing stations operated in this district, and this number has been materially increased since. Humpbacks and chums were the principal species of salmon taken.

Sakhalin district.—The Sakhalin district includes the entire coast line of Sakhalin island with the exception of that facing the Amur estuary, which belongs to the Nikolaevsk district. It is the smallest

district, and at present is of little importance. In 1913 there were 14 stations on the island and they produced chum and humpback salmon.

Okhotsk-Kamchatka district.—The Okhotsk section covers the coast line of the northern part of the Okhotsk Sea from Port Ayan to Penjin Promontory, about 1,620 miles. Chum, humpback, coho, and red salmon, and Dolly Varden trout are found here. The West Kamchatka section includes the coast line from the Sopotschnaya River down to the southern Ozernof shore fishing stations, a distance of about 335 miles. The Ozornaya River is, so far as known, the only river in this section that the red salmon visit in any quantities. In 1913 there were 152 fishing stations in this section, most of which were leased to Japanese. The number has since been increased. All five species of salmon and the Dolly Varden trout are found here. The East Kamchatka section covers the coast line of eastern Kamchatka and Anadir Peninsulas, about 1,843 miles. The majority of the fishing stations are concentrated around Karaginsky (Count Litka) Bay, in the straits from the Malo-Voyam River to Kitchigin River, about 135 miles long, and in the region of Kamchatka River. All five species of salmon and Dolly Varden trout are taken here and most of the canneries are located here and in the West Kamchatka section.

Southwestern district.—This district covers the waters from the southern boundary of the Amur River estuary (the line between Capes Lazarev and Pogibi) down to the Chosen frontier, including Vanina Bay, Imperial Harbor, Peter the Great Bay, and other bays. The total length of the shore line is about 1,350 miles. The northern part, from Lazarev-Pogibi line to Cape Povorotni, with the exception of various bays, includes the conventional waters, while the southern part, composed of Peter the Great Bay and Posiet Bay, are excluded from the conventional waters. In the first-named section chum and humpback salmon are caught to some extent. In the southern section chum and humpback salmon are taken and marketed fresh.

Amur River.—The Amur River is subdivided into two districts—the Marinsk, or the Lower Amur, district and the Khabarovsk district. The first named includes the area from the village Troitskoe to the village Sophiskoe, or a tract about 278 miles long. The Khabarovsk district includes the river line from the northern boundary of the Maryinsk district up the river to Khabarovsk, about 127 miles. Chum salmon form the bulk of the catch in this district.

FISHERY RIGHTS AND REGULATIONS.

Along the entire seacoast of Siberia, by virtue of the Russo-Japanese convention of 1907, concluded for 12 years, and, it is reported, with what truth we have no means of telling at present, renewed in 1919, the Japanese are permitted to engage in fishing on equal terms with Russians. In such sections there is no restriction with regard to the nationality of the laborers employed or the method of preparing the fish, except that the manufacture of fish manure from fish of the salmon variety is prohibited. On the face of it this convention looks like an equitable agreement, but in putting the Japanese on the same footing as the Russians it subjected them

to a lot of unstated and arbitrary laws, by-laws, and local regulations, besides making the tenure exceedingly short, virtually only one year, as a result of which Japanese capital refuses to erect more than the crudest of plants.

The Department of Domains fixes the limits of the stations, and these are sold at public tender, usually during February and March.

The exhaustion of the fishery resources of many of the European waters belonging to Russia has forced some of her more enterprising fishermen to seek for new supplies in her Siberian waters, and as these resources become better known, and means of transportation are increased and improved, there will doubtless be a tremendous impetus given to their development.

The World War which devastated Europe between 1914 and 1918 had a particularly disastrous effect on Russia, where the terribly devastating internecine warfare resulting from the revolution within her borders sapped her resources to such an extent that her Siberian fishery operators have been unable to do anything other than make a bare living out of the business and not even that in many cases owing to the uncertainty of business conditions. As a result of these distressing handicaps upon the operations of the Russians, the Japanese have had virtually a free hand in their exploitation of the coastal fishery resources of Siberia. As Siberia in the near future will be the greatest producer of salmon, it behooves us to bestir ourselves if we are to retain our command of the salmon market by taking an active part in the development of Siberia's fishery resources, for which development Russia has not heretofore welcomed foreign capital. When peace finally comes to that devastated land, however, her capital will be so depleted that she will doubtless welcome relief from whatever source it comes, and as she knows the United States has no territorial aspirations in her direction we will doubtless be far more welcome than the Japanese, of whose disinterestedness the Russians are extremely suspicious.

Fishing rights in the gulfs and bays not included in the Russo-Japanese convention, such as Peter the Great Bay, Imperial Harbor, Vanina Bay, Avatchinsk Bay, and others, as well as the rivers of Okhotsk and Kamchatka, are granted by the Governor General, without public tenders, to persons of good repute, but for one year only, and if they show their ability to establish a successful fishing station a lease for 12 years can be secured on the basis of paying a royalty of 2½ cents per pood (36.112 pounds) of prepared fish. Under the terms of the lease only Russian subjects can be employed at the stations, while all sailing vessels serving the stations must be under the Russian flag.

