CHIGNIK OPERATIONAL PLANS, 2003

By

Kenneth A. Bouwens
George Pappas
Heather Finkle
and
Philip Tschersich

Regional Information Report[1] No. 4K03-28

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

May 2003

1 The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished division reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data; this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

TABLE OF CONTENTS

	Page
CHIGNIK WATERSHED ECOLOGICAL ASSESSMENT AND BLACK RIVER SONAR PROJECT	PINK DIVIDER
CHIGNIK RIVER SMOLT ENUMERATION PROJECT.....	PINK DIVIDER
CHIGNIK RIVER WATERSHED SOCKEYE SALMON CATCH AND ESCAPEMENT SAMPLING AND RUN APPORTIONMENT	PINK DIVIDER
CHIGNIK LAGOON SOCKEYE SALMON TEST FISHERY.....	PINK DIVIDER
CHIGNIK FIXED-LEADS MONITORING PROJECT	PINK DIVIDER

CHIGNIK WATERSHED ECOLOGICAL ASSESSMENT AND BLACK RIVER SONAR PROJECT OPERATIONAL PLAN, 2003

By

Kenneth A. Bouwens
and
Heather Finkle

Alaska Department of Fish and Game
Division of Commercial Fisheries
211 Mission Road
Kodiak, AK 99615

May 2003

TABLE OF CONTENTS

Page

LIST OF TABLES i

LIST OF FIGURES i

LIST OF APPENDICES i

INTRODUCTION 1

GOALS 3

Limnology 3

Juvenile Salmon Distribution 3

Stable Isotope Sampling 3

Sonar Feasibility 4

METHODS 4

Supervision 4

Limnology 4

Station Placement and Sample Collection 4
Water Sampling 5
Zooplankton Sampling 5
Light Measurement 5
Temperature, Dissolved Oxygen, Water Clarity, and Salinity Sampling 6
Lab Setup 6
Water Sample Processing 6

Juvenile Salmon Distribution 7

Beach Seine Sampling 8
Fyke Net Sampling 8
Trawl Sampling 9

Stable Isotope Sampling 9

Sonar Feasibility 10

SAFETY 10

REPORTING 11

TIMESHEETS 11

TABLE OF CONTENTS

	Page
LITERATURE CITED	12
TABLES	13
FIGURES	14
APPENDIX	22

LIST OF TABLES

Table		Page
1.	Location of the various sampling locations for the Chignik Ecological Assessment Project, 2003.	13

LIST OF FIGURES

Figure		Page
1.	Map of the Chignik River watershed with an inset of western Alaska	14
2.	Map of Chignik Lake showing the limnology stations and the approximate locations of the beach seine sites	15
3.	Map of Black Lake showing the limnology station and the approximate locations of the beach seine sites	16
4.	Map of Chignik Lagoon showing the approximate locations of the beach seine sites	17
5.	Detailed Lake Survey Form	18
6.	Beach Seine Data Form	19
7.	Fyke Net Data Form	20
8.	Trawl Data Form	21

LIST OF APPENDICES

Appendix		Page
A.1.	Smolt age-weight-length (AWL) sampling materials and methods	23
A.2.	Information necessary for completing AWL forms	25
A.3.	Statistical week calendar	26
A.4.	Photo of a smolt with the preferred area highlighted	27
A.5.	An example of correctly labeled smolt AWL slides	28
A.6.	Chignik gear, project, and location AWL database codes	29
B.	Timeline of periodic sampling events	30

INTRODUCTION

The Chignik watershed consists of two major rivers, two lakes and a lagoon (Figures 1 through 4). At the head of the system is Black Lake; it drains into Chignik Lake via the Black River. Chignik Lake empties into Chignik Lagoon through the Chignik River. The early sockeye salmon *Oncorhynchus nerka* run enters the Chignik River beginning in mid-May and continues through late-July; the majority of these fish are bound for Black Lake and its associated tributaries. The late run begins entering the river mid-June, and continues through late-September. These fish spawn in Chignik Lake and its tributaries. Chignik Lagoon serves as a rearing environment for the post-smolt exiting the lakes in the spring (Phinney 1968).

A series of natural degradation processes are taking place in the Chignik River watershed. Black Lake, the large and shallow (41.1 km^2, mean depth = 3 m) upper lake, is getting progressively shallower, potentially reducing sockeye fry rearing habitat. Additionally, the Alec River, a major Black Lake tributary, has recently changed course and partially drains through Fan Creek (Figure 1). A sand spit has formed directly west of the mouth of Fan Creek, spanning over two-thirds of the lake's width at that point (Figure 3). The juvenile salmon that emerge from Alec River historically rear in Black Lake (Narver 1966). The morphological changes to Black Lake, however, may force the Black Lake fish downstream to rear in Chignik Lake.

