THE SALMON OF THE YUKON RIVER.

By CHARLES H. GILBERT,

Professor of Zoology, Stanford University.

CONTENTS.

	Page.
Introduction	317
The king salmon (*Oncorhynchus tschawytscha*)	318
Rate of travel	318
Growth and age at maturity	320
The chum or dog salmon (*Oncorhynchus keta*)	325
Rate of travel	326
Year classes	326
Proportions of sexes	327
Size at maturity	328
Growth and scale readings	329
The sockeye salmon (*Oncorhynchus nerka*)	330
The coho salmon (*Oncorhynchus kisutch*)	331
The humpback salmon (*Oncorhynchus gorbuscha*)	332

INTRODUCTION.

The summer of 1920 was spent by the writer, in company with Henry O'Malley, at that time field assistant of the United States Bureau of Fisheries, in investigating the runs of salmon to the Yukon River. The primary object of the expedition was to ascertain the advisability of permitting the operation of one or more salmon canneries on the Yukon, in view of the possibility that they might so curtail the salmon supply that it would fail to provide natives, and white inhabitants as well, with the stores of fish that they find essential under the rigorous conditions of the far northern climate. It was to be determined whether there existed an excess above the needs of the inhabitants that could safely be used for commercial purposes for export beyond the boundaries of Alaska.

This phase of the situation has been dealt with in a report to the Commissioner of Fisheries and was published in 1921.[1] Some of the details that are given in that report concerning the movements of the salmon during their run and the rate of travel that they maintain in their ascent of the river are herein repeated, but the body of the present paper is concerned with the growth-history of the Yukon salmon and the ages at which they have reached maturity. The Yukon River is near the northern limit of range for the Pacific salmon. The effect of the arctic cold on growth and age of maturing is an interesting problem.

[1] Investigation of the Salmon Fisheries of the Yukon River, by Charles H. Gilbert and Henry O'Malley. Bureau of Fisheries Document No. 909a, pp. 128-154. Washington, 1921.

Three of the five species of salmon that occur along the Pacific shores of North America enter the Yukon Basin in sufficient numbers to constitute distinct runs. These are the king or chinook salmon, the chum or dog salmon, and the coho or silver salmon. The names here given are those by which these species are known in other districts of Alaska and generally along the coast to the southward. Unfortunately, in the Yukon Basin, there is confusion in this regard. The coho or silver salmon is most frequently called *chinook*, while the various grades of the chum or dog salmon are known as "*silvers*," "*half-breeds*," and "*dogs*." The king salmon alone, of the three species that ascend the river in numbers, is called by the same name by which it is elsewhere designated.

The two remaining species of Pacific coast salmon, the humpback and the sockeye or red salmon, enter the river each year in small numbers and have no economic importance. To what extent the individuals of these species may be strays from other streams that have well-defined runs has not been determined.

The material on which the present paper is based was obtained from June 15 to July 31, 1920, at the cannery of the Carlisle Packing Co., located in the entrance to Kwiguk Channel, a branch of the Kwikluak or South Mouth of the Yukon.

THE KING SALMON (Oncorhynchus tschawytscha).

The king salmon is the most highly prized for human consumption of the three Yukon species. It is also valued for dog feed, especially in the upper course of the river, for by the time the salmon have fought their way upstream a thousand miles or more even the richest species contains no more oil than is needed to furnish satisfactory dog feed. As it enters the mouth of the river, the Yukon king is the richest salmon known to us. It there drips oil profusely when hung on the racks to dry and is, in fact, too rich for most successful canning. The canned product, if handled roughly, or if shipped to distant points, is in danger of breaking down to a substance of mushlike consistency. King salmon taken at some point higher up the river, where a portion of the oil would have been expended during the ascent, would in this respect furnish a better commercial product.

RATE OF TRAVEL.

The run begins at the mouth of the river in the latter part of May or early in June, almost as soon as the river is clear of ice after the spring break-up; and it lasts as a commercially valuable run for about three weeks. Tradition has it the king salmon appear at points as high as Tanana and the Ramparts at the same time as the first steamer that ascends the river from St. Michaels on the opening of navigation. This would indicate an unprecedentedly high rate of travel in a river with very swift current. Such incomplete data as we have concerning the ascent of salmon in other rivers indicate a rate not to exceed 10 to 20 miles per day. But in the Yukon Basin the distances to be traversed are great—some of the spawning beds being 2,000 to 3,000 miles from the sea—and the summer season is much shorter than in any other large salmon river. These two factors necessitate a high rate of speed in ascending the river, and the fact that this has been developed in the Yukon salmon is one more instance of close adaptation to the conditions of their environment on the part of a highly localized race. Rapid ascent of a river means expenditure of energy out of all proportion to the distance to be traversed. Unusual stores of potential energy in the form of oil are therefore required by the Yukon salmon. We have already referred to the unusually rich provision of oil in the case of the king

salmon, and the same is true of the chum or dog salmon of the Yukon, which excels in richness and amount of oil the chum salmon from all other rivers in as great a degree as that which distinguishes the Yukon kings from other king salmon.

As regards the rate at which they ascend the river, we have more reliable and complete data for the Yukon than have been secured in any other stream. Records were obtained of their first appearance at a large number of localities. Some of these were ascertained by means of wireless messages sent during the early days of the run, before the dates of the first captures should be forgotten. Many others were obtained during our ascent of the river in early August, when all fishing camps were visited and records were inspected concerning the run of the summer. In a number of instances complete written records were available, which gave not only the date on which the first captures were made, but the numbers of fish taken on each day of the season. While we recognize that the capture of the first salmon of the season at different points along the river may vary within a few days in relation to the beginning of the run, we are convinced from an examination of our data that this source of error is not serious and that reliable conclusions concerning rate of travel can be drawn from the table (1) presented below. Whenever two or more records were obtained from different fishermen in the same locality the earliest has been selected.

It will be noted that the lowest rates of travel apparently occur in the lower course of the river. But the results are here obscured by the known fact that salmon, on entering the tidal area of a stream, move back and forth with the tides for an undetermined period, before seriously undertaking the ascent of the river. The influence of this factor, however, will not alone suffice to explain the constant increase in rate of travel as far up the river as Tanana, where it had reached an average for the entire river below this point of 62 miles per day over a period of 13 days.

Above Tanana, the rate again decreases, possibly due to the retarding influence of the Rampart Rapids together with the general increase in current found in the upper portion of the river, but the rate exhibits an unmistakable tendency again to augment as Dawson is approached. The first king salmon to reach Dawson in the middle of July, 1920, had been traveling against a consistently rapid current for 29 days, at the rate of 52 miles per day, and during this period, as always within the river, had taken no food.

TABLE 1.—DATES OF CAPTURE OF FIRST KING SALMON AT A SERIES OF LOCALITIES ALONG THE YUKON RIVER DURING SEASON OF 1920.

Locality.	Date.	Approximate number of miles traveled.	Miles traveled per day.	Locality.	Date.	Approximate number of miles traveled.	Miles traveled per day.
South mouth of river	June 13	.....	.....	Whiskey Creek, above Louden.	June 27	622	52
Run begins south mouth	June 15	.....	.....	Ruby	...do.....	659	55
Pilot Station	June 20	107	21	Tanana	June 28	804	62
Marshall	...do.....	144	29	Fish Creek, above Rampart Rapids	July 3	851	47
Russian Mission	June 21	204	34	Circle	July 11	1,227	47
Paimiut	June 22	259	37	Charlie Creek	July 12	1,317	49
Holy Cross	June 23	279	35	Eagle	July 13	1,402	50
Halls Rapids, above Anvic	June 24	346	38	De Wolf's fish camp	July 14	1,478	51
Camp 51 miles below Kaltag	June 27	440	37	Dawson	...do.....	1,504	52
Kaltag	June 28	491	38				
Koyukuk	June 29	555	40				

The season of 1920 was notably late in Alaska; the break-up occurred in the Yukon fully a week later than usual, and the salmon were equally delayed in entering. As shown by the above table, the first king salmon taken in the delta was captured June 13.

The run culminated quickly within a week after that date, then maintained itself at a fair level for about three weeks, and was practically over by the close of the first week in July. Stragglers appeared during subsequent weeks in July and August but became less and less numerous.

GROWTH AND AGE AT MATURITY.

We have no knowledge concerning the feeding grounds of the Yukon salmon and must leave the question open to what extent, if at all, the young traverse the passes in the Aleutian Chain and attain their growth in the North Pacific. It is entirely possible that throughout their life in the ocean, they remain within the confines of the Bering Sea. None of them have been detected traversing the channels between the Aleutian Islands, nor have they been recognized elsewhere along lines of their migration routes in the sea.

Conditions in Bering Sea, it would seem, must be less favorable for rapid growth than in districts farther south. The northern part of the sea and a strip around the coasts, including Bristol Bay, are covered with ice floe during the winter and early spring months. The temperatures to which the salmon are then exposed must be near the freezing point. At the time they seek the river mouth in May or June the surface temperature in Bering Sea approaches 40° F. Under such adverse conditions growth during the winter season must be at or near a standstill and in the spring might well not be resumed before the beginning of the streamward migration. In that event the scales would exhibit no growth accomplished during the year in which the fish was captured. A salmon in its fifth year would indicate in its scale structure the completion of four full years' growth, and the margin of the scale would be formed by the winter check of the fourth year. In other districts to the southward the salmon of the spawning run have already responded to spring conditions and have begun a period of rapid growth before entering the streams. The scales have participated in this renewed growth, and the margins exhibit a larger or smaller band of widely spaced rings, which lie outside the winter check of the previous year. But in the case of the Yukon king salmon this is not present. The winter check of the previous year forms the margin, and usually no trace exists of any growth belonging to the current year. A very few cases form doubtful exceptions to this generalization, with the outer one to three rings more widely separated at least in a portion of their course. This feature is shown distinctly in the accompanying series of photographs of the scales of Yukon king salmon, ranging from those in their third to those in their seventh year (Figs. 276 to 285).