The regulations governing the river districts vary from those relating to coast concessions, and also vary from each other, as the local authorities in the river districts are authorized to issue temporary rules and regulations to cover local conditions.

On the Amur River, within the boundaries of the Nikolaevsk, Maryinsk, and Khabarovsk districts, the fishing stations are leased by public auction to the highest bidder, some on a long-term basis and others for only one year. At stations above the city of Nikolaevsk, within 30 miles of the Amur estuary and farther, no foreign labor is allowed. Below the city of Nikolaevsk foreign labor can be

employed to handle the fish on shore, but the actual fishing can be done only by Russian subjects.

At the present time the chief aim of the Russian authorities is to break the monopoly the Japanese have of the fisheries along the greater part of the coast. This will be an exceedingly difficult thing to do, owing to the proximity of the Japanese to the Siberian coast, the ease with which they can transport by water the necessary supplies, etc., for carrying on the fisheries, the vastly greater skill in carrying on this work displayed by them over their Russian competitors, and their unlimited supply of cheap labor, while the Russian fisheries are badly hampered as a result of the few Russian subjects available for such work and the consequent high wage cost of same. Japan also has another big advantage in that she is at present almost the sole market for the greater part of the salmon and other fishes taken in Siberia. The very fact of this fish being necessary for feeding her people will cause Japan to battle hard to hold her present advantage.

In order to encourage opposition to the Japanese, the Russian authorities in 1913 gave to Denbigh & Biritich, on a long lease, a fishing station on the Kamchatka River (eastern shore of Kamchatka peninsula), and to S. Grooshetsky & Co. one on the Bolsha River (western shore of Kamchatka). In order to safeguard the fishery in the lease each was to build a fish hatchery with a capacity of 3,000,000 salmon per annum in the vicinity of the station. Each was to release 500,000 in 1914, 1,000,000 in 1915, and 3,000,000 yearly from 1916 to the end of the lease. Owing to technical difficulties only the latter firm built a hatchery, and this not until 1915 or 1916. It has since been shut down.

The development of the salmon and other fisheries of Siberia has been much hampered by the disinclination of the Russian Government to permit foreigners to acquire fishing concessions except on very short tenure. As the Russians themselves are generally unskilled in fishing operations, and are compelled to do the work with Russian labor, which is quite scarce, they do but little with their concessions. American capital would doubtless be available for developing Siberia's fisheries were it assured of a sufficiently long tenure of lease with some other minor concessions.

APPARATUS EMPLOYED.

In the river districts somewhat primitive fishing apparatus is employed. Spears, dip nets, and the other simple forms which seem to be common to all savage tribes depending upon the water for the greater part of their subsistence, are all in use by the natives living along the upper reaches.

Weirs of a primitive type known as "zaezdka," are also used. These have a lead consisting of willow poles and branches built from the river bank or a sand bank out into the stream. At the outer end is attached a net compartment with a lead, into which the fish, which have been following the lead in the search for an opening, pass. Two men in a boat are anchored close by, and as soon as 30 or 40 salmon have passed into the compartment, it is hauled up and the fish emptied into the boat, after which the net is reset.

Haul seines of varying lengths and depths are used in connection with the more important river fishing stations.

Along the coast the Japanese use a floating trap net somewhat similar to the type used in Alaska, also haul seines and a few gill nets.

ABUNDANCE OF SALMON.

It is exceedingly difficult to secure even approximate statistics of the Siberian catch of salmon, owing to the wide extent of coast, the totally inadequate means of transportation preventing close supervision, the presence of so many foreigners who go directly home with their catches at the end of the season, and the crude system of control in operation by the authorities.

The following table shows the catch of salmon in the four districts for the year 1898:

District.	Spring.	Summer.	Autumn.
Nikolaevsk		7,464,896	4,685,480
Okhotsk.....	60,000	873,000	2,662,000
Kamchatka.....	1,067,000	316,950	665,500
Sakhalin.....	666,000	635,000	748,000
Total.....	1,793,000	9,289,846	8,760,980

In the Anadir district the catch in 1909 was as follows: Cape St. Michael, 91,616; above Cape Neuman, 8,234; Anadir River, 150,746; Anadir River estuary, 9,864; Hanchelar River, 6,121; Cape Observation, 270,000; total, 536,581. The catch by natives and small Russian fishermen is estimated at about 3,000,000 and 500,000 fish, respectively. In addition to this, 130 barrels of caviar, weighing 14 tons, were prepared, and there were 20 tons from Cape Observation.

