

INTERNATIONAL PACIFIC SALMON  
FISHERIES COMMISSION

APPOINTED UNDER A CONVENTION  
BETWEEN CANADA AND THE UNITED STATES FOR THE  
PROTECTION, PRESERVATION AND EXTENSION  
OF THE SOCKEYE SALMON FISHERIES IN  
THE FRASER RIVER SYSTEM

PROGRESS REPORT

#6

THE ENERGY EXPENDITURES OF FRASER RIVER SOCKEYE  
SALMON DURING THE SPAWNING MIGRATION  
TO CHILKO AND STUART LAKES

BY

D. R. IDLER

Vancouver Technological Station,  
Fisheries Research Board of Canada

W. A. CLEMENS

International Pacific Salmon Fisheries Commission

---

COMMISSIONERS

SENATOR THOMAS REID

A. J. WHITMORE

F. D. MATHERS

ARNIE J. SUOMELA

MILO MOORE

DeWITT GILBERT

DIRECTOR OF INVESTIGATIONS

LOYD A. ROYAL

---

NEW WESTMINSTER, B. C.

CANADA

1959

## ABSTRACT

Analyses of the fat, protein and water contents of 165 and 135 Fraser River sockeye salmon of the Stuart and Chilko Lake runs sampled in 1956 at selected points on the migration route provided detailed information on the energy expenditures of both sexes of these races. From the time of entrance into the Fraser River until the completion of spawning the average Stuart Lake male used 91% of its body fat reserves and the female 96%; the Chilko male used 77.6% and the female 91.4%. At the same time the Stuart male used 31% of its protein reserves and the female 53% while the Chilko male used 42% and the female 61%. During migration in the river the Stuart male expended 1.01 Cal. to maintain 1 kg. of its live weight for 1 km. while the female expended 1.16 Cal./kg./km. This is equivalent to 44.2 Cal./kg./day and 51.6 Cal./kg./day respectively. The energy expended by a standard Stuart Lake male in travelling from Albion at the mouth of the Fraser River to death on the spawning grounds in Forfar Creek, tributary to Stuart Lake, a distance of 1023 km. (635 mi.) was 1398 Cal. for the maintenance of 1 kg. of live fish. The corresponding value for the female was 1644 Cal. The energy expended by standard Chilko fish in travelling from Albion to death on the spawning grounds in the Chilcotin River, a distance of 596 km. (370 miles) was 1293 Cal. for the male and 1903 Cal. for the female.

In spite of the large percentage change in moisture content for both sexes from the time they entered the river until death on the spawning grounds, the standard Stuart Lake female actually lost 13.3% body water while the male increased the body water by 10.6% which was not sufficient to fully compensate for losses in fat and protein weight. On the Chilko run the body of the standard female lost 10.5% water from Albion until death while the standard male gained 19.7% which again was insufficient to balance the loss in fat and protein.

The fat and protein reserves contributed by the viscera of the Chilko fish were relatively insignificant (2-4%). The reserve materials which went into the development of the gonads were considerable especially in the case of the females. In the case of the males the weight of the testes increased from 2.36% of the live weight to 3.12%; while the weight of the ovaries increased from 3.59% to 15.7% from the time the fish entered the river until arrival on the spawning grounds. Expressed as total average weights the data are: males 58.9 gm. to 75.8 gm.; females 79.9 gm. to 263.7 gm.

The data indicate that the females on the 1956 Stuart and Chilko Lake runs when entering the Fraser River were in the same stage of sexual maturity as were also the females of the 1956 and 1957 runs.

The energy reserves per unit of live fish were almost identical for both sexes when the fish entered the river on the 1956 and 1957 Stuart Lake runs, although the 1956 fish were approximately 5% heavier than 1957 fish.

## TABLE OF CONTENTS

FOREWORD .....	v.
INTRODUCTION .....	1
PROCEDURES .....	4
DATA .....	4
THE STANDARD FISH .....	6
CHANGES IN A STANDARD FISH OF THE STUART LAKE RUN .....	7
Water and Weight .....	7
Fat .....	7
Protein .....	7
Energy Expenditures .....	9
Changes in Proximate Composition of 1956 Stuart Lake Sockeye Compared with Amur River Chum .....	13
CHANGES IN A STANDARD FISH OF THE CHILKO LAKE RUN .....	13
Water and Weight .....	13
Fat .....	14
Protein .....	15
Energy Expenditures .....	15
Changes in the Composition of the Viscera of the Standard Fish on the Chilko Run .....	16
COMPARISON OF THE GONADS OF THE 1956 AND 1957 STUART LAKE SOCKEYE WITH THE AMUR RIVER CHUM SALMON .....	19
COMPARISON OF GONADS OF 1956 STUART AND CHILKO LAKE SOCKEYE .....	20
CHANGES IN THE PHYSICAL MEASUREMENTS OF THE STANDARD FISH ON THE STUART LAKE AND CHILKO LAKE SOCKEYE RUNS COMPARED WITH AMUR RIVER CHUM SALMON .....	20
Snout Length .....	20
Liver .....	20
COMPARISON OF THE ENERGY CONSUMPTION OF STANDARD STUART AND CHILKO LAKE SOCKEYE WITH AMUR RIVER CHUM SALMON .....	21
COMPARISON OF THE TOTAL BODY ENERGY EXPENDED TO MAINTAIN 1 KG. OF LIVE FISH FROM ALBION TO DEATH ON THE STUART AND CHILKO LAKES RUNS .....	22
SUMMARY .....	22
LITERATURE CITED .....	25
APPENDICES .....	26

## FOREWORD

These investigations were instigated by the International Pacific Salmon Fisheries Commission and have been carried out on a fully collaborative basis between scientists of the International Pacific Salmon Fisheries Commission and the Vancouver Technological Station of the Fisheries Research Board of Canada. Scientists of the former organization have contributed their knowledge of the Fraser River watershed, the ability to identify the pure races of salmon in chronological order, personnel to collect the samples, and have planned the biological phases of the project. Scientists of the Fisheries Research Board of Canada have planned and interpreted the program from a chemical and biochemical viewpoint, and provided the laboratory facilities.

The authors wish to express their sincerest thanks to Mr. Loyd A. Royal, Director of Investigations, International Pacific Salmon Fisheries Commission, Dr. J. L. Kask, Chairman, Fisheries Research Board of Canada, and to Dr. H. L. A. Tarr, Director, Vancouver Technological Station, for advice and encouragement and to Mr. A. P. Ronald, Mrs. W. Mons, Mr. J. McBride, Mr. C. Tai and Mr. I. Bitners for technical assistance in performing the many analyses. Special thanks are due to Mr. G. Berry for making the many calculations necessary to permit a meaningful interpretation of the data.

Without the special techniques developed by Mr. S. R. Killick of the International Pacific Salmon Fisheries Commission, the chronological selection of samples of pure races would not have been possible. To him the authors are deeply indebted for all the detailed arrangements connected with the collection of the samples.

## INTRODUCTION

This investigation of the energy expenditures of Fraser River sockeye salmon is directed toward attaining some understanding of the role that energy reserves play in the survival and successful spawning of the fish. The present report of the 1956 investigations of the Stuart and Chilko Lake runs has been delayed until some of the results obtained from the 1957 Stuart Lake run could be evaluated. It is anticipated that the data obtained in 1957 and subsequent years will result in an extension and some possible modification of the conclusions reached in the present report. Every effort has been made to keep the conclusions precise and conservative.

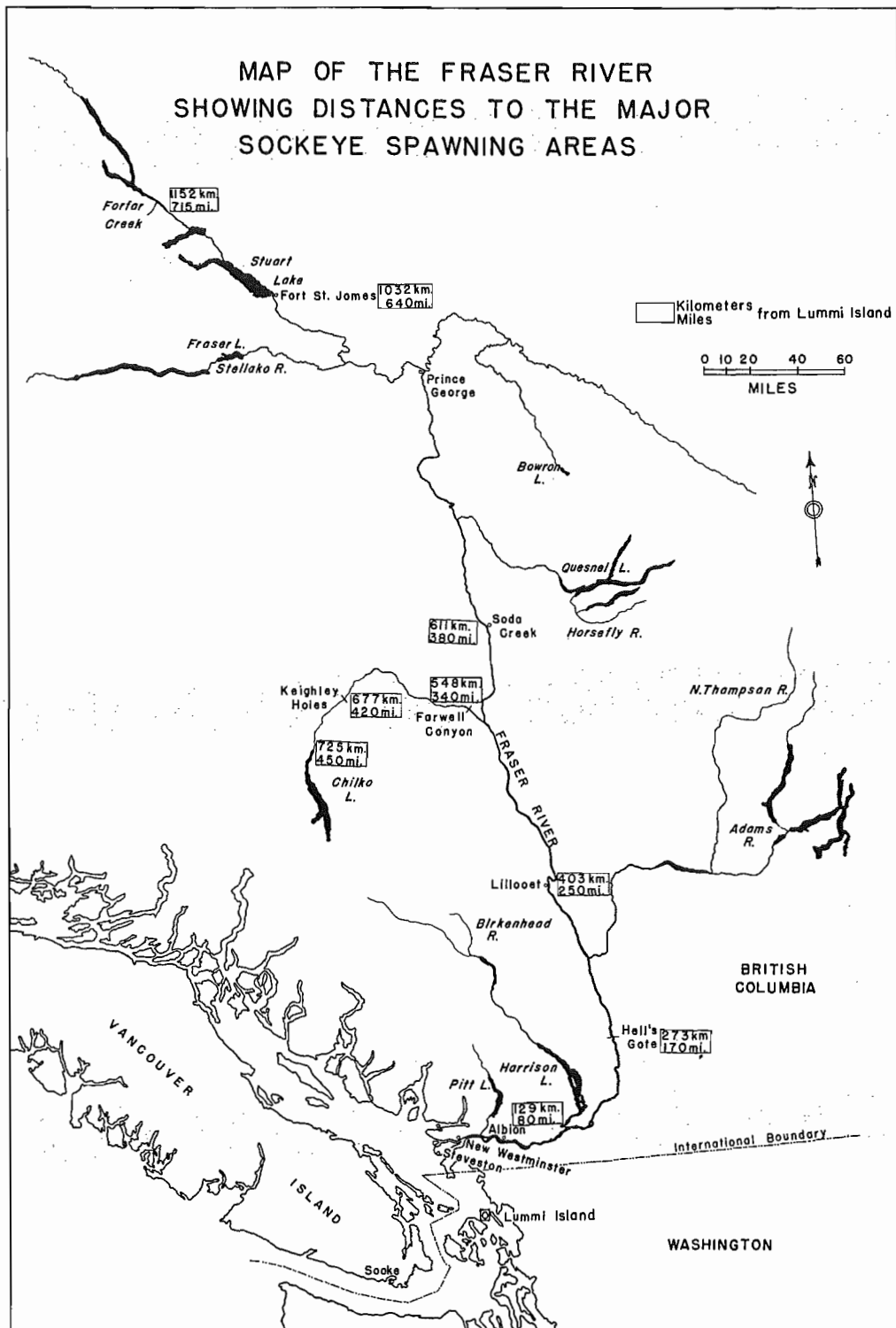
The physical, chemical, biochemical and physiological changes occurring in migrating salmon have been the subject of intensive investigations (Davidson and Shostrum, 1936; Greene, 1926; Killick, 1955; Miescher-Rüsch, 1880; Paton, 1898; Pentigov, Mentov, Kurnaev, 1928; Rutter, 1902). It has been ascertained that all species of Pacific salmon (*Oncorhynchus*) do not feed during the entire period of the spawning migration. The amazing ability of all these fish to extensively deplete not only the body reserves of fat but also of protein, has been established. The increase in snout length, particularly of the male, the increase in skin thickness, the uptake of water accompanying losses in fat and protein, the increased weight of the gonads, particularly for the female, the loss in pigmentation from the flesh, the decreased enzymic activity of the stomach and other changes have been qualitatively or semi-quantitatively established for some species. Percentage composition changes, whether they apply to the entire fish or to individual organs and tissues, do not permit a quantitative assessment of the changes taking place in migrating salmon. The fish, particularly the female, is constantly changing weight, and for some organs and tissues these changes are of a very large order of magnitude. The only way in which the changes occurring in a single fish as it moves up the river could be precisely measured would be to remove the fish from the water, analyse it, put it back in the water and analyse it again at subsequent points. This is, of course, impossible. A larger sample of the population which would permit an assessment of the changes occurring in an average fish presents an alternative approach. Other approaches are possible and these will be discussed in the text. There are several reasons why previous studies have either partially or completely failed to obtain data which would accurately permit energy expenditures to be calculated, either on a time or distance of travel basis. These include (1) non-continuous sampling during

the spawning migration; (2) too few samples; (3) too few chemical analyses; (4) difficulties in converting data to a standard fish due to large variations in the dimensions of individuals; (5) difficulties in establishing a pure race. The studies of Pentegov and his co-workers on chum salmon (*Oncorhynchus keta*) on the Amur River overcame these difficulties to a large extent but even in this investigation the workers appear to have had too few samples at certain critical points.

In the present study the following points are significant: 1. The fish going to Stuart and Chilko Lakes were each of a pure race. 2. They were selected in chronological order. 3. The size variation was in most instances of a very small order of magnitude. 4. Only four-year-old fish were taken for analysis and the few fish representing the extremes of the population either as to size or analytical composition were discarded from each point. 5. The number of fish taken of each sex were in most cases greater than, or equal to those taken on the Amur River study but in both cases larger samples would have been desirable. 6. In order to obtain the maximum significance for the data, each fish was analyzed individually. Some of the results have been compared with those obtained on large samples for the 1957 Stuart Lake run for which statistical calculations have been made, but a complete statistical analysis of data presented in this report will not be made until the analyses for 1957 have been completed.

The main objective of this project will be to assess the effect of delay on the successful spawning of the fish. For this reason it has been considered desirable to repeat the study on the Stuart Lake run for a minimum of three consecutive years, particularly for the purpose of answering two important questions: (1) do the fish reach the river in the same stage of sexual maturity each year, and (2) do the fish reach the river with the same energy reserves each year?

In 1957 the International Pacific Salmon Fisheries Commission made available to scientists at the Vancouver Technological Station, Fisheries Research Board of Canada, three groups of 80 Stuart Lake migrants for detailed chemical studies. Certain facts obtained from these large samples have been of great value in facilitating the interpretation of the data in this report. The sampling stations on the migration routes and the distances involved are shown in the accompanying map (FIGURE 1). The elevations attained, the distances travelled and the number of days taken in travel are presented in TABLE 1.



**FIGURE 1.** Map of the Fraser River showing distances to the major sockeye spawning areas.

TABLE 1—Distances and days of travel of Stuart and Chilko sockeye to energy sampling stations in 1956.

STUART RUN					
Location	Elevation in Feet	Distance in Miles	In Km.	Days—Out*	
Lummi Island	0	0	0	0	
		80			3
Albion	10	80	129	3	
		90			4
Hell's Gate	280	170	273	7	
		80			3
Lillooet	664	250	403	10	
		130			4
Soda Creek	1321 (Calc.)	380	611	14	
		260			9
Fort St. James	2225	640	1032	23	
		75			4
Forfar Cr. Mouth	2270	715	1152	27	
		0			7
Forfar Cr. (spent fish)	2270	715	1152	34	
		0			5
Forfar Cr. (dead fish)	2270	715	1152	39	
		715 miles	1152 km.		

\* 27 days of travel from Lummi Island or 24 days from Albion;  
12 days on spawning grounds.

CHILKO RUN					
Albion	10	0	0		
		260			11
Farwell Canyon	1110	260	419	11	
		80			5
Keighley Holes	3640 (Calc.)	340	548	16	
		30			2
Chilko Sp. Grounds	3840	370	596	18	
		0			18
Chilko (spent fish)	3840	370	596	36	
		0			7
Chilko (dead fish)	3840	370	596	43	
		370 miles	596 km.		

\* 18 days of travel from Albion;  
25 days on spawning grounds.

## PROCEDURES

Immediately upon removal from the water, each fish was placed in a waterproof polyethylene bag and stored in ice. All fish were processed within 24 hours of being caught. Each fish was measured, weighed and the viscera removed and weighed separately as were the gonads. Each entire eviscerated fish was then ground in a "silent cutter" until homogeneous and a one-pound sample was canned and processed for subsequent analysis. The viscera were canned separately and homogenized in a Waring Blendor prior to analysis. All proximate analyses were done in duplicate. Protein was determined by the conventional macro Kjeldahl method. Moisture was determined with a Cenco moisture balance. The official methods for fat determination are very tedious and in view of the hundreds of samples to be analyzed a rapid method developed by Mr. P. J. Schmidt at the Vancouver Technological Station of the Fisheries Research Board of Canada has been employed. The procedure is as follows:

The sample of canned salmon is ground into a finely divided homogeneous mass in a Waring Blendor. Ten grams of the sample are weighed into a 100-ml. volumetric flask. Forty ml. of acetone and some boiling chips are added and the mixture is refluxed for 1 hour. Thirty-five ml. of methylene chloride are added and refluxed for an additional 30 min. The solution is then cooled to 25°C. and made up to volume with methylene chloride and shaken. It is filtered through glass wool and 50 ml. of the filtrate is measured into a 100-ml. tared beaker. The solvent is evaporated on a steam bath and the sample is then heated in a vacuum oven at 100°C. for 1 hour. After cooling it is weighed and the per cent oil is calculated. The following formula is used for calculating the per cent oil in most samples of sockeye salmon:

$$\% \text{ Oil} = \frac{\text{Wt. of oil}}{\text{Wt. of sample}} \times \frac{93}{50} \times 100$$

It was found that when 7 ml. of water (the approximate amount of water present in 10 gm. of canned salmon) was mixed with 93 ml. of acetone and methylene chloride mixed in the proportions 40 and 53 respectively, a water layer of 7 ml. remained at the top in which salmon oil was not miscible. However, in the case of an actual oil determination, no water layer could be seen and apparently the

water phase was tied to the fish residue and was retained on the glass wool filter. Since none of the oil is soluble in this water fraction, it was assumed that after making the solution up to 100 ml., the actual volume of oil and solvent was 93 ml., which accounts for the factor  $\frac{93}{50}$ .

The oil-acetone-methylene chloride solution is clear, contains no water phase and evaporates easily and smoothly without leaving any solid residue with the oil. The oil extracted in this manner is completely soluble in ether. This method was compared with another very similar but slightly modified method in which the fish residue was removed after refluxing and washed free of oil and the entire amount of solvent then evaporated. The results of these determinations are given in TABLE 2 and show that there is no need for removing the residue and washing it free of oil after refluxing.

The data in TABLE 3 show a comparison of this new method with the A.O.A.C. method (Method No. 18.10 of the Association of Official Agricultural Chemists), which is an acid-hydrolysis method. The results show that the A.O.A.C. method consistently gave lower values. However, since all the extracted oil in the new procedure is soluble in ether, it is concluded that the recovery of oil from canned salmon in the new procedure is more complete than with the A.O.A.C. method. Further, the reproducibility of the method is good, and since the present study is more concerned with differences in fat content than with absolute fat content, the agreement with the official method is considered adequate.

The metric system is used throughout the discussion with the exception of water temperature data, to permit the results to be more readily compared with those of other investigations. The calorie (Cal.) in the text refers to the large calorie or kilogram calorie. One gram of fat has been taken as equal to 9.3 Cal. and 1 gram of protein as equal to 4.1 Cal. The kilometer, equal to 0.621 miles and the meter equal to 1.094 yards have been used as the units of distance; the centimeter, equal to 0.394 inches, has been used as the unit of length and the gram, equal to 0.035 ounces, has been used as the unit of weight.

## DATA

The detailed data on which the present paper is based are contained in TABLES 12 to 74 inclusive and placed in the Appendix.

The information for each fish is given in TABLES 12 to 58.

TABLES 59 to 62 present the weight-length data of the average (standard) fish of each sex for the two runs at each point. Data on the weight of the gonads, weight of the flesh, weight of the entire fish, weight of the eviscerated fish and weight of the liver are included. For Chilko Lake fish the weight



TABLE 2—Oil content of sockeye salmon by two methods.

No. of Sample	Per Cent Oil	
	New Method	Similar Method But Residue Removed
1	7.28	7.26
2	15.1	14.9
3	12.7	12.6
4	11.7	11.8
5	12.3	12.4

TABLE 3—Oil content of canned sockeye salmon as determined by the new and A.O.A.C. methods.

Sample Number	Per Cent Oil			
	New Method		A.O.A.C. Method	
	Duplicates	Average	Duplicates	Average
6	6.82	6.78	6.02	5.98
	6.75		5.94	
7	8.37	8.44	7.92	7.96
	8.50		8.00	
8	7.12	7.22	6.57	6.51
	7.32		6.44	
9	10.6	10.6	9.90	9.80
	10.6		9.70	
10	7.33	7.32	6.38	6.41
	7.30		6.44	
11	8.43	8.38	7.72	7.76
	8.33		7.80	
12	8.40	8.34	8.03	8.05
	8.28		8.07	
13	7.19	7.21	6.74	6.71
	7.23		6.68	

data were then revised in reference to the average lengths of the fish in the run on the basis of the approximation that the weight of the fish is proportional to the length cubed. These figures are treated as representing the standard fish at the beginning of the run at Albion. For the Stuart Lake fish the data are revised to the fish at Lummi Island since the lengths of these fish very nearly exactly represent the average of the run.

TABLES 63 to 66 show the moisture, fat and protein analyses of a kilogram of eviscerated fish of each sex after the extremes of the populations have been discarded. From the tables, the changes in each of these components between any two points may be found readily. The energy consumptions per unit distance (Cal. per km.) and per unit time (Cal. per day) are presented between each two points on the migration route. If percentage composition or change in percentage composition between any two points is desired, this may be found from the weight data on the left hand side of the page by dividing

by ten. These data are self-explanatory and since, as has been pointed out earlier, the data on changes in the average fish are more meaningful than the changes in percentage composition of the fish, these data will only be referred to as necessary under the general discussion of the standard fish.

TABLES 67 to 70 give the data for the standard fish that TABLES 63 to 66 give per kilogram of fish. In addition to the absolute composition of the standard fish in grams at each point and the changes for the standard fish between points expressed in Cal. per km. and Cal. per day, an additional column labelled "B" in the tables is included. This column serves the useful purpose of relating all changes back to the standard fish at the beginning of each run and is an expression of the changes between any two points expressed as a percentage of the reserves at Lummi Island for fish going to Stuart Lake and at Albion for fish going to Chilko Lake.

TABLES 71 to 74 give the analyses of the viscera of the Chilko fish.

### THE STANDARD FISH

Changes in the percentage composition of a fish as it moves up the river provide an excellent qualitative picture of the large magnitude of the changes taking place. However, the ultimate goal of a study of this type is to establish the absolute change in body composition of individual fish. If a fish could be removed from the river, analysed and returned, then this goal could be achieved with nearly 100% accuracy. Since this is impossible, some other means must be found to determine the absolute weight changes as a fish moves up river so that the percentage composition data can be given added significance. The 1956 study was undertaken on very short notice and the number of fish taken at each point was the maximum considered feasible with the facilities, personnel and time available. In 1957, the number of fish was increased and included groups of 80 fish obtained at Lummi Island, Lillooet and Forfar Creek. These fish serve a very useful purpose in the calculations for the average fish at each successive point of the 1956 runs. The data showed that the "body" length (i.e. the standard length, — the tip of the snout to the end of the vertebral column, minus the snout length, — the tip of the snout to the anterior margin of the eye orbit) did not change during the course of the migration upstream. For the 1956 Stuart sockeye, all fish from each point are corrected to the "body" length of the fish at Lummi Island. For the 1956 Chilko sockeye, all fish have been corrected to the "body" length of the average fish of the run. The fish from each point are of such uniform length that the correction is never large. Over the small body lengths involved the weight is assumed to vary as the length cubed. This fact has been established for *Salmo salar*. If the height and girth of the fish of each pure race

are as constant as the length at each selected station, it should ultimately be possible to obtain an even more precise standard fish by either taking these measurements or alternately measuring the volume of the eviscerated fish at each point. This possibility will be explored in the 1957 studies. In general, the 1956 results show the constantly decreasing energy reserves that would be expected as the average or standard fish moves up river. However, even though the few very large and very small fish have been discarded it is not always possible to measure the changes over short distances. This is caused by the fact that the small loss in energy reserves is more than offset by the error in determining the average reserves of the population. For this reason for Stuart Lake fish there is little to be gained by discussing both Albion and Lummi Island so Albion is omitted. Similarly, Fort St. James and Forfar Creek are close together and the former has been selected for more detailed discussion in the present report.

When a detailed analysis of the data for two or three years is available it should be possible to verify and extend some of the conclusions reached at this time. The three groups of 80 fish obtained in 1957 make it possible to tentatively assess the accuracy of the smaller 1956 sampling. Thus in 1957 the standard eviscerated male had a body weight at Lummi Island of  $2322 \pm 40$  gm. (mean  $\pm$  standard error) whereas the 1956 standard eviscerated male had a body weight of 2497 gm. In 1957 at Lillooet the eviscerated male decreased to  $2185 \pm 25$  gm., and increased at Forfar Creek to  $2382 \pm 47$  gm. In 1956 the eviscerated male followed the same trend, decreasing to 2286 gm. at Lillooet and increasing to 2429 gm. at Forfar Creek. In 1957 the

standard eviscerated female continually decreased in weight from  $2151 \pm 19$  gm. at Lummi Island to  $1908 \pm 41$  gm. at Lillooet and  $1775 \pm 10$  gm. at Forfar Creek. Similarly, the standard eviscerated female in 1956 continually decreased in weight through the same three points from 2227 gm., 2009 gm. and finally 1680 gm. The relative values show that if the conditions of the fish in 1956 and 1957 were similar the females sampled at Forfar Creek in 1956 were somewhat lighter than the average of the population but the data from the other points for both sexes are in good agreement. The data also

show that the 1956 fish of both sexes on the Stuart Lake run were of the order of 5% heavier than the 1957 Stuart Lake fish. The analyses on the flesh and on the head, skin, bones and tail, which combined reconstitute the eviscerated fish, have been completed for the 1957 group of 80 fish taken at Lummi Island. The eviscerated average male had 14.6% fat while the eviscerated female had 15.1% fat. Comparing these data with 13.6% for the 1957 Lummi Island male and 14.1% for the 1957 Lummi Island female it can be seen that both sexes had slightly greater fat reserves in 1956.

## CHANGES IN A STANDARD FISH OF THE STUART LAKE RUN

### Water and Weight

From Lummi Island until its death on the spawning grounds, the body of the standard male sockeye salmon gained 168 gm. of water which was a gain of 10.6% in body water. The body of the standard female lost 187 gm. of water for a loss in body water of 13.3%. Both sexes showed a loss in body water of 5% for the first 250 miles, that is from Lummi Island to Lillooet (FIGURE 2). From Lillooet to Fort St. James both sexes took on body water with the males gaining 20% compared with 13% for the females. The result was that both sexes showed a gain in body water from Lummi Island to Fort St. James, 8% for the females and 20% for the males. From Fort St. James until spawning was completed both sexes lost body water, 14% of the body reserve at Lummi Island for the female and 8% for the male. From spawning until death the females continued to lose more body water than the males, 8% (108 gm.) of the water at Lummi Island as compared with 2% (28 gm.). At no point on the migration had the female taken on sufficient water to balance the losses in fat and protein. The only point at which the female showed a significant gain in body water was between Lillooet and Fort St. James (186 gm.) but this was more than offset by a loss of 227 gm. in fat and protein. From Lummi Island until death the females lost 187 gm. of body water and 556 gm. of fat and protein for a total weight loss of 743 gm. For the males, Fort St. James was again the point where the water gains were the greatest and the gain in body water (317 gm.) from Lummi Island nearly counteracted the losses in fat and protein (340 gm.). As in the case of the females, the males did not maintain this balance and at death the gain in body water from Lummi Island (168 gm.) did not balance the loss in fat and protein (487 gm.). The overall weight loss of the standard eviscerated female was 34% from Lummi Island until death, whereas in the male it was only 13%.

### Fat

The female commenced the spawning migration with somewhat greater body fat reserves than the male per unit of body weight, 15.1% as com-

pared with 14.6%. However, because of the difference in weight of the sexes the fat reserves of the standard female (337 gm.) were somewhat less than for the standard male (365 gm.). The percentage utilization of the original fat reserves was consistent for the two sexes with those of the female being somewhat larger. The female with her somewhat greater reserves proportional to her body weight used a somewhat greater percentage of these reserves (77%) from Lummi Island to Fort St. James than did the male (73%). This extensive utilization of body fat reserves for the sexes continued until death at which time the females had used 96% of their Lummi Island fat reserves while the males had used 91%.

When considering the energy reserves utilized by each sex, the completion of the spawning act is probably the most critical point. The body of the standard female used 314 gm. of fat from Lummi Island until it spawned. This represented a total utilization of 93% of the fat reserves at Lummi Island. The male used 326 gm. of fat or 89% of its reserves at Lummi Island. It may be concluded that although the female used more fat per unit of body weight from Lummi Island until it successfully spawned it also entered the river with more fat than the male per unit body weight in an amount approximately sufficient to balance the difference (FIGURE 2).

### Protein

The protein reserves of both sexes *per unit of body weight* were very nearly equal at Lummi Island with the average female having only about 1.7% greater reserves than the male but as in the case of the fat reserves, the standard female had somewhat less protein (443 gm.) than the male (488 gm.) because of its lesser weight. By the time the female had successfully spawned it had used 41% of the body protein it had at Lummi Island whereas the male had used only 30%. The female continued to draw more heavily on protein reserves up until the time of death when it had expended 53% of the Lummi Island reserves compared with only 32% for the male (FIGURE 2).

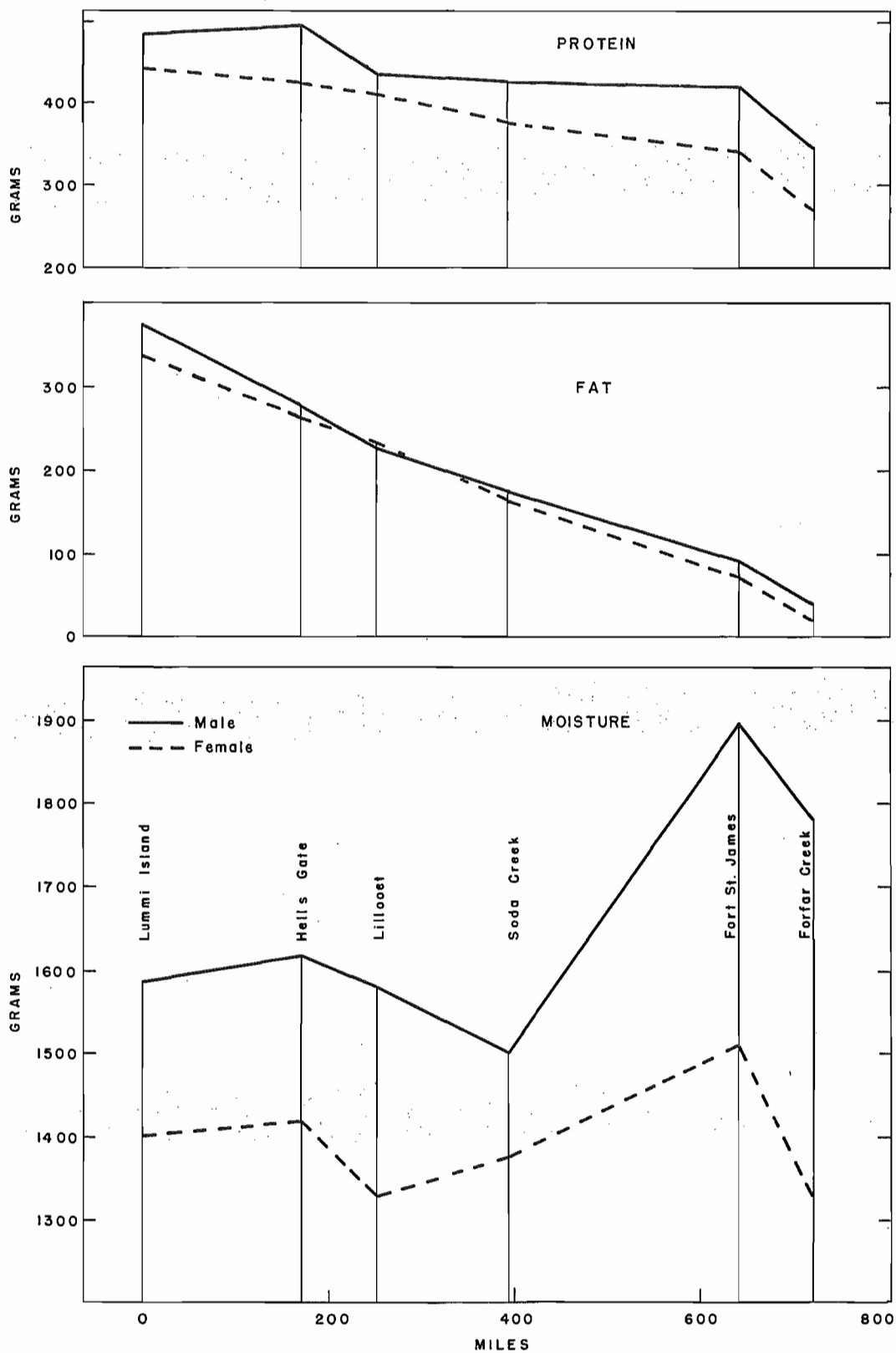


FIGURE 2. Changes in composition of standard eviscerated Stuart Lake fish, 1956.

