

STUDIES OF THE SCALES OF UMPQUA

RIVER SPRING CHINOOK SALMON

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INTRODUCTION

A study of the scales of Umpqua River spring chinook salmon was made from mid-September to December 1, 1951. The study was undertaken to determine the age composition and probable life history of spring Chinooks in this river. The study was made at the Oregon State College Fisheries Research Laboratory at Yaquina, Oregon. The salmon scales were obtained by fishery biologists and other personnel of the State Game Commission. Scales obtained in the years 1946 through 1951 were studied.

Thanks are expressed to Mr. H. Ross Newcomb of the Oregon State Game Commission and the Unit for his assistance in determining the age of salmon by scale pattern interpretation. Mr. Newcomb also provided helpful information concerning the time and the size of the Umpqua River spring Chinook run. Thanks are also due Mr. Carl Bond, instructor in the Department of Fish and Game Management at Oregon State College, for help in interpreting scale patterns.

METHODS

Five specimens from each scale envelope were cleaned and mounted dry between two microscope slides. The mounts were studied under a binocular microscope and also by means of a camera lucida. Each slide

* An assignment by the Oregon Game Commission to the Oregon Cooperative Wildlife Research Unit. Approved by the Coordinating Committee Oct. 11, 1951.

was examined on at least three separate occasions. The age determination was made each time without referring to any previous age determination for that scale. Scales of questionable age were examined by either Mr. Newcomb or Mr. Bond. A few slides containing scales whose age could not be definitely established were omitted from the study.

The ages of fish given in this paper represent the year of life in which the fish was taken. A fish aged five years, for example, would have four annuli (or three annuli plus an assumed annulus at the edge in cases where much absorption was evident) plus some growth beyond the fourth annulus. It would be in its fifth year of life but would not have completed five full years of growth.

Some experimenting was done with methods that had an indirect bearing on scale reading. Scale impressions were made using cellulose acetate. Only a few scale impressions were made since they were found to be of little value in this particular study. Prints of certain scales were made by using the scale as the photographic negative and projecting it onto enlarging paper. The details of these two methods and of the method used in making dry mounts of scales will not be discussed here. This information is available at the Cooperative Wildlife Research Unit at Oregon State College.

DISCUSSION

The source of the scales used in this study was from the catch by sport fishermen. It must be assumed that the fishermen are taking a representative sample of the population if the age composition of the race is to be determined from this sample. There is the possibility

that sport fishing is selective but it is thought to be no more so than gill nets. References will be cited in later paragraphs showing age characteristics of the spring Chinook run. The age characteristics of the fish under study agree closely with these findings. It is thought, therefore, that the fish under study do represent a typical cross-section of the Umpqua River spring Chinook run.

The vast majority of the scales examined showed a closely-spaced area of circuli at the nucleus. Gilbert (1913) refers to this tight-ringed area as the 'stream type' of nucleus. It indicates a period of growth in fresh water at a slower rate than that attained in the ocean. This nuclear area represents approximately one year spent in fresh water. The 'sea type' of nucleus mentioned by Gilbert (op. cit.) was not observed in any of the scales examined. This type of nucleus is characterized by more widely-spaced circuli and would appear in the scales of Chinooks that went to sea shortly after hatching in their first year of life. A few scales showed closely-spaced circuli extending well beyond the first annulus. This would suggest that the fish had spent two years or at least more than one year in fresh water. Mr. Newcomb stated that Chinooks six inches in length had been obtained at Winchester in April and May. Winchester is about one-hundred miles above the mouth of the Umpqua River. The size of these fish would indicate that they were in their second year of life although no age determinations were made. Apparently some young Chinooks remain in fresh water considerably longer than one year, possibly two full years, before migrating to the ocean. The majority of Umpqua River spring Chinooks, however, spent one year in fresh water and migrated to the ocean early in their second year.

Individual scales showed variations in their growth rate in the second and subsequent years. The second year of life in most cases was marked by a broad band of widely-spaced circuli indicating much growth. The growth in the third and fourth years was generally less than in the second year. The evidence for this is the narrower bands of circuli on the scales formed during these years. It may be said that growth increases at a decreasing rate after the second year. It must be remembered that scale growth is correlated with the growth of the fish in length as Van Oosten (1929) pointed out. Growth of Chinooks in later years, as with humans, takes the form of a weight increase to a greater extent than an increase in length.

