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ALASKA PENINSULA SALMON CATCH AND ESCAPEMENT SAMPLING  
1991 OPERATIONAL PLANS

By

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Alaska Department of Fish and Game  
Division of Commercial Fisheries  
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Kodiak, Alaska 99615

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FIELD MANUAL  
1991 SALMON CATCH SAMPLING  
FOR THE ALASKA PENINSULA

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March 1991

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## INTRODUCTION

The Alaska Peninsula and Aleutian Islands Management Areas commercial fishing area encompasses the Aleutian Islands, the North Alaska Peninsula west of Cape Menshikof, and the South Alaska Peninsula west of Kupreanof Point (Figures 1-8). There are approximately 444 salmon producing streams in the Aleutian Islands Area and 275 salmon producing streams in the Alaska Peninsula Area (ADF&G 1985).

Five species of salmon are commercially harvested in the Alaska Peninsula and Aleutian Islands Management Areas: chinook, sockeye, pink, chum, and coho. The average catch from 1980-89 was chinook, sockeye, pink, chum, and coho salmon. The 1990 harvest was 29,372 chinook, 4,813,534 sockeye, 3,661,830 pink, 1,361,830 chum, and 498,562 coho salmon. The fishing gear used is purse seine, drift gill net, and set gill net. During 1990, a total of 121 purse seine permits, 161 drift gill net permits, and 114 set gill net Area M permits were fished in Area M. Area T permits that fished in Area M waters included 63 drift gill net and 15 set gill net permits. The Port Heiden and Cinder River sections and the Ilnik section after July compose an overlap area between the Alaska Peninsula and Bristol Bay during May, June, August, and September. No commercial salmon fishing effort presently occurs west of Unalaska Island.

Within the Alaska Peninsula and Aleutian Islands Management Areas, the majority of the catch is from local stocks. However, there two major interception fisheries. The first is in the South Unimak (Unimak District) and the Shumagin Islands fishery, where the June sockeye catch is predominantly fish migrating to Bristol Bay, while the second occurs in the Southeast Mainland area where the majority of the sockeye are migrating to the Chignik River system.

Economically, sockeye and pink salmon are usually the primary species in the South Alaska Peninsula while sockeye and chum salmon are usually the primary species in the North Alaska Peninsula and the Aleutian Islands. In some North Peninsula fisheries, chinook and coho salmon may be more economically important than chum salmon. In 1990, the total salmon catch for both areas was 10,342,001 salmon worth approximately \$52,655,2810 ex-vessel (ADF&G 1991).

A basic function of fisheries management is to allow effort on stocks with harvestable surpluses while protecting those with returning runs below escapement requirements. Assignment of catch to river system of origin is a prerequisite for forecasting and evaluating escapement goals. In 1985, an expanded chinook, sockeye, chum, and coho salmon commercial catch sampling operation was initiated in the Alaska Peninsula Management Area for establishing a data base for separating stocks, evaluating escapement goals, forecasting, and assessing inseason run timing. The current emphasis is on sockeye and chum salmon.

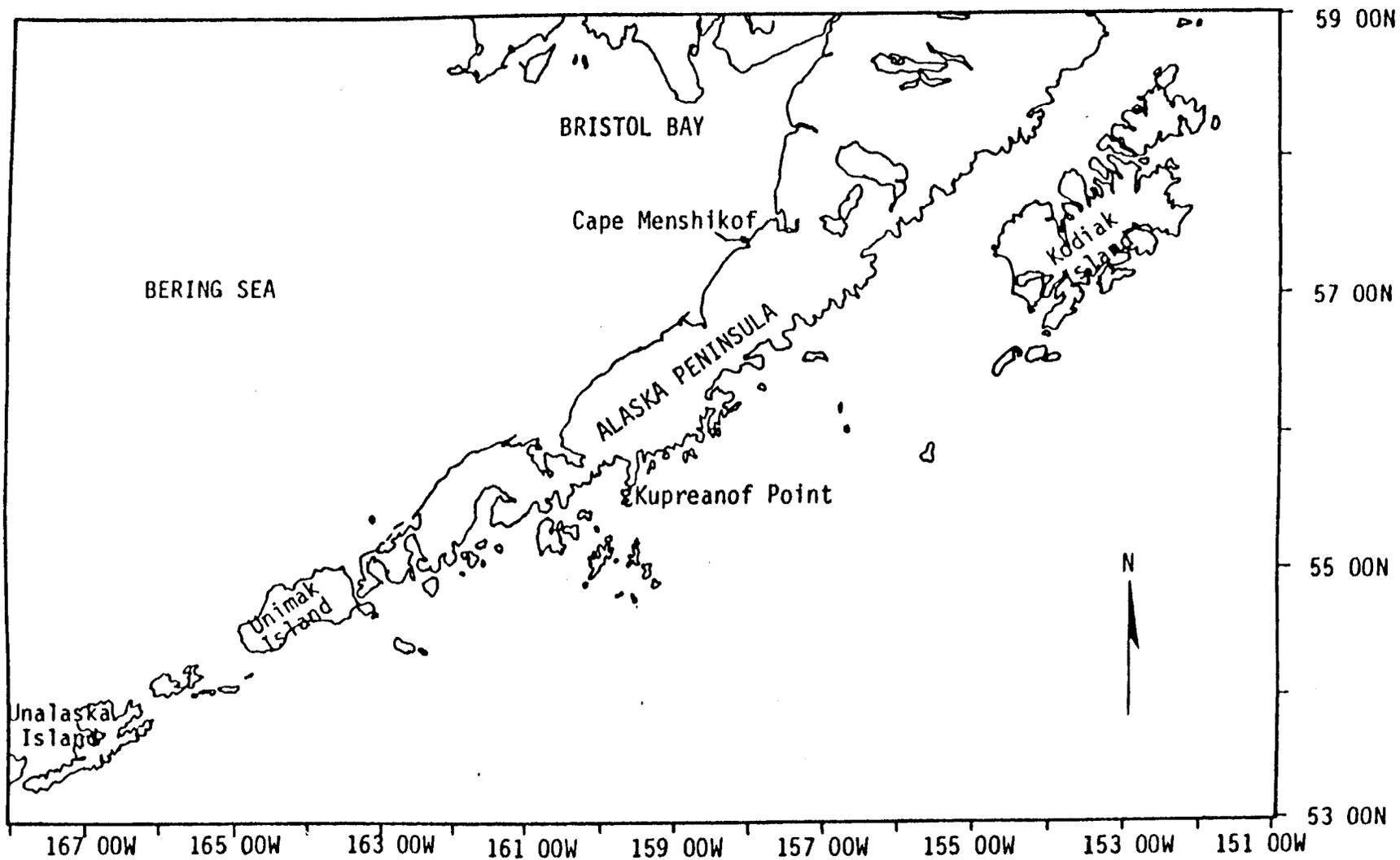


Figure 1. Map of the Alaska Peninsula and Eastern Aleutian Islands Management Areas, the study area on the Pacific Ocean portion of the map is from Kupreanof Point to Unalaska Island and on the Bering Sea from Unalaska Island to Cape Menchikof.

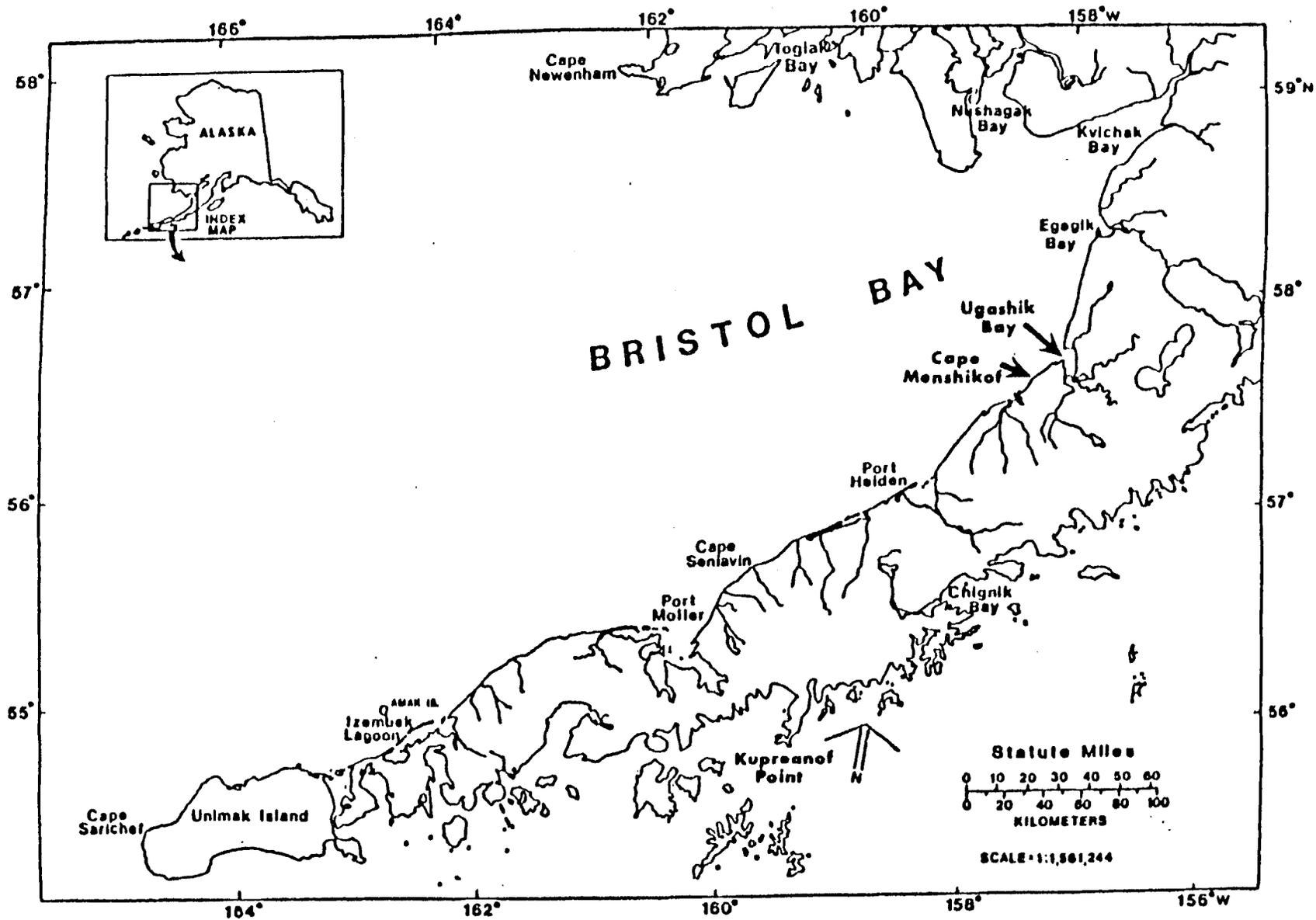


Figure 2. Map of the Alaska Peninsula Area from Kvichak Bay to Unimak Island.

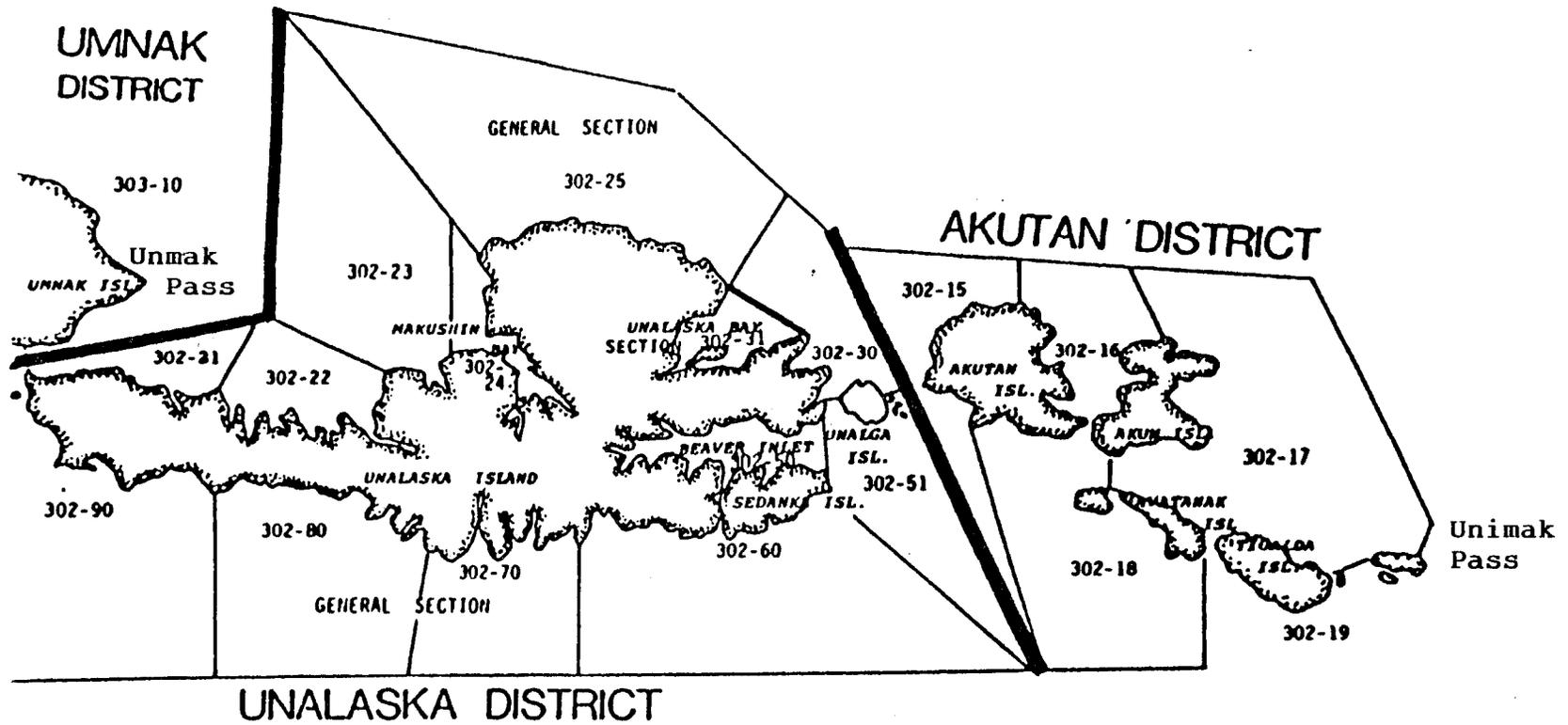


Figure 3. Map of the Aleutian Islands Area from Unmak Pass to Unimak Pass with the statistical salmon areas shown.

1991

Alaska Dept. of Fish and Game  
Alaska Peninsula Salmon Statistical Areas.

Port Moller to Cape Menshikof

This map is intended as a general guide for the fisherman, tender operators and other industry personnel. For exact descriptions of the district and section boundaries, closed waters, legal gear etc; Please consult the current issue of the Alaska Commercial Finfish Regulations for the Alaska Peninsula area. ( See chapters 09- Articles 1,2,& 9 ).

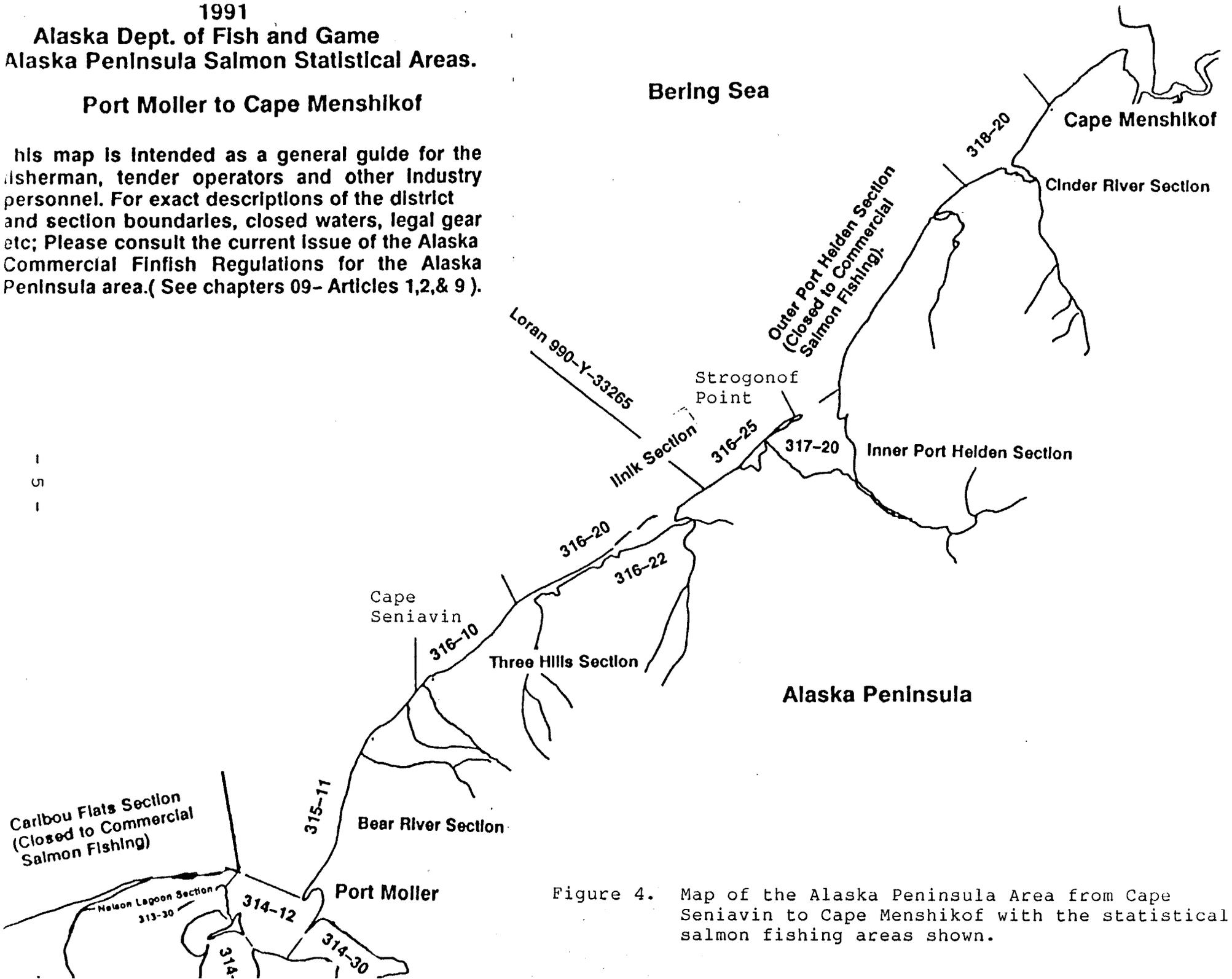


Figure 4. Map of the Alaska Peninsula Area from Cape Seniavin to Cape Menshikof with the statistical salmon fishing areas shown.

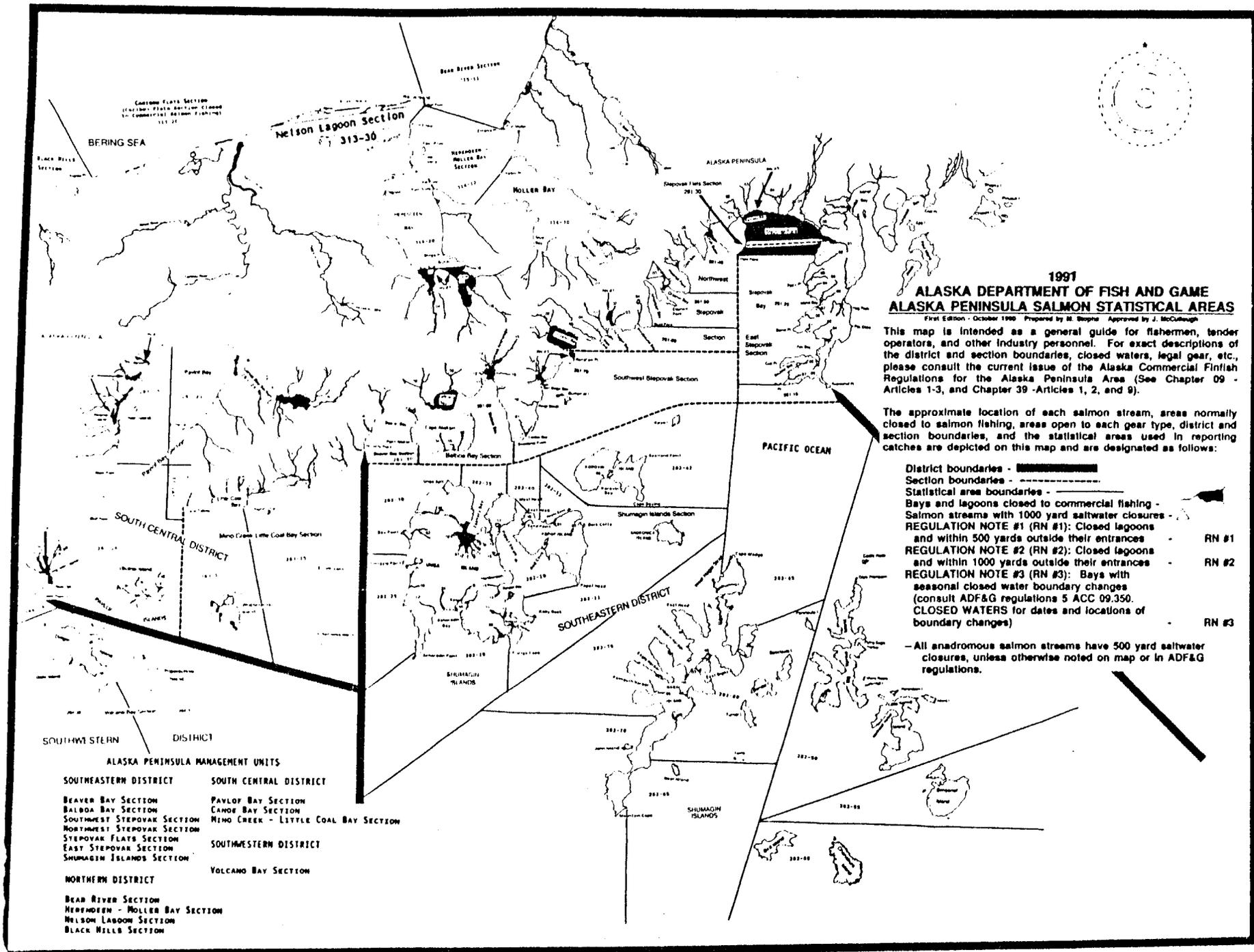


Figure 5. Map of the Alaska Peninsula Area from Arch Point to Kupreanof Point with the statistical salmon fishing areas shown.

1961  
ALASKA DEPARTMENT OF FISH AND GAME  
ALASKA PENINSULA SALMON STATISTICAL AREAS  
Map No. 1000 Proposed by M. J. R. and J. R. M.

This map is prepared as a reference guide for the fisherman and the general public. It is not intended to be used as a legal document. The boundaries shown on this map are based on the Alaska Department of Fish and Game's interpretation of the Alaska Commercial Fisheries Regulations and the Alaska Peninsular Area Code Chapter 99 Articles 1, 2 and Chapter 78 Articles 1 and 2.

The statistical division of each fishing stream into areas is made to permit the fisherman to report the catch of salmon by stream and by area. The statistical areas used in reporting catches are depicted on this map and are designated as follows:

DISTRICT BOUNDARIES ————

SECTION BOUNDARIES ————

STATISTICAL BOUNDARIES ————

RAVE AND LAGOONS CLOSED TO COMMERCIAL FISHING ————

SALMON STREAMS WITH 200 YARD SALT WATER CLOSURES ————

SALMON STREAMS WITH 1000 YARD SALT WATER CLOSURES ————

REGULATION NOTE #1 (RN#1): CLOSED LAGOONS AND MATERS WITHIN 500 YARDS OUTSIDE THEIR ENTRANCES ————

REGULATION NOTE #2 (RN#2): CLOSED LAGOONS AND MATERS WITHIN 1000 YARDS OUTSIDE THEIR ENTRANCES ————

REGULATION NOTE #3 (RN#3): BAYS WITH SEASONAL CLOSED WATER BOUNDARY CHANGES ————

(CONSULT ADF&G REGULATIONS SAC 09 350 CLOSED MATERS FOR DATES AND LOCATIONS OF BOUNDARY CHANGES)

ALL ANADROMOUS SALMON STREAMS HAVE 500 YARD SALT WATER CLOSURES, UNLESS OTHERWISE NOTED ON THE MAP OR IN ADF&G REGULATIONS.

- ALASKA PENINSULA SALMON STATISTICAL AREAS
- Northwestern District
    - Leedner-Moffet Bay Section
    - Leedner Bay Section
    - Bechev Bay Section
    - Sharonov Lagoon Section
    - Uliya Bay Section
    - Uliya Bay Section
  - North Central District
    - Leedner-Moffet Bay Section
    - Leedner Bay Section
    - Bechev Bay Section
    - Sharonov Lagoon Section
    - Uliya Bay Section
    - Uliya Bay Section
  - South Central District
    - Leedner-Moffet Bay Section
    - Leedner Bay Section
    - Bechev Bay Section
    - Sharonov Lagoon Section
    - Uliya Bay Section
    - Uliya Bay Section
  - Uliya Bay Section
    - Cape Loring Section
    - Sharonov Lagoon Section

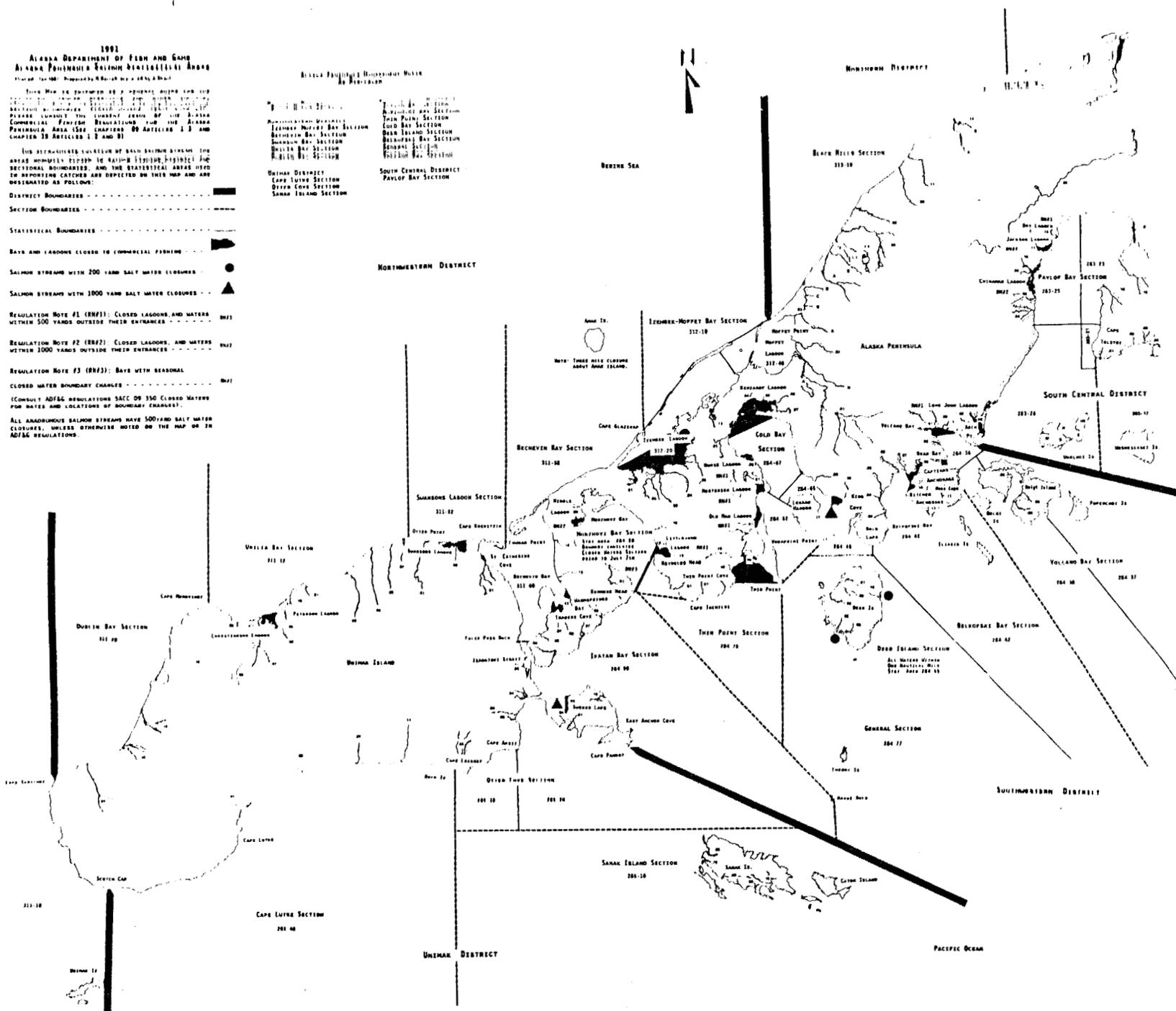


Figure 6. Map of the Alaska Peninsula from Cape Sarichef to Pavlof Bay with the statistical salmon fishing areas shown.

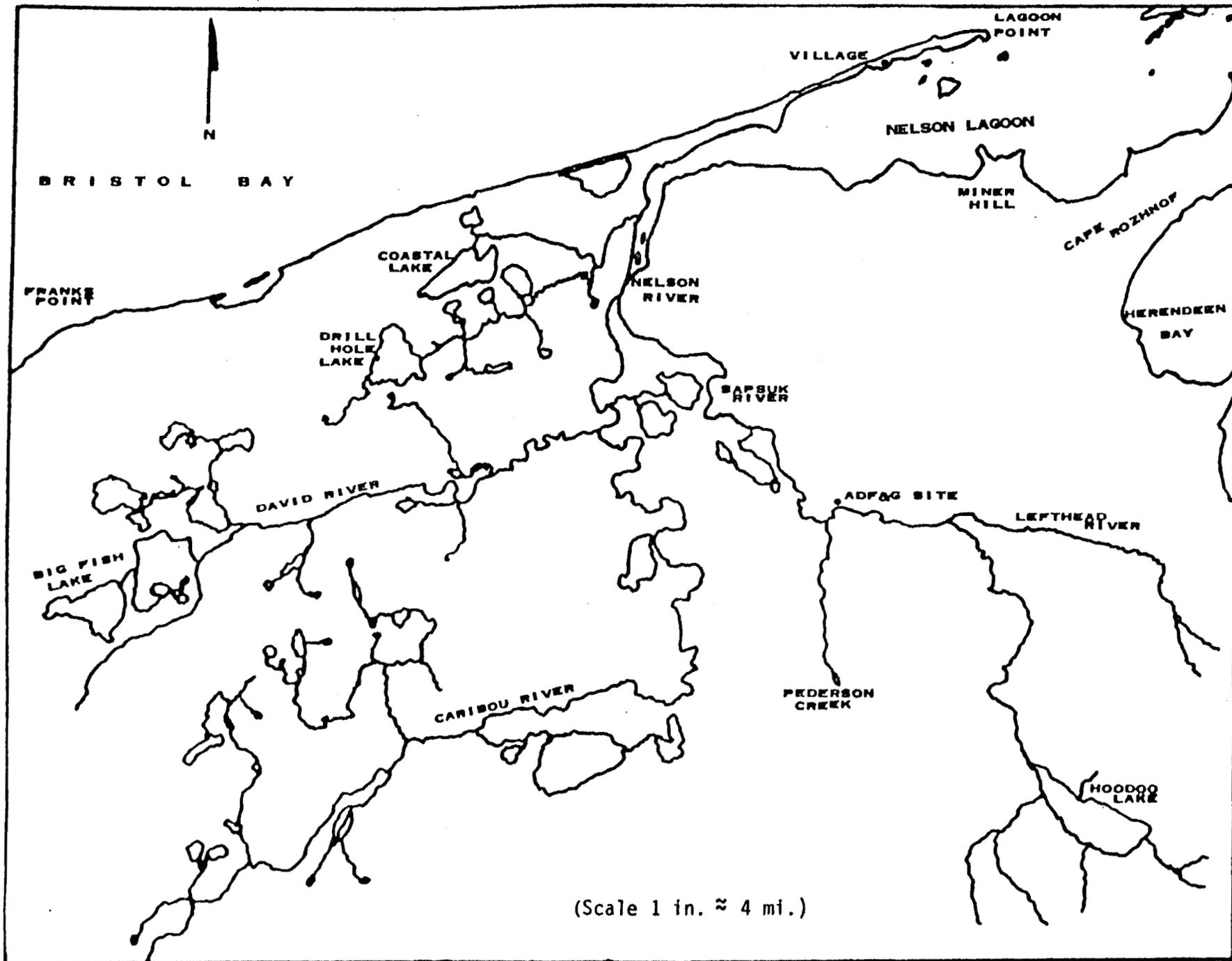


Figure 7. Map of the Nelson River drainage.

