UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Sport Fisheries and Wildlife
Division of Fishery Services

Tumwater, Washington

Special Report

SOCKEYE FISHERY INVESTIGATIONS ON THE QUINAULT RIVER SYSTEM

Quinault Indian Reservation
Grays Harbor County, Washington
December 1971

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INTRODUCTION

The Quinault Indian Reservation is located on the Pacific coast in Western Washington. Quinault River is the largest river system traversing the reservation and it is the only river system on the reservation supporting a sockeye fishery. Taholah, the principal community on the reservation, is located at the mouth of the Quinault River. Historically, the Quinaults have depended upon the fish resources from the river for their livelihood.

Catches of sockeye salmon (Oncorhynchus nerka), the most abundant salmon species in the Quinault River system, have been declining during recent years. In 1969 the Tumwater office of the Bureau of Sport Fisheries and Wildlife, under tribal agreement, initiated studies to determine reasons for the reduced catches, and to recommend remedial action. This is the third report prepared for the tribe concerning the sockeye fishery. The report provides data collected from spawning ground surveys, downstream migrant studies, and trawling investigations which were not covered in either of the previous reports.

DATA COLLECTION

Index areas have been established on Big Creek, Alder Creek and Inner-Merriman Creek, all tributaries to the Quinault River above Quinault Lake, to monitor the sockeye spawning escapement. Counts were initiated in 1952 on Alder Creek and 1956 and 1962 on Big Creek and Inner-Merriman Creek, respectively. The earliest counts were made by Washington State Department of Fisheries personnel. Most state counts were made once a season by walking the streams and counting both live fish and carcasses. In 1962, Bureau biologists began conducting spawning ground surveys, and made one or two counts on each index area per season. In 1970, Bureau biologists expanded the spawning ground count program to include coverage of the index areas approximately once every two weeks.

Juvenile sockeye salmon rear mainly in Quinault Lake and in the summer of 1969 a midwater trawling program was initiated to sample the pre-smolt sockeye population to determine their growth rates in the lake. Twenty-six trawl samples were taken from 1969 to 1971. Location, depths, and lengths of tows were variable. Length frequencies were recorded for each sample. With the exception of a few early samples, the fish were divided into two-millimeter length groups and a mean individual weight recorded for each group. The condition factor (K) was calculated for each length group.

In order to expand the study of juvenile sockeye in Quinault Lake an informal cooperative program was developed with the Fisheries Research Institute of the University of Washington. Advanced acoustical echo integration equipment and techniques are being used to estimate the size of the pre-smolt population. Echograms are recorded monthly from a series of echo-sounding transects on the lake (Figure 1). A graduate student of the University of Washington will analyze the data collected on this portion of the sockeye study in preparation for his thesis.

To collect information on sockeye smolts leaving Quinault Lake a fyke net was installed approximately 500 yards downstream from the lake outlet. The net was one-half inch stretch mesh with an approximate 32 square-foot section opening. The net was first set when visual observations of schooling smolts were made near the lake outlet. The fyke net was operated through the smolting season when water conditions and work schedules permitted.

To continue a phase of the program covered in an earlier report, scales and length-weight data were collected from samples of adult sockeye commercially caught at Taholah. The average lengths, weights, and age of the adults taken in the Indian net fishery were then compared to previously reported findings.

RESULTS

Spawning ground count data are tabulated in Tables 1-3. Personnel representing two agencies and the tribe were involved in the data collection. Peak counts on the spawning grounds indicate a general downward trend in numbers of spawning adult fish in recent years.

Length-grequency curves for each trawl and fyke net sample are presented in Figure 2. Year classes and their respective mean lengths (μ) are defined where practical for each sample. Figure 3 exhibits the growth in length of progeny from the 1969 broodyear. Very few fish of the size 56-80mm T.L. were taken in the trawl samples; however, many schools of juvenile sockeye in this size range were observed in May and June around the perimeter of the lake. This suggests that the pre-smolt sockeye were not distributed homogeneously throughout the pelagic zone with the younger fish and thus not subject to capture in the trawl samples. Apparently the pre-smolt sockeye in Quinault Lake form shore oriented schools upon reaching approximately 50-60mm T.L. in size, actively feed during daylight hours, and change food habits to some degree, which results in a faster growth rate just prior to smoltification.

The calculated condition factors (K) appear in Table 8. Inspection of the 1969 year class indicate that the peak condition of the younger pelagic oriented fish occurred in June. Whether the timing of the peak condition was a result of the smoltification process reducing competition for food and space in the pelagic areas or a natural increase in the abundance of food is not known.

In a previous report, analysis of data collected from adults taken in the commercial fishery at Taholah strongly suggested that adults having spent three years at sea were dominant in the run until about mid-May. Adults having spent two years at sea were dominant from mid-May to the close of the season and were dominant in an "all-season" basis. Figure 3 depicts the length-frequencies of four samples taken in the 1970 season and supports the earlier findings.

DISCUSSION AND RECOMMENDATIONS

Data collected to date are limited and only suggest features that might be occurring in the Quinault sockeye salmon life cycle. Useful conclusive statements are not yet possible. Future investigations should be directed toward obtaining data which would be useful in predicting the future harvest potential and to maximize control of that harvest potential. Prerequisite to accomplishing these objectives are basic data concerning stock size, mortality rates, and factors affecting mortality rates. Only by attaining valid indices or estimates of these statistics can the ultimate goals be obtained.

Specifically, the following information will be necessary to develop a sound scientific management program:

An estimate or index of egg deposition

An estimate of survival to emergence

An estimate of the fry population size just after lake entry

An estimate of the smolt population size

An estimate of the returning adult population size

Acoustical techniques, though promising, required much more elaborate and refined electronic equipment than was available to our office. For this reason, assistance was solicited from the University of Washington's Fishery Research Institute where experimental gear being developed shows great promise. These acoustical techniques, in our opinion, have the greatest potential to obtain reliable estimates of escapement, juvenile population size, and biomass at any time during their lake residence.

To help provide a necessary portion of the acoustical studies, the lake trawling program should be refined and continued. Growth rates and condition factors should be among the primary considerations. These efforts should be coordinated with the Fisheries Research Institute staff.

Charles E. Osborn
Fishery Management Biologist
Date: March 31, 1972

APPROVED:

Richard J. Navarre
Project Leader
Date: April 10, 1972

REVIEWED:

D. H. Rasmussen, Regional Supervisor
Division of Fishery Services
Date: April 13, 1972

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Figure 1. Echogram of a Transect on Lake Quinault - September 8, 1971