Most of the scales examined exhibited absorption at their margins. This phenomenon occurs after the fish enter fresh water and cease to feed. Loss of weight occurs and is manifest at the scale margin as a translucent area lacking circuli or as a ragged marginal area.

The following paragraphs will discuss the age composition of spring Chinooks for the years in which scales were available for study.

1946

Scales from thirty-seven Chinooks were obtained in 1946. Only thirty-four are considered here, however, as the age of three fish was not definitely established. The Winchester dam weir count of spring Chinooks was 1974 for this year and the thirty-four fish represent a 1.7% sample of this figure. The entire run of spring Chinooks is somewhat larger than the actual weir count. Some Chinooks remain below the

Winchester counting weir and a few go into the South Fork of the Umpqua River. The weir count is a good indicator of the size of the run, however, since the vast majority of spring Chinooks in the run are included. Table 1, page 6, gives the catch data for the fish under study. This table shows that three fish or 9% were in their sixth year of life. Nineteen specimens or 56% were five-year fish. Six specimens or 17% were in their fourth year of life and an equal number were three-year-olds.

Table 1 shows that the sex ratio was eighteen female to fourteen male fish. Two fish were of unrecorded sex. This nearly-equal sex ratio did not apply among individuals in each age group. The six-year age group contained two females and a single male fish. It is interesting to note the preponderance of female fish in the five-year class. Fourteen females but only three males were five-year-olds. Two females and four males were in the four-year group. All fish in the three-year group (jacks) were males. It is evident that the males were predominant among the three and four-year-old fish. A greater percentage of females than males is evident in the five and six-year group. Fraser (1919) found a greater proportion of males among two and three-year-old spring Chinooks and a greater proportion of females in the older age groups. The differential sex ratio among individuals in the different age groups in our sample agrees with the findings of Fraser (op. cit.) with the exception of the four-year group.

A study of column 6, Table 1, will show that fish were taken in April through October. Most four, five, and six-year specimens were obtained in April and May during the open season. Three-year old fish appear in the

catch somewhat later due partly to a later open season for fish 20 inches in length or less. Most three-year-old fish fall into this category.

TABLE 1 - Catch Data from 1946 Spring Chinook Salmon*

1 Age	2 Sex	3 Fork Length	4 Weight	5 Taken At	6 Date	7 Slide No.
6 yrs.	female	39.0"	34.0 lbs.	Forks	April 16	16
6 yrs.	"	32.0"	20.0 lbs.	Winchester	July 21	7
6 yrs.	male	43.0"	41.0 lbs.	"	May 31	6A
5 yrs.	female	36.0"	24.0 lbs.	Forks	April 6	16A
5 yrs.	"	32.0"	18.0 lbs.	"	" 8	11
5 yrs.	"	37.0"	24.0 lbs.	Cleveland	" 14	9A
5 yrs.	"	-	27.0 lbs.	Forks	" 16	21
5 yrs.	"	37.0"	-	Winchester	" 21	2
5 yrs.	"	35.5"	-	"	" 21	2A
5 yrs.	"	36.0"	21.0 lbs.	Rock Creek	" 30	17A
5 yrs.	"	36.0"	20.0 lbs.	" "	May 1	17
5 yrs.	"	33.0"	-	Winchester	" 5	1
5 yrs.	"	-	21.0 lbs.	Steamboat	" 15	18A
5 yrs.	"	37.0"	-	Winchester	" 30	11A
5 yrs.	"	35.0"	22.0 lbs.	Rock Creek	June 27	10A
5 yrs.	"	36.0"	-	Winchester	July 13	13A
5 yrs.	"	38.0"	-	"	" 20	13
5 yrs.	-	35.0"	-	"	April 28	8
5 yrs.	-	34.5"	-	"	May 4	1A
5 yrs.	male	32.0"	-	Cleveland	" 12	15
5 yrs.	"	38.0"	25.0 lbs.	Rock Creek	" 14	18
5 yrs.	"	38.5"	25.0 lbs.	Idleyld Park	" 26	12
4 yrs.	female	32.0"	18.0 lbs.	" "	" 18	12A
4 yrs.	"	31.0"	15.0 lbs.	Cleveland	June 2	15A
4 yrs.	male	27.5"	10.5 lbs.	"	April 14	9
4 yrs.	"	27.5"	-	Winchester	" 21	8A
4 yrs.	"	30.0"	13.0 lbs.	Glide	May 28	10
4 yrs.	"	30.0"	12.0 lbs.	Winchester	" 30	4A
3 yrs.	male	16.0"	2.0 lbs.	Glide	May 24	19
3 yrs.	"	18.5"	-	Winchester	July 6	14A
3 yrs.	"	17.0"	-	"	" 6	14
3 yrs.	"	19.0"	3.0 lbs.	Rock Creek	" 15	3
3 yrs.	"	20.0"	-	Winchester	" 23	7A
3 yrs.	"	21.0"	-	"	Oct. 23	5