Another striking peculiarity of the Yukon king salmon is found in their early history as fry and fingerlings. We did not secure any of the young, although attempts were made to capture them with minnow seines on their downward migration, near the mouth of the river. But the central areas of the adult scales contain records of the early history and show conclusively in every instance that the young remained in fresh water for a full year's growth before descending to the sea. In the photographs that follow, the line "1" points to the outer margin of the stream growth, which presents a nucleus of finely crowded lines, beyond which are the widely spaced lines indicating rapid growth after reaching the sea.

This habit of the Yukon kings is in striking contrast to what is observed in streams farther south. In the Fraser River, the Columbia, the Klamath, the Sacramento, and

all other streams thus far examined a considerable proportion of the adult salmon are developed from fry that passed to sea during their first year and completed only a small portion of their first year's growth in fresh water. This "sea type" develops at an earlier age than do those that tarry a year in fresh water, and it frequently constitutes half or more than half the entire run. The absence of the "sea type" in the Yukon may well be related to the severity of the fall and winter, the lateness of the spring, and the shortness of the summer season. It would seem that the hatching of the eggs, the absorption of the yolk, and the emergence of the fry from the gravels must be correspondingly retarded.

A third peculiarity of the Yukon king salmon consists in the retardation of the age at which they attain maturity. In the Columbia River, where, owing to the use of beach seines, wheels, and traps, the smaller salmon are captured in due proportion with those of larger size, the youngest chinooks of stream type that are captured in the spawning run are in their second year. These are all male fish, as are those of the next larger size, which are in their third year. Female chinooks of stream type do not mature in the Columbia until their fourth year, when they are not far inferior in numbers to males of equal age. The commercially valuable portion of the Columbia River run consists of 4 and 5 year fish. Comparatively few individuals reach their sixth year, and none has to my knowledge been reported in its seventh year. The condition in the Yukon is far different. No 2-year fish were secured, and but one 3-year fish, which was a male, 16 inches long, the scale of which is represented in Figure 276.

In spite of the fact that fishing was prosecuted exclusively by gill nets, which during the king salmon run were of large mesh ($8\frac{1}{2}$ or $8\frac{3}{4}$ inches), fish of diminutive size were frequently entangled in the web and captured. Special attention was paid to these, with the object of ascertaining the earliest age at which maturity would be attained in the Yukon race. In addition to the 16-inch individual in its third year, above noted, we examined 44 specimens ranging from 17 to 27 inches, all of them males, in their fourth year. From this it is apparent that no female king salmon mature on the Yukon until after their fourth year. They are therefore retarded at least one year in reaching maturity, as compared with king salmon in the more southern part of the range of the species. (See Figs. 277 and 278.)

Continuing the examination of larger sizes we encountered the first 5-year male at 25 inches, the males of this age ranging from 25 to 40 inches. In the fifth year, for the first time, we encountered female salmon, but these were very few in number. Among the 131 individuals in their fifth year that we have examined, selected wholly by size without reference to sex, there are 119 males and only 12 females. This indicates a still further retardation in age of maturing of females. Not only are there no 4-year mature females (so abundant in more temperate latitudes), but comparatively few females develop maturity even at the age of 5. The 12 of which we have record lie in size within the range of the 5-year males, the smallest being 30 and the largest 37 inches long. (See Figs. 279 and 280.)

The male 6-year fish are numerous, the 79 individuals represented in our series ranging widely from 29 to 48 inches. There is thus a wide overlap in size between the 5 and the 6 year fish, as is always the case, although, as will be noted, the 4 and the 5 year males show but little overlap. Among the 6-year fish, for the first time, females

are really abundant, exceeding in number the males of equal age. Of the 185 6-year individuals, selected without reference to sex, 79 are males and 106 females. (See Figs. 281 to 283.)

Another evidence of retarded development is found in the class of 7-year fish. In streams thus far studied from the Sacramento to the Fraser it is very rare for a king salmon to attain the age of 7 years. Only two such specimens have been observed to my knowledge. In the Yukon, however, members of this class are not uncommon. Although not specially sought for, 42 are included in our series, 10 of these being males and 32 females. Here, again, the late development of females compared with males is made evident. (See Figs. 284 and 285.)

Table 2 gives the distribution by sex, age, and length of all the king salmon of our Yukon series of the run of 1920. For comparison similar data from a series taken from the run of 1919 by C. F. Townsend, fisheries inspector for the Bureau of Fisheries, are included in this table. It should be noted that the relative size of these various classes in our series does not represent their relative abundance in the run. While no selection was made by sex, frequent selection was made by size at critical points. Thus, special attention was paid to the smaller sizes, and these appear in our series in more than their normal proportions. The same is true of individuals approximating 30 inches in length. It was at this size that females first were found, and individuals of this length were specially selected for examination.

TABLE 2.—KING SALMON FROM MOUTH YUKON RIVER, 1920 AND 1919, DISTRIBUTED BY AGE AND BY LENGTH.

Length.	Number of specimens, 1920.							Number of specimens, 1919.						
	4 years—Males.[1]	5 years.		6 years.		7 years.		4 years—Males.[2]	5 years.		6 years.		7 years.	
		Males.	Females.	Males.	Females.	Males.	Females.		Males.	Females.	Males.	Females.	Males.	Females.
17 inches	1													
19 inches	2													
20 inches	4													
21 inches	3													
22 inches	3													
23 inches	6													
24 inches	10							1						
25 inches	8	4						5	2			1		
26 inches	3	2						11						
27 inches	4	8						10	1					
28 inches		7						6			1			
29 inches		20		1				2	2					
30 inches		18	1	1					1		1			
31 inches		12		1	1				3			1		
32 inches		11	3	4					1		1	2		
33 inches		5	3		8				1	1	2		1	1
34 inches		10	2	5	3				3		1			
35 inches		9		9	10		2		1	1	1	10		1
36 inches		4	2	3	10		2		1	1	1	4		1
37 inches		1	1	9	8		1			2	2	5		1
38 inches		4		7	14		4					5		1
39 inches		2		7	7	1	3				2	2		
40 inches		2		5	13	4	6				2	3		1
41 inches				3	13		2				2		2	1
42 inches				7	8	2	7					1	1	1
43 inches				6	7	1	2				2	1		
44 inches				4	2	1	2				1		2	
45 inches				3	1						1			
46 inches				1	1		1							
47 inches				2									1	
48 inches				1		1								
Total	44	119	12	79	106	10	32	40	16	5	20	35	7	8
Average length in inches	23.4	31.3	33.5	38.7	38.5	41.8	40.1	26.3	31	35.6	37.5	36	41.7	37.7

[1] One 3-year-old 16-inch male was discovered in 1920. No 4-year-old females were observed.
[2] No 4-year-old females were found.

The following table (3) gives the average sizes attained by the different year classes in the two years 1919 and 1920, the males and females being stated separately. In comparing these with similar averages obtained in other districts, we must bear in mind that our Yukon material shows no growth belonging to the season in which the fish were captured. Our 4-year individuals had completed three years of growth, but no more, and similarly with each of the other year groups. However, no strict comparison is possible between Yukon 4-year fish and the 3-year fish from other localities, for although the latter had produced a certain amount of new growth in their third year, they had not completed the growth of the third year when they ceased feeding and were captured. In like manner no exact correspondence can be expected between 5-year Yukon individuals and 4-year material from the Columbia or the Fraser. In comparing growth rates from these different localities, the most satisfactory basis will be found in completed lengths of the different year classes, computed from the scales. By length is meant the distance, measured over the curve of the body, from tip of snout to distal end of middle caudal rays.

TABLE 3.—AVERAGE LENGTHS FOR CERTAIN YEAR GROUPS OF YUKON KING SALMON, 1920 AND 1919.

Sex and year.	3-year group.		4-year group.		5-year group.		6-year group.		7-year group.	
	Number.	Average length.	Number.	Average length.	Number.	Average length.	Number.	Average length.	Number.	Average length.
Males:		*Inches.*		*Inches.*		*Inches.*		*Inches.*		*Inches.*
1920	1	16	44	23.4	119	31.3	79	38.7	10	41.8
1919	0	.....	40	26.3	16	31	20	37.5	7	41.7
Females:										
1920	0	.....	0	.....	12	33.5	106	38.5	32	40.1
1919	0	.....	0	.....	5	35.6	35	36	8	37.7

For comparison with other regions we have calculated the growth for each year of their lives of 77 fish belonging to the fourth, fifth, sixth, and seventh year classes and present the results in Table 4. We have followed Fraser's latest paper[2] in taking 1.5 inches (40 mm.) as the average length of the fry when the first scale ring was formed. Several differences are encountered in comparing our results with Fraser's. His material was largely taken in the Gulf of Georgia and included a mixture of fish that would mature during the then current season with others that would delay maturing for one or more years; also, doubtless, a mixture of races, bound for different river basins and unlike in certain of their characteristics. His measurements are throughout smaller than by our method, inasmuch as they do not include the length of the middle caudal rays.

Table 4, which follows, shows with regard to each year class that the growth during the year that precedes maturity is greater than during the corresponding year of classes that reach a greater age. Thus the third year's growth of fish that mature in their fourth year is greater than the third year's growth in fish that would not mature until their fifth, sixth, or seventh years. Furthermore, it is greater in 5 than in 6 year fish and greater in individuals that mature in their sixth than in those that mature in their seventh year. The third-year growths form a regularly ascending series from 7.3 inches in the oldest year class to 12.4 inches in the youngest, and the lengths of the fish at the end of their third year form a similar advancing series. According to this table we should find that the largest series of 3-year fish in the sea at any time is composed of those individuals that will earliest mature. The same is true of the growth of the fourth year

[2] Further Studies on the Growth Rate in Pacific Salmon, by C. M. Fraser. Contributions to Canadian Biology, 1918-1920, pp. 7-27. Ottawa, 1921.

and of the fifth. Slow growth and smaller size mean deferred maturity in all years except the first and the second.