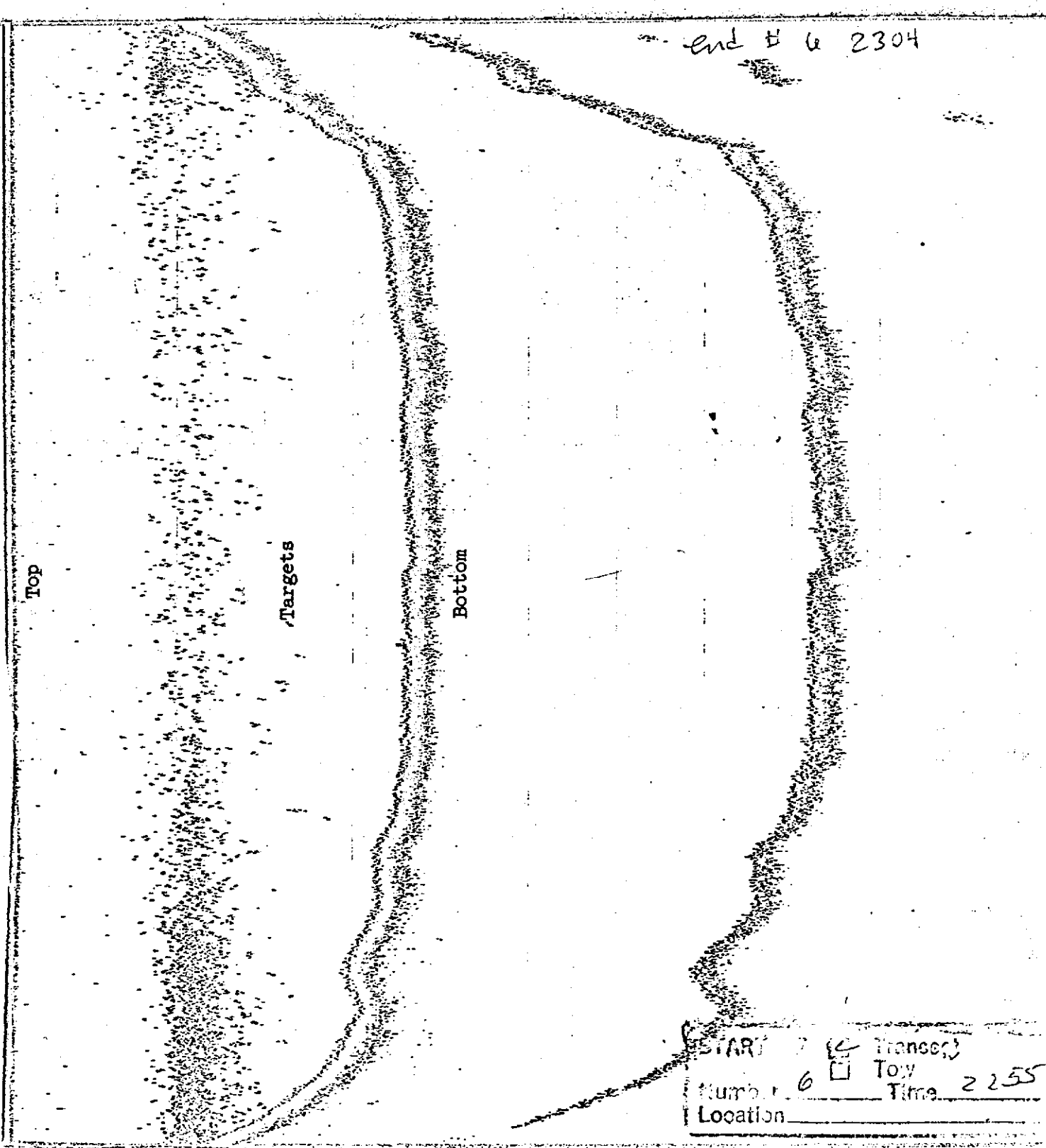
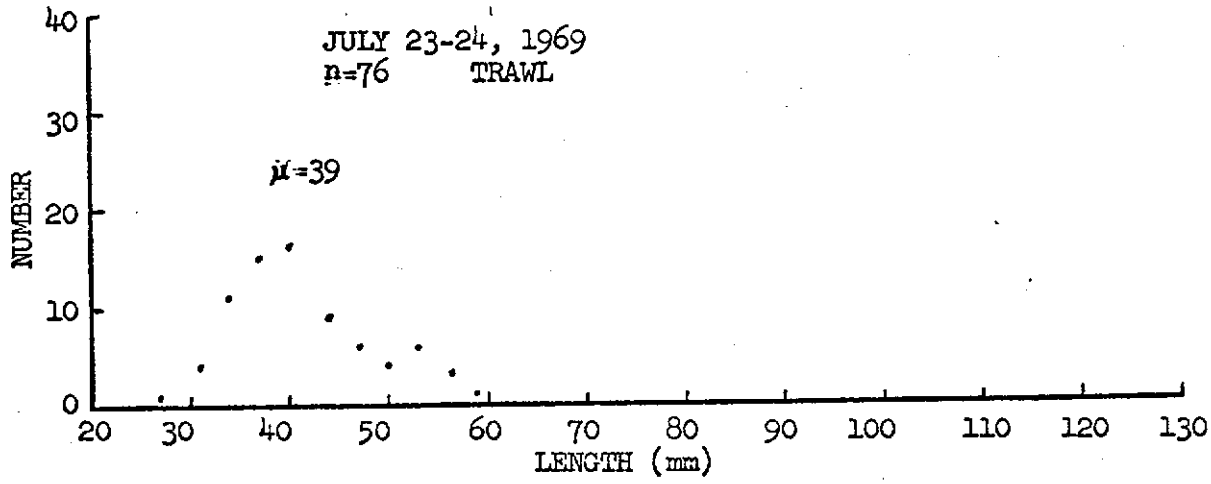
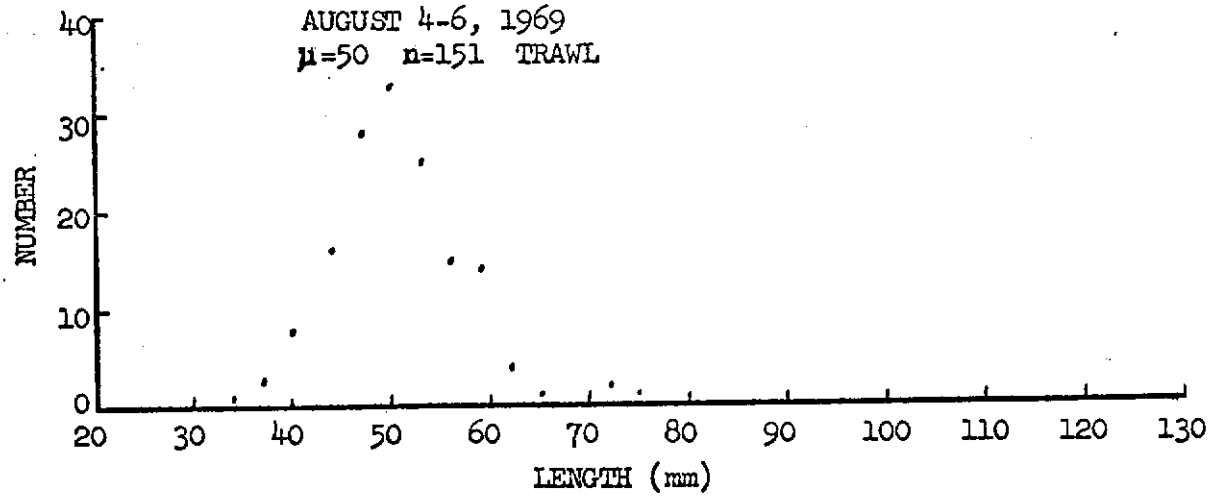
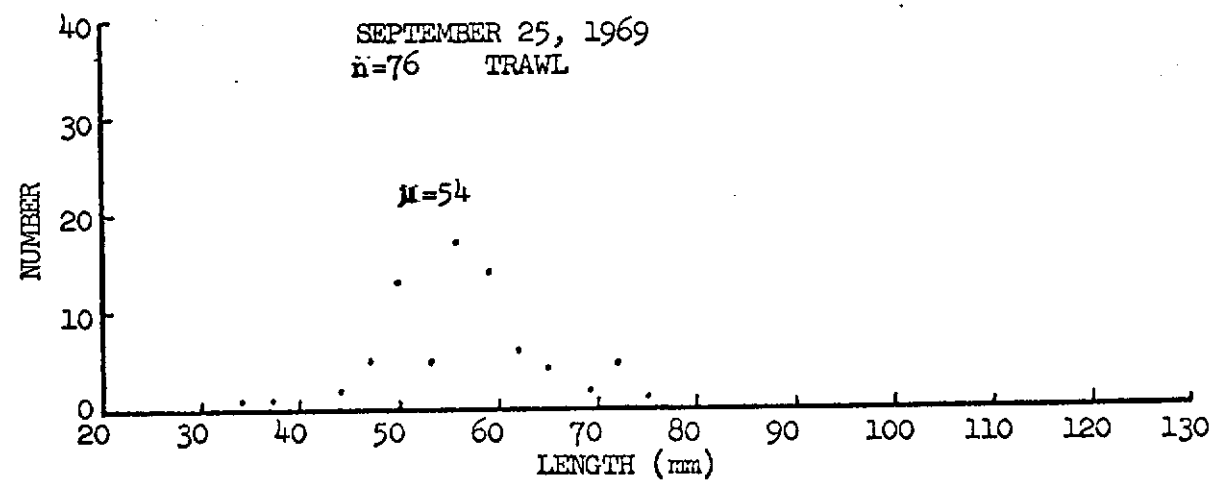


Figure 2a Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Where μ=mean length of year class as determined by length frequency inspection and n=sample size.