*All data in columns 2 through 6 were obtained from the scale envelopes containing the scales under study.

Scales from two five-year-olds and one six-year-old had closely-spaced circuli in the second year suggesting that they had spent two years in fresh water. The remaining specimens remained in fresh water only one year as indicated by their scales.

1947

Scales from eight Chinooks obtained in 1947 were available for study. Age determinations were made for all of these fish. The weir count for this year was 2994. The eight fish represent a .3% sample of this figure. Table 2, below, presents the data obtained from the 1947 specimens in tabular form.

TABLE 2 - Catch Data from 1947 Spring Chinook Salmon

1 Age	2 Sex	3 Fork Length	4 Weight	5 Taken At	6 Date	7 Slide No.
6 yrs.	---	--- none	-----			
5 yrs.	female	32.0"	20.0 lbs.	Winchester	April 13	7
5 yrs.	"	35.0"	27.0 lbs.	Forks	" 19	2
5 yrs.	"	35.5"	23.0 lbs.	Cleveland	" 20	4
5 yrs.	"	37.0"	28.0 lbs.	"	" 23	5
5 yrs.	"	34.0"	21.0 lbs.	Forks	May 13	6
5 yrs.	-	37.0"	23.0 lbs.	"	April 19	3
4 yrs.	female	33.0"	20.0 lbs.	Winchester	May 5	1
4 yrs.	male	28.0"	-	Horseshoe Bend	Aug. 2	8
3 yrs.	---	--- none	-----			

No six-year fish were obtained in 1947. Six fish or 80% were five-year fish. Five of these six fish were females. Two four-year-old fish or 20% were obtained; one male and one female. No three-year fish were obtained.

The sample was small for this year but trends similar to those observed in 1946 were apparent. Most of the specimens were in the five-year group and most of these five-year fish were females. The scales indicate that all of the fish spent one year in fresh and went to sea early in their second year of life.

1948

Scales were obtained from fifty-four fish in 1948. The age of fifty of these fish was determined. Poor scales made the age determination of the remaining four specimens questionable and they were omitted from the study. The weir count of spring Chinooks in 1948 was 2245. The fifty specimens under study represent a 2.2% sample of this figure. Table 3, page 9 presents data regarding the fish obtained in 1948. Four fish or 8% were in the six year group. One female, one male, and two fish of unknown sex were in this age group. Twenty-nine fish or 58% were five-year fish. Twenty-one of these fish were females, six were males, and two were of undetermined sex. Here again it is evident that most fish aged were five-year fish and most of these five-year fish were females. Eleven fish or 22% were four year olds. Four females, six males, and one fish of undetermined sex made up this age group. Six fish or 12% were three-year olds and all of these were males. The scales indicate that all fish went to sea early in their second year after spending approximately one year in fresh water.