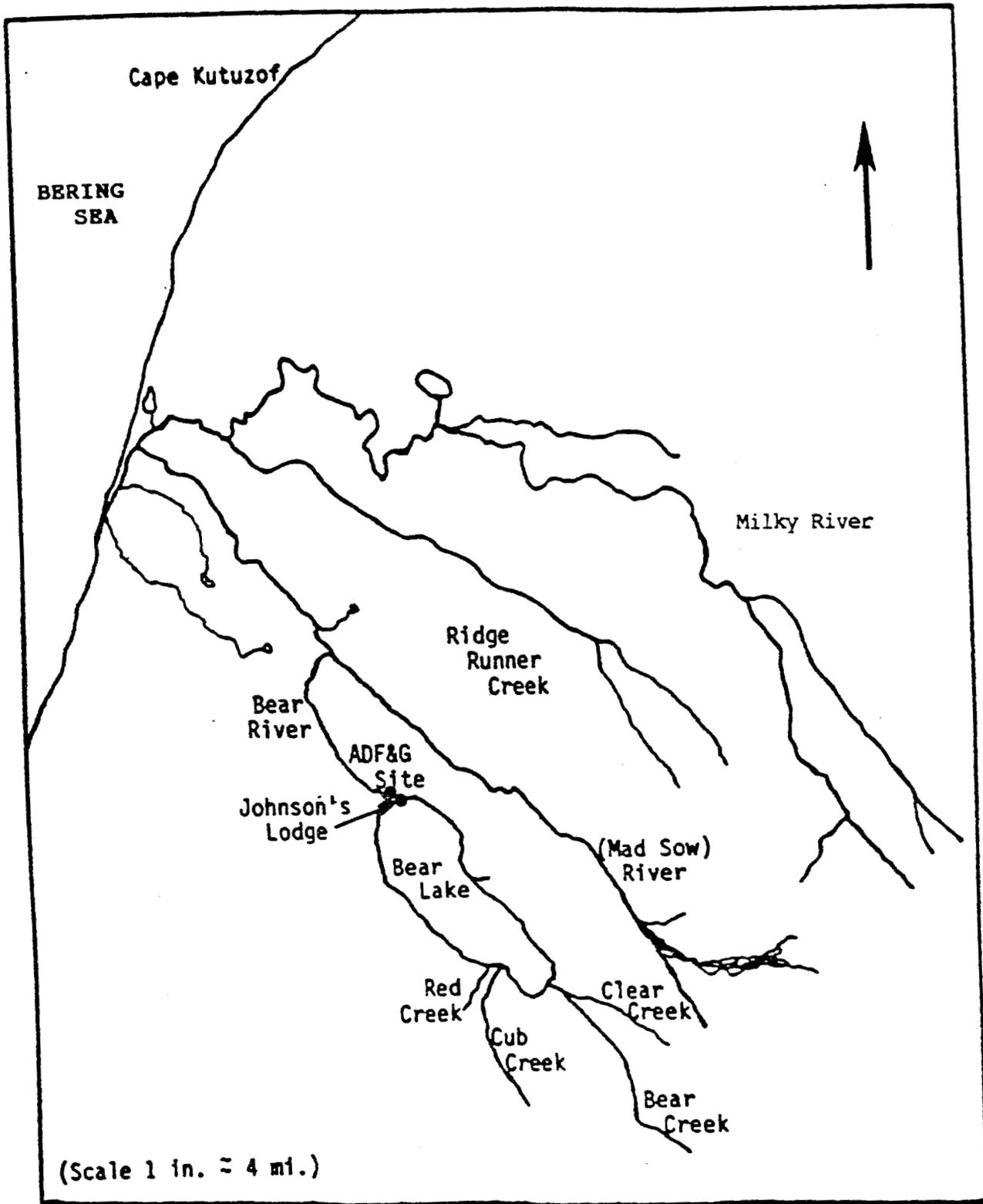


Figure 8. Map of the Bear River drainage.

## OBJECTIVES

The objective of the program is to determine the age composition in the catch of sockeye and chum salmon caught in the Alaska Peninsula fisheries and the age composition of the escapement of the major systems with a level of precision necessary for the development of brood tables for those major systems. The geographic logistical constraints particular to the area may require the definition of a major system to reflect an aggregate of spawning streams.

Long Term: Better management of the salmon resources for the Alaska Peninsula and Aleutian Islands Management Areas through improved forecasting of runs, development of stock-recruitment relationships to assess escapement requirements, and accurate assessment of stock contribution levels for mixed stock fisheries.

Short Term: Develop catch brood tables for the major sockeye and chum stocks, and determine age composition for each species of all major stocks.

1. Determine salmon catch and effort by species and statistical area (Table 1).
2. Determine the sockeye and chum sex and length composition for the major terminal fisheries within standard levels of precision.
3. Determine the chinook, sockeye, chum, and coho weight-length relationships for the terminal fisheries.
4. Determine the age composition of chinook, sockeye, chum, and coho salmon for all major stocks.
5. Establish an archive of scales suitable for analysis of stock separation in interception and mixed stock fisheries.

## SUPERVISION

The Area Research Biologist (ARB), Bob Murphy, will supervise the catch sampling crews at Port Moller and King Cove and escapement sampling at Bear Lake and Ilnik River. The ARB will be in Port Moller from approximately May 10 to September 1, and in King Cove for a short period in July to participate in and evaluate sampling operations. The ARB will monitor escapement sampling at Nelson Lagoon and Orzenoi River, and age all scales collected from these areas. The ARB will be in regular contact with the Area Management Biologist (Cold Bay), Arnie Shaul, Area Management Biologist (Sand Point), Jim McCullough, Regional Finfish Research Biologist (Kodiak), Bruce Barrett, catch sampling crews in Port Moller, King Cove, and Sand Point, and escapement sampling crews at Bear Lake and Ilnik, Orzenoi, and Nelson Rivers.

## PERSONNEL

Three person crews will be stationed to sample the commercial salmon catch for the Alaska Peninsula Management Area at Port Moller (Figure 5) and King Cove (Figure 6). Sand Point will have a two person catch sampling crew.

Port Moller personnel will consist of the (ARB), a Fishery Biologist II, PCN 11-1407 held by Robert Murphy, a Fishery Biologist I PCN 11-1433S held by Tracy McKinion, a Fishery Technician II, PCN 11-1906S held by Eugene McQueen, and a Fishery Technician II PCN 11-1776S held by Meesha Mangiaracina.

Table 1. Districts, sections, and statistical areas for the Alaska Peninsula and Aleutian Islands Management Areas, 1991.

Fishing Area Location	Statistical Areas
<b>SOUTH PENINSULA</b>	
Southeastern District	
Southeast District Mainland	281-70,80,90
Shumagin Island Section	282-10,11,20,25,30,35,40,42
Southcentral District	
Canoe Bay	283-24
Pavlof Bay	283-23,25
Southwestern District	
Volcano Bay	284-36
Belkofski Bay	284-42
King Cove	284-65
Cold Bay	284-62,65,67
Deer Island	284-55
Thin Point	284-75
Morzhovoi Bay	284-20
Ikatan Peninsula to Cape Lazaref	284-90,285-20,30
Unimak District	
Cape Lutke	285-40
<b>ALEUTIAN ISLANDS AREA</b>	
Unalaska District	302-22
<b>NORTH PENINSULA</b>	
Northwestern District	
Urilia Bay	311-32
Swanson Lagoon	311-52
Bechevin Bay	311-60 (Post-June catch)
Izembek-Moffet Bay Section	312-10; 312-20; 312-40
Northern District	
Black Hills Section	313-10
Nelson Lagoon Section	313-30
Herendeen Bay	314-20

-Continued-

Table 1. (page 2 of 2)

Fishing Area Location	Statistical Areas
Northern District (continued)	
Harbor Point to Cape Seniavin	314-12; 315-11; 315-20
Cape Seniavin to Strogonof Point	316-10; 316-20; 316-22; 316-25
Outer Port Heiden Section	317-10
Inner Port Heiden Section	317-20
Cinder River Section	318-20

King Cove personnel will consist of a Fishery Biologist I, PCN 11-1352S held by Mark Weinberger, a Fishery Technician II, PCN 11-1611S presently vacant, and a Fishery Technician II, PCN 11-1467S held by Gregory Gregg. Sand Point will consist of a Fishery Technician III, PCN N792, and Fisheries Biologist I, PCN N791.

#### *Dates of Sampling Events*

The Port Moller sampling crew is expected to begin collection of age composition data on 3 June or 4 June, when fish become available during the standard Monday through Thursday commercial fishing period, and complete sampling on approximately 12 September. The Port Moller crew will be responsible for catch sampling the commercial fisheries on the North Peninsula and possibly the South Peninsula commercial catch, if delivered to Port Moller and unavailable to the sampling crew in King Cove.

The King Cove sampling crew is expected to begin collection of Age-Weight-Length (AWL) data on 2 July or 3 July when fish become available and complete sampling about 12 September. The June sampling at King Cove may not be conducted in 1991 because of the lack of funding. The King Cove crew will be responsible for catch sampling the commercial fisheries on the South Peninsula, primarily the South Unimak, Shumagin Islands, Southeast Mainland area, and Uria Bay, as well as North Peninsula catches that are unavailable to the sampling crew at Port Moller. Sampling of the Shumagin Islands and Southeast Mainland will occur in King Cove if the fish were not available in Sand Point.

Sampling in Sand Point will be conducted from July 1 through September 10. The primary duty in Sand Point is to sample the Southeast Mainland and Shumagin Islands Sections. If a weekly sample from these sections can not be collected, the Sand Point crew must immediately notify the King Cove crew so they may obtain the sample. All openings in the South Peninsula are by emergency order, and therefore, no strict sampling schedule can be followed.

#### **BUDGET**

The FY91 remaining budget will be sufficient to operate the project through 30 June 1991. The FY92 budget, if approved, will be sufficient to implement the Port Moller sampling crew from 1 July through 31 August 1991 and from 1 June through 30 June 1992, while the King Cove sampling crew from 1 July through 25 August 1991 and from 8 June through 30 June 1992, and Sand Point from July 1 through September 10.

#### **METHODS**

Samples from the designated areas are to be representative. To ensure that this occurs, mixed loads from multiple areas will not be sampled nor will there be any pre-selection of fish for length, sex, or condition. The tender schedules and locations will allow the sampling of pure loads obtained from the separate areas. To ensure that samples are not missed the crews will begin sampling the first day the respective species catches are delivered from the designated sampling areas for each week (Sunday to Saturday). If the sampling crew believes that there is a high probability of collecting samples from the same area on more than one occasion during a week, the crew should try to collect the sample over the entire week. If it is doubtful as to whether or not another sample can be collected later in the week, the crew should collect all the samples when they

are first available. Additional sampling may occur at Canoe and Urilia Bay. It is important to determine where the tenders have loaded fish. With the set gill net fishery on the South Peninsula, the tenders run a circuit to the sites. On the South Peninsula, the tenders land in both Sand Point and King Cove, with the majority landing in King Cove. The accurate identification of area of catch for each tender will allow terminal purse seine chum (and one sockeye) catch area to possibly be used as escapement sampling.

Specific procedures for collecting and recording salmon age (scales) are in Appendix A and B. The accuracy of the data is the responsibility of the crew leaders. All questions concerning collection procedures should be brought to the attention of the ARB at the first available opportunity. The ARB is available via radio or telephone.

Sample sizes are statistically derived to include necessary criteria to address problems that may affect the accuracy and precision of age composition work or stock composition methodologies. Catch sampling crews will be collecting 600 samples/period/area for chinook, sockeye, and coho salmon, and 440 samples/period/area for chum salmon, except from Nelson Lagoon where 600/samples/period/area will be collected.

A sample size of 600 or 440 fish/species/period/area is the maximum. The maximum may not always be available, especially for small local runs and early and late in the season. Do not sample an area unless at least 75 fish can be sampled for a given species during a period. The exceptions to this rule would be for a run such as Thin Point Lake sockeye, or other areas where ADF&G has limited knowledge about the run. When deliveries are mixed between two or more fishing areas, it is best to wait for another tender with a pure load of salmon before sampling. Some areas may never have a pure load (i.e. Swanson Lagoon). For these areas, try to sample the fish when deliveries are 90% or more from one area (mark the percent of each fishing area on the top of each AWL form). Areas that will never be greater than 90% pure (i.e. Catherine's Cove), sample as time permits. Future analysis of the data will take the mixture into consideration.

All original samples taken in Port Moller will remain with the ARB. Scale samples from catch and escapement sampling will be aged by the ARB inseason. Periodically, samples collected in King Cove, or elsewhere, will be sent to Port Moller. To ensure safe delivery of data, notify the crew leader before and following the sending of data. To ensure safe delivery notify the crew leader: 1) that the data is being mailed (use a secure moisture proof container); 2) what data is being sent; 3) when delivery is expected in Port Moller; and 4) who is transporting the data. The crew leader at King Cove will maintain a log book of all outgoing catch samples. It is imperative that every precaution be taken to ensure the safe delivery of the samples to Port Moller.

Sockeye and chum sampling are the top priorities during all periods from the specified fishing areas. Chinook and coho salmon will also be sampled as time allows.

The King Cove crew will be responsible for pressing all scales that are collected in King Cove and Sand Point, and the Port Moller crew will be responsible for pressing all scales collected in any other location, unless otherwise instructed differently. The ARB and a trained assistant will read all scales collected in-season.

All crews will sample the first day of each period as the salmon become available. For each AWL sample, scales from the preferred area will be taken and as defined in Appendix A and B.

Weight sampling of salmon will occur in major fisheries when requested by the Area Management Biologists. Samples will be randomly selected so that they are representative of the harvest.

Length sampling of salmon will be limited to terminal fisheries where escapement sampling at a weir is not conducted, and, if sampling occurs, in the South Unimak-Shumagin Island June fishery (Table 2 and Table 3). In terminal catches, where no weirs are present, the standard 600 lengths (for sockeye and 440 for chum salmon) per week will be maintained to provide an adequate sample of the younger age fish for forecasting.

All crews should report all fin clipped and tagged fish. For chinook salmon having a clipped adipose fin, the head should be sealed in plastic, frozen, and sent to Andy McGregor, ADF&G, Juneau, Alaska, 99824. Catch location, catch date, gear type, species, tag number, type of tag, length, weight, and several scales from the preferred area should be included with the catch report.

Crews are to anticipate supply shortages in-season and to notify the ARB before the supplies are exhausted. Each crew leader will keep a daily log book of activities. A report from each crew leader outlining problems encountered and solutions, as well as any suggestions for the project should be turned into the ARB at the end of the season along with an equipment list and place of storage.

Appendix C contains general equipment, cabin maintenance, and crew policy.

Appendix D contains information on first aid and safety.

Equipment, food, and other items remaining at the end of the season will be sent to Cold Bay, Port Moller, Sand Point, or Kodiak for winterization; contact the ARB for winterization arrangements.

The responsibility of proper identification of catch area will be a necessary component of the dockside catch sampling crew.

#### *South Unimak and Shumagin Islands, June*

If sampling occurs during June, a fishing period will be defined as any opening. For sockeye salmon, a 200 fish sample will be taken from each additional opening that may occur within a period. The openings are established by the Area Management Biologists in Cold Bay and Sand Point. For all other areas and times, the period (week) goes from Sunday to Saturday. A sample size of 600 sockeye and 440 chum salmon for each period in each fishing area will be obtained to ensure that the sample is representative of the catch. The King Cove crew leader will supply the Bristol Bay staff (if sampling occurs) at King Salmon with a sample of 200 sockeye salmon scales from each fishing period for the June South Unimak and Shumagin Islands Section fisheries. The samples sent to King Salmon will be copies of AWL forms and the second pressing of the scales. The data will be mailed as soon after collection as possible. The individual responsible for

Table 2. Sockeye salmon catch sampling schedule for the Alaska Peninsula and Aleutian Islands Management Areas, 1991.<sup>a</sup>

Crew	SAMPLING AREA				SAMPLE			
	District/Section	Geographic Area	Statistical Area(s)	Season	Freq.	Size	Data	Fishery
Port Moller	Northern District:							
	Nelson Lagoon Section	Nelson Lagoon	313-30	5/1-9/30	Weekly	600	AL <sup>b</sup>	Terminal
	Bear River Section	Harbor Point to Cape Seniavin	314-12,315-11,20	5/1-9/30	Weekly	600	Scales	Mixed
		Cape Seniavin to Strogonof Point	316-10,20,22,25	6/25-9/30	Weekly	600	Scales	Mixed
	Ilnik Section	Ilnik Lagoon	316-22	5/1-9/30	Weekly	600	AL	Terminal
	Outer Port Heiden Section	Outer Port Heiden	317-10	8/1-9/30	Weekly	600	Scales	Mixed
	Inner Port Heiden Section	Inner Port Heiden	317-20	5/1-9/30	Weekly	600	AL	Terminal
King Cove	Northwestern District:							
		Urilia Bay	311-32	6/1-8/10	Weekly	600	AL	Terminal
	Southeastern District:							
	Southeast District Mainland	Beaver and Balboa Bays, Stepovak	281-70,80,90	6/1-9/30	Weekly	600	Scales	Mixed
	Shumagin Is. Section	Shumagin Islands	282-10,11,20,25,30,35, 40,42	7/1-8/30	Weekly	600	Scales	Mixed
	Southcentral District:							
		Long Beach	283-15	6/1-9/30	Weekly	600	Scales	Mixed
		Cape Tolstoi	283-21	6/1-9/30	Weekly	600	Scales	Mixed
		Canoe Bay	283-24	6/1-9/30	Weekly	600	Scales	Mixed
		Pavlof Bay	283-23,25	6/1-9/30	Weekly	600	Scales	Mixed
Southwestern District:								
Thin Point Section	Thin Point Lagoon	284-75	6/1-9/30	Weekly	600	AL	Terminal	
	Morzhovoi Bay	284-20	6/1-9/30	Weekly	600	AL	Terminal	

-Continued-

Table 2. (page 2 of 2)

Crew	SAMPLING AREA				SAMPLE			
	District/Section	Geographic Area	Statistical Area(s)	Season	Freq.	Size	Data	Fishery
King Cove	Unimak District:	Cape Lutke	285-40	6/1-9/30	Weekly	600	AL	Mixed
		Ikatan Peninsula to C. Lazaref	284-90,285-20,30	6/1-9/30	Weekly	600	Scales	Mixed
	Unalaska District	Aleutian Islands Management Area	302-	6/1-9/30	Weekly	600	Scales	Mixed

<sup>a</sup>Follow the same sampling schedule for chinook and coho from the designated areas. However, collect only scales from coho. Take both scales and lengths from chinook. Often it will not be possible to collect weekly samples from all the areas, but if samples are available they need to be collected.

<sup>b</sup>Collect scale samples (age data), lengths, and sex data.

Table 3. Chum salmon catch sampling schedule for the Alaska Peninsula and Aleutian Islands Management Areas, 1991.<sup>a</sup>

Crew	SAMPLING AREA				SAMPLE				
	District/Section	Geographic Area	Statistical Area(s)	Season	Freq.	Size	Data	Fishery	
Port Moller	Northern District:								
	Nelson Lagoon Section	Nelson Lagoon	313-30	5/1-9/30	Weekly	600 <sup>b</sup>	AL <sup>c</sup>	Terminal	
	Moller/Herendeen Bay Section	Herendeen Bay	314-20	5/1-9/30	Weekly	440	AL	Terminal	
	Bear River Section	Harbor Point to Cape Seniavin	314-12, 315-11, 20	5/1-9/30	Weekly	440	Scales	Mixed	
Cape Seniavin to Strogonof Point		316-10, 20, 22, 25	6/25-9/30	Weekly	440	Scales	Mixed		
King Cove	Northwestern District:								
	Izembek-Moffet Bay Section	Izembek-Moffet Bay	312-10, 20, 40	6/1-8/10	Weekly	440	AL	Terminal	
		Swanson Lagoon	311-52	6/1-8/10	Weekly	440	Scales	Mixed	
	Southeastern District:								
	Southeast District Mainland	Beaver and Balboa Bays, Stepovak	281-70, 80, 90	6/1-9/30	Weekly	440	Scales	Mixed	
				6/1-9/30	Weekly	440	Scales	Mixed	
	Shumagin Is. Section	Shumagin Islands	282-10, 11, 20, 25, 30, 35, 40, 42	6/1-9/30	Weekly	440	Scales	Mixed	
	Southcentral District:								
	Coal Bay	Canoe Bay	Pavlof Bay	283-17	6/1-9/30	Weekly	440	Scales	Mixed
				283-24	6/1-9/30	Weekly	440	Scales	Mixed
				283-23, 25	6/1-9/30	Weekly	440	Scales	Mixed
Southwestern District:									
Volcano Bay		284-36	6/1-9/30	Weekly	440	Scales	Mixed		
Belkofski Bay		284-42	6/1-9/30	Weekly	440	AL	Terminal		
Cold Bay		284-62, 65, 67	6/1-9/30	Weekly	440	Scales	Mixed		
Morzhovoi Bay		284-20	6/1-9/30	Weekly	440	AL	Both		

-Continued-

Table 3. (page 2 of 2)

Crew	SAMPLING AREA			Season	SAMPLE			
	District/Section	Geographic Area	Statistical Area(s)		Freq.	Size	Data	Fishery
King Cove	Unimak District:	Cape Lutke	285-40	6/1-9/30	Weekly	440	AL	Mixed
		Ikatan Peninsula to C. Lazaref	284-90,285-20,30	6/1-9/30	Weekly	440	Scales	Mixed

<sup>a</sup>Follow the same sampling schedule for chinook and coho from the designated areas. However, collect only scales from coho. Take both scales and lengths from chinook. Often it will not be possible to collect weekly samples from all the areas, but if samples are available they need to be collected.

<sup>b</sup>Collect 600 scale samples from Nelson Lagoon.

<sup>c</sup>Collect scale samples (age data), lengths, and sex data.

age and length analysis at King Salmon will be notified by telephone of each data packet being sent.

#### **DATA ANALYSIS AND REPORTING**

The age composition and associated standard errors will be computed for all samples. A Regional Information Report and Technical Fisheries Report will be completed for the 1991 season.

Prior to 1 May 1992 the ARB will author a Technical Fisheries Report and a Regional Information Report, which covers the results of the 1991 catch sampling season.

ADF&G is attempting to separate sockeye stocks in mixed stock fisheries. North Peninsula sockeye fisheries from Port Moller to Strogonof Point and escapement samples of sockeye scales and completed Opscan Forms will be sent to Kodiak where the scales will be digitized prior to the 1991 Board of Fisheries Meeting in the fall. The ARB will work with Charlie Swanton (ADF&G, Kodiak) to develop models which may allocate the catch to the system of origin for sockeye salmon. A Regional Information Report for 1991 will be completed by May 1992, and a report to the Board of Fisheries completed by November, 1991.

## LITERATURE CITED

- ADF&G (Alaska Department of Fish and Game). 1985. An atlas to the catalog of waters important for spawning, rearing or migration of anadromous fishes. Southwestern Region, Resource Management, Region III. Division of Habitat, Anchorage, Alaska.
- Shaul, A.R., J.N McCullough, A. Quimby, M. Stopha, and R. Berceili. 1991. 1990 Alaska Peninsula and Aleutian Islands Areas annual salmon and herring management report. Regional Information Report *In Press*, Alaska Department of Fish and Game, Division of Commercial Fisheries, Region IV Report, Kodiak.

APPENDIX A

Alaska Peninsula Scale Sampling Technique

## ALASKA PENINSULA SCALE SAMPLING TECHNIQUE

If you have not taken scales before or if you have any questions ask somebody who has prior experience in the sampling procedure. Scales must be readable to be useful, so follow proper techniques when sampling.

### Important Points to Remember

#### Gum Cards

A scale card is a gum-backed sheet numbered 1 through 40. Samples are placed on the cards with no attempt to separate the fish by their sex.

It is important to keep the gum card dry at all times. If weather does not allow you to do this it is best to suspend sampling until dryer conditions prevail. A wet gum card is useless as the scales will fall-off before a readable impression can be made.

A new scale card is started for each day. Even if a card is not filled a new card is still to be started for each day. Also, a different card is to be used for each location, i.e. Nelson Lagoon vs. Herendeen Bay. It is important that scale cards and numbers match the corresponding AWL sheet.

#### Scales

1. Clean the scale by wetting it and rubbing it between your fingers. Make sure no dirt, slime and skin (no silver color) remain on the scale.
2. Mount the scale on the gum card with the ridged side up. The ridged side is the same side that is exposed on the salmon.
3. One scale will be taken from sockeye and chum. Three scales will be taken from chinook salmon, and four scales from coho salmon.
4. Take the preferred scale if it is available, if not available take a scale but note on the AWL form that it is not preferred.
5. Scales should be neat, clean, and orderly.

#### Age-Weight-Length (AWL) Sampling Form

- Age - Scale samples are taken for age.  
Weight - Taken to nearest tenth of a kilogram on any adult fish not being returned live to the water (if required).  
Length - Taken with the fish laying flat from the mid-eye point to the fork of the tail (if required). Measure to the nearest millimeter.

\*\* Fill in all information on the AWL form.

\*\* Each AWL form should match up with the appropriate scale card.

APPENDIX B

Completion of Mark-Sense AWL Forms

Length, Sex, and Scale Sampling Procedure for Sampling:  
Using Mark-Sense Forms

INTRODUCTION

Salmon from terminal catches are sampled for length, sex, and scales annually. This data base is essentially used to provide sound management of the salmon resources. This information is used by management and research biologists for: (1) forecasting run strengths; (2) setting escapement goals; (3) examining the productivity of each system; (4) salmon growth analysis; (5) catch apportionment (based on age composition and/or scale pattern analysis); (6) in-season run estimation; and (7) to gain a better understanding of the biology of each stock.

For clarification purposes, a SCALE SAMPLE and SUB-SAMPLE will be defined as follows:

SCALE SAMPLE: A data set collected from a specific sampling location, containing scales and data from a single species, collected during a single year. All data forms and scale cards of a single SAMPLE have the same statistical code. AWL and scale card number in a sample are consecutively and chronologically ordered.

SUB-SAMPLE: Any portion of a scale sample consisting of consecutively numbered AWL's and scale cards. SUB-SAMPLES usually consist of one or more time segments of a sample.

To be useful, data must be recorded on the mark-sense forms neatly and accurately. The following procedures are to be followed when sampling for length, sex, and scales using mark-sense AWL forms.

COMPLETING THE FORMS:

A completed mark-sense AWL form and accompanying gum card for sampling commercial catches of sockeye and chum salmon are shown in Appendix B.1. A completed AWL form and accompanying gum cards for sampling commercial catches of chinook and coho salmon is shown in Appendix B.2 and B.3.

Complete each section of the left side of the mark-sense form using a soft No. 2 pencil and darken the corresponding blocks as shown in the figures. Make every effort to darken the entire block as partially filled blocks are often missed by the optical scanner which reads and records the data from the mark-sense AWL forms. If the blocks are not darkened properly, considerable time will be required to edit these forms during the winter. Label only one form at a time to avoid "the carbon paper effect" and resulting stray marks.

Description:

For catch sampling: Area/Samplers (name and Wrestler, Recorder, Plucker (WRP))

Gum Card:

The AWL forms and corresponding gum card(s) are numbered sequentially by date throughout the season starting with 001 for each fishery. A separate numbering sequence will be used for each species, gear type, district, and geographic location. Consult your crew leader for the current card number. Sockeye and

Species: Sockeye Locality: Nelson Lagoon

Samplers: W. Tracy McKinnon  
P. Joann Mitchell  
R. Jim McCullough

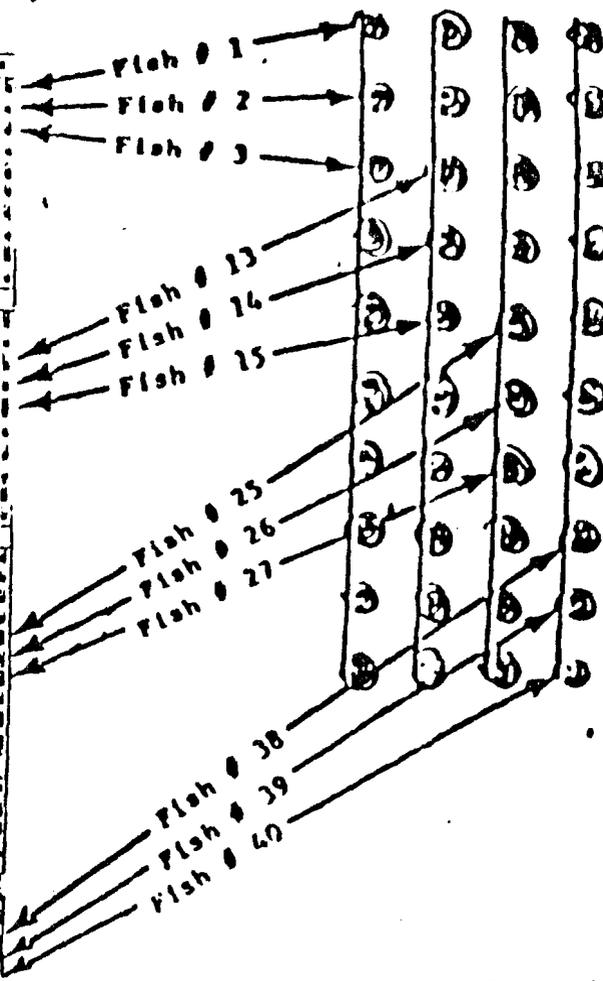
Scale readers: Tracy McKinnon  
 ADULT ADULT SALMON AGE LENGTH  
 FOAM VERSION 2.1

DO NOT WRITE IN THIS MARGIN

1029201

CALL#	083	100%	LENGTH	1%	AGE GROUP	AGE LENGTH CODE
NEEDLES	2					
DATE COLLECTED	26					
NUMBER	6					
YEAR	87					
DISTRICT	313					
SUBDISTRICT	30					
STREAM						
LOCATION	Port Moller					
PERIOD	26					
PROJECT	1					
GEAR	1					
MESH						
TYPE OF LENGTH MEASUREMENT	2					
NUMBER BLADES/FISH	1					
NO. OF CARDS	1					

EXAMPLE



Appendix B.1. Example of AWL and gum cards for sampling one scale per fish.

Species: Sockeye Card No 083  
 Locality: Nelson Lagoon Catch  
 Stat. Code: 313-30-  
 Sampling Date: Mo. 6 Day 26 Year 87  
 Gear: Purse Seine  
 Collector(s): McCullough, Mitchell, McKinnon  
 Remarks: \_\_\_\_\_





chum samples will have only 1 card per AWL form as shown in Appendix B.1. Coho and chinook samples will contain up to four cards per AWL form as shown in Appendix B.2 and B.3.

**Species:**

Refer to the reverse side of the AWL form for the correct digit.

**Day, Month, Year:**

Use appropriate digits for the date the fish are caught, not the date that they are processed.

**District:**

List only one district. Consult project leader for appropriate district and subdistrict numbers.

**Subdistrict:**

List a single subdistrict if it is known and all the fish sampled were from that single subdistrict. Leave it blank if more than one subdistrict is involved or if the subdistrict is unknown.

**Stream:**

Leave blank for catch sampling.

**Location:**

For catch sampling list the appropriate port code (Appendix B.4).

**Project:**

Refer to the reverse side of the AWL form for the correct code.

**Gear:**

Refer to the reverse side of the AWL form.

**Mesh:**

Leave blank unless specifically instructed by supervisor to do otherwise.

**Type of length measurement:**

Use (2) mid-eye to fork-of-tail (unless specifically instructed to do otherwise). Refer to Appendix B.5.

**# of cards:**

Mark 1 when sampling sockeye and chum salmon (Appendix B.1). Mark 1A, 1B, 1C, or 1D when sampling chinook and coho salmon and write the card numbers perpendicular to the left of the fish # column as shown in Appendix B.2.