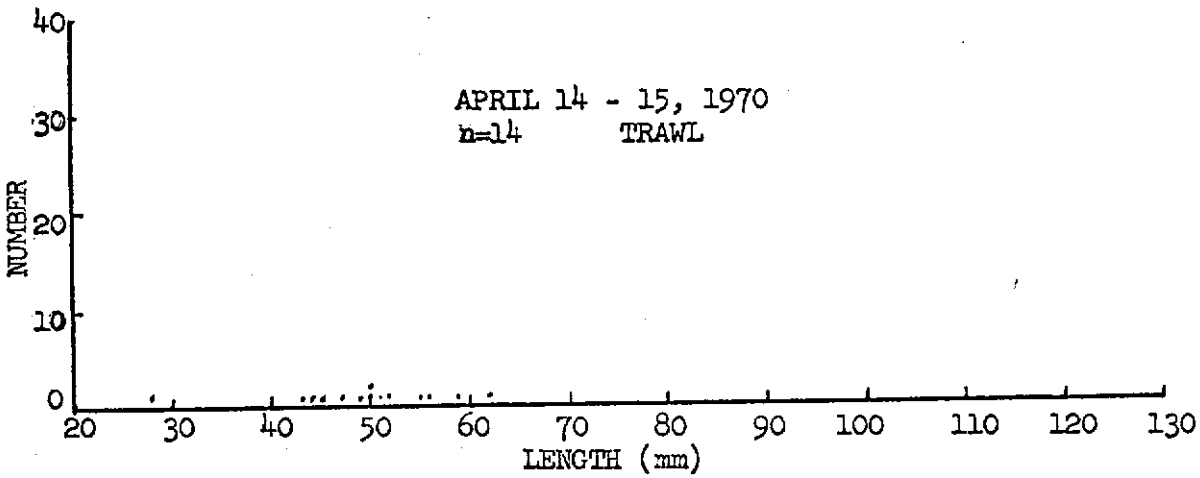


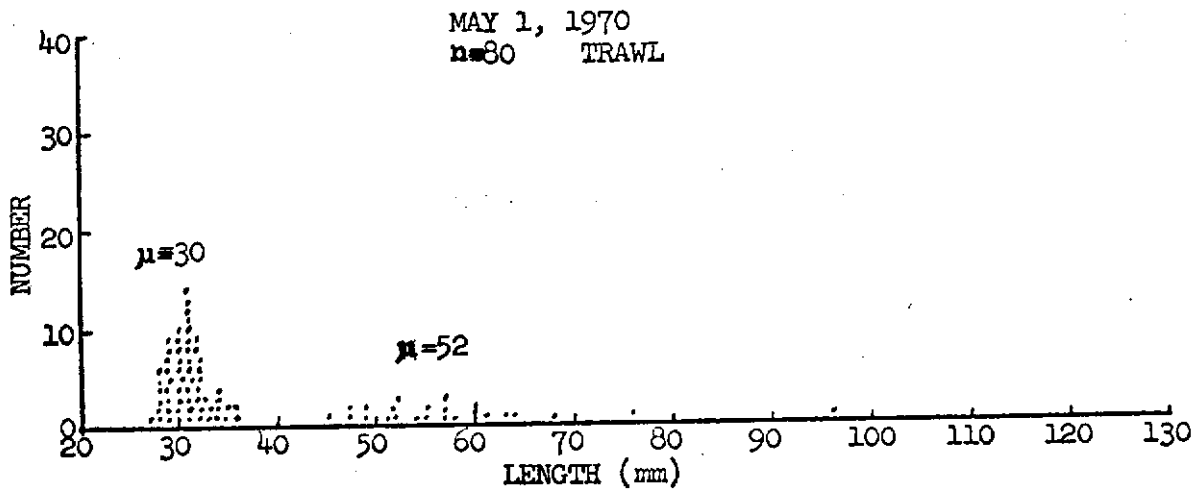




μ=mean length. n=number of fish in sample.

Figure 2b Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd





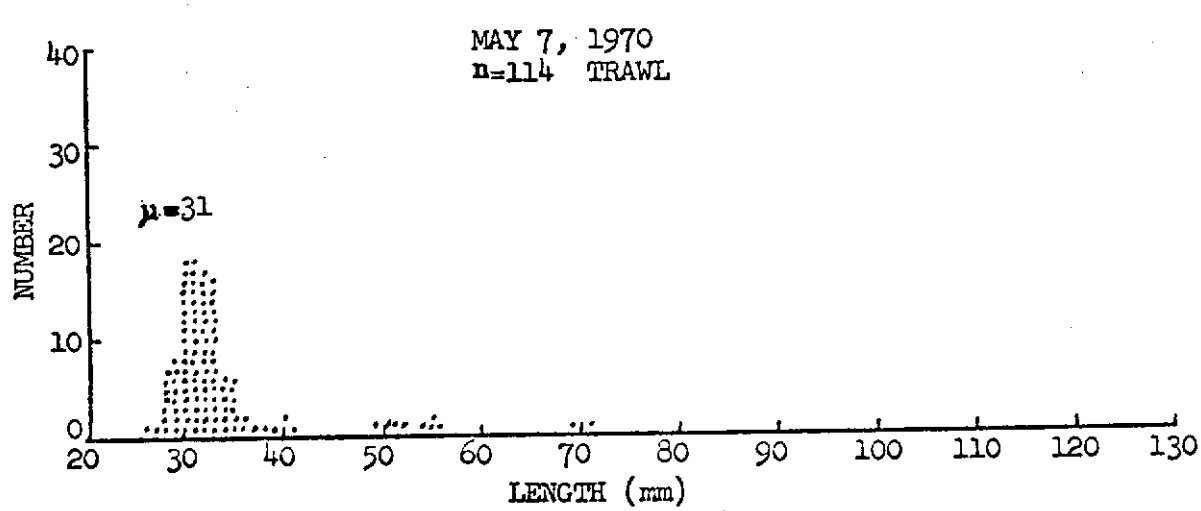
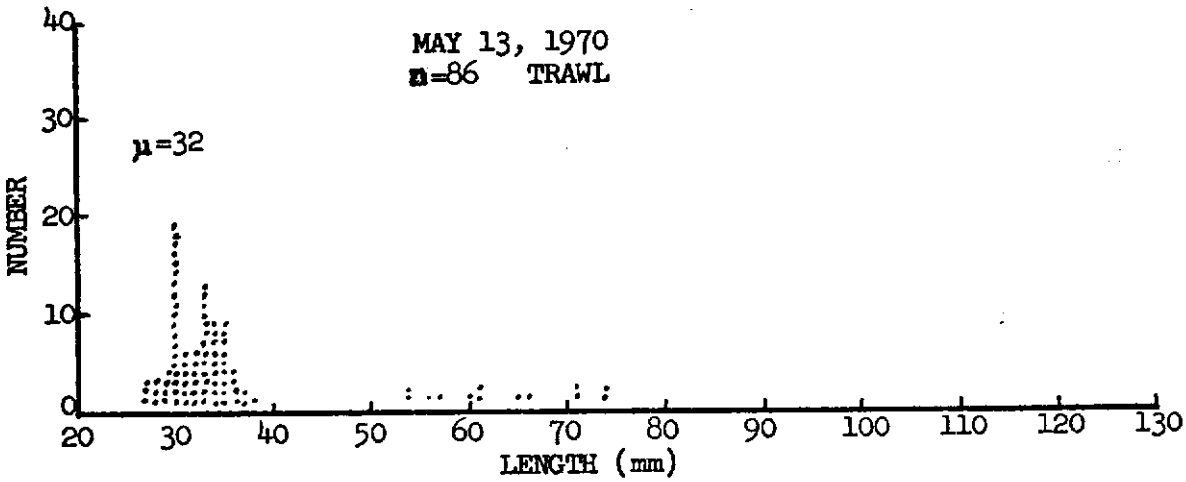
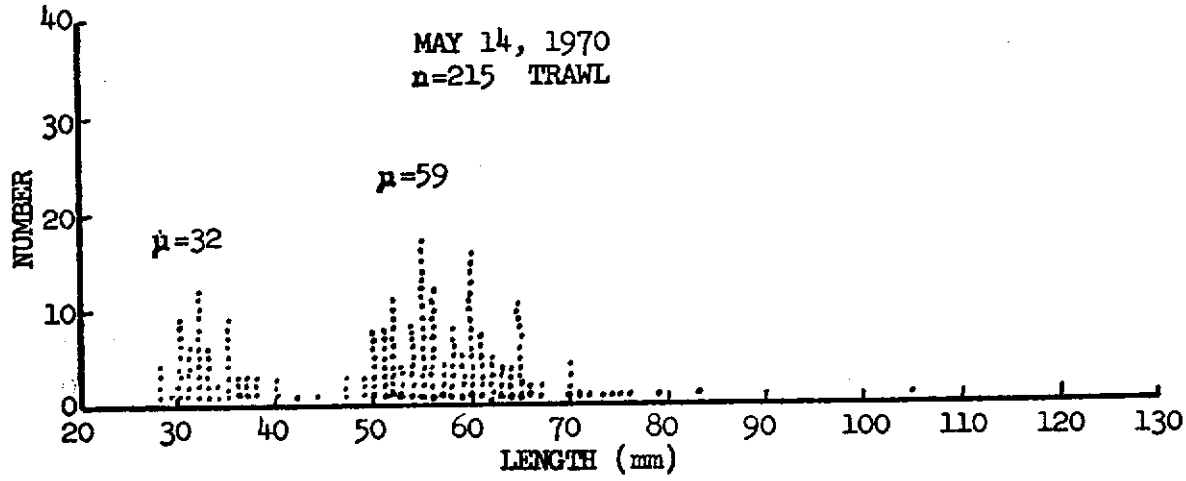