TABLE 3 - Catch Data from 1948 Spring Chinook Salmon

1 Age	2 Sex	3 Fork Length	4 Weight	5 Taken At	6 Date	7 Slide No.
6 yrs.	female	40.0"	30.0 lbs.	Cleveland	May 16	14
6 yrs.	male	43.0"	50.0 lbs.	Forks	" 1	46
6 yrs.	-	39.0"	38.0 lbs.	Cleveland	April 25	45
6 yrs.	-	43.0"	42.5 lbs.	-	-	49
5 yrs.	female	32.0"	27.0 lbs.	Winchester	April 17	35
5 yrs.	"	36.0"	18.0 lbs.	"	" 30	39
5 yrs.	"	32.0"	18.0 lbs.	"	May 3	24
5 yrs.	"	36.0"	22.0 lbs.	Forks	" 6	31
5 yrs.	"	35.0"	25.0 lbs.	Cleveland	" 6	6
5 yrs.	"	31.5"	14.5 lbs.	"	" 9	27
5 yrs.	"	33.0"	16.5 lbs.	"	" 10	5
5 yrs.	"	36.5"	22.0 lbs.	Forks	" 10	25
5 yrs.	"	34.0"	18.0 lbs.	Cleveland	" 12	8
5 yrs.	"	33.0"	17.0 lbs.	"	" 12	9
5 yrs.	"	32.0"	15.0 lbs.	"	" 15	13
5 yrs.	"	31.0"	14.0 lbs.	Leatherwood	" 16	18
5 yrs.	"	36.0"	20.5 lbs.	Winchester	" 16	23
5 yrs.	"	36.0"	24.5 lbs.	Cleveland	" 16	15
5 yrs.	"	32.0"	16.5 lbs.	"	" 16	16
5 yrs.	"	36.0"	25.0 lbs.	Rock Creek	" 17	28
5 yrs.	"	32.0"	18.0 lbs.	Winchester	" 18	3
5 yrs.	"	34.5"	21.0 lbs.	Cleveland	" 18	1
5 yrs.	"	32.0"	17.0 lbs.	"	" 18	38
5 yrs.	"	31.5"	14.0 lbs.	"	" 20	51
5 yrs.	"	35.5"	-	Winchester	" 30	48
5 yrs.	male	38.0"	29.0 lbs.	Cleveland	April 22	32
5 yrs.	"	32.5"	16.0 lbs.	Winchester	" 30	41
5 yrs.	"	35.0"	22.5 lbs.	Cleveland	May 12	12
5 yrs.	"	39.0"	28.0 lbs.	"	" 12	11
5 yrs.	"	37.0"	25.0 lbs.	Winchester	" 25	40
5 yrs.	"	34.0"	26.0 lbs.	Campbell Falls	" 30	2
5 yrs.	-	30.0"	13.0 lbs.	-	April 26	37
5 yrs.	-	36.0"	26.0 lbs.	-	" 26	54
4 yrs.	female	29.5"	13.0 lbs.	Cleveland	April 18	33
4 yrs.	"	26.0"	9.0 lbs.	"	May 6	29
4 yrs.	"	30.0"	13.0 lbs.	Winchester	" 12	10
4 yrs.	"	33.0"	20.0 lbs.	Rock Creek	" 14	26
4 yrs.	male	26.0"	12.0 lbs.	Cleveland	March 30	7
4 yrs.	"	31.0"	16.0 lbs.	Winchester	April 24	43
4 yrs.	"	30.0"	13.5 lbs.	Winchester	April 24	53
4 yrs.	"	23.0"	9.0 lbs.	"	" 25	44
4 yrs.	"	24.5"	10.0 lbs.	"	" 26	47
4 yrs.	"	29.0"	12.0 lbs.	"	May 6	20
4 yrs.	-	27.0"	9.0 lbs.	"	April 22	34
3 yrs.	male	20.0"	4.0 lbs.	Leatherwood	May 16	17
3 yrs.	"	21.5"	4.0 lbs.	Winchester	" 16	21
3 yrs.	"	22.5"	5.0 lbs.	"	" 16	22
3 yrs.	"	22.5"	6.0 lbs.	Cleveland	" 18	4
3 yrs.	"	15.0"	1.5 lbs.	Winchester	" 22	36
3 yrs.	"	20.0"	-	Idleyld	" 31	30

1949

Scales from twenty-nine spring Chinooks were available for study in 1949. Age determinations were made for all of these fish. This figure represents a 1.3% sample of the 2109 spring Chinooks counted in 1949. Table 4, page 11, presents data relative to the fish under study for 1949. One specimen or 3.4% was a six-year-old. Twenty-one fish or 72.4% were five-year fish. The sex ratio among the five-year fish was eleven females to ten males. This is a departure from the sex ratio noted among five-year individuals in 1946, 1947 and 1948. Females were greatly in the majority in the latter three years. Only one specimen obtained in 1949 (3.4%) was a four-year old. The reason for this paucity of four-year fish is not known. Six specimens or 21% were three-year fish and all of these were males. The scales indicate that all fish went to sea after spending approximately one year in fresh water.