According to the statistics of the Fisheries Control, the catch of salmon in the Amur River in 1910 was as follows: Spring salmon, 7,701,344; summer salmon, 21,384,549; autumn salmon, 9,546,254; in all, 38,632,147. Of this number 34,649,025 fish were marketed and the balance consumed locally. Japan bought 23,228,481 fish, valued at \$473,800; the balance was valued at \$681,345. In addition there were 4,766,784 pounds of salmon caviar, valued at an average price of \$0.114 per pound, totaling \$543,413, which brings the total value of the salmon catch and by-products up to \$1,698,558. During the same year, in Peter the Great Bay, 8,263 salmon were caught.

The number of salmon caught in eastern and western Kamchatka and in the bays and rivers in this region not included in the Fishing Convention, and at the Russian river stations, in 1911, was as follows:

Species.	Western Kamchatka.	Eastern Kamchatka.	River stations.	Bays and river outlets.	Total.
Chavitch (king).....	5,421	7,818	207	590	14,036
Keta (chum).....	3,082,300	2,675,000	297,300	890,700	6,945,300
Krasnala (red).....	2,136,800	747,000	689,000	236,240	3,809,040
Garbuska (humpback).....	39,448,500	1,411,000	1,320,200	175,980	42,355,680
Kishutch (coho).....	327,200	179,000	114,200	7,770	628,170
Total.....	45,000,221	5,019,818	2,420,907	1,311,370	53,752,316

In the Okhotsk district the catch amounted to 827,274 keta and 37,790 krasnaia. Of salmon caviar 489 tons were prepared by the Japanese and 60 tons by the Russians.

In 1915 about 50,000 barrels of pickled salmon were prepared on the Amur River. In the sections covered by the Fishing Convention 6,000,000 salmon, mostly keta with a few krasnaia, were dry-salted, while 80,000,000 humpback salmon, called "salmon trout" in Japan, were so prepared. No fish were frozen for the European market, due to the war. A considerable quantity of caviar was prepared, but the quantity is unknown. The pack of canned salmon is shown elsewhere.

In the "Pacific Fisherman" (February, 1917), Seattle, Wash., its Hakodate (Japan) correspondent reports the following particulars of the 1916 salmon season:

During the year 1916 the salmon catches in the States of Kamchatka and Okhotsk, Siberia, varied greatly according to districts. On the west coast of Kamchatka and Okhotsk there was a big run all season, but the run on the east coast of Kamchatka was extremely poor, except in the Kamchatka River. The distribution of salmon varieties is always limited to about the following districts:

Chums are present in large quantities on the east coast of Kamchatka and Okhotsk, but on the west coast of Kamchatka they are never plentiful.

Red salmon are almost entirely limited to two districts, the Kamchatka and Ozer-naya rivers, being very scarce in other districts.

Humpbacks are found all along the coast, but most especially in the district of Boliskreska [Bolsheryetzk], where there is always a large run.

Silver salmon are found in small quantities on the west and east coasts of Kam-chatka at certain seasons of every year.

King salmon are present in very limited quantities, early in the season on the west and east coasts of Kamchatka.

There were 17 canneries operated in 1916, and they packed about 470,000 cases. There were 218 fishing places on the shores, and the number of salmon caught during the season was 94,582,228.

All the salmon packers and fishermen in Siberia have used steamers for the transportation of their goods for several years past, but owing to the high rates now prevailing on steamer tonnage they were obliged again to make use of sailing vessels. Prices of all equipment and outfits for the canneries and salting stations were from 30 per cent to 50 per cent higher than for the previous year, but as a result of the strong demand for salmon products due to the European war, all the markets are in good condition. Accordingly, preparations for the coming season are expected to be on a more extensive scale, both as to number and size of canneries and development of the fisheries.

The above statement is accompanied by the following estimate of the number of salmon caught in 1916 in the States of Kamchatka and Okhotsk, except in the rivers:

Species.	Okhotsk.	East Kam-chatka.	West Kam-chatka.	Total.
	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>
Chum.....	1,432,312	2,318,964	1,069,056	5,470,382
Humpback.....	8,710,320	1,778,112	79,926,512	85,412,944
King.....		3,276		3,276
Red.....		308,502	3,311,304	3,019,806
Silver.....			75,870	75,870
Total.....	5,192,632	4,406,854	84,982,742	94,582,228

FREEZING SALMON.

As when the Russians owned Alaska, the exploitation of Siberia was carried on for many years by trading companies with large powers granted by the Government. In 1892 a very enterprising company was in charge, judging from the following extract from a letter written on February 2, 1893, by the late Eugene G. Blackford,

the well-known fish dealer of New York, to the late Col. Marshall McDonald, then United States Commissioner of Fish and Fisheries:

I have just learned of the arrival in Chicago of 60,000 pounds of frozen salmon. They were caught in Petropavlovsk, Kamchatka. These fish are a new venture undertaken by a commercial trading company who control that country, and these salmon have been taken from a river where none have been caught before, and my information is that they catch fish weighing as much as 150 pounds each. The above lot of fish was brought frozen to Tacoma and then shipped by refrigerator car to Chicago, where they were sold to Mr. Booth, of the Booth Packing Co., Chicago. Mr. Booth has declined to pay for them because of their not being in satisfactory condition.