The current spawning escapement goals for the Chignik River watershed are the results of studies conducted in the late 1960s (e.g., Narver 1966; Burgner et al. 1969). These studies were rooted on the carrying capacity and spawner-recruit relationships of Black Lake. The early run (Black Lake) escapement goal was set at 400,000 sockeye spawners, and the late run (Chignik Lake) goal was 250,000 spawners. At that time, Black Lake supported the early run fry, presumably, for most of the year. The environmental conditions of the Chignik River system have changed since those goals were set. To accommodate juvenile sockeye rearing in the nursery lakes' present condition, current escapement goals may need revision.

The collection of limnology data will allow the estimation of available forage for rearing sockeye salmon in both Black and Chignik Lakes. Water sampling will indicate nutrient levels available for plankton production and the physical conditions of the Chignik watershed. Analysis of zooplankton species composition, abundance, and size will provide the information necessary to assess the impacts of the current sockeye salmon population on its food base.

The Chignik River weir facility is located three miles from Chignik Lagoon and is the home base for all commercial salmon and herring management operations in the Chignik Management Area. The weir was first installed in 1922 to quantify escapements into the Chignik River. Salmon are counted through the weir, ten minutes out of each hour, using remote video cameras positioned in two gates. Timed counts are expanded to estimate the hourly counts.

Escapement goals are in place for both runs; therefore, a method of separating the catch and escapement into an early or late-run component is necessary. Tagging studies from the 1960s determined that there is substantial overlap between the two runs each year during late June and July as fish pass the existing counting weir in the Chignik River below Chignik Lake. Therefore, managing the fisheries based on average time of entry curves is not appropriate. In general, the freshwater age of sockeye salmon from the early run tend to be age 1. and those from the late run

tend to be age 2. Unfortunately, the disparity in freshwater age between the stocks is not large enough to use as an indicator of stock-of-origin. Genetic stock identification is likely possible, but it is expensive and would not be available for inseason stock separation.

Scale Pattern Analysis (SPA), which is based on differential freshwater growth patterns reflected on scales collected from adult fish of a known stock, has been used successfully to separate the returning adult Chignik stocks. SPA may not be reliable in the future if fish from the two stocks share the same freshwater rearing environment. A sonar project located at Black River would provide more reliable and timely stock composition estimates which would aid in run reconstruction, run forecasting and management of the fishery.

The University of Washington, Applied Physics Laboratory (UWAPL), has developed the Dual Frequency Identification Sonar (DIDSON). Output from this sonar consists of an image that is of such high resolution one can see the individual fins on a fish. DIDSON gear has been field tested as a counter for sockeye salmon in the Kenai, Wood, and Copper Rivers and has shown great promise. The major drawbacks of this gear were its relatively short range (about 30 m) and problems dealing with the high volumes of data it generated. UWAPL is currently developing a longer-range sonar that is expected to be preferable to the original model. ADF&G, in other regions, has purchased several models and will be operating them in the summer of 2003, and data storage problems will likely be resolved this summer. A longer-ranged DIDSON may be purchased for this project after the 2003 field season.

The Chignik Weir is a formidable structure and takes about two weeks to install. It has washed out on numerous occasions, and depending on flow conditions, it can take considerable time to reinstall. Other than a weir, sonar is the only effective technology that can be used to count sockeye salmon escapement in the Chignik River. Sonar has been used several times in the past to provide escapement counts. These counts were not reliable, however, because counts from the sonar gear used were never properly compared to counts from the weir. As with any new technique, the accuracy of the DIDSON sonar needs to be assessed prior to using it as a primary method of enumeration. The Chignik River is unique in that it is a large system (where a sonar could be used) which has a weir so an accurate measure of fish passage is available. Therefore, the DIDSON can be operated in the Chignik River concurrently with the weir and counts can be compared. This will also allow any bugs to be worked out while the gear is in close proximity to the base of operations. Operating the DIDSON in the Chignik River will serve as feasibility study of using the DIDSON as a contingency in case the weir does wash out. The system can then later be deployed in the Black River.

The sonar portion of the 2003 field season will be dedicated to logistical reconnaissance and feasibility. Potential sonar locations in the Chignik and Black rivers will be identified and adult sockeye salmon migration patterns will be identified. If, after the 2003 season a sonar project using the DIDSON gear seems feasible and if funding is secured, in 2004 the sonar will be operated in the Chignik River in conjunction with the weir. The sonar will then be installed in Black River in 2005.