TABLE 4 - Catch Data from 1949 Spring Chinook Salmon

1 Age	2 Sex	3 Fork Length	4 Weight	5 Taken At	6 Date	7 Slide No.
6 yrs.	male	39.0"	30.0 lbs.	Winchester	April 17	23
5 yrs.	female	37.0"	25.0 lbs.	Winchester	April 15	20
5 yrs.	"	36.0"	27.5 lbs.	"	" 15	21
5 yrs.	"	34.0"	18.0 lbs.	"	" 16	28
5 yrs.	"	39.0"	25.0 lbs.	"	" 17	26
5 yrs.	"	32.0"	17.5 lbs.	"	" 17	24
5 yrs.	"	35.0"	19.0 lbs.	"	May 5	15
5 yrs.	"	36.0"	23.5 lbs.	"	" 8	14
5 yrs.	"	34.0"	19.0 lbs.	"	" 14	11
5 yrs.	"	38.0"	28.0 lbs.	"	" 14	13
5 yrs.	"	33.0"	-	Brantons	" 14	12
5 yrs.	"	36.0"	20.5 lbs.	Winchester	-	17
5 yrs.	male	31.5"	16.0 lbs.	Cleveland	April 15	22
5 yrs.	"	33.0"	19.5 lbs.	Winchester	" 15	19
5 yrs.	"	32.0"	16.0 lbs.	"	" 15	18
5 yrs.	"	36.0"	24.0 lbs.	"	" 19	25
5 yrs.	"	31.5"	15.0 lbs.	Forks	" 27	27
5 yrs.	"	35.0"	18.0 lbs.	Leatherwood	" 28	29
5 yrs.	"	33.0"	17.5 lbs.	Winchester	May 8	16
5 yrs.	"	36.0"	26.0 lbs.	"	" 19	7
5 yrs.	"	37.5"	27.0 lbs.	"	" 19	9
5 yrs.	"	36.0"	-	"	" 29	4
4 yrs.	male	25.0"	-	Winchester	May 29	5
3 yrs.	male	17.0"	-	Winchester	May 19	10
3 yrs.	"	18.0"	-	"	" 19	8
3 yrs.	"	19.0"	2.0 lbs.	-	" 26	3
3 yrs.	"	12.0"	-	Cleveland	" 29	6
3 yrs.	"	15.5"	-	Rock Creek	" 31	2
3 yrs.	"	18.0"	2.0 lbs.	" "	" 31	1

1950

Scales from only three fish were available for study from 1950. The weir count of spring Chinooks for this year was 2044. The sample available represented only .1% of this figure. Table 5, page 12, presents data relative to the 1951 specimens. The sample is too meager to be of much

significance. Two of the three fish taken were five-year-olds however. This is consistent with findings in previous years. The scales indicate that all three fish had spent one year in fresh water and went to sea early in their second year.

TABLE 5 - Catch Data from 1950 Spring Chinook Salmon

1 Age	2 Sex	3 Fork Length	4 Weight	5 Taken At	6 Date	7 Slide No.
6 yrs.	- - -	none - - -	-			
5 yrs.	male	34.0"	19.0 lbs.	-	May 27	2
5 yrs.	-	33.0"	15.5 lbs.	Elkton	April 29	1
4 yrs.	male	27.0"	8.0 lbs.	Forks	April 30	3

1951

Scales from sixty spring Chinooks were obtained in 1951. Age determinations were made for fifty-five of these fish. The age of five fish could not be determined due to poor scales and the five are omitted from consideration here. The total 1951 weir count of spring Chinooks was 2939 as of October 31. The fifty-five fish represent a 1.9% sample of this figure. Table 6, page 13, presents data relative to the fish under study for 1951. Four fish or 7% were six-year-olds. Only one female was in this group. Thirty specimens or 54% were five-year fish. Twelve females, ten males, and eight fish of unspecified sex were in this five-year group. This sex ratio is similar to that noted for five-year specimens in 1949. Eleven fish or 20% were four-year-olds. Of the seven of these of known, six were males and one was a female. A similar preponderance of males in the four-year age