Nothing further appears to have been done in this line until in 1903, when a Berlin fish merchant outfitted and sent to the Siberian coast a refrigerator steamer with a capacity of 2,500 tons. The fish were caught mainly in the Amur River and were frozen immediately after being brought aboard. In all, 160,000 salmon were obtained, and these were in excellent condition when landed at Hamburg, Germany.

In 1907 the Salmon Steam Fishing Co., a combined British and Japanese company, chartered the steamers *Zenobia* and *Zephyrus*. These vessels were fitted with refrigerating apparatus and cold-storage chambers and sent to the Kamchatkan Peninsula to get a cargo. Both secured good cargoes.

In 1909 two refrigerating steamers visited the coast and froze salmon for the European market. One vessel was outfitted by a British company and the other by a German company, J. Lindenberg (Inc.). The latter reported that the dog salmon, the principal species frozen, were large and very bright. The British steamer left England in April and arrived home again late in December.

CANNING SALMON.

In 1900 the Kamchatka Commercial & Industrial Co. (Ltd.), was organized at St. Petersburg, Russia, by A. T. Prozoraf, president of the St. Petersburg Chamber of Commerce; P. M. Grunwalt; H. T. M. Court, and A. A. Prozoraf, secretary. A complete canning outfit was purchased in the United States, and the first cannery in Siberia established at Petropavlovsk, Avacha Bay, Kamchatka.

The San Francisco Trade Journal, under date of December 19, 1902, printed the following item relating to the operations of this cannery:

On December 8 the Russian barkentine *Bitte* arrived from Petropavlovsk, Siberia, with 10,436 cases canned salmon. This is the first consignment of salmon received from them.

The greater part of the pack comprised dog salmon, although they were labeled "pink" salmon, the rest being reds and kings.

In 1903 the company did not operate, the fishing season being devoted to moving the plant to Ust-Kamchatka, at the mouth of the Kamchatka River, where, after being in use altogether for two or three years, it was abandoned and left all standing.

In 1907 two canneries were established in the estuary of the Amur River, near Nikolaevsk, but beyond getting out samples they were never operated.

In 1910 A. G. Denbigh, an Englishman, built a modern cannery near the second site of the Kamchatkan Commercial & Industrial Co. That year the cannery produced only about 10,000 cases, but each year since the equipment of the plant has been enlarged and improved until in 1913 the pack amounted to 60,000 cases. Early in 1914 a

complete two-line plant of American can-packing machinery was installed.

In 1912 Mr. Denbigh built another cannery $1\frac{1}{2}$ miles away from the above plant. This plant was first operated with German and Norwegian sanitary machinery, but in 1914 a two-line American sanitary can-packing plant was installed, the can-making plant at the first plant making all the cans needed at the two canneries.

In 1915 a number of additions were made to both plants in the line of flat fillers, etc., while still more were in contemplation for 1916.

Mr. Denbigh also operates a hand cannery at Kompakova, on the west side of the Kamchatka Peninsula.

Up to 1912 very few canneries, and these very primitive affairs, had been built by the Japanese, owing to the uncertainty of tenure referred to previously. The "canneries" were mere sheds or shelters where the cans—which were brought from Japan, made or half made—were filled, closed, and cooked, furnace-heated, vertical retorts being used for the latter purpose. If the owner lost his concession at the end of the fishing season he simply took his retorts away with him and the buildings were left to his successor.

In 1912 a Tokyo company (Ichigumi & Co.) put up two canneries near the Ozernaya River in Kamchatka, while a Japanese from Niigata, Japan, also put up a small plant in the same vicinity. Both plants were cheaply built and operated with hand-power machinery and small vertical retorts. That year the two companies together packed about 13,500 cases of salmon.

The same season Ichigumi & Co. put up another hand-power cannery, and Tsutsumi & Co., of Hakodate, Japan, built two others of the same type near the Kamchatka River, on the east coast.

In 1913 Tsutsumi & Co. built a modern cannery at Ozernaya and installed a complete line of American sanitary can-making and can-packing machinery.

The same year Ichigumi & Co. put up two hand-power canneries near the Kamchatka River, having succeeded to the concessions formerly held here by Tsutsumi & Co. In 1914 they built a modern plant and installed a complete line of American sanitary can-making and can-packing machinery.

The St. Petersburg firm of S. Grooshetsky & Co., which has been engaged for a number of years in the freezing of salmon and in the preparation of salmon caviar, under the name of the Pacific Ocean Sea Industry Association, erected a cannery near Ozernaya in 1914, and installed in it a full line of American sanitary can-making and can-packing machinery. This plant will compare favorably with most of our Alaska canneries. The buildings are of iron.