The failure of similar results to appear in Doctor Fraser's article, above referred to, may be due to the mixed nature of his material. His second, third, and fourth year classes are not composed of fish maturing in their second, third, or fourth years, but are accidental assemblages of fish that were in their second, third, and fourth years at the time they came into his hands. His second-year class doubtless contained individuals that would eventually mature variously in their second, third, fourth, and fifth years; and his third-year class, fish that would mature in their third, fourth, and fifth years. Under such conditions differential methods of growth of year classes could not be discovered, even if they should exist. In Doctor Fraser's 1915 material it was indicated that the 4-year fish that were preparing to spawn were larger than those of equal age that would remain in the sea for another year. That result was in harmony with our present findings but was not verified by him in the material of 1916.

TABLE 4.—CALCULATED GROWTH OF YUKON KING SALMON.

Year class.	Number of specimens.	Inches of growth at end of—						Inches of growth during—					
		First year.	Second year.	Third year.	Fourth year.	Fifth year.	Sixth year.	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Sixth year.
Fourth	7	2.6	11.5	23.9	.....	.....	.....	2.6	8.9	12.4	0	.....	.....
Fifth	33	2.7	12.6	22	33.7	.....	.....	2.7	9.9	9.4	11.7	0	.....
Sixth	22	3	11.6	19.2	27.8	38	.....	3	8.6	7.6	8.6	10.2	0
Seventh	15	2.5	11.7	19	27	34	40.7	2.5	9.2	7.3	8	7	6.7
Average	.....	2.7	11.9	21	29.5	36	40.7	2.7	9.2	9.2	9.4	8.6	6.7

In the following table (5) is given the average weight for all specimens of a given length, the males and females being stated separately. The weights were taken with an ordinary spring-balance scales reading to pounds and half pounds. No high degree of accuracy can be claimed for this method, but the results present interesting terms of comparison with the king salmon races of other rivers. The number of records available for each length is insufficient for a wholly reliable average, a fact that will explain irregularities in progression in the table. It will be noted that females of equal length with males average slightly heavier than the latter. There was no noticeable elongation of the jaws in the males at the time this material was examined.

TABLE 5.—AVERAGE WEIGHTS BY UNITS OF LENGTH, YUKON KING SALMON, 1920.

Length.	Males.		Females.		Length	Males.		Females.	
	Number of specimens.	Average weights.	Average weights.	Number of specimens.		Number of specimens.	Average weights.	Average weights.	Number of specimens.
		Pounds.	*Pounds.*				*Pounds.*	*Pounds.*	
16 inches	1	2	.....	.....	34 inches	15	18.2	18.3	4
17 inches	1	2	.....	.....	35 inches	18	20.3	20.4	12
20 inches	4	4	.....	.....	36 inches	7	21.7	22	14
21 inches	3	4.7	.....	.....	37 inches	9	22.4	23.9	11
22 inches	3	5	.....	.....	38 inches	10	25.2	26.3	19
23 inches	6	5.8	.....	.....	39 inches	10	26.8	28	13
24 inches	10	6.1	.....	.....	40 inches	12	29.8	30.5	19
25 inches	11	7.4	.....	.....	41 inches	4	34.3	32.9	15
26 inches	5	7.8	.....	.....	42 inches	9	36.2	34.1	16
27 inches	13	9.6	.....	.....	43 inches	7	35.9	38.3	9
28 inches	7	10.1	.....	.....	44 inches	5	41.2	41.8	4
29 inches	21	11.3	.....	.....	45 inches	3	43.7	42	1
30 inches	19	12.6	11	1	46 inches	1	46	46.5	2
31 inches	13	14	14	1	47 inches	2	49.5	.....	.....
32 inches	15	14.8	17	3	48 inches	1	48	.....	.....
33 inches	5	16.4	17.1	11					

The nuclear area of the scales of Yukon king salmon is of extremely small size and contains correspondingly few rings. Undoubtedly this indicates comparatively very small size for the fingerlings at the time of their downward migration. Our table indicates an average size for migrating fingerlings of 2¾ inches. This is based on the assumption that the fry are 1½ inches long when the first scale ring is formed. If, as seems more probable, they are slightly longer than this, our computed lengths of migrating fingerlings would be correspondingly increased but could not much exceed 3 inches. The greatest length indicated on any scale examined by us is 4⅛ inches. The number of nuclear rings for each year class is as follows:

TABLE 6.—NUMBER OF NUCLEAR RINGS, YUKON KING SALMON, 1920.

Year class.	Individuals having nuclear rings to the number of—											Average number of rings
	5	6	7	8	9	10	11	12	13	14	15	
Fourth	1	1	6	18	7	9	1	.....	.....	.....	.....	8.5
Fifth	1	4	11	9	34	18	5	3	1	.....	1	9.1
Sixth	1	10	26	36	29	29	7	11	1	.....	.....	9
Seventh	2	8	7	9	5	.....	.....	1	.....	.....	.....	7.9

THE CHUM OR DOG SALMON (Oncorhynchus keta).

The chum or dog salmon of the Yukon does not differ from other races of chums that frequent streams in the more southern portion of its range either in external appearance or in any of the structural peculiarities that distinguish this species. As is the case elsewhere, individuals captured in the sea or those that enter streams well in advance of the spawning period are symmetrical silvery fish, easily mistaken at a glance for the sockeye salmon. The discoloration of the skin and the elongation of the jaws, which are later provided with greatly enlarged teeth, are of universal occurrence in this species (as, indeed, in all of the species of Pacific salmon) when sexual maturity is approached. In shorter streams that are colonized by chum salmon, the fish delay entrance until nearly ripe and when first seen have already lost their silvery livery. But in the Yukon, this species penetrates to spawning gravels in the far upper reaches of the river, and it populates as well practically all the tributaries in the middle and the lower course of the stream. We find, accordingly, among the chums entering the mouth of the river a mixture of colonies, some of which are bound for the headwaters, in reaching which they will spend six weeks or more, and others that have not far to go. It is undoubtedly for this reason that the entering fish vary so widely in different portions of the run in the extent of development of those striking characteristics that accompany maturity.

During the season of 1920 all the early chums were of bright silvery color and had abundant oil and a pinkish flesh that turned a deeper red on drying. But in a short time changes appeared, even at the mouth of the river. At first occasional individuals, usually males, appeared in a more advanced stage, with brightly colored bars on the sides of the body and with long hooked jaws. When these were first observed they stood out conspicuously from their fellows, which were still in the "silver" stage. By the last of June these seasonal changes had become obvious in the great mass of chums then running. It was the rule for the males to exhibit elongated jaws, provided with canine teeth, and to show the beginnings of the bright cross-bars that characterize the spawning males of this species. It might be thought that this development would continue un-

checked until the end of the season, but, strangely, during the second week in July a fresh run of chums that was no further advanced than were the chums of early June made its appearance. These also were of bright silvery color and had symmetrical jaws and abundant oil. Although entering relatively late, it seems safe to assume that this run was far from its spawning period and had far to go. Along all the lower and middle portions of the river fishermen who prepare dried salmon for winter use distinguish between the silvery chums and the others. The "silvers" have flesh of brighter color, rich in oil, and of more substance when dried. The others are known as "dog salmon," with intermediate stages called "half-breeds," and are far inferior in value for human consumption or as dog feed.

The Yukon chums in their prime are doubtless of far higher quality than chums from any other river. The differences between them and other races of chums are of similar nature to those that distinguish the Fraser River sockeyes from the same species known as red salmon in the average Alaska streams and to those that distinguish the chinook salmon of the Columbia from the same species ("king salmon") in the shorter streams of the north. The differences in all these cases are not only of similar nature, they are due to the same cause. The fine quality of Yukon chums, Fraser sockeyes, and Columbia chinooks is due to the great length of stream which they must traverse, while fasting, on the way to their spawning grounds and to the large store of oil that they must lay up for use at this time. In no other respects are the chum salmon of the Yukon different from the same species found elsewhere. The Yukon king salmon, as we have previously noted, are characterized by the same excessive provision of oil. They also exhibit in the different portions of the run equally striking differences between bright individuals, relatively green as to eggs and milt, and the sexually advanced forms, with hooked jaws and discolored skin. It would be no less logical to recognize two or three kinds of king salmon than it is to distinguish, as is popularly done on the Yukon, two or three kinds of chums, according to the degree of their advancement toward spawning.

RATE OF TRAVEL.

The chum salmon is generally known as a species that spawns exclusively in the lower courses of streams, often scarcely above the reach of the tides and never far from salt water. It is a remarkable reversal of habit in the Yukon chums that colonies of them should penetrate more than 2,000 miles to the upper tributaries of that great river; and it testifies to the flexibility of organization in salmon that a species that is in general not adapted to long journeys while fasting, can, under spur of necessity, make such journeys without food and exhibit great speed and endurance. From records of the first appearance of chums at a large number of stations during the season of 1920, it was apparent that their rate of travel was not far below that of the powerful king salmon. They entered the river about a week later than the kings, at Tanana they were not more than 10 days behind the latter, and at Dawson they were some 14 days behind the kings. The lower 800 miles of the river, as far as Tanana, were traversed at the rate of 50 miles per day, and the next 700 miles, between Tanana and Dawson, were covered at the rate of 35 miles per day. The lower 1,500 miles were ascended at the rate of 42 miles per day.

YEAR CLASSES.

We have already noted that the king salmon of the Yukon are retarded in their development and mature on the average more than one year later than the king salmon

from southern waters. A similar retardation is observed in chum salmon, which average distinctly older in the Yukon than in any other region of which we have record.