## Energy Expenditures

By averaging the energy expenditures for a standard fish between Lummi Island and each subsequent point up to Fort St. James the female fish are found to expend 2.81 Cal./km. and the males 3.11 Cal./km. When only the fish at Lummi Island and Fort St. James are considered, the females average 2.76 Cal./km. and the males 2.70 Cal./km. Similar results are obtained when the energy expenditures from Lummi Island to Soda Creek and Lummi Island to Fort St. James are averaged, 2.91 Cal./km. for females and 2.97 Cal./km. for males. It is to be expected that the greater the distance between points the more significant the result. Averaging the energy expenditures for female and male standard fish between Lummi Island and Soda Creek and Lummi Island and Fort St. James it is found that the females use 129 Cal./day while the males use 131 Cal./day. From Fort St. James until the fish have spawned the females use 74 Cal./day while the males use 70 Cal./day. From the time of spawning until the time of death the females use 59 Cal./day while the males use only 23 Cal./day. Thus the energy expenditure per unit of time for female and male standard fish are nearly identical until spawning is completed. The females would appear to expend more energy than the males from spawning until death but because of the short time interval (5 days) from spawning until death this difference should be treated with reservation until the data for 1957 are available.

The energy expenditure of the standard fish of both sexes in different parts of the river is of considerable interest. The energy expended from the entire body of the fish should provide a good approximation for comparing the sexes, although it must be remembered that the internal organs (i.e. the alimentary tract) will provide some energy but this will probably not differ greatly with sex (see discussion on the Chilko Lake run). The data for the weights and some analyses of the internal organs of 1957 Stuart Lake migrants suggest that the energy reserves in the viscera are of a similar magnitude for the two sexes. It must be emphasized that the absolute energy expenditure over relatively short distances must be verified using more fish. However, if the river is divided into relatively large segments, then much greater confidence can be placed in the results.

In travelling between Lummi Island and Hell's Gate the body of the standard female used 2.68 Cal./km. of fat and protein, over the same route 2.80 Cal./km. were expended from the body of the standard male, the average live weight of a standard female between Lummi Island and Hell's Gate was 2464 gm., while a standard male weighed 2708 gm. To compare the energy expenditures of the sexes this difference in weight must be considered. The standard female thus utilized 1.09 Cal. from the body reserves to maintain 1 kg. of its live weight for

1 km. between Lummi Island and Hell's Gate (i.e.  $2.68 \text{ Cal./km.} \div 2.464 \text{ kg.}$ ). The standard male used 1.03 Cal. (i.e.  $2.80 \text{ Cal./km.} \div 2.708 \text{ kg.}$ ) from the body reserves to maintain 1 kg. of its live weight for 1 km. over the same route. Both sexes increase the gonad weight by about the same amount between these points, 20 gm. for the female and 17 gm. for male. From Lummi Island to Lillooet the females consumed 2.73 Cal./km. while the males consumed 3.67 Cal./km. On an equal weight of live fish basis, these figures become 1.13 Cal./kg./km. and 1.39 Cal./kg./km. respectively. The increased energy consumption for males between Hell's Gate and Lillooet as compared with the interval between Lummi Island and Hell's Gate is apparent. The females used 2.84 Cal./km. compared with 2.73 Cal./km. while the males used 5.46 Cal./km. as compared with 2.80 Cal./km. On an equal weight basis the females' energy consumption increased from 1.09 to 1.22 Cal./km./kg. while the males increased from 1.03 to 2.15 Cal./km./kg. An increase would be anticipated because the elevation of the river shows an average increase of only .312 m./km. between Lummi Island and Hell's Gate whereas a rise of .908 m./km. exists between Hell's Gate and Lillooet. Further, the temperature of the river would also result in increased energy consumption between Hell's Gate and Lillooet (62°F.) as compared with Lummi Island to Hell's Gate (58°F.) (TABLES 4, 5, 6). It would appear that the increased energy consumption is either too great for the males or too small for the females since such significant difference would not be anticipated between sexes. Apparently the consumption found for the males up to Lillooet and particularly between Hell's Gate and Lillooet is too high, i.e., the average male taken at Lillooet had greater reserves than the average of the run. This conclusion is strengthened by the low energy consumption for males between Lillooet and Soda Creek, 2.42 Cal./km. as compared with 5.46 Cal./km. between Hell's Gate and Lillooet. This would not be anticipated as the change in elevation of the river between Lillooet and Soda Creek is .957 m. per km. as compared with .907 m. per km. between Hell's Gate and Lillooet and the water temperatures were very similar, 62.5°F. as compared with 62°F. (TABLES 4, 5, 6). The females reflect the trend that would be anticipated and show an energy consumption between Lillooet and Soda Creek of 3.67 Cal./km. as compared with 2.84 Cal./km. between Hell's Gate and Lillooet but here also the average between Hell's Gate and Soda Creek is more significant than the absolute figures which would not be expected to differ by more than 5%.

In summary it appears that the male standard fish has not been so accurately sampled as has the female, and this is reflected most in the short distance from Hell's gate to Lillooet. The greater distance from Lummi Island to Soda Creek permitted far greater accuracy and here we find that males expend-

TABLE 4—Water temperatures in °F. concurrent with the peak presence of the Early Stuart and Chilko runs during migration, spawning and death, 1956 and 1957.

Early Stuart Peak			Chilko Peak		
	1956	1957		1956	1957
*July 4	55.3	58.0	**July 30	62.0	61.0
5	55.0	58.0	31	62.0	61.5
6	55.3	58.5	August 1	63.0	61.0
7	55.5	59.0	2	62.0	60.0
8	58.0	60.0	3	62.0	59.5
9	60.0	59.5	4	61.0	60.3
10	61.0	59.5	5	59.3	61.3
11	61.5	58.5	6	61.0	60.0
12	62.0	60.0	7	63.0	58.5
13	62.3	59.0	8	62.8	59.0
14	62.0	58.5	9	61.0	60.0
15	62.0	58.0	10	59.0	61.0
16	62.0	57.0	11	58.0	58.0
17	62.0	58.0	12	57.5	57.5
18	62.0	59.0	13	59.0	57.0
19	63.0	60.0	14	60.0	57.0
20	63.0	59.5	15	62.0	—
21	63.0	59.0	16	60.5	—
22	64.5	59.5	17	59.0	—
23	65.0	60.0	18	59.0	—
24	66.0	60.0	19	59.0	56.5
25	67.0	62.0	20	59.0	56.7
26	66.0	62.0	21	58.5	56.7
27	63.5	60.0	22	59.0	57.5
28	(62.0)	(61.0)	23	59.0	57.0
29	(62.0)	(60.0)	24	58.5	56.3
30	62.0	57.0	25	58.0	54.0
31	62.0	58.3	26	58.0	53.3
August 1	48.0	47.0	27	57.3	51.0
2	48.0	42.5	28	56.3	52.8
3	49.0	48.5	29	56.0	53.5
4	49.0	48.5	30	56.0	54.0
5	49.5	48.5	31	55.8	53.0
6	49.5	49.5	September 1	54.8	53.8
7	49.0	48.5	2	54.8	53.0
8	48.8	49.0	3	52.0	53.8
9	50.0	48.5	4	50.3	54.0
10	50.5	48.0	5	51.6	54.3
11	50.5	49.0	6	53.0	54.0
12	52.5	51.0	7	53.8	53.3
			8	54.0	53.5
			9	53.5	53.8
			10	53.8	53.5
			11	54.0	53.3
			12	54.0	53.0
			13	54.3	53.3
			14	54.8	53.8
			15	54.8	53.5
			16	54.8	52.9
			17	54.8	49.3
			18	54.8	47.8
			19	54.8	47.5
			20	53.5	48.5
			21	53.3	49.5
			22	51.5	50.3
			23	51.8	50.5

\* Date of Lummi Island sample.

\*\* Date of Albion sample.

**TABLE 5—The average water temperatures in °F. during the 1956 and 1957 Stuart Lake sockeye run.**

	1956	1957
Lummi Island to Hell's Gate .....	58.0	59.0
Hell's Gate to Lillooet .....	62.0	59.5
Lillooet to Soda Creek .....	62.5	58.5
Soda Creek to Fort St. James .....	62.0	60.0
In Forfar Creek until spent .....	48.9	47.8
In Forfar Creek from spent to death .....	50.9	49.1

**TABLE 6—Changes in elevation per unit distance up river and weighted average water temperatures between stations.**

Locations	Distances (km.)	Changes in Elevation (metres)	Changes in Elevation Per Unit Distance Up River (metres/km.)	Average Weighted River Temp. °F.
<b>Stuart Lake Run</b>				
Lummi Island to Hell's Gate .....	274	85.4	.312	58
Hell's Gate to Lillooet .....	129	117	.907	62
Lillooet to Soda Creek .....	209	200	.957	62.5
Soda Creek to Fort St. James .....	418	276	.660	62
<b>Chilko Lake Run</b>				
Albion to Farwell Canyon .....	419	335	.800	62
Farwell Canyon to Keighley Holes .....	129	771	5.98	59
Albion to Keighley Holes .....	548	1106	2.02	—

ed 3.24 Cal. from the body per kilometer travelled, or expended 1.26 Cal. (3.24 Cal./km. ÷ 2.586 g.) to sustain 1 kg. of live fish for 1 km. in the river while the female expended 3.05 Cal./km. or 1.28 Cal./km./kg. The still greater distance involved from Lummi Island to Fort St. James should permit a more accurate assessment of the true relative energy consumption of the sexes in the river. The females consumed 2.76 Cal./km. or 1.16 Cal./km./kg. while the males consumed 2.69 Cal./km. or 1.01 Cal./km./kg. This is equivalent to 51.6 Cal./kg./day for females and 44.2 Cal./kg./day for males. *This reflects a body energy expenditure per unit of live weight of approximately 12% more for females than for males from Lummi Island to Fort St. James.* This would be anticipated if both sexes used approximately the same energy per unit of live weight to maintain life during the migration because of the greater gonad size of the female. Thus, the standard female ovaries had increased 190 gm. at Fort St. James over the

weight at Lummi Island whereas the male testes had increased only 12.4 gm. The gonads were not analyzed for the 1956 run but some preliminary data are available for the gonads of the 1957 Stuart run which would be sufficiently similar to permit an estimation of the energy difference for the sexes.

The ovaries would have a fat content of about 12% as compared with 2% for the testes. The protein content of each will be taken as 17.5%. The female thus deposited about 22.5 gm. more oil and 31.9 gm. more protein in the ovaries than the male deposited in the testes. This represents a total of 339 Cal. more (9.3 x 22.5 + 4.1 x 31.9) going into ovaries than into testes. Between Lummi Island and Fort St. James the body of the standard male expends 2781 Cal. The body of the standard female expends 362 Cal. more than the male on an equal weight of live fish basis between Lummi Island and Fort St. James. This is in good agreement with the extra 339 Cal. diverted into the female gonads.

From Soda Creek to Fort St. James it would be anticipated that the energy consumption would be less than between Hell's Gate and Soda Creek because the change in altitude in meters per kilometer is .907 between Hell's Gate and Lillooet, .957 between Lillooet and Soda Creek and only .660 between Soda Creek and Fort St. James (TABLE 4). The data support this reasoning. The standard female used 2.32 Cal./km. while the standard male used 1.89 Cal./km. between Soda Creek and Fort St. James. This contrasts with an expenditure for females of 3.35 Cal./km. and for males of 3.60 Cal./km. between Hell's Gate and Soda Creek.

The energy expended by the sexes from Fort St. James until the time the fish spawned at Forfar Creek was 73.9 Cal./day for the females and 75.6 Cal./day for the males. When these data are recalculated and expressed as the body energy required to maintain the life processes of a kilogram of live fish it becomes 35.7 Cal./day/kg. for females and 30.1 Cal./day/kg. for the males.

The energy expended by the female from spawning until death was very much greater than that expended by the male. The female expended 58.8 Cal./day as compared with only 22.7 Cal./day for the male. This is equivalent to 35.3 Cal./day/kg. for females and 9.8 Cal./day/kg. for males. Because the time interval was rather short (5 days) the quantitative aspect of these figures must be checked another year. However, the results are qualitatively in agreement with the observed greater activity of the female after completion of the spawning act. Probably the important point to note is the greatly decreased energy consumption of both sexes between completion of the spawning act and death, and not their expenditures relative to each other. This decreased energy consumption in the final days of life must be borne in mind when assessing the possible effects of delay. During this period, could the fish increase their activity if previous delay made it necessary? Experimental delay based on the above data should provide additional insight into this aspect of the problem.

From the foregoing discussion it can be seen that the body of the standard female and the standard male averaged approximately the same energy expenditure, including gonad development, during the migration to the spawning grounds. From Fort St. James until death the standard female expended more body energy than the standard male per unit of live weight and in addition underwent further gonad development.

Does the female have energy reserves in excess of those of the male sufficient to compensate for the extra energy diverted to gonad development? The answer is evidently "no". On an equal weight of live fish basis at Lummi Island the standard females showed an identical body protein content and only

7 gm. more body fat when compared with males (the percentage composition data for the body suggest that the protein reserves of the female are somewhat greater than those of the male). However, it must be borne in mind that the body protein energy reserves relative to the live weight of the fish will not necessarily follow the same pattern.

If the female does not have sufficiently greater reserves to compensate for the greater energy expenditure and yet lives as long as the male, where does the energy come from? The preliminary data for 1957 and the Chilko data suggest that the viscera do not supply the additional energy. The female must utilize a greater proportion of the body reserves than does the male. The data show that this is the case. The body of the standard dead male at Forfar Creek had 91.3% less fat and 31.6% less protein than the body of the standard male at Lummi Island. By comparison, the body of the standard dead female at Forfar Creek contained 95.6% less fat and 52.6% less protein than did the body of the standard female at Lummi Island. The body percentage composition data at death do not adequately emphasize the difference in the sexes. The body water was 82% for the males and 82.9% for the females. Fat was 1.5% for the males and 1.0% for the females and protein was 15.6% for the males and 14.3% for the females. However, the absolute weight loss of the two sexes was quite different. The body of the standard female weighed only 1468 gm. at death while at Lummi Island it weighed 2227 gm. By contrast the body of the standard male weighed 2143 gm. at death compared with 2497 gm. at Lummi Island. Thus, while the standard female lost 34% of its body weight and consumed 80% of its total body fat plus protein the standard male lost only 14% body weight and only consumed 57% of its total fat plus protein. From the energy viewpoint this represents a consumption at death of 80% of the Lummi Island calorie reserves for the body of the standard female and 69% for the body of the standard male.

In connection with energy reserves and their expenditure in relation to the successful spawning of sockeye salmon, the question arises as to the effect that reduction of energy reserves by reason of delays may have on the ability of the fish to reach the spawning grounds and, if they reach these, on their ability to complete the spawning sequence. If a delay in the river involves an energy expenditure of 128-131 Cal./day, in other words if a fish maintains normal activity, and if it still spawns on schedule, it will be required to increase its energy expenditure rate at a time in its life when energy consumption would normally be small. If the fish were delayed would the males, and more importantly, would the females be able to draw more completely on their body reserves. A point will be reached beyond which the fish can no longer draw on fat and protein for energy but because a fish has



died it cannot be assumed that this point has been reached. Reserves of an essential body metabolite such as a mineral, hormone, enzyme or vitamin may run out independent of the energy expended. Time may also be an important factor.

Future studies should include a planned delay of fish in order to attempt to determine the ability of each sex to further deplete the energy reserves. The data suggest that the female may be the limiting sex in this regard but she may be able to continue to draw further on her reserves while the male may not. It is thus essential to make the determination for both sexes.

#### Changes in Proximate Composition of 1956 Stuart Lake Sockeye Compared with Amur River Chum

In discussing the changes in the chemical composition of the body of Stuart Lake migrants it appears of interest to include a comparison with the data obtained by Pentegov and co-workers with the chum salmon, *O. keta*, on the Amur River. If we consider Langre Island, which was Pentegov's first point of collection, to correspond with Lummi Island, then Sophiskoye village which is 407 km. up river would correspond with Lillooet which is 402 km. The total distance to the spawning ground is 1150 km. for the Fraser River fish and 1193 km. for the Amur River fish. The average rate of travel on the Amur was calculated to be 44.6 km./day, while on the Fraser it was 42.7 km./day. The temperature at the 400 km. check points were 62°F. for the Fraser and 61°F. for the Amur. The average daily temperature on most of the route to Stuart Lake was almost constant, while on the Amur it showed a general decrease as the fish moved upstream. The chum salmon apparently swam in water temperatures of only 50°-55°F. for the final two-thirds of the river migration, while the sockeye moved in an average water temperature of 62°F.

#### CHANGES IN A STANDARD FISH OF THE CHILKO LAKE RUN

In some instances values obtained on the Stuart run will be included in brackets for purposes of comparison and later in the report additional comparisons will be made. The values in brackets are merely meant to serve as reminders of the order of magnitude of the results on the Stuart Lake run. It must be borne in mind that unless stated, the values for Stuart originate at Lummi Island and the values for the Chilko Lake run originate at Albion. However, the values at these points are not greatly different when considered chronologically in relation to spent or dead fish.

#### Water and Weight

From Albion until its death on the spawning grounds the body of the standard female lost 156

(TABLES 4, 5, 6). The temperature on the spawning grounds was about 48°F. in each case. The analyses apply to the entire eviscerated fish on the Stuart Lake fish whereas the head and tail were removed on the Amur River fish.

From the first check point until death the average water content of the sexes combined had increased from about 63.5% to 82.5% in the Stuart fish and from 68% to 85% in the Amur fish (TABLE 7). There appears to be no consistent difference between the sexes. The fat content of the Stuart Lake sockeye decreased from about 14.8% to 1.3% while for chum the decrease was from 10% to 0.3%. The apparently greater fat content for the female chum at the starting point was not substantiated at two of the other three check points in the first 400 km. and at least part of the difference may represent a sampling error. The protein values in the Russian work were obtained by difference but should be accurate. At the first two check points there is a consistently greater protein content in the chum. However, at death the chum appear to have depleted their stores more than the sockeye depleted theirs.

It is when we consider the standard fish, where percentage composition changes are replaced by absolute weight changes and where the changing weight of the fish is taken into account, that a more meaningful comparison can be made. This will be discussed after the Chilko run has been considered. It is obviously desirable to ascertain whether the higher water content of the chum at death as compared with the sockeye and the other differences in the two species entirely represent a difference in body composition or to what extent the exclusion of the head and tail affects the results. The question may be resolved when analyses have been completed on the various organs and tissues of the three groups of 80 of the 1957 Stuart Lake migrants under investigation.

gm. of body water (187 gm.) for a loss in body water of 10.5% (13.3%). The body of the standard male sockeye salmon gained 320 gm. of water (168 gm.), which was a gain of 19.5% (10.6%) in body water. For the first 419 km. from Albion both sexes lost body water. The females lost 15.4% while the males lost 7.3%; it will be recalled that in the early stages of the Stuart run from Lummi Island to Lillooet, which is about the same distance, losses were also experienced by both sexes and were of the order of 5%. It appears therefore that it is a general phenomenon that sockeye of both sexes lose body water during the early stages of the migration from the sea up the river. It must be remembered that the river migration on the Chilko Lake run is appreciably shorter than that of the Stuart Lake run.

TABLE 7—A comparison of the proximate percentage composition of 1956 Stuart Lake sockeye and Amur River chum salmon.

Kilometers	Sex	Amur River <i>O. keta</i>			Stuart Lake <i>O. nerka</i>		
		Water	Fat	Protein	Water	Fat	Protein
0	♂	68.7	9.19	21.08	63.7	14.6	19.5
	♀	67.0	11.28	20.68	63.1	15.1	19.9
400	♂	70.1	8.26	20.53	69.3	10.0	19.1
	♀	70.4	7.70	20.70	66.3	11.7	20.2
Spawned	♂	85.4	0.11	13.66	81.1	1.9	15.5
	♀	77.9	1.57	15.85	80.8	1.4	16.0
Fresh Dead	♂	85.7	0.17	13.26	82.0	1.5	15.6
	♀	84.6	0.49	13.96	82.9	1.0	14.3

However, both sexes show large gains in body water from Farwell Canyon to Keighley Holes, averaging 12 and 13% for the two sexes. It will be recalled that in the latter part of the Stuart Lake run from Lillooet to Fort St. James both sexes took on body water, the females gaining approximately 13% compared with 20% for the males. So again we find that the loss in body water which occurs early in the migration is replaced in the later stages of the river migration. From Keighley Holes until completion of the spawning act the females show little change in body water while the males continue to show a large increase, amounting to 28.4% of the reserves at Albion. For roughly comparable data on the Stuart Lake run the interval from Soda Creek until the fish had spawned may be considered. Here again the females showed little change in water content experiencing a decrease of about 3.5% of the reserves at Lummi Island while again the males showed a large increase in water amounting to 17.5% of the reserves at Lummi Island. From the time the spawning act is completed until death both sexes show large decreases in body water. The female lost 10.7% of the reserves that it had at Lummi Island, the male lost 13.9%. By comparison on the Stuart Lake run it will be recalled the female lost of the order of 8% of the Lummi Island reserves while the male approximately retained its body water losing only about 2%. As on the Stuart Lake run, at no point did the female take on sufficient water to balance the losses in fat and protein. As a matter of fact at no point was the water in the standard fish significantly greater in absolute amount than it was at Albion. Late in its life the Chilko male took on enough water to balance the losses of fat and protein but as in the case of the Stuart Lake run at death this balance was not maintained.

#### Fat

The female commenced the spawning migration with somewhat greater body fat reserves than the male per unit of body weight, 14.8% as compared with 14.1%. It will be recalled that a similar situation existed at Lummi Island on the Stuart run where the reserves of the female were 15.1% as compared with 14.6% for the male. However, as on the Stuart run because the standard female was smaller than the standard male, the actual reserves of the female at Albion were less, 343 gm., than those of the standard male, 355 gm. At Albion on the Chilko Lake run the standard eviscerated female weighed 2320 gm. as compared with 2334 gm. on the Stuart Lake run; the standard eviscerated male on the Chilko Lake run weighed 2520 gm. as compared with 2596 gm. for the standard eviscerated male on the Stuart Lake run. The standard female was 50.5 cm. in body length on the Stuart run and 50.3 cm. on the Chilko run. The standard male was 51 cm. on both runs. The female used a consistently greater percentage of her fat reserves at each point as compared with the male. Thus at death the female had consumed 91.4% of the fat reserves which she had at Albion while the male had only consumed 77.6% of its reserves. The importance of the reserves utilized up until the time of completion of the spawning act has been emphasized for the Stuart Lake run. It will be recalled that on the Stuart Lake run the standard female had used 93.0% of her Lummi Island reserves at the completion of the spawning act where the male had only used 88.6% of its reserves. If the Stuart Lake run data are calculated from Albion the values are 92.5% and 88.3% respectively. On the Chilko run the female had only used 85.8% of her reserves at Albion at the completion of the spawning act and the male had

used only 73.8% of its reserves at Albion. At Farwell Canyon which is 419 kilometers from Albion we have a distance comparable to the distance which the Stuart Lake fish travelled between Lummi Island and Lillooet. Up to Farwell Canyon the female utilized 42.6% of the fat reserves which she had at Albion whereas the male utilized 32.9% of the fat reserves it had at Albion. Up to Lillooet on the Stuart run the female had utilized 30.3% of its fat reserves and the male 37.4% of those available at Lummi Island. On the Stuart run it will be recalled that it was concluded that although the female used more fat per unit of body weight from Lummi Island until it successfully spawned, it also entered the river with more fat than the male in an amount approximately sufficient to balance this deficit. However, on the Chilko run the difference in fat consumption for the two sexes is not compensated by the increased stores of the female upon entering the river. In general, then, the difference between the sexes is much more pronounced on the Chilko run than on the Stuart as far as fat consumption is concerned.

### Protein

It will be recalled that the protein reserves of both sexes on the Stuart run were very nearly equal at Lummi Island per unit of body weight with the average female having about 1.7% greater reserves than the male. A very similar situation applies to the Chilko run. The body of the female had 19.4% protein at Albion while the body of the male had 18.9% or a difference of  $2\frac{1}{2}$  to 3% in favor of the female. Up until the time of death the female on the Chilko run had used 60.5% of the reserves at Albion while the male had used only 41.6% of its reserves at Albion. It will be recalled that on the Stuart run the females had used more of their protein reserves at death than had the males, 53% of the Lummi Island reserves as compared with 32% for the males. If the Stuart Lake run data are calculated from Albion the results are 54.8% and 33.6% respectively. The greater protein consumption of the females as compared with the males on the Chilko run was also clearly evident after the fish had spawned when the females had used 43.2% of the Albion protein reserves as compared with only 28.6% by the males. A more detailed comparison of the conditions on the two runs will be given later.

### Energy Expenditures

Before discussing the energy expenditures of the Chilko Lake fish reference should be made to the sampling of fish. It has been pointed out for the Stuart Lake fish that in general the selection of an average fish of both sexes has been fairly satisfactory. Where discrepancies did exist there were a sufficient number of sampling stations to permit detection of irregularities. However, this does not apply to Keighley Holes on the Chilko run. The fish from this point, while somewhat longer than those

from the preceding points, were apparently out of proportion in their other dimensions and/or had greater reserves than the average of the population. As a result the energy reserves of the average fish are high in proportion to those at Albion and Farwell. It is to be expected with relatively small samples that this situation would occur occasionally. The fish at this point were caught by Indians. Unfortunately, it appears that probably through habit the largest fish were selected. It is recognized that the use of the formula "weight varies as the length cubed" on these larger fish introduces a comparative error and the data are used with caution. In future years it is hoped to overcome this difficulty by determining the volume of the body of each fish by means of its weight and the weight of water which it displaces or to measure the height and girth of each fish taken for analysis as well as taking similar measurements for a large number of fish at each point on the river. The alternative would be to sample a large enough number of fish that the average of the population would be obtained but the number of stations would have to be kept small.

The change in elevation per unit distance up the river from Albion to Farwell Canyon is approximately 0.8 meters per kilometer, which is similar to the change in elevation between Hell's Gate and Soda Creek (approximately 0.9) on the Stuart run, and the energy expenditures are also comparable. Thus the standard female expends 4.1 Cal./km. between Albion and Farwell whereas between Hell's Gate and Soda Creek on the Stuart run the average female expended 3.3 Cal./km. Between Albion and Farwell the standard male expends 3.1 Cal./km. whereas between Hell's Gate and Soda Creek the standard Stuart male expends 3.6 Cal./km. Thus, since the data between Albion and Farwell indicate that the changes are of the expected order of magnitude supporting evidence is available for the poor samples at Keighley Holes, for if Keighley Holes samples were correct then, for example, the energy expended by the standard female between Albion and Keighley Holes is calculated to be 2.8 Cal./km., whereas the change in elevation is 20 m./km. or  $2\frac{1}{2}$  times that experienced by the fish in going from Albion to Farwell. Since it is a relatively short distance from Farwell to the spawning ground and since the fish spend such a long time on the spawning grounds relative to the time required to travel this distance, the sample at Keighley Holes is not critical from the point of view of assessing the energy expenditures of the fish over the greater part of their life. Thus, from Albion to Farwell the standard female expended 157 Cal./day whereas from Farwell until the time the fish had spawned it halved its energy consumption and only consumed 73 Cal./day. This greatly decreased energy consumption is no doubt due in large part to the low temperature of the water in the area of the spawning ground as compared with the temperature of

the water in the Fraser River. In a similar manner the male which was consuming 117 Cal./day from Albion to Farwell dropped its energy consumption to 70 Cal./day from Farwell until the time it spawned. In time, Farwell Canyon to spawning represents 25 days which for the Stuart run is equivalent to the time from Lillooet until the fish spawned. Here the standard female expended 106 Cal./day and the standard male 89 Cal./day. It thus appears that, as would be expected, the Chilko fish expend less energy per unit of time than do the Stuart fish over this very large part of the total time which the fish spend on the spawning migration. In other words, it appears that the greatly increased energy consumption which the fish must experience from Albion to Keighley Holes with its attending rapid change in elevation as compared with the changes encountered by the fish on the Stuart Lake run is balanced by the decreased energy consumption while the fish wait for the ripening of the gonads in the relatively cool waters of the spawning area. From the time of spawning until death on the spawning grounds the consumption of energy for the female on the Chilko run remains at a fairly high level of the order of 71 Cal./day, whereas for the male it drops to 54 Cal./day. It will be recalled that on the Stuart Lake run the females also expended more calories per day from the completion of the spawning act until death than did the males.

#### Changes in the Composition of the Viscera of the Standard Fish on the Chilko Lake Run

Any thorough discussion of the viscera must take into account the changing weight and composition of the gonads particularly for the female and the decrease in weight of the alimentary tract of both sexes. It is not possible to evaluate these changes precisely at the present time but as was mentioned earlier, this is being investigated. The weight changes in the internal organs of the 1957 fish suggest that their energy stores during the river migration must be very small in comparison with the changes taking place in the body. The liver and possibly the kidney will provide some stored energy. These aspects of the problem will be considered in detail when the chemical analyses of the individual organs are completed. For the fish on both runs the almost quantitative extrusion of eggs was apparent whereas although the milt decreased appreciably after spawning, the extrusion was certainly not quantitative. The alimentary tract of 1957 Stuart Lake males decreased in weight from  $90.5 \pm 3.3$  gm. to  $16.4 \pm 1.0$  gm., while that of the females decreased from 78.3 to 12.9 gm. This was the only internal change of a large enough order of magnitude to appreciably affect the energy reserves with the exception of the changes in female gonads. The fat of the pyloric appendages has been emphasized as an energy source for the Atlantic *Salmo salar* (Paton). If the fat from this source is mainly ex-

pendent early in the migration as both the data for *Salmo salar* and the above data suggest, then the order of magnitude may be sufficient to provide a significant supplement to that coming from the body. Since the weight of the gonads for the standard fish of both sexes has been determined, and since the analysis of the entire viscera is available, a correction can be made to the data in TABLES 8 to 11 for the approximate composition of the gonads and the depletion of the viscera energy stores can be calculated with reasonable accuracy. TABLE 8 shows the composition of the viscera without testes or ovaries. The composition of the viscera of the standard fish was calculated from the analytical data obtained on the combined viscera plus gonads by applying a correction which assumed that the gonads had the following composition: testes — fat 2%, water 80% and protein 18%; ovaries — fat 12%, water 66%, protein 22%. These figures are based partially on analytical results on the 1957 Stuart run and partially on results of Paton and his co-workers on *Salmo salar* and should fairly accurately represent the composition of the testes and ovaries while the fish are in the river. The value for the moisture of the testes is probably a little low for fish once they have arrived at the spawning grounds but at this time the only samples concerned are those after spawning and at death where the contributions of the sex products are considerably decreased for the male and absent for the female. The calculations show that the viscera of the standard male lost 57% of the Albion fat reserves at death whereas the female viscera showed a 79% loss. For protein the male viscera decreased 32% while the female decreased 49%. While these percentage losses of the fat and protein reserves of the viscera are quite large the quantitative aspect in relation to the depletion of the body reserves needs to be examined. The body of the standard male between Albion and death on the spawning grounds expended 2.75 gm. of body fat while expending only 5.1 gm. of fat from the viscera exclusive of the testes. Thus, the entire fat supplied by the viscera including the alimentary tract accounts for only 1.85% of the fat energy expended by the standard male from the time it enters the river to the time it dies on the spawning grounds. From the point of view of prolonging the life of the salmon it appears that this amount of energy is almost negligible and the approximation made in estimating the composition of the gonads is sufficiently accurate. Over the same distance the body of the standard male expended 198 gm. of protein whereas only 6.9 gm. of protein were expended from the viscera. The viscera thus expended only 3.9% of the protein expended by the body over the distance from Albion to death. The results for the female are very similar. The body of the standard female expended 314 gm. of fat from Albion until death on the spawning grounds whereas only 8.7 gm. of fat were expended from the viscera over the same distance. The fat expended from

TABLE 8—Estimated composition of the viscera excluding the sex products for the standard fish on the Chilko run.