In 1915 a number of extensive improvements in the way of new buildings, machinery, etc., were made to the various plants, and during the winter of 1915-16 several of the canning firms had representatives in this country selecting much additional machinery for use during the 1916 season. During the latter season Tsutsumi & Co. erected a large new plant at Kiseka and a one-line plant above Kiseka. This company also operates a can-making plant at Hakodate, equipped with American Can Co. machinery and with a capacity of 800,000 cans per day. Owing to the heavy demand, caused by the war, a number of small hand-pack canneries also operated.

In 1917 A. G. Denbigh built a cannery at Javino, on the west coast of Kamchatka Peninsula. All the machinery in this plant is electric driven.

In 1918 the ravages occasioned by the war so far as personnel, transportation, tinplate shortage, and market conditions were concerned had come to a head, and as a result the Grooshetsky & Co. and some of the smaller canneries did not operate, while Tsutsumi & Co. operated only those of its canneries which packed red salmon.

In 1919 conditions were much more favorable in Siberia, and as a result the three Russian plants which were shut down in 1918 reopened. Tsutsumi & Co. erected and operated a new cannery in Ust-Kamchatka. The Nichiro Gyogyo Kabushi Kaisha, or Russo-Japanese Fisheries Co. (Ltd.), built and operated two additional one-line canneries at Kompakova and Kiseka.

The following table shows the detailed pack of canned salmon made by the various companies operating in Siberia in 1915:

SIBERIA CANNED SALMON PACK IN 1915.^a

Name and cannery location, ^b	Canneries.	One-pound flats.					Total.
		Reds.	Spring.	Silvers.	Chums, ^c	Humpbacks.	
A. G. Denbigh, Kamchatka River (2) and Kompakova.....	3	Cases. 58,000	.....	Cases. 20,000	Cases. 38,000	.....	Cases. 122,000
Food Products Exp. Co.....	4	d 35,000	.....	.....	.....	.....	35,000
S. Grooshetsky & Co., Bolsheryetzk.....	1	6,000	.....	.....	23,000	.....	29,000
Minard & Co.....	1	.....	.....	.....	7,000	.....	7,000
Nichiro Fishing Co. (Ltd.), Kamchatka River.....	1	14,703	3,334	2,191	11,981	.....	32,209
Sugamiya.....	1	2,200	.....	.....	.....	.....	2,200
Tsutsumi & Co., Ozernaya.....	1	e 37,800	.....	.....	8,800	.....	46,600
Hand-pack canneries, East and West Kamchatka.....	2	1,000	.....	.....	4,000	10,000	15,000
Total.....	10	154,703	3,334	28,191	92,781	10,000	289,009

^a From Pacific Fisherman Yearbook for 1916, p. 44.

^b There were also a couple of small canneries operated on the Amur River which are not shown here.

^c Called "Pinks" in Siberia.

^d Includes 10,000 cases one-half pound flats of 8 dozen each.

^e Includes 10,800 cases one-half pound flats of 8 dozen each.

In order to show the changes which have occurred since 1915 the detailed pack made by the various companies for 1919 is given.

SIBERIA CANNED SALMON PACK IN 1919.^a

Name.	Cannery location.	Number of canneries operated.	Spring.			
			1-lb. flats.	1-lb. talls.	1-lb. flats.	1-lb. flats.
Grooshetsky, S., & Co.....	Ozernaya, Bolsheryetzk.....	2	.....	.....	8,363	.....
Hakama, B., & Co.....	Opala.....	1	.....	.....	7,550	.....
Hokuyo-Gyogyo Kabushiki Kaisha (Ltd.).....	Ust-Kamchatka ^b	2	.....	.....	73,058	.....
Nichiro Gyogyo Kabushiki Kaisha (Ltd.).....	Bolsheryetzk, Opala, and Ust-Kamchatka.....	3	1,533	.....	56,877	.....
Shindo, B., & Co.....	Narachevsky.....	1	.....	.....	888	.....
Suda, K., & Co.....	Palana R.....	1	.....	.....	900	.....
Tsutsumi & Co.....	Ust-Kamchatka, Ozernaya, Javino, Koshegochinaky, Bolsheryetzk (2), and Kuffol.....	7	3,575	557	112,398	18,266
Tsushutsu-Shokuhin Kabushiki Kaisha (Ltd.).....	Opala Goluginsky, Koshegochinaky, Javino ^c	4	.....	.....	80,832	17,604
Total.....	.....	21	5,108	557	340,863	35,870

^a From Pacific Fisherman Yearbook for 1920, p. 86.

^b Formerly Denbigh canneries at Nerplchr and Seaside.

^c Javino cannery bought from A. G. Denbigh & Co.

SIBERIA CANNED SALMON PACK IN 1919—Continued.