GOALS

Limnology

The limnology portion of the study seeks to monitor the limnetic dynamics of the Chignik watershed. This will facilitate the reassessment of existing escapement goals for the Chignik watershed concurrent with the present ecological conditions and fishery production levels. This goal will be met by completing the following tasks:

1) Measure zooplankton abundance, species composition, and various water chemistry parameters in Black Lake and Chignik Lake.

2) Model the current carrying capacity of the Chignik and Black Lakes based on euphotic volume, nutrient availability, zooplankton abundance, and juvenile salmon bioenergetics.

Juvenile Salmon Distribution

The juvenile salmon distribution portion of the study is designed to monitor the age, weight, and length as well as the relative distribution of juvenile sockeye salmon within the Chignik watershed throughout the growing season. This goal will be met by completing the following tasks:

1) Systematically collect juvenile salmon from Black Lake, Black River, Chignik Lake, Chignik River, and Chignik Lagoon using a beach seine, fyke net and pelagic trawl.

2) Randomly collect age, weight, and length (AWL) data from juvenile sockeye salmon and length data from juvenile coho and chinook salmon caught from the watershed.

3) Summarize the catch and AWL data in a report.

Stable Isotope Sampling

The stable isotope sampling portion of the study is designed to investigate the autecology of juvenile sockeye salmon within the Chignik Watershed. This goal will be met by completing the following tasks:

1) Systematically collect juvenile sockeye salmon from Black Lake, Black River, Chignik Lake, Chignik River, and Chignik Lagoon using a beach seine, fyke net and pelagic trawl and preserve them for stable isotope analysis.

2) Systematically collect juvenile sockeye salmon prey (both pelagic and benthic) from Black Lake, Black River, Chignik Lake, Chignik River, and Chignik Lagoon and preserve them for stable isotope analysis.

3) Ship both predator and prey samples to Dr. Bruce Finney at the University of Alaska Fairbanks for analysis.

Sonar Feasibility

The sonar feasibility portion of the study is designed to determine the applicability of the DIDSON sonar to count adult sockeye salmon in both the Chignik and Black rivers. This goal will be met by completing the following tasks:

1) Measure the bottom profile of both the Chignik and Black rivers in various locations.

2) Determine the migration patterns and behaviors of adult sockeye salmon migrating through the same locations through visual observation.

3) Assess the logistical applicability of the same locations with regards to sonar installation and application.

METHODS

Supervision

Project Biologist	Ken Bouwens	FB II
Crew leader	Heather Finkle	FB I
Crew	Chris Owens	FWT II

Limnology

Station Placement and Sample Collection

Four limnology stations will be established in Chignik Lake (Figure 2), and one station will be established in Black Lake (Figure 3). The exact latitude and longitude of these stations was determined using a global positioning system (GPS) in prior years (Table 1). The stations will be set at the same locations. A buoy will mark each station. In addition, stations 2 and 3 will be established in Bear Lake on the Alaska Peninsula (Table 1).

Sampling at Chignik and Black lakes will take place at monthly intervals (Appendix B). Temperature, dissolved oxygen, and light transmittance parameters will be measured at all stations. Water samples will be collected from a depth of 1 m and 29 m at stations two and four on Chignik Lake. Water samples will be collected from the single station on Black Lake. Zooplankton samples will be taken from all stations.

Limnology data will be collected monthly at Bear Lake. Water samples will be collected from a depth of 1 m and 29 m and zooplankton samples will be taken from stations 2 and 3. Temperature, dissolved oxygen, and light transmittance parameters will be measured at both stations.

Salinity data will be collected from Chignik Lagoon. Transects, which have yet to be determined, will be established at the head, mouth, and midway down the lagoon to establish a salinity profile.

Water Sampling

A Van Dorn sampler will be prepared and lowered to the desired sampling depth on a metered line by qualified personnel. A messenger will be attached to the line and released to trip the mechanism that will close the Van Dorn bottle at depth. The sampler will be pulled up to the surface and the contents emptied into a pre-cleaned, labeled, plastic carboy container. Each container will be rinsed with a small portion of sample water, which will be discarded prior to pouring the sample water into the carboy. This procedure will be repeated (without rinsing) until the carboy is 2/3 to 3/4 full. Any samples that contain sediment will be discarded and another sample will be collected. The carboys will be kept cold and dark in a cooler while in transport. The sampling depths, stations, and other appropriate comments will be recorded on the *Detailed Lake Survey* (DLS) *Form* (Figure 5).