The earliest report on the ages attained by this species and on the relative proportions of the year classes was based on a small collection taken at Bellingham, Wash., early in August, 1910.[3] The number investigated was too small (58 in all) to give reliable averages, but the percentages indicated do not differ materially from those obtained in 1916 by Dr. C. M. Fraser from collections of adequate size taken at Nanaimo and Qualicum, in the Gulf of Georgia. In both cases the majority of the chums were found maturing at the age of 3 and 4 years, with very few individuals at 5 years and an occasional rare specimen in its second year. Table 7 gives the results derived from both sources and also, for comparison, includes a similar grouping of Yukon chums.

TABLE 7.—YEAR-CLASS DISTRIBUTION, SOUTHERN AND YUKON CHUM SALMON.

Origin of salmon.	2 years.	3 years.	4 years.	5 years.	Total.
Southern chums:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Number.*
Bellingham	0	53.5	44.8	1.7	58
Qualicum	0	34.5	64.3	1.2	1,300
Nanaimo	0.1	46.6	52.4	.9	700
Average of southern chums	0.1	44.8	53.8	1.3	2,058
Yukon chums	0	3.3	68.1	28.6	448

The Yukon chums mature in their third, fourth, and fifth years, as is the case in more southern waters, but the number of 3-year-olds is diminished from nearly half to one-thirtieth of the total number, and the 5-year fish show a corresponding increase from 1 to nearly 30 per cent. The retardation in the maturing of the northern race is thus evident.

PROPORTIONS OF SEXES.

It has commonly been reported that dog-salmon males are greatly in excess of the females, but no thoroughly satisfactory investigation of this subject has been made. To accomplish this, an examination would have to be made of the ratio of males to females at frequent intervals throughout an entire run. It might well be expected that the proportions of the sexes would differ widely during consecutive portions of the run, with the result that any deficiency in the number of females observed at the beginning of the run would be compensated for by an excess of females later on. Such an occurrence has been repeatedly observed in certain sockeye colonies. Four-year male sockeyes entering Rivers Inlet, British Columbia, in 1917, varied from 100 per cent of the 4-year class in early July to 52 per cent on July 31; and the 5-year males varied from 59 per cent of the 5-year group on July 10 to 23 per cent on July 31. It is clear, therefore, that a series of observations on fish bound for one river only will be necessary to enable us to determine this point.

Doctor Fraser's results, from fish taken partly near the mouth of the Little Qualicum River and partly from the vicinity of Nanaimo, agree in showing from both districts an increased percentage of males in the older year classes. The percentages of males in the third, fourth, and fifth year classes in the Nanaimo lot, range 42.6, 62.1, and 100; in the Qualicum lot, 51, 63.8, and 86.4. If these represented the average percentages

[3] Age at Maturity of the Pacific Coast Salmon of the Genus Oncorhynchus, by Charles H. Gilbert. Bulletin, U. S. Bureau of Fisheries, Vol. XXXII, 1912 (1914), p. 18. Washington, 1913.

during the entire season we should have a considerable preponderance of males over females on the spawning beds and we should also have indicated a relatively earlier maturing of females than of males. Both of these results would be unexpected. While no determination has been made of the ratio of the sexes in dog-salmon fry, analogy with other species of salmon would make it appear probable that males and females are in approximately equal numbers at the time of hatching. If this be true, a final excess of males in the spawning run could only be brought about by selective mortality directed against the females. It does not seem probable that this exists. As regards an earlier maturing of the females than of the males, producing a heavier percentage of females in the younger groups, we can only note that this would be the reverse of what occurs in king salmon, sockeyes, and cohos.

In the Bellingham material, previously referred to, we found 67 per cent males and 33 per cent females, the proportion of males and females being approximately the same in the third and the fourth year groups. In Doctor Fraser's material, the totals showed 59 per cent males and 41 per cent females.

The Yukon specimens, 448 in number, contained 57.6 per cent males and 42.4 per cent females. The 3-year fish had 53.3 per cent males; the 4-year fish, 53.8 per cent; and the 5-year fish 67 per cent.

SIZE AT MATURITY.

The length and weight frequencies are given in Tables 8 and 9, which follow. These indicate unmistakably that the northern race is retarded in its growth and reaches a smaller size in each year class than is attained in Puget Sound and the Gulf of Georgia by fish of equal age. To compare with the average lengths of Yukon chums, we repeat below those given by Doctor Fraser based on Qualicum and Nanaimo material. As measurements of the latter were taken only to the base of the middle caudal rays and our measurements include the length of the middle rays themselves, we have added 7½ per cent to Doctor Fraser's measurements to make them comparable.

TABLE 8.—YUKON CHUM SALMON, 1920, GROUPED BY AGE, SEX, AND LENGTH.

Length.	Number of individuals in—						Length.	Number of individuals in—					
	Third year.		Fourth year.		Fifth year.			Third year.		Fourth year.		Fifth year.	
	Males.	Females.	Males.	Females.	Males.	Females.		Males.	Females.	Males.	Females.	Males.	Females.
21 inches		1					29 inches			2		9	
22 inches				2			29.5 inches			2		7	
22.5 inches		3		4			30 inches			1		3	
23 inches	2			11			30.5 inches					1	
23.5 inches		1	1	16			31 inches					4	
24 inches	2		3	31	1	3	31.5 inches					2	
24.5 inches	4	2	9	31		6							
25 inches			19	14	1	8	Total	8	7	164	141	86	42
25.5 inches			16	15		9	Average length in inches	24	23	26.4	24.4	28.2	25.7
26 inches			24	12	3	4	Gulf of Georgia, average length in inches (Fraser)	28	26.9	30.7	29.1		
26.5 inches			26	4	4	4							
27 inches			25		10	5							
27.5 inches			24	1	10	1							
28 inches			7		16	1							
28.5 inches			5		15	1							

TABLE 9.—YUKON CHUM SALMON, 1920, GROUPED BY AGE, SEX, AND WEIGHT.

Weight.	Number of individuals in—						Weight.	Number of individuals in—					
	Third year.		Fourth year.		Fifth year.			Third year.		Fourth year.		Fifth year.	
	Males.	Females.	Males.	Females.	Males.	Females.		Males.	Females.	Males.	Females.	Males.	Females.
4 pounds		1		1			12 pounds			1		13	
5 pounds	1	2		17			13 pounds			1		5	
6 pounds	3	3	7	51		3	14 pounds					4	
7 pounds	3	1	28	52	3	17	17 pounds					1	
8 pounds	1		52	18	8	13							
9 pounds			47	2	20	6	Total	8	7	164	141	86	42
10 pounds			22		18	3	Average weight in pounds	6.5	5.6	8.3	6.5	10.5	7.7
11 pounds			6		14								

The length-weight relationship, indicated in Table 10, is given without reference to age. The average weight of all males and, separately, of all females that have the same length is stated. According to this table, females average slightly lighter than males of equal length, those from 23 to 28 inches in length averaging 97 per cent of the corresponding males. The reverse of this might have seemed reasonable because of the slightly lengthened jaws in the males.

TABLE 10.—AVERAGE WEIGHTS, BY UNITS OF LENGTH, YUKON CHUMS, 1920.

Length.	Males.		Females.		Length.	Males.		Females.	
	Specimens.	Average weight.	Average weight.	Specimens.		Specimens.	Average weight.	Average weight.	Specimens.
	Number.	*Pounds.*	*Pounds.*	*Number.*		*Number.*	*Pounds.*	*Pounds.*	*Number.*
21 inches	0		4	1	27 inches	69	9.1	9	7
22 inches	0		5.1	9	28 inches	43	10.3	9.5	2
23 inches	3	5.7	5.7	28	29 inches	21	11.3		
24 inches	19	6.7	6.4	73	30 inches	5	12.6		
25 inches	36	7.3	7.3	46	31 inches	6	14.3		
26 inches	56	8.2	7.9	24					

GROWTH AND SCALE READINGS.

In Figures 290 to 298 are presented photographs of a series of scales of Yukon chum salmon that include representatives of all the year classes found in our collection. All of these agree in belonging to the sea type—that is, the scales were wholly formed in the sea, the fry having passed out of the river at a very early age, before even the nuclear plate and the first scale ring had been formed.

The Yukon chums agree in this respect with their southern relatives. All leave their native streams as soon as the yolk is absorbed and they are free swimming. In more southern districts this seaward migration is easily accomplished. The eggs are laid in gravels not far removed from the tides, and the young, when free, easily drop down with the current to the shore line. The case is less simple with the Yukon fish, many of which have 2,000 miles or more to cover at a period when they average only 1½ inches long. No information is available concerning the dates on which this migration is effected. Observations farther south indicate a very early descent to the sea in the spring of the year. It is not known, however, to what extent hatching of the eggs and development of the young on the Yukon are retarded by the very low temperatures to

which they are exposed. Growth during the seaward migration can not be considerable, for none of the material that we have examined indicates the formation of the scale nucleus while still in the stream.

Growth of this species in the sea seems to proceed with remarkable regularity, with the result that the scales are diagrammatic in their simplicity and seldom afford any difficulty in determination of age. In the case of the Yukon race, such uncertainty as may be experienced is concerned with the interpretation of the peripheral region of the scale and is based on the fact that the scale margins differ widely in condition among individuals captured on the same date. It is generally recognized that individuals of a given race will vary materially in the date on which they begin the rapid growth of the spring after the winter pause. Among the fish captured in May or early June in more southerly waters an occasional individual may indicate no growth of the current season, while others will vary in the number of peripheral wide rings by which the amount of spring growth may be computed. In the Yukon dog salmon, however, this variation at the time they leave their feeding grounds and enter on their spawning run is extreme. An occasional fish, as shown by Figure 296, had begun no new growth of the year, the margin of the scale being formed by the close-ringed check of the previous winter. Others, as represented in Figure 294, had barely inaugurated the new growth, which is indicated by two or three wide rings outside the winter check. There then follow fairly complete series with ever-increasing growth of the season, as shown in Figures 297, 290, 291, and 292, the last named having finished an average season's growth for the third year, with the exception of the winter check.