Name.	Cannery location.	Silver.		Chum.	Humpback.		Total.
		1-lb. talls.	1-lb. flats.	1-lb. flats.	1-lb. talls.	1-lb. flats.	Full cases.
Groshetsky, S., & Co....	Ozernaya, Bolsheryetzk. Opala.....		5,337			20,248	33,948
Hakama, S., & Co.....	Ust-Kamchatka ^a		31,484	78,589			7,550
Hokuyo-Gyogyo Kabushiki Kaisha (Ltd.).	Bolsheryetzk, Opala, and Ust-Kamchatka.....		20,941	11,018		12,200	183,131
Nichiro Gyogyo Kabushiki Kaisha (Ltd.).	Narachefsky.....		177				102,569
Shindo, S., & Co.....	Palana R.....						1,065
Suda, K., & Co.....	Ust - Kamchatka, Ozernaya, Javino, Koshegolskiy, Bolsheryetzk (2), and Kuftoi.....	17,909	30,516	12,376	50,027	60,807	900
Tsutsumi & Co.....	Opala, Goluiginskiy, Koshegolskiy, Javino. ^b						308,429
Yushutsu-Shokuhin Kabushiki Kaisha (Ltd.).						14,484	112,620
Total.....		17,909	88,455	101,983	50,027	107,739	748,512

^a Formerly Denbigh canneries at Nerpichr and Seaside.
^b Javino cannery bought from A. G. Denbigh & Co.

The following table shows the pack of canned salmon in Siberia from 1910, the virtual inception of the industry, to 1919, inclusive:

Year.	Canneries operated.	Reds.	Silvers.	Pinks, or dogs. ^a	Springs.	Humpbacks.	Total.
		<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>	<i>Full cases.</i>
1910.....	1	5,500	2,500	2,000			10,000
1911.....	1	15,000	6,000	4,000			25,000
1912.....		43,500	18,000	16,000			77,500
1913.....		162,900	7,000	21,000		2,500	133,400
1914.....		85,000	22,500	27,000		2,000	138,500
1915.....	10	119,703	28,191	92,781	3,334	10,000	254,009
1916.....	18	229,406	54,662	129,598	2,047	56,064	471,787
1917.....	18	275,212	29,980	66,056	2,556	137,197	511,001
1918.....	15	296,960	43,588	23,685	2,027	15,177	331,337
1919.....	21	377,290	106,364	101,983	5,108	157,766	749,512
Total.....		1,551,471	318,775	484,003	15,072	380,704	2,749,026

^a Dog salmon are marketed under a "pink" label.

SALTING SALMON.

By far the greater part of the salmon catch of Siberia is either pickled or dry salted. This was the earliest commercial method initiated on the coast and has been followed for a number of years, mainly by the Japanese. The coast is dotted with concessions worked by Japanese, while there are large numbers in operation along the rivers, these being restricted to Russians. An idea of the extent of this branch of the industry may be gathered when it is stated that in 1915 there were 50,000 barrels of pickled salmon prepared in the Amur region, while the Japanese dry salted about 6,000,000 dog salmon, including also a few reds, and 80,000,000 humpbacks, or "salmon trout," as they are called in Japan.

In pickling salmon the fish are split down the back, the sides being held together by the belly. The roe, gills, and viscera are removed and the fish are then washed, and after salting are placed in large

tanks for seven or more days, or until they are thoroughly struck, after which they are packed in barrels, flesh side up, except the two top layers, which have the skin side up. To about 700 pounds of fish 180 pounds of salt are used.

The dry salting, next to drying, is the most primitive method employed in preserving salmon. The process consists simply in splitting the fish up the belly, removing the gills and entrails, and then filling the belly with salt. The fish are then placed in rows on matting and covered with salt, and other rows are placed on top of them until the pile is from 8 to 10 feet high, when the entire lot is covered with matting and left for about seven days, after which they are relaid and again covered with salt. For shipping, the fish are packed in mats.

A very odd feature in connection with the operation of most of the Japanese plants is that the salt to be used in curing the fish is usually dumped loose onto some level spot, with absolutely no covering over it, and exposed to the elements.

The Japanese consume enormous quantities of these dry-salted salmon. During the Russian-Japanese war the latter country's fishermen were cut off from access to their usual fishing grounds, with the result that they were forced to look elsewhere for fish. During 1905 and 1906 large quantities were prepared in Alaska, British Columbia, and Washington for this trade, but as soon as the war ended and the Japanese got access once more to their old fishing grounds, the Japanese duty on salt fish, which had been suspended during and for a short period after the war, was reimposed. As a result our fishermen soon quit the business, and since then operations on this coast have been almost wholly restricted to Japanese operating in British Columbia waters.

At the height of the production on this coast Mr. King, the American consular agent at Hakodate, Japan, made the following suggestions to preparers and shippers of dry-salted salmon for the Japanese trade:

The salmon should arrive in Japan by December 1. Most of these fish are used among the Japanese for New Year's presents. After the new year the price invariably declines 20 to 30 per cent, and for a month or two the fish are difficult to dispose of, as the consumers always stock up before the new year.

The salmon should weigh not less than 5 pounds when thoroughly cured. They should be free from spots, which are usually found on the salmon if caught in fresh or brackish water. No Japanese would think of giving a salmon with red and black spots to a friend for a New Year's present, and spotted fish never realize more than half the price obtainable for clean white fish. The salmon should be split up the belly and should be salted with fine salt. Coarse salt always tears the flesh of the fish when being rubbed in. Care should be taken that the salmon are not oversalted.