Zooplankton Sampling

A 0.2 m diameter, 153 micron mesh, conical net will be used to collect all zooplankton samples with vertical tows. Prior to sampling, the bottom depth of each station will be determined by lowering a weighted, metered line. The collection basin and townet will be cleaned of any debris by rinsing with filtered water. The plankton townet will be lowered at a steady rate, ensuring the weighted cod-end stays below the opening of the net, until the cod-end is approximately 1 m from the lake bottom or to the end of the towline. The net will be manually retrieved at a constant rate of ~0.5 m/sec., stopping when the rim of the net is just above the water's surface. Contents of the net will be washed with filtered water into the collection basin. The basin will be removed from the net and all sample contents will be emptied into a labeled, 125 ml bottle filled with 12.5 ml formalin (10% buffered solution by volume). Filtered water will be used to rinse the collection basin and completely fill the bottle. The bottle will be capped and sealed with electrical tape to prevent the contents from leaking.

The sample bottle will be stored at room temperature- it cannot be frozen. Samples will be sent to Kodiak in a separate container from the water samples. Macrozooplankton species will be identified and enumerated at the Near Island Limnology lab following established protocols (Koenings et al. 1987; Thomsen et al. 2002).

Light Measurement

Light levels will be measured from the bright side of the boat using a Li-Cor Li-250 electronic photometer. Light readings, recorded in kilolux (Klux), will begin just above the lake's surface (incidence). Measurements will continue to be taken just below the water's surface at 0.5 m intervals, down to 5 m (i.e., 0.5, 1, 1.5, …5), and then every meter (5, 6, 7, etc.) thereafter until the light level is 1% of the surface reading. Data will be recorded on the DLS form (Figure 5).

Temperature, Dissolved Oxygen, Water Clarity, and Salinity Sampling

Water temperature (^{o}C) and dissolved oxygen (DO); mg/l) levels will be measured at each station with a WTW Oxi 197 meter. Prior to use, the meter's probe membrane will be examined for wear (tears, folds, and air bubbles). A handheld thermometer will measure the surface temperature to ensure the meter is working properly. An incidence reading will be taken above the water's surface. The probe will then be lowered into the water and another reading will be taken directly below the water's surface. Subsequent measurements will be taken at 0.5 m intervals until the probe reaches 5 m. Readings will be taken every meter thereafter until the probe reaches 25 m, after which 5 m increments will be used. Temperature and DO readings will be recorded on the DLS form (Figure 5). Measurements will be taken until the probe is 1 m off the lake bottom or the depth exceeds the cord length.

Secchi Disk (SD) transparency will be measured at each limnology station to assess water clarity. SD depth will be measured on the shaded side of the boat. The SD will be lowered into the water on a metered line until it disappears from view, then pulled up until it reappears. The depth of the disk when it disappeared, the depth it reappeared, and the average of the two readings will be recorded. Results will be recorded on the DLS form (Figure 5).

Lagoon salinity will be measured with an electronic salinity meter. Readings will be taken and recorded at 0.5 m depth intervals to the bottom. Sufficient sets of readings will be taken along each transect to provide a salinity profile. Exact methods will be determined in the field considering tide and weather. Measurements will be taken within one half hour of high slack tide and recorded in a field notebook.

Lab Setup

Filtration equipment (filter towers and flasks), graduated cylinders, burettes, and carboys will be washed with phosphate-free soap. All equipment will be rinsed with tap water four times and then rinsed four times with filtered water. The wastewater flasks do not need to be washed. All necessary bottles will be washed with phosphate free soap and pre-labeled before sending them to the field.

Before collecting any samples, reagents and necessary equipment required for filtration will be prepared and configured. A vacuum pump and filter apparatus will be set at 15 psi pump suction. Reagent preparation is outlined in Koenings et al. (1987) and Thomsen et al. (2002).

Water Sample Processing

Water sample processing will be completed directly after field sampling. Water will not be held more than three days before processing. Each sample will be processed separately. Poly bottles and graduated cylinders will be rinsed with a small portion of the water sample. The water samples will be processed into the following subsamples:

1) Alkalinity and pH: Samples of refrigerated water will be measured for pH by using a Corning pH meter. Alkalinity will be assessed by acid titration as described by Koenings et al. (1987) and Thomsen et al. (2002).

2) Unfiltered frozen water nutrient content: 450 ml of sample water will be placed into a 500 ml poly bottle. Space will be left to allow expansion due to freezing. The bottle will be frozen and then sealed.

3) Phytoplankton: 100 ml of sample water will be placed into a 125 ml poly bottle. Two ml of Lugol's acetate will be added to the sample and the solution will be mixed gently. The bottle will be sealed with electrical tape and stored in the dark at room temperature.