When it is recalled that these dog salmon enter the Yukon in company with the king salmon and that the king salmon have not in any case made unmistakable growth for the current season, the habit of the dog salmon in this regard seems most peculiar. In the early and middle parts of the run, to which alone we had access, none of the individuals examined had begun a winter check at the margin of the scales for the current year. Where a marginal winter check existed, it had been formed the previous winter and presented no real difficulty in determining age. If the latter part of the run should be found to contain a group of individuals in which a check was forming at the scale margin and also another group with scales like Figure 293, in which the marginal check belonged to the previous winter and no further growth had been registered, a real difficulty might arise in determining the age of such individuals. The two groups would show essentially similar scale structure, but one would be one year older than the other. It is not probable, however, that representatives of these two classes would be found together in any portion of the run. As the season advanced we should expect to find extremely few, if any, that had failed to produce some new growth of the year.

THE SOCKEYE SALMON (Oncorhynchus nerka).

A few scattering sockeyes (Alaska red salmon) enter the Yukon River during July and early August. In 1919 the Carlisle Packing Co. put up 22 cases of talls and 6 cases of flats of this species and handled a total of about 300 fish. The sockeyes appeared even less numerous in the following year, when only 5 cases, containing about 60 fish, were packed.

If a permanent colony of red salmon exists in the Yukon, it must ascend to the lakes near the source of the river, but we have no knowledge that such spawning grounds for this species exist. That individuals ascend the river for long distances is certain,

for we learned of their occasional occurrence up the river from men who were acquainted with the different species of salmon, and we observed one, a male, decidedly pink in color, at Ruby on August 14, 1920, some 650 miles above the mouth of the river.

We examined 23 specimens in 1920 on July 5, 7, 8, 9, and 13. Thirteen of these were in their fifth year (see Figs. 299 and 300), having spent their first year (perhaps 15 months) in fresh water and having descended to the sea in their second year. The scales exhibit a vigorous fresh-water growth, followed by three complete year records at sea. A few of these scales, as in Figure 300, have a marginal check, which was formed during the preceding winter; but a majority have at the margin from one to four wide rings denoting new growth of the year.

In addition to the individuals in their fifth year, one year of which was spent in fresh water, we have eight that had remained in fresh water an additional year and were maturing in their sixth year. A scale of one of the latter class is represented in Figure 301, the division between first and second year's growth in fresh water being clearly indicated. Here, again, the growth of the new year is faintly but unmistakably shown along the anterior left-hand margin of the scale.

A third class of individuals is represented by Figure 302, these having descended to the sea soon after hatching and prior to the growth of the scale. The two salmon we examined belonging to the sea type, one a male 27½ inches long, the other a female 23½ inches long, had matured in their fourth year, one year earlier than any of those that had lingered in fresh water.

Whether the Yukon red salmon are strays from some colony to the southward or form an unflourishing local race can not be determined at present. There is no reason to believe that more than one race is represented in our meager material.

THE COHO SALMON (Oncorhynchus kisutch).

The coho or silver salmon develops a regular run in the Yukon River, appearing sparingly at the mouth of the river in the latter part of July, but the run does not show any real development until in August. The Carlisle Packing Co., in 1919, packed 7 cases of cohos on July 14 and 3 on August 2. From August 3 to 9, 59 cases were put up and in the following week 985 cases. The total pack to August 30 was 3,181 cases.

In 1920 this species was entering the mouth of the river in very limited numbers during the last week in July and does not appear in the cannery pack of that year, as canning operations were discontinued before the run had developed. During the early half of August, between the mouth of the river and Tanana, we found at all fishing camps that occasional individuals were being taken. But we were unable to learn of its occurrence in the main river above Tanana. It is well attested that the species enters the Tanana and spawns in one or more tributaries of the Kantishna. How generally it is distributed over the basin we were unable to ascertain.

When the coho enters the river it is a perfectly symmetrical fish, with brilliant silvery color, but in traversing the lower portion of the river it takes on a red livery, and the males assume at the same time the characteristic snub-nosed appearance of the breeding fish, the upper jaw becoming bluntly hooked over the lower in a manner characteristic of this species.

Scales of Yukon cohos are represented in Figures 286 to 289. As in all other coho colonies that we have examined, those from the Yukon are always in their second year

of sea growth when captured.[4] Outside the narrow-ringed central area, which records the life in fresh water, we invariably find in this species a vigorous summer growth, succeeded by a well-marked winter check, and this in turn followed by an extensive marginal growth of widely-spaced rings, which measure the growth of the current season of capture.

In the southern part of its range, where the coho uniformly spends one season in fresh water before migrating seawards, the spawning run (aside from a few male grilse in their second year) consists exclusively of 3-year fish. As we proceed northward, however, we encounter individuals that have tarried two years in the streams and are maturing in their fourth year. These are more abundant in the Yukon than in any other stream we have examined. Our small collection of 31 individuals comprises 12 that have spent one year in a stream and are 3 years old (see Figs. 286 and 287) and 18 that remained two years in fresh water and are in their fourth year (Fig. 288). If the customary proportions are shown in this collection, some 60 per cent of the young spend two years in fresh water. One individual of our collection (Fig. 289) had apparently spent three years in the river and was maturing in its fifth year. The number of individuals at our disposal is too small in the various classes to give reliable averages. Six 3-year males average 23.8 inches in length (middle caudal rays included, as in all our measurements); four 3-year females, 24.6 inches. Eleven 4-year males (two years in fresh water) average 24.5 inches; six 4-year females, 25.3 inches. As males are consistently larger than females among Pacific salmon, we have additional reason for distrusting the adequacy of the above figures. The 5-year male (three years in stream) is 23 inches long.

THE HUMPBACK SALMON (Oncorhynchus gorbuscha).

Scattering humpbacks enter the river in July and August and are then so near their spawning time that they would be unable to ascend the stream for any considerable distance. We observed one ripe male at Andreafski on August 3 and were unable to learn of the occurrence of the species beyond that point.

The individuals observed were all small and without value, having often liquid milt and partly free eggs. Four specimens measured from 20 to 22 inches in length and weighed from 4 to 5 pounds. As in the case of all other humpbacks that have been examined for age, these were in their second year and had proceeded to sea as soon as free swimming, their scales registering none but sea growth. The small size was doubtless due in part to the fact that they were maturing so early in the season, thus greatly limiting the growth of the second year. The scales all indicated this history, for the area representing growth of the second year was narrow and contained a partial check at the margin.

[4] We do not here include the few male grilse, which in more southern districts mature during the first year at sea.

FIG. 276.—Scale of king salmon taken from mouth Yukon River July 2, 1920. Male, 16 inches long, weight 2 pounds; in its third year.

FIG. 277.—Scale of king salmon taken from mouth Yukon River July 2, 1920. Male, 24 inches long, weight 6 pounds; in its fourth year.

FIG. 278.—Scale of king salmon taken from mouth Yukon River June 18, 1920. Male, 24½ inches long, weight 7 pounds; in its fourth year.

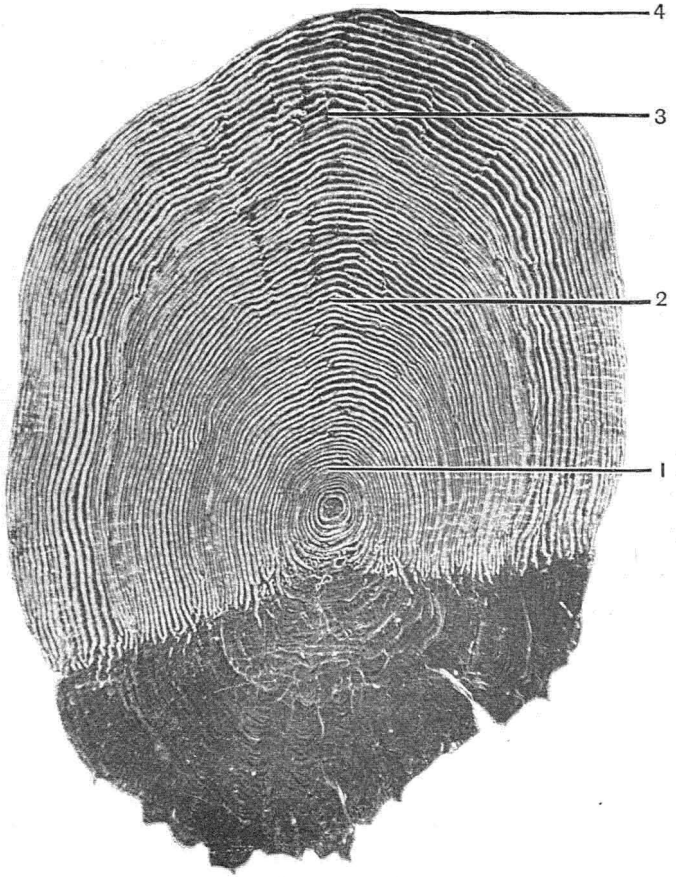

FIG. 279.—Scale of king salmon taken from mouth Yukon River June 18, 1920. Male, 31½ inches long, weight 14 pounds; in its fifth year.

FIG. 280.—Scale of king salmon taken from mouth Yukon River July 2, 1920. Male, 28 inches long, weight 9 pounds; in its fifth year.