It is extremely important to keep the mark-sense forms flat, dry, and clean. Fish slime and water curling will cause data to be misinterpreted by the optical scanning reader machine. If unnecessary pencil marks, dark spots, etc. are visible, they need to be erased or else the machine will misinterpret the mark. It is necessary to completely fill in all information and darken the boxes (if needed) after each day.

Additional data columns are available on the reverse of the AWL for individual project use. If you take weights, you need to transfer the dark boxes on the

Appendix B.4. Assigned port and weir location codes.

---

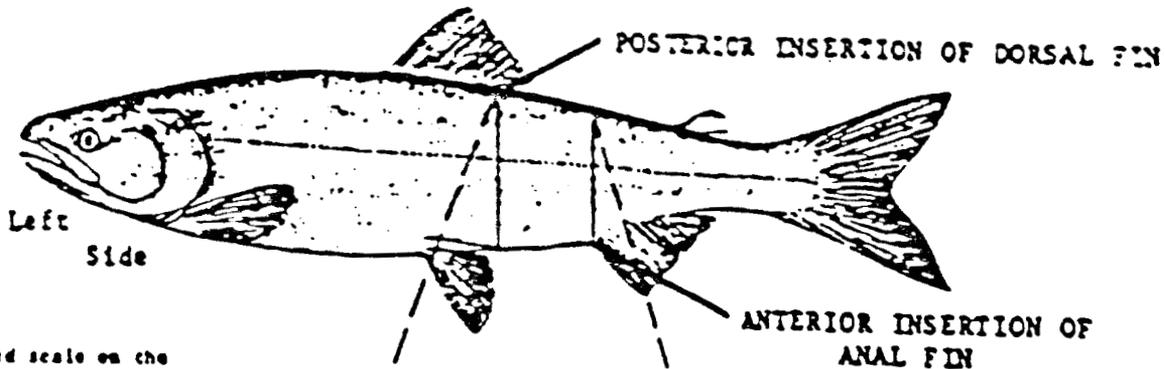
Port Codes

---

150 - King Cove  
151 - Port Moller  
152 - Dutch Harbor  
153 - Akutan  
154 - Sand Point  
155 - Bear River, ADF&G Camp  
156 - Nelson River, ADF&G Camp  
157 - Canoe Bay  
158 - Ilnik Lagoon, ADF&G Camp  
159 - Sandy Lake  
160 - Thin Point Lake  
161 - Urilia Bay  
162 - Middle Lagoon  
163 - Orzenoi River, ADF&G Camp

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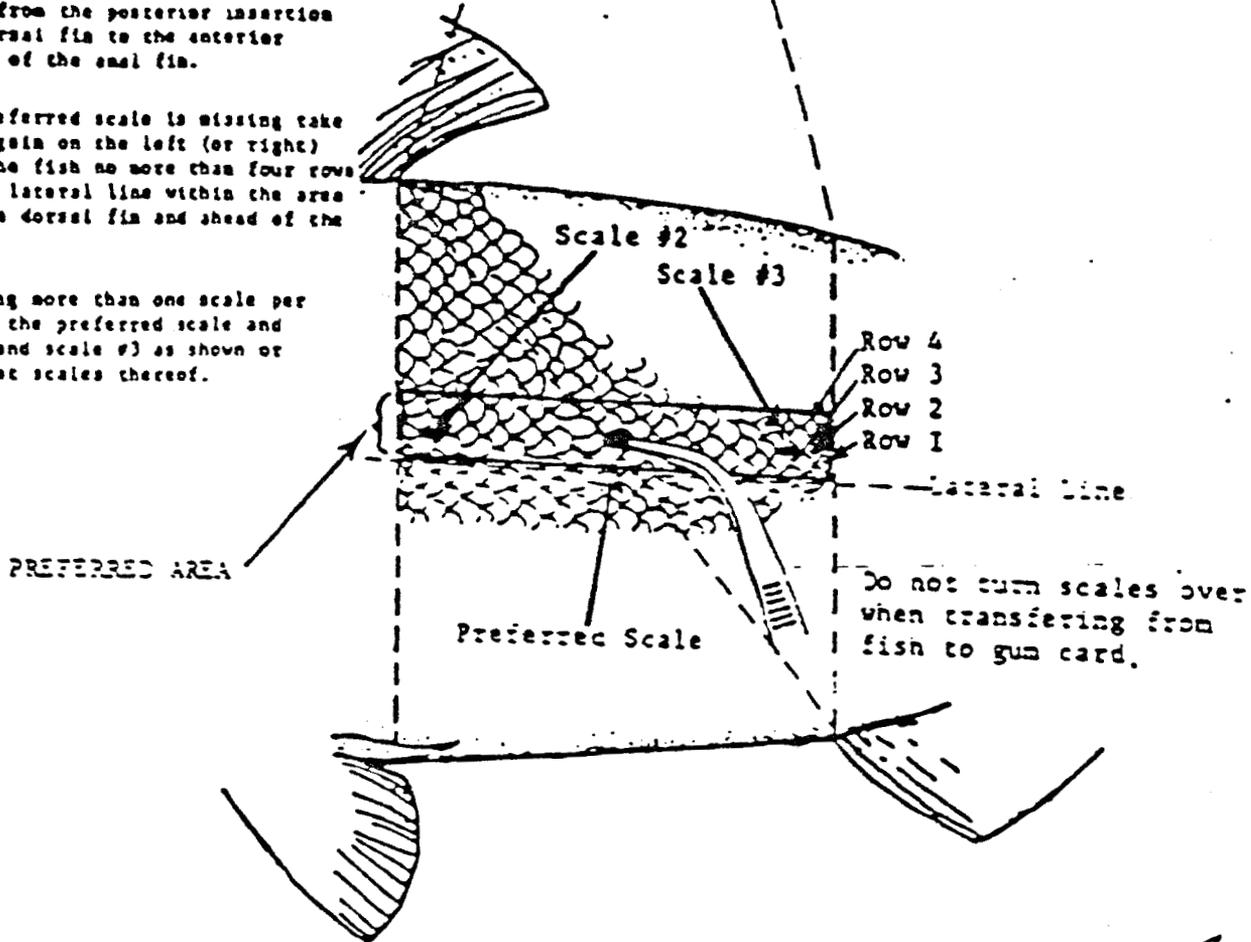
Appendix B.5. Scale sampling procedure showing the preferred area on an adult salmon.



Take the preferred scale on the left side of the fish, two rows above the lateral line and on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin.

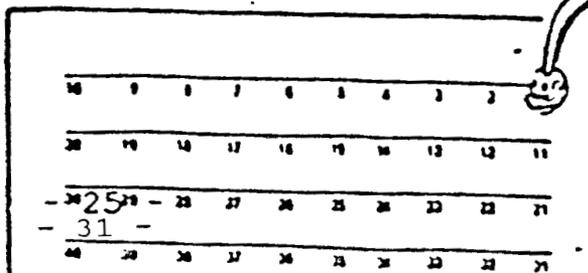
If the preferred scale is missing take a scale again on the left (or right) side of the fish no more than four rows above the lateral line within the area behind the dorsal fin and ahead of the anal fin.

If sampling more than one scale per fish take the preferred scale and scale #2 and scale #3 as shown or the closest scales thereof.



NOTE: Mount scales with anterior portion of scale oriented toward top of card.

Place scales directly over number on gum card.



front left margin of the form to the left margin on the back. This code needs to be exactly as it appears on the front.

GUM CARD(S):

Fill out the gum cards as shown in Appendices B.1 and B.2.

Species:

Write out completely (i.e., chinook, sockeye, etc.).

Locality:

For catch sampling, write down area in which fish were caught followed by the word catch (e.e., Herendeen Bay Catch).

Statistical code and Sampling date:

Transfer the appropriate digits from the AWL form.

Gear:

Write out completely.

Collector(s):

Record the last name or initials of the person(s) sampling.

Remarks:

Record any pertinent information such as; number of scales per fish sampled, vessel/tender name, etc. Transfer this same information to the top margin of the AWL.

SAMPLING:

A. GENERAL

1. Sex the fish and darken M or F in the sex columns. If any difficulty was encountered in this procedure, write "I had trouble sexing these fish" on the top margin of the AWL and ask your supervisor for help as soon as possible before sexing additional fish.
2. Measure all species length in millimeters from the middle of the eye to the fork of the tail, refer to Appendix B.3. Record length by blackening the appropriate column blocks on the AWL form. Column 3 on the AWL form is used for fish over 999 millimeters long. Measure all species of salmon to the nearest mm. Check the calipers daily before use to ensure the accuracy of the measurements.
3. Pluck the "preferred scale" from the fish using forceps. Remove all slime, grit, and skin from the scale by moistening and rubbing between fingers. The "preferred scale" is located on the left side of the fish, two rows above the lateral line on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin. Refer to Appendix B.5. If the "preferred scale" is missing, select a scale within the preferred area on either the left or right side of the fish. If no scales are present in the "preferred area" on both sides of the fish, sample a scale as close to the preferred area as possible and darken the 8 under "age error code" on the AWL form.

4. Clean, moisten and mount scale on gum card directly over number 1 as shown in Appendix B.5. The side of the scale facing up on the gum card is the same as the side facing up when it was adhered to the fish. The exposed facing side is referred to as the "sculptured" side of the scale. The ridges on this sculpture side can be felt with a fingernail or forceps. Mount scale with anterior end oriented toward top of gum card.
5. When sampling sockeye and chum salmon repeat steps 1 through 4 for up to 40 fish on each AWL form.
6. When taking three scales per fish as with chinook or four scales per fish as with coho salmon sample the "preferred scale" and scale #2 and scale #3 as shown in Appendix B.5. Scale #2 is one inch to the left of the "preferred scale," scale #3 is located one inch to the right, and scale #4 is located between next to any of the other three preferred scales. All are two rows above the lateral line. Mount the three scales from fish #1 over 1, 11, and 21, or 31 if four scales are taken (coho), on the gum card as shown in Appendix B.2. Continuing, mount the 3 scales from fish #2 over 2, 12, and 22, etc.
7. Use plastic scale card holders to hold individual scale cards during sampling and cover the completed gum card with wax paper for storage.
8. When sampling at a weir, you may use the old AWL forms or field notebook to record the data. Keep the mark-sense forms in camp where they will be clean, dry, and flat. After sampling is done for the day transfer the data to the mark-sense forms on a daily basis. It is the responsibility of the data collector to transcribe the data before turning it over to the ARB.
9. Miscellaneous:
  - a. When scales are sampled in wet conditions it is difficult to mount scales in a fashion so as to result in a good scale impression being made. Glue often obscures scale features and scales frequently adhere poorly to the card. Try to keep all the paperwork dry during this time. If the gumcard does get wet, the scales should be remounted.
  - b. For adipose clipped fish record the head tag number on the corresponding row in the first five columns on the reverse side of the AWL.
  - c. Look down the form from two angles after the data has been recorded to pick up any glaring mistakes. A common error occurs, for instance, in placing both the 4 and 7 of a 475 mm fish in the 100's column with nothing in the 10's column.
  - d. Keep all fish slime off forms and erase any stray marks on the forms before turning them in to your supervisor.
  - e. Write in all comments explicitly and completely under remarks, transfer remarks to top margin of AWL.

- f. Responsibility for accuracy lies first with the primary data collector(s). The port supervisor will return sloppy or incomplete data to individual collectors. After editing a form, place your initials next to card #, but not in left margin. Editing these forms will save valuable time for the ARB during the winter, and is an extremely important part of your job duties.
10. As soon as possible after completion send the samples and mark-sense forms to the ARB in Port Moller. During scheduled radio calls before and following the sending of data to the ARB, the crew leader will notify the ARB: (1) that the data is being mailed (use a moisture-proof container); (2) what data is being sent; (3) when delivery is expected in Port Moller; and (4) who is transporting the data. It is important that these steps are followed to ensure delivery.

#### B. SAMPLING SCENARIOS:

1. Differing size crews if lengths are needed. If they are not, the Recorder should pluck scales instead.
  - a. One person: Wrestle the fish into the measuring board, wearing a glove on one hand. Measure the fish and write the sex and length down on the measuring board to be transferred to the AWL after ten fish have been measured. Next, pluck the preferred scale(s), clean, and mount on the gum card which is taped to the AWL in the clipboard which is sitting on the end of the measuring board. After 10 fish have been processed, remove the glove and record the sexes and lengths on the AWL with your clean hand. A slime rag may be helpful.
  - b. Two persons:
    - (1) When sampling more than one scale per fish, one person can wrestle the fish and record data while the other plucks and mounts the scales. The wrestler needs to wear a glove that he can slip off his writing hand to record the sex and length data on the AWL form, if necessary.
    - (2) When sampling one scale per fish, the person plucking the scales also records the data.
  - c. Three persons: One person wrestles the fish, one plucks and mounts the scales, and the third records the data or also plucks scales.
2. Sampling tote to tote:
  - a. When sampling for 3 or 4 scales per fish (chinook and coho) use a two or three man crew. If lengths or weights are needed, three persons will be required.
  - b. When sampling for 1 scale per fish (sockeye and chum) use a two or three man crew. If lengths or weights are needed, three persons will be required.
3. Sampling on a table connected to a vat:

- a. Use three people for one scale per fish; one recorder or wrestler, one wrestler, and one plucker. Two people may be plucking if no length data is collected. The wrestler lays out and measures 10 fish at a time. The plucker samples these 10 fish, placing the scales on his fingers in a systematic manner before cleaning and mounting them on the gum card.

### SCALE SAMPLING CHECKLIST

Clipboard	Pencils (No.2)	Gloves
Gum Cards	Forceps	Measuring board or calipers
AWL's	Wax paper inserts	Sampling Manual
		Plastic scale card holders

### Some Reminders

1. For greater efficiency in scale reading and digitizing, mount scales with anterior end toward top of scale card.
2. AWL's should be carefully edited before submitting to ARB. This is extremely important, and cannot be emphasized enough. Re-check header information on AWL's; make sure all available information is filled in. Take extra care to use the catch date and not sample date. Page numbers should not be repeated; a frequent error is to begin a week's sample with the last page number used the week before. This is particularly important if the data regularly is sent to town; it is easy to forget which numbers were used. Crew leaders should take time to ensure that the boxes are being blackened correctly, if the boxes are not darkened properly or sloppily marked the optical scanner records the information incorrectly or misses it entirely. Keep marks within each rectangle and completely fill them. Do not go outside the rectangle. After the AWL's are edited, place editor's initial next to page number, but not in left margin.
3. Check to make sure error codes (listed on back) are being used correctly, i.e. error code 7 is wrong species, error code 8 is non-preferred. Error code 6 is for the use of the scale reader, it refers to the reabsorption of the scale.
4. Transfer important comments from scale cards to AWL's. After pressing scales, the cards are seldom referred to again, and important remarks can be lost. Write comments in the top margin (not on the left side) or on the reverse of the AWL. If no room is available on the AWL to completely explain the remarks, use a separate piece of paper.
5. Never put data from different dates on one AWL or one scale card. Even if only one scale is collected that day, begin a new card and AWL for the next day.
6. If weights are requested to be taken, they may be noted in the right margin of the AWL during sampling, but be sure to transfer the weights

to the appropriate columns on the reverse of the AWL before submitting it to the ARB, and darken in the code from the left margin of to the back of the form.

7. The data processing program uses the "litho code" on the AWL. (It is located in the lower left margin of the AWL.) It helps if the AWL's are used in the order of this code. It should not be hard to keep them in order if they are arranged that way before page numbering. Those who sample different areas throughout the season can arrange the litho codes in order before each sample is taken.
8. If AWL's get wrinkled or blotched they should be copied over before submitting to the ARB. The optical scanning machine is extremely sensitive to wrinkles and blotches and will misread or reject the sheets.

APPENDIX C  
General Equipment, Camp Maintenance  
and Camp Policy

## GENERAL EQUIPMENT, CAMP MAINTENANCE, AND CAMP POLICY

### Camp Maintenance

Maintaining a clean and efficient camp site is required. A few of the things to check are:

1. Maintenance of living accommodations and other installations will be performed as necessary. All materials necessary will be provided.
2. Grounds will be kept free of litter. All garbage will be bagged up and disposed of at the nearest sanitary landfill or burned at least once a week. Special precautions should be observed to ensure that garbage does not attract bears and other scavenger species.
3. Upon completion of the summer season, all camp equipment will be cleaned preparatory to winter storage.
4. All sampling nets, tents, and tarps must be dry before being stored.
5. A complete and detailed camp inventory will be taken by the crew leader at the close of the field season. Serial and State Property numbers must be included if they are present.
6. All skiffs and ATV's will be chained and locked to a stationary object.

### Camp Policy

1. No alcoholic beverages are to be stored in areas open to public view including cook tents. If alcohol is consumed at a camp an employee must be off-duty and under no circumstances shall he or she engage in the operation of any State equipment, including boats and motors nor shall he or she return to duty status under the influence of alcohol.
2. The crew leader of each sampling station shall establish a policy on living standards and personnel behavior in accordance with normal guidelines.
3. All sampling stations will operate as directed. No crew leader shall be off location for more than 24 hours unless specifically authorized by the ARB. Time-off for individual crew members shall be scheduled by the crew leader and shall have the option as to whether sampling duties allow time-off from the location.
4. All employees will be required to act in a professional manner at all times and shall be especially courteous to the public.
5. It will be the responsibility of the crew leader to report any equipment abuse to the ARB and to ensure that abuse does not occur.

Additionally, the crew leader must also report within 24 hours to the ARB any loss of equipment which occurs.

## Equipment Maintenance

Equipment maintenance is perhaps one of the most important operations you will perform during the field season. The outboard motors and generators must be kept in good operating condition.

It will be the crew leader's responsibility to assign the most knowledgeable member of the crew to the job of maintaining and servicing the equipment. It will be this persons responsibility to see that all equipment is kept in operating condition.

## Outboard Motors

Your outboard motor will perform longer and trouble-free if these suggestions are followed:

1. The correct outboard fuel mixture is 50:1. Always pour the oil into the tank first, then add 2 or 3 gallons of gas and mix thoroughly, then fill tank to capacity always using a large funnel and chamois filter.
2. Chain saws have a fuel mixture 25:1. Chain saw gas should be mixed in a 5 gallon can and clearly marked that it is chain saw fuel.
3. When mixing gasoline or filling the tanks of the generator, stove or lantern, keep the following in mind:
  - a. Always mix fuel tanks or equipment under cover to prevent water contamination and always use a funnel and filter.
  - b. Fill camp stoves and lanterns outside as the danger of fire is very real.
  - c. A little extra effort toward cleanliness will pay in hours of trouble free operation.
4. Always place outboard motors in neutral when starting.
5. Check daily the clamp screws that hold the outboard to the transom. Also routinely check the motor for loose screws and bolts, cracks, and breaks, especially in the area of the lower unit.
6. Never start or run an outboard in the tilted position.
7. In the normal operation of a water pump, a "tell-tale" stream of water is discharged from a hole in the bottom edge of the cowling or from the back of the shaft. If this stream of water stops, the water pump is not working and the motor should be shut off. The side plate over the water intake can be removed for temporary relief as it may be plugged. If the pump continues not to function, the outboard should not be run, and a report to base camp should be made.
8. Check the grease in the lower unit of the outboards propeller once a week, and drain and replace the lower unit grease every three weeks. Jet units must be greased daily. This is crucial. Special grease guns will be provided.

9. If the skeg or jet unit hits bottom, check the screws for tightness and housing damage.
10. If your outboard will not start, check the following:
  - a. Check to see if the fuel line is connected to the motor and the tank and not pinched or kinked.
  - b. Check to see if there is water in the gasoline.
  - c. Check to see if the engine is flooded.
  - d. Check the spark plugs as they may be fouled or defective (replace if needed).
11. All outboards are to be tilted in the up position when moored to prevent silt accumulation in the jet unit and water pump.

Lastly, it should be emphasized that the salmon enumeration counts and sampling must continue, as they are very important to the program.

#### Boats

1. Boats are to be kept clean and free of loose tools and debris, and moored at locations where they are not subject to damage by wave action or through contact with the river bottom in rock laden areas.
2. Each crew leader will be responsible for maintaining mooring stakes on the river bank sufficient for the boats assigned to his subproject plus one transient craft. Further responsibility includes maintaining a bow line on each assigned craft and ensuring that each boat is properly moored at the end of each work day to preclude possible loss or damage.

#### Generators

Portable generators may be supplied to field camps. Their maintenance follows the same line as for the outboards. Since some of the generators have 4-cycle engines, mixed gas must not be used. The crankcase oil reservoir should be checked daily and maintained at the full level. After 25 hours of operation the oil should be changed. Spark plugs should be checked after every five (5) hours of operation.

#### Food Orders

Grocery orders should be placed with Port Moller during the evening radio schedule.

#### Personal Gear and Pets

Generally 100 lbs. is a maximum for personal gear. If you anticipate bringing more than that amount to your field camp, check with your supervisor first. Pets, (especially dogs) should not be brought to field camps. Past experience indicates, that one or more of the following problems usually occur:

1. Problem of transportation in small planes for some pets.

2. Who is going to pay for the pet food and who is going to purchase it in town?
3. Some pets attract bears, etc. Dogs will chase a bear until the bear gets mad and then when the bear goes for the dog, the dog will run to his owner or the cabin.
4. Your pet may not be compatible with the other members of your camp and may interfere with work.
5. A pet that gets sick or injured can cause you considerable expense if it must be brought back to town.
6. Rabies is common on the Alaska Peninsula, be careful of all mammals including ground squirrels, fox, wolf, otters, and your pet. If bitten save the head of the animal if possible, wrap the head in several layers of plastic, put in a good box and freeze if possible. Notify your supervisor of the accident. Arrangements will be made to immediately for examination at the nearest clinic. Burn and bury remaining parts of the carcass away from water sources and cabins, take precautions such as wearing plastic gloves to dispose of the carcass. Do not send suspected rabies animals out of your area unless you are bitten, burn and bury the carcass as instructed.

#### Compatibility of Field Personnel

If you find yourself unable to get along with other members at your camp, notify the ARB and an attempt will be made to solve the problem. Considerable effort is needed by all parties to remain compatible throughout the field season. Usually, the person with the most experience in camp will be the crew leader. If it is not clear who has been designated crew leader in your camp ask your supervisor.

APPENDIX D  
First Aid and Safety

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**MEMORANDUM****STATE OF ALASKA**

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To: Catch and Escapement Sampling Crews

1991 FIELD CAMPS

From: Bob Murphy  
Area Research Biologist  
Division of Commercial Fisheries  
Department of Fish & Game - Kodiak

SUBJECT: Health and Welfare of Crew Members

It is your responsibility to ensure that your crew members are fully aware of health and safety practices (e.g. boiling water to prevent dysentery and kill giardia, basic first aid, location of fire extinguishers, etc.). More often than not, these obvious practices are ignored. With camps as they are, neglect of health practices can have serious ramifications if an employee were to become ill.

King Cove and Port Moller have medical clinics. Insurance forms will be available at both locations. Inform the ARB in Port Moller or AMB's in Sand Point or Cold Bay immediately of any illness or injury that will require medical assistance or lost work time.

A State rifle or shotgun will be provided at each camp. You may bring your own firearm if you wish. Loaded guns are prohibited inside the camp facilities. Loaded, meaning a round in the chamber of the gun. Anyone handling a firearm should always treat it as if it were loaded. Guns should be kept clean and oiled and be completely unloaded while being cleaned. Any horseplay with or misuse of firearms while working for the Department of Fish and Game will not be tolerated and will be grounds for immediate dismissal. Completely unload a firearm of all rounds before entering a vessel or airplane. Keep an empty chamber under the firing pin of each pistol to prevent accidental discharge by accidentally dropping the weapon.

Do not antagonize bears - each one is a potential danger. Do not encourage bears to come around camp by leaving food or unburned garbage around. Do not shoot at a bear unless, in your best judgement, he is endangering someone's life or damaging personal or state property. Use your best judgement on whether to shoot a bear if property is at stake. When, and if, trying to frighten a bear away by shooting near it. By chance, you may wound the animal accidentally. If you are having problems with a particular bear around camp, call the ARB or AMB and notify them of the situation. The Game Division personnel will take care of the problem, if it is feasible.

Burn all garbage to prevent bear problems. Cut out both ends of tin cans and flatten them and box them for empty return flights. Never start fires with fuel. Be sure all burn barrels have proper grates or covers to prevent grass fires from sparks. Garbage from Ilnik and Orzenoi Rivers should be double-bagged and sent to Chignik, Port Moller, or Sand Point for proper disposal.

Do not endanger life or property by going out in a boat on dangerously rough water. If you are unfamiliar with Marine Safety, ask the crew leader or ARB for information or advice. All personnel must wear a life jacket when out on open water. Use your head - if you think it is dangerously rough, do not go out.

Extra shear pins, a spare propeller, oars, and a tool kit which includes pliers, spark plugs, and a spark plug wrench should be in the boat at all times. In case travel at night becomes necessary, carry a flashlight.

Some camps may be furnished with 3-wheel or 4-wheel all terrain vehicles (ATV's). The following safety precautions shall be observed at all times regarding Department ATV's. Only employees of the State may use the vehicles. Non-Fish and Game employees are not allowed on these vehicles at any time. The safety helmet provided must always be worn during operation of an ATV. An ATV may provide transport of State materials, supplies, and equipment between camp sites and supply planes or vessels. In addition, they may be used for transportation to and from assigned duties in the field such as monitoring a fishery or collecting harvest information, etc.

Check your camp's fire extinguisher. Know where it is and how to use it! Inventory your camp first aid kit, replace items as needed and become familiar with basic first aid treatment. Review the first aid booklet.

Take pains to avoid intestinal parasites carried by beaver and otter etc. When in doubt, boil your drinking water 10-15 minutes.

Keep the cabin, surrounding area, and yourself clean and neat. Appearance is important. You will not always be notified of the intended arrival of visitors, officials, etc. Impressions of visitors are often based on appearance.

Rabies is common on the Alaska Peninsula, be careful of all mammals including ground squirrels, fox, wolf, otters, and your pet. If bitten save the head of the animal if possible, wrap the head in several layers of plastic, put in a good box and freeze if possible. Notify your supervisor of the accident immediately. Burn and bury remaining parts of the carcass away from water sources and cabins, take precautions such as wearing plastic gloves to dispose of the carcass. Do not send suspected rabies animals out of your area unless you are bitten.

FIELD MANUAL  
1991 SALMON WEIRS AND ESCAPEMENT SAMPLING  
FOR THE ALASKA PENINSULA

by

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## INTRODUCTION

The basic function of fisheries management is to allow effort on stocks with a harvestable surplus while protecting stocks with returning runs not meeting the minimum escapement requirements.

In 1991, weirs at Bear River, Nelson River, Orzenoi Lake, and Ilnik Lagoon (Figures 1-4) will enumerate and sample the escapement. Field camps at Middle Lagoon and Thin Point Lake will estimate the escapement and sample fish from the commercial or subsistence catch if needed.

## OBJECTIVES

Long Term: To improve management of the salmon resources for the Alaska Peninsula and Aleutian Islands Management Areas through improved forecasting, development of stock-recruitment relationships to assess escapement requirements, and accurate assessment of stock composition.

Short Term:

1. Determine salmon escapement by species.
2. Determine the sockeye and chum salmon age, length, and sex composition for the major systems within standard levels of precision.
3. Determine the age, length, and weight composition of sockeye smolt for the major systems within standard levels of precision.

## SUPERVISION

The Area Management Biologist (AMB) in Cold Bay, Arnie Shaul, will supervise the Middle Lagoon, Nelson Lagoon, and Thin Point projects. The Area Management Biologist in Sand Point, Jim McCullough, will supervise the Orzenoi River project. The Area Research Biologist (ARB) in Port Moller, Bob Murphy, will directly supervise the Bear River and Ilnik Lagoon crews. The Area Research Biologist (ARB) will train the sampling crews on the proper techniques and procedures, and visit the camps, if possible, to insure sampling is being conducted properly.

## PERSONNEL

ADF&G will staff Bear River from about 26 May through 1 September, Nelson River from 1 June through 31 July, Orzenoi River from June 10 through August 10, and Ilnik Lagoon from 15 May through 15 July. A weir is operated at Bear and Nelson Rivers and Ilnik Lagoon. The personnel assigned to these projects are responsible for counting the adult run and sampling adult and smolt salmon. Two people will be assigned to each project; additional assistance, if needed, will be provided.

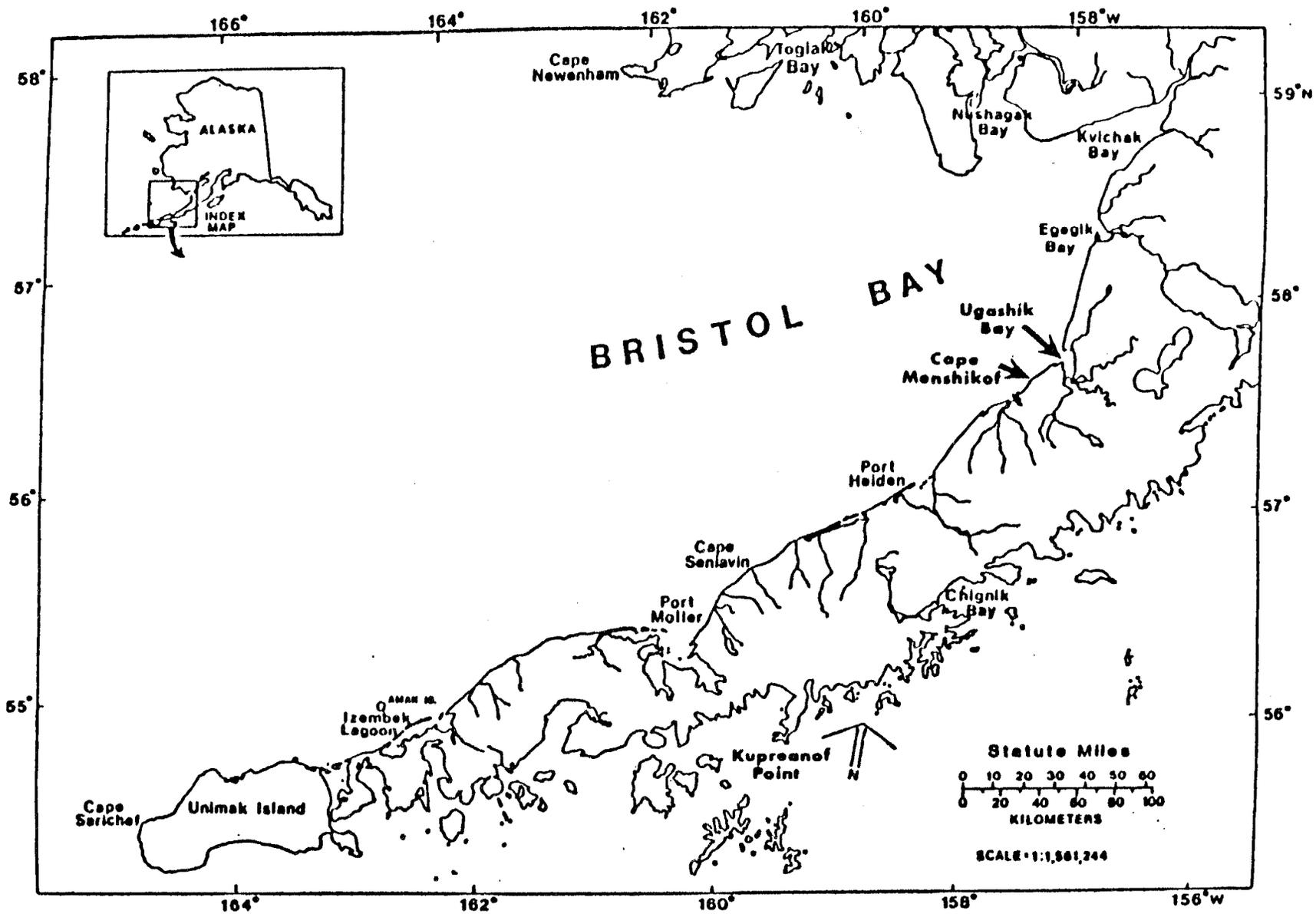


Figure 1. Map of the Alaska Peninsula Area from Kvichak Bay to Unimak Island.

