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U.S. FISH & WILDLIFE SERVICE--ALASKA

Department of Commerce
National Oceanic and Atmospheric Administration
Auke Bay Laboratory
Auke Bay, Alaska

ANADROMOUS FISHES INVESTIGATIONS

Auke Lake Sockeye Salmon Studies
Plan of Operations, April 1, 1978-March 31, 1979

INTRODUCTION

Auke Lake sockeye salmon, Oncorhynchus nerka, studies are directed toward the development and evaluation of salmon culture technology applicable to the rehabilitation and maintenance of Alaska's sockeye salmon stocks. This research was initiated in response to the general concern expressed by resource user groups and governmental resource management agencies for the depressed condition of many Alaskan sockeye stocks. Present research has been conducted, in part, under a cooperative agreement between the National Marine Fisheries Service and the Alaska Department of Fish & Game, Fisheries Rehabilitation and Enhancement Division.

RESEARCH OBJECTIVES

Sockeye salmon culture research at Auke Lake is primarily concerned with developing the methodology to increase smolt production from natural rearing systems. Presently, research is directed toward evaluating the use of hatchery propagated short-term reared fry to supplement natural recruitment and stimulate smolt production.

Auke Lake offers a research environment to comparatively evaluate the smolt production potential of wild and hatchery produced sockeye fry. The natural Auke Lake sockeye stock provides the necessary experimental control and the hatchery donor stock for the experiments. Hatchery propagated fry from the 1973 and 1974 brood years were short-term reared, fin-marked and released in 1974 and 1975, respectively. Enumeration and sampling of the subsequent annual smolt emigrations will provide comparative data on the smolting capacity of the wild and cultured fry.

Enumeration of the 1978 smolt emigration will provide comparative data for the wild and hatchery propagated smolts from the 1974 brood year and for wild smolts from the 1975 and 1976 brood years. Migrating age III smolts will represent the ultimate seaward contribution of the 1974 brood year. Migrating age II and age I smolts will provide continuing data for the 1975 and 1976 brood years.

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Spawners returning to Auke Lake will provide an estimate of comparative marine survival of wild and hatchery propagated fish from the 1973 and 1974 brood years. Returning spawners of hatchery origin will be identified at the Auke Creek weir by fin marks. Details for the enumeration and sampling of the 1978 emigrant sockeye smolt and returning sockeye spawners are presented below.

SMOLT ENUMERATION

April 1. Prepare Enumeration Site

Install counting weir--Auke Creek will be completely screened with a V-shaped weir approximately 30 yards down stream of the outflow of Auke Lake. The weir will have two aperatures to receive 1-meter square fyke nets with attached live boxes.

Weir maintenance--The weir screen will be cleaned as required to prevent any reduction in flow that would result in raising the natural lake level. Vandalism may create some problems with weir integrity. Periodic inspection of the weir screens for holes or other damage will be necessary. Damage should be repaired immediately.

Fyke net and live box maintenance--During the emigration, the fyke nets and live box screens should be inspected daily for holes or other damage. Repair damaged equipment immediately. Report any vandalism to the Alaska State Police.

April 15 - June 15. Enumeration and Sampling Emigrant Smolts

Emigrating smolts will be captured and retained by fyke nets with attached live boxes. This method of capture is assumed to have the least harmful effect on the captured smolts.

Occasionally, as experienced in 1976, associated migrating species such as Dolly Varden, Salvelinus malma, are captured in large numbers with the smolts and cause increased smolt mortality in the live boxes. Observations of the behavior of the migrating Dolly Varden indicated that smolt mortality could be reduced by modification of the fyke net fishing procedure during the peak emigration period. We will use the modified procedure during the 1978 emigration.

April 15 - May 10. Fyke nets with attached live boxes will be fished in both aperatures of the weir. The fyke nets will be fished 24 hours daily. All emigrating smolts and associated species captured will be enumerated and released. The enumeration of emigrating smolts will follow the daily catch processing flow diagram (Appendix, page 1).

May 11 - June 15. Fyke nets with attached live boxes will be fished according to the following procedure. The weir apertures will be marked (A) and (B). Fyke nets will be fished for 24-hour periods at each aperture on an alternating schedule. The daily schedule for this procedure is presented below.