Figure 2e Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd





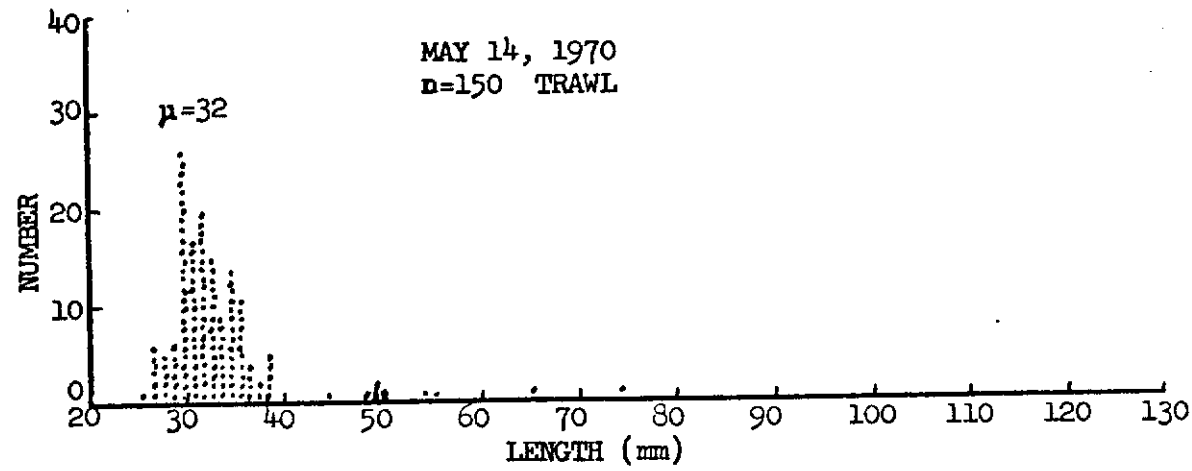
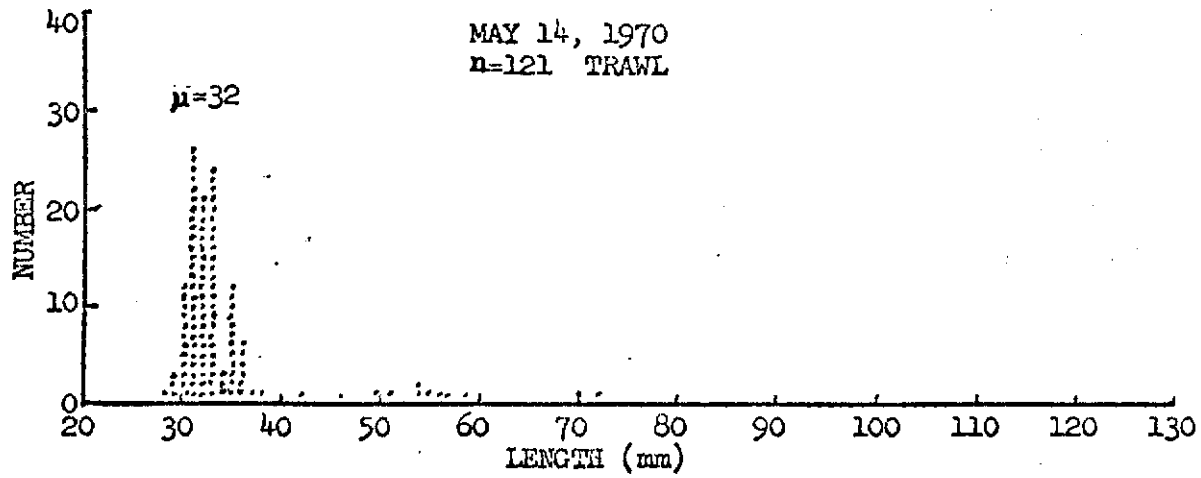


Figure 2d Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd



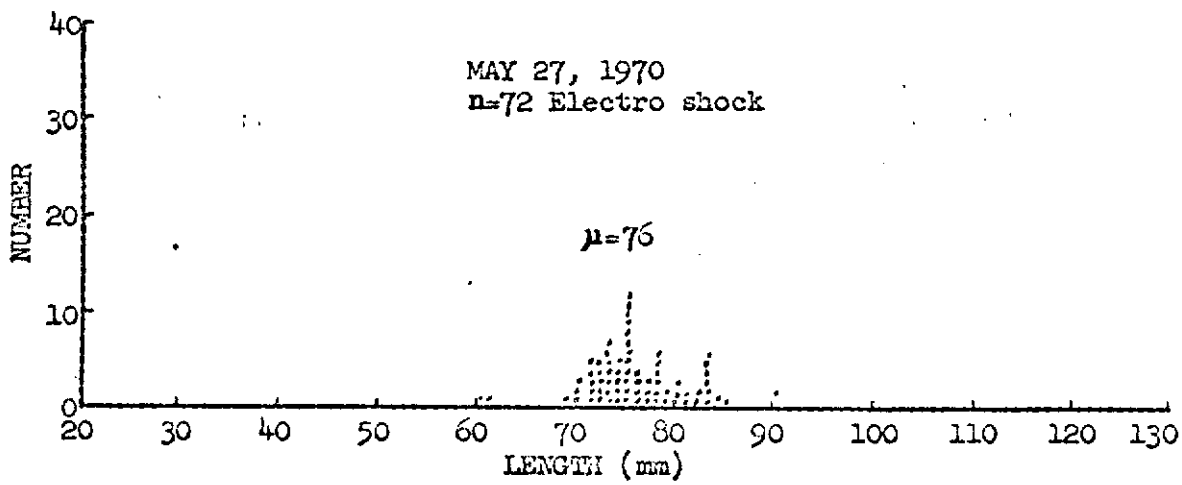
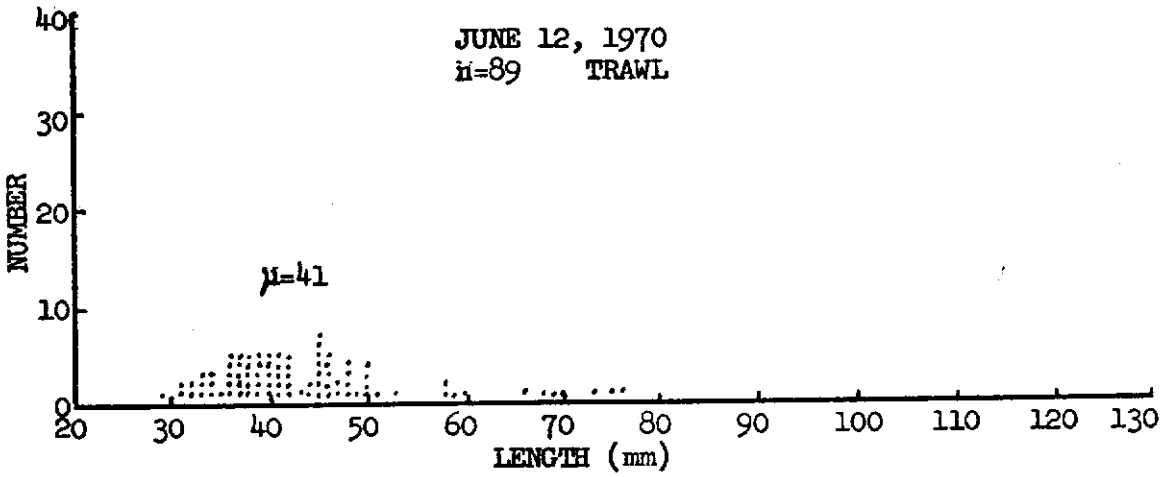
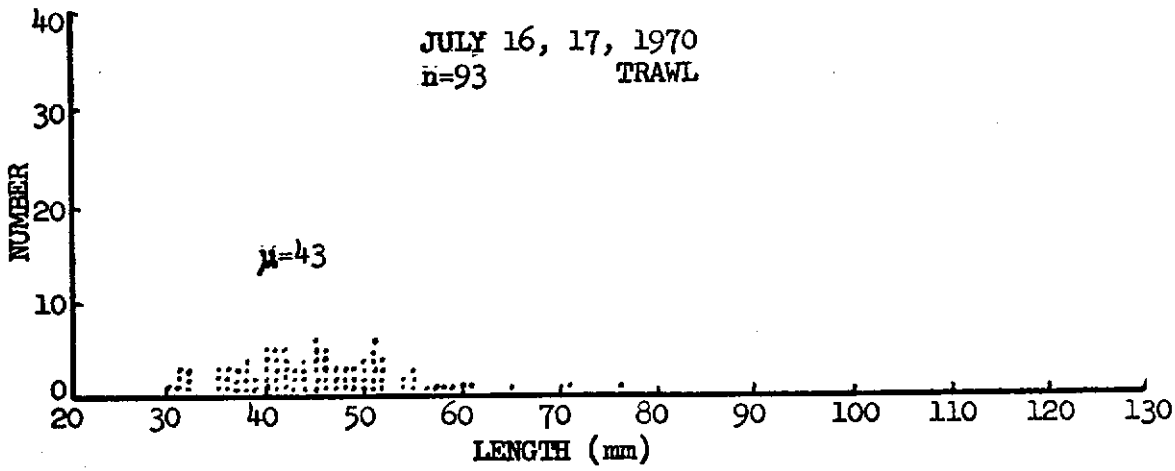