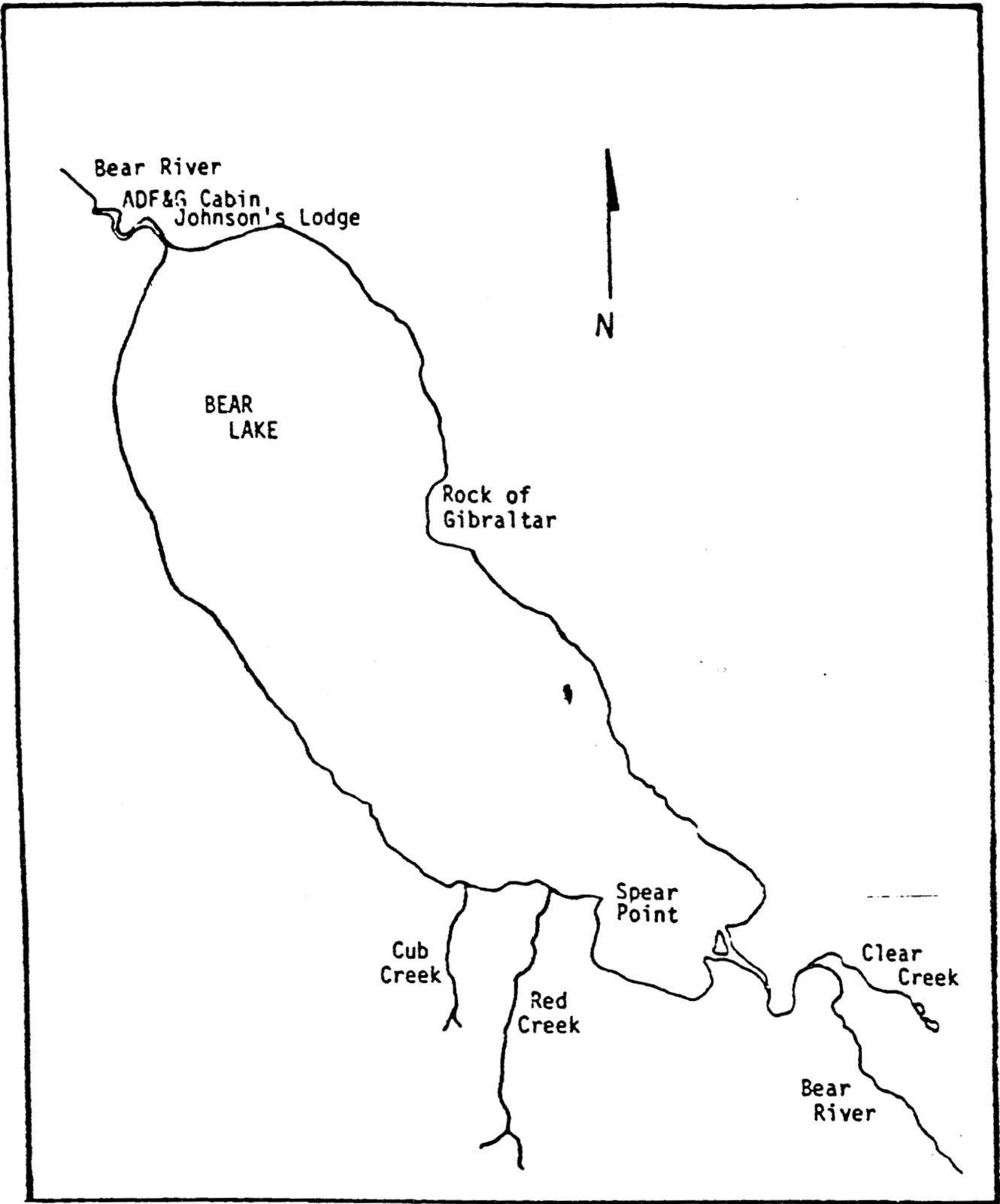


Figure 2. Map of the Bear Lake drainage.

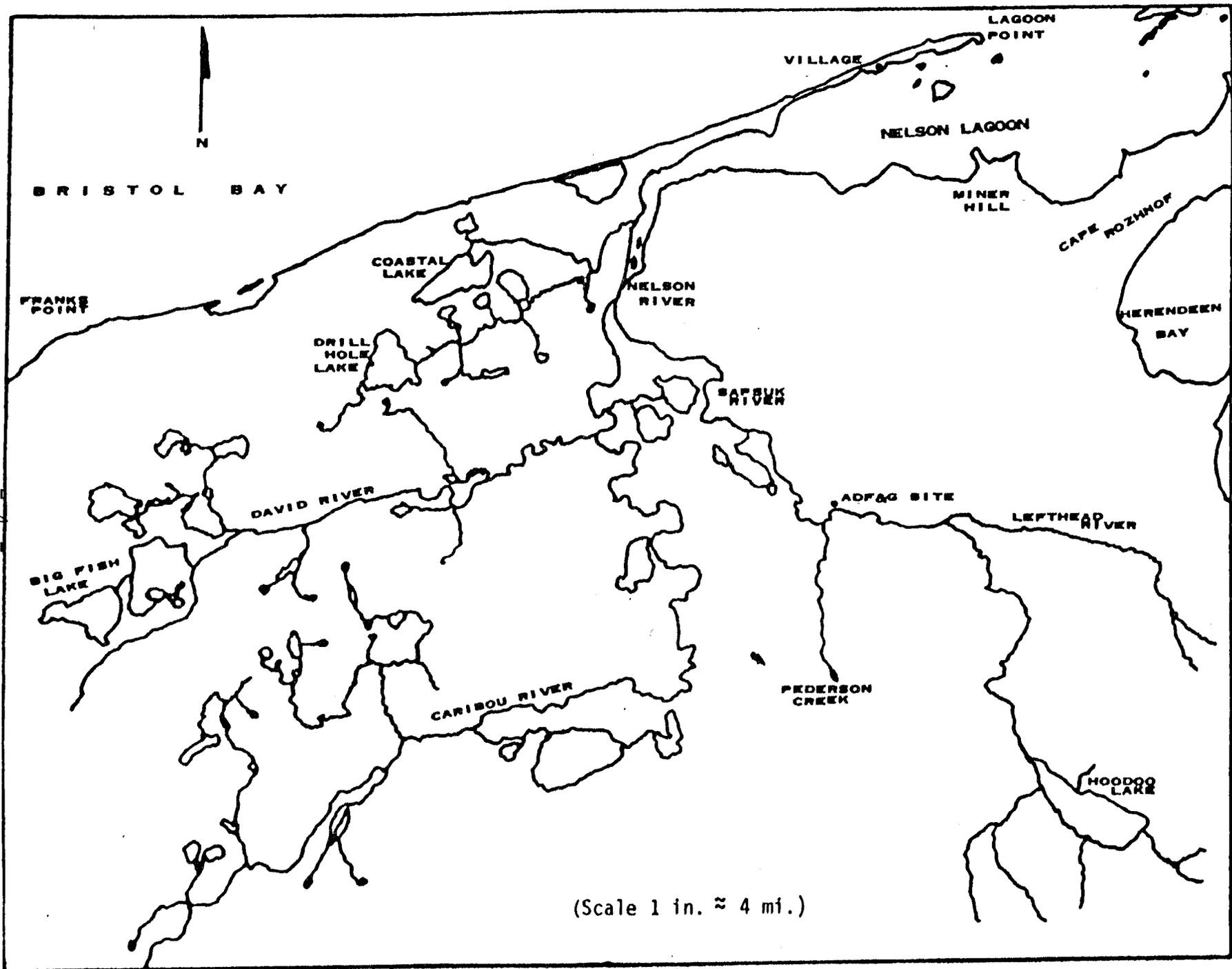


Figure 3. Map of the Nelson River drainage.

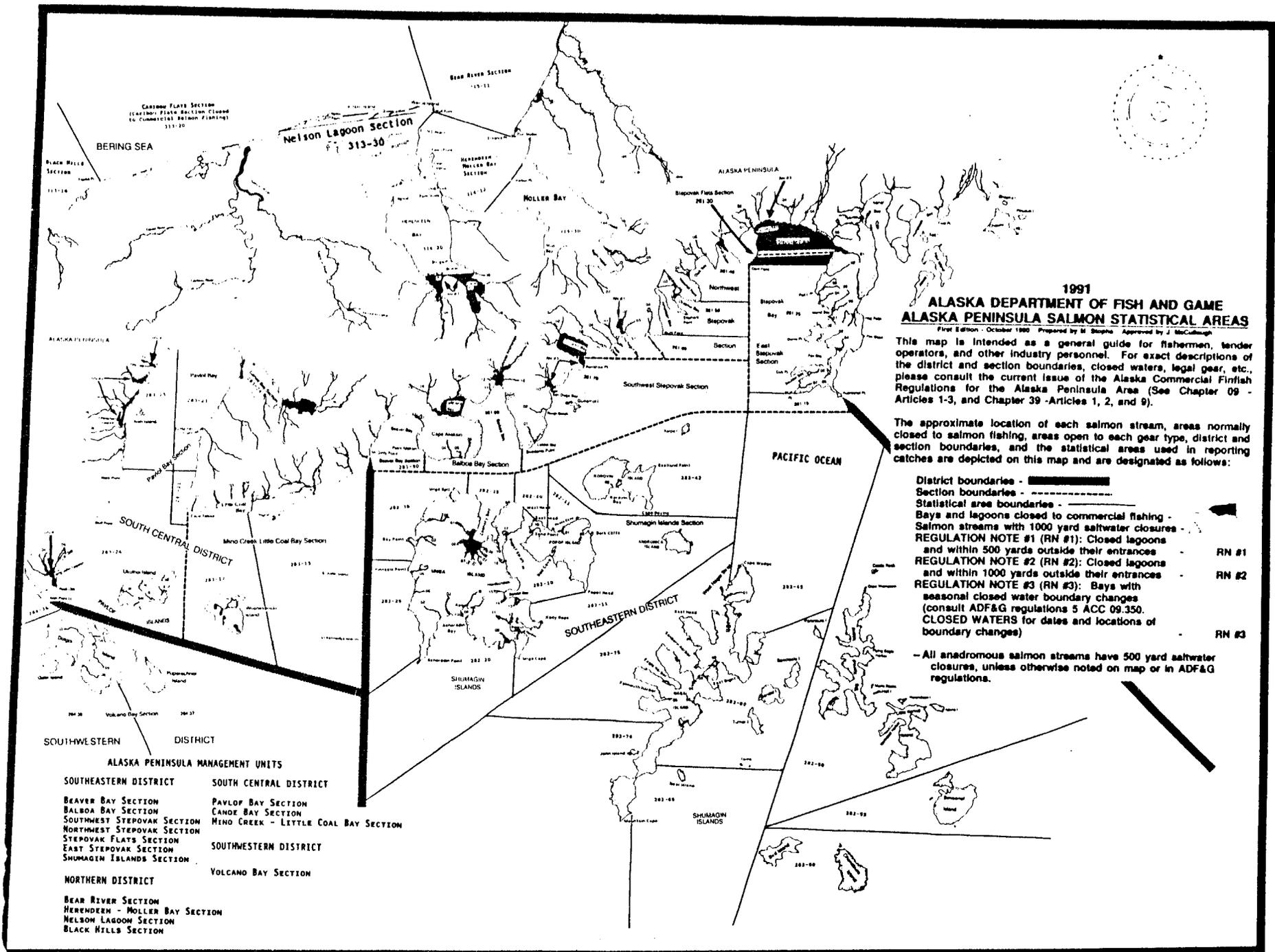


Figure 4. Map of the Alaska Peninsula Area from Arch Point to Kupreanof Point with the statistical salmon fishing areas shown.

## PROCEDURES

### *Escapement Enumeration*

#### Bear River

The Bear River weir will be manned from about 26 May through 15 September. The 1991 weir will be placed in the location where the 1990 weir was located. After the wooden tripods are in place, the tripod tables should be loaded with sand bags. After the stringers, pickets and catwalk are in place, sand bags should be stacked from the catwalk to the top of the tripod against the back legs of the tripod.

After the weir is fully operational, the counting tower should be made ready in case the weir washes out. The counting panels for the tower should be repainted and installed along the river bottom opposite the lower tower. Counting procedures, in an emergency, for Bear River tower would be the same as those described for Nelson River tower.

The main objective of the Bear River weir project is to record the number of salmon escaping into Bear Lake. Large numbers of fish (> 200) should not be allowed to stage behind the weir. If large numbers of fish (> 200) start to accumulate behind the weir, open up the weir and count them through.

Use two tally whackers while counting sockeye adults and sockeye jacks. Any sockeye salmon under 16 inches (400 mm) in length (mm; mid eye to tail fork) will be considered jacks. Use the counting form provided to record the data (Table 1). On the weir forms, note the time of day, amount of time the gate is opened to pass fish, and the number of fish by species passed each time the gate is open. Cumulative daily counts and cumulative seasonal counts for each species will be relayed to the Area Management Biologist (AMB) during normal radio schedules. When the project is completed send all forms to the AMB.

Make note of other species, however, count them individually by species.

Weir maintenance is very important to prevent weir washout. Keep the weir clean of debris and check the river substrate as often as possible to make sure no escape holes do not occur. If the weir cannot be used for some reason, the tower will be used and the procedures for the Nelson River tower will be utilized.

#### Nelson River Weir

The Nelson River weir will be manned from about 1 June through 31 July. The weir is a floating design similar to one used on the Little Susitna River in 1988. The weir should be fish tight before salmon arrive (about mid-June).

After the weir is fully operational, the counting tower should be made ready in case the weir fails. The counting panels should be repainted annually and installed on the river bottom in the same location as in past years.

On the weir forms note the time of day, amount of time the gate is opened to



pass fish, and the number of fish by species passed each time the gate is open. Cumulative daily counts and cumulative seasonal counts for each species will be relayed to the Area Management Biologist (AMB) during normal radio schedules. When the project is completed send all forms to the AMB.

The main objective of the Nelson River weir is to record the number of salmon escaping into the Hoodoo Lake-Sapsuk River. Large numbers of fish (> 200) should not be allowed to stay behind the weir. If fish start to accumulate behind the weir, open up a fish gate and count them through.

Two to four tally whackers may be necessary for counting sockeye adults, chum salmon, chinook, and coho salmon. Any sockeye salmon under 400 mm in length (mm; mid eye to tail fork) will be considered a jack. Use the counting form provided to record all data.

As with Bear River, weir maintenance is important. Keep the weir clean of debris and check to insure the weir is fish tight. If the weir cannot be used, the tower and the procedures for the Nelson River Tower will be utilized.

#### Nelson River Tower

The Nelson River tower will be used if the weir is not operational. The first task will be to install the weir and paint and install the counting panels. Logbooks are provided for recording daily and cumulative count data.

Counting Procedures are as follows:

Hour One: Counts are made during the first 10 minutes and last 10 minutes of the hour. The counts are added together and multiplied by 3 to obtain the hour one estimate.

Hour Two: No actual counts are made. The count is estimated by adding the last count in hour one to the first count in hour three and multiplying by 3.

Hour Three: Counts are made during the first 10 minutes and last 10 minutes of the hour. The counts are added together and multiplied by 3 to obtain the hour three estimate. The same procedure as during hour one.

Hour Four: No actual counts are made. The count is estimated by adding the last count in hour three to the first count in hour five and multiplying by 3.

This procedure is repeated throughout the balance of the day until the last count. Due to poor visibility, caused by darkness during the end of the last hour, two 10 minute counts are made at the beginning of the hour. The first 10 minute count is used along with the last 10 minute count prior to the previous hour to calculate the previous hour's count. To calculate the last hour's count, add the two 10 minute counts together and multiply by 3.

The night count estimate is made by averaging the last hourly count of day A with the first hourly count of day B, and multiplying the average by the number

of night hours.

Use the Daily Tower Counting Form to calculate daily escapement (Table 2) and escapement form when reporting counts over the radio. Calculations should be re-checked for errors.

### Ilnik Lagoon

The Ilnik Lagoon weir will be staffed from about 15 May through 15 July. The 1991 weir will be placed, in the same location as in 1990, about 1 mile below the village. A cable will be installed and run across the river along the river bottom. The cable will be attached to deadheads located on each bank and winched tight. Plywood will be attached to the cable and run parallel with the current. The purpose of the plywood is to act as a firm substrate for the tripods to rest. The tripods should be loaded with sand bags. After the stringers, pickets and catwalk are in place, sand bags should be stacked on top of the tripod against the back legs.

The main objective of the Ilnik Lagoon weir project is to record the number of salmon escaping into Ilnik River and Lake. Large numbers of fish (> 200) should not be allowed to stage behind the weir. If fish start to accumulate behind the weir, open up the weir and count them through.

Weir maintenance is extremely important at Ilnik to decrease the resistance on the weir. Due to the tidal influence, a large amount of debris tends to accumulate on the pickets. Keep the weir clean of debris and check it as often as needed to insure there are no holes for fish to escape. In the deeper channels, a dry suit and face mask will be needed to visually inspect the weir to make certain that it is fish tight.

### Orzenoi (Orzinski) Lake, Middle Lagoon, and Thin Point Projects

Activities for the Middle Lagoon and Thin Point projects will be supervised by the Cold Bay Area Management Biologist (Arnie Shaul), while the Orzenoi Lake project will be supervised by the Sand Point Area Management Biologist (Jim McCullough). Basic duties will include estimates of escapement by species, movements of fish, catch reports, and other assigned duties. In 1991, the weir will be located in the same location as in 1990.

Sampling kits will be provided for each project. In Orzenoi Bay and Middle Lagoon, it may be possible to sample the commercial catch. When sampling the commercial catch, priority should be given to sampling seine caught fish. For terminal fisheries, seine caught fish have the same population characteristics as the escapement. For the Thin Point project it may be possible to sample subsistence caught fish; priority should be given to seine caught fish but gill net caught fish should be sampled if they are available.

The goal is to sample 240 adult fish per week. Follow the techniques for sampling as found in Appendix A. Send samples and edited AWL forms to Port Moller as soon as possible after collection.

Table 2. Daily counting tower form.

Water level: .88'  
 Precipitation: .10"  
 Wind : 20 W  
 Ceiling: 400 solid  
 Visibility: 3 miles  
 Water Temp MAX 10'  
 MIN 6.5

DAILY COUNTING TOWER FORM  
 EXAMPLE

LOCATION NELSON RIVER

DATE JULY 13 1967 SPECIES REDS

JACK SOCKEYE

(Disregard if this page is used for species other than sockeye!)

NIGHT COUNT ESTIMATE

Previous Days Last Hour Estimate 435

Today's First Hour Estimate 150

Total 585  
 2/Total 292.5 Night Est.

18

3

21

2/Total 10.5 Night Est.

Number of Night Hours 7 x 292.5 = 2048

7 x 10.5 = 74

Hour Count A + Count B = Total X 3 = Hour Est. Daily Accum.

Count A + Count B = Total X 3 = Hour Estimate

TOTAL SALMON (Adults & Jacks)						(JACKS ONLY)			
7	29	21	50	150	2198	0	1	1	3
8	21	21	42	126	2321	1	1	2	6
9	21	7	28	84	2408	1	1	2	6
10	7	11	18	54	2462	1	0	1	3
11	11	25	36	108	2570				
12	25	2	27	81	2651				
1	2	0	2	6	2657				
2	0	27	27	81	2738				
3	27	43	70	210	2948				
4	43	185	228	684	3632				
5	185	203	388	1164	4796				
6	203	110	313	939	5735				
7	110	100	210	630	6365				
8	100	64	164	492	6857				
9	64	106	170	510	7367				
10	106	78	184	552	7919				
11	78	39	117	351	8270				

Daily Total 8270

Daily Total \_\_\_\_\_

Yesterdays Accumulated Total 96,615 = 70

Yesterdays Accumulated Total \_\_\_\_\_

Current Accumulated Total 104,885

Current Accumulated Total \_\_\_\_\_

### *Escapement sampling for age, length, and sex composition*

Bear, Nelson, and Orzenoi Rivers and Ilnik Lagoon

Escapement sampling will be conducted by the crews stationed at Bear and Nelson Rivers and Ilnik Lagoon. Sockeye salmon will be the primary species sampled, except for Nelson River, where chum and possibly coho salmon will also be sampled for age composition. Samples will be collected at all weirs using the weir live box trap. If the weir washes out, samples will be seined. The ARB will visit each camp early in the season to make sure scales are being worked up properly. Appendix A describes sampling and recording procedures.

The sample goal is 240 adult fish per week per species. A week is the standard Sunday to Saturday. Sampling should begin on Monday and be completed that day, if possible. If it is not completed, subsequent days should be sampled to obtain the 240 fish sample. If this cannot be done, continue to collect samples on subsequent days until the goal is reached or the week terminates.

### *Smolt Sampling*

Out-migrating sockeye smolt will be collected at Bear Lake. After the weir and tower are operational, sampling will begin. A weekly sample size of 200 smolt will be collected during the duration of the smolt out-migration, which will probably last 4 to 6 weeks. Smolt will be sampled for age, weight, and length composition. Appendix B gives sampling and recording procedures. Sampling will begin on Tuesday, the third day of the week, so as not to interfere with adult sampling. Estimate the peak migration, and note if the migration is relatively light, moderate, or heavy.

A fyke net will be located behind the weir near the center of the river, so the water velocity is just below the washout threshold of the net. A good procedure is to attach the net behind the weir using the tripods as a support for the net. The net will be fished as long as it is necessary to capture 200 smolt. Near dusk is when out-migration usually peaks. If 200 smolt are not captured on Tuesday, sampling will continue until the goal is met or the week terminates. Check the net frequently to avoid unnecessary mortality.

### *General Camp Maintenance and Procedures*

During the season, the duties outlined above may take longer than 37.5 hours/week to accomplish. When this happens at Bear River or Ilnik Lagoon, notify Bob Murphy, at Nelson River notify Arnie Shaul, and at Orzenoi River notify Jim McCullough. They will decide what projects take priority and whether or not to authorize overtime. Each employee is allowed 20 hours of overtime a month (2 pay periods). No additional overtime may be worked or claimed unless it is first authorized.

Cabin and facilities maintenance is an important aspect of being able to accomplish objectives comfortably. Maintenance can usually be accomplished during slow periods of the season. As soon as the camp is established, look

the situation over and make a list of projects that need to be accomplished. Send in a list of materials needed for these jobs. Also, try to anticipate problems before they occur. Ordering replacement parts, before a deteriorating piece of equipment actually breaks, will prevent long delays in repair due to the logistics involved.

Appendix C provides general information including radio schedules, ordering food and supplies, compliance with ADF&G regulations, equipment/maintenance, procedures regarding violations, emergencies, firearms, bears, garbage, boating, fire and first aid safety, drinking water, personal gear and pets, compatibility of field personnel, and cleanliness of cabin.

### **DATA REPORTING**

Prior to June 1, 1992 the ARB will author a Regional Information Report and Technical Fisheries Report which covers the results of the 1991 escapement sampling season. Prior to 1 June 1992 the Area Management Biologist will author an Annual Management Report which covers the results of the 1991 season.

APPENDIX A

Scale Sampling Techniques

## ALASKA PENINSULA SCALE SAMPLING TECHNIQUE

The following is an explanation of how salmon scale samples are taken. If you have not taken scales before or if you have any questions ask somebody who has had experience with scale sampling. Scales must be readable to be useful, so follow proper technique when sampling.

### *Important Points to Remember*

#### Gum Cards

A scale card is a gum-backed sheet numbered 1 through 40. Samples are placed on the cards with no attempt to separate the fish by their sex.

It is important to keep the gum card dry at all times. If weather does not allow you to do this, it is best to suspend sampling until dryer conditions exist. A wet gum card is useless as the scales will fall off and prevent a readable impression from being taken.

A new scale card is started for each day. Even if a card is not filled, a new card is still to be started for each day. Also, a different card is to be used for each location, i.e. Bear River versus Nelson River. It is important that scale cards and numbers match the corresponding AWL sheet.

#### Scales:

1. Clean the scale by wetting it and rubbing it between your fingers. Make sure no dirt, slime, and skin (no silver color) remains on the scale.
2. Mount the scale on the gum card with the ridged side up. The ridged side is the same side that is exposed on the salmon.
3. One scale will be taken from sockeye and chum salmon. Three scales will be taken from chinook salmon and four from coho salmon.
4. Take the preferred scale if it is available, if they are not available, take a scale in an area close to the preferred area, but note that it is not preferred.
5. Scales should be neat, clean, and orderly.

#### Age-Weight-Length (AWL) Sampling Form

Age - Scale samples are needed to age the fish.

Weight - Recorded to the nearest tenth of a pound on any adult fish not being returned live to the water.

Length - Recorded to the nearest millimeter from the mid-eye point to the fork in the tail.

Fill in all information on the AWL form.

Each AWL form must match up with the appropriate scale card.

## Length, Sex, and Scale Sampling Procedure for Sampling: Using Mark-Sense Forms

### INTRODUCTION:

Salmon from the catch are sampled for length, sex, and age annually by field crews throughout the state. This data base is essential to sound management of the States' salmon resources. This information is drawn upon by management and research biologists for: (1) forecasting run strengths; (2) setting escapement goals; (3) examining the productivity of aquatic systems; (4) salmon growth analysis; (5) catch apportionment (based on age composition and/or scale pattern analysis); (6) in-season run estimation; and (7) to gain a better understanding of the biology of each stock.

For clarification purposes a SCALE SAMPLE and SUB-SAMPLE will be defined as follows:

**SCALE SAMPLE:** A data set collected from a specific sampling location, containing scales and data from a single species, collected during a single year. All data forms and scale cards of a single SAMPLE have the same statistical code. AWL and scale card number in a sample are consecutively and chronologically ordered.

**SUB-SAMPLE:** Any portion of a scale sample consisting of consecutively numbered AWL's and scale cards. SUB-SAMPLES usually consist of one or more time segments of a sample.

To be useful, data must be recorded on the mark-sense forms neatly and accurately. The following procedures are to be adhered to when sampling for length, sex, and scales using mark-sense AWL forms.

### COMPLETING THE FORMS:

A completed mark-sense AWL form (Appendices A.1 and A.2) and accompanying gum card for sampling escapement catches of sockeye and chum salmon are shown in Appendix A.3. A completed AWL form and accompanying gum card for sampling commercial catches of chinook and coho salmon are shown in Appendices A.4 and A.5.

Complete each section of the left side of the mark-sense form using a soft No. 2 pencil and darken the corresponding blocks as shown in the figures. It is imperative that you darken the box completely and neatly. The number inside the box should be completely darkened. Make every effort to darken the entire block as partially filled blocks are often missed by the optical scanner which reads and records the data from the mark-sense AWL forms. Label only one form at a time to avoid "the carbon paper effect" and resulting stray marks. It is necessary to review the forms after each day and ensure that all the data is filled in and appropriately marked.

### Description:

For escapement sampling: Species/Area/Catch or Escapement/gear type i.e. weir/Samplers (W-R-P).

DESCRIPTION: Sockeye Nelson River

Wrestler: CSD  
Scale-Plucker: MB

Scale: J111  
Reader:

ADF&G ADULT SALMON AGE LENGTH  
FORM VERSION 2 1

DO NOT WRITE IN THIS MARGIN

101945

DO NOT WRITE IN THIS AREA

CARD: 001

SPECIES: 2

DAY: 24

MONTH: 6

YEAR: 88

DISTRICT: 313

SUBDISTRICT: 30

STREAM: 003  
Sapsuk

LOCATION: ADFig 56  
Cabin

PERIOD: 26

PROJECT: 3

GEAR: Trap

MESH:

TYPE OF LENGTH MEASUREMENT: 2

NUMBER SCALES/FISH: 1

OF CARDS: 1

SEX	100's	LENGTH	T's	AGE GROUP	AGE GROUP CODE
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
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50					

Appendix A.1. Example of opscan form for the Sapsuk River.

Example

Nelson Lagoon  
Sapsuk River



81 - IN THIS MARGIN

DESCRIPTION: Sockeye Bear Lake

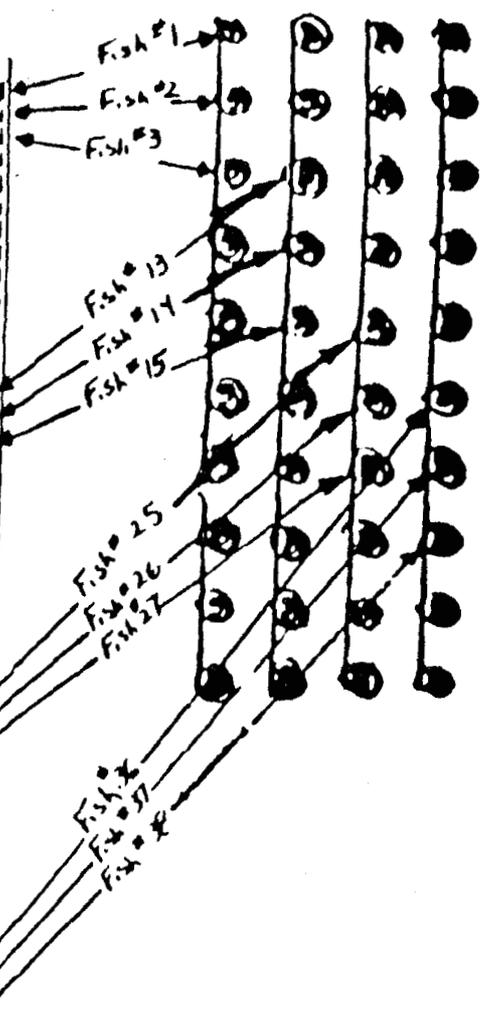
Recorder: J.M. Scale Reader: J.M.  
 Director: J.M.B. Reader:  
 Scale Method: J.M.

ADFG ADULT SALMON AGE LENGTH FORM VERSION 21

101944

CARD:	004
SPECIES:	2
DAY:	3
MONTH:	7
YEAR:	88
DISTRICT:	315
SUBDISTRICT:	11
STREAM:	002
LOCATION:	Bear Lake ADFG 55
PERIOD:	28
PROJECT:	3
GEAR:	Trap
MESH:	
TYPE OF LENGTH MEASUREMENT:	2
NUMBER SCALES/FISH:	1
# OF CARDS:	1

100's	LENGTH	1's	AGE GROUP	AGE GROUP CODE
	Example			
	Bear Lake			



Species	Sockeye	Card No	C.G. 9
Locality	Bear River		
Stat Code	315-11-002		
Sampling Date Mo	7	Day	3
Year	88		
Gear	Trap		
Collector(s)	Sundby, McKinnon		
Remarks	1 scale / fish		

Appendix A.3. Example of AWL and scale cards for one scale/fish samples.

Appendix A.4. Example of AWL and scale cards for 2 scales/fish samples.