TABLE 6 - Catch Data from 1951 Spring Chinook Salmon

1 Age	2 Sex	3 Fork Length	4 Weight	5 Taken At	6 Date	7 Slide No.
6 yrs.	female	43.0"	30.5 lbs.	Idleyld Park	April 27	21
6 yrs.	male	40.0"	30.0 lbs.	Winchester	May 9	32
6 yrs.	"	43.0"	34.0 lbs.	"	" 20	46
6 yrs.	"	42.0"	31.5 lbs.	Idleyld Park	" 21	50
5 yrs.	female	35.0"	22.0 lbs.	Winchester	April 15	5
5 yrs.	"	38.0"	23.0 lbs.	R. bridge	" 15	8
5 yrs.	"	-	18.0 lbs.	Winchester	" 15	3
5 yrs.	"	-	22.0 lbs.	R. bridge	" 15	6
5 yrs.	"	37.0"	18.0 lbs.	R. bridge	" 15	2
5 yrs.	"	-	20.0 lbs.	Winchester	" 22	18
5 yrs.	"	38.0"	26.5 lbs.	Idleyld Park	" 24	20
5 yrs.	"	-	18.0 lbs.	Rock Creek	" 28	22
5 yrs.	"	-	21.5 lbs.	"	May 1	23
5 yrs.	"	-	14.0 lbs.	Winchester	" 5	26
5 yrs.	"	33.0"	17.0 lbs.	Rock Creek	" 21	48
5 yrs.	"	-	20.0 lbs.	Winchester	" 24	51
5 yrs.	male	38.0"	28.0 lbs.	"	April 15	10
5 yrs.	"	-	20.0 lbs.	R. bridge	" 15	4
5 yrs.	"	38.0"	25.0 lbs.	R. bridge	" 15	9
5 yrs.	"	36.0"	20.0 lbs.	Winchester	May 5	28
5 yrs.	"	-	28.0 lbs.	"	" 5	29
5 yrs.	"	-	19.5 lbs.	"	" 5	27
5 yrs.	"	39.0"	27.0 lbs.	Rock Creek	" 6	30
5 yrs.	"	-	28.0 lbs.	Winchester	" 20	45
5 yrs.	"	-	20.0 lbs.	Pinetree	" 20	43
5 yrs.	-	32.0"	15.5 lbs.	Winchester	April 22	16
5 yrs.	-	-	23.0 lbs.	"	" 22	19
5 yrs.	-	-	21.5 lbs.	Sawyers	" 29	56
5 yrs.	-	-	30.0 lbs.	Elkton	May 4	57
5 yrs.	-	-	27.0 lbs.	"	" 6	58
5 yrs.	-	-	14.5 lbs.	Cleveland	" 20	42
5 yrs.	-	36.0"	21.0 lbs.	Winchester	" 20	44
5 yrs.	-	36.0"	20.0 lbs.	Idleyld	" 31	55
4 yrs.	female	32.0"	20.0 lbs.	Winchester	April 22	17
4 yrs.	male	28.0"	15.0 lbs.	R. bridge	" 15	1
4 yrs.	"	30.0"	13.0 lbs.	Idleyld	May 13	36
4 yrs.	"	-	10.0 lbs.	-	" 16	49
4 yrs.	"	24.0"	4.0 lbs.	Winchester	" 20	41
4 yrs.	"	27.0"	10.0 lbs.	Rock Creek	" 21	47
4 yrs.	"	27.0"	13.0 lbs.	" "	" 29	52
4 yrs.	-	27.0"	10.0 lbs.	Branton Bar	April 22	14
4 yrs.	-	28.0"	11.0 lbs.	Winchester	" 22	15
4 yrs.	-	24.0"	10.0 lbs.	Winchester	May 5	25
4 yrs.	-	24.0"	6.5 lbs.	Idleyld	" 30	53
3 yrs.	male	21.0"	4.5 lbs.	Winchester	May 5	24
3 yrs.	"	19.5"	4.0 lbs.	Idleyld	" 10	33
3 yrs.	"	18.0"	3.0 lbs.	-	" 12	35
3 yrs.	"	18.0"	2.0 lbs.	Idleyld	" 16	37
3 yrs.	"	22.0"	4.0 lbs.	"	" 18	38
3 yrs.	"	22.5"	4.5 lbs.	"	" 18	39
3 yrs.	"	17.0"	-	"	" 20	40
3 yrs.	"	19.5"	-	Winchester	" --	31
3 yrs.	"	16.0"	2.0 lbs.	"	July 22	59
3 yrs.	"	16.0"	1.5 lbs.	Steamboat	" 28	60

group was observed in 1946, 1948, 1949 and 1950. Ten fish or 19% were three-year-olds and all of these were males. One five-year fish apparently spent two years in fresh water. Scale analysis indicated that all of the other fish spent about one year in fresh water before going to sea.