Location	Male			Female		
	Moisture	Fat	Protein	Moisture	Fat	Protein
<b>Albion</b>						
gm.	93.70	8.99	18.40	84.70	11.00	21.50
Cal.		83.61	75.44		102.3	88.15
<b>Farwell</b>						
gm.	75.50	5.32	16.66	58.40	6.21	21.66
Cal.		49.49	68.31		5.77	88.81
<b>Chilko Spent</b>						
gm.	103.3	3.35	13.45	98.98	3.36	14.45
Cal.		31.16	55.15		31.28	59.25
<b>Chilko Dead</b>						
gm.	103.8	3.89	11.50	88.36	2.35	10.87
Cal.		36.20	47.15		21.88	44.57

TABLE 9—Comparison of the gonads for Stuart Lake sockeye 1956 and 1957 and Amur River chum salmon.

Location	Days	Km.	Water Temp.	Testes %*	Ovaries %*
			°F.		
<b>Fraser (1956)</b>					
Lummi Island	0	0	56	2.36 (7) ***	3.59 (13)
Lillooet	10	403	62	3.56 (7)	6.52 (13)
Fort St. James	23	1032	62		11.70 (13)
Spawning Grounds	27	1152	48	3.12 (7)	15.70 (7)
<b>Fraser (1957)**</b>					
Lummi Island			58	2.20 (23)	3.37 (33)
Lillooet			58	3.46 (40)	6.40 (40)
Fort St. James			61	—	11.30 (16)
Spawning Grounds			47	3.31 (25)	13.70 (55)
<b>Amur River</b>					
Langre Island	0	0	63	4.11 (10)	7.02 (8)
Sophiskoya	12	407	62	4.21 (10)	10.10 (10)
Spawning Grounds	33	1192	48	3.08 (8)	17.40 (10)

\* Expressed as per cent of the live weight of the standard fish at each station.

\*\* See introduction.

\*\*\* Number of fish.

TABLE 10—Comparison of gonads of 1956 Stuart and Chilko Lake sockeye.

Location	Days	Km.	Testes %*	Ovaries %*
<b>Stuart</b>				
Albion .....	0	0	2.53	4.02
Soda Creek .....	11	483	3.35	7.44
<b>Chilko</b>				
Albion .....	0	0	3.37	4.01
Farwell Canyon .....	11	419	3.57	7.04

\* Expressed as per cent of the live weight of the standard fish at each station.

TABLE 11—Changes in the protein, fat, moisture and total calorie content of Stuart and Chilko Lake sockeye and Amur River chum salmon from the designated sampling station until death.

	Sex	Stuart Lake		Chilko Lake	Amur River
		Lummi Is. Death	Albion Death	Albion Death	Langre Is. Death
Protein	♂	-31.6%	-33.6%	-41.6%	-57.3%
	♀	-52.6	-54.8	-60.5	-57.7
Fat	♂	-91.3	-91.1	-77.6	-98.7
	♀	-95.6	-95.2	-91.4	-97.3
Moisture	♂	+10.6	+ 4.2	+19.7	-15.2
	♀	-13.3	-20.2	-10.5	-20.7
Total Energy	♂	-69.1	-69.0	-64.2	-77.2* (77.9)**
	♀	-79.8	-79.2	-80.0	-78.8* (79.5)**

\* Values given in the original work using 9.42 Cal./gm. for fat and 4.42 Cal./gm. for protein.

\*\* Recalculated from the original data using 9.3 Cal./gm. for fat and 4.1 Cal./gm. for protein to make the results comparable to those found in the present study.

the viscera of the standard female thus only represented 2.77% of the fat expended from the body of the standard female. The protein expended from the viscera of the standard female was identical percentagewise to that expended from the viscera of the standard male and accounted for only 3.9% of the protein expended by the body over the same distance. If it is borne in mind that the results can only be semi-quantitative until precise gonad data are available, a further breakdown of the data on the viscera indicates an interesting trend. For the early part of the run between Albion and Farwell Canyon the fat expended from the viscera of the standard male is 3.14% of that expended from the body whereas from Farwell Canyon until the fish are spent it is only 1.35%. The female showed the same trend, the figures being 3.29% between Albion and Farwell Canyon and 1.93% between Farwell Canyon and the completion of the spawning act. These would be the

results that would be expected judging from the decreased weight of the alimentary tract with time for the Stuart Lake fish in 1957. A logical explanation of these results is the one suggested by Paton for *Salmo salar*, namely, that the fat stored in the pyloric appendages is utilized early in the migration. The trend on protein is the reverse. For males from Albion to Farwell Canyon the protein expended from the viscera is only 1.93% of that expended from the body whereas from Farwell Canyon until the time the fish have spawned the protein expended from the viscera is 3.57% of that expended from the body. From Albion to Farwell the female showed no protein expended from the viscera while from Farwell until the time the fish have spawned the protein expended from the viscera represents 6.8% of that expended from the body. The overall results from Albion until the completion of the spawning act are thus the same for both sexes.

#### COMPARISON OF THE GONADS OF THE 1956 AND 1957 STUART LAKE SOCKEYE WITH THE AMUR RIVER CHUM SALMON

The magnitude of the energy which a starving upstream migrant must expend to produce the sex products has been discussed briefly in the section on energy expenditure. The standard Stuart Lake male had reached a near maximum gonad weight by the time it reached Hell's Gate and the maximum weight of 88 gm. was attained at Lillooet. By contrast, the female gonad had an initial weight of 88 gm. and it continued to increase in weight until it weighed 329 gm. on arrival at the spawning grounds.

The weight of the ovaries, particularly in relation to the live weight of the fish, should serve not only as an excellent criterion of the degree of sexual maturity but by so doing should provide useful data on the position of a fish in the river relative to its energy reserves. For example, when fish arrive in the spawning area over a long period of time, such as with *Salmo salar* in the rivers of Scotland, the ratio of gonad to live weight continually increased. The ovaries which in May and June accounted for only 1.2% of the weight of the fish increased to 23.2% in September and October. The increase in testes was from 0.15% to 3.32%.

In 1956 at Lummi Island the ovaries represented 3.59% of the live weight of the standard Stuart Lake female whereas in 1957 they represented 3.37% (TABLE 9). Although the 1957 data represent more fish, there is excellent agreement between the two years' data. If for any reason the run was delayed at sea this ratio of the weight of the ovaries to the live weight of the fish should show an increase at any given point on the river. It appears that not only did the fish arrive at

Lummi Island at the same chronological time but they also arrived in the same state of sexual maturity. The ovaries in 1956 at Lillooet were 6.52% of the weight of the live female and 6.40% in 1957. Again the agreement is excellent and shows that the fish are on schedule chronologically and biologically. Although the 1956 fish appear to be slightly more sexually mature on arrival at the spawning grounds it will be noted that the 1956 figure is based on only 7 fish. A more probable explanation of this difference may be related to the difficulty of sampling the fish immediately upon arrival on the spawning grounds. It will be noted that in 1956 and 1957 the data obtained at Fort St. James which is only 120 km. (75 miles) from the spawning grounds are in excellent agreement, 11.7% as compared with 11.3%. Thus, there is good preliminary evidence that the fish were in the same biological as well as chronological order in 1956 and 1957. The next report which will be written after the chemical analyses of the 1957 samples are completed will include a complete analysis of the data relative to the sexual maturity of the fish. In 1957 samples were taken in chronological order of the peak and of the late fish of the Early Stuart run and of the peak fish of the Late Stuart run. These data should answer the very important question does the sexual maturity of each segment of a run increase with time of arrival in the river? If it does, then delay would affect each group differently. If it does not, then data as to the effect of delay might well apply to all groups if other influences, notably energy reserves, are equal. The changing temperature effects with time will also be taken into consideration.



There was also excellent agreement between the two years for the percentage ratio of the weight of the testes to the live weight of the fish at Lummi Island (2.36%), Lillooet (3.56%) and Forfar Creek (3.12%). The small increase during the first 403 km. (250 miles) up to Lillooet is followed by a small decrease somewhere over the last 750 km. (465 miles) between Lillooet and the spawning grounds. This decrease in the testes weight in the final stages of maturation of the gonads is apparently significant and similar data

### COMPARISON OF GONADS OF 1956 STUART AND CHILKO LAKE SOCKEYE

It has now been established that the 1956 and 1957 Stuart Lake migrants were in the same stage of sexual development as measured by the weight of the gonads in relation to the live weight of the fish. It was thus concluded that the fish were biologically as well as chronologically on time. The question next arises whether the Stuart and Chilko fish were in the same stage of sexual development. The female is the more accurate indicator because very pronounced changes take place in the weight of the gonads in a very short period of time. The

were obtained for chum salmon (*O. keta*) on the Amur River in Russia. The chum salmon arrived in the river with a greater weight of ovaries proportional to the body weight but also had a greater proportion on arrival at the spawning ground. It should be noted that the chum were much larger than the sockeye and the average weight of the ovaries was 276 gm. at Langre Island compared with 88 gm. at Lummi Island, while that of the testes was 213 gm. compared with 59 gm.

ovaries of the Stuart Lake females represents 4.02% of the body weight at Albion while the ovaries of the Chilko Lake females represents 4.01%. At Soda Creek and Farwell Canyon, which are approximately 11 days distant from Albion (TABLE 10) the ovaries represent 7.44% of the live weight of the Stuart fish and 7.04% of the live weight of the Chilko fish respectively. The data strongly indicate that the two races are in a nearly identical stage of sexual development.

### CHANGES IN THE PHYSICAL MEASUREMENTS OF THE STANDARD FISH OF THE STUART AND CHILKO LAKE SOCKEYE RUNS COMPARED WITH AMUR RIVER CHUM SALMON

#### Snout Length

Changes in the head of migrating salmon have been noted by several investigators; for example, Pentegov and his co-workers state that the head of the chum salmon male on the Amur River was 1.11 times as long at death as it was when it entered the river. The female was 1.07 times as long. They found a maximum increase in the length of the head of the males of 1.26 times that when the fish entered the river, and the females 1.1 times. At the moment of death in males the weight of the head had increased 1.43 times and in females 1.9 times. The increase in the length of the head percentage-wise is considerably less than for the increase in snout length in the present studies. The snout length of the males on the Stuart Lake run was 1.4 times as long at death as it was at Albion, whereas for females the value was 1.19. On the Chilko Lake run the relationship between the sexes was still valid with the male snout increasing 1.6 times as compared with 1.46 for the female. However, it will be noted that the increase for the female on the Chilko run was actually slightly greater than the increase for the male on the Stuart Lake run.

During the first week from Albion on both the Stuart and the Chilko runs there is no increase in the snout length of the male, and there may even be a very slight decrease. There is actually no increase on the Stuart Lake run for males during the first 18 days from Albion to Soda Creek, and only

a very slight increase for males on the Chilko run during the first 16 days between Albion and Keighley Holes and the entire increase that was observed for the males on both runs essentially takes place during the next 20 days from Soda Creek to the time of spawning for the Stuart Lake males and from Keighley Holes to the time of spawning for the Chilko Lake males. As was the case with males, the females on both runs appear to show a very small decrease over the first 7-day period. As was the case with the males the greater part of the change in the snout length of the females occurs during the later stages of the migration.

#### Liver

Changes in the weight of the liver on the two runs were quite significant for the males. On the Chilko Lake run the males almost doubled the weight of their liver from Albion until their death on the spawning grounds. A similar trend was shown for the males on the Stuart Lake run but the increased weight of the liver was of a much smaller order of magnitude. The liver reached its maximum weight with the arrival of the fish at the spawning ground, after which there was quite a rapid decrease in the weight. By contrast, on the Chilko Lake run the maximum weight of the liver was attained at death. No significance can be attached to these changes until the analytical data have been obtained on the livers of the 1957 Stuart Lake run.



# COMPARISON OF THE ENERGY CONSUMPTION OF STANDARD STUART AND CHILKO LAKE SOCKEYE WITH AMUR RIVER CHUM SALMON

It was pointed out earlier that a more meaningful comparison of the data for sockeye and chum could be made on the standard fish rather than from a consideration of the changing percentage composition. Emphasis has also been placed on the importance of determining the ultimate extent to which a given species of fish can deplete its energy reserves. In order to directly compare the Stuart Lake and the Chilko runs it is necessary to compare the same initial sampling point, Albion, whereas to compare the Stuart sockeye and the Amur River chum Lummi Island and Langre must be taken. In this regard it should be noted that the time from Lummi Island to Albion is less than 10% of the time from Lummi Island to death. The standard fish of both sexes at Albion appear to be a little larger than the average of the run (or Lummi Island a little smaller) but for purposes of the present comparison the effect on the results is of very little significance. In the discussion which follows it is desirable to keep in mind the major points of comparison of the three runs: 1. Both the Stuart and the Amur fish have the same long battle (27 and 31 days respectively) against the river and reach the spawning grounds only a few days before spawning, while the Chilko fish are only 18 days in the river. 2. The rate of river travel on the Stuart and the Amur is similar, 42.4 km./day and 44.6 km./day; while the Chilko fish move at only 33.1 km./day. 3. The Stuart and Amur fish spend 27 and 31 days in the river where the temperature is about 62°F. although temperatures in the upper section of the Amur may be only 50 to 55°F. The Chilko fish spend only 18 days in the 60°F. water of the river and 25 days in the cold water, 53° - 54°F., of the spawning area. 4. The stage of sexual development of the Stuart Lake and Chilko Lake sockeye was almost identical upon arrival in the river whereas if the ratio of gonad weight to total live fish weight is fairly constant for sockeye and chum then the chum were (*ca.* 14 days) more advanced sexually than were the sockeye. However, the chum also have a proportionately greater ovary/body weight ratio than sockeye at the time of spawning, suggesting the stage of sexual development for the sockeye and chum is approximately the same.

The comparisons are as follows: 1. The results for the standard females show that the total consumption of energy relative to the body reserves on entering the river was similar for the two species of fish and for all three races (TABLE 11). 2. The fat consumption for females is greatest for the chum,

97.3%, followed closely by the Stuart 95.6%, while the Chilko fish, to which energy reserves would not be expected to be so critical, died when only 91.4% of the body fat reserves had been consumed. 3. The female chum also consumed more protein than the Stuart Lake sockeye, 57.7% as compared with 52.6%, but because of the relatively lower energy of protein as compared with fat, this does not greatly affect the total energy consumption. The protein consumption (60.5%) by the Chilko Lake female sockeye was greater than for the fish of either of the longer runs. Thus, it can be seen that the Chilko Lake female fish did not utilize fat reserves as efficiently as did the females that made longer river migrations but were able to utilize more body protein to obtain the necessary energy. This raises an important question. Could the female draw on the remainder of her fat energy reserves up to say 95-98% as do the fish that have consumed less body protein? An experimental delay of the Chilko run fish would possibly provide an answer. 4. All three groups lost body water with the greatest amount being lost by fish with the greater fat losses and least by the Chilko Lake fish. 5. For males the total energy consumption is different for each group. The greatest consumption was by the Amur River chum, 77.9%, followed by the Stuart sockeye, 69.1%, and finally the Chilko sockeye only consumed 64.2% of the body energy reserves at Albion. It should be pointed out that the study on the Amur lacked sufficient samples of dead fish to permit more definite conclusions to be formulated. 6. The consumption of fat by the males of the three groups followed exactly the same trend as was found for females, only the differences were more pronounced. The chum used 98.7% of the reserves followed by Stuart Lake fish with 91.3% while the Chilko Lake males only used 77.6% of the Albion reserves. 7. The male on the Chilko run did draw more heavily on body protein (41.6%) than did the Stuart Lake fish (33.6%) apparently associated with the far lesser consumption of fat but neither male sockeye even approached the 57.3% protein consumption of the male chum. 8. Both races of male sockeye showed a gain in body water while the chum showed a substantial loss.

In partial summary, all factors indicate that only in the Amur River fish do males and females draw nearly equally on body reserves. For sockeye, the female draws more heavily on her reserves than does the male whether the run is long or relatively short. The shorter run sockeye of both sexes draw more heavily on body protein reserves than do the longer run sockeye that draw more heavily on fat reserves.

## COMPARISON OF THE TOTAL BODY ENERGY EXPENDED TO MAINTAIN 1 KG. OF LIVE FISH FROM ALBION TO DEATH ON THE STUART AND CHILKO LAKE RUNS

Albion will be taken as the starting point for both races. To obtain the average weight of the live fish while energy was being expended, the following procedure was followed. The energy expended by the standard fish was calculated between Albion and Fort St. James, between Fort St. James and spawning and between spawning and death. The weights of the live fish were then averaged between the same points. This average weight in kg. was then multiplied by the energy consumed between the points and the sum of these values divided by the sum of the calories expended between each pair of locations. The answer is the average weight of the standard fish from Albion to death. If this value is then divided into the total energy expended from the body of the standard fish between Albion and death the result will be *the energy expended from the body of the standard fish in order to maintain 1 kg. of live fish from Albion to death*. The data show that the live weights of the standard fish during average energy consumption were 2.66 kg. and 2.32 kg. respectively for males and females on the Stuart Lake run. For the Chilko Lake run the location or time selected were Albion, Farwell, spawned and dead and the corresponding values were 2.61 kg. for males and 2.12 kg. for females.

The body of the average male on the Stuart Lake run had 5386 Cal. at Albion and 1668 Cal. at death or 3718 Cal. were expended from the body.

*The energy expended from the body of the standard male in order to maintain 1 kg. of live fish from Albion to death was therefore 1398 Cal. (3718 Cal.  $\div$  2.66 kg.). The value for the standard Stuart Lake female was 1644 Cal./kg. (3816  $\div$  2.32). Thus the body of the standard female expends 17.6% more energy than does the body of the standard male from Albion to death. It will be recalled that the difference between the sexes was 12% for the river migration.*

*For the Chilko Lake fish the energy expended from the body of the standard male in order to maintain 1 kg. of live fish from Albion to death on the Chilko Lake run was 1293 Cal./kg. (3376 Cal.  $\div$  2.61 kg.) and for the female it was 1903 Cal./kg. (4035 Cal.  $\div$  2.12 kg.). Thus the male on the Chilko Lake run consumed 8% less calories per unit of body weight than did the male on the Stuart Lake run, while the female on the Chilko Lake run consumed 16% more calories per unit of body weight than the female on the Stuart Lake run. It will be recalled, however, that the female on both runs used an almost identical percentage of the total Albion energy reserves (79%) while the male used a smaller percentage on the Chilko Lake run (64%) as compared with the Stuart Lake run (69%). The most striking feature of these data is that the female on the Chilko Lake run expended 47.2% more calories per unit weight of live fish from Albion until death on the spawning grounds than did the male.*

### SUMMARY

1. This is the first of a series of investigations designed to study the energy expenditures of Fraser River sockeye salmon, *Oncorhynchus nerka*, during the spawning migration, spawning and death.

2. The present report describes the results obtained on the 1956 sockeye run to Stuart and Chilko Lakes. A comparison of the results with certain data for the 1957 Stuart Lake run is included. Certain comparisons are made with the results of these investigations and those obtained for chum salmon, *Oncorhynchus keta*, on the Amur River by other investigators.

3. A. The fish were of a pure race. B. They were selected in chronological order. C. The members of the populations were nearly uniform in length. D. Moisture-proof bags and refrigeration were used to assure the samples reached the laboratory in good condition. E. Only 4-year old fish were taken for analysis and the extremes of the population either as to size or analytical composition were discarded from each point. F. Each fish was analyzed individually.

4. The average fish of the populations (standard fish) appears to have been sampled with sufficient accuracy to permit the evaluation of energy changes occurring during the interval from arrival on the spawning grounds until the completion of the spawning act. Larger samples will have to be taken, at least at certain locations, in subsequent years in order to verify or modify the calculations of energy expenditures of the average fish in relatively small segments of the river.

5. The volume of a relatively large number of eviscerated fish has been obtained at Lummi Island, Lillooet and Forfar Creek for the 1957 Stuart Lake migrants and when these data are complete further interpretation may be possible of the 1956 data.

6. Analytical data have been obtained on the protein, fat and water content of the entire fish exclusive of viscera for approximately 165 males and females at selected points on the Stuart Lake run and for approximately 135 males and females at selected points on the Chilko Lake run. In addition,

an analysis of the viscera was made for fish on the Chilko Lake run.

7. Tables are presented which interpret the data for the 1956 Stuart and Chilko Lake sockeye in the following manner. For both runs the average weight-length data are presented for the average fish from each point as are the weights of the entire viscera, gonads and liver. Each point also includes the moisture, fat and protein analyses for the average eviscerated fish of each sex. The data for each run are then converted so that they apply to the standard fish at each point. The weight and analytical data on the viscera apply only to the Chilko Lake run. A second table for each run interprets the changes per kilogram of eviscerated fish of both sexes. From this table it is possible, without calculation, to obtain the changes between any two points on the migration, for example, change in the total grams of moisture, fat or protein and changes in the energy expenditure from the body of either sex expressed in Calories per unit distance (Cal./km.) or in Calories per unit time (Cal./day). For the Chilko Lake fish similar data are also presented for the changes occurring in the viscera. An additional table for each run analyzes the data with the view of showing the changes occurring in the body of the average (standard) fish of each sex on each run. In addition to the data which may be obtained from the previous table, this table presents the data so that they may be interpreted in terms of percentage of moisture, fat and protein reserves which the fish had at Albion and which have been used up to the point under consideration. A similar table is given for the viscera of the standard fish at each point on the Chilko Lake run. Because these data are interpreted so completely in the tables they are only referred to in the text where it is felt that the results have particular significance especially from the comparative point of view.

8. The many differences in condition encountered by fish on the Stuart and Chilko Lake runs are discussed and these are compared with conditions encountered by *O. keta* on the Amur River. Both the Stuart and the Amur fish spend about 25 days in the river and reach the spawning ground only a few to 12 days before spawning, while the Chilko fish are only 19 days in the river and 25 on the spawning ground. In general, temperatures in the Fraser River are appreciably higher than those in the spawning area so the Chilko Lake migrants spend 25 days in the relatively cool waters of the spawning grounds whereas the Stuart Lake migrants spend only 12 days under these conditions. The total time elapse from entering the river until death is approximately 37 days for those going to Stuart Lake and 44 days for the Chilko Lake fish. The rates of travel in the river of the Stuart Lake sockeye and the Amur River chum were very similar, averaging about 43 km./day while the Chilko River sockeye moved at only 33 km./day.

9. The average sizes of the fish on the Chilko Lake and Stuart Lake runs for 1956 were almost identical when the fish entered the river and the body fat reserves of the Chilko Lake fish were similar to those going to Stuart Lake. The fat reserves of the female were greater than those of the male for both runs. Thus, at Lummi Island on the Stuart Lake run the reserves of the female were 15.1% compared with 14.6% for the male while on the Chilko run the body of the average female contained 14.8% at Albion as compared with 14.1% for the male. The body fat reserves of the average fish at Lummi Island for the 1956 Stuart Lake run were slightly greater than those of a large sample (80 fish) taken for another study in 1957 when the eviscerated average female had 14.3% fat while the eviscerated male had 13.4% fat. At Lummi Island on the Stuart Lake run the body protein reserves of the female on a unit weight basis were only 1.7% greater than the reserves of the male, in other words, the female had approximately 3% greater body protein reserves than did the male.

10. The very large increase in the weight of the ovaries of the female during the spawning migration has been used to evaluate the sexual maturity of the fish on the various runs. The data are evaluated as a ratio of the weight of the gonads to the live weight of the fish at a given location. The data strongly suggest that the female migrants to Stuart and Chilko Lake are in the same stage of sexual development at Albion where the ovaries of the female going to Stuart Lake represent 4.02% of the live weight of the fish while they represent 4.01% of the live weight of the fish going to Chilko Lake. On a time elapse basis further check is provided 11 days later at Soda Creek and Farwell Canyon where the ovaries now represent 7.44% of the live weight of the Stuart Lake fish as compared with 7.04% of the live weight of the Chilko Lake fish.

11. The data show that the 1956 fish of both sexes on the Stuart Lake run were approximately 5% heavier than those on the 1957 Stuart Lake run.

12. The fish of both sexes on the 1956 and 1957 Stuart Lake run showed the same trend in weight changes. The data suggest that the female samples during 1956 from Forfar Creek were somewhat lighter than the average of the population but for other points and for both sexes the data are in good agreement.

13. On both the 1956 Chilko and Stuart Lake runs the fish of both sexes, exclusive of viscera, lose body water over the first 400 km. This averages about 10% for the fish of both runs. Loss was somewhat greater for the fish going to Chilko than it was for those going to Stuart Lake but the total distance for the Chilko fish migration was spent in fresh water while for the Stuart fish part of the distance from Lummi Island to Lillooet was spent in brackish water. For the remainder of the river

migration, i.e., from Keighley Holes until the completion of the spawning act in Chilko River and from Soda Creek until the completion of the spawning act in Forfar Creek, the males showed large increases in body water, 28.4% of the Albion reserves for the Chilko Lake migrants and 17.5% of the reserves at Lummi Island for the Stuart Lake migrants. The females of both runs showed very little change. Both sexes of both races lose body water from the time of the completion of the spawning act until death and the losses during this interval were greater for the Chilko Lake fish of both sexes, with the males losing 14% of the Lummi Island reserves compared with 11% for the females. Comparable data for the Stuart Lake run was 2% for the male and 8% for the female. At no point on either the Chilko or the Stuart Lake run did the body of the average eviscerated female take on sufficient water to balance the losses in fat and protein. This was particularly apparent on the Chilko Lake run where the absolute amount of water in the average fish was never significantly greater than it was at Albion.

14. On the Stuart Lake run the female used 96% of her Lummi Island fat reserves up to the time of death on the spawning grounds, while the males used 91%. Up to the completion of the spawning act the comparable figures were 93% and 89%. However, although the female used more fat per unit of body weight from Lummi Island until she successfully spawned, she also entered the river with more fat than the male per unit of body weight in an amount approximately sufficient to balance the deficit. On the Chilko Lake run the female consumed 91.4% of the Albion fat reserves up until the time of death, while the male consumed only 77.6%. On the Chilko run the difference in fat consumption for the two sexes is not compensated by the increased stores of the female upon entering the river.

15. Up until the time of death on the Stuart Lake run the body of the standard female expended 53% of the Albion protein reserves compared with only 32% for the male. The female on the Chilko run used 61% of the reserves at Albion while the male used 42%. The results clearly show that both sexes on the Stuart Lake run used their fat more efficiently while both sexes on the Chilko Lake run draw more heavily on their body protein reserves.

16. On the Stuart Lake run the average energy expended from the body reserves of the female to maintain 1 kg. of its live weight for 1 km. was 1.16 Cal., while the fish was in the river. The corresponding value for the male was 1.01 Cal./kg./km. This is equivalent to 51.6 Cal./kg./day for females and 44.2 Cal./kg./day for males. On the Chilko Lake run, while the fish were in the river, from Albion to Farwell Canyon, the standard female expended 157 Cal./day from its body while the standard male expended 117 Cal./day. In the cooler waters of the

spawning area the energy consumption dropped so that from Farwell until the time the fish had spawned the females consumed 73 Cal./day as compared with 70 Cal./day for the males. From the time the spawning act was completed until death the consumption of energy for the females remained at a fairly high level of 71 Cal./day whereas for the male it dropped to 54 Cal./day.

17. In order to compare the energy expended from the body of the standard fish on the two runs on an equal basis it is necessary to make allowances for the live weight of the fish proportionally to the intervals over which the energy is being expended. When this is done the energy expended from the body of the standard male from Albion until death on the spawning ground on the Stuart Lake run in order to maintain 1 kg. of live fish was 1398 Cal. while the value for the females was 1644 Cal./kg. Thus the body of the standard female expends 17.6% more energy than does the body of the standard male from Albion to death on the Stuart Lake run. From Albion until death on the spawning grounds on the Chilko Lake run the male expended 1293 Cal./kg. while the female expended 1903 Cal./kg. Thus the male on the Chilko Lake run consumed 8% less Cal. per unit of body weight than did the male on the Stuart Lake run while the female on the Chilko Lake run consumed 16% more calories per unit of body weight than the male on the Stuart Lake run. The most striking point is the female on the Chilko Lake run expended 47.2% more Cal./unit weight of live fish from Albion until death on the spawning grounds than did the male. This is far in excess of the 17.6% difference on the Stuart Lake run.

18. The previous comments have not considered the changes in the viscera. The analyses of the viscera on the Chilko Lake run and subsequent analysis of the gonads at various stages of maturity make it possible to estimate the viscera reserves with a fair degree of accuracy. The changes in the viscera are quite extensive and the percentage drops in both total reserves at Albion, e.g., the fat reserves of the male dropped by 57% from Albion until death on the spawning grounds, while for the female the decrease was 79%. The protein dropped 32% in the male as compared with 49% in the female. However, the entire fat supplied by the viscera accounted for only 1.85% of the fat energy expended by the body of the standard male. For the females this figure was 2.77%. The protein expended from the viscera was 3.9% of the protein expended by the body of the standard male from Albion to death and approximately the same for the standard female. Thus, while the changes in the viscera may be very significant from a percentage composition point of view they contribute a very small fraction of the total energy expended by the fish, and from the point of view of delay are rather insignificant.

19. Another vital point that must be considered is whether or not the fish arrive in the same stage of sexual maturity each year. The data for the 1956 and 1957 Stuart Lake sockeye migrants indicate that the ratio of the weight of the gonads to the live weight of the fish is an excellent indicator for sexual maturity. Thus, at Lummi Island in 1956 the ovaries represented 3.59% of the live weight of the female, while in 1957 they represented 3.37%. This relationship changes rapidly and by Lillooet only 10 days later it had become 6.52% at Lillooet on the 1956 run and 6.40% at Lillooet on the 1957 run. Data at other points confirm the general phenomenon and show that the 1956 and 1957 Stuart Lake fish were not only on time chronologically but were also on time from the point of view of sexual maturity. The testes of the males for the two years showed the same excellent agreement, increasing slightly in weight during the early river migration and decreasing slightly in the later stages of the river migration. A similar comparison can be made for the 1956 Stuart and Chilko Lake sockeye. It will be recalled that their body weights were very similar. At Albion on the Stuart Lake run the ovaries of the female were 4.02% of the live weight of the fish. At Albion on the Chilko Lake run the weight of the ovaries was 4.01% of the live weight of the fish. Eleven days later at Soda Creek the ovaries were 7.44% of the live weight of the fish on the Stuart Lake run and 7.04% of the live weight of the fish on the Chilko Lake run. This agreement is as accurate as the time elapse will permit. The Chilko Lake males appear to be more sexually mature than the Stuart Lake males on arrival in the Fraser River and this may have some relation to the fact that the males on the

Chilko Lake run died before they had consumed as large a proportion of their body energy as had the males of the Stuart Lake run.

20. Many comparisons are given with the data obtained in this report and those found by investigators on chum salmon, *O. keta*, of the Amur River.

21. Changes in physical measurements are not discussed at length in this report. However, it is of interest to note that the snout length of the males on the Stuart Lake run was 1.4 times as long at death as at Albion whereas for the female the value was 1.19. On the 1956 Chilko Lake run the relationship between the sexes was still valid with the male snout increasing to 1.6 times as compared with 1.46 for the females. However, it will be noted that the increase for the female on the Chilko run was actually slightly greater than the increase for the male on the Stuart Lake run. During the early stages of the run there is no increase in snout length and possibly even a decrease. The changes in the weight of the liver were very dramatic for fish on the Chilko Lake run where the males almost doubled the weight of the liver from Albion until death on the spawning grounds. A similar trend was shown for the males on the Stuart Lake run but the increased weight of the liver was of a much smaller order of magnitude. The liver reached its maximum weight with the arrival of the fish at the spawning ground after which there was a rapid decrease in the weight. By contrast on the Chilko Lake run the maximum weight of the liver was attained at death. Further significance cannot be attached to these changes until the analytical data have been obtained on the livers of the 1957 Stuart Lake run.