COHO/SALTARY/ESC./WEIR *Comments: Peak of coho run*  
 DESCRIPTION: *Samplings Dinnocenzo, Pearson, Holmes Scale Reader:*

ADP80 ADULT SALMON AGE-LENGTH  
 FORM VERSION 2.1

CARD: 001 A&B SPECIES: Coho DAY: 25 MONTH: Sept YEAR: DISTRICT: 259 SUBDISTRICT: 41 STREAM: 415 LOCATION: Salty Weir METHOD: 38 PROJECT: Escapement GEAR: MESH: TYPE OF LENGTH MEASUREMENT NUMBER SCALES/FISH # OF CARDS	1011	LENGTH	1's	AGE GROUP	AGE ERROR CODE

Cord 001 A

Cord 001 B

Species: Coho Card No. 001 B  
 Locality: Saltary Weir  
 Dist. Code: 259-41-415  
 Sampling Date: Mo 9 Day 25 Year 86  
 Gear: Weir Trap  
 Collector(s): Dinnocenzo, Pearson, Holmes  
 Remarks: Peak of Run  
Samplings 21-40 2 scales/fish

Species: Coho Card No. 001 A  
 Locality: Saltary Weir  
 Dist. Code: 259-41-415  
 Sampling Date: Mo 9 Day 25 Year 86  
 Gear: Weir trap  
 Collector(s): Dinnocenzo, Pearson, Holmes  
 Remarks: Peak of Run  
Samplings 1-20 2 scales/B&U

Litho Code

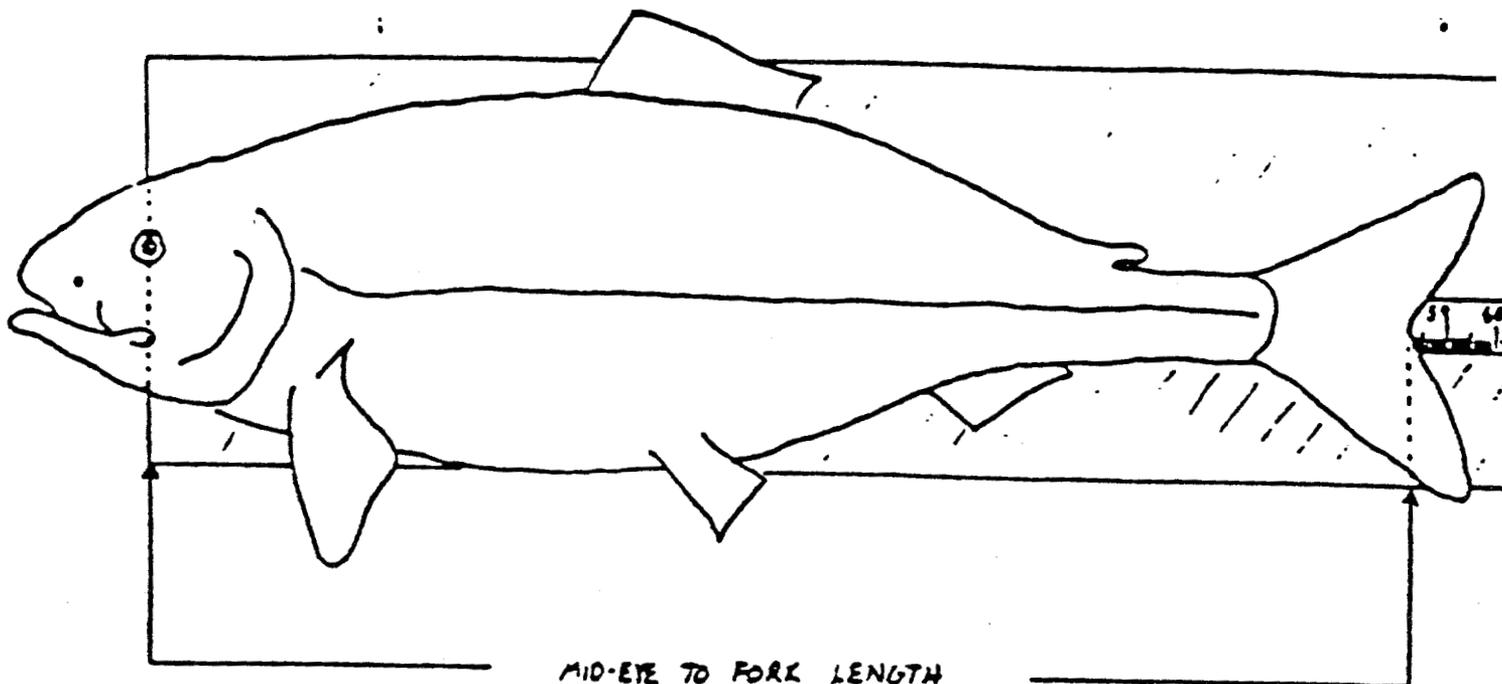


- Card:** The AWL forms and corresponding gum card(s) are numbered sequentially by date throughout the season starting with 001. A separate numbering sequence will be used for each species, gear type, district, and geographic location. Consult your port supervisor for the current card number. Sockeye and chum samples will have only 1 card per AWL form as shown in Appendix B.1. Coho and chinook samples will contain up to four cards per AWL form as shown in Appendices A.4 and A.5.
- Species:** Refer to the reverse side of the AWL form for the correct digit.
- Day, Month, Year:**  
Use appropriate digits for the date the fish are caught.
- District:**  
List only one district. Consult project leader for appropriate district, sub-district, and stream numbers.
- Subdistrict:**  
List a single sub-district if it is known and all the fish sampled were from that single sub-district. Leave blank if more than one sub-district is involved or if the subdistrict is unknown.
- Stream:**  
Leave blank for catch sampling; for escapement sampling consult project leader for appropriate number.
- Location:**  
List the appropriate code as shown on Appendix A.6.
- Period:**  
Leave blank.
- Project:**  
Refer to the reverse side of the AWL form for the correct code.
- Gear:**  
Refer to the reverse side of the AWL form.
- Mesh:**  
Leave blank unless specifically instructed by supervisor to do otherwise.-
- Type of length measurement:**  
Use (2) mid-eye to fork of tail (unless specifically instructed to do otherwise). Refer to Appendix A.7.
- # of cards:**  
Mark 1 when sampling sockeye and chum salmon (Appendix A.3). Mark 1A, 1B, 1C, or 1D when sampling chinook and coho salmon and write the card numbers perpendicular to the left of the fish # column as shown in Appendix A.4.

Appendix A.6. Assigned port and weir location codes. (Use under location in filling out AWL's for catch and escapement sampling.)

---

- 150 - King Cove
  - 151 - Port Moller
  - 152 - Dutch Harbor
  - 153 - Akutan
  - 154 - Sand Point
  - 155 - Bear River, ADF&G Camp
  - 156 - Nelson River, ADF&G Camp
  - 157 - Canoe Bay
  - 158 - Ilnik Lagoon
  - 159 - Orzenoi Lake, ADF&G Camp
-



Because the length and form of the snout of salmon changes as the fish approaches sexual maturity, length measurements are made from the middle of the eye to the fork of the tail. The length is always recorded to the nearest millimeters. The procedure for measuring length (mid-eye to fork) of the salmon is as follows:

1. Place the salmon flat on the board with the head to your left and the dorsal fin away from you.
2. Make sure your eye is directly over the end of the board. Line the eye of the salmon up with the edge of the board and hold the head in place with your left hand. It helps to place a finger in the salmon's eye for reference.
3. Flatten and spread the tail against the board with your right hand.
4. Read the mid-eye to fork length to the nearest five millimeters.

It is extremely important to keep the mark-sense forms flat, dry, and clean. Fish slime and water curling will cause data to be misinterpreted by the optical scanning reader machine. If unnecessary pencil marks, dark spots, etc. are visible, they need to be erased or else the machine will misinterpret the mark. It is necessary to completely fill in all information and darken the boxes (if needed) after each day.

Additional data columns are available on the reverse of the AWL for individual project use. If you take weights, you need to transfer the dark boxes on the front left margin of the form to the left margin on the back. This code needs to be exactly as it appears on the front.

#### GUM CARD(S):

Fill out the gum cards as shown in Appendices A.3 and A.4.

#### Species:

Write out completely (i.e., chinook, sockeye, etc.).

#### Locality:

For catch sampling, write down area in which fish were caught followed by the word catch (e.e., Herendeen Bay Catch).

#### Statistical code and Sampling date:

Transfer the appropriate digits from the AWL form.

#### Gear:

Write out completely.

#### Collector(s):

Record the last name or initials of the person(s) sampling.

#### Remarks:

Record any pertinent information such as; number of scales per fish sampled, vessel/tender name, etc. Transfer this same information to the top margin of the AWL.

#### SAMPLING:

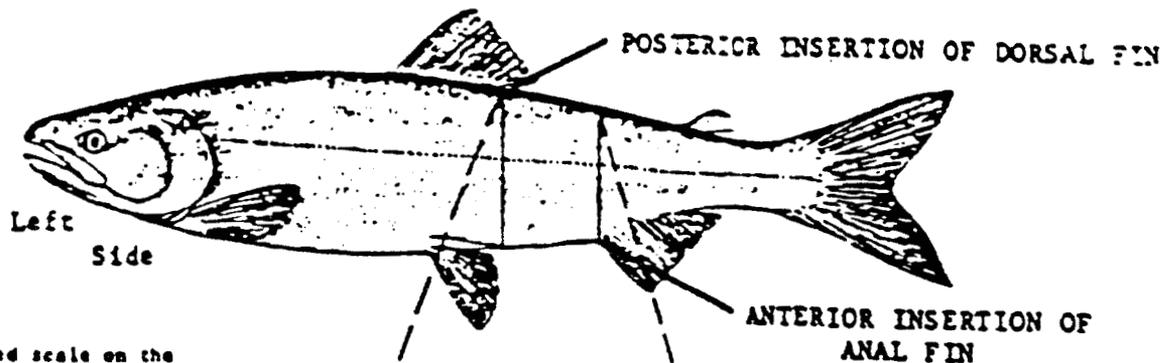
##### A. GENERAL

1. Sex the fish and darken M or F in the sex columns. If any difficulty was encountered in this procedure, write "I had trouble sexing these fish" on the top margin of the AWL and ask your supervisor for help as soon as possible before sexing additional fish.
2. Measure all species length in millimeters from the middle of the eye to the fork of the tail, refer to Appendix A.7. Record length by blackening the appropriate column blocks on the AWL form. Column 3 on the AWL form is used for fish over 999 millimeters long. Measure all species of salmon to the nearest mm. Check the calipers daily before use to ensure the accuracy of the measurements.
3. Pluck the "preferred scale" from the fish using forceps. Remove all

slime, grit, and skin from the scale by moistening and rubbing between fingers. The "preferred scale" is located on the left side of the fish, two rows above the lateral line on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin. If the "preferred scale" is missing, select a scale within the preferred area on either the left or right side of the fish. If no scales are present in the "preferred area" on both sides of the fish, sample a scale as close to the preferred area as possible and darken the 8 under "age error code" on the AWL form.

4. Clean, moisten and mount scale on gum card directly over number 1. The side of the scale facing up on the gum card is the same as the side facing up when it was adhered to the fish. The exposed facing side is referred to as the "sculptured" side of the scale. The ridges on this sculpture side can be felt with a fingernail or forceps. Mount scale with anterior end oriented toward top of gum card.
5. When sampling sockeye and chum salmon repeat steps 1 through 4 for up to 40 fish on each AWL form.
6. When taking three scales per fish as with chinook or four scales per fish as with coho salmon sample the "preferred scale" and scale #2 and scale #3. Scale #2 is one inch to the left of the "preferred scale," scale #3 is located one inch to the right, and scale #4 is located between next to any of the other three preferred scales. All are two rows above the lateral line. Mount the three scales from fish #1 over 1, 11, and 21, or 31 if four scales are taken (coho), on the gum card. Continuing, mount the 3 scales from fish #2 over 2, 12, and 22, etc.
7. Use plastic scale card holders to hold individual scale cards during sampling and cover the completed gum card with wax paper for storage.
8. When sampling at a weir, you may use the old AWL forms or field notebook to record the data. Keep the mark-sense forms in camp where they will be clean, dry, and flat. After sampling is done for the day transfer the data to the mark-sense forms on a daily basis. It is the responsibility of the data collector to transcribe the data before turning it over to the ARB.
9. Miscellaneous:
  - a. When scales are sampled in wet conditions it is difficult to mount scales in a fashion so as to result in a good scale impression being made. Glue often obscures scale features and scales frequently adhere poorly to the card. Try to keep all the paperwork dry during this time. If the gum card does get wet, the scales should be remounted.
  - b. For adipose clipped fish record the head tag number on the corresponding row in the first five columns on the reverse side of the AWL.
  - c. Look down the form from two angles after the data has been recorded

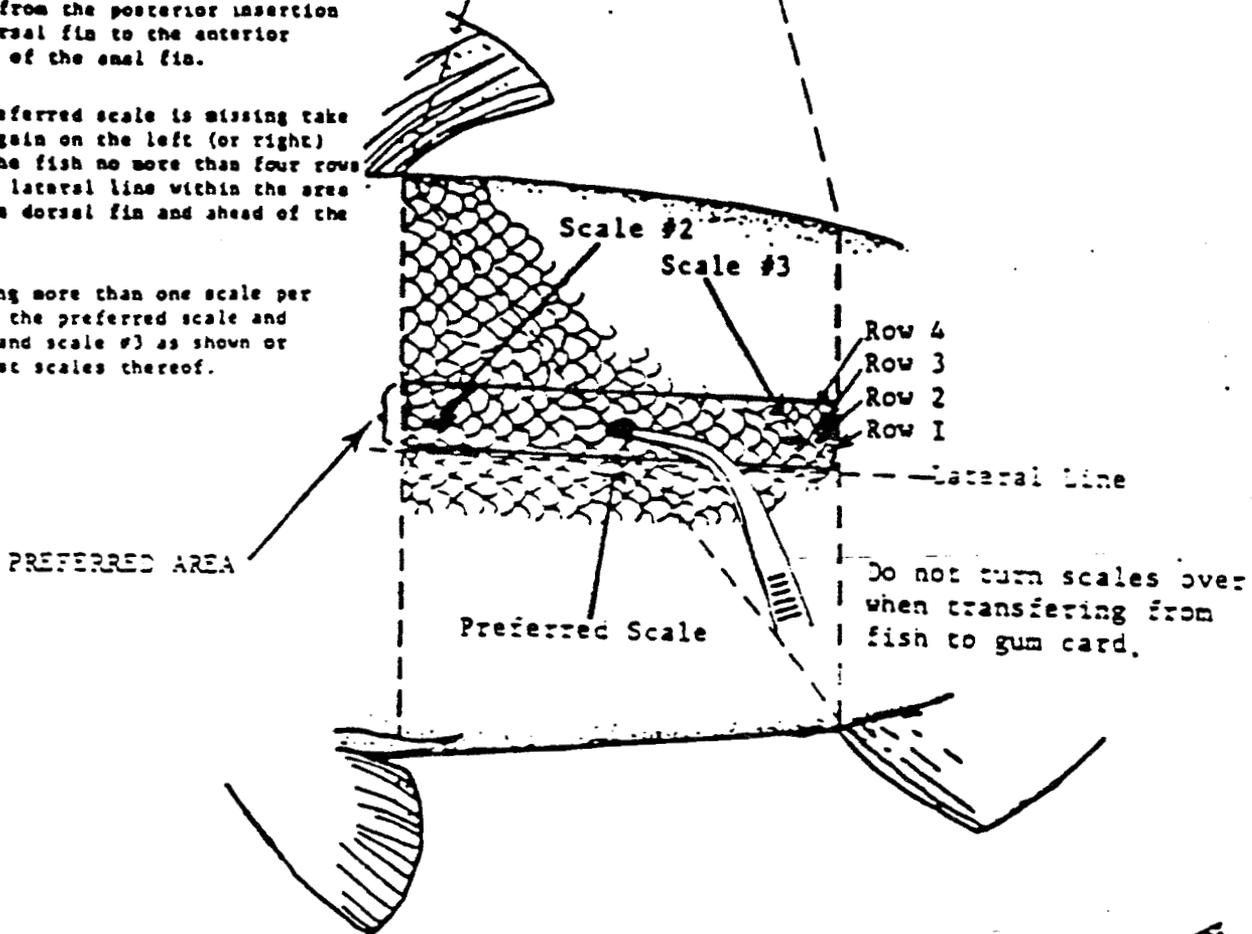
Appendix A.8. Scale sampling procedure showing the preferred scale sampling area on an adult salmon.



Take the preferred scale on the left side of the fish, two rows above the lateral line and on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin.

If the preferred scale is missing take a scale again on the left (or right) side of the fish no more than four rows above the lateral line within the area behind the dorsal fin and ahead of the anal fin.

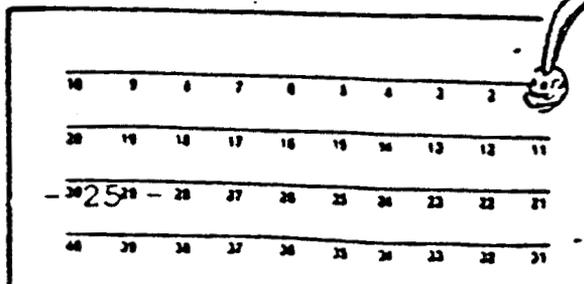
If sampling more than one scale per fish take the preferred scale and scale #2 and scale #3 as shown or the closest scales thereof.



NOTE: Mount scales with anterior portion of scale oriented toward top of card.



Place scales directly over number on gum card.



to pick up any glaring mistakes. A common error occurs, for instance, in placing both the 4 and 7 of a 475 mm fish in the 100's column with nothing in the 10's column.

- d. Keep all fish slime off forms and erase any stray marks on the forms before turning them in to your supervisor.
  - e. Write in all comments explicitly and completely under remarks, transfer remarks to top margin of AWL.
  - f. Responsibility for accuracy lies first with the primary data collector(s). The port supervisor will return sloppy or incomplete data to individual collectors. After editing a form, place your initials next to card #, but not in left margin. Editing these forms will save valuable time for the ARB during the winter, and is an extremely important part of your job duties.
10. As soon as possible after completion send the samples and mark-sense forms to the ARB in Port Moller. During scheduled radio calls before and following the sending of data to the ARB, the crew leader will notify the ARB: (1) that the data is being mailed (use a moisture-proof container); (2) what data is being sent; (3) when delivery is expected in Port Moller; and (4) who is transporting the data. It is important that these steps are followed to ensure delivery.

#### B. SAMPLING SCENARIOS:

1. Differing size crews if lengths are needed. If they are not, the Recorder should pluck scales instead.
  - a. One person: Wrestle the fish into the measuring board, wearing a glove on one hand. Measure the fish and write the sex and length down on the measuring board to be transferred to the AWL after ten fish have been measured. Next, pluck the preferred scale(s), clean, and mount on the gum card which is taped to the AWL in the clipboard which is sitting on the end of the measuring board. After 10 fish have been processed, remove the glove and record the sexes and lengths on the AWL with your clean hand. A slime rag may be helpful.
  - b. Two persons:
    - (1) When sampling more than one scale per fish, one person can wrestle the fish and record data while the other plucks and mounts the scales. The wrestler needs to wear a glove that he can slip off his writing hand to record the sex and length data on the AWL form, if necessary.
    - (2) When sampling one scale per fish, the person plucking the scales also records the data.
  - c. Three persons: One person wrestles the fish, one plucks and mounts the scales, and the third records the data or also plucks scales.

2. Sampling tote to tote:
  - a. When sampling for 3 or 4 scales per fish (chinook and coho) use a two or three man crew. If lengths or weights are needed, three persons will be required.
  - b. When sampling for 1 scale per fish (sockeye and chum) use a two or three man crew. If lengths or weights are needed, three persons will be required.
3. Sampling on a table connected to a vat:
  - a. Use three people for one scale per fish; one recorder or wrestler, one wrestler, and one plucker. Two people may be plucking if no length data is collected. The wrestler lays out and measures 10 fish at a time. The plucker samples these 10 fish, placing the scales on his fingers in a systematic manner before cleaning and mounting them on the gum card.

#### SCALE SAMPLING CHECKLIST

Clipboard  
Gum Cards  
AWL's

Pencils (No.2)  
Forceps  
Wax paper inserts

Gloves  
Measuring board or calipers  
Sampling Manual  
Plastic scale card holders

APPENDIX B

Procedure for Sampling Salmon Smolt

Once the field camp is established, sockeye smolt will be sampled for length, weight, and age data on a weekly basis during the peak outmigration. Smolt sampling will terminate when less than 10 smolt are captured over a 24 hour period, and after consulting with the ARB in Port Moller.

Two hundred smolt will be sampled per week. When more than 200 smolt are captured in the fyke net, place the smolt in a large container and gently stir the smolt. Randomly remove a portion of the catch and sample. Stop this procedure when 200 smolt are sampled. Return the remaining smolt back to the river.

Smolt will be worked up the day following capture. A smolt sampling day encompasses the 24 hours between noon of one day to noon of the following day, and is identified by the calendar date corresponding to the first 12 hour period. Age, weight, and length data will be recorded on adult AWL forms (Appendix B.1). Refer to Appendix A and B of the standard procedures for recording data on AWL forms. Record at the top of each form: personnel collecting the data, length of time the gear was fished (in hours), the hours from/to the gear was fished, approximate numbers of sockeye smolt and other species captured.

Use a knife to remove 5-10 scales from the preferred area (Appendix B.2). Mount the scales on a glass slide (Appendix B.3). Label the left portion of the slide with: location, date, specimen number, and collectors.

Measure smolt length from the tip of the snout to the fork of the tail, in the nearest millimeter (Appendix B.4).

Blot excess water from the smolt with a paper towel before weighing. Weights will be recorded to the nearest gram.

DESCRIPTION: Sockeye Smolt Bear Lake

Sundby McCullough

Time: 2.25 hrs.

279 Sockeye  
14 Octo

ADF&G ADULT SALMON AGE LENGTH  
FORM VERSION 2 1

IS MARGIN

UN I

101943

CARD:	1
SPECIES:	2
DAY:	17
MONTH:	6
YEAR:	88
DISTRICT:	315
SUBDISTRICT:	11
EAM:	002
ATION:	055
PERIOD:	25
PROJECT:	3
GEAR:	Trap
MESH:	
TYPE OF LENGTH MEASUREMENT:	1
NUMBER SCALES/FISH:	
# OF CARDS:	

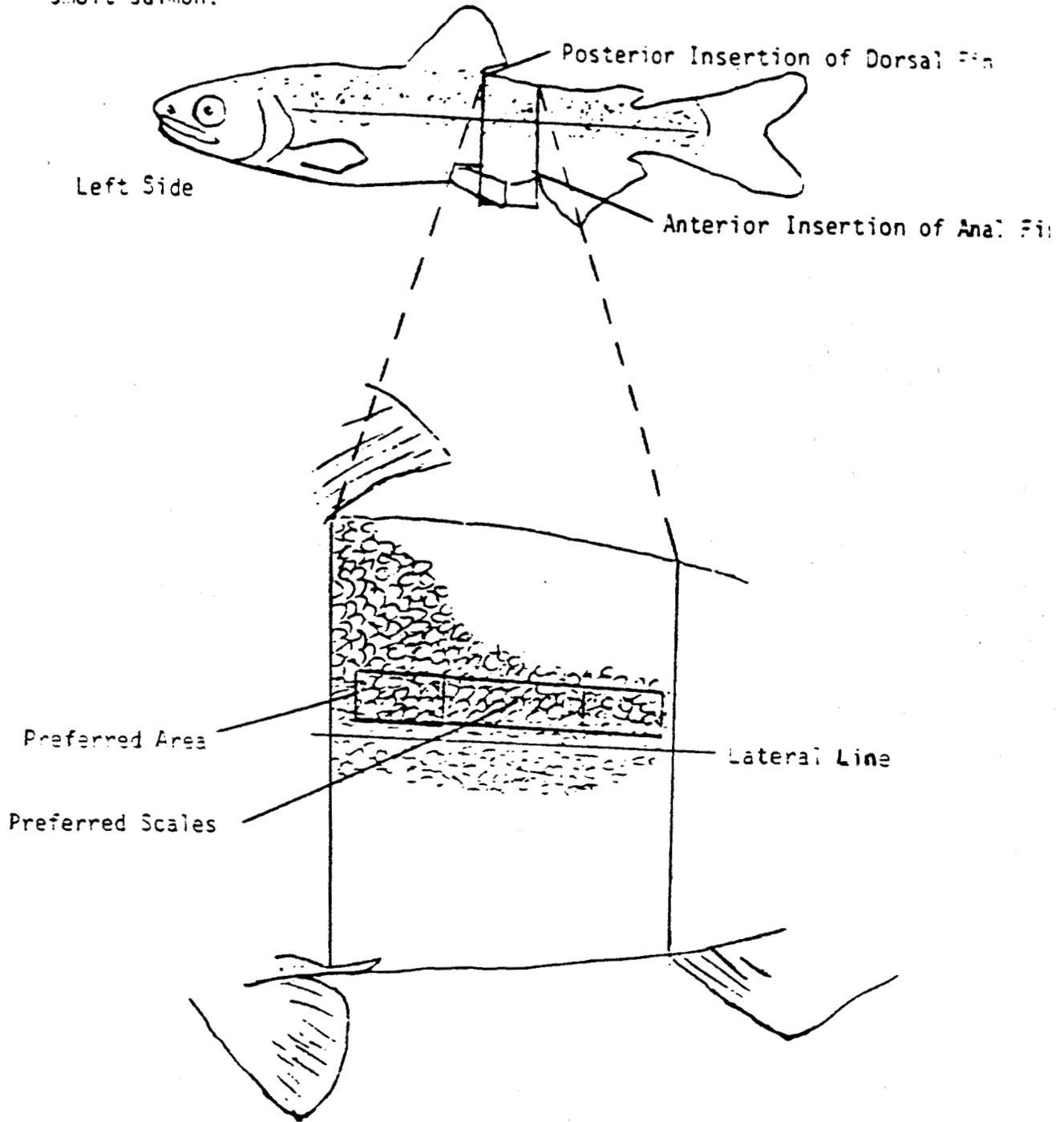
SEX	100's	LENGTH	1's	AGE GROUP	AGE ERROR CODE
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
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29					
30					
31					
32					
33					
34					
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37					
38					
39					
40					

Appendix B.1. Example of opscan form for the Bear Lake smolt.

Example

Bear Lake Smolt

Appendix B.2. Scale sampling procedure showing the preferred scale sampling area on a smolt salmon.



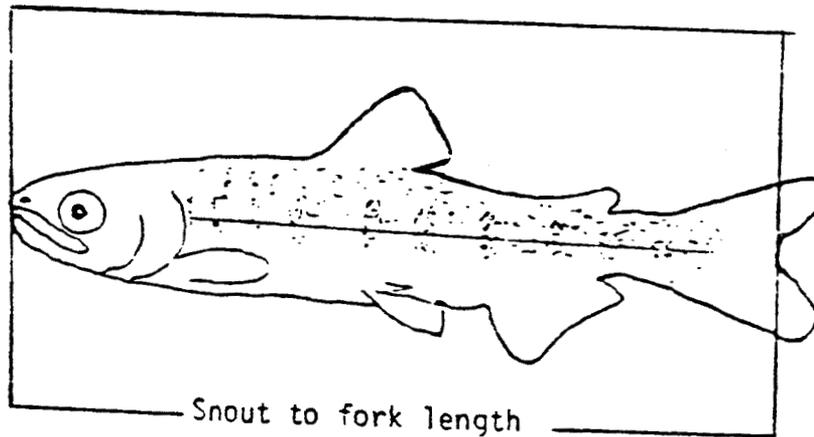
Appendix B.3. Salmon smolt glass slide example.

Location  
 Collection Date  
 Fish Reference Number  
 Collector  
 Collector

Bear River	○ ○ ○ ○ ○	○ ○ ○ ○ ○	○ ○ ○ ○ ○	○ ○ ○ ○ ○	○ ○ ○ ○ ○
------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

Number    Number    Number    Number    Number  
 100       101       102       103       104

Appendix B.4.        Measuring smolt length.



*Murray*

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# NOAA Technical Memorandum NMFS ABFL-2

U.S. DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service

A Guide to the Collection and  
Identification of Presmolt Pacific  
Salmon in Alaska with an  
Illustrated Key

MILTON B. TRAUTMAN

SEATTLE, WA  
NOVEMBER 1973

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- NMFS ABFL-1. An improved incubator for salmonids and results of preliminary tests of its use. By Jack E. Bailey and William R. Heard.
- NMFS ABFL-2. A Guide to the Collection and Identification of Presmolt Pacific Salmon in Alaska with an Illustrated Key. By Milton B. Trautman.

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# A Guide to the Collection and Identification of Presmolt Pacific Salmon in Alaska with an Illustrated Key

MILTON B. TRAUTMAN<sup>1</sup>

## ABSTRACT

This field and laboratory key contains recommendations for types of equipment needed, instructions for preserving and labeling specimens, and descriptions of the characters used in identifying five species of Pacific salmon. The key is illustrated with six line figures: 1) juvenile salmon, 2) the first gill arch, 3) head with gill arch in situ, 4) first gill arch and eye for comparison with longest rakers, 5) method of counting anal fin rays, and 6) ventral surface of head showing branchiostegals. Five plates of stippled line drawings of five lengths (25 to 110 mm fork length) for each of the five species of Pacific salmon, an annotated opposable key, and a glossary are also included.

## INTRODUCTION

As adults, the five species<sup>2</sup> of Pacific salmon of the genus *Oncorhynchus* inhabiting western North American waters are easily identified, but as subadults or as smolts in silvery coloration, they are less easily recognized. As juveniles less than 125 mm (5 inches) in fork length (FL), they may be quite difficult to identify. In addition, characters by which presmolt juveniles can be distinguished may vary with geographic area.

Several keys for identification of juvenile salmon have been published, most of which utilize the number, length, and shape of the gill rakers on the first gill arch; number of pyloric caeca and branchiostegals; and absence of parr marks, or if present, their size and shape (Foerster and Pritchard, 1935; Schultz, 1936; Haig-Brown, 1947; Clemens and Wilby, 1961; McPhail and Lindsey, 1970; Wilimovsky<sup>3</sup>). In addition to

the above characters, the key in this paper emphasizes and illustrates the distribution of those chromatophores (usually melanophores) which are reliable enough to aid in the specific identification of juveniles.

This key describes the characters typical of presmolt juveniles of the five species of Pacific salmon in Alaska. The common names recommended by the American Fisheries Society (Bailey et al., 1970, p. 17) are used, despite the fact that other names appear to be in more general use. These other names are inserted in parentheses after their respective species. Trouts, Atlantic salmon (*Salmo salar*), and some other salmonoids are included in the key because of their resemblance to Pacific salmon.

Before presenting the key, it appears advisable to describe the equipment and methods I recommend for preserving specimens, labeling specimens, and counting, measuring, and removing parts of specimens, so that those not acquainted with my procedures may more accurately and quickly identify their material.

<sup>1</sup> Professor Emeritus of Zoology, Ohio State University, Columbus, OH 43210. The author was employed in Alaska by the National Marine Fisheries Service, Auke Bay Fisheries Laboratory during the summers of 1959 and 1961. The specimens were obtained and most of the drawings made at that time.

<sup>2</sup> A sixth species, *O. mason* (Brevoort), inhabits the streams of eastern Asia from the Okhotsk Sea to Formosa.

<sup>3</sup> N. J. Wilimovsky, 1958. Provisional keys to the fishes of Alaska. On file Natl. Mar. Fish. Serv., Auke Bay Fish. Lab., Auke Bay, AK 99821.

## RECOMMENDED EQUIPMENT

*Magnifiers:* Magnification in the range of 4 to 30 will prove helpful in identification of juvenile salmon. A binocular microscope having such a range is the most satisfactory, but any type of magnifier of more than 4 power and less than 30 may be used provided it is not necessary to use one's hand to hold it—usually both hands are needed to manipulate a specimen. In the field, a binocular unit containing lenses inserted in a frame or headstrap or a jeweler's eye magnifier (especially if one wears glasses) may be used.

*Forceps:* Four or five inches long with straight or curved tips—for lifting fins, holding back gill covers, etc.

*Scalpel:* A sharp blade an inch or two long—for removing gill arches, opening body cavities, etc.

*Teasing needle:* A needle inserted in a wooden or metal handle—for separating closely set gill rakers, etc.

*Dividers:* For measuring and comparing various body parts; dividers in which one or both legs can be "broken" are the most satisfactory.

*Scissors:* About 6 inches long with the blades or cutting surface of about 1 inch.

*Ruler:* Graduated in millimeters to measure fish lengths and parts; one which includes inches also desirable.

## PRESERVING SPECIMENS

The careful preserving of specimens cannot be too strongly emphasized. Much time is lost in attempting to identify improperly preserved fishes; it is only when properly preserved that they may be rapidly and correctly identified. Frequently, juvenile salmon that have died in nets become soft, bleached, and torn. For the sake of accuracy it is better not to attempt to identify such material.

To preserve juveniles, upon capture place them in a solution of 1 part Formalin to 9 parts water. If live fishes are placed in too strong a Formalin solution, they may die with their mouths widely agape or the chromatophores may close so tightly as to be difficult to detect. If placed in too weak a Formalin solution, the fishes become bleached and soft and may decompose. If fishes are to be preserved for more than a year (or permanently),

leave them in the Formalin solution at least 1 wk and if possible no longer than 4 mo. When fish are removed from the Formalin solution, soak them in water for 24 to 48 hr; then place them in a solution containing 70% ethyl alcohol and 30% water or 35% isopropyl alcohol and 65% water.

Do not crowd or pack fishes in a container, especially if they are alive or only recently dead. Fresh fishes, if packed too tightly, will become permanently deformed upon hardening in Formalin, will be bleached where their bodies come in close contact, or will decompose. A container is too crowded if the fishes will not readily move as the container is slowly rotated or shaken. When sufficient room is allowed, identification will be facilitated because the fishes will harden without discoloring; bodies and fins will not be deformed, twisted, or broken; and the chromatophores will remain nearly or fully open.

## LABELING SPECIMENS

Labeling specimens fully and properly is of great importance; unlabeled or mislabeled specimens are of little or no value. Put the label with the specimens at the time the fishes are preserved. Label paper should remain firm when wet and should not become pulpy. Write clearly with pencil or permanent ink, recording the following data.