LENGTH AND WEIGHT CLASSES

The length and weight of fish in the same age group showed no apparent variations from one year to the next. Table 7 below gives the length and weight range of the fish in the different age groups for the six years under consideration. Table 7 shows considerable overlapping in both length and weight ranges. Figure 1, page 15, shows the length and weight ranges of the fish under study for all six years. A study of Figure 1 shows that spring Chinooks cannot be accurately aged merely by weighing or taking their length but some generalizations seem possible. Specimens in the 40 inch, 30 pound category are probably six-year-old fish. A typical five-year-old would measure about 35 inches in length and weigh about 22 pounds. A 27 inch, 12 pound fish would be expected to be a four-year-old. Chinooks approaching the length of 20 inches would probably fall into the three-year group. Fraser (op. cit.) averaged the lengths of stream type Chinook salmon. The average lengths obtained were: five-year fish - 31.5", four-year fish - 27.6", three-year fish - 20.9", and two-year fish - 12.5".

TABLE 7 - Length and Weight Ranges of Umpqua River Spring Chinook Salmon of Different Age Groups, 1946-1951

Age Group	Length Range	Weight Range
6	32.0" to 43.0"	20 to 50 lbs.
5	30.0" to 39.0"	14 to 30 lbs.
4	23.0" to 33.0"	4 to 20 lbs.
3	12.0" to 22.5"	1.5 to 6 lbs.