#### LITERATURE CITED

- Davidson, F. A. and O. E. Shostrom. 1936. Physical and chemical changes in the pink salmon during the spawning migration. Report U. S. Bur. Fish., No. 33.2: 1-37.
- Greene, C. W. 1926. The physiology of the spawning migration. *Physiol. Revs.* 6: 201-241.
- Killick, S. R. 1955. The chronological order of Fraser River sockeye salmon during migration, spawning and death. *Internat. Pacific Salmon Fish. Comm., Bull.* VII.
- Miescher-Rüsch, F. 1880. Contributions to the biology of the Rhine salmon. *U. S. Bur. Fish. Bull.*, 8: 427-474.
- Paton, N. D. et al. 1898. Report of investigation on the life history of salmon. *Rept. Fish. Res. Bd. Scotland*, 16: 699-908.
- Pentegov, B. P., Mentov, Yu. N. and E. F. Kurnaev. 1928. Physico-chemical characteristics of breeding migration fast of keta. *Bull. Pacific Sci. Fish. Res. Station (Vladivostok)* 2: Pt. I.
- Rutter, C. 1902. Natural history of the quinnat salmon. *U. S. Bur. Fish. Bull.* 22: 67-141.

## APPENDIX

In the following tables the abbreviations and arrangements are:

gm.	grams
Cal.	large Calories
km.	kilometer
Cal./km.	Calories per kilometer
Cal./day	Calories per day
M.	Moisture
F.	Fat
P.	Protein
N/A	Not applicable
N.U.M.	No upstream migration
Column 1—Composition	The total weight in gm. for the moisture, fat and protein, and total value in Calories for the fat and protein.
A	The increase or decrease in grams of moisture, fat and protein between locations.
B	Each determination as given in A is expressed as a percentage of the total weight at the first location sampled.
C and D	Each determination of fat and protein as given in A is expressed in C as Calories per kilometer (Cal./km.) and in D as Calories per day (Cal./day) between locations.

The fat content of each individual fish is uncorrected so the average at each location is obtained by multiplying the uncorrected average by 0.93 (see procedures).

TABLE 12—STUART RUN: Lengths and weight of sockeye salmon caught at Lummi Island.

No.	Total Length (cm.)	Standard Length (cm.)	Snout Length (cm.)	Body Length (cm.)	Weight (Flesh + Viscera) (gm.)
MALES					
1	59.8	54.0	3.3	50.7	2635.4
2	59.4	53.5	2.8	50.7	2581.0
3	59.6	54.0	3.0	51.0	2721.6
4	61.5	56.9	3.5	53.4	3288.6
5	57.5	52.0	3.0	49.0	2268.0
6	61.3	55.4	3.1	52.3	2721.6
7	58.5	53.2	3.0	50.2	2780.6
7 Males	59.7	54.1	3.1	51.0	2713.8
FEMALES					
1	57.1	52.0	2.5	49.5	2440.4
2	58.1	52.5	2.4	50.1	2408.6
3	60.0	54.5	2.3	52.2	2694.4
4	59.0	53.4	2.5	50.9	2494.8
5	57.9	52.5	2.3	50.2	2268.0
6	57.8	52.4	2.3	50.1	2494.8
7	58.6	54.1	3.0	51.1	2667.2
8	55.0	49.9	2.4	47.5	2100.2
9	56.5	51.2	2.6	48.6	2213.6
10	58.2	53.0	2.4	50.6	2522.0
11	58.0	53.0	2.5	50.5	2268.0
12	59.5	54.0	2.5	51.5	2494.8
13	61.5	56.0	2.6	53.4	2862.2
13 Females	58.2	53.0	2.5	50.5	2456.1

TABLE 13—STUART RUN: Flesh analyses (%) of sockeye salmon caught at Lummi Island.

No.	Nitrogen	Protein	Fat	Moisture	Total
MALES					
1	3.12 — 3.20	(19.75) 19.5 — 20.0	(13.0) 13.0 — 13.0	(65.35) 65.3 — 65.4	97.8 — 98.4
2	3.06 — 3.09	(19.2) 19.1 — 19.3	(16.05) 16.1 — 16.0	(62.9) 62.5 — 63.3	97.6 — 98.7
3	3.07 — 3.11	(19.3) 19.2 — 19.4	(16.55) 16.6 — 16.5	(63.95) 63.9 — 64.0	99.6 — 100.0
4	3.22 — 3.29	(20.35) 20.1 — 20.6	(16.5) 16.6 — 16.4	(63.0) 63.0 — 63.0	99.5 — 100.2
5	3.15 — 3.13	(19.65) 19.7 — 19.6	(14.5) 14.1 — 14.9	(64.05) 63.9 — 64.2	97.6 — 98.8
6	3.07 — 3.11	(19.3) 19.2 — 19.4	(15.3) 15.2 — 15.4	(63.9) 64.0 — 63.8	98.2 — 98.8
7	3.05 — 3.09	(19.2) 19.1 — 19.3	(18.15) 18.1 — 18.2	(62.5) 62.3 — 62.7	99.5 — 100.2
7 Males		19.54	14.62	63.66	
FEMALES					
1	3.17 — 3.16	(19.8) 19.8 — 19.8	(16.85) 16.7 — 17.0	(62.45) 62.2 — 62.7	98.7 — 99.5
2	3.17 — 3.18	(19.85) 19.8 — 19.9	(16.25) 16.3 — 16.2	(63.4) 63.3 — 63.5	99.3 — 99.7
3	3.13 — 3.19	(19.75) 19.6 — 19.9	(16.8) 16.7 — 16.9	(63.15) 63.1 — 63.2	99.4 — 100.0
4	3.15 — 3.18	(19.8) 19.7 — 19.9	(14.45) 14.4 — 14.5	(64.35) 64.3 — 64.4	98.4 — 98.8
5	3.29 — 3.16	(20.2) 20.6 — 19.8	(12.75) 13.2 — 12.3	(65.4) 65.3 — 65.5	97.4 — 99.3
6	3.04 — 3.09	(19.15) 19.0 — 19.3	(20.05) 20.1 — 20.0	(60.1) 60.2 — 60.0	99.0 — 99.6
7	3.13 — 3.12	(19.65) 19.8 — 19.5	(16.1) 15.7 — 16.5	(63.3) 63.2 — 63.4	98.4 — 99.7
8	3.28 — 3.28	(20.5) 20.5 — 20.5	(14.3) 14.5 — 14.1	(64.7) 64.4 — 65.0	99.0 — 100.0
9	3.28 — 3.22	(20.3) 20.5 — 20.1	(14.75) 14.8 — 14.7	(64.0) 64.0 — 64.0	98.8 — 99.3
10	3.13 — 3.18	(19.75) 19.6 — 19.9	(18.1) 18.0 — 18.2	(61.85) 61.8 — 61.9	99.4 — 100.0
11	3.17 — 3.15	(19.75) 19.8 — 19.7	(16.15) 16.4 — 15.9	(63.05) 63.2 — 62.9	98.5 — 99.4
12	3.19 — 3.19	(19.9) 19.9 — 19.9	(17.4) 17.2 — 17.6	(62.2) 62.5 — 61.9	99.0 — 100.0
13	3.19 — 3.19	(19.9) 19.9 — 19.9	(17.7) 17.6 — 17.8	(62.1) 62.2 — 62.0	99.5 — 99.9
13 Females		19.87	15.14	63.08	



TABLE 14—STUART RUN: Weight analyses of viscera from sockeye salmon caught at Lummi Island.

No.	Weight of Gonads (gm.)	Total Weight of Viscera (gm.)
MALES		
1	45	201
2	54	227
3	48	228
4	86	276
5	52	159
6	51	196
7	80	235
7 Males	59	217
FEMALES		
1	75	224
2	96	222
3	82	245
4	92	244
5	110	227
6	75	206
7	86	221
8	66	189
9	89	220
10	95	250
11	82	227
12	98	211
13	104	292
13 Females	88	229

TABLE 15—STUART RUN: Lengths and weight of sockeye salmon caught at Albion.

No.	Total Length (cm.)	Standard Length (cm.)	Snout Length (cm.)	Body Length (cm.)	Weight (Flesh + Viscera) (gm.)
MALES					
1	60.0	54.5	3.4	51.1	2948.4
2	61.7	56.0	3.2	52.8	2748.8
3	57.0	51.6	2.7	48.9	2240.8
4	61.1	55.8	3.6	52.2	2807.8
5	56.7	51.3	3.3	48.0	2553.8
6	61.0	54.5	3.4	51.1	3007.4
7	60.0	54.4	3.6	50.8	2608.2
8	60.0	55.0	3.1	51.9	2975.6
9	59.0	53.0	3.5	49.5	2780.6
9 Males	59.6	54.0	3.3	50.7	2741.3
FEMALES					
1	58.7	54.6	3.1	51.5	2807.8
2	57.7	52.6	2.6	50.0	2581.0
3	60.3	52.6	2.6	50.0	2581.0
4	59.1	54.2	2.5	51.7	2295.2
5	56.6	51.3	2.8	48.5	2127.4
6	59.5	53.7	2.6	51.1	2780.6
7	57.6	52.2	2.4	49.8	2522.0
8	59.1	53.2	2.7	50.5	2553.8
9	57.0	51.5	2.5	49.0	2408.6
9 Females	58.4	52.8	2.6	50.2	2517.5

TABLE 16—STUART RUN: Flesh analyses (%) of sockeye salmon caught at Albion.

No.	Nitrogen	Protein	Fat	Moisture	Total
<b>MALES</b>					
1	3.09 — 3.11	(19.35) 19.3 — 19.4	(12.0) 12.1 — 11.9	(66.7) 66.8 — 66.6	97.8 — 98.3
2	3.19 — 3.16	(19.85) 19.9 — 19.8	(16.75) 17.0 — 16.5	(63.0) 62.9 — 63.1	99.2 — 100.0
3	3.13 — 3.11	(19.5) 19.6 — 19.4	(13.3) 13.3 — 13.3	(66.65) 66.6 — 66.7	99.3 — 99.6
4	3.11 — 3.09	(19.35) 19.4 — 19.3	(14.2) 14.1 — 14.3	(66.45) 66.8 — 66.1	99.5 — 100.5
5	2.96 — 2.96	(18.5) 18.5 — 18.5	(17.3) 17.1 — 17.5	(63.85) 63.9 — 63.8	99.4 — 99.9
6	3.12 — 3.09	(19.4) 19.5 — 19.3	(17.2) 17.1 — 17.3	(63.45) 63.2 — 63.7	99.6 — 100.5
7	3.16 — 3.20	(19.9) 19.8 — 20.0	(12.4) 12.3 — 12.5	(67.6) 67.6 — 67.6	99.7 — 100.1
8	3.16 — 3.19	(19.85) 19.8 — 19.9	(14.35) 14.1 — 14.6	(64.55) 64.4 — 64.7	98.3 — 99.2
9	3.01 — 3.01	(18.8) 18.8 — 18.8	(15.7) 15.7 — 15.7	(62.7) 62.6 — 62.8	97.1 — 97.3
9 Males		19.39	13.76	65.0	
<b>FEMALES</b>					
1	3.11 — 3.07	(19.3) 19.4 — 19.2	(16.05) 16.0 — 16.1	(63.35) 63.2 — 63.5	98.4 — 99.0
2	3.19 — 3.15	(19.8) 19.9 — 19.7	(13.95) 13.8 — 14.1	(65.45) 65.4 — 65.5	98.9 — 99.5
3	3.19 — 3.19	(19.9) 19.9 — 19.9	(16.8) 17.0 — 16.6	(63.45) 63.4 — 63.5	99.9 — 100.4
4	3.13 — 3.16	(19.7) 19.6 — 19.8	(10.45) 10.2 — 10.7	(69.55) 69.6 — 69.5	99.3 — 100.1
5	3.31 — 3.37	(20.9) 20.7 — 21.1	(14.1) 13.9 — 14.3	(65.55) 65.8 — 65.3	99.9 — 101.2
6	3.17 — 3.14	(19.7) 19.8 — 19.6	(15.5) 15.9 — 15.1	(64.25) 64.1 — 64.4	98.8 — 100.1
7	3.21 — 3.23	(20.15) 20.1 — 20.2	(15.25) 15.3 — 15.2	(65.35) 65.5 — 65.2	100.5 — 101.0
8	3.21 — 3.18	(20.0) 20.1 — 19.9	(12.8) 12.9 — 12.7	(66.3) 66.6 — 66.0	98.6 — 99.6
9	3.15 — 3.16	(19.75) 19.7 — 19.8	(14.85) 15.0 — 14.7	(65.2) 65.4 — 65.0	99.4 — 100.2
9 Females		19.91	13.41	65.38	

TABLE 17—STUART RUN: Weight analyses of viscera from sockeye salmon caught at Albion.

No.	Weight of Gonads (gm.)	Total Weight of Viscera (gm.)
MALES		
1	66	191
2	65	207
3	56	169
4	76	226
5	75	145
6	55	178
7	56	165
8	69	206
9	80	231
9 Males	66	191
FEMALES		
1	80	221
2	96	245
3	113	240
4	116	210
5	87	198
6	107	250
7	102	222
8	97	227
9	115	215
9 Females	101	225

TABLE 18—STUART RUN: Lengths and weight of sockeye salmon caught at Hell's Gate.

No.	Total Length (cm.)	Standard Length (cm.)	Snout Length (cm.)	Body Length (cm.)	Weight (Flesh + Viscera) (gm.)
MALES					
1	63.1	57.6	3.6	54	3288.6
2	63.5	57.5	3.4	54.1	3261.4
3	59.1	53.6	3.3	50.3	2721.6
4	56.8	51.3	3.1	48.2	2100.2
5	60.2	54.3	4.1	50.2	2408.6
6	62.5	56.3	3.3	53.0	3034.6
7	58.5	53.3	3.0	50.3	2154.6
8	56.0	50.6	2.5	48.1	2213.6
9	58.4	53.4	3.1	50.3	2240.8
9 Males	59.8	54.2	3.3	50.9	2602.7
FEMALES					
1	55.8	50.5	2.5	48	2041.2
2	56.8	51.5	2.3	49.2	2014.0
3	60.0	54.5	2.6	51.9	2667.2
4	60.2	54.6	2.3	52.3	2721.6
4 Females	58.2	52.8	2.4	50.4	2361.0

TABLE 19—STUART RUN: Flesh analyses (%) of sockeye salmon caught at Hell's Gate.

No.	Nitrogen	Protein	Fat	Moisture	Total
MALES					
1	3.13 — 3.14	(19.6) 19.6 — 19.6	(14.9) 15.0 — 14.8	(64.65) 64.6 — 64.7	99.1 — 99.3
2	3.10 — 3.10	(19.4) 19.4 — 19.4	(13.55) 13.6 — 13.5	(66.75) 66.8 — 66.7	99.6 — 99.8
3	3.22 — 3.28	(20.2) 20.1 — 20.3	(13.5) 13.6 — 13.4	(65.45) 65.4 — 65.5	98.9 — 99.4
4	3.27 — 3.21	(20.25) 20.4 — 20.1	(9.65) 9.8 — 9.5	(69.15) 69.1 — 69.2	99.3 — 98.8
5	3.33 — 3.38	(20.95) 20.8 — 21.1	(10.5) 10.4 — 10.6	(67.85) 67.8 — 67.9	99.0 — 99.6
6	3.13 — 3.25	(19.95) 19.6 — 20.3	(13.75) 13.9 — 13.6	(65.6) 65.2 — 66.0	98.4 — 100.2
7	3.32 — 3.32	(20.8) 20.8 — 20.8	(13.0) 13.0 — 13.0	(66.45) 66.4 — 66.5	100.2 — 100.3
8	3.32 — 3.37	(20.95) 20.8 — 21.1	(12.25) 12.2 — 12.3	(67.15) 67.0 — 67.3	100.0 — 100.7
9	3.24 — 3.27	(20.35) 20.3 — 20.4	(10.5) 10.5 — 10.5	(67.4) 67.4 — 67.4	98.2 — 98.3
9 Males		20.27	11.53	66.72	
FEMALES					
1	3.11 — 3.09	(19.35) 19.4 — 19.3	(10.85) 10.9 — 10.8	(67.15) 67.2 — 67.1	97.2 — 97.5
2	3.24 — 3.27	(20.35) 20.3 — 20.4	(12.7) 12.7 — 12.7	(66.85) 66.5 — 67.2	99.5 — 100.2
3	3.01 —	(15.5) 18.8 —	(64.75) 15.5 — 15.5	(64.8 — 64.7)	99.0 — 99.1
4	3.28 — 3.27	(20.45) 20.5 — 20.4	(13.95) 13.6 — 14.3	(65.15) 65.3 — 65.0	99.0 — 100.1
4 Females		19.74	12.32	65.98	

TABLE 20—STUART RUN: Weight analyses of viscera from sockeye salmon caught at Hell's Gate.

No.	Weight of Gonads (gm.)	Total Weight of Viscera (gm.)
MALES		
1	88	234
2	107	262
3	82	179
4	46	141
5	76	165
6	78	207
7	74	164
8	76	175
9	66	160
9 Males	77	187
FEMALES		
1	136	229
2	95	194
3	101	223
4	97	226
4 Females	107	218

TABLE 21—STUART RUN: Lengths and weight of sockeye salmon caught at Lillooet.

No.	Total Length (cm.)	Standard Length (cm.)	Snout Length (cm.)	Body Length (cm.)	Weight (Flesh + Viscera) (gm.)
<b>MALES</b>					
1	58.9	53.3	3.4	49.9	2154.6
2	62.5	57.2	4.1	53.1	2807.8
3	58.3	52.4	2.6	49.8	2408.6
4	65.6	58.8	3.4	55.4	3202.4
5	62.0	56.6	3.0	53.6	2807.8
6	57.5	52.5	2.7	49.8	2268.0
7	59.3	53.6	3.5	50.1	2354.2
7 Males	60.6	54.9	3.2	51.7	2571.9
<b>FEMALES</b>					
1	58.0	52.5	2.9	49.6	2327.0
2	58.6	53.2	2.7	50.5	2327.0
3	58.8	53.8	2.2	51.6	2440.4
4	59.0	54.3	2.5	51.8	2327.0
5	60.0	54.7	2.5	52.2	2780.6
6	57.5	52.3	1.9	50.4	2068.4
7	60.2	55.0	2.5	52.5	2608.2
8	56.3	51.5	2.5	49.0	1814.4
9	60.1	54.8	2.3	52.5	2667.2
10	58.3	53.2	2.3	50.9	2440.4
11	62.5	57.3	2.8	54.5	2522.0
12	60.4	55.5	2.3	53.2	2694.4
13	55.3	50.6	2.0	48.6	1900.6
13 Females	58.8	53.7	2.4	51.3	2378.3

TABLE 22—STUART RUN: Flesh analyses (%) of sockeye salmon caught at Lillooet.

No.	Nitrogen	Protein	Fat	Moisture	Total
<b>MALES</b>					
1	3.13	19.6	6.6	70.7	96.9
2	2.73	17.1	12.4	71.0	100.5
3	3.15	19.7	9.5	69.2	98.4
4	3.22	20.1	9.6	70.5	100.2
5	3.19	19.9	14.0	66.6	100.5
6	2.91	18.2	11.5	69.3	99.0
7	3.11	19.4	12.1	67.8	99.3
7 Males		19.1	10.0	69.3	
<b>FEMALES</b>					
1	3.61	22.6	12.8	64.3	99.7
2	3.24	20.3	12.8	66.1	99.2
3	3.07	19.2	13.2	67.0	99.4
		(20.05)	(10.35)	(66.85)	
4	3.21 — 3.20	20.1 — 20.0	10.3 — 10.4	66.8 — 66.9	97.2 — 97.3
5	3.16	19.8	12.1	68.3	100.2
6	3.15	19.7	11.7	67.1	98.5
7	3.11	19.4	12.8	66.3	98.5
8	3.17	19.8	10.8	67.4	98.0
9	2.94	18.4	13.0	70.2	101.6
10	3.32	20.8	17.2	60.9	98.9
11	3.51	21.9	9.2	66.4	97.5
12	3.26	20.4	17.0	62.6	100.0
13	3.22	20.1	10.9	68.3	99.3
13 Females		20.2	11.7	66.3	

TABLE 23—STUART RUN: Weight analyses of viscera from sockeye salmon caught at Lillooet.

No.	Weight of Gonads (gm.)	Weight of Liver (gm.)	Total Weight of Viscera (gm.)
MALES			
1	57	30	135
2	95	45	200
3	80	42	175
4	120	50	250
5	85	50	185
6	110	50	210
7	95	52	180
7 Males	92	46	191
FEMALES			
1	150	35	260
2	154	30	265
3	150	40	265
4	175	70	300
5	175	80	310
6	140	60	245
7	150	70	280
8	110	55	200
9	175	80	305
10	180	80	315
11	185	75	310
12	163	84	286
13	110	57	208
13 Females	155	63	273

TABLE 24—STUART RUN: Lengths and weight of sockeye salmon caught at Soda Creek.

No.	Total Length (cm.)	Standard Length (cm.)	Snout Length (cm.)	Body Length (cm.)	Weight (Flesh + Viscera) (gm.)
MALES					
1	59.0	53.5	3.5	50.0	2327.0
2	59.5	54.0	3.1	50.9	2327.0
3	60.0	54.8	3.0	51.8	2381.4
4	62.0	57.0	3.3	53.7	2635.4
4 Males	60.1	54.8	3.2	51.6	2418
FEMALES					
1	56.5	51.3	2.4	48.9	2181.8
2	58.0	52.5	2.6	49.9	2041.2
3	60.9	55.5	3.2	52.3	2635.4
4	58.7	53.0	2.2	50.8	2268.0
5	57.8	52.7	2.3	50.4	2127.4
6	56.2	51.0	2.2	48.8	1873.4
7	60.0	54.8	2.2	52.6	2354.2
8	58.8	54.0	2.4	51.6	2327.0
9	56.7	51.5	2.5	49.0	2213.6
10	57.8	52.6	2.3	50.3	2295.2
10 Females	58.1	52.9	2.4	50.5	2232

TABLE 25—STUART RUN: Flesh analyses (%) of sockeye salmon caught at Soda Creek.

No.	Nitrogen	Protein	Fat	Moisture	Total
MALES					
1	3.48	21.8	8.8	68.6	99.2
2	2.93	18.3	8.8	71.2	98.3
3	3.21	20.1	8.0	71.0	99.1
4	2.99 — 2.96	(18.6) 18.7 — 18.5	(10.35) 10.4 — 10.3	(69.85) 69.7 — 70.0	98.8 — 98.8
4 Males		19.7	8.4	70.2	
FEMALES					
1	3.03	18.9	9.1	71.4	99.4
2	3.07	19.2	8.0	70.7	97.9
3	2.81	17.6	9.1	73.0	99.7
4	2.97	18.6	9.6	71.6	99.8
5	3.08	19.3	11.2	68.3	98.8
6	3.18	19.9	7.5	71.3	98.7
7	3.09	19.3	11.2	69.9	100.4
8	3.13	19.6	9.5	72.1	101.2
9	3.04 — 3.04	(19.0) 19.0 — 19.0	(9.5) 9.5 — 9.5	(69.75) 69.8 — 69.7	98.3 — 98.2
10	3.22	20.1	(7.2) 7.1 — 7.3	72.0	99.3
10 Females		19.2	8.6	71.0	

TABLE 26—STUART RUN: Weight analyses of viscera from sockeye salmon caught at Soda Creek.

No.	Weight of Gonads (gm.)	Weight of Liver (gm.)	Total Weight of Viscera (gm.)
MALES			
1	67	37	166
2	75	41	190
3	91	45	202
4	92	43	215
4 Males	81	42	193
FEMALES			
1	72	58	286
2	121	50	226
3	229	65	365
4	174	66	307
5	147	54	258
6	154	49	252
7	244	63	349
8	158	60	276
9	174	62	289
10	183	55	290
10 Females	166	58	290

TABLE 27—STUART RUN: Lengths and weight of sockeye salmon caught at Fort St. James.

No.	Total Length (cm.)	Standard Length (cm.)	Snout Length (cm.)	Body Length (cm.)	Weight (Flesh + Viscera) (gm.)
MALES					
1	60.8	55.0	4.0	51.0	2948.4
2	61.9	56.2	4.5	51.7	2635.4
3	58.2	52.6	3.7	48.9	2522.0
4	56.5	51.8	3.9	47.9	2154.6
5	57.8	52.7	3.4	49.3	2213.6
6	59.0	53.2	3.5	49.7	2494.8
7	58.6	53.2	4.6	48.6	2327.0
8	61.2	55.8	3.7	52.1	2408.6
9	61.7	55.5	5.0	50.5	2948.4
9 Males	59.5	54.0	4.0	50.0	2517.0
FEMALES					
1	58.6	53.2	2.3	50.9	2581.0
2	57.5	52.2	2.7	49.5	2295.2
3	61.8	56.9	3.6	53.3	2835.0
4	59.0	54.2	2.5	51.7	2667.2
5	56.8	51.8	2.4	49.4	2213.6
6	56.3	50.6	2.3	48.3	1955.0
7	57.2	51.7	2.5	49.2	2154.6
8	54.8	49.8	2.6	47.2	2100.2
9	62.8	57.0	2.5	54.5	2748.8
10	58.4	53.0	2.3	50.7	2295.2
11	59.0	53.3	2.9	50.4	2467.6
12	59.1	53.6	2.1	51.5	2295.2
13	59.5	54.1	2.6	51.5	2467.6
13 Females	58.5	53.2	2.6	50.6	2390.5
Not included in the calculations:					
Male	54.9	49.5	3.0		2127.4



TABLE 28—STUART RUN: Flesh analyses (%) of sockeye salmon caught at Fort St. James.

No.	Nitrogen	Protein	Fat	Moisture	Total
<b>MALES</b>					
1	2.72 — 2.71	(17.95) 17.0 — 16.9	(5.55) 5.5 — 5.6	(76.1) 76.1 — 76.1	98.5 — 98.7
2	2.46 — 2.51	(15.55) 15.4 — 15.7	(2.65) 2.9 — 2.4	(80.0) 79.8 — 80.2	97.6 — 98.8
3	2.76 — 2.77	(17.3) 17.3 — 17.3	(5.6) 5.6 — 5.6	(75.75) 75.7 — 75.8	98.6 — 98.7
4	2.74 — 2.71	(17.0) 17.1 — 16.9	(4.6) 4.6 — 4.6	(77.1) 77.0 — 77.2	98.5 — 98.9
5	2.74 — 2.76	(17.2) 17.1 — 17.3	(2.5) 2.5 — 2.5	(78.65) 78.8 — 78.5	98.1 — 98.6
6	2.82 — 2.77	(17.45) 17.6 — 17.3	(5.2) 5.0 — 5.4	(75.95) 75.7 — 76.2	98.0 — 99.2
7	2.56 — 2.55	(15.95) 16.0 — 15.9	(2.1) 2.1 — 2.1	(78.2) 78.4 — 78.0	98.5 — 99.3
8	2.72 — 2.71	(16.95) 17.0 — 16.9	(6.2) 6.1 — 6.3	(75.75) 75.5 — 76.0	98.5 — 99.3
9	2.58 — 2.54	(16.0) 16.1 — 15.9	(3.9) 3.9 — 3.9	(78.6) 78.6 — 78.6	98.4 — 98.6
9 Males		16.8	3.99	77.3	
<b>FEMALES</b>					
1	2.76 — 2.81	(17.45) 17.3 — 17.6	(6.55) 6.4 — 6.7	(74.6) 74.7 — 74.5	98.2 — 99.0
2	2.92 — 2.85	(18.05) 18.3 — 17.8	(5.15) 5.1 — 5.2	(74.7) 74.5 — 74.9	97.4 — 98.4
3	2.64 — 2.65	(16.55) 16.5 — 16.6	(3.55) 3.6 — 3.5	(78.0) 77.9 — 78.1	97.9 — 98.3
4	2.77 — 2.72	(17.15) 17.3 — 17.0	(6.45) 6.4 — 6.5	(75.25) 75.2 — 75.3	98.6 — 99.1
5	2.82 — 2.78	(17.5) 17.6 — 17.4	(4.55) 4.9 — 4.2	(76.9) 76.9 — 76.9	98.5 — 99.4
6	2.66 — 2.69	(16.7) 16.6 — 16.8	(3.0) 3.0 — 3.0	(78.5) 78.5 — 78.5	98.1 — 98.3
7	2.66 — 2.71	(16.75) 16.6 — 16.9	(2.4) 2.5 — 2.3	(78.65) 78.6 — 78.7	97.5 — 98.1
8	2.76 — 2.71	(17.1) 17.3 — 16.9	(3.9) 3.9 — 3.9	(77.2) 77.2 — 77.2	98.0 — 98.4
9	2.68 — 2.61	(16.55) 16.8 — 16.3	(3.0) 3.1 — 2.9	(79.05) 78.9 — 79.2	98.1 — 99.1
10	2.76 — 2.78	(17.35) 17.3 — 17.4	(4.45) 4.5 — 4.4	(76.4) 76.3 — 76.5	98.0 — 98.4
11	2.83 — 2.76	(17.55) 17.7 — 17.4	(4.85) 4.9 — 4.8	(76.1) 76.1 — 76.1	98.3 — 98.7
12	2.65 — 2.69	(16.7) 16.6 — 16.8	(4.55) 4.6 — 4.5	(76.85) 76.8 — 76.9	97.9 — 98.2
13	2.67 — 2.72	(16.85) 16.7 — 17.0	(3.45) 3.5 — 3.4	(78.4) 78.2 — 78.6	98.3 — 99.1
13 Females		17.0	3.99	77.0	

Not included in the calculations:

Male	2.87 — 2.87	(17.9) 17.9 — 17.9	(3.55) 3.4 — 3.7	(76.65) 76.5 — 76.8	97.8 — 98.4
------	-------------	-----------------------	---------------------	------------------------	-------------

TABLE 29—STUART RUN: Weight analyses of viscera from sockeye salmon caught at Fort St. James.

No.	Weight of Gonads (gm.)	Weight of Liver (gm.)	Total Weight of Viscera (gm.)
MALES			
1	71	53	191
2	72	44	189
3	67	44	187
4	67	43	165
5	58	49	183
6	80	48	211
7	62	46	181
8	60	65	197
9	69	67	236
9 Males	67.3	51.0	193
FEMALES			
1	243	77	404
2	278	49	370
3	319	66	481
4	295	69	424
5	233	54	342
6	252	53	369
7	290	40	380
8	290	56	389
9	360	62	506
10	259	61	385
11	257	65	401
12	278	75	428
13	286	63	418
13 Females	280	61.0	407
Not included in the calculations:			
Male	43	37	144

TABLE 30—STUART RUN: Lengths and weight of sockeye salmon caught at Forfar Creek mouth.

No.	Total Length (cm.)	Standard Length (cm.)	Snout Length (cm.)	Body Length (cm.)	Weight (Flesh + Viscera) (gm.)
MALES					
1	61.8	55.6	4.6	51.0	2894.0
2	62.4	57.1	3.8	53.3	2780.6
3	60.0	54.6	4.0	50.6	2608.2
4	63.0	57.5	4.3	53.2	2835.0
5	63.4	57.2	4.2	53.0	3234.2
6	61.0	56.0	3.7	52.3	2581.0
7	65.3	59.2	5.1	54.1	3148.0
7 Males	62.4	56.7	4.2	52.5	2868.7
FEMALES					
1	55.0	50.0	2.3	47.7	1701.0
2	57.1	51.5	2.5	49.0	1814.4
3	60.6	55.6	3.3	52.3	2494.8
4	59.2	54.2	2.7	51.5	2213.6
5	58.1	52.6	2.6	50.0	2100.2
6	56.5	51.7	2.3	49.4	1955.0
7	57.8	52.8	2.4	50.4	1955.0
7 Females	57.8	52.6	2.6	50.0	2033.4
Not included in the calculations:					
Male	42.3	38.4	2.0	36.2	852.8

TABLE 31—STUART RUN: Flesh analyses (%) of sockeye salmon caught at Forfar Creek mouth.