Figure 2e Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd





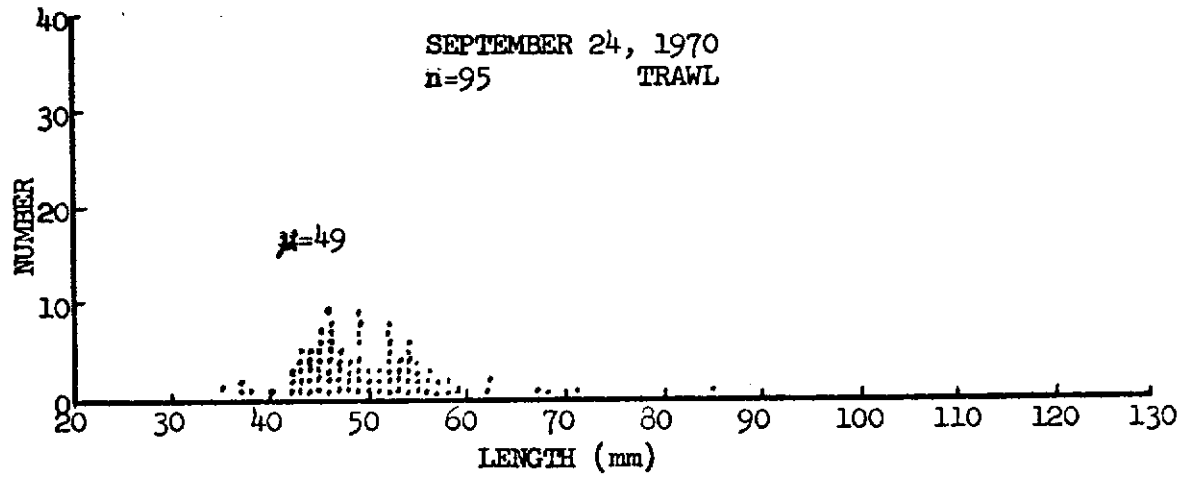
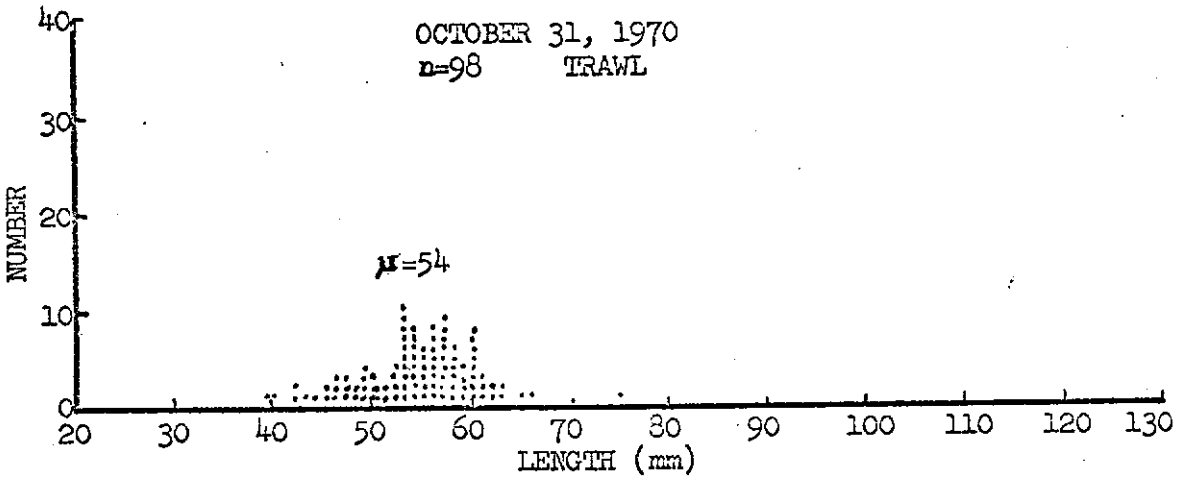
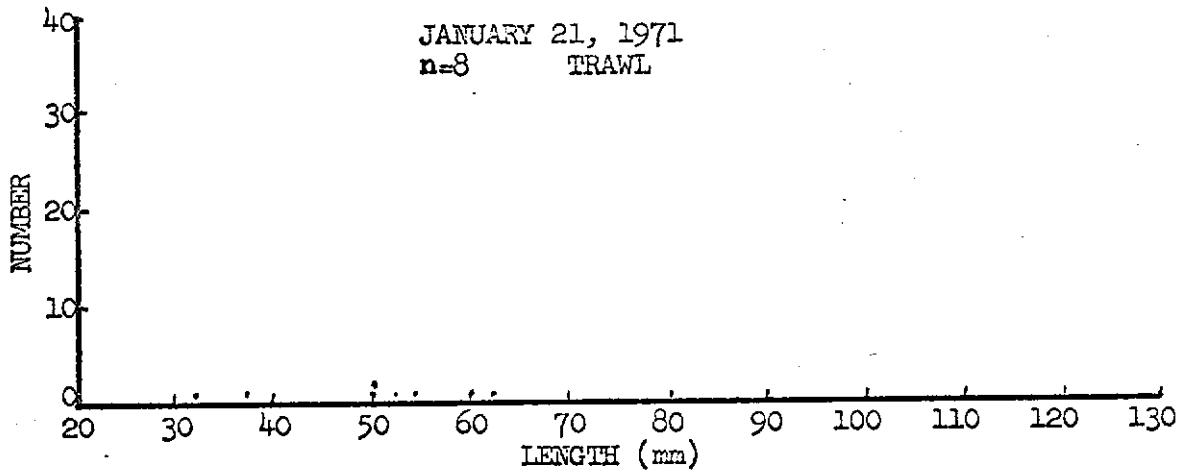


Figure 2f Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd





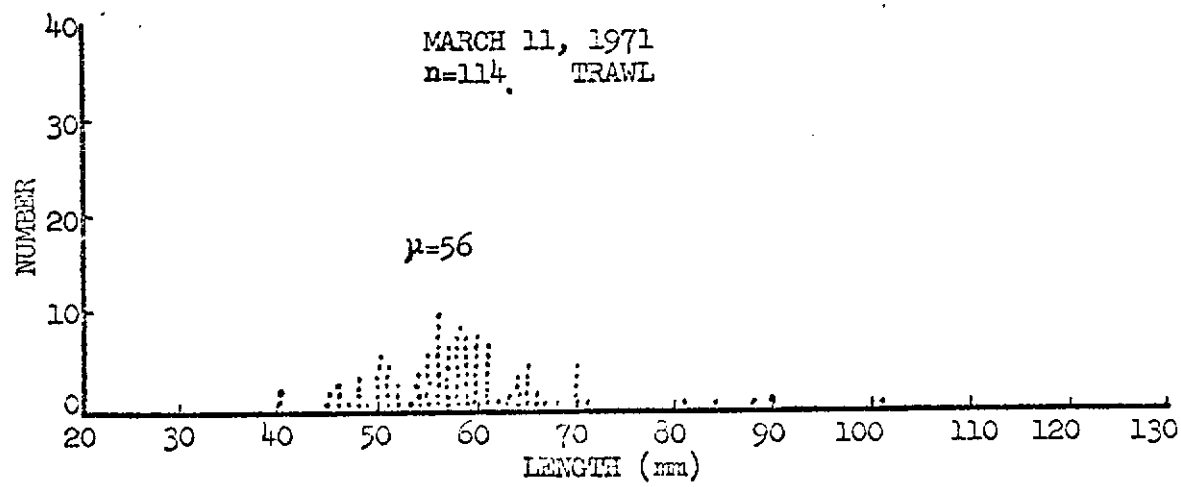
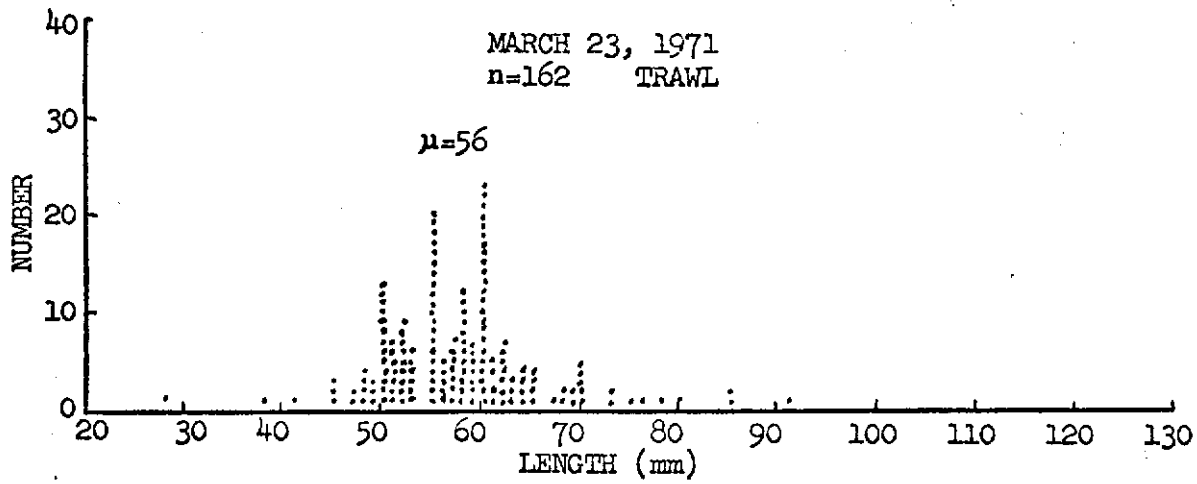
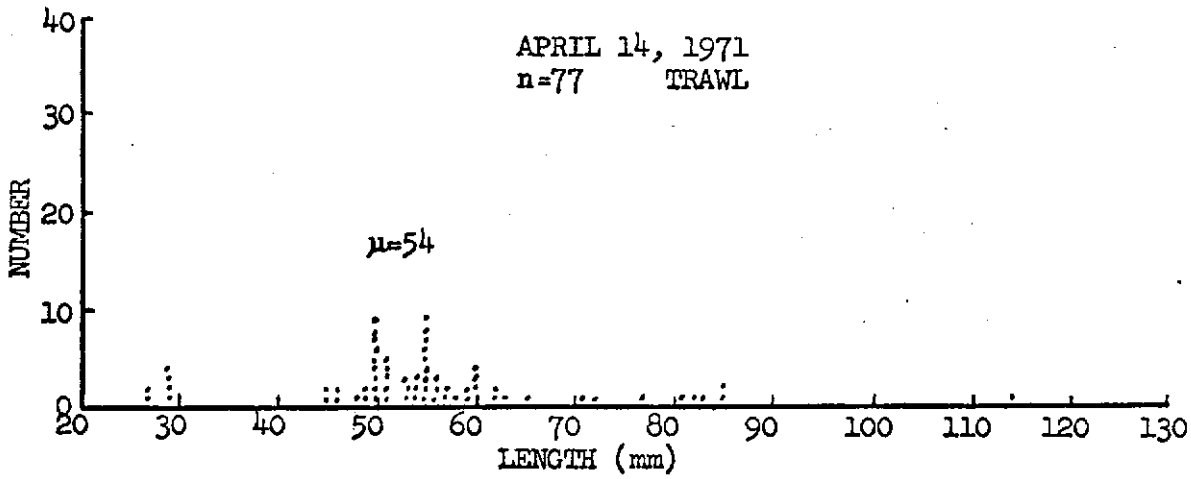