Fishing Day	Weir Aperture	
	(A)	(B)
1	X	
2		X
3	X	X
4		X
5	X	
6	X	X
7	Repeat sequence.	

A fyke net without attached live box will always be placed in the alternate aperture. Enumeration of the catch will follow the daily catch processing flow diagram. When weir apertures (A) and (B) are fished concurrently (Day 3, Day 6) it is essential that the catches be processed and recorded separately by site.

The weir, nets, and live boxes will be checked each evening at 2000 hours. Accumulated detritus should be removed from the nets and live boxes. Smolts in the live boxes may be enumerated and recorded with the daily catch tally the following morning. During storm periods with heavy precipitation or wind, the nets and live boxes will be checked at frequent intervals as required to keep the nets clear and fishing properly.

Past observations have shown that sockeye smolts will emigrate from Auke Lake during daylight hours when heavy overcast conditions are present. This is especially true during peak emigration periods. Storm conditions also promote heavy smolt movement. If the fishing schedule is interrupted to clean the nets or for some other reason, record in the daily log the time interval that the weir is open.

Enumeration of daily catch-Usually smolts emigrating from the lake will be enumerated at 0800 each morning. Each daily catch will be recorded appropriately on a daily catch processing form (Appendix, page 1). Smolts enumerated at any other time during the preceding 24 hours will be recorded in the daily log and processed on a separate daily catch processing form. Smolts processed at times other than 0800 will be tallied with the daily 24-hour total catch at 0800 the following morning. Enumeration of sockeye salmon smolts will be the primary objective. In addition, coho salmon, Oncorhynchus kisutch, smolts will be retained for a tagging study by the Alaska Department of Fish & Game (ADF&G).

ADF&G will be responsible for providing one person at the enumeration site at 0800 hours each morning to handle the coho smolt. Records of the number of coho smolts tagged and tag identification will be available for project records.

Sampling the daily catch-Sockeye salmon smolts will be sampled daily to collect age, length, and weight data. Scales collected for age determination will be mounted on glass microscope slides and labeled. Instructions for this procedure are presented in the Appendix, page 3. Smolts sampled for length will be measured from the tip of snout to the fork of the tail (TS-FT). Length measurements will be to the nearest millimeter. The weight of sampled smolts will be taken to the nearest 1/10 gram. Each smolt will be lightly blotted with a damp paper towel before weighing. Data collected will be recorded daily on the forms provided (Appendix, page 4). A maximum of 50 smolts (20 wild and 30 hatchery) will be sampled daily for these data. Sampling instructions are detailed on the daily catch processing form.

Approximately 5% of the emigrating sockeye smolts will be examined to determine the percentage of marked smolt in the emigration. The number of marked smolts in each daily sample will be recorded by fin mark on the daily catch processing form. The number of wild smolts in the sample will be recorded similarly.

Handling stress-Sockeye smolts during the migratory period are physiologically quite fragile. Scales are deciduous and can be easily removed from the fish. Great care must be exercised when handling the smolts to reduce handling mortalities to a minimum. Handling stress can be reduced by:

1. Remove as much detritus as possible from the live boxes before removing smolts.
2. Try to remove the large fish (Dolly Varden, cutthroat trout) from the live boxes first.
3. When removing smolts from the live boxes, remove small lots to prevent mechanical injury due to weight.
4. Smaller numbers of fish in the dip net will reduce scale loss.
5. Keep water fresh in the sample holding containers.
6. Anesthetize smolts before handling in sample processing (see below).

Anesthetize smolts for sample processing-Reduce handling stress, especially for the smolts processed in the daily sample, by anesthetizing before handling. 2-phenoxyethanol will be used in a concentration of 10 drops per gallon of water as an anesthetic. Some variation in this concentration may be necessary depending on water temperature. Solubility of the anesthetic in water increases with increasing water temperature. Smolts placed in the anesthetic solution should lose equilibrium and become quiescent in 2-3 minutes. Anesthetize only 3-5 smolts at a time to prevent over anesthetization and death. Revive smolts in freshwater after processing and release.

April 15 - June 15. Daily Log

Maintain a daily log for the smolt enumeration activity. In addition to unusual observations or difficulties experienced, record the following observations:

1. 0800 and 2000-Surface water temperature in °C at the counting weir.
2. Brief weather description for last 24 hours (at 0800).
3. Vandalism.
4. Fyke net fishing hours.
5. Net repairs and cleaning problems.
6. Fyke net catches of sockeye at 0800 and at other times as required.
7. Other species enumerated from the live box.