No.	Nitrogen	Protein	Fat	Moisture	Total
MALES					
1	2.89 — 2.82	(17.85) 17.6 — 18.1	(4.45) 4.3 — 4.6	(76.15) 76.1 — 76.2	98.0 — 98.9
2	2.77 — 2.80	(17.4) 17.3 — 17.5	(5.3) 5.3 — 5.3	(76.1) 76.2 — 76.0	98.6 — 99.0
3	2.85 — 2.86	(17.85) 17.8 — 17.9	(6.3) 6.3 — 6.3	(73.6) 73.6 — 73.6	97.7 — 97.8
4	3.02 — 2.99	(18.8) 18.9 — 18.7	(3.9) 4.0 — 3.8	(75.7) 75.7 — 75.7	98.2 — 98.6
5	2.82 — 2.81	(17.6) 17.6 — 17.6	(4.25) 4.3 — 4.2	(76.7) 76.7 — 76.7	98.5 — 98.6
6	2.78 — 2.76	(17.35) 17.4 — 17.3	(5.7) 5.5 — 5.9	(75.65) 75.6 — 75.7	98.4 — 98.9
7	2.69 — 2.72	(16.9) 16.8 — 17.0	(2.4) 2.5 — 2.3	(78.85) 79.0 — 78.7	97.8 — 98.5
7 Males		17.68	4.3	76.1	
FEMALES					
1	2.89 — 2.92	(18.2) 18.1 — 18.3	(2.95) 3.0 — 2.9	(76.6) 76.8 — 76.4	97.9 — 97.6
2	2.91 — 2.94	(18.3) 18.2 — 18.4	(5.45) 5.4 — 5.5	(74.3) 74.4 — 74.2	97.8 — 98.3
3	2.86 — 2.82	(17.75) 17.9 — 17.6	(3.45) 3.5 — 3.4	(76.8) 76.9 — 76.7	97.7 — 98.3
4	2.80 — 2.79	(17.45) 17.5 — 17.4	(4.05) 4.3 — 3.8	(76.7) 76.6 — 76.8	98.4 — 98.0
5	2.91 — 2.99	(18.45) 18.2 — 18.7	(5.2) 5.2 — 5.2	(74.85) 74.7 — 75.0	98.1 — 98.9
6	2.81 — 2.84	(17.7) 17.6 — 17.8	(2.6) 2.6 — 2.6	(78.7) 78.7 — 78.7	98.9 — 99.1
7	2.82 — 2.77	(17.45) 17.6 — 17.3	(2.0) 2.0 — 2.0	(78.5) 78.5 — 78.5	97.8 — 98.1
7 Females		17.90	3.4	76.6	
Not included in the calculations:					
Male	2.69 — 2.67	(16.75) 16.8 — 16.7	(3.7) 3.8 — 3.6	(76.4) 76.4 — 76.4	96.7 — 0

TABLE 32—STUART RUN: Weight analyses of viscera from sockeye salmon caught at Forfar Creek mouth.

No.	Weight of Gonads (gm.)	Weight of Liver (gm.)	Total Weight of Viscera (gm.)
MALES			
1	63	67	209
2	76	60	212
3	97	44	197
4	108	49	213
5	104	57	233
6	84	54	216
7	92	69	257
7 Males	89	57.0	220
FEMALES			
1	244	44	315
2	278	51	364
3	375	63	489
4	358	58	448
5	324	69	428
6	340	32	390
7	317	32	383
7 Females	319	49.9	402
Not included in the calculations:			
Male	35	23	67

TABLE 33—STUART RUN: Lengths and weight of spent sockeye salmon caught at Forfar Creek.

No.	Total Length (cm.)	Standard Length (cm.)	Snout Length (cm.)	Body Length (cm.)	Weight (Flesh + Viscera) (gm.)
<b>MALES</b>					
1	59.0	53.1	3.7	49.4	2181.8
2	61.9	56.9	4.8	52.1	2440.4
3	59.5	55.8	4.7	51.1	2381.4
4	62.0	56.6	5.0	51.6	2635.4
5	59.9	54.4	4.3	50.1	2467.6
6	60.4	55.4	4.8	50.6	2381.4
7	59.0	54.6	4.5	50.1	1927.8
8	63.0	57.8	4.6	53.2	2581.0
9	60.0	54.4	4.7	49.7	2154.6
10	62.2	56.6	4.6	52.0	2807.8
11	61.2	55.7			2295.2
12	57.8	54.3	4.2	50.1	1900.6
12 Males	60.5	55.5	4.5	51.0	2346
<b>FEMALES</b>					
1	57.8	53.4	2.6	50.8	1646.6
2	61.0	56.3	3.1	53.2	2154.6
3	56.5	52.1	2.7	49.4	1447.0
4	60.6	55.0	3.4	51.6	2213.6
5	58.6	53.5	3.7	49.8	1814.4
6	56.8	51.5	2.4	49.1	1787.2
7	60.2	55.2	3.0	52.2	1873.4
8	56.0	51.6	2.8	48.8	1533.2
9	57.7	53.0	2.6	50.4	1646.6
10	57.2	53.2	2.9	50.3	1787.2
11	57.3	52.6	3.4	49.2	1614.8
12	57.5	53.1	2.5	50.6	1474.2
12 Females	58.2	53.3	2.9	50.4	1749
Not included in the calculations:					
Male	66.5	60.6	5.2		3234.2
Female	55.3	51.9	2.5		1161.2

TABLE 34—STUART RUN: Flesh analyses (%) of spent sockeye salmon caught at Forfar Creek.

No.	Nitrogen	Protein	Fat	Moisture	Total
MALES					
1	2.58 — 2.66	(16.35) 16.1 — 16.6	(2.0) 1.9 — 2.1	(80.1) 80.2 — 80.0	98.0 — 98.9
2	2.57 — 2.59	(16.15) 16.1 — 16.2	(2.8) 2.8 — 2.8	(79.6) 79.4 — 79.8	98.3 — 98.8
3	2.53 — 2.51	(15.75) 15.8 — 15.7	(1.85) 1.8 — 1.9	(81.45) 81.1 — 81.8	98.6 — 99.5
4	2.51 — 2.53	(15.75) 15.7 — 15.8	(2.85) 2.8 — 2.9	(80.0) 80.2 — 79.8	98.3 — 98.9
5	2.41 — 2.48	(15.3) 15.1 — 15.5	(2.25) 2.2 — 2.3	(80.2) 80.1 — 80.3	97.4 — 98.1
6	2.44 —	15.3 —	(2.3) 2.3 — 2.3	(80.75) 80.8 — 80.7	98.3 — 98.4
7	2.64 — 2.64	(16.5) 16.5 — 16.5	(1.65) 1.7 — 1.6	(81.3) 81.4 — 81.2	99.3 — 99.6
8	2.28 — 2.24	(14.15) 14.3 — 14.0	(1.25) 1.1 — 1.4	(82.95) 82.9 — 83.0	98.0 — 98.7
9	2.46 — 2.48	(15.45) 15.4 — 15.5	(1.35) 1.3 — 1.4	(81.9) 81.8 — 82.0	98.5 — 98.9
10	2.50 — 2.55	(15.75) 15.6 — 15.9	(3.35) 3.3 — 3.4	(79.45) 79.5 — 79.4	98.3 — 98.8
11	2.46 — 2.41	(15.25) 15.4 — 15.1	(1.75) 1.8 — 1.7	(82.2) 82.3 — 82.1	98.9 — 99.5
12	2.23 —	13.9 —	(1.0) 1.0 — 1.0	(83.75) 83.8 — 83.7	98.6 — 98.7
12 Males		15.47	1.89	81.14	
FEMALES					
1	2.43 — 2.39	(15.05) 15.2 — 14.9	(1.4) 1.4 — 1.4	(81.0) 81.1 — 80.9	97.2 — 97.7
2	2.62 — 2.58	(16.25) 16.4 — 16.1	(2.05) 2.0 — 2.1	(80.55) 80.3 — 80.8	98.4 — 99.3
3	2.43 — 2.40	(15.1) 15.2 — 15.0	(1.6) 1.6 — 1.6	(80.85) 80.8 — 80.9	97.4 — 97.7
4	2.47 — 2.51	(15.55) 15.4 — 15.7	(1.5) 1.5 — 1.5	(80.75) 80.7 — 80.8	97.6 — 98.0
5	2.47 — 2.44	(15.35) 15.4 — 15.3	(1.55) 1.6 — 1.5	(81.7) 81.9 — 81.5	98.3 — 98.9
6	2.72 — 2.72	(17.0) 17.0 — 17.0	(2.75) 2.8 — 2.7	(78.6) 78.7 — 78.5	98.2 — 98.5
7	2.61 — 2.58	(16.2) 16.3 — 16.1	(1.1) 1.0 — 1.2	(80.9) 80.7 — 81.1	97.8 — 98.6
8	2.66 — 2.57	(16.35) 16.6 — 16.1	(1.2) 1.2 — 1.2	(82.2) 82.2 — 82.2	99.5 — 100.0
9	2.60 — 2.57	(16.2) 16.3 — 16.1	(1.4) 1.3 — 1.5	(80.8) 80.8 — 80.8	98.2 — 98.6
10	2.63 — 2.68	(16.6) 16.4 — 16.8	(1.15) 1.2 — 1.1	(80.35) 80.3 — 80.4	97.8 — 98.4
11	2.69 — 2.68	(16.8) 16.8 — 16.8	(1.55) 1.5 — 1.6	(80.0) 79.8 — 80.2	98.1 — 98.6
12	2.39 — 2.43	(15.05) 14.9 — 15.2	(1.4) 1.4 — 1.4	(81.9) 81.9 — 81.9	98.2 — 98.5
12 Females		15.96	1.44	80.80	
Not included in the calculations:					
Male	2.63 — 2.63	(16.4) 16.4 — 16.4	(6.3) 6.3 — 6.3	(75.75) 75.5 — 76.0	98.2 — 98.7
Female	2.19 — 2.21	(13.75) 13.7 — 13.8	(1.2) 1.2 — 1.2	(83.4) 83.3 — 83.5	98.2 — 98.5

TABLE 35—STUART RUN: Weight analyses of viscera from spent sockeye salmon caught at Forfar Creek.

No.	Weight of Gonads (gm.)	Weight of Liver (gm.)	Total Weight of Viscera (gm.)
MALES			
1	38	48	169
2	35	52	134
3	40	48	150
4	36	54	152
5	54	48	167
6	38	44	136
7	17	47	126
8	23	44	136
9	36	45	136
10	46	55	175
11	50	51	159
12	40	35	115
12 Males		48.0	146
FEMALES			
1		40	120
2		62	159
3		40	107
4		58	149
5		28	107
6		40	111
7	48	49	155
8		37	100
9		46	108
10		43	120
11		42	104
12		35	74
12 Females		43.0	118
Not included in the calculations:			
Male	80	52	193
Female		18	59

TABLE 36—STUART RUN: Lengths and weight of fresh dead sockeye salmon caught at Forfar Creek.

No.	Total Length (cm.)	Standard Length (cm.)	Snout Length (cm.)	Body Length (cm.)	Weight (Flesh + Viscera) (gm.)
MALES					
1	58.0	53.0	3.9	49.1	2068.4
2	63.0	58.3	5.2	53.1	2608.2
3	59.1	54.0	4.6	49.4	2014.0
4	61.6	56.2	4.4	51.8	2127.4
5	60.1	55.6	4.1	51.5	2181.8
6	58.8	54.4	4.4	50.0	2041.2
7	57.6	52.1	4.2	47.9	1986.8
8	60.4	54.8	4.5	50.3	2295.2
9	60.0	54.4	4.5	49.9	2213.6
10	61.8	56.9	4.7	52.2	2467.6
10 Males	60.0	55.0	4.5	50.5	2200
FEMALES					
1	54.0	49.2	2.7	46.5	1079.6
2	61.5	57.4	3.6	53.8	1873.4
3	53.8	49.4	2.7	46.7	1333.6
4	58.0	54.4	3.4	51.0	1474.2
5	54.4	50.1	2.8	47.3	1247.4
6	59.5	55.4	3.4	52.0	1873.4
7	55.4	50.6	2.7	47.9	1360.8
8	56.1	51.4	2.8	48.6	1388.0
9	56.4	52.5	3.1	49.4	1814.4
10	60.4	56.5	3.1	53.4	1760.0
11	54.2	50.4	2.8	47.6	1161.2
12	51.2	49.2	2.6	46.6	1020.6
12 Females	56.2	52.2	3.0	49.2	1449
Not included in the calculations:					
Males	66.6	60.7	5.5		3034.6
	56.1	52.0	4.3		1646.6
Females	62.1	57.4	3.1		2041.2
	65.5	60.5	3.7		2494.8

TABLE 37—STUART RUN: Flesh analyses (%) of fresh dead sockeye salmon taken at Forfar Creek.

No.	Nitrogen	Protein	Fat	Moisture	Total
<b>MALES</b>					
1	2.42 — 2.45	(15.2) 15.1 — 15.3	(1.9) 1.9 — 1.9	(81.95) 81.7 — 82.2	98.7 — 99.4
2	2.65 — 2.67	(16.65) 16.6 — 16.7	(1.45) 1.4 — 1.5	(81.55) 81.6 — 81.5	99.5 — 99.8
3	2.55 — 2.57	(16.0) 15.9 — 16.1	(1.5) 1.4 — 1.6	(81.4) 81.3 — 81.5	98.6 — 99.2
4	2.48 —	15.5 —	(1.15) 1.2 — 1.1	(83.65) 83.3 — 84.0	99.9 — 100.7
5	2.40 — 2.37	(14.9) 15.0 — 14.8	(1.05) 1.0 — 1.1	(83.35) 83.1 — 83.6	98.9 — 99.7
6	2.72 — 2.76	(17.15) 17.0 — 17.3	(2.05) 2.0 — 2.1	(80.95) 80.7 — 81.2	99.7 — 100.6
7	2.39 — 2.41	(15.0) 14.9 — 15.1	(1.3) 1.4 — 1.2	(81.7) 81.7 — 81.7	97.8 — 98.2
8	2.33 — 2.29	(14.45) 14.6 — 14.3	(2.05) 2.0 — 2.1	(81.6) 81.4 — 81.8	97.7 — 98.5
9	2.40 — 2.42	(15.05) 15.0 — 15.1	(2.0) 2.0 — 2.0	(82.25) 82.0 — 82.5	99.0 — 99.6
10	2.57 —	16.1 —	(1.15) 1.20 — 1.1	(81.3) 81.2 — 81.4	98.4 — 98.7
10 Males		15.60	1.49	81.97	
<b>FEMALES</b>					
1	2.60 — 2.52	(16.05) 16.3 — 15.8	(0.95) 0.9 — 1.0	(80.9) 80.9 — 80.9	97.6 — 98.2
2	2.44 — 2.44	(15.3) 15.3 — 15.3	(1.6) 1.5 — 1.7	(81.65) 81.7 — 81.6	98.4 — 98.6
3	2.45 — 2.45	(15.3) 15.3 — 15.3	(1.95) 1.9 — 2.0	(82.4) 82.3 — 82.5	99.5 — 99.8
4	2.12 — 2.17	(13.45) 13.3 — 13.6	(1.0) 1.0 — 1.0	(84.2) 84.1 — 84.3	98.4 — 98.6
5	2.32 — 2.37	(14.65) 14.5 — 14.8	(0.8) 0.8 — 0.8	(83.9) 83.9 — 83.9	99.2 — 99.5
6	2.37 — 2.40	(14.9) 14.8 — 15.0	(3.75)* 3.5 — 4.0	(79.7) 79.6 — 79.8	97.9 — 98.8
7	— 2.37	14.8 —	(1.1) 1.2 — 1.0	(82.2) 82.1 — 82.3	97.9 — 98.3
8	— 2.08	13.0 —	(0.8) 0.8 — 0.8	(84.15) 84.1 — 84.2	97.9 — 98.0
9	2.02 — 2.04	(12.7) 12.6 — 12.8	(1.0) 1.0 — 1.0	(84.7) 84.7 — 84.7	98.3 — 98.5
10	2.24 — 2.19	(13.85) 14.0 — 13.7	(0.9) 0.8 — 1.0	(83.75) 83.6 — 83.9	98.1 — 98.9
11	2.21 — 2.30	(14.1) 13.8 — 14.4	(0.8) 0.8 — 0.8	(83.5) 83.6 — 83.4	98.0 — 98.8
12	2.08 — 2.13	(13.15) 13.0 — 13.3	(0.8) 0.8 — 0.8	(84.2) 84.5 — 83.9	97.7 — 98.6
12 Females		14.30	1.02	82.94	

\* 6 — Fat high.

Not included in the calculations:

Males	2.31 — 2.33	(14.5) 14.4 — 14.6	(0.8) 0.8 — 0.8	(84.05) 83.9 — 84.2	99.1 — 99.6
	2.29 — 2.34	(14.45) 14.3 — 14.6	(0.8) 0.8 — 0.8	(83.05) 83.0 — 83.1	98.1 — 98.5
Females	2.25 — 2.25	(14.1) 14.1 — 14.1	(1.0) 1.0 — 1.0	(82.9) 82.8 — 83.0	97.9 — 98.1
	2.43 — 2.51	(15.45) 15.2 — 15.7	(2.5) 2.5 — 2.5	(81.65) 81.6 — 81.7	99.3 — 99.9

TABLE 38—STUART RUN: Weight analyses of viscera from dead sockeye salmon taken at Forfar Creek.

No.	Weight of Gonads (gm.)	Weight of Liver (gm.)	Total Weight of Viscera (gm.)
MALES			
1	35	36	123
2	24	44	119
3	26	30	99
4	16	28	95
5	43	39	131
6	21	31	103
7	33	27	104
8	20	43	136
9	32	30	105
10	35	48	175
10 Males		36	119
FEMALES			
1		14	70
2		39	109
3		29	87
4		24	85
5		19	58
6		38	107
7		19	76
8		19	74
9		32	82
10		27	151
11		24	68
12		17	125
12 Females		25	91
Not included in the calculations:			
Males	18	52	131
	13	30	84
Females		37	118
		43	125



TABLE 39—CHILKO RUN: Lengths and weight of sockeye salmon caught at Albion.

No.	Total Length (cm.)	Standard Length (cm.)	Snout Length (cm.)	Body Length (cm.)	Weight (Flesh + Viscera) (gm.)
<b>MALES</b>					
1	59.0	53.7	3.1	50.6	2494.8
2	59.5	53.1	2.9	50.2	2494.8
3	59.9	54.3	3.2	51.1	3148.0
4	55.0	54.5	3.5	51	2268.0
5	56.3	50.5	3.0	47.5	2268.0
6	61.0	54.7	3.0	51.7	2948.4
7	55.0	49.0	3.1	45.9	2240.8
8	59.8	53.7	3.3	50.4	2608.2
9	58.6	52.7	2.8	49.9	2522.0
10	57.9	52.7	2.9	49.8	2553.8
11	57.0	51.1	2.8	48.3	2494.8
12	60.9	55.2	3.2	52	2862.2
13	58.5	52.8	2.9	49.9	2240.8
13 Males	58.34	52.9	3.1	49.87	2549.6
<b>FEMALES</b>					
1	55.3	50.0	2.4	47.6	2268.0
2	60.5	54.7	2.7	52	3061.8
3	59.0	53.0	2.3	50.7	2667.2
4	58.8	53.0	1.8	51.2	2553.8
5	56.7	51.0	2.6	48.4	2354.2
6	58.8	52.7	2.5	50.2	2240.8
7	60.0	54.8	2.4	52.4	2721.6
8	58.3	52.6	2.3	50.3	2608.2
9	60.0	54.2	3.0	51.2	2635.4
10	58.5	52.7	2.4	50.3	2553.8
11	55.6	50.4	2.0	48.4	2327.0
11 Females	58.3	52.6	2.4	50.25	2544.7
Not included in the calculations:					
Males	57.1	51.6	2.5		2154.6
	63.9	57.5	3.5		3315.8
	64.0	57.7	3.6		3374.8
	62.2	56.3	3.7		3148.0

TABLE 40—CHILKO RUN: Flesh analyses (%) of sockeye salmon caught at Albion.

No.	Nitrogen	Protein	Fat	Moisture	Total
<b>MALES</b>					
1	3.03 — 3.07	(19.05) 18.9 — 19.2	(15.2) 15.5 — 14.9	(64.85) 64.8 — 64.9	98.6 — 99.6
2	2.97 — 3.04	(18.8) 18.6 — 19.0	(15.6) 15.8 — 15.4	(64.1) 64.2 — 64.0	98.0 — 99.0
3	2.96 — 2.92	(18.4) 18.5 — 18.3	(17.75) 17.8 — 17.7	(62.7) 62.5 — 62.9	98.5 — 99.2
4	3.03 — 3.07	(19.05) 18.9 — 19.2	(14.35) 13.9 — 14.8	(64.7) 64.7 — 64.7	97.5 — 98.7
5	2.98 — 2.97	(18.6) 18.6 — 18.6	(15.4) 15.4 — 15.4	(63.45) 63.5 — 63.4	97.4 — 97.5
6	2.97 — 2.92	(18.45) 18.6 — 18.3	(14.7) 14.6 — 14.8	(65.05) 65.0 — 65.1	97.9 — 98.5
7	3.01 — 3.01	(18.8) 18.8 — 18.8	(14.8) 14.8 — 14.8	(65.2) 65.2 — 65.2	98.8 — 98.8
8	3.14 — 3.09	(19.45) 19.6 — 19.3	(11.75) 11.9 — 11.6	(67.7) 67.5 — 67.9	98.4 — 99.4
9	3.13 — 3.15	(19.65) 19.6 — 19.7	(13.8) 13.9 — 13.7	(64.55) 64.5 — 64.6	97.8 — 98.2
10	3.04 — 3.07	(19.1) 19.0 — 19.2	(16.5) 16.6 — 16.4	(63.55) 63.5 — 63.6	98.9 — 99.4
11	3.03 — 3.07	(19.05) 18.9 — 19.2	(15.95) 16.2 — 15.7	(64.3) 64.0 — 64.6	98.6 — 100.0
12	3.03 — 2.99	(18.8) 18.9 — 18.7	(16.35) 16.5 — 16.2	(64.1) 64.3 — 63.9	98.8 — 99.7
13	3.03 — 3.03	(18.9) 18.9 — 18.9	(14.7) 14.4 — 15.0	(65.4) 65.6 — 65.2	98.5 — 99.5
13 Males		18.93	14.08	64.59	
<b>FEMALES</b>					
1	3.01 — 3.02	(18.85) 18.8 — 18.9	(15.4) 15.6 — 15.2	(64.65) 64.6 — 64.7	98.6 — 99.2
2	3.08 — 3.05	(19.2) 19.3 — 19.1	(17.3) 17.5 — 17.1	(63.6) 63.5 — 63.7	99.7 — 100.5
3	3.16 — 3.13	(19.7) 19.8 — 19.6	(14.4) 14.1 — 14.7	(64.4) 64.6 — 64.2	97.9 — 99.1
4	2.97 — 3.02	(18.75) 18.6 — 18.9	(18.7) 18.8 — 18.6	(61.75) 61.5 — 62.0	98.7 — 99.7
5	3.07 — 3.11	(19.3) 19.2 — 19.4	(16.3) 16.3 — 16.3	(64.05) 64.0 — 64.1	99.5 — 99.8
6	2.99 — 3.05	(18.9) 18.7 — 19.1	(14.9) 14.9 — 14.9	(64.65) 64.5 — 64.8	98.1 — 98.8
7	3.16 — 3.13	(19.7) 19.8 — 19.6	(14.8) 14.7 — 14.9	(63.6) 63.6 — 63.6	97.9 — 98.3
8	3.11 — 3.12	(19.45) 19.4 — 19.5	(18.2) 18.1 — 18.3	(62.5) 62.4 — 62.6	99.9 — 100.4
9	3.18 — 3.17	(19.85) 19.9 — 19.8	(12.55) 12.7 — 12.4	(66.05) 65.8 — 66.3	98.0 — 98.9
10	3.25 — 3.26	(20.35) 20.3 — 20.4	(14.2) 14.4 — 14.0	(65.6) 65.6 — 65.6	99.9 — 100.4
11	3.12 — 3.16	(19.65) 19.5 — 19.8	(18.0) 17.9 — 18.1	(62.95) 62.9 — 63.0	100.3 — 100.9
11 Females		19.43	14.78	63.98	
Not included in the calculations:					
Males	3.09 — 3.11	(19.35) 19.3 — 19.4	(13.9) 13.6 — 14.2	(64.65) 64.7 — 64.6	97.5 — 98.3
	3.04 — 2.98	(18.8) 19.0 — 18.6	(14.7) 14.4 — 15.0	(63.95) 64.0 — 63.9	96.9 — 98.0
	3.01 — 2.99	(18.75) 18.8 — 18.7	(18.4) 18.1 — 18.7	(62.5) 62.5 — 62.5	99.3 — 100.0
	3.13 — 3.16	(19.7) 19.6 — 19.8	(17.3) 17.2 — 17.4	(63.4) 63.4 — 63.4	100.2 — 100.6

TABLE 41—CHILKO RUN: Viscera analyses (%) of sockeye salmon caught at Albion.

No.	Nitrogen	Protein	Fat	Moisture	Total
MALES					
1	2.52 — 2.57	(15.95) 15.8 — 16.1	(4.3) 4.3 — 4.3	(78.55) 78.5 — 78.6	98.6 — 99.0
2	2.40 — 2.37	(14.9) 15.0 — 14.8	(4.3) 4.3 — 4.3	(79.15) 79.1 — 79.2	98.2 — 98.5
3	2.66 — 2.69	(16.7) 16.6 — 16.8	(5.4) 5.4 — 5.4	(77.05) 77.1 — 77.0	99.0 — 99.3
4	2.71 — 2.70	(16.9) 16.9 — 16.9	(5.85) 5.9 — 5.8	(76.9) 77.0 — 76.8	99.5 — 99.8
5	2.44 — 2.37	(15.05) 15.3 — 14.8	(6.45) 6.5 — 6.4	(77.35) 77.3 — 77.4	98.5 — 99.2
6	2.59 — 2.57	(16.15) 16.2 — 16.1	(5.9) 5.8 — 6.0	(77.5) 77.4 — 77.6	99.3 — 99.8
7	2.59 — 2.51	(15.95) 16.2 — 15.7	(4.3) 4.4 — 4.2	(78.55) 78.5 — 78.6	98.4 — 99.2
8	2.74 — 2.77	(17.2) 17.1 — 17.3	(5.15) 5.1 — 5.2	(77.2) 77.2 — 77.2	99.4 — 99.7
9	2.57 — 2.54	(16.0) 16.1 — 15.9	(4.9) 5.0 — 4.8	(78.15) 78.1 — 78.2	98.8 — 99.3
10	2.52 — 2.48	(15.65) 15.8 — 15.5	(7.2) 7.2 — 7.2	(75.95) 76.0 — 75.9	98.6 — 99.0
11	2.58 — 2.61	(16.2) 16.1 — 16.3	(6.1) 6.6 — 5.6	(77.35) 77.3 — 77.4	99.0 — 100.3
12	2.53 — 2.52	(15.8) 15.8 — 15.8	(6.5) 6.4 — 6.6	(77.1) 77.2 — 77.0	99.2 — 99.6
13	2.90 —	(4.0) 18.1 —	(78.5) 4.0 — 4.0	78.5 — 78.5	100.6 — 100.6
13 Males		16.20	5.03	77.64	
FEMALES					
1	3.06 — 3.05	(19.1) 19.1 — 19.1	(10.35) 10.6 — 10.1	(68.35) 68.1 — 68.6	97.3 — 98.3
2	3.07 — 3.05	(19.15) 19.2 — 19.1	(9.5) 9.5 — 9.5	(68.55) 68.5 — 68.6	97.1 — 97.3
3	2.55 — 2.57	(16.0) 15.9 — 16.1	(9.2) 8.9 — 9.5	(71.9) 72.1 — 71.7	96.5 — 97.7
4	3.04 — 3.08	(19.15) 19.0 — 19.3	(13.0) 12.9 — 13.1	(66.8) 66.7 — 66.9	98.6 — 99.3
5	3.21 — 3.18	(20.0) 20.1 — 19.9	(11.0) 11.2 — 10.8	(66.4) 66.2 — 66.6	96.9 — 97.9
6	3.11 — 3.08	(19.35) 19.4 — 19.3	(9.95) 10.1 — 9.8	(66.95) 66.7 — 67.2	95.8 — 96.7
7	3.54 — 3.59	(22.25) 22.1 — 22.4	(12.0) 12.0 — 12.0	(65.75) 65.9 — 65.6	99.7 — 100.3
8	3.15 — 3.18	(19.8) 19.7 — 19.9	(12.7) 12.6 — 12.8	(65.65) 65.6 — 65.7	97.9 — 98.4
9	3.18 — 3.15	(19.8) 19.9 — 19.7	(12.4) 12.2 — 12.6	(66.35) 66.2 — 66.5	98.1 — 99.0
10	3.37 — 3.36	(21.05) 21.1 — 21.0	(10.8) 10.7 — 10.9	(67.45) 67.3 — 67.6	99.0 — 99.6
11	3.05 — 3.10	(19.25) 19.1 — 19.4	(11.1) 10.9 — 11.3	(68.65) 68.5 — 68.8	98.5 — 99.5
11 Females		19.54	10.31	67.53	

Not included in the calculations:

Males	2.96 — 2.98	(18.55) 18.5 — 18.6	(9.2) 9.1 — 9.3	(70.85) 70.8 — 70.9	98.4 — 98.8
	2.29 — 2.32	(14.4) 14.3 — 14.5	(7.95) 7.9 — 8.0	(75.65) 75.6 — 75.7	97.8 — 98.2
	2.51 — 2.54	(15.8) 15.7 — 15.9	(7.05) 7.0 — 7.1	(76.25) 76.2 — 76.3	98.9 — 99.3
	2.60 — 2.57	(16.2) 16.3 — 16.1	(5.3) 5.3 — 5.3	(78.45) 78.4 — 78.5	99.8 — 100.1

TABLE 42—CHILKO RUN: Weight analyses of viscera from sockeye salmon caught at Albion.

No.	Weight of Gonads (gm.)	Weight of Liver (gm.)	Total Weight of Viscera (gm.)
MALES			
1	104	38	220
2	71	29	169
3	94	44	251
4	92	30	190
5	81	29	190
6	70	41	208
7	119	39	236
8	138	34	233
9	86	43	211
10	38	38	162
11	77	34	192
12	73	36	201
13	74	32	151
13 Males	85.92	35.92	201.08
FEMALES			
1	88	41	206
2	112	52	257
3	68	50	199
4	89	40	201
5	96	39	206
6	106	42	209
7	116	44	229
8	109	43	235
9	119	48	242
10	124	54	259
11	93	50	232
11 Females	101.82	45.73	225.00
Not included in the calculations:			
Males	91	48	210
	59	59	226
	103	42	240
	75	49	233

TABLE 43—CHILKO RUN: Lengths and weight of sockeye salmon caught at Farwell Canyon.

No.	Total Length (cm.)	Standard Length (cm.)	Snout Length (cm.)	Body Length (cm.)	Weight (Flesh + Viscera) (gm.)
MALES					
1	62.2	56.4	2.9	53.5	3120.8
2	58.4	52.6	3.0	49.6	2100.2
3	58.4	53.6	2.5	51.1	2240.8
4	60.2	54.3	3.3	51	2748.8
5	60.2	55.3	3.5	51.8	2522.0
6	60.9	55.4	3.1	52.3	2354.2
7	55.0	49.8	2.7	47.1	1760.0
8	62.9	57.0	3.9	53.1	2667.2
9	60.8	55.4	2.9	52.5	2440.4
9 Males	59.89	54.42	3.09	51.33	2439.38
FEMALES					
1	56.0	51.0	2.3	48.7	1927.8
2	57.7	52.7	1.6	51.1	1955.0
3	55.6	50.8	1.8	49	1814.4
4	56.9	51.9	2.2	49.7	1787.2
5	57.2	52.3	2.1	50.2	2240.8
6	58.7	53.6	2.0	51.6	2268.0
7	57.9	52.4	2.1	50.3	2181.8
8	58.3	53.4	2.4	51	2127.4
9	56.3	51.4	1.9	49.5	2127.4
10	56.6	51.8	2.3	49.5	2041.2
11	57.2	52.1	2.2	49.9	1927.8
12	59.3	53.9	2.7	51.2	2240.8
13	54.4	49.4	1.9	47.5	1728.2
14	60.5	54.7	2.5	52.2	2467.6
15	58.8	54.0	2.6	51.4	2440.4
16	56.1	51.3	1.9	49.4	1814.4
17	59.4	54.2	2.0	52.2	2240.8
18	56.3	50.4	1.9	48.5	2014.0
19	56.8	51.8	1.9	49.9	2295.2
19 Females	57.37	52.27	2.12	50.15	2086.33
Not included in the calculations:					
Male	69.0	55.9	3.1		2440.4

TABLE 44—CHILKO RUN: Flesh analyses (%) of sockeye salmon caught at Farwell Canyon.