Figure 2g Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd





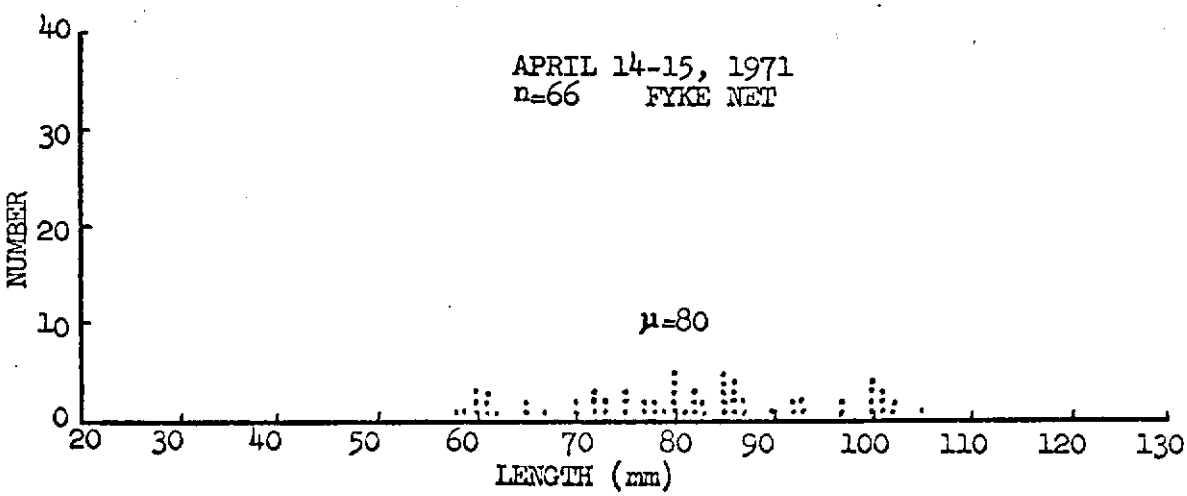
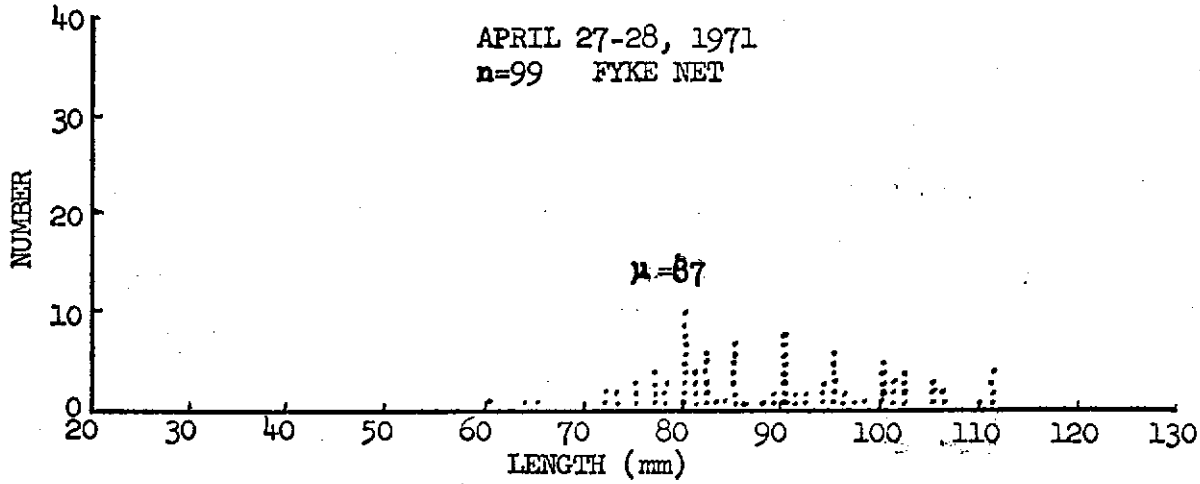
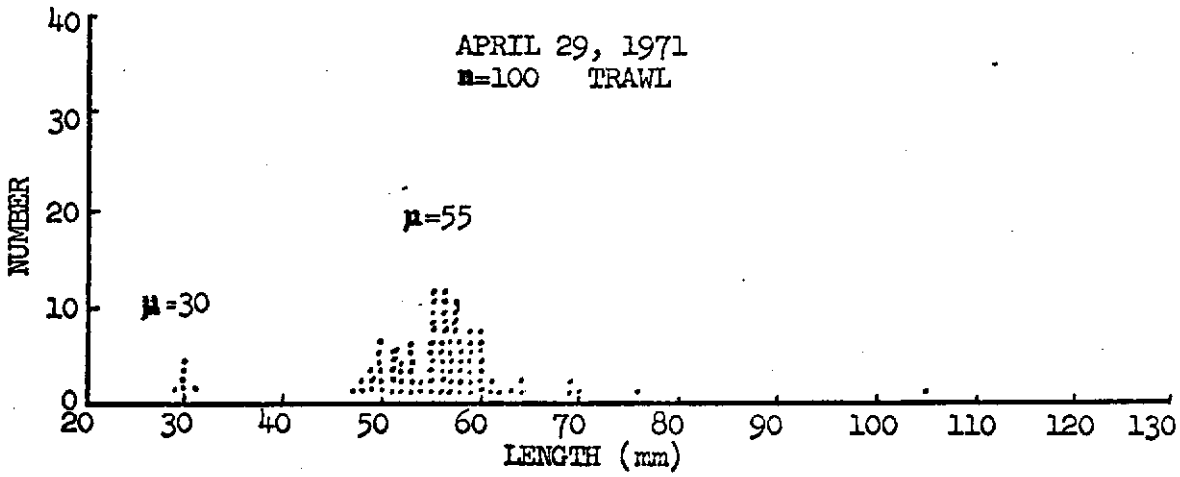


Figure 2h Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye Cont'd





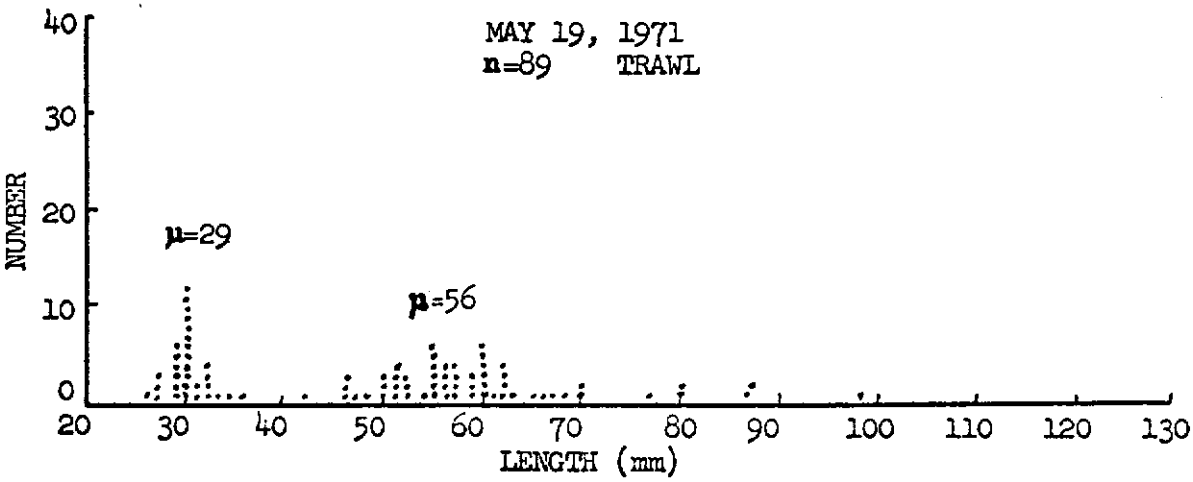
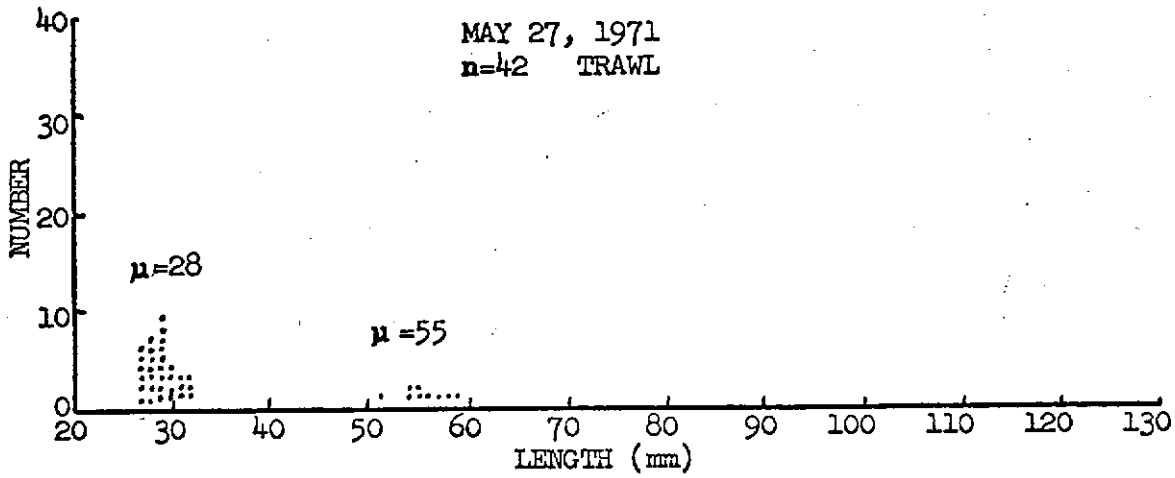
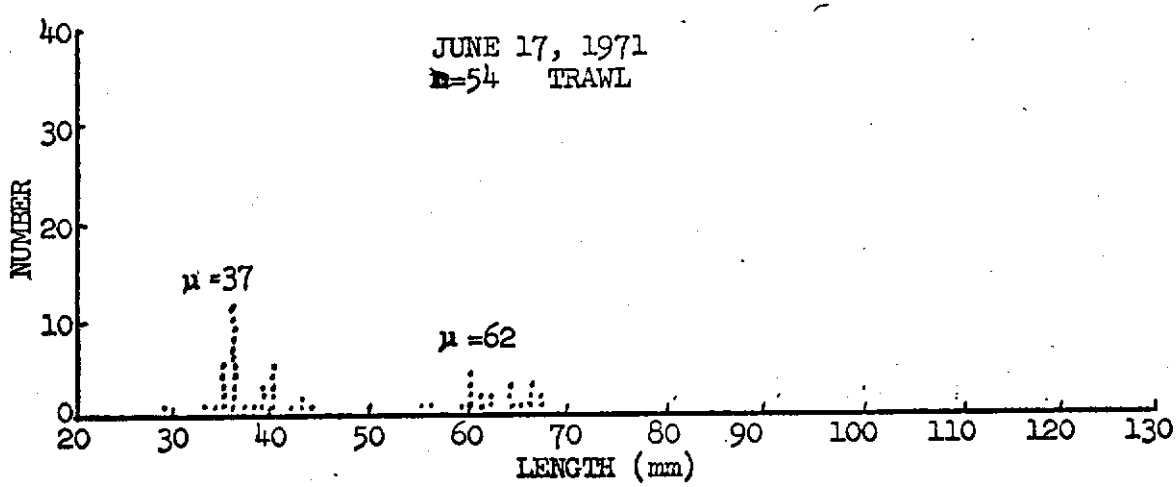