Semga salting is a more improved and sanitary method than that of straight pickling and is used when the fish are being prepared for the European market. Selected fish are cut open along the belly and the viscera and gills are carefully removed. In order that the salt may penetrate the flesh more thoroughly, the flesh on the inside is scored several times. The fish are then carefully washed and rubbed with brushes, after which they are kept on ice for 24 hours. The brine is carefully prepared and very strong. When properly struck the fish are repacked into barrels.

"Kolodka" is a very crude and cheap method of salting. The fish are half salted and half dried without being cut open, and are sold at the place where prepared.

The natives prepare a great many salmon for the winter use of themselves and their dogs, the same as do the Alaskan natives. The fish are dried without the use of salt. The product is known as "youkala."

Some salmon bellies are also cut out and salted, although this has never attained to prominence.

Some fresh salmon, as well as salted, are smoked for local consumption.

Barrels, or tierces, for packing salmon are made from cedar, larch, or fir, with a net capacity of 900 to 1,000 pounds of fish, and are bound with wooden and iron hoops.

THE SALMON FISHERIES OF JAPAN.

Outside of Karafuto (that portion of Sakhalin Island, south of 50° north latitude, which belongs to Japan) and the Kuril Islands, the salmon fisheries of Japan are comparatively small, the principal portion of the immense catches made by Japanese fishermen being along the coasts of Siberia and Karafuto.

All of the five species of salmon found on the American side are to be found in the waters of Sakhalin during the usual spawning periods.

The dog salmon (*O. keta*), which is known in Japan as "sake," and when canned as "pink" salmon, is to be found on Hokushu Island, running up the various streams for spawning purposes from September to December.

On the same island is to be found also the masu (*O. masou*), a salmon, according to Dr. Jordan,^a very similar to the humpback, the scales being a little larger, the caudal fin without black spots, and the back usually immaculate. It is fairly abundant in the streams of Kokushu, the island formerly known as Yezo, and is found nowhere else in the world. The author had an opportunity to examine a dry-salted masu (it might be well to state here that in Japanese masu means "trout") at the fish house of the Royal Fish Co., in Vancouver, British Columbia, in January, 1916. The manager, Mr. Emy, had imported the fish from his own country. Both in size and general appearance it closely resembled a humpback salmon, and when cut open the flesh had the same coloring observable in our humpback. This species, and the true humpback found in more northern waters, especially in Siberia, are dry salted in immense numbers and are generally marketed under the name of "white trout" or "salmon trout."

In Japan the "red trout" seem to be our rainbow and brook trouts, which were introduced into Japanese waters some years ago. The red salmon (*O. nerka*) is to be found landlocked in Lake Akan in the northern part of the island. It is smaller in size than the sea species. This species has been introduced into the waters of Honshu.

The section of this report devoted to the salmon fisheries of Siberia treats quite fully of the activities of the Japanese in that quarter.

^a Fishes, p. 296. By David Starr Jordan. N. Y., 1907.

In Sakhalin, or Karafuto, as it is called in Japan, the Japanese have had a rather checkered career. At one time this island belonged to the Chinese Empire. Early in the nineteenth century the southern portion was occupied by the Japanese. In 1875 she bartered it to Russia in exchange for some small islands in the Kuril group. As a result of the Russo-Japanese war the southern half, or all that portion south of 50° north latitude, was in 1905 ceded to Japan.

The salmon fisheries of this island are of much importance. For many years the Japanese had a virtual monopoly of them, but very early in the present century the Russians attempted to restrict considerably the activities of the Japanese fishermen, and encouraged her own subjects to compete with them. Many hundreds of Russians and Koreans were encouraged to migrate to the island and engage in its fisheries. Despite these handicaps, the operations of the Japanese fishermen, according to the statistics shown below, do not seem to have suffered.

Year.	Salmon. ^a	Spring salmon.	Total.
	Koku. ^b	Koku. ^b	Koku. ^b
1897.....	8,589	34,246	42,835
1898.....	6,335	11,228	17,563
1899.....	8,379	22,959	31,338
1900.....	7,719	8,797	16,516
1901.....	3,089	12,735	15,824
1902.....			24,725

^a Species not specified.

^b Koku equals about 5½ bushels.

Considerable fishing is carried on around the island of Yetorofu, one of the Kuril group. Here are found red (*O. nerka*), silver (*O. kisutch*), and dog salmon (*O. keta*), also either the humpback or Dr. Jordan's masu.

CANNING INDUSTRY.

The salmon canning industry in Japan proper was inaugurated by the Hokushu Colonization Department, a local branch of the Federal Government. For some time this department had operated a fishery school on Hokushu Island, at which experimental work in the canning of salmon and other fishery products was carried on. This establishment canned considerable salmon during the Russo-Japanese war.