### Field Number

Use your own or a department number. A satisfactory method is to use the first initial of your surname or your full surname, the last two digits of the year, and your collection number. Thus, if Joe Brown in 1962 preserves his fifth collection, he writes B-62-5 or Brown-62-5; if for the Department of Salmon Investigations he writes, SI-62-5. When a departmental symbol is used, it often is desirable for the collector to add his initials or name to the label.

### Name of Water Body and Locality

Use names on standard maps. Whenever possible, avoid temporary or local names, such as

Brown's fishing camp. An example of a brief but adequate recording is: Alaska, Naknek River System, Katmai National Monument, Brooks Lake.

### Date

Include the month, day, and year and, if pertinent, the hour.

The following additional information may be needed at times.

### Method of Capture

Describe type of gear and size if significant, i.e., seine (2 cm mesh), fry net (1 cm mesh), trawl (1 cm bag), etc.

### Temperature

Measure temperature of air and/or water. If water is ice-covered, what percent?

### Other Water Conditions

If a *stream*: estimate its average width and maximum depth; if tidal and brackish, to what

extent; degree of turbidity and source—glacial silt, plankton, etc.; degree of gradient—low, moderate, or high; percentage of stream in pools, with or without current; percentage of stream in riffles, whether flow is sluggish, moderate, or swift; dominant bottom types—sand, gravel, boulders, bedrock, muck, silt, etc.; aquatic vegetation—submerged, emergent, or both (name dominant species or genera if known). If a *lake or bay*: state whether fresh, brackish, or saline; if tidal, state to what extent; estimate size and possible depth; give degree of turbidity, type of bottom, and amount and kinds of aquatic vegetation.

### Remarks

Describe anything that may aid in identification of the fishes, such as peculiar markings, habits, or habitats.

## CHARACTERS USED IN IDENTIFYING SPECIES

A juvenile salmon is shown in Figure 1 to assist in recognizing and defining the characters and the counts and measurements used when keying out a specimen.

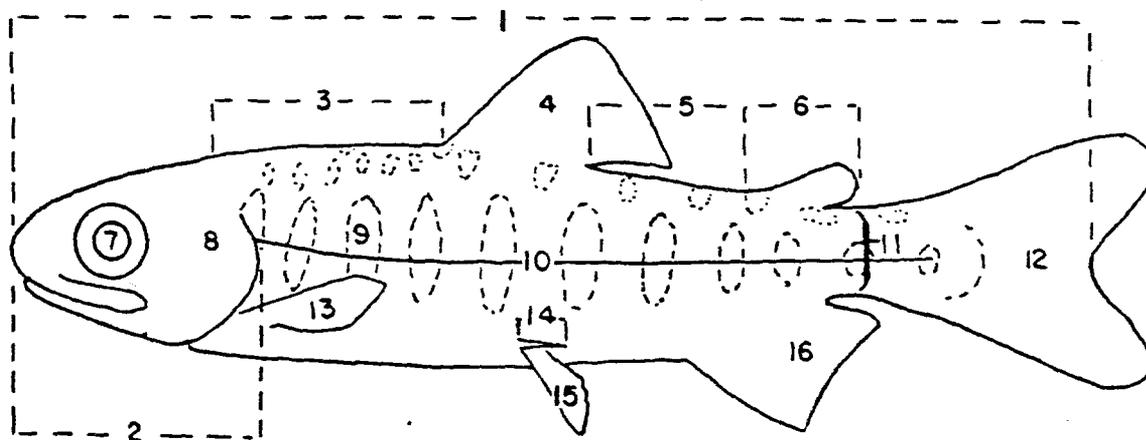
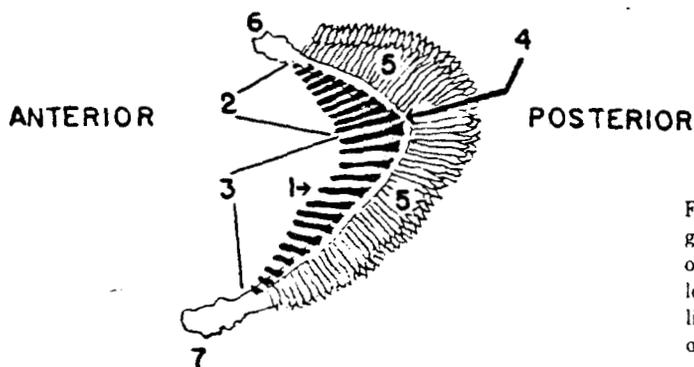


Figure 1.—Juvenile salmon, illustrating parts and methods of measuring: 1) fork length; 2) head length; 3) predorsal ridge; 4) dorsal fin; 5) portion of postdorsal ridge between posterior end of dorsal fin base and origin of adipose fin; 6) adipose fin; 7) pupil of eye; 8) gill cover, beneath which is gill chamber containing gill arches; 9) a parr mark; 10) lateral line; 11) caudal peduncle; 12) caudal fin or tail; 13) pectoral fin; 14) axillary process or scale; 15) pelvic fin; 16) anal fin.

## First Gill Arch

Beneath each gill cover are four fully formed gill arches; the first gill arch on either side is the part used for specific identification. A gill arch (Fig. 2) consists primarily of a bony central arch to which the gill rakers are attached anteriorly, the gill filaments (lamellae) posteriorly. The gill rakers prevent solid substances such as food from being carried out through the branchial clefts and protect the delicate gill filaments. The numbers of gill rakers vary somewhat among individuals of each species of salmon, but the difference in average number between some species is sufficiently great to enable one to use them as specific characters.

The rakers on the gill arch may be counted as a unit, or the upper and lower limbs may be counted separately. The two limbs are joined



ward. With a sharp scalpel, cut between the dorsal ends of the first and second arches, making a deep incision parallel with them; then cut the remainder of the attachment away. Next cut the ventral attachment in the same manner; and when both ends are free, remove the arch. Great care must be taken so that all rudimentary rakers may be removed and counted. After finishing the examination of the arch, reinsert it in the gill chamber for possible future examination.

## Gill Raker and Eye Comparison

The longest rakers are compared with the length of the eye (Fig. 4). With dividers, obtain the measurement of the length of the longest raker; then place one point of the dividers at the anterior edge of the eye, the other extending

at an angle, the upper being the shorter. When a raker is situated astride the angle, it is included in the lower limb count. When all of the rakers on the arch are counted as a unit, a single number is given; otherwise, both limbs are recorded separately (the upper limb first), and then added, thus  $12 + 20 = 32$ .

The gill rakers nearest the angle of the arch are the longest; the rakers become progressively shorter as they approach the attachment ends of each arch. The rakers near the ends are often rudimentary and can be counted only under magnification.

It may be difficult to count all of the rakers accurately while the first gill arch is in place, in which case it will be necessary to remove the arch. To do this, turn back or cut away gill cover as shown in Figure 3. Lift the first gill arch up-

Figure 2.—First gill arch of salmon after removal from left gill chamber: 1) gill raker; 2) gill rakers attached to upper or shorter limb of arch; 3) gill rakers attached to lower or longer limb of arch; 4) angle of arch (junction of the two limbs or bones); 5) gill filaments (lamellae); 6) upper point of arch attachment; 7) lower point of arch attachment.

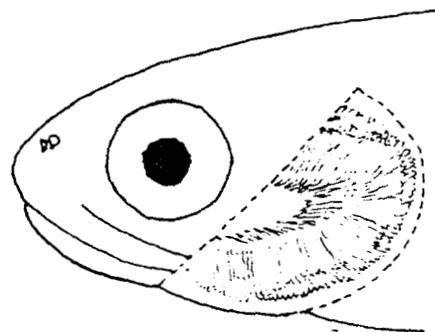


Figure 3.—Head of salmon. Dotted lines indicate that portion of gill cover which has been removed to show first gill arch in place.

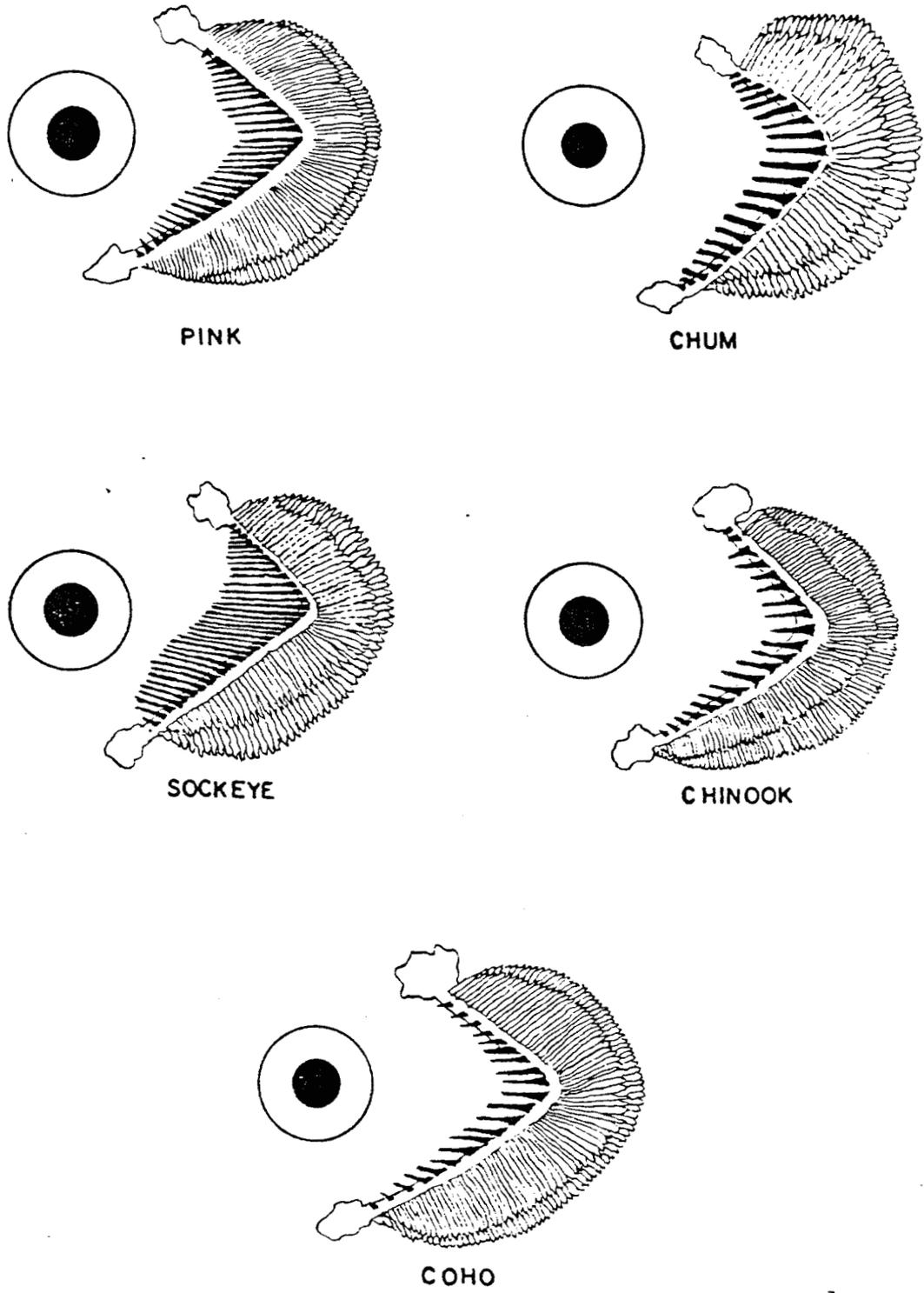


Figure 4. — First gill arch and eye for comparison with longest gill raker length of five species of Pacific salmon.

toward the opposite edge. Because the raker is shorter than the eye length in juvenile salmon, it is simplest to note where the raker reaches in relation to the pupil. Like many body part ratios, the gill raker-eye size ratios change as the juvenile salmon increases in length. For example, in specimens about 40 mm FL, the longest raker may be contained about 3 times the eye length, but in 140 mm specimens of the same species, the raker may be contained only about 2 times. This and other proportional changes must be considered.

### Anal Fin Measurement and Count

To compare the length of the fin base with the longest ray, measure the anal fin base with dividers; then project the posterior leg of the dividers forward to the opposite tip of the longest ray as shown in Figure 5 by dotted line.

In counting the number of rays (Fig. 5), do not count those anteriormost ones which are less than half the length of the longest rays, such as those marked "0." Count all rays, such as No. 1, that are half (or more than half) the length of the longest ray, taking great care to observe the last ray—No. 15 in Figure 5. The last ray is usually split to its base and appears superficially as two rays, but it is in reality only one and should be counted as such.

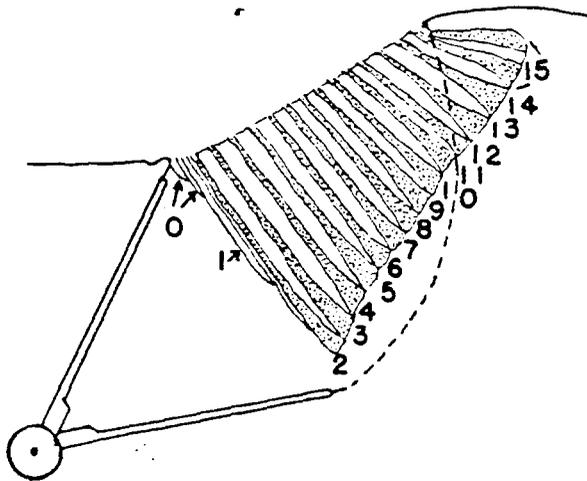


Figure 5.—Anal fin of salmon, illustrating method of measuring length of fin base and of counting rays (rays 2 to 15 are stippled here for emphasis).

### Branchiostegal Count

All branchiostegals (Fig. 6), including the smallest, anteriormost ones are counted. Usually this may be accomplished satisfactorily only under magnification and with juveniles longer than 40 mm FL. The branchiostegal count is used primarily as an additional character in specimens otherwise difficult to identify, and is especially valuable in separating the chinook salmon (usually 15 or 16) from the coho salmon (usually 13 or 14).

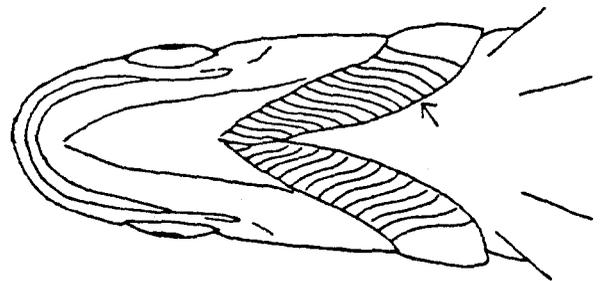


Figure 6.—Ventral surface of head of salmon. Arrow points to one of 14 branchiostegals on left side of head.

### Pyloric Caeca Count<sup>4</sup>

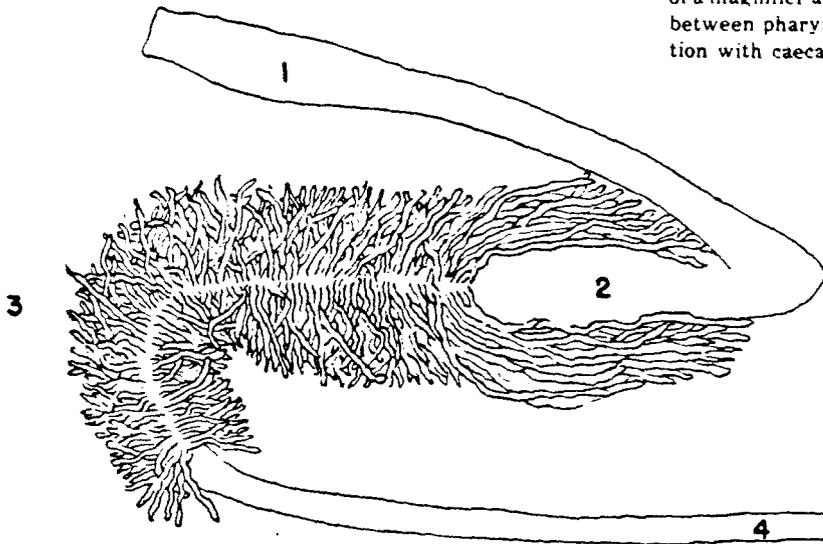
With a scalpel, widely open the abdominal cavity. Sever the esophagus as far forward as possible; then cut off the intestine near the posterior end of the stomach. The stomach and caeca can now be removed as a unit (Fig. 7). Use magnification and teasing needle as aids in counting. Counts of pyloric caeca are useful chiefly as an additional character for questionable specimens, especially in separating the chinook salmon (more than 100 caeca) from the coho salmon (fewer than 90).

### Color Pattern Variations

Juvenile salmon from certain waters or at certain stages of development may have their parr marks or other markings masked by a bluish-

<sup>4</sup>In the key, I have used pyloric caeca counts of my own, plus published accounts of others and especially the more recent ones, such as Clemens and Wilby (1961) and McPhail and Lindsey (1970).

Figure 7. - Major portion of alimentary tract of salmon with pyloric caeca spread apart preparatory to counting with aid of a magnifier and teasing needle: 1) esophagus (part of tract between pharynx and stomach), 2) stomach, 3) pyloric section with caeca, 4) intestine.



or greenish-silvery sheen, especially when they are alive. To identify these fish, it may be necessary to preserve them first in Formalin to intensify their markings.

Juveniles of one species from certain waters, such as habitually turbid ones, may have their melanophores restricted in size or distribution, thereby resembling superficially another species. As an example, coho salmon normally have the adipose and anal fins densely speckled with rather large melanophores. But in some specimens, the melanophores may be reduced in size or distribution, so that coho salmon superficially resemble chinook salmon. Conversely, juvenile chinook salmon may have the melanophores unusually numerous and well developed, thereby resembling coho salmon. To avoid error in identification, compare the size and number of melanophores on the fins with those on the body; if few and small on the body, they should be few and small on the fins.

Color variations also occur regionally. An example is the predorsal stripe in chinook salmon, which in fish from some waters is normally a solid dark bar in specimens less than 80 mm FL; in chinook salmon in other waters the stripe may be reduced to a series of oblong blotches.

The length when individuals attain smolt coloration varies greatly, both regionally and in specimens from the same locality; some fish of

the same species may lose parr and other presmolt markings when only half as large as other fish.

## HOW TO USE KEY

Because of the variations in morphology and coloring, it is advisable to use the key in conjunction with the figures and plates and to check a large combination of characters.

In using the key, first make certain your specimen is a Pacific salmon by examining the characters under the two opposable groups labeled "1." Next, note the absence or presence of parr marks (see sections "Combination of" under opposable groups 2). If no parr marks are present and your specimen has not entered the silvery smolt stage, it is probably a pink salmon, but to make sure, compare it with the identifying characters between opposable groups 2. If parr marks are present, note the absence or presence of melanophores on adipose and anal fins (see groups 3). If melanophores are absent, see sections "Combination of" under groups 4; if present, see "Combination of" sections under groups 5. Decide which "Combination of" most closely fits your specimen, then verify it by comparing the descriptions of the identifying characters for the opposable groups.

## KEY TO PRESMOLT JUVENILE SALMON

- Salmonoid fishes having fewer than 20 rays in the dorsal fin (excludes grayling); strong teeth on jaws and tongue (excludes ciscoes and whitefishes); many pyloric caeca (excludes smelts, family Osmeridae); an axillary process or scaly appendage above pelvic fin (Fig. 1, No. 14); an adipose fin; cycloid scales; upper jaw formed by both premaxillary and maxillary . . . . .1.
- 1a Base of anal fin *shorter* than longest ray (Fig. 5). Anal rays usually 9 to 12 (rarely 8 or 13). Gill rakers normally fewer than 20 on first gill arch (Fig. 3). Dorsal fin of larger juveniles of some species with several blackish spots.  
 CHAR, TROUTS, ATLANTIC SALMON. . . . .Not in this key.
- 1b Base of anal fin *longer* than longest ray (Fig. 5). Anal rays usually 13 to 17 (rarely 12, 18, or 19). Gill rakers normally 20 to 40 on first gill arch (rarely 19). Dorsal fin of larger juveniles lack blackish spots but tip of fin may be blackish.  
 PACIFIC SALMON—genus *Oncorhynchus*. . . . .2.
- 2a *Combination of: No parr marks on sides and no prominent specklings on back of presmolt juveniles. Usually no melanophores on anal and adipose fins; if melanophores present, they are few and very small, and if on adipose, are restricted to its posterior, free edge.*  
 PINK (HUMPBACK) SALMON—*O. gorbuscha*. . . . .Plate 1.
- General development—Similar to chum salmon in that yolk sac may not disappear until juvenile is more than 34 mm FL, after which development toward smolt shape and coloration is rapid. When less than 50 mm FL, this species is similar to chum salmon in being more terete than the sockeye, chinook, and coho salmon; body depth immediately before dorsal fin usually more than 1.5 times head length.
- Parr marks—Only species of salmon lacking parr marks in the presmolt juvenile.
- Coloration of body—*Preserved material*—In juveniles less than 40 mm FL, back is dark to lateral line and ventral half of body light when bicolored; dorsal third of body is darkest, sides lighter, ventral third lightest (usually milky-white or silvery) when tricolored. Few or no melanophores on lower sides and belly. In juveniles more than 40 mm FL, bicolored or tricolored condition is normally not evident, the dark back lightening gradually downward to the very light belly. *Living specimens*—Dorsal half of body bright bluish or greenish with much silvery reflection; ventral half milky or silvery-white.
- Fins—Anal and dorsal fins averaging smaller than in chum salmon; these fins in this species and in chum salmon distinctly smaller than in sockeye, chinook, or coho salmon. In specimens less than 40 mm FL the longest anal ray, when measured into head length, extends from tip of snout to about center of eye; in larger presmolt juveniles, this measurement extends from tip of snout to anterior half of eye. Anal rays usually 14 to 16 (extremes 13 to 17). *Dorsal fin* has few specklings and only a slight tendency toward a dark anterior edge in juveniles less than 50 mm FL; over 50 mm, blackish anterior edge becomes pronounced and tip of fin dusky. *Caudal fin* has speckling confined to basal half in juveniles less than 50 mm; with increasing length of juveniles, specklings appear along rays, and in large presmolt juveniles lobes tend to become blackish.

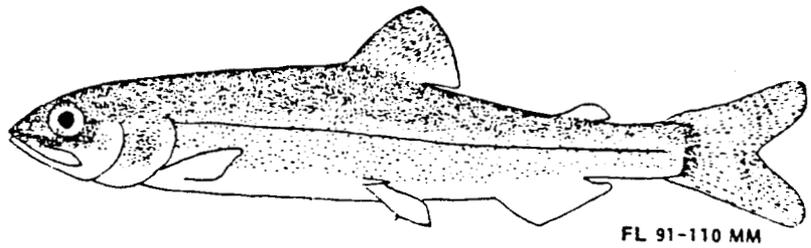
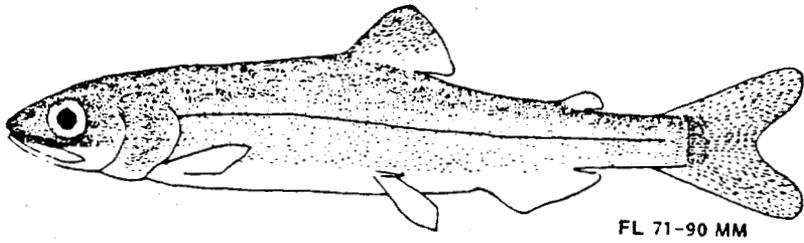
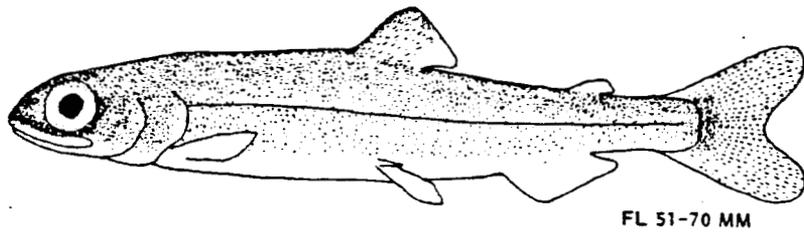
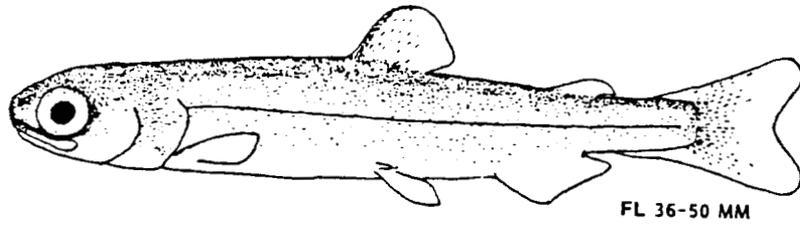
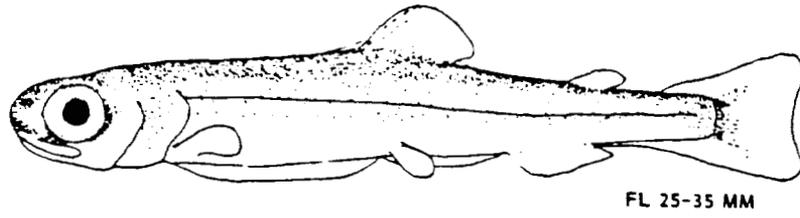


Plate 1.—Pink salmon.

Gill rakers (see Fig. 4) — Eleven to fourteen on upper limb, 14 to 19 on lower, total usually ranging between 27 and 33 (extremes 25 and 35); rakers slender and rather long; most similar in size and number to sockeye salmon but shorter and usually fewer (normally less than 31).

Pyloric caeca — Usually 130 to 195 (extremes 95 to 224); slender and rather long; differ sufficiently in numbers from coho and sockeye salmon, which have fewer than 100, to be a distinct aid in specific identification.

Branchiostegal rays — Usually 11 to 14 (rarely 10 or 15); average number less than in other species, almost invariably less than in chinook salmon, which usually has 15 to 18 (rarely 14).

Scales in lateral line — More than 170, more than in any other of the Pacific salmon; lateral line scale counts may be obtained under magnification in specimens longer than 60 mm FL.

Habits — Shortest life span of any species, between 18 mo and 2 yr. Only a comparatively small proportion of adults make extended migration in fresh water. Majority spawn in fresh waters within a short distance of brackish water or in intertidal waters. Many young enter brackish or salt waters within a few hours or days after emerging from redds, and comparatively few are found in fresh water when more than 45 mm FL.

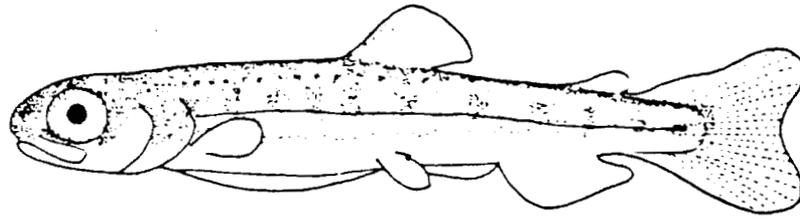
2b *Combination of:* Both parr marks on sides and dark spottings on back usually obvious in living, presmolt juveniles and always in preserved specimens under magnification (may be faint in fishes from turbid waters); parr marks become faint and disappear as juvenile assumes smolt coloration . . . . . 3.

3a No melanophores normally present on adipose and anal fins of presmolt juveniles, or if present, few and quite small. Parr marks occupy a larger area above lateral line than below it, and in some specimens anterior parr marks may be almost entirely above the lateral line.  
CHUM AND SOCKEYE SALMON . . . . . 4.

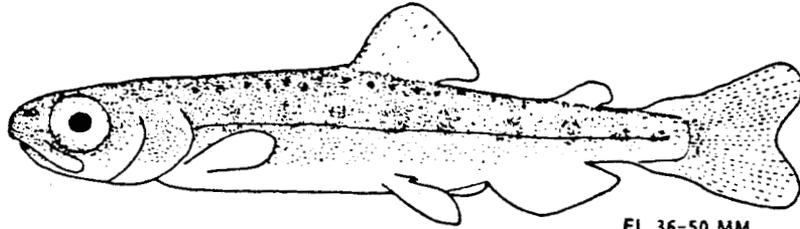
3b Melanophores normally obvious on adipose fin in living specimens and always in preserved specimens under magnification (may be indistinct in juveniles from silty waters). Anteriormost parr marks appear to occupy as large (or almost as large) an area below lateral line as above it; these parr marks are usually large, long, and wide.  
CHINOOK AND COHO SALMON . . . . . 5.

4a *Combination of:* Gill rakers 19 to 26 (average 23), notably fewer and much shorter than in sockeye salmon, which have more than 28. Normally *no* melanophores on adipose and anal fins. Anterior squarish (quadrangle) parr marks situated almost or entirely above lateral line in specimens less than 50 mm FL; in presmolt juveniles more than 50 mm FL, anterior parr marks tend to be long and very narrow and sometimes may extend well below lateral line.  
CHUM (DOG) SALMON — *O. keta* . . . . . Plate 2.

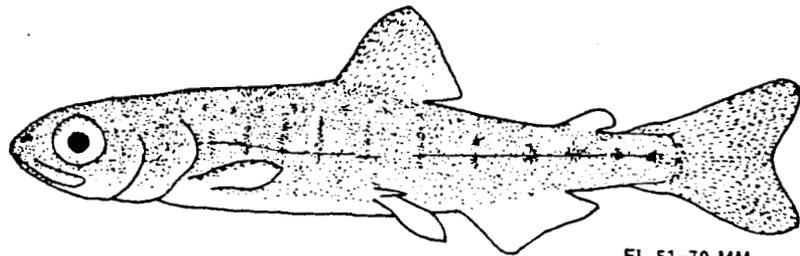
General development — Similar to pink salmon in that yolk sac may not disappear until juvenile is more than 34 mm FL, after which development toward smolt shape is rapid. Also similar to pink salmon in being more terete (when less than 50 mm FL) than the sockeye, chinook, and coho salmon; body depth immediately before dorsal fin usually 1.5 to 1.8 times head length.



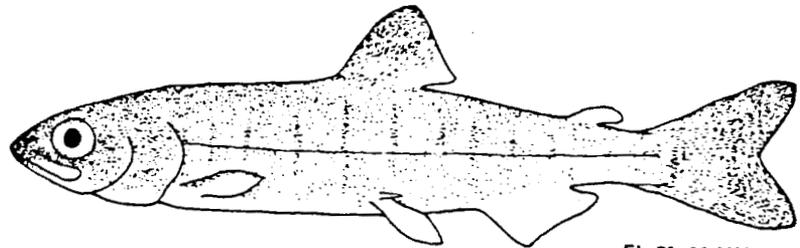
FL 25-35 MM



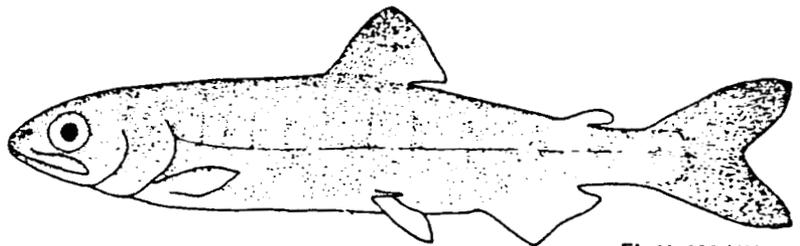
FL 36-50 MM



FL 51-70 MM



FL 71-90 MM



FL 91-110 MM

Plate 2.—Chum salmon.

Parr marks—Anterior parr marks in specimens less than 50 mm FL are more squarish (quadrated) and do not extend quite so far below lateral line as in sockeye salmon; in presmolt juveniles more than 50 mm FL, parr marks tend to become longer and more narrow than in sockeye salmon, and some tend to extend well below lateral line.

Coloration of body—*Preserved material*—Dorsal ridge stripe usually present, sometimes a series of blotches in juveniles less than 50 mm FL, becoming faint or disappearing in presmolt juveniles more than 50 mm FL; a prominent irregular row of spots and blotchings between dorsal ridge and upper edge of parr marks, these usually most distinct in specimens between 34 and 50 mm, often fading or disappearing in larger juveniles. *Living specimens*—Markings may be obscured by greenish or bluish overcast of dorsal half of body and whitish or silverish sheen of ventral half.

Fins—Anal and dorsal fins small, averaging slightly larger in size than those of pink salmon and averaging considerably smaller in height and area than those of sockeye salmon. Length of longest anal ray, when measured from snout to eye, reaches to, or almost to, center of eye; in sockeye salmon this measurement usually extends well beyond center of eye. Anal rays usually 13 or 14 (extremes 13 to 17). *Dorsal fin* has few or no distinct spottings in specimens less than 50 mm FL; in larger presmolt juveniles a dusky spot develops on tip. *Caudal fin* has faint spots largely confined to basal half in juveniles less than 50 mm FL; in larger juveniles lobes become blackish.