Figure 21 Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd





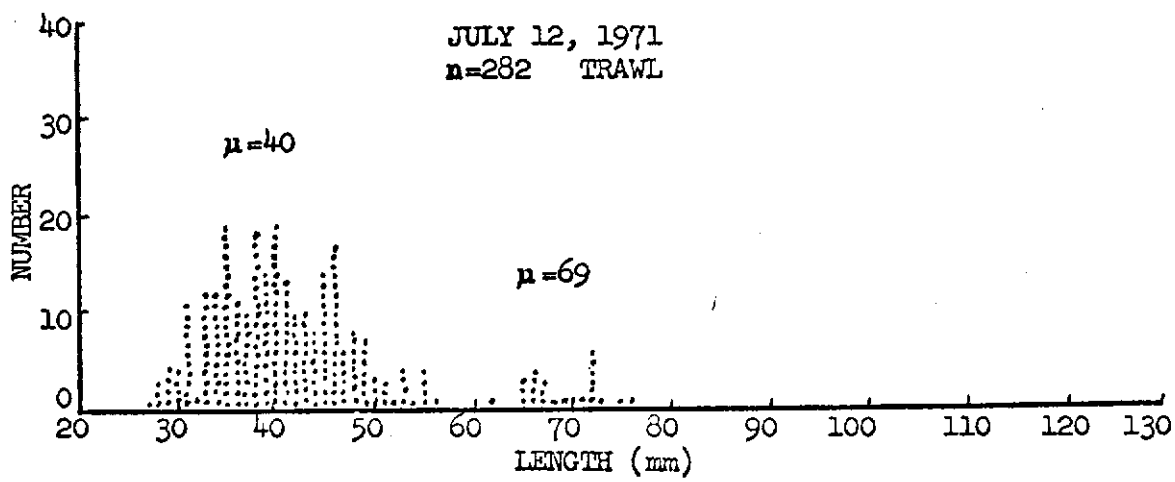


Figure 3. Mean lengths of fry

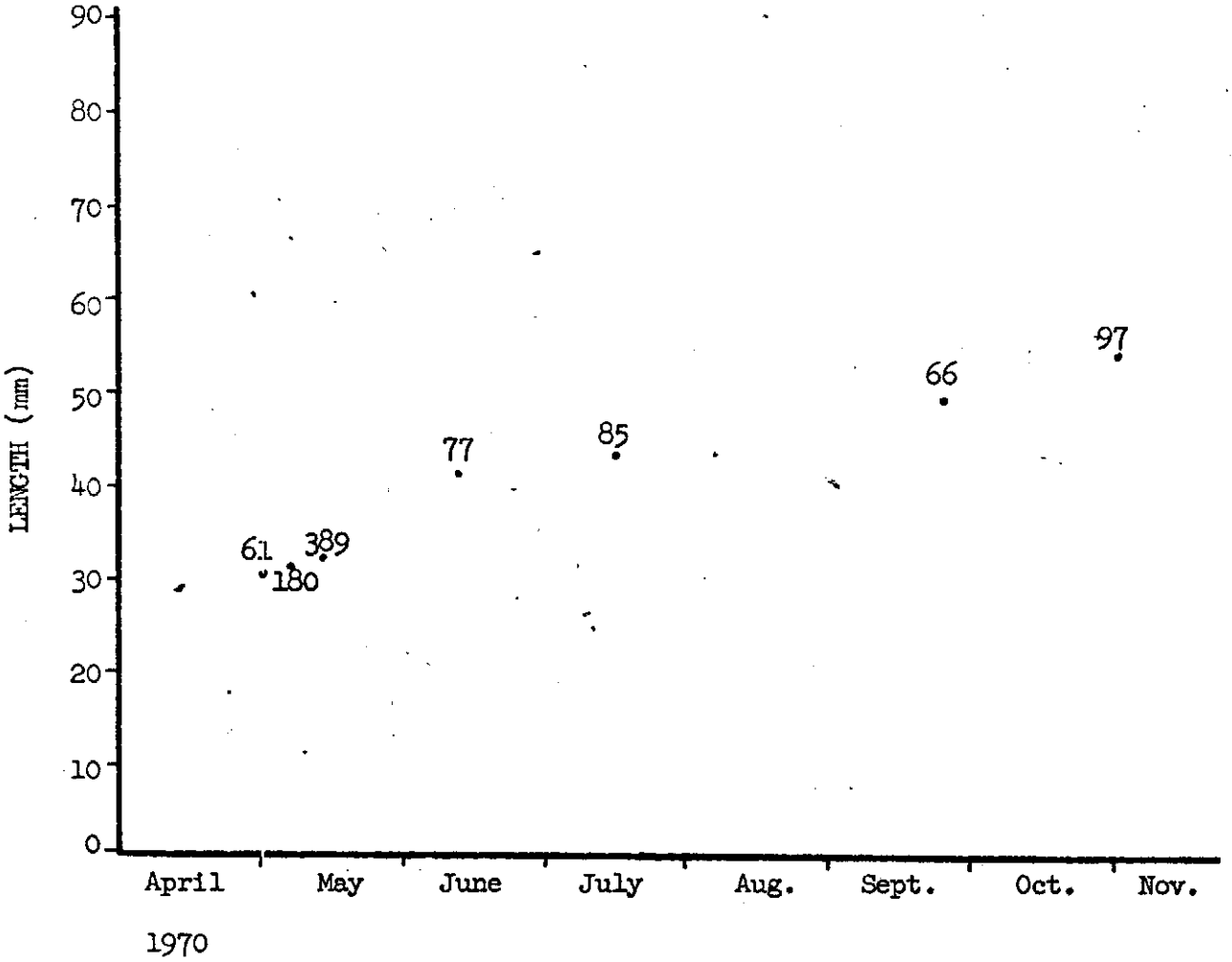
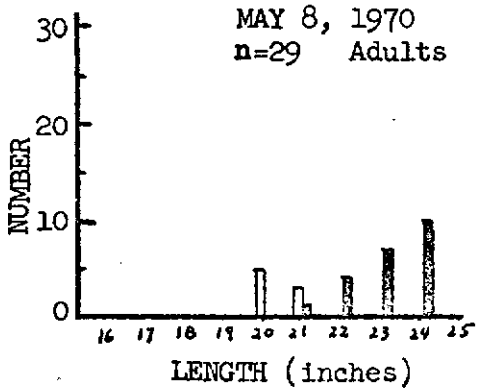
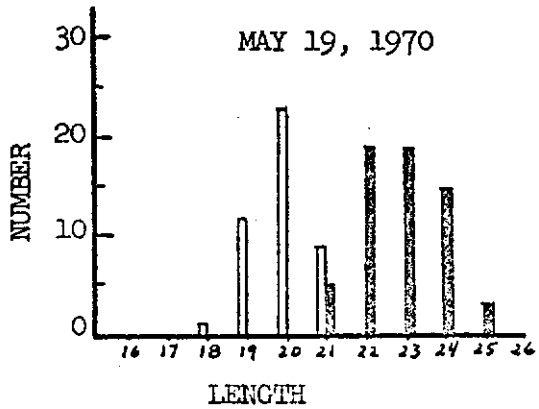
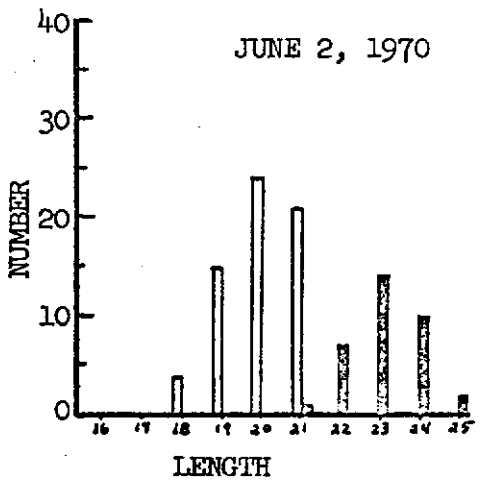
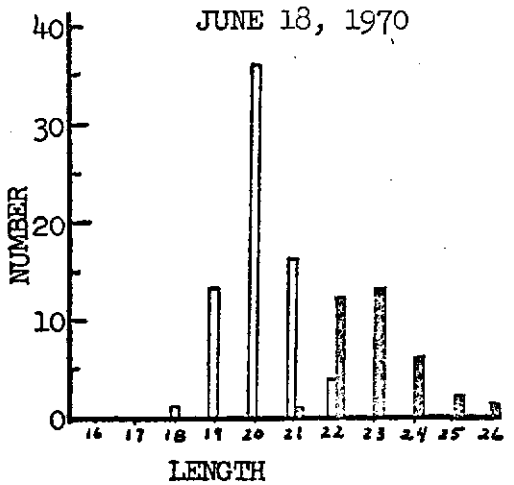