No.	Nitrogen	Protein	Fat	Moisture	Total
MALES					
1	3.22 — 3.24	(20.2) 20.1 — 20.3	(11.15) 11.1 — 11.2	(68.15) 68.1 — 68.2	99.3 — 99.7
2	3.26 — 3.25	(20.35) 20.4 — 20.3	(12.2) 12.1 — 12.3	(66.75) 66.6 — 66.9	99.0 — 99.6
3	3.21 — 3.18	(20.0) 20.1 — 19.9	(10.2) 10.2 — 10.2	(67.5) 67.6 — 67.4	97.5 — 97.9
4	2.89 — 2.87	(18.0) 18.1 — 17.9	(15.45) 15.3 — 15.6	(65.15) 65.1 — 65.2	98.3 — 98.9
5	3.08 — 3.02	(19.1) 19.3 — 18.9	(11.3) 11.3 — 11.3	(67.7) 67.6 — 67.8	97.8 — 98.4
6	3.06 — 3.08	(19.2) 19.1 — 19.3	(10.55) 11.0 — 10.1	(69.1) 69.0 — 69.2	98.2 — 99.5
7	3.02 — 3.01	(18.85) 18.9 — 18.8	(10.55) 10.5 — 10.6	(68.8) 68.8 — 68.8	98.1 — 98.3
8	3.06 — 3.01	(18.95) 19.1 — 18.8	(9.8) 9.7 — 9.9	(69.3) 69.3 — 69.3	97.8 — 98.3
9	3.10 — 3.10	(19.4) 19.4 — 19.4	(12.0) 11.8 — 12.2	(67.5) 67.5 — 67.5	98.7 — 99.1
9 Males		19.34	10.67	67.80	
FEMALES					
1	3.24 — 3.22	(20.2) 20.3 — 20.1	(9.6) 9.8 — 9.4	(68.45) 68.4 — 68.5	97.9 — 98.6
2	3.14 — 3.12	(19.55) 19.6 — 19.5	(13.3) 13.2 — 13.4	(66.3) 66.1 — 66.5	98.8 — 99.5
3	3.16 — 3.16	(19.8) 19.8 — 19.8	(10.9) 10.7 — 11.1	(67.5) 67.3 — 67.7	97.8 — 98.6
4	3.02 — 3.02	(18.9) 18.9 — 18.9	(9.7) 9.8 — 9.6	(69.3) 69.2 — 69.4	97.7 — 98.1
5	3.05 — 3.03	(19.0) 19.1 — 18.9	(13.7) 13.8 — 13.6	(66.75) 66.8 — 66.7	99.2 — 99.7
6	3.16 — 3.21	(19.95) 19.8 — 20.1	(11.7) 11.6 — 11.8	(66.65) 66.5 — 66.8	97.9 — 98.7
7	3.25 — 3.21	(20.2) 20.3 — 20.1	(11.0) 11.1 — 10.9	(68.05) 68.2 — 67.9	98.9 — 99.6
8	2.87 — 2.90	(18.0) 17.9 — 18.1	(12.55) 12.3 — 12.8	(67.35) 67.5 — 67.2	97.4 — 98.4
9	3.02 — 2.98	(18.75) 18.9 — 18.6	(14.0) 13.6 — 14.4	(65.5) 65.5 — 65.5	97.7 — 98.8
10	3.29 — 3.25	(20.45) 20.6 — 20.3	(11.15) 11.1 — 11.2	(66.6) 66.9 — 66.3	97.7 — 98.7
11	3.05 — 3.05	(19.1) 19.1 — 19.1	(11.6) 11.8 — 11.4	(66.65) 66.6 — 66.7	97.1 — 97.6
12	3.20 — 3.15	(19.85) 20.0 — 19.7	(12.2) 12.2 — 12.2	(68.0) 67.9 — 68.1	99.8 — 100.3
13	3.25 — 3.27	(20.35) 20.3 — 20.4	(9.2) 9.2 — 9.2	(69.2) 69.2 — 69.2	98.7 — 98.8
14	3.37 — 3.39	(21.15) 21.1 — 21.2	(12.6) 12.6 — 12.6	(66.2) 66.3 — 66.1	99.8 — 99.9
15	2.98 — 3.00	(18.7) 18.6 — 18.8	(12.9) 13.0 — 12.8	(67.1) 67.0 — 67.2	98.4 — 99.0
16	2.96 — 2.98	(18.55) 18.5 — 18.6	12.7 —	(67.0) 67.0 — 67.0	98.2 — 98.3
17	3.09 — 3.04	(19.15) 19.3 — 19.0	(9.75) 9.7 — 9.8	(70.3) 70.2 — 70.4	98.9 — 99.5
18	3.02 — 3.02	(18.9) 18.9 — 18.9	(9.8) 9.7 — 9.9	(68.65) 68.8 — 68.5	97.1 — 97.6
19	3.25 — 3.25	(20.3) 20.3 — 20.3	(8.9) 8.8 — 9.0	(68.25) 68.1 — 68.4	97.2 — 97.7
19 Females		19.52	10.63	67.57	

Not included in the calculations:

Male	3.15 — 3.18	(19.8) 19.7 — 19.9	(11.2) 11.3 — 11.1	(68.05) 68.0 — 68.1	98.8 — 99.3
------	-------------	-----------------------	-----------------------	------------------------	-------------

TABLE 45—CHILKO RUN: Viscera analyses (%) of sockeye salmon caught at Farwell Canyon.

No.	Nitrogen	Protein	Fat	Moisture	Total
MALES					
1	2.81 —	17.6 — (18.4)	4.4 — 4.4 (4.4) (4.3)	78.1 — 78.2 (78.15) (77.35)	100.1 — 100.2
2	2.91 — 2.97	18.2 — 18.6 (18.7)	4.3 — 4.3 (3.6)	77.3 — 77.4 (77.9)	99.8 — 100.3
3	2.97 — 3.00	18.6 — 18.8 (16.35)	3.6 — 3.6 (6.65)	77.8 — 78.0 (77.85)	100.0 — 100.4
4	2.62 — 2.61	16.4 — 16.3 (17.4)	6.8 — 6.5 (3.1)	77.8 — 77.9 (79.65)	100.6 — 101.1
5	2.78 — 2.79	17.4 — 17.4 (16.95)	3.1 — 3.1 (3.55)	79.6 — 79.7 (77.9)	100.1 — 100.2
6	2.74 — 2.69	17.1 — 16.8 (17.25)	3.8 — 3.3 (2.7)	78.0 — 77.8 (78.8)	98.9 — 97.9
7	2.75 — 2.77	17.2 — 17.3 (16.25)	2.8 — 2.6 (3.35)	78.8 — 78.8 (79.2)	98.6 — 98.9
8	2.64 — 2.56	16.5 — 16.0	3.5 — 3.2 (4.6)	79.3 — 79.1 (77.4)	98.3 — 99.3
9	2.82 —	17.6 —	4.8 — 4.4	77.4 — 77.4	99.4 — 99.8
9 Males		17.39	3.75	78.24	
FEMALES					
1	3.70 — 3.76	23.1 — 23.5 (23.3)	10.7 — 10.2 (10.45)	64.3 — 64.5 (64.4)	97.6 — 98.7
2	3.84 —	24.0 — (22.15)	12.7 — 12.2 (12.45)	63.2 — 63.0 (63.1)	99.2 — 99.9
3	3.55 — 3.53	22.2 — 22.1 (25.9)	12.3 — 12.1 (10.6)	62.8 — 63.0 (62.9) (63.05)	97.0 — 97.5
4	4.14 — 4.15	25.9 — 25.9 (20.2)	10.8 — 10.4 (10.8)	63.2 — 62.9 (67.05)	99.2 — 99.9
5	3.21 — 3.24	20.1 — 20.3 (20.25)	11.0 — 10.6 (10.8)	66.9 — 67.2 (67.35)	98.0 — 98.1
6	3.18 — 3.30	19.9 — 20.6 (23.35)	10.8 — 10.8 (11.7)	67.6 — 67.1 (64.05)	97.8 — 99.0
7	3.77 — 3.70	23.6 — 23.1 (24.0)	11.4 — 12.0 (10.95)	63.9 — 64.2 (65.4)	98.4 — 99.8
8	3.84 — 3.84	24.0 — 24.0 (21.25)	11.1 — 10.8 (11.35)	65.5 — 65.3 (65.75)	100.1 — 100.6
9	3.41 — 3.39	21.3 — 21.2 (21.25)	11.4 — 11.3 (10.45)	65.6 — 65.9 (65.5)	98.1 — 98.6
10	3.38 — 3.42	21.1 — 21.4 (22.55)	10.5 — 10.4 (10.55)	65.5 — 65.5 (64.55)	97.1 — 97.3
11	3.56 — 3.49	22.3 — 21.8 (23.7)	10.4 — 10.7 (10.7)	64.4 — 64.7 (63.9)	97.1 — 97.2
12	3.79 — 3.79	23.7 — 23.7 (22.85)	10.7 — 10.7 (9.25)	63.9 — 63.9 (67.85)	98.3 — 98.3
13	3.66 — 3.64	22.9 — 22.8 (21.6)	9.1 — 9.4 (10.55)	67.8 — 67.9 (65.6)	99.7 — 100.2
14	3.44 — 3.47	21.5 — 21.7 (22.3)	10.8 — 10.3 (9.1)	65.8 — 65.4 (66.45)	97.2 — 98.3
15	3.52 — 3.61	22.0 — 22.6 (22.35)	9.2 — 9.0 (11.15)	66.7 — 66.2 (65.5)	97.2 — 98.5
16	3.53 — 3.46	22.1 — 21.6 (24.75)	11.1 — 11.2 (10.0)	65.5 — 65.5 (63.2)	98.2 — 98.8
17	3.97 — 3.95	24.8 — 24.7 (20.85)	10.1 — 9.9 (9.45)	63.4 — 63.0 (64.5)	97.6 — 98.3
18	3.29 — 3.38	20.6 — 21.1 (22.85)	9.7 — 9.2 (11.9)	64.6 — 64.4 (63.9)	94.2 — 95.4
19	3.66 — 3.64	22.9 — 22.8	11.8 — 12.0	63.4 — 64.4	98.1 — 99.2
19 Females		22.60	10.01	64.95	

Not included in the calculations:

Male	3.01 — 3.00	18.8 — 18.8 (18.8)	4.2 — 4.2 (4.2)	78.4 — 78.5 (78.45)	101.4 — 101.5
------	-------------	-----------------------	--------------------	------------------------	---------------

**TABLE 46—CHILKO RUN: Weight analyses of viscera from sockeye salmon caught at Farwell Canyon.**

No.	Weight of Gonads (gm.)	Weight of Liver (gm.)	Total Weight of Viscera (gm.)
<b>MALES</b>			
1	85	47	206
2	65	27	149
3	80	36	179
4	101	43	232
5	73	37	185
6	105	34	197
7	90	27	161
8	80	31	180
9	107	29	194
9 Males	87.33	34.56	187.00
<b>FEMALES</b>			
1	150	39	226
2	144	32	217
3	113	30	172
4	163	47	243
5	138	45	231
6	146	49	248
7	130	45	215
8	140	44	223
9	150	48	253
10	131	44	224
11	124	40	210
12	178	53	289
13	98	50	188
14	164	44	265
15	187	51	289
16	114	47	206
17	243	61	354
18	143	47	238
19	140	46	244
19 Females	147.16	45.37	238.68
Not included in the calculations:			
Male	83	34	189



TABLE 47—CHILKO RUN: Lengths and weight of sockeye salmon caught at Keighley Holes.

No.	Total Length (cm.)	Standard Length (cm.)	Snout Length (cm.)	Body Length (cm.)	Weight (Flesh + Viscera) (gm.)
MALES					
1	60.0	54.2	3.6	50.6	2721.6
2	62.8	57.6	3.8	53.8	3175.2
3	60.7	56.2	3.4	52.8	2581.0
4	59.5	53.6	3.3	50.3	2862.2
5	63.7	57.3	4.5	52.8	3175.2
6	61.1	55.2	3.3	51.9	2608.2
7	65.4	59.0	3.7	55.3	3288.6
8	60.0	54.2	3.5	50.7	2327.0
9	57.6	52.5	3.0	49.5	2467.6
10	63.5	57.0	3.8	53.2	2948.4
11	57.5	52.0	2.9	49.1	2354.2
12	61.0	55.5	3.5	52	2862.2
13	62.0	56.2	3.1	53.1	2780.6
13 Males	61.14	55.42	3.49	51.93	2780.92
FEMALES					
1	60.4	54.5	3.6	50.9	2494.8
2	58.5	53.0	3.3	49.7	2408.6
3	56.7	50.8	2.5	48.3	2213.6
4	58.3	52.6	3.2	49.4	2440.4
5	60.5	54.4	3.4	51	2608.2
6	61.4	55.4	2.8	52.6	2667.2
7	58.0	52.0	2.8	49.2	2268.0
8	59.8	54.2	3.0	51.2	2467.6
9	60.0	54.5	3.2	51.3	2327.0
10	62.0	56.8	3.2	53.6	2921.2
11	60.2	54.5	2.8	51.7	2608.2
12	59.8	54.0	2.6	51.4	2553.8
13	60.0	54.2	2.5	51.7	2494.8
14	57.9	53.2	2.8	50.4	2181.8
15	59.4	54.0	2.9	51.1	2268.0
16	60.5	53.6	2.6	51	2780.6
16 Females	59.59	53.86	2.95	50.91	2481.49

Not included in the calculations:

Male	60.8	55.0	3.0		2780.6
------	------	------	-----	--	--------

TABLE 48—CHILKO RUN: Flesh analyses (%) of sockeye salmon caught at Keighley Holes.

No.	Nitrogen	Protein	Fat	Moisture	Total
<b>MALES</b>					
		(20.25)	(12.4)	(66.5)	
1	3.22 — 3.26	20.1 — 20.4	12.4 — 12.4	66.5 — 66.5	99.0 — 99.3
		(19.15)	(10.15)	(69.65)	
2	3.02 — 3.10	18.9 — 19.4	10.1 — 10.2	69.6 — 69.7	98.6 — 99.3
		(19.5)	(9.7)	(69.75)	
3	3.11 — 3.13	19.4 — 19.6	9.7 — 9.7	69.7 — 69.8	98.8 — 99.1
		(19.1)	(12.15)	(67.7)	
4	3.05 — 3.06	19.1 — 19.1	11.9 — 12.4	67.7 — 67.7	98.7 — 99.2
		(19.2)	(7.2)	(71.25)	
5	3.06 — 3.08	19.1 — 19.3	7.0 — 7.4	71.1 — 71.4	97.2 — 98.1
		(19.5)	(6.45)	(72.85)	
6	3.11 — 3.13	19.4 — 19.6	6.3 — 6.6	72.8 — 72.9	98.5 — 99.1
		(18.45)	(12.9)	(66.2)	
7	2.95 — 2.96	18.4 — 18.5	12.9 — 12.9	66.1 — 66.3	97.4 — 97.7
		(18.25)	(14.85)	(65.2)	
8	2.91 — 2.93	18.2 — 18.3	14.8 — 14.9	65.1 — 65.3	98.1 — 98.5
		(19.8)	(11.3)	(69.35)	
9	3.16 — 3.17	19.8 — 19.8	11.2 — 11.4	69.2 — 69.5	100.2 — 100.7
		(19.45)	(9.75)	(69.55)	
10	3.09 — 3.14	19.3 — 19.6	9.7 — 9.8	69.5 — 69.6	98.5 — 99.0
		(19.25)	(8.2)	(70.65)	
11	3.06 — 3.10	19.1 — 19.4	8.2 — 8.2	70.5 — 70.8	97.8 — 98.4
		(18.85)	(8.6)	(71.05)	
12	2.99 — 3.04	18.7 — 19.0	8.5 — 8.7	70.9 — 71.2	98.1 — 98.9
		(19.2)	(9.85)	(70.0)	
13	3.07 — 3.07	19.2 — 19.2	9.7 — 10.0	69.9 — 70.1	98.8 — 99.3
13 Males		19.23	9.55	69.21	
<b>FEMALES</b>					
		(19.45)	(10.9)	(68.75)	
1	3.11 — 3.12	19.4 — 19.5	10.7 — 11.1	68.7 — 68.8	98.8 — 99.4
		(19.95)	(9.55)	(68.65)	
2	3.18 — 3.20	19.9 — 20.0	9.4 — 9.7	68.5 — 68.8	97.8 — 98.5
		(19.9)	(11.0)	(66.9)	
3	3.16 — 3.20	19.8 — 20.0	11.1 — 10.9	66.8 — 67.0	97.5 — 98.1
		(19.5)	(8.9)	(70.75)	
4	3.11 — 3.14	19.4 — 19.6	8.8 — 9.0	70.5 — 71.0	98.7 — 99.6
		(18.4)	(9.35)	(70.8)	
5	2.93 — 2.96	18.3 — 18.5	9.2 — 9.5	70.7 — 70.9	98.2 — 98.9
		(19.65)	(9.15)	(70.2)	
6	3.13 — 3.15	19.6 — 19.7	9.1 — 9.2	70.2 — 70.2	98.9 — 99.1
		(19.8)	(12.4)	(66.95)	
7	3.16 — 3.16	19.8 — 19.8	12.5 — 12.3	66.9 — 67.0	99.0 — 99.3
		(19.5)	(9.95)	(69.55)	
8	3.10 — 3.14	19.4 — 19.6	9.9 — 10.0	69.5 — 69.6	98.8 — 99.2
		(19.55)	(10.85)	(68.6)	
9	3.11 — 3.15	19.4 — 19.7	10.8 — 10.9	68.5 — 68.7	98.7 — 99.3
		(19.85)	(10.2)	(69.9)	
10	3.13 — 3.21	19.6 — 20.1	10.1 — 10.3	69.7 — 70.1	99.4 — 100.5
		(19.4)	(8.8)	(70.15)	
11	3.10 — 3.11	19.4 — 19.4	8.8 — 8.8	70.1 — 70.2	98.3 — 98.4
		(18.55)	(13.5)	(67.45)	
12	2.96 — 2.97	18.5 — 18.6	13.4 — 13.6	67.4 — 67.5	99.3 — 99.7
		(19.6)	(10.15)	(68.45)	
13	3.15 — 3.12	19.7 — 19.5	10.4 — 9.9	68.4 — 68.5	98.5 — 97.9
		(19.35)	(8.5)	(70.6)	
14	3.10 — 3.09	19.4 — 19.3	8.6 — 8.4	70.6 — 70.6	98.6 — 98.3
		(20.2)	(6.05)	(72.0)	
15	3.22 — 3.25	20.1 — 20.3	6.1 — 6.0	72.0 — 72.0	98.1 — 98.4
		(19.8)	(10.3)	(69.35)	
16	3.17 — 3.17	19.8 — 19.8	10.3 — 10.3	69.3 — 69.4	99.4 — 99.5
16 Females		19.53	9.30	69.32	

Not included in the calculations:

		(18.9)	(17.55)	(62.05)	
Male	3.02 — 3.03	18.9 — 18.9	17.5 — 17.6	62.0 — 62.1	98.4 — 98.6

TABLE 49—CHILKO RUN: Viscera analyses (%) of sockeye salmon caught at Keighley Holes.

No.	Nitrogen	Protein	Fat	Moisture	Total
MALES					
1	2.83 — 2.85	(17.75) 17.7 — 17.8	(4.45) 4.4 — 4.5	(78.45) 78.4 — 78.5	100.5 — 100.7
2	2.90 — 2.91	(18.15) 18.1 — 18.2	(4.55) 4.5 — 4.6	(77.75) 77.7 — 77.8	100.3 — 100.6
3	3.74 — 3.77	(23.4) 23.4 — 23.4	(12.05) 12.1 — 12.0	(63.4) 63.4 — 63.4	98.9 — 98.8
4	3.32 — 3.33	(20.8) 20.8 — 20.8	(3.45) 3.4 — 3.5	(76.3) 76.2 — 76.4	100.4 — 100.7
5	2.83 — 2.84	(17.75) 17.7 — 17.8	(3.55) 3.4 — 3.7	(78.25) 78.2 — 78.3	99.3 — 99.8
6	3.63 — 3.66	(22.8) 22.7 — 22.9	(12.15) 12.1 — 12.2	(64.45) 64.4 — 64.5	99.2 — 99.6
7	3.51 — 3.51	(21.9) 21.9 — 21.9	(10.65) 10.6 — 10.7	(63.4) 63.3 — 63.5	95.8 — 96.1
8	3.67 — 3.69	(22.95) 22.9 — 23.0	(10.45) 10.3 — 10.6	(64.65) 64.6 — 64.7	97.8 — 98.3
9	3.89 —	(10.9) 24.3 —	(63.2) 10.8 — 11.0	(63.1 — 63.3)	98.2 — 98.6
10	3.85 — 3.87	(24.15) 24.1 — 24.2	(12.25) 12.2 — 12.3	(62.85) 62.7 — 63.0	99.0 — 99.5
11	3.32 — 3.34	(20.85) 20.8 — 20.9	(11.3) 11.2 — 11.4	(66.9) 66.8 — 67.0	98.8 — 99.3
12	3.01 — 3.04	(18.9) 18.8 — 19.0	(3.7) 3.7 — 3.7	(77.05) 77.0 — 77.1	99.5 — 99.8
12 Males		21.14	7.71	69.72	
FEMALES					
1	3.57 — 3.57	(22.3) 22.3 — 22.3	(11.75) 11.7 — 11.8	(65.05) 64.8 — 65.3	98.8 — 99.4
2	3.72 — 3.77	(23.45) 23.3 — 23.6	(12.5) 12.4 — 12.6	(64.1) 64.0 — 64.2	99.7 — 100.4
3	3.45 — 3.39	(21.4) 21.6 — 21.2	(12.2) 12.1 — 12.3	(64.15) 64.1 — 64.2	97.8 — 97.7
4	3.34 — 3.37	(21.0) 20.9 — 21.1	(11.65) 11.4 — 11.9	(64.65) 64.5 — 64.8	96.8 — 97.8
5	3.16 — 3.18	(19.85) 19.8 — 19.9	(3.95) 3.9 — 4.0	(77.0) 76.9 — 77.1	100.6 — 101.0
6	3.10 — 3.13	(19.5) 19.4 — 19.6	(4.3) 4.1 — 4.5	(77.7) 77.7 — 77.7	101.2 — 101.8
7	3.83 — 3.83	(23.9) 23.9 — 23.9	(11.95) 11.8 — 12.1	(63.25) 63.2 — 63.3	98.9 — 99.3
8	2.61 — 2.64	(16.4) 16.3 — 16.5	(3.7) 3.6 — 3.8	(78.25) 78.2 — 78.3	98.1 — 98.6
9	3.68 — 3.71	(23.1) 23.0 — 23.2	(11.25) 11.1 — 11.4	(65.1) 65.0 — 65.2	99.1 — 99.8
10	2.39 — 2.42	(15.0) 14.9 — 15.1	(5.35) 5.3 — 5.4	(77.3) 77.2 — 77.4	97.4 — 97.9
11	3.52 — 3.57	(22.15) 22.0 — 22.3	(14.15) 14.1 — 14.2	(61.1) 60.9 — 61.3	97.0 — 97.8
12	2.95 — 2.95	(18.4) 18.4 — 18.4	(3.45) 3.5 — 3.4	(79.15) 79.1 — 79.2	101.0 — 101.0
13	3.82 — 3.85	(24.0) 23.9 — 24.1	(11.4) 11.3 — 11.5	(63.75) 63.6 — 63.9	98.8 — 99.5
14	2.93 — 2.94	(18.35) 18.3 — 18.4	(3.95) 3.8 — 4.1	(77.8) 77.8 — 77.8	99.9 — 100.3
15	2.81 — 2.84	(17.7) 17.6 — 17.8	(3.25) 3.2 — 3.3	(79.5) 79.4 — 79.6	100.2 — 100.7
16	2.93 — 2.96	(18.4) 18.3 — 18.5	(3.35) 3.3 — 3.4	(78.15) 78.2 — 78.1	99.8 — 100.0
16 Females		20.31	7.45	71.00	

Not included in the calculations:

Male	2.86 — 2.86	(17.9) 17.9 — 17.9	(6.4) 6.4 — 6.4	(75.5) 75.4 — 75.6	99.7 — 99.9
------	-------------	-----------------------	--------------------	-----------------------	-------------

TABLE 50—CHILKO RUN: Weight analyses of viscera from sockeye salmon caught at Keighley Holes.

No.	Weight of Gonads (gm.)	Weight of Liver (gm.)	Total Weight of Viscera (gm.)
MALES			
1	94	27	170
2	111	34	214
3	100	26	181
4	81	30	178
5	79	36	184
6	70	25	152
7	98	41	211
8	93	29	177
9	123	26	208
10	90	35	210
11	82	25	161
12	84	25	169
13	117	33	211
13 Males	94.00	30.15	186.62

FEMALES			
1	205	46	300
2	170	41	252
3	174	42	261
4	192	45	287
5	289	51	385
6	219	52	319
7	160	36	243
8	231	50	323
9	185	47	266
10	244	70	370
11	228	50	317
12	180	40	260
13	226	50	323
14	189	46	280
15	208	50	295
16	198	51	295
16 Females	206.13	47.94	298.50

Not included in the calculations:

Male	91	26	174
------	----	----	-----

TABLE 51—CHILKO RUN: Lengths and weight of spent sockeye salmon caught at the spawning grounds.

No.	Total Length (cm.)	Standard Length (cm.)	Snout Length (cm.)	Body Length (cm.)	Weight (Flesh + Viscera) (gm.)
MALES					
1	58.5	54.6	5.0	49.6	2721.6
2	61.5	56.2	4.6	51.6	3234.2
3	62.0	56.0	5.3	50.7	2948.4
4	59.3	54.0	3.5	50.5	2327.0
5	61.0	56.5	5.0	51.5	2807.8
6	60.5	55.0	4.5	50.5	2635.4
7	62.2	56.3	6.0	50.3	3034.6
8	63.0	58.5	5.5	53	3061.8
9	57.3	52.3	6.0	46.3	2295.2
10	65.0	58.4	6.0	52.4	3148.0
11	60.3	54.5	4.7	49.8	2240.8
12	62.8	58.5	6.0	52.5	2975.6
13	62.8	57.5	5.0	52.5	2921.2
14	60.0	55.0	5.0	50	2807.8
15	59.2	54.3	5.0	49.3	2522.0
15 Males	61.03	55.84	5.14	50.70	2778.76
FEMALES					
1	61.5	56.0	3.5	52.5	1927.8
2	57.8	52.4	3.7	48.7	1787.2
3	56.4	52.3	3.4	48.9	1560.4
4	56.0	50.9	3.5	47.4	1787.2
5	56.8	51.7	4.3	47.4	1787.2
6	55.6	50.2	3.2	47	1760.0
7	58.8	53.6	3.6	50	1841.6
8	56.0	50.5	3.6	46.9	1900.6
9	60.5	55.0	2.8	52.2	2041.2
10	59.7	54.4	3.3	51.1	1927.8
11	58.4	54.3	3.3	51	1927.8
11 Females	57.95	52.85	3.47	49.37	1840.80
Not included in the calculations:					
Females	62.2	56.4	3.7		2381.4
	56.7	51.4	4.2		2268.0
	60.5	55.6	3.8		2295.2
	58.8	53.9	3.7		2522.0

TABLE 52—CHILKO RUN: Flesh analyses (%) of spent sockeye salmon caught at spawning grounds.

No.	Nitrogen	Protein	Fat	Moisture	Total
MALES					
1	2.00 — 2.01	(12.55) 12.5 — 12.6	(3.5) 3.4 — 3.6	(81.85) 81.8 — 81.9	97.7 — 98.1
2	2.13 — 2.15	(13.35) 13.3 — 13.4	(4.9) 4.8 — 5.0	(79.25) 79.1 — 79.4	97.2 — 97.8
3	1.91 — 1.89	(11.85) 11.9 — 11.8	(3.55) 3.6 — 3.5	(83.4) 83.3 — 83.5	98.8 — 98.8
4	2.47 — 2.49	(15.5) 15.4 — 15.6	(2.65) 2.5 — 2.8	(81.45) 81.4 — 81.5	99.3 — 99.9
5	2.26 — 2.29	(14.2) 14.1 — 14.3	(3.75) 3.7 — 3.8	(79.0) 78.9 — 79.1	96.7 — 97.2
6	1.75 — 1.76	(10.95) 10.9 — 11.0	(4.05) 4.0 — 4.1	(83.4) 83.4 — 83.4	98.3 — 98.5
7	1.90 — 1.91	(11.9) 11.9 — 11.9	(5.7) 5.7 — 5.7	(82.05) 82.0 — 82.1	99.6 — 99.7
8	2.32 — 2.38	(14.7) 14.5 — 14.9	(4.05) 4.0 — 4.1	(80.3) 80.3 — 80.3	98.8 — 99.3
9	1.78 — 1.77	(11.1) 11.1 — 11.1	(3.4) 3.2 — 3.6	(84.25) 84.2 — 84.3	98.5 — 99.0
10	1.87	11.7	(3.85) 3.8 — 3.9	(82.75) 82.8 — 82.7	98.2 — 98.4
11	1.67 — 1.70	(10.5) 10.4 — 10.6	(1.65) 1.6 — 1.7	(85.9) 86.0 — 85.8	98.0 — 98.1
12	2.29 — 2.29	(14.3) 14.3 — 14.3	(6.65) 6.7 — 6.6	(78.3) 78.4 — 78.2	99.4 — 99.1
13	2.27 — 2.29	(14.25) 14.2 — 14.3	(2.1) 2.0 — 2.2	(82.55) 82.5 — 82.6	98.7 — 99.1
14	1.99 — 2.01	(12.5) 12.4 — 12.6	(3.65) 3.6 — 3.7	(82.55) 82.4 — 82.7	98.4 — 99.0
15	1.92 — 1.94	(12.05) 12.0 — 12.1	(3.4) 3.3 — 3.5	(82.05) 82.0 — 82.1	97.3 — 97.7
15 Males		12.76	3.52	81.94	
FEMALES					
1	1.94 — 1.96	(12.2) 12.1 — 12.3	(2.95) 2.9 — 3.0	(82.4) 82.4 — 82.4	97.4 — 97.7
2	2.24 — 2.27	(14.1) 14.0 — 14.2	(1.65) 1.5 — 1.8	(81.5) 81.7 — 81.3	96.8 — 97.7
3	2.11 — 2.19	(13.45) 13.2 — 13.7	(3.55) 3.5 — 3.6	(83.7) 83.7 — 83.7	100.4 — 101.0
4	2.33 — 2.34	(14.6) 14.6 — 14.6	(2.6) 2.6 — 2.6	(80.05) 80.0 — 80.1	97.2 — 97.3
5	2.26 — 2.30	(14.25) 14.1 — 14.4	(2.25) 2.2 — 2.3	(82.0) 82.0 — 82.0	98.3 — 98.7
6	2.19 — 2.21	(13.75) 13.7 — 13.8	(2.65) 2.5 — 2.8	(81.2) 81.1 — 81.3	97.3 — 97.9
7	2.24 — 2.26	(14.05) 14.0 — 14.1	(4.7) 4.7 — 4.7	(78.95) 78.8 — 79.1	97.5 — 97.9
8	2.22 — 2.24	(13.95) 13.9 — 14.0	(2.7) 2.6 — 2.8	(82.95) 82.8 — 83.1	99.3 — 99.9
9	2.21 — 2.31	(14.1) 13.8 — 14.4	(2.25) 2.2 — 2.3	(83.15) 83.0 — 83.3	99.0 — 100.0
10	2.42 — 2.43	(15.15) 15.1 — 15.2	(3.65) 3.6 — 3.7	(80.31) 80.17 — 80.45	98.9 — 99.4
11	2.35 — 2.40	(14.85) 14.7 — 15.0	(2.5) 2.5 — 2.5	(80.65) 80.5 — 80.8	97.7 — 98.3
11 Females		14.04	2.66	81.53	
Not included in the calculations:					
Females	2.48 — 2.50	(15.55) 15.5 — 15.6	(4.3) 4.3 — 4.3	(79.9) 79.7 — 80.1	99.5 — 100.0
	2.36 — 2.39	(14.85) 14.8 — 14.9	(4.75) 4.7 — 4.8	(79.45) 79.4 — 79.5	98.9 — 99.2
	2.22	13.9	(5.65) 5.6 — 5.7	(79.4) 79.3 — 79.5	98.8 — 99.1
	2.30 — 2.32	(14.45) 14.4 — 14.5	(5.3) 5.3 — 5.3	(77.75) 77.7 — 77.8	97.4 — 97.6

TABLE 53—CHILKO RUN: Viscera analyses (%) of spent sockeye salmon caught at spawning grounds.