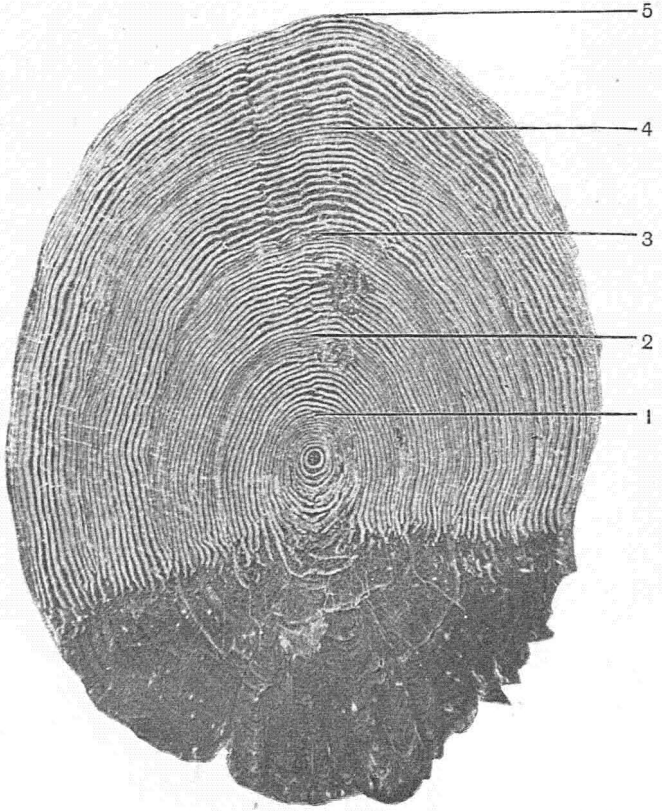

FIG. 281.—Scale of king salmon taken from mouth Yukon River July 8, 1919. Male, 30½ inches long; in its sixth year.

FIG. 282.—Scale of king salmon taken from mouth Yukon River July 8, 1919. Female, 36 inches long; in its sixth year.

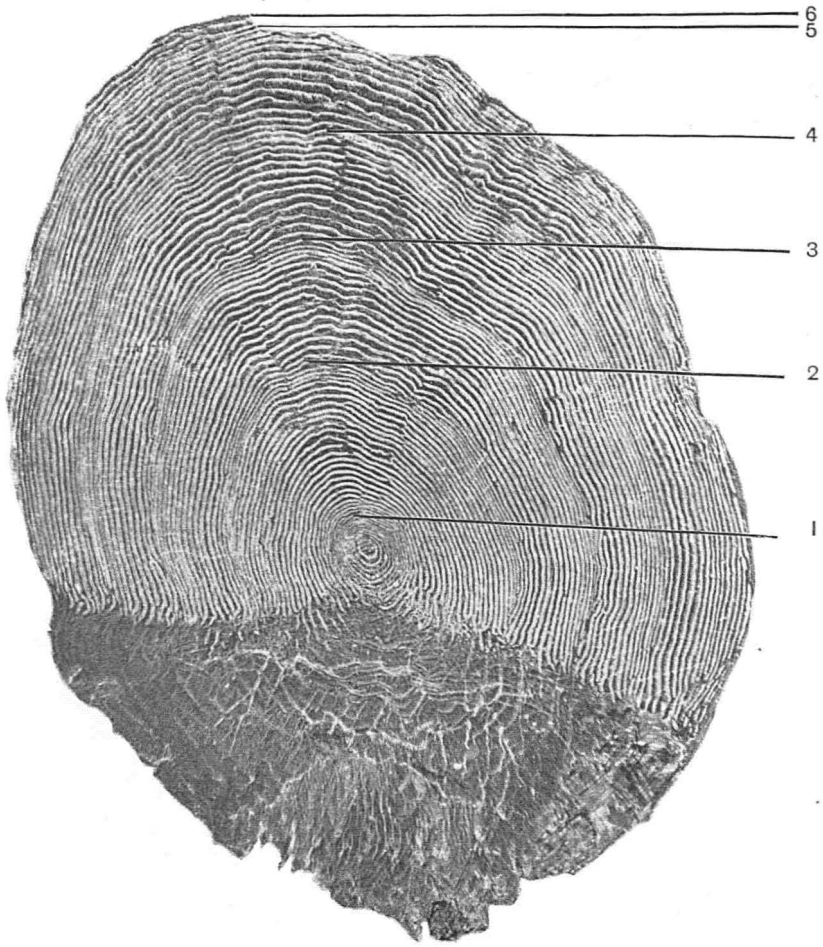

FIG. 283.—Scale of king salmon taken from mouth Yukon River July 8, 1919. Male, 28½ inches long; in its sixth year.

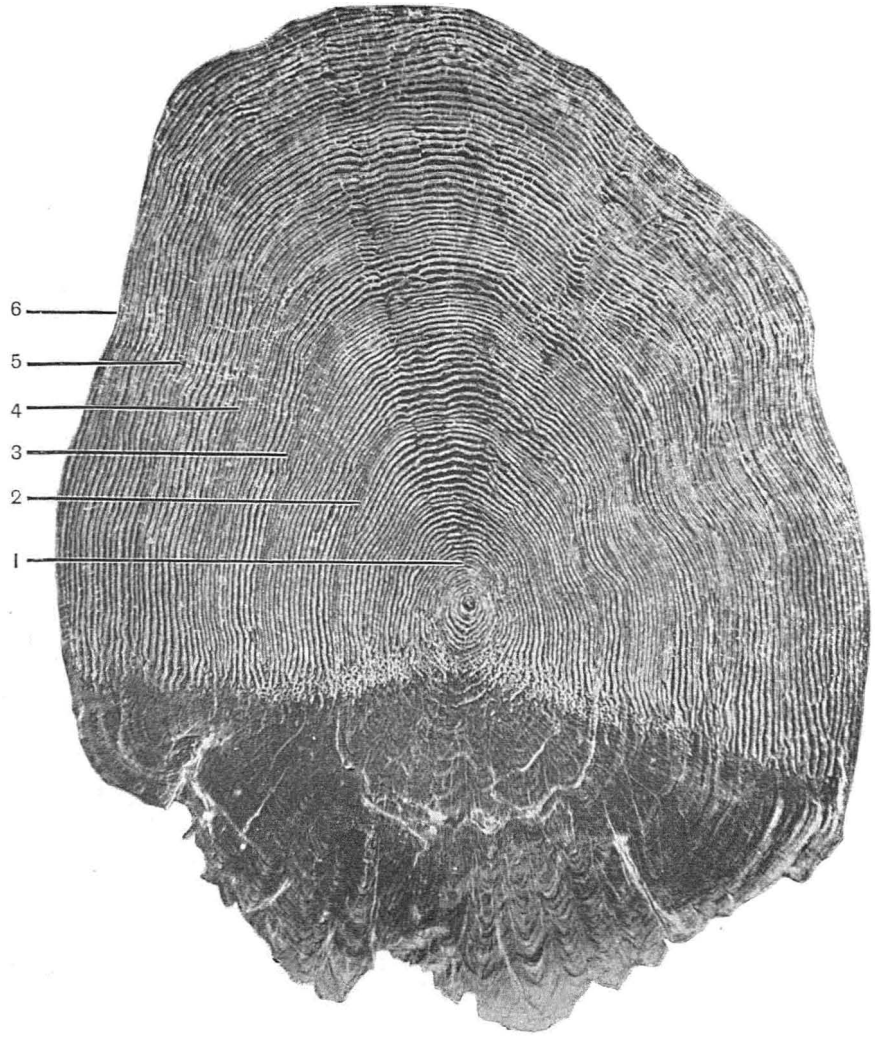

FIG. 284.—Scale of king salmon taken from mouth Yukon River June 25, 1919. Female, 37 inches long; in its seventh year.

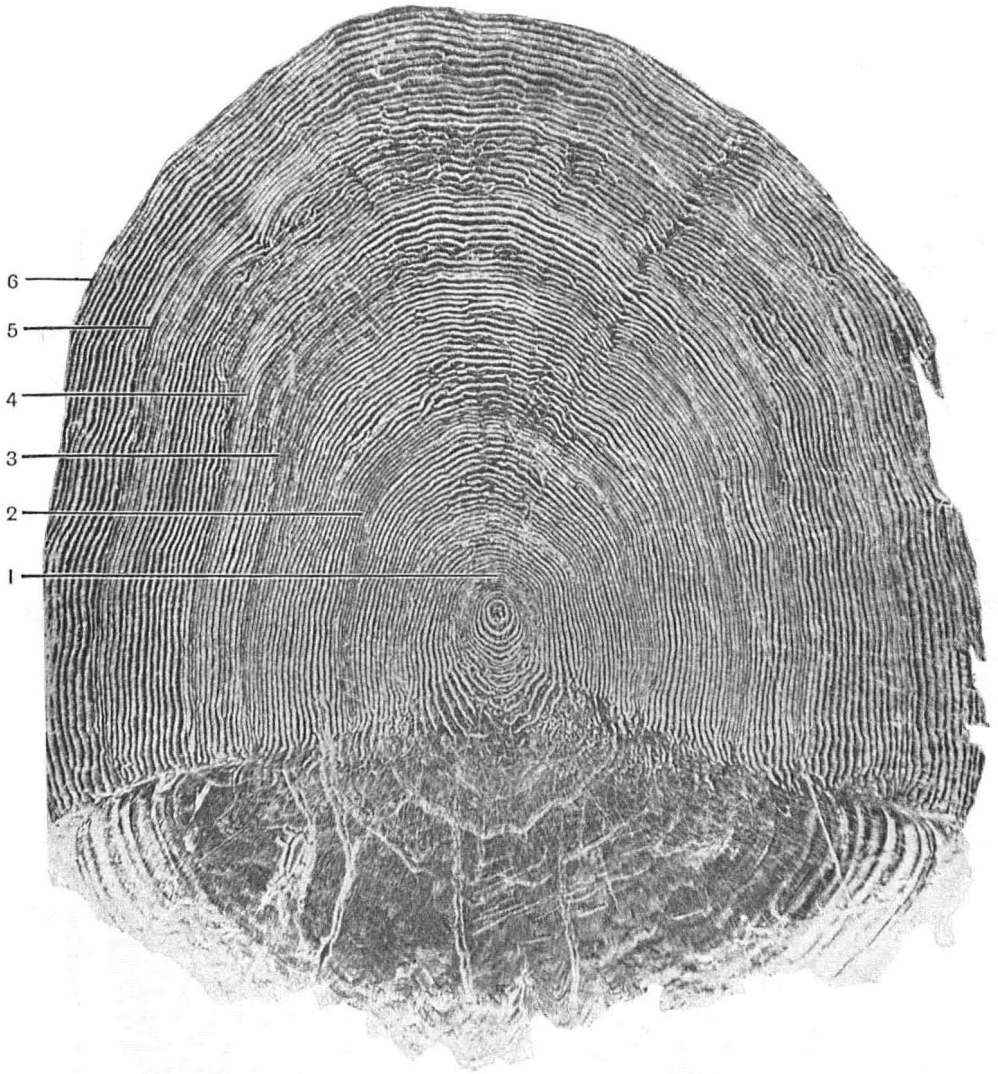

FIG. 285.—Scale of king salmon taken from mouth Yukon River July 8, 1919. Male, 33½ inches long; in its seventh year.