4) Particulates: Four graduated cylinders will be filled with 1000 ml (1 L) each of sample water for each of the four particulate samples (chlorophyll *a*, N, P, C). As water turbidity changes, it may be necessary to reduce the filtrate volume from 1000 to 500 or even 300 ml to prevent damaging the vacuum pump. Filtrate volumes will be logged on the DLS form (Figure 5) and on the sample bottle's label. Multiple filter towers may be used if the equipment is available. Using sterile forceps, a sterile Whatman GF/F filter will be placed on the filter apparatus. One hundred ml of deionized water will be used to rinse the tower and moisten the filter. The rinse water will be discarded from the flask after being drawn through the filter. A portion of sample water will be poured from the graduated cylinder(s) into the filter tower(s). The vacuum pump should be run at approximately 15 psi; increased sample water turbidity may require increasing the pump's draw to 20 psi. As the sample passes through the filter, more of the sample water will be added from the graduated cylinder until all 1000 ml are filtered. As the last 50 ml of the chlorophyll *a* sample is filtered, a mixture of 5 ml of $MgCO_3$ solution and 5 ml of filtered water will be added to the tower. The pump will be turned off when all towers are empty. The particulate nutrient filters will be removed with forceps from the filter apparatus, placed in labeled petri dishes, and stored frozen.

5) Filtered frozen water nutrient content: A small portion of sample water will be filtered through the apparatus and discarded to rinse the filtration flask. Then approximately 450 ml of filtrate will be retained from the filtrate flask and placed in a rinsed (with filtrate) 500 ml bottle. The bottle will be frozen then sealed.

Processed samples and frozen ice packs will be shipped to the Near Island Lab in a sealed cooler after the frozen samples have hardened. The samples will be shipped via commercial air carrier as soon as possible. Zooplankton samples will be placed in a Zip-lock bag after being sealed with electrical tape and shipped separately so they will not freeze. Before shipping, lab personnel (481-1901) and the Project Biologist (486-1085 wk, 486-5337 hm) will be contacted to inform them of arrival time. Original DLS forms (Figure 5) will be shipped to the Lab and a copy will be made and retained at Chignik.

Juvenile Salmon Distribution

Every three weeks (Appendix B), the relative abundance and distribution of juvenile salmon will be estimated. Multiple forms of sampling gear will be used to achieve this objective. Sampling will occur in Chignik Lake, Chignik Lagoon, Chignik River, Black River, and Black Lake (Table 1) as weather conditions permit.

Beach Seine Sampling

Eight beach seine stations in Chignik Lake (Figure 2), four stations in Chignik Lagoon (Figure 4), three stations in Chignik River (see 2001 field log), two stations in Black River, and five stations in Black Lake (Figure 3) will be identified and marked (Table 1). A single haul will be made at each location with a beach seine. Each end of the net will be retrieved simultaneously and the lead line will remain in contact with the bottom at all times. Care will be taken to set the gear in a similar manner between different sites and between sampling events at the same site.

After the set is made, all fish species will be identified and counted. Large hauls may require estimating the catch abundance. All fish held for age, weight, and fork length (FL) sampling will be kept in an aerated tote. A total of forty juvenile sockeye, and 20 each coho *O. kisutch*, and chinook *O. tshawytscha* salmon will be randomly sampled from the catch and measured for FL to the nearest millimeter (mm). The first 20 juvenile sockeye salmon will also be sampled per set for age and weight data. If a specific fish is too small to obtain scales, the location on the slide will be left blank and the age of the fish will be assumed as age 0. Fish collected for AWL sampling will be placed in a zip lock bag containing water and enough MS-222 to induce mortality. A waterproof paper label that contains the date, the location, AWL number and the method of capture will be placed in the bag with the collected fish. All AWL fish will then be transported to the Chignik field lab for AWL processing (Appendix A.1-5.) Fish sampled for AWL data will be stored individually in whirlpack bags, labeled, and frozen for storage. All information collected (FL and AWL) will be recorded on the *Beach Seine Data Form* (Figure 6).

Fyke Net Sampling

A fyke net will be used to sample fish in Black River. The net will be set with the wings extending at 45-degree angles upstream from the net. The net will be fished during the dark hours every three weeks for 12 hours each session. A diagram of the net and the surrounding area will be drawn in a field notebook to correspond with a recorded GPS location (Table 1). The net will be monitored at least every two hours; if large catches or excessive debris accumulates, the net will be monitored more frequently to avoid fish mortality or trap displacement. Catch data will be recorded on the *Fyke Net Data Form* (Figure 7).