No.	Nitrogen	Protein	Fat	Moisture	Total
MALES					
1	2.05 — 2.09	(12.95) 12.8 — 13.1	(2.8) 2.7 — 2.9	(85.25) 85.2 — 85.3	100.7 — 101.3
2	2.43 — 2.45	(15.25) 15.2 — 15.3	(2.4) 2.4 — 2.4	(81.05) 80.9 — 81.2	98.5 — 98.9
3	1.74 — 1.76	(10.95) 10.9 — 11.0	(3.4) 3.4 — 3.4	(82.6) 82.5 — 82.7	96.8 — 97.1
4	2.34 — 2.34	(14.6) 14.6 — 14.6	(2.8) 2.8 — 2.8	(81.0) 81.0 — 81.0	98.4 — 98.4
5	2.34 — 2.37	(14.7) 14.6 — 14.8	(2.85) 2.7 — 3.0	(83.3) 83.2 — 83.4	100.5 — 101.2
6	2.02 — 2.08	(12.8) 12.6 — 13.0	(2.9) 2.7 — 3.1	(83.95) 83.7 — 84.2	99.0 — 100.3
7	2.58 — 2.61	(16.2) 16.1 — 16.3	(3.15) 3.1 — 3.2	(81.2) 81.1 — 81.3	100.3 — 100.8
8	2.14 — 2.14	(13.4) 13.4 — 13.4	(2.95) 2.9 — 3.0	(83.45) 83.2 — 83.7	99.5 — 100.1
9	1.69 — 1.73	(10.7) 10.6 — 10.8	(3.35) 3.3 — 3.4	(84.55) 84.5 — 84.6	98.4 — 98.8
10	1.79 — 1.79	(11.2) 11.2 — 11.2	(1.35) 1.3 — 1.4	(84.55) 84.5 — 84.6	97.0 — 97.2
11	1.87 — 1.84	(11.6) 11.5 — 11.7	(2.2) 2.2 — 2.2	(83.65) 83.5 — 83.8	97.2 — 97.7
12	2.67 — 2.69	(16.75) 16.7 — 16.8	(3.3) 3.2 — 3.4	(78.3) 78.2 — 78.4	98.1 — 98.6
13	2.36 — 2.38	(14.85) 14.8 — 14.9	(1.4) 1.4 — 1.4	(84.7) 84.6 — 84.8	100.8 — 101.1
14	2.20 — 2.23	(13.85) 13.8 — 13.9	(2.85) 2.8 — 2.9	(82.8) 82.8 — 82.8	99.4 — 99.6
15	2.05 — 2.06	(12.85) 12.8 — 12.9	(2.75) 2.7 — 2.8	(84.6) 84.4 — 84.8	99.9 — 100.5
15 Males		13.51	2.51	83.00	
FEMALES					
1	1.62 — 1.66	(10.25) 10.1 — 10.4	2.5	(86.65) 86.4 — 86.9	99.0 — 99.8
2	1.68 — 1.71	(10.6) 10.5 — 10.7	2.4	(86.45) 86.4 — 86.5	99.3 — 99.6
3	2.17 — 2.18	(13.6) 13.6 — 13.6	2.4	(82.5) 82.5 — 82.5	98.5 — 98.5
4	1.93 — 1.98	(12.25) 12.1 — 12.4	2.9	(83.35) 83.3 — 83.4	98.3 — 98.7
5	1.90 — 1.91	(11.9) 11.9 — 11.9	(2.35) 2.3 — 2.4	(84.5) 84.4 — 84.6	98.6 — 98.9
6	2.04 — 2.07	(12.85) 12.8 — 12.9	(2.85) 2.8 — 2.9	(83.95) 83.9 — 84.0	99.5 — 99.8
7	1.83 — 1.83	(11.4) 11.4 — 11.4	(2.85) 2.8 — 2.9	(84.5) 84.5 — 84.5	98.7 — 98.8
8	1.99 — 2.02	(12.5) 12.4 — 12.6	(3.65) 3.6 — 3.7	(82.3) 82.0 — 82.6	98.0 — 98.9
9	1.83 — 1.87	(11.55) 11.4 — 11.7	(2.6) 2.6 — 2.6	(84.45) 84.4 — 84.5	98.4 — 98.8
10	2.32 — 2.34	(14.55) 14.5 — 14.6	4.4	(79.15) 79.1 — 79.2	98.0 — 98.2
11	2.05 — 2.09	(12.95) 12.8 — 13.1	4.6	(82.1) 82.0 — 82.2	99.4 — 99.9
11 Females		12.22	2.84	83.63	
Not included in the calculations:					
Females	2.92 — 2.97	(18.45) 18.3 — 18.6	(6.9) 6.7 — 7.1	(71.75) 71.7 — 71.8	96.7 — 97.5
	3.51 — 3.54	(22.0) 21.9 — 22.1	(8.45) 8.3 — 8.6	(68.0) 68.0 — 68.0	98.2 — 98.7
	3.26	20.4	(9.45) 9.0 — 9.9	(68.9) 68.8 — 69.0	98.2 — 99.3
	3.44 — 3.44	(21.5) 21.5 — 21.5	(9.95) 9.9 — 10.0	(66.2) 66.1 — 66.3	97.5 — 97.8

TABLE 54—CHILKO RUN: Weight analyses of viscera from spent sockeye salmon caught at spawning grounds.

No.	Weight of Gonads (gm.)	Weight of Liver (gm.)	Total Weight of Viscera (gm.)
MALES			
1	86.0	53.0	200.0
2	82.0	70.0	208.0
3	32.0	82.0	167.0
4	43.0	61.0	150.0
5	76.0	66.0	191.0
6	82.0	47.0	210.0
7	68.0	68.0	183.0
8	95.0	65.0	234.0
9	40.0	69.0	139.0
10	72.0	77.0	231.0
11	17.0	62.0	110.0
12	85.0	66.0	204.0
13	71.0	63.0	172.0
14	84.0	86.0	235.0
15	63.0	57.0	149.0
15 Males	66.40	66.13	185.53
FEMALES			
1		46.0	121.0
2		33.0	130.0
3		32.0	81.0
4		36.0	106.0
5		39.0	121.0
6		28.0	86.0
7		38.0	124.0
8		45.0	125.0
9		45.0	116.0
10		45.0	127.0
11		47.0	96.0
11 Females		39.45	112.09
Not included in the calculations:			
Females		38.0	290.0
		38.0	369.0
		27.0	311.0
		29.0	489.0



TABLE 55—CHILKO RUN: Lengths and weight of fresh dead sockeye salmon caught at the spawning grounds.

No.	Total Length (cm.)	Standard Length (cm.)	Snout Length (cm.)	Body Length (cm.)	Weight (Flesh + Viscera) (gm.)
MALES					
1	62.7	58.3	5.3	53	2381.4
2	61.3	57.1	5.0	52.1	2408.6
3	58.7	54.2	5.3	48.9	2213.6
4	62.3	58.0	5.1	52.9	2608.2
5	60.5	56.1	4.6	51.5	2748.8
6	61.0	56.0	5.6	50.4	3089.0
7	60.9	56.3	5.0	51.3	2295.2
8	63.0	58.1	5.8	52.3	2748.8
9	64.6	58.8	5.5	53.3	2748.8
10	60.2	55.4	4.8	50.6	2327.0
11	62.0	57.1	5.8	51.3	2494.8
12	66.0	61.0	6.4	54.6	2835.0
13	60.5	55.5	5.5	50	2327.0
14	64.7	59.7	6.2	53.5	3120.8
14 Males	62.03	57.26	5.42	51.84	2596.21
FEMALES					
1	55.0	50.1	4.0	46.1	1614.8
2	57.5	54.0	3.3	50.7	1955.0
3	60.0	55.6	3.4	52.2	1900.6
4	57.3	53.6	3.0	50.6	1614.8
5	56.6	51.7	3.0	48.7	1247.4
6	57.0	52.4	3.1	49.3	1614.8
7	55.8	52.2	3.2	49	1419.8
8	58.4	54.1	3.5	50.6	1701.0
9	59.3	54.0	4.0	50	1474.2
10	60.1	55.4	4.0	51.4	1646.6
11	57.3	52.4	3.2	49.2	1560.4
12	56.4	53.0	3.3	49.7	1501.4
13	61.5	56.8	3.7	53.1	1873.4
14	58.5	54.6	4.0	50.6	1646.6
15	59.5	55.6	3.6	52	1986.8
15 Females	58.01	53.70	3.49	50.21	1650.51
Not included in the calculations:					
Male	67.5	60.8	6.7		3288.6

TABLE 56—CHILKO RUN: Flesh analyses (%) of fresh dead sockeye salmon taken at Chilko River.

No.	Nitrogen	Protein	Fat	Moisture	Total
MALES					
1	1.84 — 1.86	(11.55) 11.5 — 11.6	(1.6) 1.5 — 1.7	(86.05) 86.0 — 86.1	99.0 — 99.4
2	2.04 — 2.06	(12.85) 12.8 — 12.9	(2.6) 2.6 — 2.6	(83.25) 83.1 — 83.4	98.5 — 98.9
3	1.81 — 1.82	(11.35) 11.3 — 11.4	(4.15) 4.1 — 4.2	(82.20) 82.1 — 82.3	97.5 — 97.9
4	2.12 — 2.13	(13.3) 13.3 — 13.3	(3.3) 3.1 — 3.5	(82.0) 81.9 — 82.1	98.3 — 98.9
5	1.57 — 1.61	(9.95) 9.8 — 10.1	(5.35) 5.4 — 5.3	(83.8) 83.7 — 83.9	98.8 — 99.4
6	1.89 — 1.90	(11.85) 11.8 — 11.9	(4.05) 4.0 — 4.1	(83.35) 83.3 — 83.4	99.1 — 99.4
7	1.62 — 1.68	(10.3) 10.1 — 10.5	(4.55) 4.6 — 4.5	(85.1) 85.3 — 84.9	100.0 — 99.9
8	2.14 — 2.19	(13.55) 13.4 — 13.7	(3.45) 3.4 — 3.5	(80.5) 80.4 — 80.6	97.2 — 97.8
9	1.88 — 1.90	(11.85) 11.8 — 11.9	(3.9) 3.9 — 3.9	(83.7) 83.6 — 83.8	99.3 — 99.6
10	2.06 — 2.11	(13.05) 12.9 — 13.2	(3.85) 3.8 — 3.9	(82.15) 82.1 — 82.2	98.8 — 99.3
11	1.72 — 1.79	(11.0) 10.8 — 11.2	(3.5) 3.5 — 3.5	(83.3) 83.2 — 83.4	97.5 — 98.1
12	1.68 — 1.68	(10.5) 10.5 — 10.5	(3.15) 3.1 — 3.2	(87.05) 87.0 — 87.1	100.6 — 100.8
13	2.01 — 2.06	(12.75) 12.6 — 12.9	(2.3) 2.3 — 2.3	(84.4) 84.2 — 84.6	99.1 — 99.8
14	2.11 — 2.11	(13.2) 13.2 — 13.2	(5.95) 5.8 — 6.1	(79.2) 79.2 — 79.2	98.2 — 98.5
14 Males		11.93	3.43	83.29	
FEMALES					
1	2.01 — 2.05	(12.7) 12.6 — 12.8	(5.0) 5.0 — 5.0	(81.2) 81.2 — 81.2	98.8 — 99.0
2	1.81 — 1.84	(11.4) 11.3 — 11.5	(4.6) 4.6 — 4.6	(82.6) 82.4 — 82.8	98.3 — 98.9
3	1.63 — 1.61	(10.15) 10.2 — 10.1	(1.55) 1.6 — 1.5	(86.95) 86.8 — 87.1	98.6 — 98.7
4	1.73 — 1.80	(11.05) 10.8 — 11.3	(1.3) 1.2 — 1.4	(86.15) 86.1 — 86.2	98.1 — 98.9
5	1.82 — 1.88	(11.6) 11.4 — 11.8	(1.0) 1.0 — 1.0	(87.25) 87.2 — 87.3	99.6 — 100.1
6	1.80 — 1.80	(11.3) 11.3 — 11.3	(1.5) 1.4 — 1.6	(87.0) 87.0 — 87.0	99.7 — 99.9
7	1.62 — 1.66	(10.25) 10.1 — 10.4	(1.0) 1.0 — 1.0	(86.95) 86.8 — 87.1	97.9 — 98.5
8	1.62 — 1.69	(10.35) 10.1 — 10.6	(1.55) 1.6 — 1.5	(87.2) 87.1 — 87.3	98.7 — 99.5
9	1.96 — 1.98	(12.35) 12.3 — 12.4	(2.6) 2.5 — 2.7	(85.25) 85.1 — 85.4	99.9 — 100.5
10	1.75 — 1.77	(11.0) 10.9 — 11.1	(1.4) 1.4 — 1.4	(86.1) 86.0 — 86.2	98.3 — 98.7
11	1.81 — 1.83	(11.35) 11.3 — 11.4	(1.4) 1.4 — 1.4	(86.4) 86.4 — 86.4	99.1 — 99.2
12	1.92 — 1.96	(12.15) 12.0 — 12.3	(2.95) 2.9 — 3.0	(83.25) 83.0 — 83.5	97.9 — 98.8
13	1.94 — 1.99	(12.25) 12.1 — 12.4	(1.5) 1.6 — 1.4	(84.6) 84.5 — 84.7	98.0 — 98.7
14	1.82 — 1.84	(11.45) 11.4 — 11.5	(0.9) 0.8 — 1.0	(85.5) 85.4 — 85.6	97.6 — 98.1
15	1.91 — 1.96	(12.1) 11.9 — 12.3	(2.8) 2.8 — 2.8	(83.5) 83.4 — 83.6	98.1 — 98.7
15 Females		11.43	1.93	85.33	
Not included in the calculations:					
Male	1.66 — 1.67	(10.4) 10.4 — 10.4	(2.45) 2.4 — 2.5	(86.05) 85.9 — 86.2	98.7 — 99.1

TABLE 57—CHILKO RUN: Viscera analyses (%) of fresh dead sockeye salmon taken at Chilko River.

No.	Nitrogen	Protein	Fat	Moisture	Total
MALES					
1	1.71 — 1.75	(10.8) 10.7 — 10.9	2.6 (2.55)	(85.1) 85.0 — 85.2	98.3 — 98.7
2	1.86 — 1.86	(11.6) 11.6 — 11.6	(3.4) 2.5 — 2.6	(85.55) 85.5 — 85.6	99.6 — 99.8
3	1.42 — 1.42	(8.9) 8.9 — 8.9	(3.3) 3.3 — 3.5	(86.3) 86.2 — 86.4	98.4 — 98.8
4	2.01 — 2.04	(12.7) 12.6 — 12.8	(2.7) 3.2 — 3.4	(83.6) 83.5 — 83.7	99.3 — 99.9
5	1.91 — 1.94	(12.0) 11.9 — 12.1	(2.85) 2.7 — 2.7	(84.6) 84.5 — 84.7	99.1 — 99.5
6	1.42 — 1.42	(8.9) 8.9 — 8.9	(10.35) 2.8 — 2.9	(85.75) 85.6 — 85.9	97.3 — 97.7
7	1.60 — 1.71	(12.15) 10.0 — 10.7	(3.2) 3.5	(86.4) 86.4 — 86.4	99.9 — 100.6
8	1.91 — 1.98	(11.3) 11.9 — 12.4	(4.4) 3.2 — 3.2	(83.5) 84.7 — 84.9	99.8 — 100.5
9	1.78 — 1.84	(10.9) 11.1 — 11.5	(83.6) 4.4 — 4.4	(85.0) 83.5 — 83.5	99.0 — 99.4
10	1.75 — 1.75	(12.4) 10.9 — 10.9	(4.45) 2.8	(82.3) 85.0 — 85.0	98.7 — 98.7
11	1.99 — 1.99	(11.3) 12.4 — 12.4	(82.85) 4.3 — 4.6	(83.6) 82.3 — 82.3	99.0 — 99.3
12	1.79 — 1.82	(10.35) 11.2 — 11.4	2.6 3.5	(86.7) 83.5 — 83.7	98.2 — 98.6
13	1.65 — 1.67	(15.0) 10.3 — 10.4	(2.6) 2.6	(82.85) 86.6 — 86.8	99.5 — 99.8
14	2.40 — 2.40	15.0 — 15.0	2.5 — 2.7	82.8 — 82.9	100.3 — 100.6
14 Males		11.33	2.96	84.72	
FEMALES					
1	1.41 — 1.43	(8.85) 8.8 — 8.9	(2.2) 2.2 — 2.2	(87.9) 87.8 — 88.0	98.8 — 99.1
2	1.88 — 1.89	(11.8) 11.8 — 11.8	2.1 (85.5)	85.5 — 85.5	99.4 — 99.4
3	1.27 — 1.28	(7.95) 7.9 — 8.0	3.8 (88.35)	88.3 — 88.4	100.0 — 100.2
4	1.81 — 1.83	(11.35) 11.3 — 11.4	2.0 (86.6)	86.5 — 86.7	99.8 — 100.1
5	1.65	10.3 (1.1)	1.1 — 1.1	(87.55) 87.2 — 87.9	98.6 — 99.3
6	1.56 — 1.58	(9.85) 9.8 — 9.9	1.9 (86.6)	86.4 — 86.8	98.1 — 98.6
7	1.52 — 1.54	(9.55) 9.5 — 9.6	2.0 (86.75)	86.7 — 86.8	98.2 — 98.4
8	2.10 — 2.16	(13.3) 13.1 — 13.5	(3.2) 3.1 — 3.3	(83.55) 83.4 — 83.7	99.6 — 100.5
9	1.83 — 1.83	(11.4) 11.4 — 11.4	(2.95) 2.9 — 3.0	(85.35) 85.2 — 85.5	99.5 — 99.9
10	1.53 — 1.55	(9.65) 9.6 — 9.7	1.9 (87.5)	87.4 — 87.6	99.1 — 99.2
11	1.79 — 1.81	(11.25) 11.2 — 11.3	2.3 (86.05)	86.0 — 86.1	99.5 — 99.7
12	1.74 — 1.74	(10.9) 10.9 — 10.9	2.8 (86.0)	85.9 — 86.1	99.6 — 99.8
13	1.76 — 1.83	(11.2) 11.0 — 11.4	2.8 (85.55)	85.5 — 85.6	99.3 — 99.8
14	1.74 — 1.79	(11.05) 10.9 — 11.2	1.8 (85.6)	85.6 — 85.6	98.3 — 98.6
15	1.72 — 1.75	(10.85) 10.8 — 10.9	(3.25) 3.2 — 3.3	(84.3) 84.2 — 84.4	98.2 — 98.6
15 Females		10.62	2.24	86.21	
Not included in the calculations:					
Male	1.46 — 1.51	(9.25) 9.1 — 9.4	(2.7) 2.7 — 2.7	(86.2) 86.1 — 86.3	97.9 — 98.4

**TABLE 58—CHILKO RUN: Weight analyses of viscera from fresh dead sockeye salmon taken at Chilko River.**

No.	Weight of Gonads (gm.)	Weight of Liver (gm.)	Total Weight of Viscera (gm.)
<b>MALES</b>			
1	22.0	64.0	130.0
2	13.0	65.0	143.0
3	30.0	73.0	147.0
4	16.0	71.0	149.0
5	78.0	83.0	217.0
6	59.0	81.0	177.0
7	27.0	70.0	137.0
8	50.0	88.0	162.0
9	16.0	78.0	160.0
10	15.0	72.0	147.0
11	14.0	69.0	138.0
12	14.0	83.0	154.0
13	27.0	62.0	128.0
14	91.0	67.0	245.0
14 Males	33.71	73.29	159.57
<b>FEMALES</b>			
1		37.0	76.0
2		48.0	111.0
3		51.0	100.0
4		45.0	93.0
5		26.0	74.0
6		42.0	104.0
7		32.0	85.0
8		46.0	137.0
9		43.0	106.0
10		38.0	100.0
11		43.0	103.0
12		47.0	95.0
13		49.0	112.0
14		41.0	85.0
15		57.0	147.0
15 Females		43.00	101.87

Not included in the calculations:

Male	21.0	94.0	188.0
------	------	------	-------

TABLE 59—The actual and revised length (cm.) and weight (gm.) measurements of the average (standard) male fish from the Stuart Lake sockeye spawning migration run of 1956.

Location	No. of Fish	Total Length <sup>2</sup>	Standard Length	Snout Length	Body Length	Weight Live Fish	Weight Eviscerated Fish	Weight Testes	Weight Entire Viscera	Weight Liver	%M %F %P		
											Grams of Each Are of Revised Eviscerated Fish Weight		
SAN JUAN	8	60.7	55.1	3.0	52.1	2904	2659	50	245	Not	%	63.58	14.70
A.M. R.M. <sup>1</sup>		59.2	53.9	2.9	51.0	2693	2465	46	227	Weighed	gm.	1567	485.5
LUMMI ISLAND	7	59.7	54.1	3.1	51.0	2714	2497	59	217	Not	%	63.66	14.62
A.M. R.M.		59.7	54.1	3.1	51.0	2714	2497	59	217	Weighed	gm.	1589	487.9
ALBION	9	59.6	54.0	3.3	50.7	2744	2550	66	191	Not	%	64.99	13.76
A.M. R.M.		60.0	54.3	3.3	51.0	2791	2596	67	194	Weighed	gm.	1687	503.4
HELL'S GATE	9	59.8	54.2	3.3	50.9	2603	2416	77	187	Not	%	66.72	11.53
A.M. R.M.		59.9	54.3	3.3	51.0	2618	2430	77	188	Weighed	gm.	1621	492.6
LILLOOET	7	60.6	54.9	3.2	51.7	2572	2381	92	191	46	%	69.30	10.00
A.M. R.M.		59.8	54.1	3.1	51.0	2469	2286	88	183	44	gm.	1584	436.6
SODA CREEK	4	60.1	54.8	3.2	51.6	2418	2225	81	193	42	%	70.20	8.40
A.M. R.M.		59.4	54.1	3.2	51.0	2338	2147	78	186	41	gm.	1507	423.0
FT. ST. JAMES	9	59.5	54.0	4.0	50.0	2517	2324	67	193	51	%	77.30	3.99
A.M. R.M.		60.7	55.1	4.1	51.0	2671	2466	71	205	54	gm.	1906	414.3
FORFAR MOUTH	7	62.4	56.7	4.2	52.5	2689	2649	89	220	57	%	76.10	4.30
A.M. R.M.		60.7	55.1	4.1	51.0	2630	2429	82	202	52	gm.	1848	429.4
FORFAR SPENT	12	60.5	55.5	4.5	51.0	2346	2200	38	146	48	%	81.14	1.89
A.M. R.M.		60.5	55.5	4.5	51.0	2346	2200	38	146	48	gm.	1785	41.58
FORFAR DEAD	10	60.0	55.0	4.5	50.5	2200	2081	28	119	36	%	81.97	1.49
A.M. R.M.		60.6	55.6	4.6	51.0	2266	2143	29	123	37	gm.	1757	31.94

1 Revised measurements (R.M.) are the actual measurements (A.M.) changed in proportion to those of a fish of body length 51.0 cm.

2 All measurements are averages.

TABLE 60—The actual and revised length (cm.) and weight (gm.) measurements of the average (standard) female fish from the Stuart Lake sockeye spawning migration run of 1956.

Location	No. of Fish	Total Length <sup>2</sup>	Standard Length	Snout Length	Body Length	Weight Live Fish	Weight Eviscerated Fish	Weight Ovaries	Weight Entire Viscera	Weight Liver	%M %F %P			
											Grams of Each Are of Revised Eviscerated Fish Weight			
SAN JUAN														
A.M.	10	58.1	52.8	2.4	50.4	2579	2323	71	256	Not	%	62.84	15.90	19.50
R.M. <sup>1</sup>		58.2	52.9	2.4	50.5	2595	2337	72	258	Weighed	gm.	1468	371.5	455.6
LUMMI ISLAND														
A.M.	13	58.2	53.0	2.5	50.5	2456	2227	88	229	Not	%	63.08	15.14	19.87
R.M.		58.2	53.0	2.5	50.5	2456	2227	88	229	Weighed	gm.	1405	337.2	442.5
ALBION														
A.M.	9	58.4	52.8	2.6	50.2	2518	2293	101	225	Not	%	65.38	13.41	19.91
R.M.		58.8	53.2	2.7	50.5	2563	2334	103	229	Weighed	gm.	1526	313.0	464.7
HELL'S GATE														
A.M.	4	58.2	52.8	2.4	50.4	2361	2143	107	218	Not	%	65.98	12.32	19.74
R.M.		58.3	52.9	2.4	50.5	2375	2156	108	219	Weighed	gm.	1422	265.6	425.6
LILLOOET														
A.M.	13	58.8	53.7	2.4	51.3	2378	2105	155	273	63	%	66.30	11.70	20.20
R.M.		57.8	52.8	2.3	50.5	2269	2009	148	260	60	gm.	1332	235.0	405.7
SODA CREEK														
A.M.	10	58.1	52.9	2.4	50.5	2232	1942	166	290	58	%	71.00	8.60	19.20
R.M.		58.1	52.9	2.4	50.5	2232	1942	166	290	58	gm.	1379	167.0	372.9
FT. ST. JAMES														
A.M.	13	58.5	53.2	2.6	50.6	2391	1984	280	407	61	%	77.00	3.99	17.00
R.M.		58.4	53.1	2.6	50.5	2376	1972	278	405	61	gm.	1518	78.88	335.2
FORFAR MOUTH														
A.M.	7	57.8	52.6	2.6	50.0	2033	1631	319	402	50	%	76.60	3.40	17.90
R.M.		58.4	53.1	2.6	50.5	2095	1680	329	414	51	gm.	1287	57.13	300.8
FORFAR SPENT														
A.M.	12	58.2	53.3	2.9	50.4	1749	1631	None	118	43	%	80.80	1.44	15.96
R.M.		58.3	53.5	2.9	50.5	1759	1641	N/A	119	43	gm.	1326	23.63	261.9
FORFAR DEAD														
A.M.	12	56.2	52.2	3.0	49.2	1449	1358	None	91	25	%	82.94	1.02	14.30
R.M.		57.7	53.6	3.1	50.5	1567	1468	N/A	98	27	gm.	1218	14.97	209.9

1 Revised measurements (R.M.) are the actual measurements (A.M.) changed in proportion to those of a fish of body length 50.5 cm.

2 All measurements are averages.

TABLE 61—Actual and revised length (cm.) and weight (gm.) measurements of the average (standard) male fish from the Chilko Lake sockeye spawning migration run of 1956.

Location	No. of Fish	Total Length <sup>2</sup>	Standard Length	Snout Length	Body Length	Weight Live Fish	Weight Eviscerated Fish	Weight Testes	Weight Entire Viscera	Weight Liver	%M %F %P %M %F %P						
											Grams of Each Are of Revised Eviscerated Fish Weight			Grams of Each Are of Revised Viscera Weight			
ALBION	13	58.3 59.7	52.9 54.3	3.1 3.2	49.8 51.1	2550 2738	2349 2520	86 92	201 216	36 39	%	64.6	14.1	18.9	77.6	5.0	16.2
A.M. R.M. <sup>1</sup>											gm.	1628	355.3	476.3	167.5	10.79	35.00
FARWELL CANYON	9	59.9 59.7	54.4 54.2	3.1 3.1	51.3 51.1	2439 2411	2252 2225	87 86	187 185	35 34	%	67.8	10.7	19.3	78.2	3.8	17.4
A.M. R.M.											gm.	1509	238.1	429.5	144.5	7.02	32.16
KEIGHLEY HOLES	13	61.1 60.1	55.4 54.5	3.5 3.4	51.9 51.1	2781 2654	2594 2475	94 90	187 178	30 29	%	69.2	9.6	19.2	69.7	7.7	21.1
A.M. R.M.											gm.	1713	237.6	475.2	124.1	13.71	37.56
CHILKO SPENT	15	61.0 61.5	55.8 56.2	5.1 5.1	50.7 51.1	2779 2845	2593 2655	66 68	186 190	66 68	%	81.9	3.5	12.8	83.0	2.5	13.5
A.M. R.M.											gm.	2175	92.94	339.9	157.7	4.75	25.65
CHILKO RIVER DEAD	14	62.0 61.2	57.2 56.4	5.4 5.3	51.8 51.1	2596 2492	2437 2339	34 32	160 153	73 70	%	83.3	3.4	11.9	84.7	3.0	11.3
A.M. R.M.											gm.	1948	79.53	278.4	129.7	4.59	17.30

1 Revised measurements (R.M.) are the actual measurements (A.M.) changed in proportion to those of a fish of body length 51.1 cm.

2 All measurements are averages.

TABLE 62—Actual and revised length (cm.) and weight (gm.) measurements of the average (standard) female fish from the Chilko Lake sockeye spawning migration run of 1956.

Location	No. of Fish	Total Length <sup>2</sup>	Standard Length	Snout Length	Body Length	Weight Live Fish	Weight Eviscerated Fish	Weight Ovaries	Weight Entire Viscera	Weight Liver	%M		%F	%P	%M	%F	%P
											Grams of Each Are of Revised Eviscerated Fish Weight			Grams of Each Are of Revised Viscera Weight			
											%	gm.		%	gm.		%
ALBION	11	58.3	52.7	2.4	50.3	2545	2320	102	225	46	%	64.0	14.8	19.4	67.5	10.3	19.5
A.M. R.M. <sup>1</sup>		58.3	52.7	2.4	50.3	2545	2320	102	225	46	gm.	1485	343.3	450.0	151.9	23.20	43.90
FARWELL CANYON	19	57.4	52.3	2.1	50.2	2086	1848	147	239	45	%	67.6	10.6	19.5	65.0	10.0	22.6
A.M. R.M.		57.5	52.4	2.1	50.3	2099	1859	148	240	46	gm.	1257	197.0	362.4	156.1	24.01	54.26
KEIGHLEY HOLES	16	59.6	53.9	3.0	50.9	2482	2183	206	299	48	%	69.3	9.3	19.5	71.0	7.5	20.3
A.M. R.M.		58.9	53.2	2.9	50.3	2399	2107	199	288	46	gm.	1460	195.9	410.8	204.5	21.46	58.46
CHILKO SPENT	11	58.0	52.9	3.5	49.4	1841	1729	Nil	112	40	%	81.5	2.7	14.0	83.6	2.8	12.2
A.M. R.M.		59.0	53.9	3.6	50.3	1943	1826	N/A	118	42	gm.	1488	48.56	255.6	98.98	3.36	14.45
CHILKO RIVER DEAD	15	58.0	53.7	3.5	50.2	1651	1549	Nil	102	43	%	85.3	1.9	11.4	86.2	2.3	10.6
A.M. R.M.		58.1	53.8	3.5	50.3	1661	1558	N/A	103	43	gm.	1329	29.60	177.6	88.78	2.35	10.87

1 Revised measurements (R.M.) are the actual measurements (A.M.) changed in proportion to those of a fish of body length 50.3 cm.

2 All measurements are averages.



TABLE 63—Analyses at and changes between locations of a kg. of eviscerated male fish from the Stuart Lake sockeye spawning migration run of 1956.