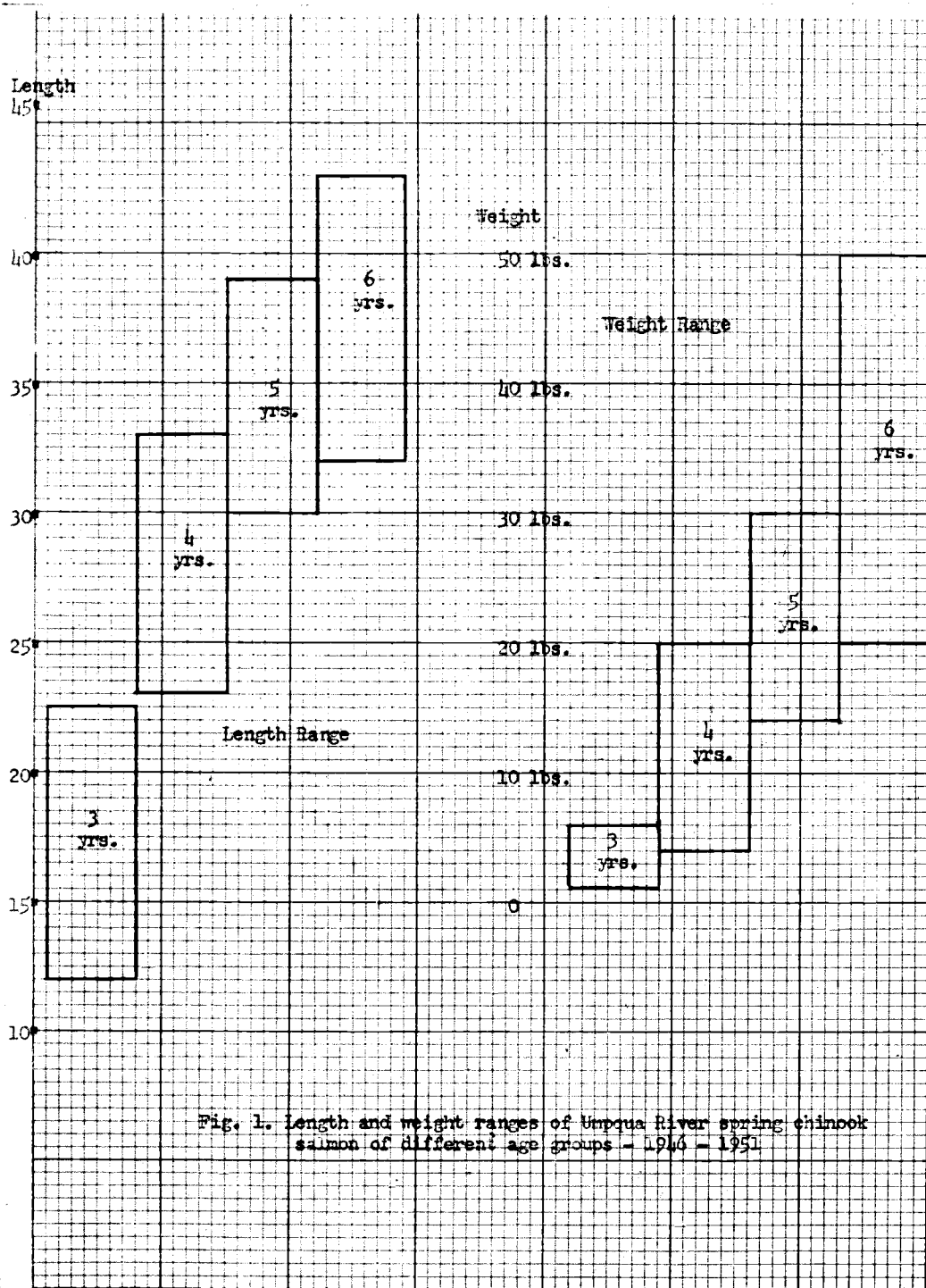


Fig. 1. Length and weight ranges of Umpqua River spring chinook salmon of different age groups - 1946 - 1951

SUMMARY

Scales from 191 Umpqua River spring Chinooks obtained during the years 1946 through 1951 were available for study. Age determinations were made for all but twelve of these fish. It is believed that the fish obtained from the sport fishery constitute a representative sample of the age and sex composition of the Umpqua River spring Chinook run. A larger sample, particularly for the years 1947 and 1950, would have been desirable.

Practically all of the scales examined showed a close-ringed nuclear area indicating that about one year had been spent in fresh water. The close spacing of circuli extended to the second annulus on a few scales suggesting that some Chinooks may spend a second year in fresh water. The growth of the fish in the second year was generally greater than in subsequent years. This is indicated by a wide band of circuli in the second year. The growth in later years of a Chinook's life is more pronounced as a weight increase rather than an increase in length. Absorption to some degree was apparent in most of the scales examined.

The ages of 179 of the 191 specimens available have been established. By adding the total number of fish in each age group from 1946 through 1951 together, a summary of the age composition is possible. Twelve specimens (7%) were in the six-year group, 107 specimens (60%) were in the five-year group, 32 specimens (18%) were in the four-year group, and 28 specimens (15%) were in the three-year group. The percentage of specimens in each age group each year follows closely the trends shown in the total percentages above. Exceptions were the years 1947 when only a small number of individuals were involved and 1949 when only one four-year-old (3.4%) was obtained. Another way of stating this is that the age composition of spring Chinooks was fairly constant for each of the six years under study.

It is apparent that the predominant age at maturity is five years for fish of the race under discussion. Gharrett and Hodges (1950) found in their preliminary studies that five-year fish were predominant among Umpqua River spring Chinook salmon. Rich and Holmes (1928) found that the greatest number of spring Chinooks matured in their fifth year in the Columbia River and its tributaries.

The sex of 158 fish was indicated on the scale collection envelopes. Of this number, 75 were females and 83 were males. Males were slightly in excess of females among the six-year fish but the sample was small and the fact is of questionable significance. Sixty per cent of the fish of known sex were females among the five-year fish. The percentage varied in different years but, among five-year fish, more than half were females in any one year. Male fish were predominant among four-year-olds. In any one year, at least sixty per cent of the four-year-old fish were males. All three-year-old fish were males.

The length and weight ranges of Chinooks of different age groups overlap but the length and weight of a particular fish does give a basis for an intelligent guess of the age of the fish in question. Such a 'guess' should be substantiated by scale analysis if an accurate age determination is desired.

The age assessment work was undertaken in order to ascertain the age composition of spring Chinook salmon in the Umpqua River. It was not intended to be a detailed life history study of this race of fish. Such an inquiry would help fill in some of the gaps in our knowledge of the early life history of the race. Scale analysis alone does not give precise

information as to the time, rate, and pattern of downstream migration.

Additional study of Umpqua spring Chinooks from the time they enter the river until they spawn would also be desirable to help clarify this phase of their life history.

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Appendix A

Distances upstream from the mouth of the Umpqua River

Elkton -----	48 miles	
Branton's Bar -----	99	"
Cleveland Rapids -----	111	"
Forks -----	113	"
Winchester -----	120	"
Glide -----	145	"
Idleyld Park -----	150	"
Steamboat -----	170	"