Figure 4. Length frequencies of two year classes of Quinault sockeye salmon as determined by monthly samples taken from the commercial fishery at Taholah in 1970-71.









1967 year class) determined by scale
1966 year class) examination

Table 1. Sockeye spawning index area counts in Alder Creek from 1956 through 1970.

Alder Creek	Date	Distance	Count	Fish/mi.	Peak	Est. of run	Remarks
1952	UKN	0.6	1,273	2,123			State count
1953	UKN	0.6	286	477			" "
1954	UKN	0.6	2,803	4,667			" "
1955	UKN	0.6	1,720	2,850			" "
1956	UKN	0.6	1,593	2,658			" "
1957	UKN	0.6	1,119	1,865			" "
1958	UKN	0.6	1,280	2,132			" "
1959	UKN	0.6	919	1,532			" "
1960	UKN	0.5	1,403	2,806			" "
1961	UKN	0.5	745	1,490			" "
1962	UKN	0.5	436	872			" "
1963	11/25	0.5	936	1,872			" "
1964	UKN	0.5	1,734	3,468			" "
	11/19	0.5	1,080	2,160			FWS count
1965	11/18	0.5	925	1,850			State count
	12/16	0.5	945	1,890			FWS count
	12/17	0.5	1,156	2,312			State count
1966	UKN	0.5	1,543	3,086			State count
1967	UKN	0.5	966	1,932			FWS count
	12/11	0.5	815	1,630			FWS count
1968	10/26	0.5	100	200			McMinds count
	11/26	0.5	1,953	3,906			State count
	12/26	0.5	1,790	3,580			State count
1969	11/26	0.5	475	950			FWS count
	12/10	0.5	303	606	3rd wk.		" "
	12/23	0.5	664	1,328	in Dec		" "
1970	1/8	0.5	96	192			FWS count
	1/22	0.5	64	128			" "
	2/4	0.5	7	4			" "
	10/30	0.5	7	14			" "
	11/12	0.5	449	898			" "
	12/1	0.5	496	992	last wk.		" "
	12/17	0.5	222	444	of Nov.		" "
1971	1/5	0.5	96	192			" "

Table 2. Sockeye spawning index area counts in Big Creek from 1956 through 1970.

Big Creek	Date	Distance	Count	Fish/mi.	Peak	Est. of Run	Remarks
1956	UKN	0.5 mi.	874	1,748		No. est.	
1957	UKN	0.5	1,018	2,036		" "	
1958	UKN	0.75	723	964		" "	
1959	UKN	0.75	853	1,137		" "	
1960	UKN	0.75	1,816	2,421		" "	
1961	UKN	1.5	1,575	1,050		" "	
1962	UKN	1.5	1,975	1,317		" "	State count
	12/13	1.5	1,465	976		" "	FWS count
1963	UKN	1.5	3,154	2,103		" "	State count
	12/3	1.5	2,438	1,621		" "	FWS count(Bridge to mouth)
	12/4	1.5	1,109	738		" "	FWS count(Racks to bridge)
1964	11/18	1.5	1,628	985		" "	State count
	11/20	UKN	975	UKN		" "	FWS count
	UKN	1.5	1,781	1,186		" "	FWS count (inclusio of 11/20 count UKN)
1965	12/17	UKN	1,043	UKN			State count
1966			N O T	S U R V E Y E D			
1967	12/16	1.3	1,964	1,511		" "	FWS count
1968	10/26	1.3	11,017	8,460		" "	McMinds count
	11/26	1.3	2,282	1,755		" "	State count
	12/26	1.3	2,360	1,817		" "	State count
1969	11/26	1.3	1,760	1,352	last wk.		FWS count
	12/10	1.3	1,092	843	in Nov.		" "
1970	1/8	1.3	259	199			FWS count
	2/4	1.3	4	3			" "
	11/3	1.3	218	168			" "
	11/12	1.3	912	700	3rd wk.		" "
	12/1	1.3	455	350	in Nov.		" "
1971	1/5	1.3	14	10			" "

Table 3. Sockey spawning index area counts in Inner Creek from 1962 through 1970.

Inner Creek	Date	Distance	Count	Fish/mi.	Peak	Est. of run	Remarks
1962	UKN	2.0	680	340			State count
1963	UKN	2.0	3,224	1,612			State count
	12/6	3.5	3,647	1,041			FWS count
	12/9	1.0	262	262			FWS count
1964	UKN	2.0	4,785	2,393			State count
	11/19	2.7	4,538	1,680			FWS count
1965	12/16	2.0	1,158	576			State count
1966	UKN	2.0	5,660	2,830			State count
1967	UKN	2.0	2,141	1,070			FWS count
1968	10/26	<2.0	3,540				McMinds count
	11/26	2.0	5,645	2,822			State count
	12/26	2.0	3,810	1,905			State count
1969	11/26	2.0	497	248	2nd		FWS count
	12/10	2.0	822	411	week in		FWS count
	12/23	2.0	829	415	Dec.		FWS count
1970	1/8	2.0	612	306			FWS count
	1/22	1.0	161	161			" "
	2/4	2.0	136	68			" "
	2/12	2.0	68	34			" "
	11/12	2.0	696	348			" "
	12/1	2.0	924	462	1st		" "
	12/17	2.0	804	402	week in		" "
	1/5	2.0	183	92	Dec.		" "

Table 4. A chonological comparison of the condition factors of progeny from the 1969 broodstock. Condition (K) = $\frac{W}{L^3} \times 10^5$ where (W) is the mean weight of all fish within a two millimeter length group (L).

Length Group in (mm)	5/14/70	6/12/70	9/24/70	10/31/70	3/11/71	3/23/71	4/14/71	4/29/71	5/19/71	5/27/71	6/17/71	7/12/71
26-27									.636	.761		.761
28-29	.410								.680	.696		.495
30-31	.559								.630	.707		.606
32-33	.470								.668	.724		.672
34-35	.757								.640		.832	.676
36-37	.690										.870	.674
38-39	.677										.795	.660
40-41	.633	.530	.512	.560							.820	.713
42-43	.630	.630	.693	.546		.630					.882	.708
44-45	.500	.578	.677	.622	.495	.568	.682				.825	.673
46-47		.615	.680	.545	.500	.606	.624	.576				.706
48-49		.662	.708	.568	.392	.597	.624	.605				.670
50-51	.803	.576	.668	.614	.485	.598	.651	.720	.796			.720
52-53	.855	.546	.717	.612	.517	.577	.650	.576	.738	.739		.718
54-55	.865		.680	.630	.578	.590	.639	.603	.753	.825	.943	.735
56-57	.738		.650	.604	.583	.569	.639	.730	.773	.811	.892	.649
58-59	.792			.616	.578	.582	.616	.568	.632	.854	.923	
60-61	.833			.605	.611	.588	.620	.580	.744		.890	
62-63	.829			.595	.580	.608	.664	.449	.816		.920	.720
64-65	.855			.667	.602	.591	.711	.584	.785		.913	.730
66-67	.820				.616	.517					.900	.766
68-69												.775
70-71												.777
72-73												.774