Location	COMPOSITION			A.C.D.	Lummi to			Hell's Gate to			Lillooet to			Soda Creek to			Ft. St. James to			Forfar Spent	
	M.	F.	P.		M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.
LUMMI ISLAND																					
Grams	637	146	195																		
Calories	N/A	1358	799																		
HELL'S GATE																					
Grams	667	115	203	A gm.	+ 30	- 31	+ 8														
Calories	N/A	1070	832	C Cal./km.	N/A	- 1.06	0														
				D Cal./day	N/A	- 41.1	0														
LILLOOET																					
Grams	693	100	191	A gm.	+ 56	- 46	- 4	+ 26	- 15	- 12											
Calories	N/A	930	783	C Cal./km.	N/A	- 1.06	- 0.04	N/A	- 1.08	- 0.38											
				D Cal./day	N/A	- 42.8	- 1.6	N/A	- 46.7	- 16.3											
SODA CREEK																					
Grams	702	84	197	A gm.	+ 65	- 62	+ 2	+ 35	- 31	- 6	+ 9	- 16	+ 6								
Calories	N/A	781	807	C Cal./km.	N/A	- 0.94	0	N/A	- 0.86	- 0.07	N/A	- 0.72	0								
				D Cal./day	N/A	- 41.2	0	N/A	- 41.3	- 3.6	N/A	- 37.3	0								
FT. ST. JAMES																					
Grams	773	40	168	A gm.	+136	-106	- 27	+106	- 75	- 35	+ 80	- 60	- 23	+ 71	- 44	- 29					
Calories	N/A	372	689	C Cal./km.	N/A	- 0.96	- 0.11	N/A	- 0.92	- 0.19	N/A	- 0.89	- 0.15	N/A	- 0.97	- 0.28					
				D Cal./day	N/A	- 42.9	- 4.8	N/A	- 43.6	- 8.9	N/A	- 42.9	- 7.2	N/A	- 45.4	- 13.1					
FORFAR SPENT																					
Grams	811	19	155	A gm.	+174	-127	- 40	+144	- 96	- 48	+118	- 81	- 36	+109	- 65	- 42	+ 38	-21	- 13		
Calories	N/A	177	636	C Cal./km.	N/A	N.U.M.		N/A	N.U.M.		N/A	N.U.M.		N/A	N.U.M.		N/A	N.U.M.			
				D Cal./day	N/A	- 34.7	- 4.8	N/A	- 33.1	- 7.3	N/A	- 31.4	- 6.3	N/A	- 30.2	- 8.0	N/A	-17.7	- 4.8		
FORFAR DEAD																					
Grams	820	15	156	A gm.	+183	-131	- 39	+153	-100	- 47	+127	- 85	- 35	+118	- 69	- 41	+ 47	-25	- 12	+ 9	- 4
Calories	N/A	140	640	C Cal./km.	N/A	N.U.M.		N/A	N.U.M.		N/A	N.U.M.		N/A	N.U.M.		N/A	N.U.M.		N.U.M.	
				D Cal./day	N/A	- 31.2	- 4.1	N/A	- 29.1	- 6.0	N/A	- 27.2	- 4.9	N/A	- 25.6	- 6.7	N/A	-14.5	- 3.1	N/A	- 7.4

TABLE 64—Analyses at and changes between locations of a kg. of eviscerated female fish from the Stuart Lake sockeye spawning migration run of 1956.

Location	COMPOSITION			A.C.D.	Lummi to			Hell's Gate to			Lillooet to			Soda Creek to			Ft. St. James to			Forfar Spent		
	M.	F.	P.		M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.
LUMMI ISLAND																						
Grams	631	151	199																			
Calories	N/A	1404	816																			
HELL'S GATE																						
Grams	660	123	197	A gm.	+ 29	- 28	- 1															
Calories	N/A	1144	808	C Cal./km.	N/A	- 0.95	- 0.03															
				D Cal./day	N/A	- 37.1	- 1.14															
LILLOOET																						
Grams	663	117	202	A gm.	+ 32	- 34	+ 3	+ 3	- 6	+ 5												
Calories	N/A	1088	828	C Cal./km.	N/A	- 0.78	0	N/A	- 0.41	0												
				D Cal./day	N/A	- 31.6	0	N/A	- 18.6	0												
SODA CREEK																						
Grams	710	86	192	A gm.	+ 79	- 65	- 7	+ 50	- 37	- 5	+ 47	- 31	- 10									
Calories	N/A	800	787	C Cal./km.	N/A	- 0.99	- 0.05	N/A	- 1.02	- 0.06	N/A	- 1.38	- 0.20									
				D Cal./day	N/A	- 43.1	- 2.1	N/A	- 49.0	- 3.0	N/A	- 72.0	- 10.3									
FT. ST. JAMES																						
Grams	770	40	170	A gm.	+140	-111	- 29	+110	- 83	- 27	+107	- 77	- 32	+ 60	- 46	- 22						
Calories	N/A	372	697	C Cal./km.	N/A	- 1.00	- 0.12	N/A	- 1.02	- 0.15	N/A	- 1.14	- 0.21	N/A	- 1.02	- 0.21						
				D Cal./day	N/A	- 44.9	- 5.2	N/A	- 48.3	- 6.9	N/A	- 55.1	- 10.0	N/A	- 47.6	- 10.0						
FORFAR SPENT																						
Grams	808	14	160	A gm.	+177	-137	- 40	+148	-109	- 38	+145	-103	- 42	+ 98	- 72	- 32	+ 38	-26	- 10			
Calories	N/A	130	656	C Cal./km.		N.U.M.			N.U.M.			N.U.M.			N.U.M.			N.U.M.				
				D Cal./day	N/A	- 37.5	- 4.7	N/A	- 37.6	- 5.6	N/A	- 39.9	- 7.2	N/A	- 33.5	- 6.6	N/A	-22.0	- 3.7			
FORFAR DEAD																						
Grams	829	10	143	A gm.	+198	-111	- 56	+169	-113	- 54	+166	-107	- 59	+119	- 76	- 49	+ 59	-30	- 27	+ 21	- 4	-17
Calories	N/A	93	586	C Cal./km.		N.U.M.			N.U.M.			N.U.M.			N.U.M.			N.U.M.			N.U.M.	
				D Cal./day	N/A	- 33.6	- 5.9	N/A	- 30.4	- 6.9	N/A	- 34.3	- 8.3	N/A	- 28.3	- 5.0	N/A	-17.4	- 6.9	N/A	- 7.4	-14.0

TABLE 65—Analyses at and changes between locations of a kilogram of eviscerated male fish from the Chilko Lake sockeye spawning migration run of 1956.

Location	COMPOSITION			A.C.D.	Albion to			Farwell to			Keighley Holes to			Chilko Spent		
	M.	F.	P.													
ALBION					M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.
Grams	646.0	141.0	189.0													
Calories	N/A	1311.0	774.9													
FARWELL																
Grams	678.0	107.0	193.0	A gm.	+ 32.0	— 34.0	+ 4.0									
Calories	N/A	955.1	791.3	C Cal./km.	N/A	— 0.756	+ 0.039									
				D Cal./day	N/A	— 28.7	+ 1.49									
KEIGHLEY HOLES																
Grams	692.0	96.0	192.0	A gm.	+ 46.0	— 43.0	+ 3.0	+ 14.0	— 11.0	— 1.0						
Calories	N/A	892.8	787.2	C Cal./km.	N/A	— 0.765	+ 0.022	N/A	— 0.794	— 0.032						
				D Cal./day	N/A	— 26.2	+ 0.769	N/A	— 20.5	— 0.820						
CHILKO SPENT																
Grams	819.0	35.0	128.0	A gm.	+173.0	—106.0	— 61.0	+141.0	— 72.0	— 65.0	+127.0	— 61.0	— 64.0			
Calories	N/A	325.5	524.8	C Cal./km.		N.U.M.			N.U.M.			N.U.M.				
				D Cal./day	N/A	— 27.4	— 6.95	N/A	— 26.8	— 10.7	N/A	— 28.4	— 13.1			
CHILKO DEAD																
Grams	833.0	34.0	119.0	A gm.	+187.0	—107.0	— 70.0	+155.0	— 73.0	— 74.0	+141.0	— 62.0	— 73.0	+ 14.0	— 1.00	— 9.00
Calories	N/A	316.2	487.9	C Cal./km.		N.U.M.			N.U.M.			N.U.M.			N.U.M.	
				D Cal./day	N/A	— 23.1	— 6.67	N/A	— 21.2	— 9.48	N/A	— 21.4	— 11.1	N/A	— 1.33	— 5.27

TABLE 66—Analyses at and changes between locations of a kilogram of eviscerated female fish from the Chilko Lake sockeye spawning migration run of 1956.

Location	COMPOSITION			A.C.D.	Albion to			Farwell to			Keighley Holes to			Chilko Spent		
	M.	F.	P.													
ALBION					M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.
Grams	639.8	147.8	194.3													
Calories	N/A	1375.0	796.6													
FARWELL																
Grams	675.7	106.3	195.2	A gm.	+ 35.9	— 41.5	+ 0.9									
Calories	N/A	988.6	800.3	C Cal./km.	N/A	— 0.922	+ 0.009									
				D Cal./day	N/A	— 35.1	+ 0.336									
KEIGHLEY HOLES																
Grams	693.2	93.0	195.3	A gm.	+ 53.4	— 54.8	+ 1.0	+ 17.5	— 13.3	+ 0.1						
Calories	N/A	864.9	800.7	C Cal./km.	N/A	— 0.931	+ 0.007	N/A	— 0.960	+ 0.003						
				D Cal./day	N/A	— 31.9	+ 0.256	N/A	— 24.7	+ 0.080						
CHILKO SPENT																
Grams	815.3	26.6	140.4	A gm.	+176.0	—121.0	— 53.9	+140.0	— 79.7	— 54.8	+122.0	— 66.4	— 54.9			
Calories	N/A	247.4	575.6	C Cal./km.		N.U.M.			N.U.M.			N.U.M.				
				D Cal./day	N/A	— 31.3	— 6.14	N/A	— 29.6	— 8.99	N/A	— 30.9	— 11.3			
CHILKO DEAD																
Grams	853.3	19.0	114.3	A gm.	+214.0	—128.8	— 80.0	+178.0	— 47.3	— 80.9	+160.0	— 74.0	— 81.0	+ 38.0	— 7.6	—26.1
Calories	N/A	176.7	468.6	C Cal./km.		N.U.M.			N.U.M.			N.U.M.			N.U.M.	
				D Cal./day	N/A	— 27.8	— 7.63	N/A	— 25.3	— 10.4	N/A	— 25.5	— 12.3	N/A	—10.1	—15.3

TABLE 67—Analyses at and changes between locations of a standard eviscerated male fish from the Stuart Lake sockeye spawning migration run of 1956.

Location	COMPOSITION			A.B.C.D.	Lummi to			Hell's Gate to			Lillooet to			Soda Creek to			Ft. St. James to			Forfar Spent		
	M.	F.	P.		M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.
LUMMI ISLAND Grams Calories	1589	365.1 3395.0	487.9 2000.0																			
HELL'S GATE Grams Calories	1621	280.2 2606.0	492.6 2020.0	A gm. B % C Cal./km. D Cal./day	+ 32.0 + 2.01 N/A N/A	- 84.9 - 23.3 - 2.89 - 112.7	+ 4.70 + 0.963 + 0.073 + 2.86															
LILLOOET Grams Calories	1584	228.6 2126.0	436.6 1790.0	A gm. B % C Cal./km. D Cal./day	- 5.00 - 0.315 N/A N/A	- 136.5 - 37.4 - 3.15 - 126.9	- 51.3 - 10.5 - 0.521 - 21.0	- 37.0 - 2.33 N/A N/A	- 51.6 - 14.1 - 3.69 - 160.0	- 56.0 - 11.5 - 1.77 - 76.7												
SODA CREEK Grams Calories	1507	180.4 1678.0	423.0 1734.0	A gm. B % C Cal./km. D Cal./day	- 82.0 - 5.16 N/A N/A	- 184.7 - 50.6 - 2.81 - 122.6	- 64.9 - 13.3 - 0.435 - 19.0	+ 114.0 + 7.17 N/A N/A	- 99.8 - 27.3 - 2.75 - 132.6	- 69.6 - 14.3 - 0.846 - 40.9	- 77.0 - 4.85 N/A N/A	- 48.2 - 13.2 - 2.15 - 112.0	- 13.6 - 2.79 - 0.269 - 14.0									
FT. ST. JAMES Grams Calories	1906	98.4 915.0	414.3 1699.0	A gm. B % C Cal./km. D Cal./day	+ 317.0 + 19.9 N/A N/A	- 266.7 - 73.0 - 2.40 - 107.8	- 73.6 - 15.1 - 0.292 - 13.1	+ 285.0 + 17.9 N/A N/A	- 182.0 - 49.8 - 2.23 - 106.0	- 78.3 - 16.0 - 0.423 - 20.1	+ 322.0 + 20.3 N/A N/A	- 130.0 - 35.6 - 1.93 - 93.2	- 22.3 - 4.57 - 0.145 - 7.00	+ 399.0 + 25.1 N/A N/A	- 82.0 - 22.5 - 1.81 - 84.8	- 8.7 - 1.78 - 0.083 - 3.89						
FORFAR SPENT Grams Calories	1785	41.6 386.7	340.3 1395.0	A gm. B % C Cal./km. D Cal./day	+ 196.0 + 12.3 N/A N/A	- 325.5 - 88.6 N.U.M. - 88.5	- 148.0 - 30.3 - 17.8	+ 164.0 + 10.3 N/A N/A	- 239.0 - 65.5 N.U.M. - 82.2	- 152.0 - 31.2 - 23.1	+ 201.0 + 12.6 N/A N/A	- 187.0 - 51.2 N.U.M. - 72.5	- 96.3 - 19.7 - 16.5	+ 278.0 + 17.5 N/A N/A	- 139.0 - 38.1 N.U.M. - 64.6	- 82.7 - 17.0 - 17.0	- 121.0 - 7.61 N/A	- 56.8 - 15.6 - 48.0	- 74.0 - 15.2 - 27.6			
FORFAR DEAD Grams Calories	1757	31.9 297.0	334.4 1371.0	A gm. B % C Cal./km. D Cal./day	+ 168.0 + 10.6 N/A N/A	- 333.2 - 91.3 N.U.M. - 79.4	- 154.0 - 31.6 - 16.1	+ 136.0 + 8.56 N/A N/A	- 248.0 - 67.9 N.U.M. - 72.2	- 158.0 - 32.4 - 20.3	+ 173.0 + 10.9 N/A N/A	- 197.0 - 54.0 N.U.M. - 63.1	- 102.0 - 20.9 - 14.4	+ 250.0 + 15.7 N/A N/A	- 148.0 - 40.5 N.U.M. - 55.2	- 88.6 - 18.2 - 14.5	- 149.0 - 9.38 N/A	- 66.5 - 18.2 - 38.6	- 79.9 - 16.4 - 20.5	- 28.0 - 1.76 N/A	- 9.64 - 2.64 - 17.9	- 5.90 - 1.21 - 4.80

TABLE 68—Analyses at and changes between locations of a standard eviscerated female fish from the Stuart Lake sockeye spawning migration run of 1956.

Location	COMPOSITION			A.B.C.D.	Lummi to			Hell's Gate to			Lillooet to			Soda Creek to			Ft. St. James to			Forfar Spent		
	M.	F.	P.		M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.
LUMMI ISLAND																						
Grams	1405	337.2	442.5																			
Calories	N/A	3136.0	1814.0																			
HELL'S GATE																						
Grams	1422	265.6	425.6	A gm.	+ 17.0	- 71.6	- 16.9															
Calories	N/A	2470.0	1745.0	B %	+ 1.20	- 21.2	- 3.82															
				C Cal./km.	N/A	- 2.43	- 0.252															
				D Cal./day	N/A	- 95.1	- 9.86															
LILLOOET																						
Grams	1332	235.0	405.7	A gm.	- 73.0	-102.2	- 36.8	- 90.0	- 30.6	- 19.9												
Calories	N/A	2186.0	1663.0	B %	- 5.20	- 30.3	- 8.32	- 6.41	- 9.07	- 4.5												
				C Cal./km.	N/A	- 2.35	- 0.375	N/A	- 2.20	- 0.636												
				D Cal./day	N/A	- 95.0	- 15.1	N/A	- 94.6	- 27.3												
SODA CREEK																						
Grams	1379	167.0	372.9	A gm.	- 26.0	-170.2	- 69.6	- 43.0	- 98.6	- 52.7	+ 47.0	- 68.0	- 32.8									
Calories	N/A	1553.0	1529.0	B %	- 1.85	- 50.4	- 15.7	- 3.06	- 29.2	- 11.9	+ 3.35	- 20.2	- 7.41									
				C Cal./km.	N/A	- 2.59	- 0.466	N/A	- 2.71	- 0.639	N/A	- 3.03	- 0.644									
				D Cal./day	N/A	-113.1	- 20.4	N/A	-131.0	- 30.9	N/A	-158.3	- 33.5									
FT. ST. JAMES																						
Grams	1518	78.9	335.2	A gm.	+113.0	-258.3	-107.0	+ 96.0	-186.7	- 90.4	+186.0	-156.1	- 70.5	+139.0	- 88.1	- 37.7						
Calories	N/A	732.0	1374.0	B %	+ 8.04	- 76.7	- 24.2	+ 6.83	- 55.5	- 20.4	+ 13.2	- 46.3	- 15.9	+ 9.89	- 26.2	- 8.52						
				C Cal./km.	N/A	- 2.33	- 0.427	N/A	- 2.29	- 0.490	N/A	- 2.32	- 0.460	N/A	- 1.95	- 0.370						
				D Cal./day	N/A	-104.5	- 19.1	N/A	-109.0	- 23.2	N/A	-112.0	- 22.2	N/A	- 91.2	- 17.2						
FORFAR SPENT																						
Grams	1326	23.6	261.9	A gm.	- 79.0	-313.6	-181.0	- 96.0	-242.0	-161.0	- 6.00	-211.0	-144.0	- 53.0	-143.0	-111.0	-192.0	-55.3	- 73.3			
Calories	N/A	219.8	1074.0	B %	- 5.62	- 93.0	- 40.9	- 6.83	- 71.8	- 37.1	- 0.427	- 62.6	- 32.5	- 3.77	- 42.4	- 25.1	- 13.7	-16.4	- 16.6			
				C Cal./km.		N.U.M.			N.U.M.			N.U.M.			N.U.M.			N.U.M.				
				D Cal./day	N/A	- 85.7	- 21.8	N/A	- 83.3	- 24.9	N/A	- 81.9	- 24.5	N/A	- 66.7	- 22.8	N/A	-46.6	- 27.3			
FORFAR DEAD																						
Grams	1218	15.0	209.9	A gm.	-187.0	-322.2	-233.0	-204.0	-251.0	-216.0	-114.0	-220.0	-196.0	-161.0	-152.0	-163.0	-300.0	-63.9	-125.0	-108.0	- 8.66	-52.0
Calories	N/A	139.2	860.6	B %	- 13.3	- 95.6	- 52.6	- 14.5	- 74.4	- 48.8	- 8.11	- 65.2	- 44.3	- 11.5	- 45.1	- 36.8	- 21.4	-18.9	- 28.2	- 7.69	- 2.57	-11.8
				C Cal./km.		N.U.M.			N.U.M.			N.U.M.			N.U.M.			N.U.M.				
				D Cal./day	N/A	- 76.9	- 24.4	N/A	- 72.8	- 27.6	N/A	- 70.6	- 27.7	N/A	- 56.6	- 26.7	N/A	-37.1	- 32.1	N/A	-16.1	-42.7

TABLE 69—Analyses at and changes between locations of a standard eviscerated male fish from the Chilko Lake sockeye spawning migration run of 1956.

Location	COMPOSITION			A.B.C.D.	Albion to			Farwell to			Keighley Holes to			Chilko Spent		
	M.	F.	P.		M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.
ALBION																
Grams	1628	355.3	476.3													
Calories	N/A	3304.0	1953.0													
FARWELL																
Grams	1509	238.1	429.5	A gm.	−119.0	−117.2	− 46.8									
Calories	N/A	2214.0	1761.0	B %	− 7.31	− 32.9	− 9.83									
				C Cal./km.	N/A	− 2.60	− 0.459									
				D Cal./day	N/A	− 99.1	− 17.5									
KEIGHLEY HOLES																
Grams	1713	237.6	475.2	A gm.	+ 85.0	−117.7	− 1.1	+204.0	− 0.5	+ 45.7						
Calories	N/A	2210.0	1948.0	B %	+ 5.22	− 33.1	− 0.231	+ 12.5	+ 0.14	+ 2.65						
				C Cal./km.	N/A	− 2.00	− .009	N/A	− 0.03							
				D Cal./day	N/A	− 68.4	− 0.313	N/A	− 0.8							
CHILKO SPENT																
Grams	2175	92.94	339.9	A gm.	+547.0	−262.4	−136.4	+666.0	−145.1	− 89.6	+462.0	−144.7	−135.3			
Calories	N/A	864.3	1394.0	B %	+ 33.6	− 73.8	− 28.6	+ 40.9	− 40.8	− 18.8	+ 28.4	− 40.7	− 28.4			
				C Cal./km.		N.U.M.			N.U.M.			N.U.M.				
				D Cal./day	N/A	− 67.8	− 15.5	N/A	− 54.0	− 14.7	N/A	− 67.3	− 27.7			
CHILKO DEAD																
Grams	1948	79.53	278.4	A gm.	+320.0	−276.0	−198.0	+439.0	−158.6	−151.0	+235.0	−158.0	−197.0	−227.0	−13.4	−61.5
Calories	N/A	739.6	1141.0	B %	+ 19.7	− 77.6	− 41.6	+ 26.9	− 44.6	− 31.7	+ 14.4	− 44.5	− 41.4	− 13.9	− 3.8	−12.9
				C Cal./km.		N.U.M.			N.U.M.			N.U.M.			N.U.M.	
				D Cal./day	N/A	− 59.6	− 18.9	N/A	− 46.0	− 19.4	N/A	− 54.4	− 29.9	N/A	−17.9	−36.1

TABLE 70—Analyses at and changes between locations of a standard eviscerated female fish from the Chilko Lake sockeye spawning migration run of 1956.

Location	COMPOSITION			A.B.C.D.	Albion to			Farwell to			Keighley Holes to			Chilko Spent		
	M.	F.	P.		M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.
ALBION																
Grams	1485	343.3	450.0													
Calories	N/A	3193.0	1845.0													
FARWELL																
Grams	1257	197.0	362.4	A gm.	−228.0	−146.3	− 87.6									
Calories	N/A	1832.0	1486.0	B %	− 15.4	− 42.6	− 19.5									
				C Cal./km.	N/A	− 3.25	− 0.858									
				D Cal./day	N/A	−124.0	− 32.6									
KEIGHLEY HOLES																
Grams	1460	195.9	410.8	A gm.	− 25.0	−147.4	− 39.2	+203.0	− 1.1	+ 48.4						
Calories	N/A	1822.0	1684.0	B %	− 1.68	− 42.9	− 8.71	+ 13.7	− 0.32	+ 10.8						
				C Cal./km.	N/A	− 2.51	− 0.294	N/A	− 0.08							
				D Cal./day	N/A	− 85.7	− 10.1	N/A	− 2.00							
CHILKO SPENT																
Grams	1488	48.56	255.6	A gm.	+ 3.00	−294.7	−194.4	+231.0	−148.4	−106.8	+ 28.0	−147.4	−155.0			
Calories	N/A	452.0	1048.0	B %	+ 0.202	− 85.8	− 43.2	+ 15.6	− 43.2	− 23.1	+ 1.89	− 42.9	− 34.4			
				C Cal./km.		N.U.M.			N.U.M.			N.U.M.				
				D Cal./day	N/A	− 76.1	− 22.1	N/A	− 55.2	− 17.5	N/A	− 68.5	− 31.8			
CHILKO DEAD																
Grams	1329	29.60	177.6	A gm.	−156.0	−313.7	−272.4	+ 72.0	−167.4	−185.0	−131.0	−166.4	−233.0	−159.0	−19.0	−78.0
Calories	N/A	275.3	728.2	B %	− 10.5	− 91.4	− 60.5	+ 4.85	− 48.8	− 41.1	− 8.82	− 48.5	− 51.8	− 10.7	− 5.5	−17.3
				C Cal./km.		N.U.M.			N.U.M.			N.U.M.			N.U.M.	
				D Cal./day	N/A	− 67.8	− 26.0	N/A	− 48.7	− 23.7	N/A	− 57.3	− 35.4	N/A	−25.2	−45.7



TABLE 71—Analyses at and changes between locations for the viscera of a kilogram of male fish from the Chilko Lake sockeye spawning migration run of 1956.

Location	COMPOSITION			A.C.D.	Albion to			Farwell to			Keighley Holes to			Chilko Spent		
	M.	F.	P.													
ALBION					M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.
Grams	776.4	50.3	162.0													
Calories	N/A	467.8	664.2													
FARWELL																
Grams	782.4	37.5	173.9	A gm.	+ 6.00	— 12.8	+ 11.9									
Calories	N/A	348.8	713.0	C Cal./km.	N/A	— 0.284	+ 0.117									
				D Cal./day	N/A	— 10.8	+ 4.44									
KEIGHLEY HOLES																
Grams	697.2	77.1	211.4	A gm.	— 79.2	+ 26.8	+ 49.4	— 85.2	+ 39.6	+ 37.5						
Calories	N/A	717.0	866.7	C Cal./km.	N/A	+ 0.455	+ 0.370	N/A	+ 0.286	+ 0.119						
				D Cal./day	N/A	+ 15.6	+ 12.7	N/A	+ 73.6	+ 30.7						
CHILKO SPENT																
Grams	830.0	25.1	135.1	A gm.	+ 53.6	— 25.2	— 26.9	+ 47.6	— 12.4	— 38.8	+133.0	— 52.0	— 76.3			
Calories	N/A	233.4	553.9	C Cal./km.		N.U.M.			N.U.M.			N.U.M.				
				D Cal./day	N/A	— 6.51	— 3.06	N/A	— 4.62	— 6.36	N/A	— 24.2	— 15.6			
CHILKO DEAD																
Grams	847.2	29.6	113.3	A gm.	+ 70.8	— 20.7	— 48.7	+ 64.8	— 7.9	— 60.6	+150.0	— 47.5	— 98.1	+ 17.2	+ 4.50	—21.8
Calories	N/A	275.3	464.5	C Cal./km.		N.U.M.			N.U.M.			N.U.M.			N.U.M.	
				D Cal./day	N/A	— 4.48	— 4.64	N/A	— 2.3	— 7.77	N/A	— 16.4	— 14.9	N/A	+ 5.99	—12.8

TABLE 72—Analyses at and changes between locations for the viscera of a kilogram of female fish from the Chilko Lake sockeye spawning migration run of 1956.

Location	COMPOSITION			A.C.D.	Albion to			Farwell to			Keighley Holes to			Chilko Spent		
	M.	F.	P.													
ALBION					M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.
Grams	675.3	103.1	195.4													
Calories	N/A	958.8	801.1													
FARWELL																
Grams	649.5	100.1	226.0	A gm.	— 25.8	— 3.0	+ 30.6									
Calories	N/A	930.9	926.6	C Cal./km.	N/A	— 0.067	+ 0.30									
				D Cal./day	N/A	— 2.54	+ 11.4									
KEIGHLEY HOLES																
Grams	710.0	74.5	203.1	A gm.	+ 34.7	— 28.6	+ 7.7	+ 60.5	— 25.6	— 22.9						
Calories	N/A	692.9	832.7	C Cal./km.	N/A	— 0.486	+ 0.058	N/A	— 1.85	— 0.729						
				D Cal./day	N/A	— 16.6	+ 1.98	N/A	— 47.6	— 18.8						
CHILKO SPENT																
Grams	836.3	28.4	122.2	A gm.	+161.0	— 74.7	— 73.2	+187.0	— 71.7	—104.0	+126.0	— 46.1	— 80.9			
Calories	N/A	264.1	501.0	C Cal./km.		N.U.M.			N.U.M.			N.U.M.				
				D Cal./day	N/A	— 19.3	— 8.34	N/A	— 26.7	— 17.0	N/A	— 21.4	— 16.6			
CHILKO DEAD																
Grams	862.1	22.4	106.2	A gm.	+187.0	— 80.7	— 89.2	+213.0	— 77.7	—120.0	+152.0	— 52.1	— 96.9	+ 25.8	— 6.0	—16.0
Calories	N/A	208.3	435.4	C Cal./km.		N.U.M.			N.U.M.			N.U.M.			N.U.M.	
				D Cal./day	N/A	— 17.5	— 8.50	N/A	— 22.6	— 15.4	N/A	— 17.9	— 14.7	N/A	— 7.97	— 9.37

TABLE 73—Analyses at and changes between locations for the viscera of a standard male fish from the Chilko Lake sockeye spawning migration run of 1956.

Location	COMPOSITION			A.B.C.D.	Albion to			Farwell to			Keighley Holes to			Chilko Spent		
	M.	F.	P.		M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.
ALBION																
Grams	167.5	10.79	35.00													
Calories	N/A	100.3	143.5													
FARWELL																
Grams	144.5	7.02	32.16	A gm.	— 23.0	— 3.77	— 2.84									
Calories	N/A	65.3	131.9	B %	— 13.7	— 34.9	— 8.11									
				C Cal./km.	N/A	— 0.084	— 0.028									
				D Cal./day	N/A	— 3.18	— 1.05									
KEIGHLEY HOLES																
Grams	124.1	13.71	37.56	A gm.	— 43.4	+ 2.92	+ 2.56	— 20.4	+ 6.69	+ 5.4						
Calories	N/A	127.5	154.0	B %	— 25.9	+ 27.2	+ 7.31	— 12.2	+ 62.0	+ 15.4						
				C Cal./km.	N/A	+ 0.05	+ 0.019	N/A	+ 0.482	+ 0.173						
				D Cal./day	N/A	+ 1.70	+ 0.656	N/A	+ 12.4	+ 4.42						
CHILKO SPENT																
Grams	157.7	4.75	25.65	A gm.	— 9.8	— 6.04	— 9.35	+ 13.2	— 2.27	— 6.51	+ 33.6	— 8.96	— 11.9			
Calories	N/A	44.18	105.2	B %	— 5.85	— 56.0	— 26.7	+ 7.88	— 21.0	— 18.6	+ 20.0	— 83.0	— 34.0			
				C Cal./km.		N.U.M.			N.U.M.			N.U.M.				
				D Cal./day	N/A	— 1.56	— 1.06	N/A	— 0.844	— 1.07	N/A	— 4.17	— 2.44			
CHILKO DEAD																
Grams	129.7	4.59	17.30	A gm.	— 37.8	— 6.2	— 17.7	— 14.8	— 2.43	— 14.9	+ 5.6	— 9.12	— 20.3	— 28.0	— 0.16	— 8.35
Calories	N/A	42.70	70.93	B %	— 22.6	— 57.5	— 50.6	— 8.84	— 22.5	— 42.6	+ 3.3	— 84.5	— 58.0	— 16.7	— 1.48	— 23.9
				C Cal./km.		N.U.M.			N.U.M.			N.U.M.			N.U.M.	
				D Cal./day	N/A	— 1.34	— 1.69	N/A	— 0.706	— 1.91	N/A	— 3.14	— 3.08	N/A	— 0.21	— 4.90

TABLE 74—Analyses at and changes between locations for the viscera of a standard female fish from the Chilko Lake sockeye spawning migration run of 1956.

Location	COMPOSITION			A.B.C.D.	Albion to			Farwell to			Keighley Holes to			Chilko Spent		
	M.	F.	P.													
ALBION					M.	F.	P.	M.	F.	P.	M.	F.	P.	M.	F.	P.
Grams	151.9	23.20	43.90													
Calories	N/A	215.8	180.0													
FARWELL																
Grams	156.1	24.01	54.26	A gm.	+ 4.2	+ 0.81	+ 10.4									
Calories	N/A	223.3	222.5	B %	+ 2.76	+ 3.49	+ 23.7									
				C Cal./km.	N/A	+ 0.018	+ 0.102									
				D Cal./day	N/A	+ 0.682	+ 3.86									
KEIGHLEY HOLES																
Grams	204.5	21.46	58.46	A gm.	+ 52.6	— 1.74	+ 14.6	+ 48.4	— 2.55	+ 4.2						
Calories	N/A	199.6	239.7	B %	+ 34.6	— 7.50	+ 33.3	+ 31.9	— 11.0	+ 9.56						
				C Cal./km.	N/A	— 0.030	+ 0.109	N/A	— 0.184	+ 0.134						
				D Cal./day	N/A	— 1.01	+ 3.73	N/A	— 4.74	+ 3.44						
CHILKO SPENT																
Grams	98.98	3.36	14.45	A gm.	— 52.9	— 19.84	— 29.5	— 57.1	— 20.5	— 39.8	—106.0	— 18.1	— 44.0			
Calories	N/A	31.25	59.25	B %	— 34.8	— 85.5	— 67.2	— 37.6	— 89.0	— 90.7	— 69.8	— 78.0	—100.2			
				C Cal./km.		N.U.M.			N.U.M.			N.U.M.				
				D Cal./day	N/A	— 5.13	— 3.36	N/A	— 7.68	— 6.52	N/A	— 8.42	— 9.00			
CHILKO DEAD																
Grams	88.78	2.35	10.87	A gm.	— 63.1	— 20.5	— 33.0	— 67.7	— 21.7	— 43.4	—116.0	— 19.1	— 47.6	— 10.6	— 1.01	— 3.58
Calories	N/A	21.86	44.57	B %	— 41.6	— 89.9	— 75.2	— 44.6	— 93.5	— 98.9	— 76.4	— 82.3	—108.4	— 6.98	— 4.35	— 8.15
				C Cal./km.		N.U.M.			N.U.M.			N.U.M.			N.U.M.	
				D Cal./day	N/A	— 4.51	— 3.15	N/A	— 6.29	— 5.56	N/A	— 6.58	— 7.22	N/A	— 1.34	— 2.09