ADULT ENUMERATION

Returning Auke Lake sockeye spawners will be enumerated, as in past years, at the Auke Creek adult counting weir. The escapement will be sampled daily to determine the sex ratio, age composition, length-frequency, and weight-frequency of the returning spawners. Approximately 30 females will be sampled to determine the length-fecundity relationship for the escapement. All spawners sampled will be examined for fin marks. Returning spawners from the 1973 brood year (age 1.3, 2.2, 3.1)¹ and the 1974 brood year (age 1.2, 2.1) carrying fin marks will provide data to permit estimation of comparative marine survival as previously described.

June 15 - September 1. Enumeration of Adult Escapement

Enumeration of the escapement-Adult sockeye returning to the Auke Creek weir will be enumerated and passed upstream daily. The numbers of fish passing through the weir will be recorded in the daily log by counting period. Attention will be given to incoming spawner movement and enumeration will be as required to minimize the delay in upstream migration caused by the counting weir.

Sampling the escapement-Approximately 5% of the returning sockeye spawners will be sampled to determine the sex ratio, age composition, age-length frequency, age-weight frequency, and weight-length frequency by age for the escapement.

Data will be recorded on the adult sampling forms provided (Appendix: page 5). One scale will be taken from the third row of scales above the lateral line and directly below the dorsal fin. Scales will be placed on gummed scale cards and attached to the appropriate sample data forms. The sex, mid-eye-to-fork of tail length in millimeters and weight to the nearest 10 grams will be recorded for each fish sampled.

1. Adult age designation by the European system where the value to the right of the decimal point is freshwater age and that to the left is ocean age. One year must be added to the freshwater value to determine total age or brood year.

Fecundity sample-Approximately 30 females representative of the length frequency distribution will be sampled to determine the length-fecundity relationship for the escapement. The ovaries of each female will be identified with a numbered plastic tag and placed in cloth bags for subsequent preservation and counting. The right and left ovary of each female will be identified and recorded on the data sheet. The ovaries sampled will be preserved by boiling for 20 minutes and then placed in 5% formalin solution.

Recording fin marks-Returning spawners sampled at the weir will be examined for fin marks. Fin marks that may be observed are shown in Table 1.

Table 1.--Fin marks carried by Auke Lake sockeye spawners from the 1973 and 1974 brood years returning in 1978.

<u>Brood Year</u>	<u>Fin Marks</u>
1973	AD-RV, LV
1974	LV

Caution should be exercised when a fin mark is examined and recorded. The correct orientation of the fish and the marks is essential. The right or left side is determined by viewing the fish dorsally and from the posterior. Accurate recording of the observed fin marks is required if these data are to be apportioned to the respective brood years. Record fin marks in the "Remarks" column of the data entry for that fish. A "readable" scale will also be required. Maintain scale orientation when placing on the gummed scale card (concave side of scale down) and try to avoid regenerate scales.

REPORTS

Periodic progress reports will be submitted to the Program Manager, Anadromous Fishes Investigation. A comprehensive annual report will be prepared by September 1, 1978.

SAFETY

Safety practices will be the responsibility of the Project Leader and each individual participating in the project. Pertinent regulations in the Safety Requirements Handbook will be followed closely.

PERSONNEL

Robert Dewey, Project Leader
Robert Budke, Fisheries Technician

Submitted by:

Robert D. Dewey

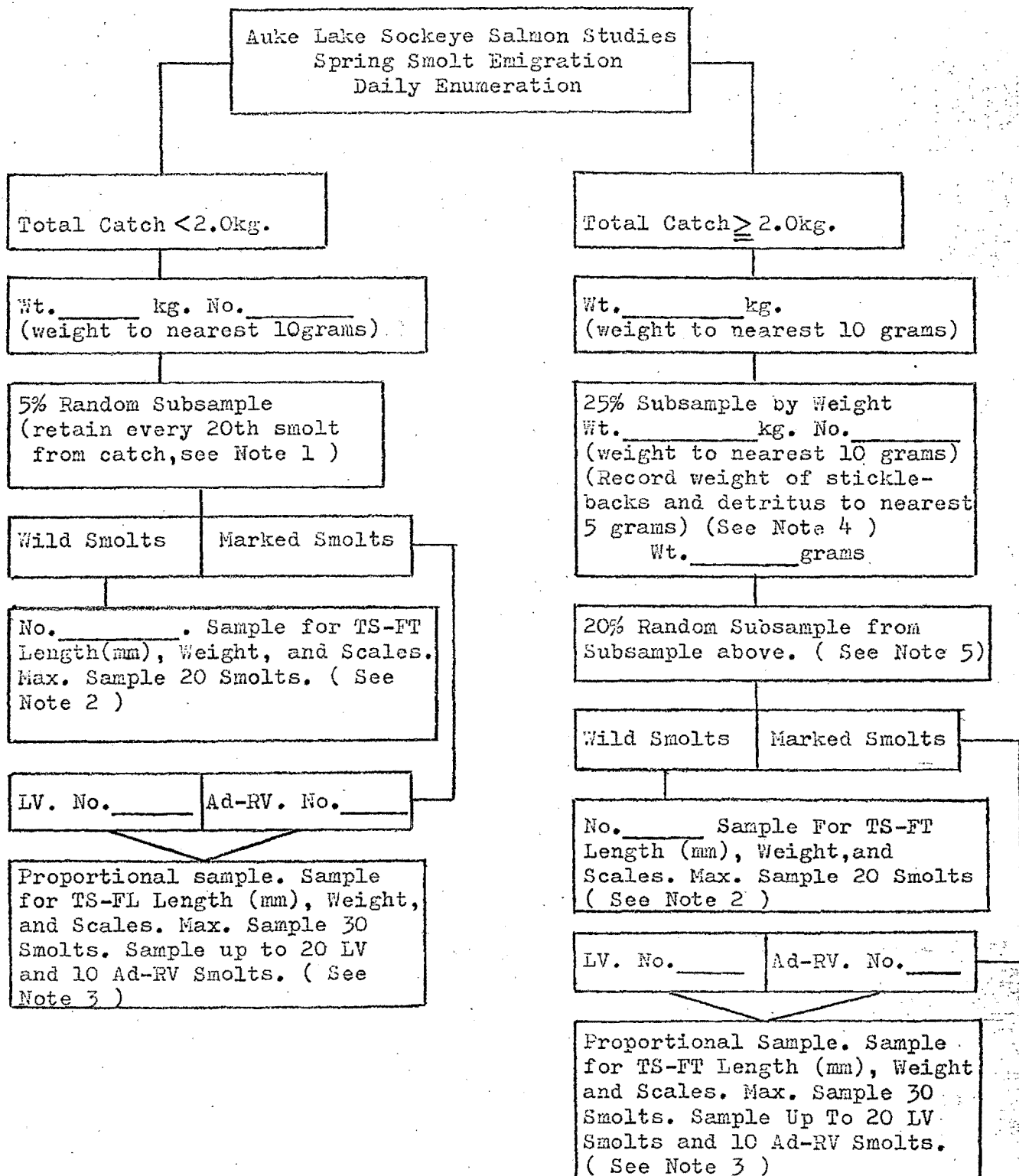
Robert Dewey, Project Leader
Fishery Research Biologist

Approved by:

William Jacobson

DAILY CATCH PROCESSING FLOW DIAGRAM
COMPLETE ONE FORM DAILY

DATE _____



GRAB SAMPLE

Wild, No. _____; LV, No. _____; Ad-RV, No. _____

NOTES

1. When enumerating a total daily catch of less than 2.0 kg of sockeye smolts, retain every 20th smolt for sample processing. This will result in a 5% sample of the smolt catch.
2. If the number of wild smolts retained is greater than 20, select 20 in a random sequence similar to the procedure for the 5% subsample above. If less than 20 smolts, process all.
3. Proportional sampling of the marked smolts is necessary to adequately allocate 1974 brood year LV marked smolts. If the number of LV marked smolts is greater than 20, select 20 for sample in random sequence as stated above. If less than 20, process all.
4. When the total daily catch of sockeye smolts is greater than or equal to 2.0 kg a 25% by weight subsample will be taken using the sample splitting net. Some minor adjustments (adding or removing a few smolts from the remainder of the catch) to the subsample may be necessary to reach the correct subsample weight. This subsample should be weighed and the smolts enumerated. Record the weight of sticklebacks and detritus in this subsample for a correction factor to be applied later to the total catch weight.
5. When enumerating the 25% by weight subsample above, retain every fifth smolt for sample processing. This will result in a 5% subsample of the total daily catch. Separate this 5% sample into wild and marked smolts and record the number of smolts in each category: wild, and LV. Processing for length, weight, and scales will be as stated in (2 and 3) above.