FIG. 286.—Scale of coho salmon taken from mouth Yukon River August 1, 1920. Female, 25½ inches long, weight 9 pounds; in its third year.

FIG. 287.—Scale of coho salmon taken from mouth Yukon River July 31, 1920. Female, 24¼ inches long, weight 7 pounds; in its third year.

FIG. 288.—Scale of coho salmon taken from mouth Yukon River July 30, 1920. Male, 23½ inches long, weight 6 pounds; in its fourth year, having spent the first two years in fresh water.

FIG. 289.—Scale of coho salmon taken from mouth Yukon River July 31, 1920. Male, 23 inches long, weight 6 pounds; apparently in its fifth year, having spent three years in stream as fingerling.

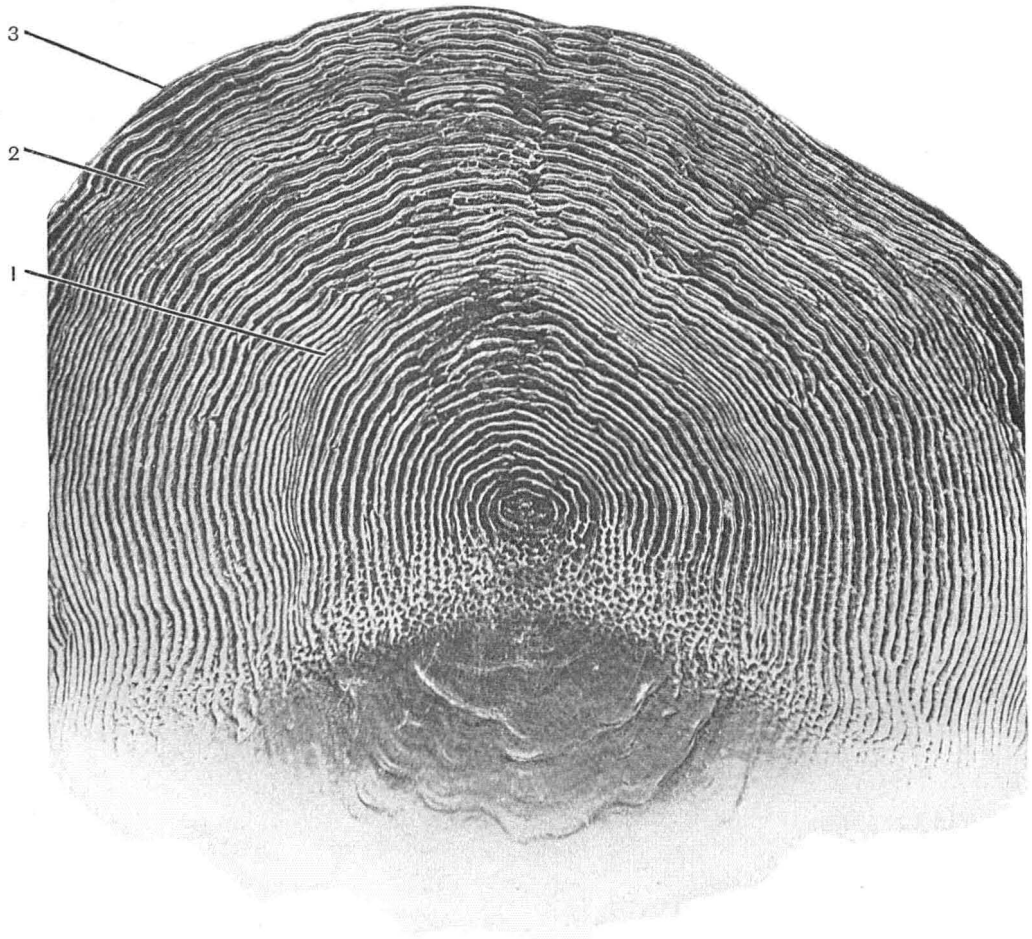

FIG. 290.—Scale of chum salmon taken from mouth Yukon River July 2, 1920. Female. 23½ inches long, weight 5 pounds; in its third year.

FIG. 291.—Scale of chum salmon taken from mouth Yukon River July 7, 1920. Female, 24½ inches long, weight 6 pounds; in its third year.

FIG. 292.—Scale of chum salmon taken from mouth Yukon River July 7, 1920. Male, 23 inches long, weight 6 pounds; in its third year.

FIG. 293.—Scale of chum salmon taken from mouth Yukon River July 31, 1920. Male, 27½ inches long, weight 9 pounds; in its fourth year.

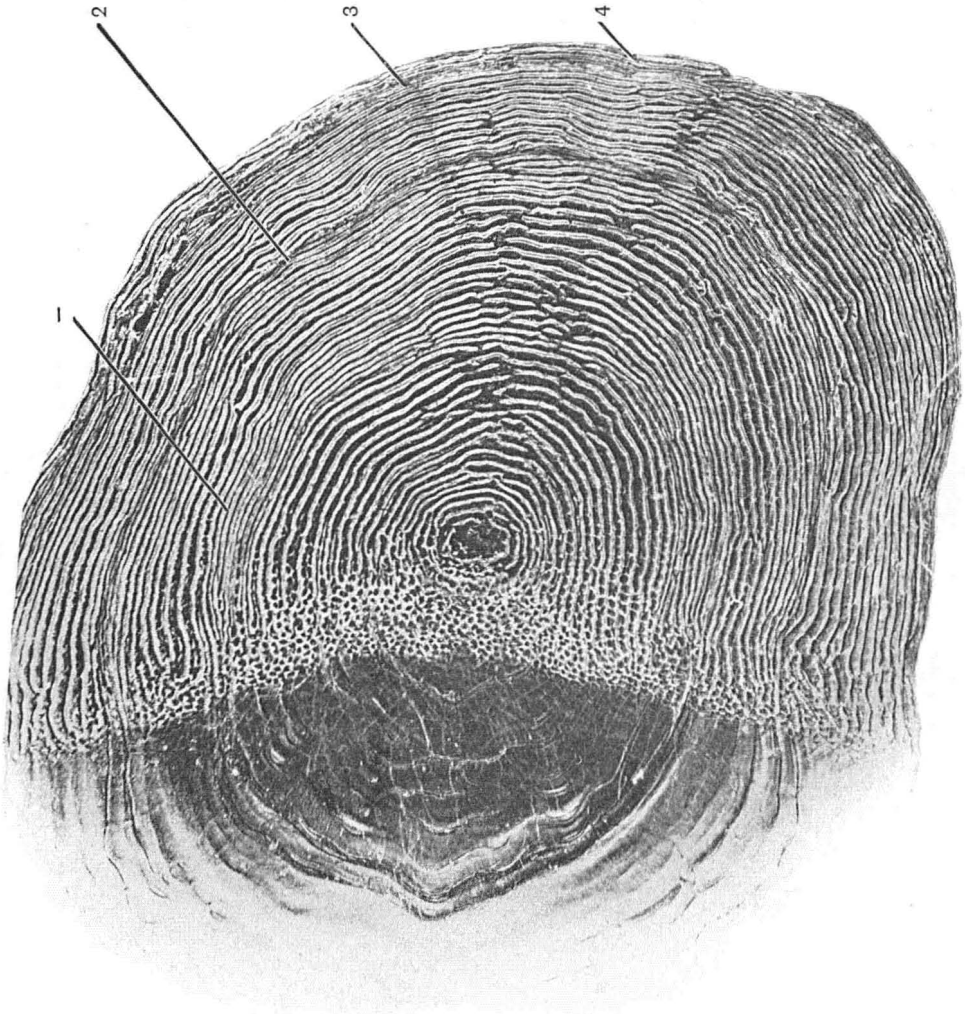

FIG. 294.—Scale of chum salmon taken from mouth Yukon River July 7, 1920. Female, 23 inches long, weight 5 pounds; in its fourth year.