All fish species captured in the fyke net will be identified and counted. Each set will last four hours maximum, depending on catch rates. All fish held for age, weight, and FL sampling will be kept in an aerated tote. Forty juvenile sockeye, and 20 each coho and chinook salmon will be randomly sampled from each set and measured for FL to the nearest mm. The first 20 juvenile sockeye salmon per set will also be sampled for age and weight data. If a specific fish is too small to obtain scales, the location on the slide will be left blank and the age of the fish will be assumed as age 0. Fish collected for AWL sampling will be placed in a zip lock bag containing water and enough MS-222 to induce mortality. A waterproof paper label that contains the date, the location, AWL number and the method of capture will be placed in the bag with the collected fish. All samples will then be transported to the Chignik field lab for AWL processing (Appendix A.1-5.) Fish sampled for AWL data will be stored individually in whirlpack bags, labeled, and frozen for storage. All information collected (FL and AWL) will be recorded on the *Fyke Net Data Form* (Figure 7).

Trawl Sampling

A trawl net will be used to collect juvenile salmonids rearing in Chignik Lake. Every three weeks six trawls will be made in Chignik Lake. Tows will be made along predetermined transects, and will usually begin at the limnology stations. The number, duration, and location of the trawls may be modified (upon consultation with the Project Biologist) inseason due to weather conditions and catch rates. The tows at Chignik Lake will be made with two boats pulling the net in tandem. Tows of Black Lake are also possible through a joint venture with the Fisheries Research Institute (FRI). FRI conducts two tows of Black Lake, each 10 minutes long; one is initiated off of Hydro Point and the other starts west of the Fan Creek drainage (Figure 3).

After each haul is made, all fish species will be identified and counted. Large hauls may require estimating the catch abundance. All fish held for age, weight, and FL sampling will be kept in an aerated tote. Forty juvenile sockeye, and 20 each coho, and chinook salmon will be randomly sampled from the catch and measured for FL to the nearest millimeter (mm). The first 20 juvenile sockeye salmon per set will also be sampled for age and weight data. If a specific fish is too small to obtain scales, the location on the slide will be left blank and the age of the fish will be assumed as age 0. Fish collected for AWL sampling will be placed in a zip lock bag containing water and enough MS-222 to induce mortality. A waterproof paper label that contains the date, the location, AWL number and the method of capture will be placed in the bag with the collected fish. All samples will then be transported to the Chignik field lab for AWL processing (Appendix A.1-5.) Fish sampled for AWL data will be stored individually in whirlpack bags, labeled, and frozen for storage. All information collected will be recorded on the *Trawl Data Form* (Figure 8).

Stable Isotope Sampling

In conjunction with the limnology sampling, an additional plankton tow will be made at each limnology station for stable isotope analysis. The contents of the zooplankton sample will be placed in a clean, labeled, 50 ml centrifuge tube or scintillation vial and frozen. The date, depth, and location of each tow will be recorded.

Monthly benthic macroinvertebrate samples will also be collected from Black Lake, Chignik Lake Chignik River, and Chignik Lagoon and frozen for stable isotope analysis. The goal of this sampling is to collect sockeye salmon prey items as identified through prior stomach content analysis. These samples will be collected by using a kick net or some other appropriate sampling device.

Processed juvenile sockeye salmon AWL samples will be chosen randomly, and separated, from all of the AWL samples throughout the season for stable isotope sampling; the sample size will be determined by the Project Biologist in-season. All isotope samples will be sent to the Institute of Marine Science at the University of Alaska, Fairbanks for processing at the end of the season.

Sonar Feasibility

Locations to operate a DIDSON sonar will be chosen in both the Chignik and Black rivers. Therefore, the bottom profile of both the Chignik and Black rivers will be measured in various locations. The beam angle of the DIDSON sonar is approximately 0.4° horizontally by 12° vertically and the maximum effective range of the sonar is approximately 20 m. The goal is to select a location where the majority of the adult sockeye salmon are passing within 20 m of the sonar and the bottom is sloped evenly at an angle of about 12^{o}.

All data concerning sonar site selection will be recorded in a dedicated field notebook. The GPS location of each profile will be recorded. Water depth will be recorded at 1 m intervals perpendicular to the river. Current speed will be measured at the surface and at 10 cm off the bottom using a hand held flow meter at 2 m intervals across the river. The substrate type will be recorded at each location.

Detailed notes on the migration patterns and behaviors of adult sockeye salmon migrating through the same locations will be taken. The dominant migration path will be noted for each location. If visual examination of fish migration is not possible other methods, such as drifting a gillnet through various depths or using a fish finder, will be explored upon consultation with the Project Biologist. The feasibility of using diversion weirs will also be explored. The locations will be monitored for the presence of milling fish.