EXCEPTIONS

- a. If the 20% subsample results in too many smolts to process for determining the distribution of wild and marked fish, then a ten (10) percent subsample can be taken from the 25% by weight subsample. This will result in a 2.5% sample of the total daily catch. This should be a manageable number of smolts to process for distribution of wild and marked fish. Use this alternative only if total daily catch approaches 20 kg (10,000 smolts). Process for length, weight, and scales as stated in (2 & 3) above.
BE SURE TO INDICATE ON FLOW DIAGRAM IF 10% SUB-SUBSAMPLE.

Maintain the 5% subsample of the total daily catch for determination of the wild-marked fish distribution if possible. It is very important that we get a reliable estimate of the number of wild and marked smolts in the emigration.

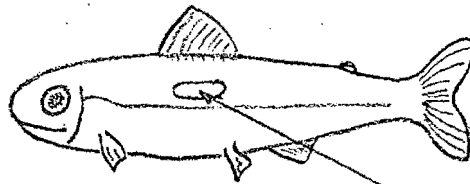
Confidence in this estimate diminishes as the sample size decreases.

GRAB SAMPLE

If time permits, take two or three grab samples each week and determine the number of wild and LV marked fish. This will serve as an index to check the composition of the wild and marked fish in the regular daily sampling. These index samples are especially important when regular samples are small (total daily catch less than 5.0 kg). Process about 200 fish for a grab sample.





Appendix 3

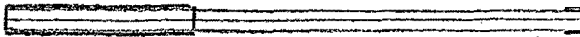
1. Scale Sampling Area on Smolt



Remove Scale Sample Here

2. Place Scale Sample on Slide and Arrange Scales

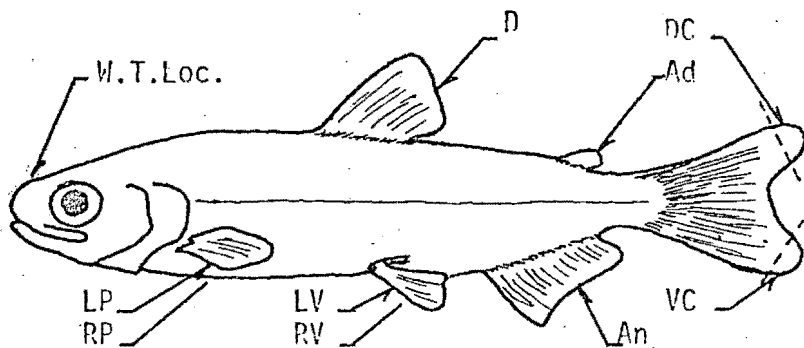
AUK LAK SOCKEYE SMOLT	MAY 3, 1977	SAMPLE	01-1-1-10					
				1	2	3	4	5
								
				6	7	8	9	10



3. Cover With Second Slide, Label Slide on Frosted End and Tape.

NATIONAL MARINE FISHERIES SERVICE

Small Fish Measurement



SPECIES _____
 LOCATION _____
 DATE _____
 SAMPLE NO. _____
 SAMPLE ORIGIN _____

FIN MARK CODES				FISH ORIGIN		WIRE TAGGED	
NO = 0	Ad = 3	LP = 6		Unknown = 0		No = 0	
RV = 1	D = 4	DC = 7	An = 9	Wild = 1		Yes = 1	
LV = 2	RP = 5	VC = 8		Hatchery = 2			

Sample Number	Fish Number	Origin	Wire Tag	Fin Mark Code	Weight gm	Fork Length mm	Age	Number of Circuli to Annulus					REMARKS
								0	1	2	3	4	
					0 0 .0 0			21	23	25	27	29	
	1												
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
	11												
	12												
	13												
	14												

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SCALE AND LENGTH DATA

Location _____ Sample No. XX Scale Card No. X

QSA-69-151