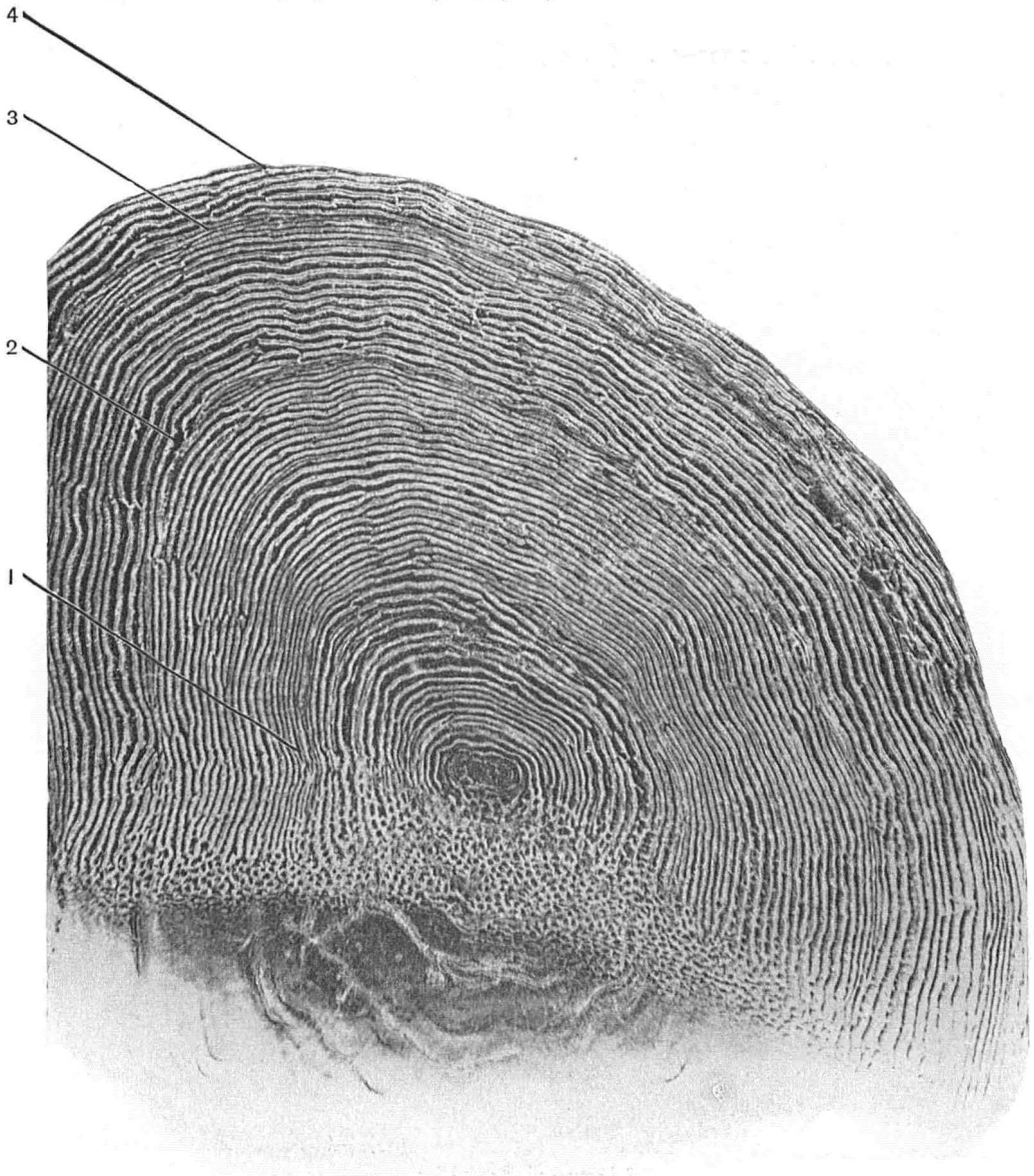

FIG 295.—Scale of chum salmon taken from mouth Yukon River July 31, 1921. Male, 27½ inches long, weight 9 pounds; in its fourth year

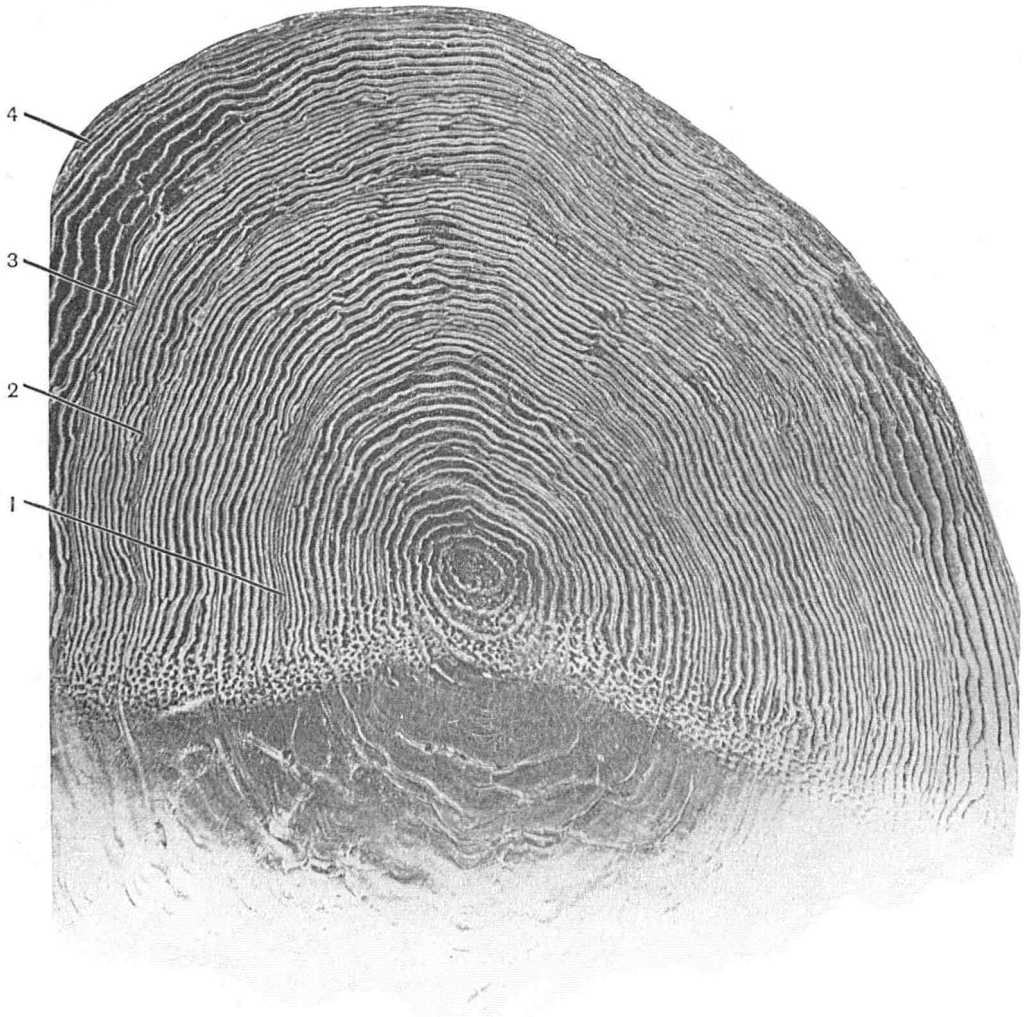

FIG. 296.—Scale of chum salmon taken from mouth Yukon River July 2, 1920. Female, 26 inches long, weight 7 pounds; in its fifth year.

FIG. 297.—Scale of chum salmon taken from mouth Yukon River July 7, 1920. Female, 24½ inches long, weight 7 pounds; in its fifth year.

FIG. 298.—Scale of chum salmon taken from mouth Yukon River July 7, 1920. Male, 28 inches long, weight 10 pounds; in its fifth year.

FIG. 299.—Scale of sockeye salmon taken from mouth Yukon River July 8, 1920. Male, 27 inches long, weight 9 pounds; in its fifth year.

FIG. 300.—Scale of sockeye salmon taken from mouth Yukon River July 8, 1920. Female, 23 inches long, weight 6 pounds; in its fifth year.

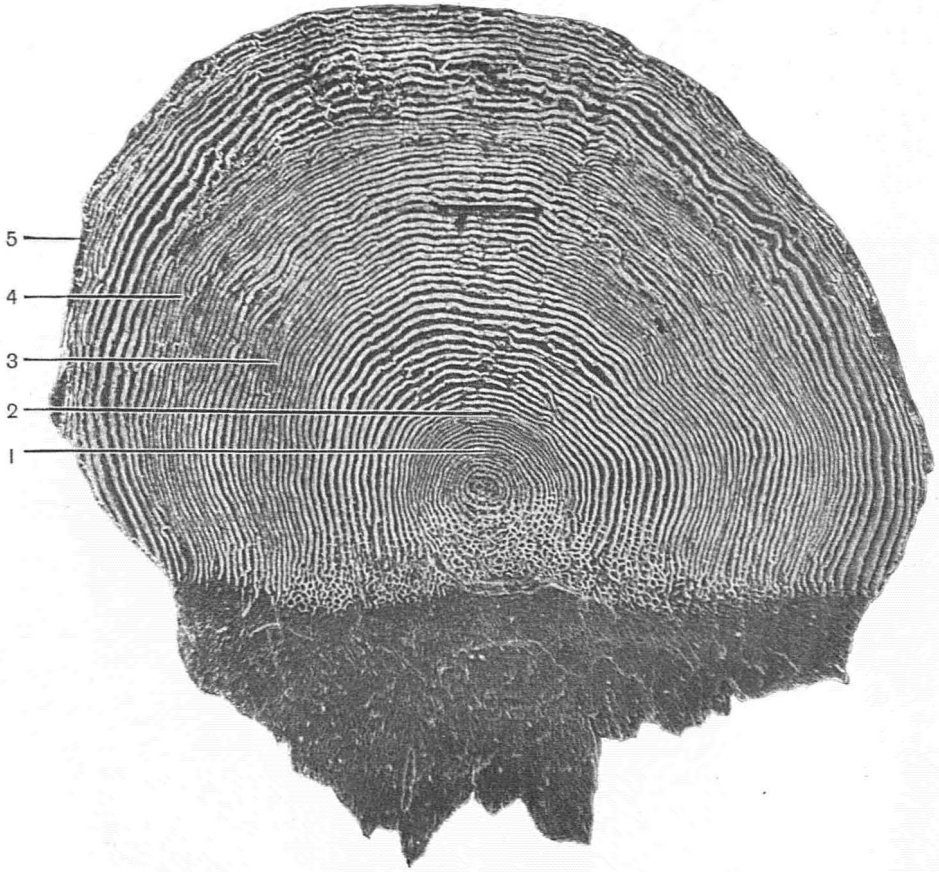

FIG. 301.—Scale of sockeye salmon taken from mouth Yukon River July 9, 1920. Male, 26½ inches long, weight 8 pounds; in its sixth year, having spent two years in lake after hatching.

FIG. 302.—Scale of sockeye salmon taken from mouth Yukon River July 13, 1920. Male, 27½ inches long; in its fourth year; sea type.