Final sonar site selection will depend on both the applicability of the site for use of the DIDSON and the logistical applicability of the site. A location for a weatherport must be located nearby and it must be accessible via jet boat. There must be a safe location to moor the skiff. Any other potentially useful information will also be recorded.

SAFETY

Safety will be the highest priority of this project. State safety regulations and Standard Operating Procedures (SOP) will be followed at all times. The crew leader and crewmember will responsibly assess and judge work place safety. On-site personnel will opt for conservative solutions to safety issues. Employees may be subject to disciplinary action without warning, including termination, for noncompliance to state safety regulations.

Employees are expected to review the following SOP before beginning fieldwork:

111-700 Safety Policies and Standards;

111-710 Office/Warehouse Safety;

111-720 Field Camp Safety;

111-730 Aircraft Safety for Passengers;

111-740 Boating Safety;

111-750 Vehicle Safety;

111-760 Laboratory Safety;

111-780 Firearm/Bear Safety.

In addition, all employees are expected to hold a current American Red Cross First Aid/CPR certification. The department will hold First Aid/CPR classes in Kodiak prior to the field season. If the employee is unable to attend the classes in Kodiak, obtaining the proper instruction will be the employee's responsibility.

A US Coast Guard approved personal floatation device will be worn at all times personnel are in a boat or on the smolt traps. Because of the remote sampling areas and the inclement weather associated with the Chignik area, a survival kit will be in the boat at all times. The kit will include matches, a hand-held VHF radio, a flare gun, an emergency position indication radio beacon (EPIRB), a GPS unit, spare motor parts, and a first aid kit. A shotgun loaded with slugs will also be taken into the field when appropriate for protection against bears.

REPORTING

The crew leader will telephone the Project Biologist at 8:30 AM daily (486-1805) unless otherwise predetermined. All data will be entered on the appropriate data forms. The crew leader will maintain a daily log of sampling activities. The written data and the daily logs will be submitted to the Project Biologist at the end of the field season. The crew leader is also responsible for compiling weekly field reports and for creating a comprehensive equipment inventory at the end of the season.

TIMESHEETS

Timesheets will be faxed to the Kodiak office (486-1841) on the 15th and the last day of each month. If these dates correspond with a weekend, the timesheets will be faxed prior to the weekend. If timesheets must be sent in early, amended timesheets can be sent to the Kodiak office if the hours actually worked differ from the hours sent on the original timesheet.

The crew leader is responsible for scheduling day to day tasks. Tasks will be scheduled to minimize overtime. The crew leader will document, as part of the daily log, all tasks that are performed and the actual hours worked to complete those tasks.

LITERATURE CITED

Burgner, R.L., C.J. DiCostanzo, R.J. Ellis, G.Y. Harry, Jr., W.L. Hartman, O.E. Kerns, Jr., O.A. Mathisen, and W.F. Royce. 1969. Biological studies and estimates of optimum escapements of sockeye salmon in the major river systems in Southwestern Alaska. Fishery Bulletin: Vol. 67, No. 2: 405-459.

Koenings, J.P., G.B. Kyle, J.A. Edmundson, and J.M. Edmundson. 1987. Limnology field and laboratory manual: Methods for assessing aquatic production. Alaska Department of Fish and Game, FRED Report No. 71. Juneau, AK 99802.

Narver, D.W. 1966. Pelagial ecology and carrying capacity of sockeye salmon in the Chignik Lakes, Alaska. Ph.D. Dissertation. University of Washington, Seattle WA.

Phinney, D.E. 1968. Distribution, abundance, and growth of postsmolt sockeye salmon in Chignik Lagoon, Alaska. Master of Science Thesis. University of Washington, Seattle WA.

Thomsen, S.E., S. Honnold, S. Schrof, and K. Spalanger. 2002. Kodiak Island lake Assessment/Limnology Project Laboratory Analysis Operational Plan. Alaska Department of Fish and Game, Division of Commercial Fisheries. Kodiak.

Table 1. Location of the various sampling locations for the Chignik Ecological Assessment Project, 2003.

Area	Description	Site/station	Latitude (N)[a]	longitude (W)[a]
Chignik Lake	Limnology	1	56°14.366'	158°48.834'
		2	56°15.344'	158°49.483'
		3	56°16.122'	158°50.612'
		4	56°17.316'	158°53.386'
	Beach Seine	1	56°15.201'	158°50.619'
		2	56°13.777'	158°19.283'
		3	56°16.080'	158°51.856'
		4		
		5	56°18.027'	158°53.525'
		6	56°17.759'	158°53.113'
		7	56°18.205'	158°50.454'
		8	56°15.381'	158°46.810'
Chignik Lagoon	Beach Seine	1		
		2		
		3		
		4		
Chignik River	Beach Seine	1		
		2		
		3		
Black Lake	Limnology	1	56°27.207'	158°59.701'
	Beach Seine	1		
		2		
		3		
		4		
		5		
Black River	Fyke	1		
		2		
		3		
	Beach Seine	1		
		2	56°20.956'	158°54.363'
		3	56°23.836'	158°56.265'
Bear Lake	Limnology	1	55°58.574'	160°11.402'
		2	55°59.092'	160°12.092'
		3	55°59.935'	160°13.666'
		4	56°00.901'	160°14.310'

[a] Blank coordinates will be filled in during the 2003 field season.