Gill rakers (see Fig. 4)—Seven to twelve on upper limb, 12 to 19 on lower, total usually ranging between 20 and 26 (extremes 19 to 30); rakers blunt and short, in sharp contrast to thinner, longer, and more numerous rakers of sockeye salmon, which has 30 to 39.

Pyloric caeca—Usually 160 to 185 (extremes 140 to 249); differ sufficiently in numbers from sockeye and coho salmon, which usually have fewer than 100, to be an aid in specific identification.

Branchiostegal rays—Usually 13 or 14 (extremes 12 to 16); of value primarily in separating this species from chinook salmon, which generally has more than 15.

Scales in lateral line—Between 125 and 155; of value chiefly in separating this species from pink salmon.

Habits—Life span usually 3 to 5 yr. for majority, 4 yr. some less than 3 yr. Jacks may occur. Majority spawn in fresh waters only a comparatively short distance from brackish water or in intertidal waters. Many young enter brackish or salt waters very shortly after emerging from redd, and few juveniles are found in fresh waters when more than 45 mm FL.

4b *Combination of:* Gill rakers 30 to 39 (average 36); notably more numerous, longer, and more slender than in chum salmon, which have fewer than 27. Normally no melanophores on adipose and anal fins. Anterior parr marks more rectangular than squarish in outline in specimens less than 45 mm FL and sometimes extend as much as a third to a half below lateral line; these oblong parr marks tend to shorten in presmolt juveniles more than 50 mm FL and to be mostly above lateral line.

SOCKEYE (RED) SALMON—*O. nerka*. . . . . Plate 3.

General development—Yolk sac usually disappears, except for trace, before juveniles reach 30 mm FL. Body deeper and species more slab-sided in all presmolt lengths than in chum and pink salmon—body depth immediately before dorsal fin usually less than 1.5 times head length.

Parr marks—See "Combination of" above.

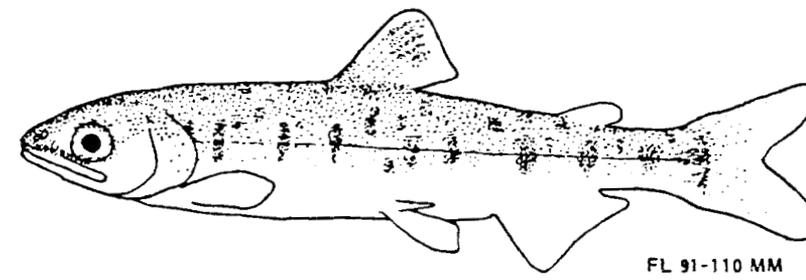
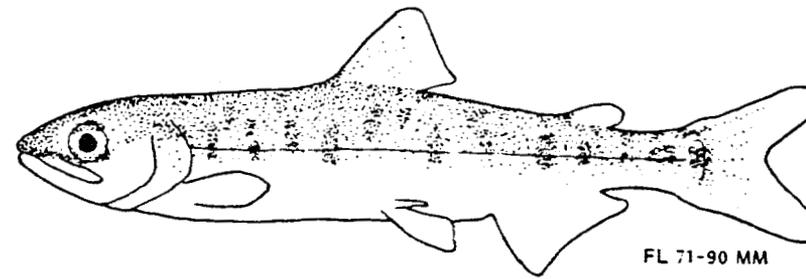
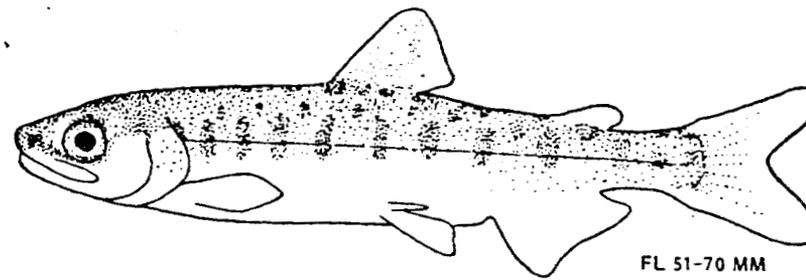
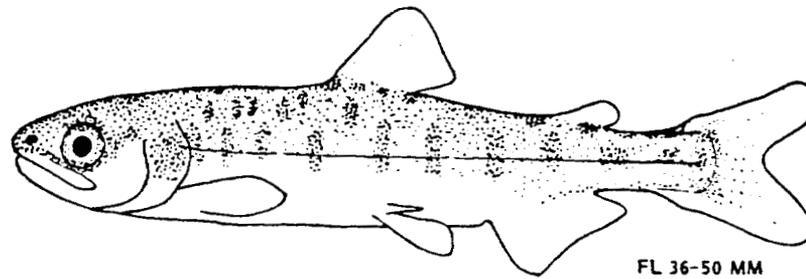
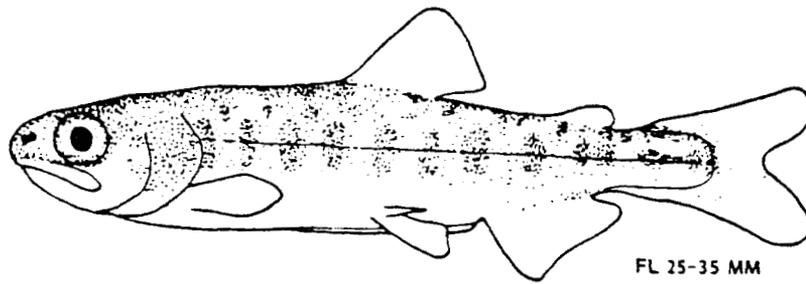


Plate 3. - Sockeye salmon.

Coloration of body—*Preserved material*—Dorsal ridge usually contains a series of more or less distinct spots in specimens less than 35 mm FL, becoming more confluent in fishes between 40 and 55 mm FL and sometimes merging into a dusky bar; in presmolt juveniles over 60 mm FL, spots or bars may disappear, after which a series of roundish spots become apparent on both sides of, and adjacent to, dorsal ridge, especially that portion behind dorsal fin; in addition to these spots, in fishes more than 35 mm FL, another longitudinal row of spots develops between dorsal ridge and upper halves of parr marks. *Living specimens*—Markings may be obscured by greenish or bluish overcast of dorsal half of body and whitish or silverish sheen of ventral half.

Fins—Anal and dorsal fins average larger in height and area than in chum and pink salmon. Length of longest anal ray, when measured from snout to eye, reaches usually from snout to beyond center of eye. Anal rays usually 14 to 16 (extremes 13 to 16). *Dorsal fin* normally has few or no distinct specklings in specimens less than 60 mm FL; a rather faint dorsal spot develops in larger presmolt juveniles in upper portion of fin, the fin being bordered on its free edges with whitish (see lowest figure, Plate 3). *Caudal fin* has few specklings on basal half, the lobes having few or no melanophores, even in rather large juveniles.

Gill rakers (see Fig. 4)—Twelve to sixteen on upper limb, 18 to 23 on lower, total usually ranging between 32 and 37 (extremes 30 to 39); rakers long and slender, averaging longer than in any other species, in sharp contrast to fewer, blunter rakers of chum salmon, which has 19 to 30.

Pyloric caeca—Usually 65 to 95 (extremes 45 to 115); usually considerably fewer than in pink, chum, and chinook salmon, and averaging more than in coho salmon.

Branchiostegal rays—Usually 13 to 15 (extremes 11 to 16); of value chiefly in separating this species from chinook salmon, which average more.

Scales in lateral line—Between 125 and 140; of value chiefly in separating this species from pink salmon, which has a higher number.

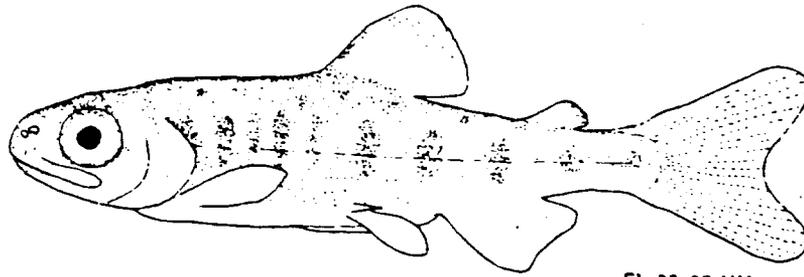
Habits—Life span usually 4 or 5 yr, some only 3. Jacks may occur. Majority of individuals highly migratory. Adults usually spawn in streams tributary to lakes; a small minority spawn in streams without a lake, in lake outlets, or on lake beaches. After rising from redd, young move downstream rather rapidly to a lake, remaining usually 1, sometimes 2, and rarely 3 yr in fresh water before entering brackish or salt water.

5a *Combination of:* Melanophores on adipose fin usually most numerous on posterior half and generally forming a dark border (see Plate 4); anterior half of adipose with few melanophores or none. Anal fin with few melanophores or none, but when melanophores are present, often quite large. Tip of dorsal fin and lobes of caudal fin darker in larger presmolt juveniles.

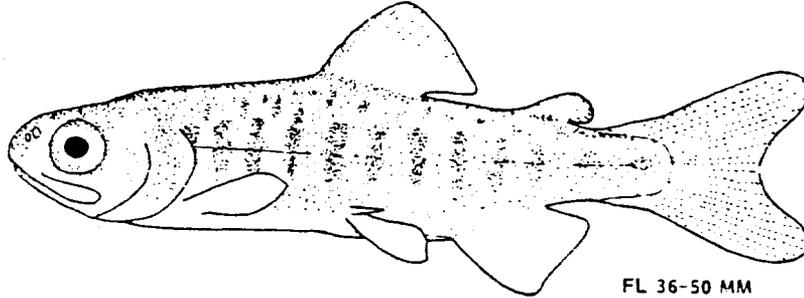
CHINOOK (KING) SALMON—*O. tshawytscha*. . . . . Plate 4.

General development—Yolk sac usually disappears or is reduced to a trace before juveniles reach 32 mm FL. Body deeper and species more slab-sided in all presmolt lengths than in chum and pink salmon; body depth immediately before dorsal fin usually less than 1.5 times head length (range 1.1 to 1.5).

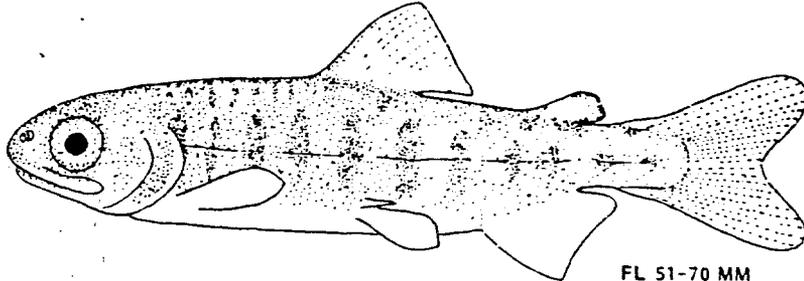
Parr marks—Almost invariably rectangular and long vertically; marks usually situated equidistant on each side of lateral line; dark parr marks and other markings contrast sharply with lighter background of body in some living and most preserved specimens.



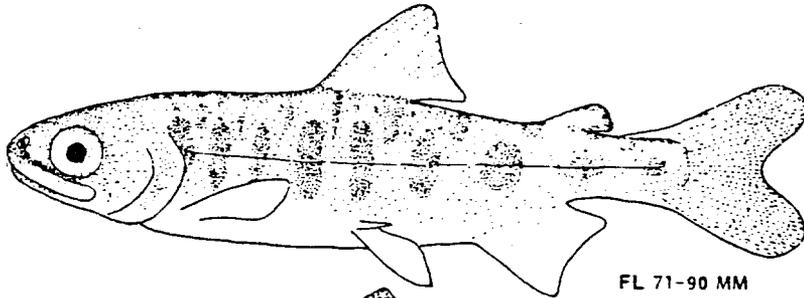
FL 25-35 MM



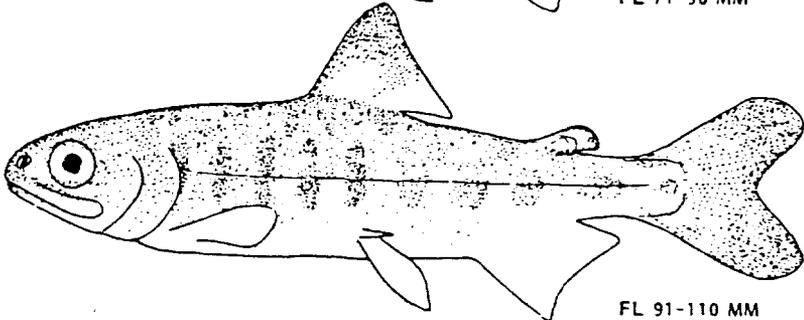
FL 36-50 MM



FL 51-70 MM



FL 71-90 MM



FL 91-110 MM

Plate 4.—Chinook salmon.

Coloration of body—*Preserved material*—Background color of body generally much lighter than body color of coho salmon, usually contrasting sharply with dark dorsal stripe or spotting, parr marks, and prominent dorsal spottings; blackish band astride dorsal ridge usually bold and unbroken in specimens less than 80 mm FL and especially on ridge before dorsal fin; in larger juveniles dorsal band often breaks up into series of spots, disappearing in larger pre-smolts as other spottings on dorsal half of body become more numerous and distinct; spottings between dorsal ridge and parr marks absent in fishes less than 35 mm FL, developing rapidly thereafter into many large and small spots and increasing in numbers as juveniles approach smolt stage. *Living specimens*—Parr marks and other markings may be obscured by bluish-silvery color of dorsal half of body and silvery sheen of ventral half.

Fins—Anal and dorsal fins averaging considerably larger in area than those of the chum and pink salmon and slightly larger than in the sockeye salmon; length of longest anal rays, when measured into head length, reaching from snout tip to beyond posterior edge of pupil and sometimes beyond posterior edge of eye; distal edge of anal slightly falcate in specimens more than 40 mm FL but averaging less falcate than does the free edge of the anal of the coho salmon. Anal rays 15 to 19, averaging higher in number than in any other species. *Dorsal fin* in young less than 60 mm FL usually has few or no distinct spottings, a blackish spot developing in the upper portion of the fin as the juveniles approach the smolt stage (see Plate 4). *Caudal fin* has comparatively few melanophores rather generally distributed in the smaller individuals, the lobes darkening as the fishes approach the presmolt stage.

Gill rakers (see Fig. 4)—Seven to twelve on upper limb, 10 to 16 on lower, total usually ranging between 20 and 25 (extremes 19 to 28); rakers short and similar in size and number to chum and coho salmon.

Pyloric caeca—Usually 140 to 185 (extremes 90 to 240); of value in separating this species from coho salmon, which normally has fewer than 85.

Branchiostegal rays—Usually 16 to 18 (extremes 13 to 19); average number greater than in any other species.

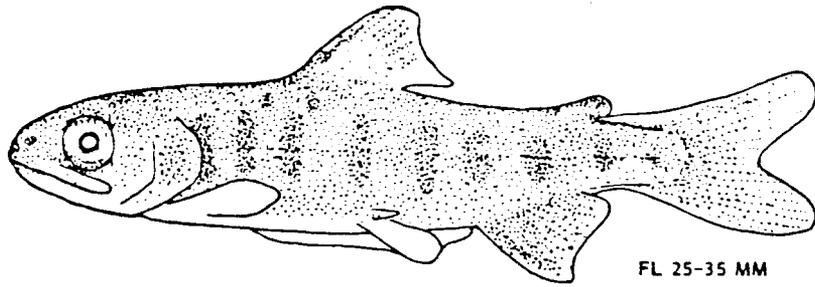
Scales in lateral line—Between 132 and 152; usually of most value in separating this species from pink salmon.

Habits—Life span 2 to 8 yr, usually 4 to 6. Jacks may occur. A portion of the juveniles enter salt water during first year of life; remainder stay in fresh waters more than 1 yr but rarely 2 yr. Juveniles of presmolt stage found in fresh waters when as long as 150 mm FL.

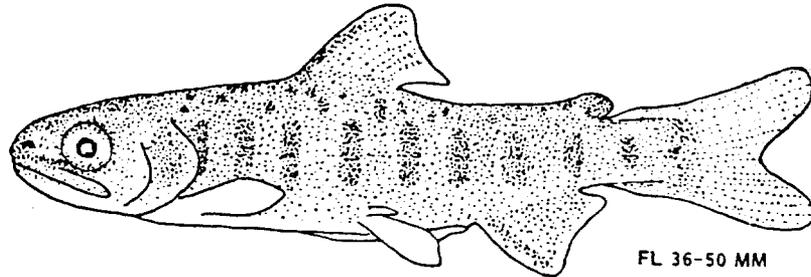
*Combination of:* Melanophores usually numerous and rather evenly distributed on adipose fin; occasionally in larger juveniles, posterior or free edge may be darker than remainder, thereby resembling somewhat melanophore distribution on adipose of chinook salmon. Anal fin in specimens larger than 30 mm FL more falcate and anterior tip more pronounced than in other species, including chinook salmon; in all except smallest specimens, anterior or leading edge of anal fin is whitish, with a dark bar parallel and posterior to it; remaining, posterior portion of fin usually abundantly speckled with melanophores except for distal and posterior edges (see Plate 5).

COHO (SILVER) SALMON—*O. kisutch*. . . . . Plate 5.

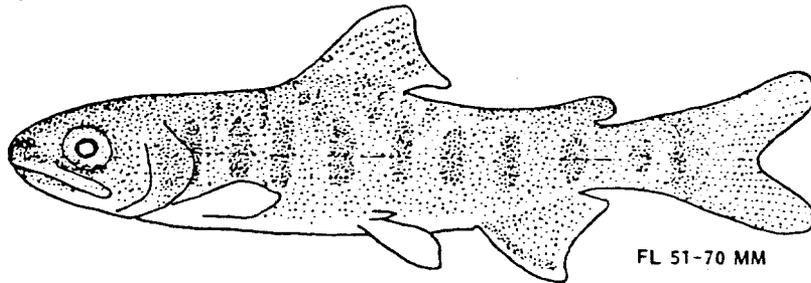
General development—Yolk sac usually disappears, except for a trace, before juveniles reach 32 mm FL. Body deeper and species more slab-sided in all pre-



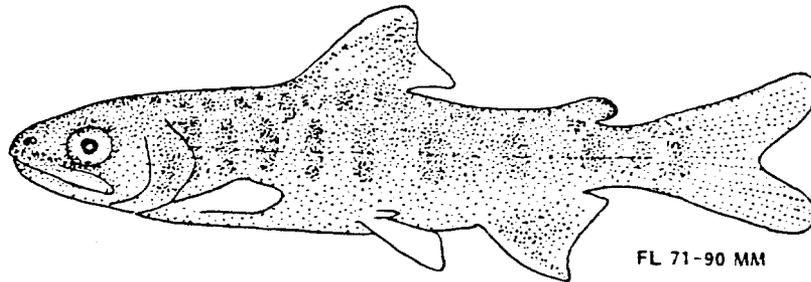
FL 25-35 MM



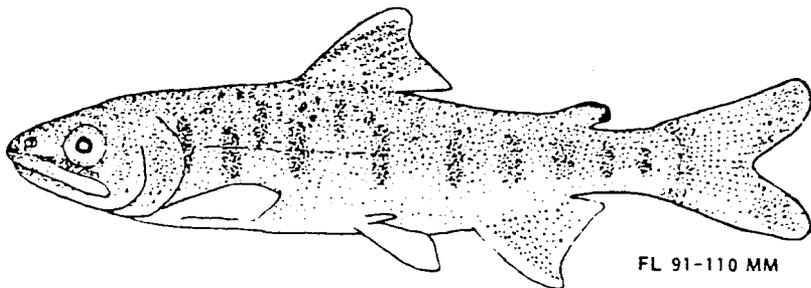
FL 36-50 MM



FL 51-70 MM



FL 71-90 MM



FL 91-110 MM

Plate 5. - Coho salmon.

- smolt lengths than in chum and pink salmon; body depth immediately before dorsal fin usually less than 1.5 times head length (range 0.9 to 1.5).
- Parr marks—Anterior parr marks always large and long vertically, their upper and lower ends more rounded than rectangular-shaped parr marks of chinook salmon; marks usually situated equidistant on each side of lateral line; usually less contrast between color of parr marks and body than in chinook salmon.
- Coloration of body—*Preserved material*—In all but smallest specimens, contrast between all body marks and background color of body is not as pronounced as in other species; dark bar along dorsal ridge usually distinct and unbroken in juveniles less than 50 mm FL, breaking up into spots or disappearing in larger specimens; back spottings on both sides of dorsal ridge usually prominent in all except smallest specimens; spots between parr marks often elongate and extending downward between them, sometimes to lateral line (see bottom figure, Plate 5); spots on dorsal half of body often increase in number and/or decrease in size as individuals approach smolt stage. *Living specimens*—Parr marks and other body markings may be obscured by dark coloration of body or by bluish sheen.
- Fins—Anal and adipose fins described under “*Combination of*” (this section). Anal rays usually 13 or 14 (extremes 13 to 16). *Dorsal fin* has comparatively few melanophores scattered over it in smallest specimens; in those more than 32 mm FL the number of melanophores increases, especially on or adjacent to anterior or leading edge; this results in a dark bar along the anterior edge behind which melanophores are rather evenly distributed; as fishes approach presmolt stage, a white anterior (or leading) edge and a whitish tip develops, followed by a dark parallel bar (see bottom figure, Plate 5). *Caudal fin* has rather even distribution of melanophores along rays in all except smallest young, this increasing in color intensity and number as fish increases in size.
- Gill rakers (see Fig. 4)—Eight to thirteen on upper limb, 9 to 14 on lower, total number usually ranging between 19 and 27 (extremes 18 to 27); rakers short and rather similar in size and number to chum and chinook salmon.
- Pyloric caeca—Usually 50 to 85 (extremes 45 to 114); of value in separating this species from chinook, pink, and chum salmon, which normally have more than 100.
- Branchiostegal rays—Usually 13 or 14 (extremes 12 to 15); average number less than in chinook salmon, which normally has 15 or more.
- Scales in lateral line—Between 120 and 140 (average 128); usually averaging fewer than in any other species.
- Habits—Life span 2 to 4 yr. Jacks may occur. Majority appear to spend 1 or 2 yr in fresh waters, a few 3 yr. Some juveniles in presmolt stage are found in fresh waters when 150 mm FL.

## GLOSSARY

- Adipose fin* A fleshy, finlike, rayless structure situated on dorsal ridge between dorsal and caudal fins (Fig. 1, No. 6).
- Anal fin* The fin situated medially and immediately behind vent between posterior end of abdomen and anterior end of caudal peduncle (Fig. 1, No. 16).
- Axillary process or scale* An accessory enlarged scale attached to upper or anterior base of pelvic fin (Fig. 1, No. 14).
- Gill opening* Opening between opercle or gill cover and side of head.
- Branchiostegals or branchiostegal rays* Elongated bones arranged fanwise within branchiostegal membranes, situated on ventral edge of gill covers (Fig. 6).
- Caudal fin* Terminal or tail fin of fishes (Fig. 1, No. 12).
- Caudal peduncle* That region of body between base of posterior ray of anal fin and base of caudal fin (Fig. 1, No. 11).
- Chromatophores* Color cells which under control of sympathetic nervous system can be altered in shape, producing color changes.
- Cycloid scales* Smooth-edged scales of soft-rayed fishes having an evenly curved posterior border devoid of minute spines.
- Dorsal fin* In salmon, a single fin composed of rays situated dorsally on body approximately halfway between head and tail (Fig. 1, No. 4).
- Dorsal ridge* Apex or dorsal junction of left and right sides of body; dorsal and adipose fins are situated on this ridge (Fig. 1, No. 3-6).
- Dorsal stripe* A band on dorsal ridge which is lighter or darker than adjacent areas.
- Falcate* Curved like a sickle; a fin is falcate when its distal edge is concave, having middle rays shorter than anterior and usually posterior rays.
- Filaments* See *gill filaments*.
- Fork length* Distance in a straight line from anteriormost part of tip of upper jaw or snout of juvenile salmon to apex of angle produced by two lobes of caudal fin (Fig. 1, No. 1).
- Gill arch* Branchial skeleton which contains gill rakers and gill filaments, or lamellae (Fig. 2).
- Gill cover, opercle, or operculum* Large, very flat, thin bones on each side of head which cover gills (see Fig. 3, which has the major portion of the gill cover removed).
- Gill filaments (lamellae)* Pleated folds of skin, richly supplied with blood vessels, attached to posterior edge of gill arch (Fig. 2, No. 5).
- Gill rakers* Projections on anterior edge of first gill arch (Fig. 2, No. 1).
- Head length* Distance in a straight line from anteriormost part of upper jaw or snout to posterior margin of opercle (Fig. 1, No. 2).
- Hypural* Complex of expanded and fused bones of last few vertebrae which support caudal fins in certain fishes.
- Jack* Precocious male salmon which spawn after spending a year or two less in the ocean than the majority of individuals; they are notably smaller than average size of spawning males of their species.
- Juvenile* As used here, a salmon between 25 and 110 mm FL which has not entered smolt stage.
- Lamellae* See *gill filaments*.
- Lateral line* A line formed by a series of sensory tubes and pores extending along sides from head to tail (Fig. 1, No. 10).
- Lateral line scale count* A count of pored scales from first scale on body behind head posteriorly to above hypural.
- Melanophores* Chromatophores with dark or black pigment.
- Parr marks* Squarish or oblong blotches or pigmented areas along sides of presmolt salmonids (Fig. 1, No. 9).
- Pectoral fins* Anterior or uppermost of paired fins of fishes, one on each side of breast immediately behind head (Fig. 1, No. 13).
- Pelvic fins* A ventral pair of fins, abdominal in salmonids (Fig. 1, No. 15).
- Postdorsal ridge* That portion of dorsal ridge behind dorsal fin (Fig. 1, No. 5).
- Predorsal ridge* That portion of dorsal ridge before dorsal fin (Fig. 1, No. 3).
- Presmolt* A juvenile salmon with parr marks; in pink salmon, which lack parr marks, demarcation between a presmolt and smolt is slight, differing chiefly in latter's more adult shape.
- Pupil of eye* Opening in iris of eye by which light reaches retina. It is circular in fishes (Fig. 1, No. 7).
- Pyloric caeca* Fingerlike diverticula, usually glandular, which open into alimentary canal

of most fishes at junction of stomach and intestine in region of pylorus (Fig. 7, No. 3).

*Rakers* See *gill rakers*.

*Redd* Excavation or nest made by a spawning salmon.

*Rudimentary* Very small and poorly formed, pertaining here chiefly to smallest gill rakers and anal rays (Fig. 5, "0").

*Slab-sided* When depth of body, measured before dorsal fin, is considerably greater than width of body.

*Smolt* As used here, a young salmon which has lost its parr marks. Pink and chum salmon fry usually go to the ocean within a few days of emerging from the streambed and usually do not undergo a visible change in morphology or color in fresh water.

*Subadult* An individual similar to an adult and approaching adulthood in age and size but still incapable of breeding.

*Terete* Nearly cylindrical in cross section and tapering toward the front and rear.

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# NOAA Technical Report NMFS CIRC-386

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U.S. DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service

## Key to Field Identification of Anadromous Juvenile Salmonids in the Pacific Northwest

ROBERT J. McCONNELL and GEORGE R. SNYDER

SEATTLE, WA.  
January 1972

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## ABSTRACT

A key is presented with descriptive illustrations to help in field identification of live, juvenile salmonids in fresh waters of the Pacific Northwest. Other juvenile fish that may be mistakenly identified as salmonids are included.

## INTRODUCTION

Species identification of live, anadromous juvenile salmonids is frequently a problem to the field biologist. The purpose of this key is to list and illustrate the external characteristics which will expedite field identification of juvenile salmonids in the Pacific Northwest.

Five species of Pacific salmon (pink, chum, sockeye, chinook, and coho); four species of trout (cutthroat, brown, Dolly Varden, and rainbow or steelhead); and other juvenile and adult fish<sup>1</sup> that may be mistaken for salmon or trout in fresh water are described in this key.

## USE OF KEY

The characteristics for identification are listed in a series of alternative statements, some of which are illustrated. To use the key, examine the first statement; if applicable, proceed to the next and continue to successive statements until the species is identified. If a statement is not applicable, pass to the alter-

<sup>1</sup> Especially adult smelt, family Osmeridae.

native characteristics indicated by numbers in parentheses (numbers on the drawings correspond to numbers of statements in the key). Continue in this manner until the specimen is identified. Some external characteristics are positive separating features (marked with asterisk), whereas others are not. Therefore, two or more statements should be considered before final rejection. If a precise identification cannot be made using the external characteristics—and the fish can be sacrificed, a positive identification can usually be made from internal features (marked with double asterisks). A bibliography of keys that utilize more descriptive internal characteristics is included in this paper.

## KEY

1. (47) Adipose fin and scales present.  
(Fig. 1)
2. (48) Fleshy appendage at base of pelvic fins present.
3. (49) Mouth large, reaching at least to center of eye.

Family Salmonidae

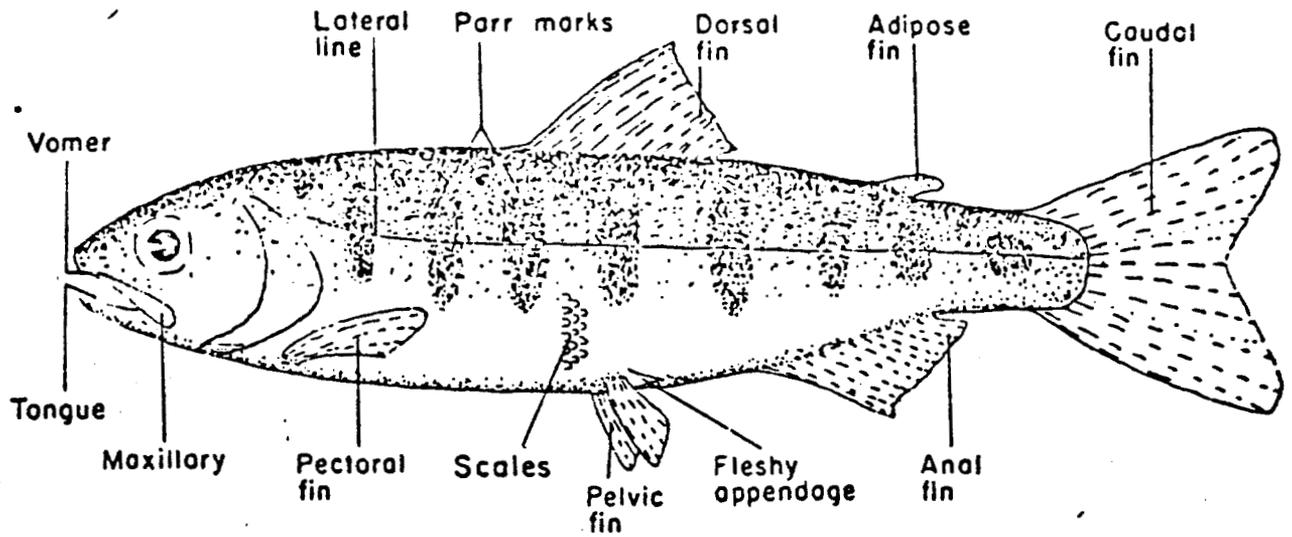


Figure 1.—A hypothetical salmonid showing external characteristics.