This same department also established a fishery school on Yetorofu Island, one of the Kuril group, which was, in 1908, taken over by Suhara Kakubei, a fisherman and graduate of the school, and used as a salmon cannery.

Some years earlier, however, about 1892 or 1893, Fujino Shirobei started canneries in Shibetsu and Bekkai, Nemuro Province, Hokushu Island, and a short time later Idzumi Shozo also started a plant at Nemuro. For a number of years these three canneries were the only producers. The plants were quite primitive, the product small, and most of it was consumed by the Japanese navy. A demand for the product was gradually worked up, however, and as a result there are now a number of small canning plants on Hokushu Island proper, the Kuril Islands, and Japanese Sakhalin. Most of these plants devote the major part of their energies to the packing

of crab meat, the canning of salmon being in most cases a side issue. A few of the plants have been equipped with machinery, but the large majority are hand-pack plants, employing but a few persons.

Most of these plants pack what is called "white trout," which is really the humpback or masu salmon. In 1912 there were in Hokushu and adjacent islands 21 canneries which packed 730 cases (48 one-pound flat cans each) of red (*O. nerka*) and 72,770 cases (48 one-pound cans each) of "white trout," a total of 73,500 cases.

On the Japanese portion of Sakhalin Island 4 canneries packed 10,120 cases (48 one-pound cans each) of "white trout" in 1912.

The pack of canned salmon in Japanese territory in recent years has been as follows:

Year.	Hokkaido and Kurils.	Karafuto (Japanese Sakhalin).	Total.
	<i>Cases.</i>	<i>Cases.</i>	<i>Cases.</i>
1912.....	73,500	10,120	83,620
1913.....	46,000	.....	46,000
1914.....	50,450	15,000	65,450
1915.....	55,000	15,000	70,000
1916.....	37,800	1,800	39,600
1917.....	39,545	16,607	56,152
1918.....	21,490	5,000	26,490
1919.....	60,500	18,000	78,500

^a Composed of 2,500 cases of 1-pound flat red salmon and 66,000 cases of 1-pound flat chum salmon.

The following table shows the quantities and value of salmon and trout taken by the Japanese fishermen in certain years:

Year.	Salmon.		Trout	
	Pounds.	Yen.	Pounds.	Yen.
1902.....	5,722,475	454,662	923,025	121,499
1907.....	9,286,267	892,879	4,500,008	332,316
1912.....	26,438,017	1,594,230	44,038,383	928,513

FISHERY METHODS.

In Japanese waters salmon are taken by means of trap nets, haul seines, and gill nets.

The haul seines used along the seashore have a length of about 500 fathoms. Each is carried by a boat of 9 feet beam with 30 men, and the right wing, called the "outing wing," is first paid out as the boat heads out from the beach. When the pocket, or bunt, is cast the boat turns its course toward the right and steers gradually landward, casting the left wing. When the school is encircled the seine is hauled ashore by the seine ropes.

The floating trap net used for salmon is known as "kaku-ami," or square trap net. This consists of a main net and lead. The main net, or heart, is 70 fathoms long, 10 fathoms wide, and 10 fathoms deep, and the lead is 120 fathoms long. The latter guides the fish toward the main net. When being fished the pot is hauled up by a boat crew and the fish transferred to the boat by means of a dip net.

FISH CULTURE.

The artificial culture of salmon is carried on in 56 hatcheries, which are distributed in Hokkaido and the prefectures of Aomori, Akita, Yamagata, Niigata, Toyama, Kyoto, Iwate, and Miyagi. Nine of these belong to the government of Hokkaido and other prefectures, while the rest are owned by fishing associations, individuals, or corporations. The number of young salmon distributed by these hatcheries amounts to over 80,000,000 a year.

The largest hatchery is the one at Chitose, under the supervision of the Hokkaido Fishery Experimental Station. It was established in 1887, and it is estimated that the fish distributed by it number from 20,000,000 to 30,000,000 yearly.

The salmon hatchery of Murakami, Niigata prefecture, dates as far back as 1881, when a regulation pertaining to the preservation of young salmon in the River Miomote was enacted by the prefecture of Niigata. This was first called the "Murakami Salmon Raising Plant," but in 1891 it was turned into a hatchery, and is now distributing 2,000,000 young salmon a year. The salmon hatchery of Nitta River, Fukushima prefecture, is very similar in its history and organization to the above.

The industry has during the last few years become very popular in Yamagata prefecture, where 22 hatcheries are in operation as private enterprises.

In the prefectures of Shiga, Miye, Shizuoka, Nagano, Yamanashi, Kanagawa, Akita, Niigata, Hyogo, Miyazaki, and Hokkaido, the masu (*O. masou*) and the landlocked hime-masu (*O. nerka*) are raised and distributed in the lakes and rivers. There are eight hatcheries working on these species. The hatchery of Lake Towada, Akita prefecture, first transplanted hime-masu from Hokkaido in 1902, and it is now hatching from 5,000,000 to 10,000,000 eggs a year for the purpose of distributing the fish among the different districts.