4. (17) Anal fin higher than long, with 8 to 12 developed rays (Fig. 2A)
5. (52) \*Teeth on head and shaft of vomer. (Fig. 3A)

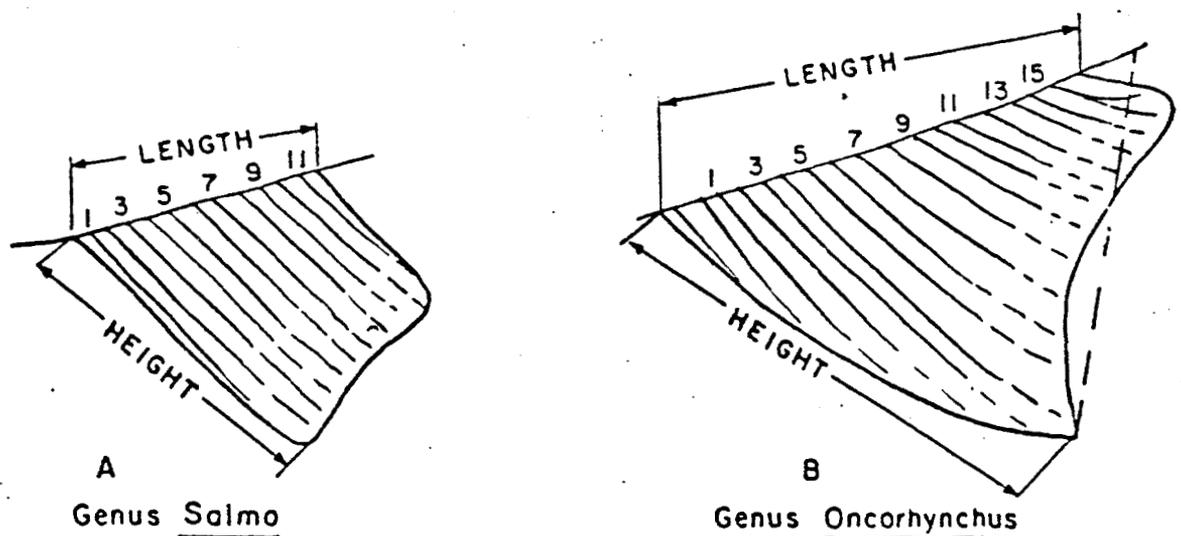


Figure 2.—Anal fins: (A) Trout, genus *Salmo*; (B) Pacific salmon, genus *Oncorhynchus*. The two drawings show differences in structure and fin ray count. (Note that the length of the anal fin is its overall basal length, and its height is that distance from the origin of the fin to the tip of the anterior lobe. In counting fin rays, include only those which originate from the base and terminate at the outer margin of the fin or are half as long as [or greater than] the longest ray.)

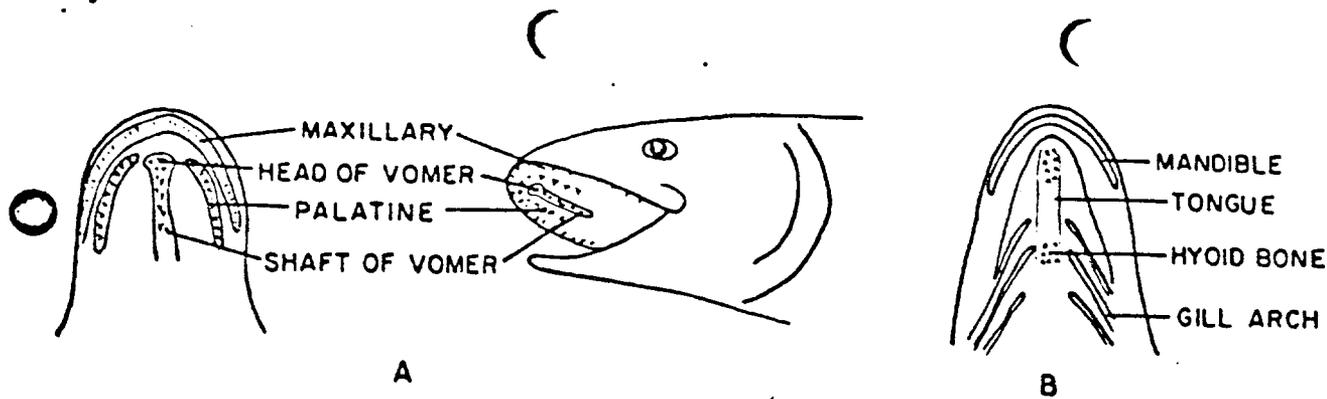


Figure 3.—Location of dentition in (A) the roof and (B) the floor of the mouth of salmonid fishes. (Presence or absence of teeth on the vomer or tongue may be determined by use of the little finger or a blunt instrument. The small hyoid teeth at the base of the tongue are located between the gill arches of the lower jaw and are difficult to find.)

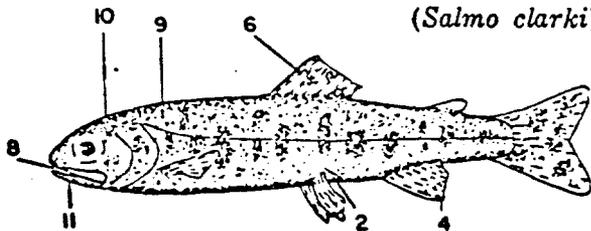
6. (18) Dorsal fin with large dark spots.  
Trout  
Genus *Salmo*

7. (53) Adipose fin not orange; no row of pale round spots along lateral line.  
8. (12) \*Small hyoid teeth at base of tongue. (Fig. 3B)

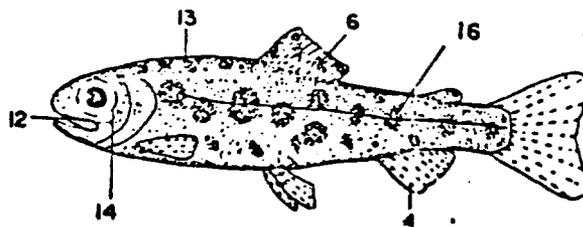
9. (13) Not more than five parr marks on mid-dorsal ahead of dorsal fin.

10. (14) Maxillary reaching past posterior margin of eye.

11. (15) Red or yellowish hyoid mark under lower jaw. Tail usually black spotted.  
Cutthroat trout  
(*Salmo clarki*)



16. (20) Parr marks almost round.  
Rainbow or steelhead trout  
(*Salmo gairdneri*)



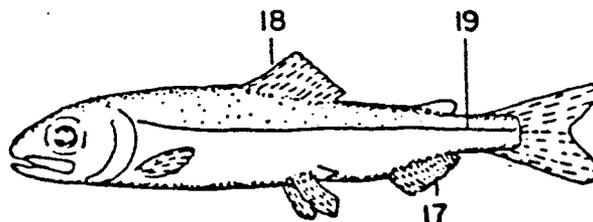
17. (4) Anal fin longer than high, with 13 or more developed rays. (Fig. 2B)  
18. (6) Dorsal fin without large dark spots, may be black tipped.

Pacific salmon  
Genus *Oncorhynchus*

19. (20) No parr marks. Fry leave fresh water while small—approximately 1.75 inches (45 mm) long.

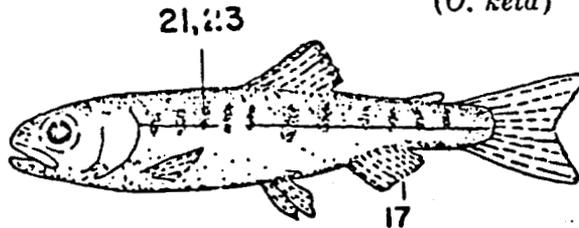
Pink salmon  
(*O. gorbuscha*)

12. (8) \*No teeth at base of tongue.  
13. (9) Five to 10 parr marks along mid-dorsal ridge ahead of dorsal fin.  
14. (10) Maxillary short, not reaching past posterior margin of eye.  
15. (11) No hyoid mark under lower jaw. Few or no spots on tail.

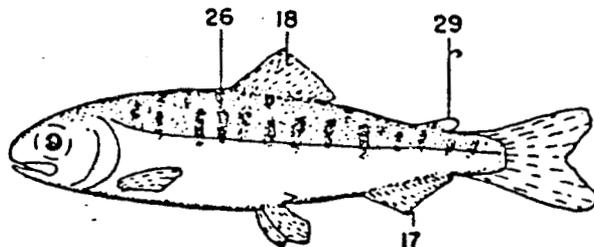


- 20. (16) Parr marks present as vertical bars or oval spots.
- 21. (30) Parr marks short, extending little, if any, below lateral line.
- 22. (25) Gill rakers on first arch, 19 to 26.  
\*\* Pyloric caeca, 140 to 186.
- 23. (26) Parr marks faint. Sides below lateral line iridescent green.
- 24. (27) Small when migrating from fresh water, approximately 1.5 inches (40 mm) long.

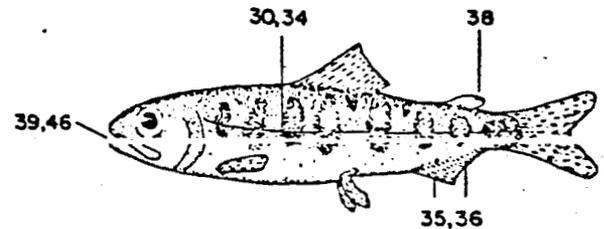
Chum salmon  
(*O. keta*)



- 25. (22) Gill rakers on first arch, 30 to 40.  
\*\*Pyloric caeca 60 to 115.
  - 26. (23) Parr marks usually sharply defined. Sides below lateral line silvery, not iridescent green.
  - 27. (24) Relatively large when migrating from fresh water, approximately 3 to 5 inches (80 to 126 mm) long.
  - 28. (31) Gill rakers long and slender, more than 19 on first arch.
  - 29. (32) Adipose fin clear, not pigmented.
- Sockeye salmon  
(*O. nerka*)

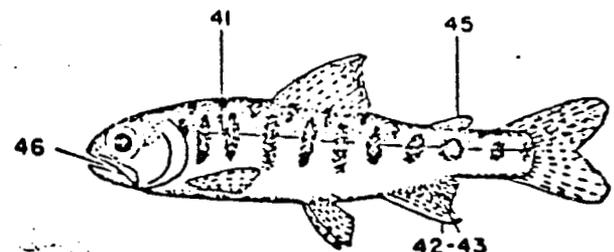


- 30. (21) Parr marks large, vertical bars centered by lateral line.
  - 31. (28) \*\*Gill rakers short and thick, fewer than 29 on first arch.
  - 32. (29) Adipose fin at least partially pigmented.
  - 33. (40) \*\*Pyloric caeca more than 90.
  - 34. (41) Parr marks broader than interspaces.
  - 35. (42) Anterior rays of anal fin not distinctly longer than rest, not white edged.
  - 36. (43) Anal fin not pigmented.
  - 37. (44) Black spots, when present, on both lobes of caudal fin.
  - 38. (45) Adipose fin not completely mottled, clear area at anterior base of fin.
  - 39. (46) Black gums along base of lower teeth.
- Chinook salmon  
(*O. tshawytscha*)



- 40. (33) \*\*Pyloric caeca less than 80.
- 41. (34) Parr marks narrower than interspaces.
- 42. (35) Anterior rays of anal fin elongated; when depressed they extend to base of last ray. (Fig. 2B)
- 43. (36) Anal fin pigmented between rays, resulting in black banding.
- 44. (37) Black spots, when present, on upper lobe of caudal.
- 45. (38) Adipose fin completely pigmented.
- 46. (36) Mouth gray to white.

Coho salmon  
(*O. kisutch*)



47. (1) Adipose fin not present; scales present or lacking.

Not Salmonidae

48. (2) No fleshy appendage at base of pelvic fins.

Smelts

Family Osmeridae

49. (3) Mouth small, not reaching center of eye; teeth weak or absent.

50. (51) Depressed dorsal fin, shorter than head.

Whitefishes

Genus *Coregonus*

51. (50) Depressed dorsal fin, longer than head.

Arctic grayling

(*Thymallus arcticus*)

52. (5) \*\*Teeth on head of vomer only.

Chars

Genus *Salvelinus*

Dolly Varden (*S. malma*)

53. (7) Adipose fin orange; row of distinct pale round spots along lateral line.

Brown trout

(*Salmo trutta*)

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GPO 9

APPENDIX C

General Equipment, Camp Maintenance  
and Camp Policy

## Equipment Maintenance

Equipment maintenance is perhaps one of the most important operations you will perform during the field season. The outboard motors and generators must be kept in good operating condition.

It will be the crew leader's responsibility to assign the most knowledgeable member of the crew to the job of maintaining and servicing the equipment. It will be this persons responsibility to see that all equipment is kept in operating condition.

## Outboard Motors

Your outboard motor will perform longer and give less trouble if these suggestions are followed:

1. The correct outboard fuel mixture is 50:1. Always pour the oil into the tank first, then add 2 or 3 gallons of gas and mix thoroughly, then fill tank to capacity always using a large funnel and chamois filter.
2. Chain saws have a fuel mixture 25:1. Chain saw gas should be mixed in a 5 gallon can and clearly marked that it is chain saw fuel.
3. When mixing gasoline or filling the tanks of the generator, stove or lantern, keep the following in mind:
  - a. Always mix fuel tanks or equipment under cover to prevent water contamination and always use a funnel and filter.
  - b. Fill camp stoves and lanterns outside as the danger of fire is very real.
  - c. A little extra effort toward cleanliness will pay in hours of trouble free operation.
4. Always place outboard motors in neutral when starting.
5. Check daily the clamp screws that hold the outboard to the transom. Also routinely check the motor for loose screws and bolts, cracks, and breaks, especially in the area of the lower unit.
6. Never start or run an outboard in the tilted position.
7. In the normal operation of a water pump, a "tell-tale" stream of water is discharged from a hole in the bottom edge of the cowling or from the back of the shaft. If this stream of water stops, the water pump is not working and the motor should be shut off. The side plate over the water intake can be removed for temporary relief as it may be plugged. If the pump continues not to function, the outboard should not be run, and a report to base camp should be made.
8. Check the grease in the lower unit of the outboards propeller once a week, and drain and replace the lower unit grease every three weeks. Jet units must be greased daily. This is crucial. Special grease guns will be

provided.

9. If the skeg or jet unit hits bottom, check the screws for tightness and housing damage.
10. If your outboard will not start, check the following:
  - a. Check to see if the fuel line is connected to the motor and the tank and not pinched or kinked.
  - b. Check to see if there is water in the gasoline.
  - c. Check to see if the engine is flooded.
  - d. Check the spark plugs as they may be fouled or defective (replace if needed).
11. All outboards are to be tilted in the up position when moored stations to preclude silt accumulation in the jet unit or water pump and skag or housing damage.

It should be emphasized that the salmon enumeration counts and sampling must continue, as they are very important to the program.

#### Boats

1. Boats are to be kept clean and free of loose tools and debris, and moored at locations where they are not subject to damage by wave action or through contact with the river bottom in rock laden areas.
2. Each crew leader will be responsible for maintaining mooring stakes on the river bank sufficient for the boats assigned to his subproject plus one transient craft. Further responsibility includes maintaining a bow line on each assigned craft and ensuring that each boat is properly moored at the end of each work day to preclude possible loss or damage.

#### Generators

Portable generators may be supplied to field camps. Their maintenance follows the same line as for the outboards. Since some of the generators have 4-cycle engines, mixed gas must not be used. The crankcase oil reservoir should be checked daily and maintained at the full level. After 25 hours of operation the oil should be changed. Spark plugs should be checked after every five (5) hours of operation.

#### Camp Maintenance

Maintaining a clean and efficient camp site is required. A few of the things to check are:

1. Maintenance of living accommodations and other installations will be performed as necessary. All materials necessary will be provided.
2. Grounds will be kept free of liter. All garbage will be bagged up and

disposed of at the nearest sanitary landfill at least once a week. Special precautions should be observed to ensure that garbage does not attract bears and other scavenger species.

3. Upon completion of the summer season, all camp equipment will be cleaned preparatory to winter storage.
4. All sampling nets, tents, and tarps must be dry before being stored.
5. A complete camp inventory will be taken by the crew leader at the close of the field season.
6. All skiffs and ATV's will be chained and locked to a stationary object.

#### Camp Policy

1. No alcoholic beverages are to be stored in areas open to public view including cook tents. If alcohol is consumed at a camp an employee must be off-duty and under no circumstances shall he or she engage in the operation of any State equipment, including boats and motors nor shall he or she return to duty status under the influence of alcohol.
2. The crew leader of each sampling station shall establish a policy on living standards and personnel behavior in accordance with normal guidelines.
3. All sampling stations will operate as directed. No crew leader shall be off location for more than 24 hours unless specifically authorized by the ARB. Time-off for individual crew members shall be scheduled by the crew leader and shall have the option as to whether sampling duties allow time-off from the location.
4. All employees will be required to act in a professional manner at all times and shall be especially courteous to the public.
5. It will be the responsibility of the crew leader to report any equipment abuse to the ARB and to ensure that abuse does not occur.

Additionally, the crew leader must also report within 24 hours to the ARB any loss of equipment which occurs.

### Food Orders

Grocery orders for Ilnik and Bear Rivers should be placed with Port Moller, Nelson River with Cold Bay, and Orzenoi River with Sand Point during the evening radio schedule.

### Personal Gear and Pets

Generally 100 lbs. is a maximum for personal gear. If you anticipate bringing more than that amount to your field camp, check with your supervisor first. Pets, (especially dogs) should not be brought to our field camps. Past experience indicates, that one or more of the following problems usually occur:

1. Problem of transportation in small planes for some pets.
2. Who is going to pay for the pet food and who is going to purchase it in town?
3. Some pets attract bears, etc. Dogs will chase a bear until the bear gets mad and then when the bear goes for the dog, the dog will run to his owner or the cabin.
4. Your pet may not be compatible with the other members of your camp and may interfere with work.
5. A pet that gets sick or injured can cause you considerable expense if it must be brought back to town.
6. Rabies is common on the Alaska Peninsula, be careful of all mammals including ground squirrels, fox, wolf, otters, and your pet. If bitten save the head of the animal if possible, wrap the head in several layers of plastic, put in a good box and freeze if possible. Notify your supervisor of the accident and your supervisor will send you into Anchorage if tests for rabies prove positive. Burn and bury remaining parts of the carcass away from water sources and cabins, take precautions such as wearing plastic gloves to dispose of the carcass. Do not send suspected rabies animals out of your area unless you are bitten, burn and bury the carcass as instructed.

### Radio Schedules

Radio schedules will be made twice during every day. Radio schedules are normally at 8:45 a.m. and 7:45 p.m. on 3.230 megahertz unless otherwise specified. The morning schedule is used for passing along the current weather (visibility, ceiling, precipitation, etc.) and the previous days escapement counts. The evening schedule are used for updated escapement counts, grocery and supply orders, and the latest pertinent fishery announcements. All camps must complete the schedule within 15 minutes, so we do not invade another areas time allotment. So, keep the conversation short. Personal conversation between camps should be arranged as not to interfere with any ADF&G schedules.

If a camp does not respond to two consecutive radio schedules, the worst will be assumed and a plane will be dispatched. If for some reason you know that you will not be able to make a schedule, notify beforehand either Cold Bay, Sand Point, or Port Moller.

## Fish and Wildlife Violations

This is not intended as an inclusive procedure for handling violations, it is not your job. Use this as a guideline for obtaining the necessary information and/or evidence to show and prove that a violation has been committed. It is important to be familiar with the commercial fishing, subsistence fishing, sport fishing, and hunting regulations in your area. Violation procedures are printed on the back cover of the commercial fishing regulation book. Request the regulation book if your camp does not have one.

The use of the 5 W's can greatly aid the Fish & Wildlife Protection officer in obtaining sufficient evidence for a case.

1. What is the violation?
2. When did the violation occur (date, time, tide condition, etc.)
3. Where did the violation occur?
4. Who is in violation and who are witnesses?
5. Why was the violation committed?

It is important that all witnesses to a violation be interviewed and all statements pertaining to a violation be recorded along with their names and addresses. If you have a camera available, pictures are extremely valuable in prosecuting offenders. Collect as much information as possible and contact your supervisor or a State Trooper from the Fish and Wildlife Protection Division immediately. If you do not feel comfortable, or your personal safety may be in danger, do not pursue the violation. Contact your supervisor and they will handle the violation. Be aware that you do not have the power to arrest somebody and never attempt this.

## Firearms

A State rifle will be provided at each camp. You may bring your own firearm if you wish. Loaded guns are prohibited inside the camp facilities. Loaded, meaning a round in the chamber of the gun. Anyone handling a firearm should always treat it as if it were loaded. Guns should be kept clean and oiled and be completely unloaded while being cleaned. Any horseplay with or misuse of firearms while working for the Department of Fish and Game will not be tolerated and will be grounds for immediate dismissal. Completely unload a firearm of all rounds before entering a vessel or airplane. Keep an empty chamber under the firing pin of each pistol.

## Bears

Do not antagonize bears - each one is a potential danger. Do not encourage bears to come around camp by leaving food or unburned garbage around. Do not shoot at a bear unless, in your best judgement, he is endangering someone's life or damaging personal or state property. Use your best judgement on whether to shoot a bear if property is at stake. When, and if, trying to frighten a bear away by shooting - do not fire toward it. By chance, you may wound it by pulling the shot, ricochets, etc. If you are having problems with a particular bear around camp, call the office and notify them of the situation. The Game Division personnel will take care of the problem, if it is feasible.

## Garbage

Burn all garbage to prevent bear problems. Cut out both ends of tin cans and squash them flat, and box them for empty return flights. Garbage pits are prohibited by the Fish and Wildlife Service on the refuge. Never start fires with fuel. Be sure all burn barrels have proper grates or covers to prevent grass fires from sparks. Garbage at Ilnik and Orzenoi Rivers should be double-bagged and removed via plane or boat.

### Transportation

We do not expect you to endanger life or property by going out in a boat on dangerously rough water. If you are unfamiliar with Marine Safety, ask the crew leader or ARB for information or advice. All personnel must wear a life jacket when out on open water. Use your head - if you think it is dangerously rough, don't go out on the water.

Extra shear pins or propellers and a tool kit which includes pliers, spark plugs, and a spark plug wrench should be in the boat at all times. In case travel at night becomes necessary, carry a flashlight.

Some camps may be furnished with 3-wheel or 4-wheel all terrain vehicles (ATV's). The following safety precautions shall be observed at all times regarding Department ATV's. Only employees of the State may use the vehicles. Non-Fish and Game employees are not allowed on these vehicles at any time. Only one employee may ride on the vehicle at one time. The safety helmet provided must always be worn during operation of an ATV. An ATV may provide transport of State materials, supplies, and equipment between camp sites and supply planes or vessels. In addition, they may be used for transportation to and from assigned duties in the field such as monitoring a fishery or collecting harvest information, etc.

Review the Marine Safety and Light Aircraft Safety Manuals before boating or flying. Do not get in a boat or plane if you feel uncomfortable with the situation. Consult the crew leader or pilot beforehand.

### Fire and First Aid

Check your camp's fire extinguisher. Know where it is and how to use it! Inventory your camp first aid kit, replace items as needed and become familiar with basic first aid treatment. Review the first aid booklet.

Take pains to avoid intestinal parasites carried by beaver and otter etc. When in doubt, boil your drinking water.

Keep the cabin, surrounding area, and yourself clean and neat. Appearance is important. You will not always be notified of the intended arrival of visitors, officials, etc. Impressions of visitors are often based on appearance.

Rabies is common on the Alaska Peninsula, be careful of all mammals including ground squirrels, fox, wolf, otters, and your pet. If bitten save the head of the animal if possible, wrap the head in several layers of plastic, put in a good box and freeze if possible. Notify your supervisor of the accident immediately. Burn and bury remaining parts of the carcass away from water sources and cabins, take precautions such as wearing plastic gloves to dispose of the carcass. Do

not send suspected rabies animals out of your area unless you are bitten, burn and bury the carcass as instructed.

### Appearance

Keep the cabin, surrounding area, and yourself clean and neat. Appearance is important even in remote camps. Impressions of visitors (public, visitors, officials, etc.) are often based on personal appearances. Do your best to look respectable and keep the grounds clean.

### Compatibility of Field Personnel

If you find yourself unable to get along with other members at your camp, notify the ARB and an attempt will be made to solve the problem. Usually, the person with the most experience in camp will be the crew leader. If it is not clear who has been designated crew leader in your camp ask your supervisor.

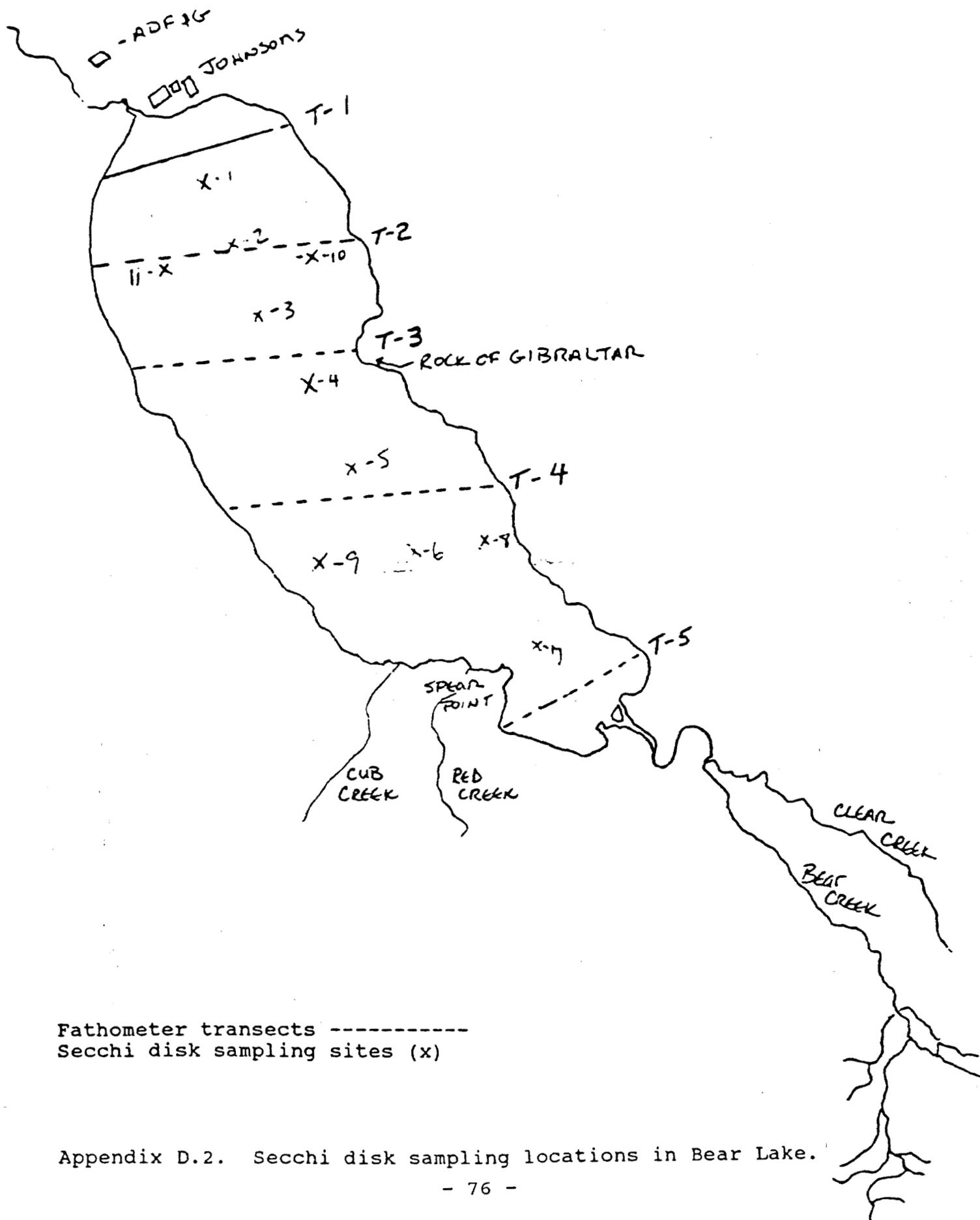
APPENDIX D  
Secchi Disk Recording

ADF&G is in the process of evaluating the rearing potential of sockeye systems. A Secchi disk is a simple tool to determine the transparency of the water. The more turbidity (silt, plankton, etc.) in the water, the lower the reading will be. Make sure the disk is clean before lowering it into the water. If the white pies are dirty, they may need to be repainted. Lower the disk into the water until it is no longer visible. It is best to do the readings on the leeward or shaded side of the boat. Wave action and turbulence will diminish your ability to accurately measure the transparency of the water. If possible, calm days are the best for taking measurements. Secchi disk readings provide us with valuable information as to the rearing habitat by euphotic volume.

The transparency usually decreases in the summer when plankton, silk, and organic matter are prevalent. Readings may vary, but will probably be in the 1.0m to 4.0m, as measured by the increments on the line attached to the Secchi disk. The measurement should be read when the disk is no longer visible to the observer. Try to be consistent with the readings (i.e. same observer, similar light and wave conditions, etc.) and take the readings every two weeks in the same locations listed on the Bear Lake map. Use the form provided to record the data and return to the ARB in Port Moller (Appendix D.1).

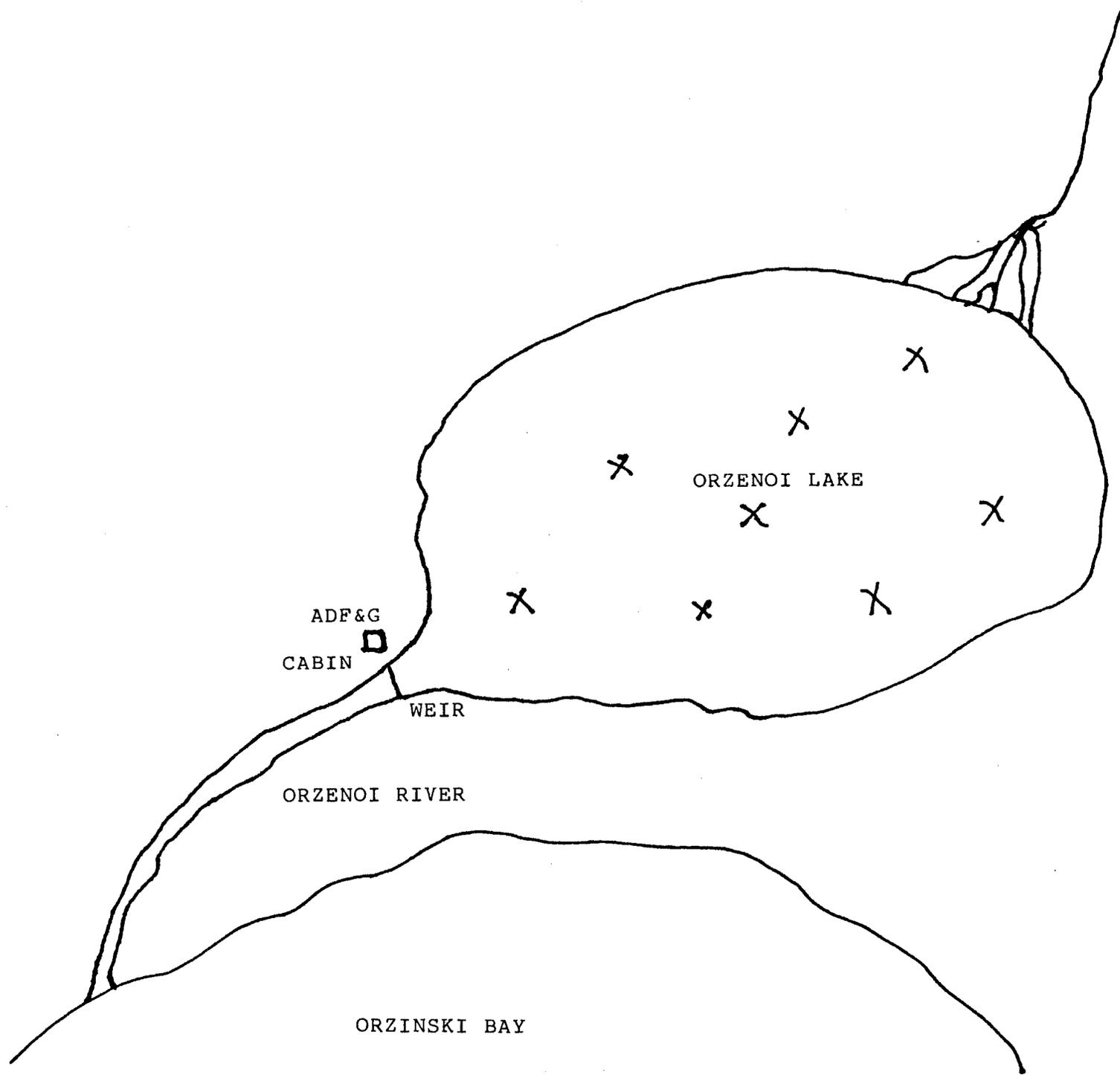
Secchi disk readings will be taken at 11 stations in Bear Lake (Appendix D.2) and at 8 stations in Orzenoi Lake (Appendix D.3.).





Fathometer transects -----  
 Secchi disk sampling sites (x)

Appendix D.2. Secchi disk sampling locations in Bear Lake.



Appendix D.3. Secchi disk sampling locations in Orzenoi lake.

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