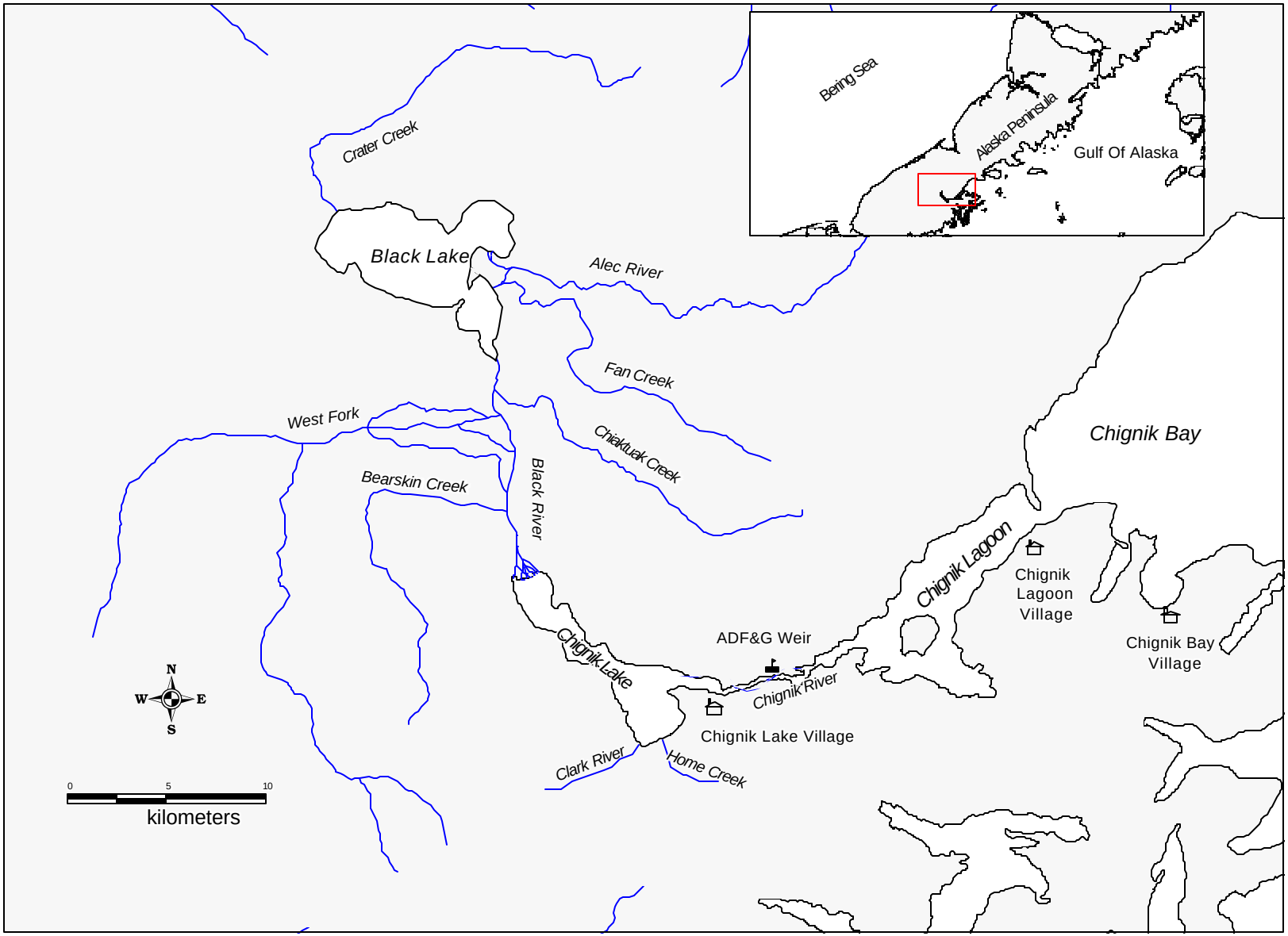


Figure 1. Map of the Chignik River watershed with an inset of western Alaska.

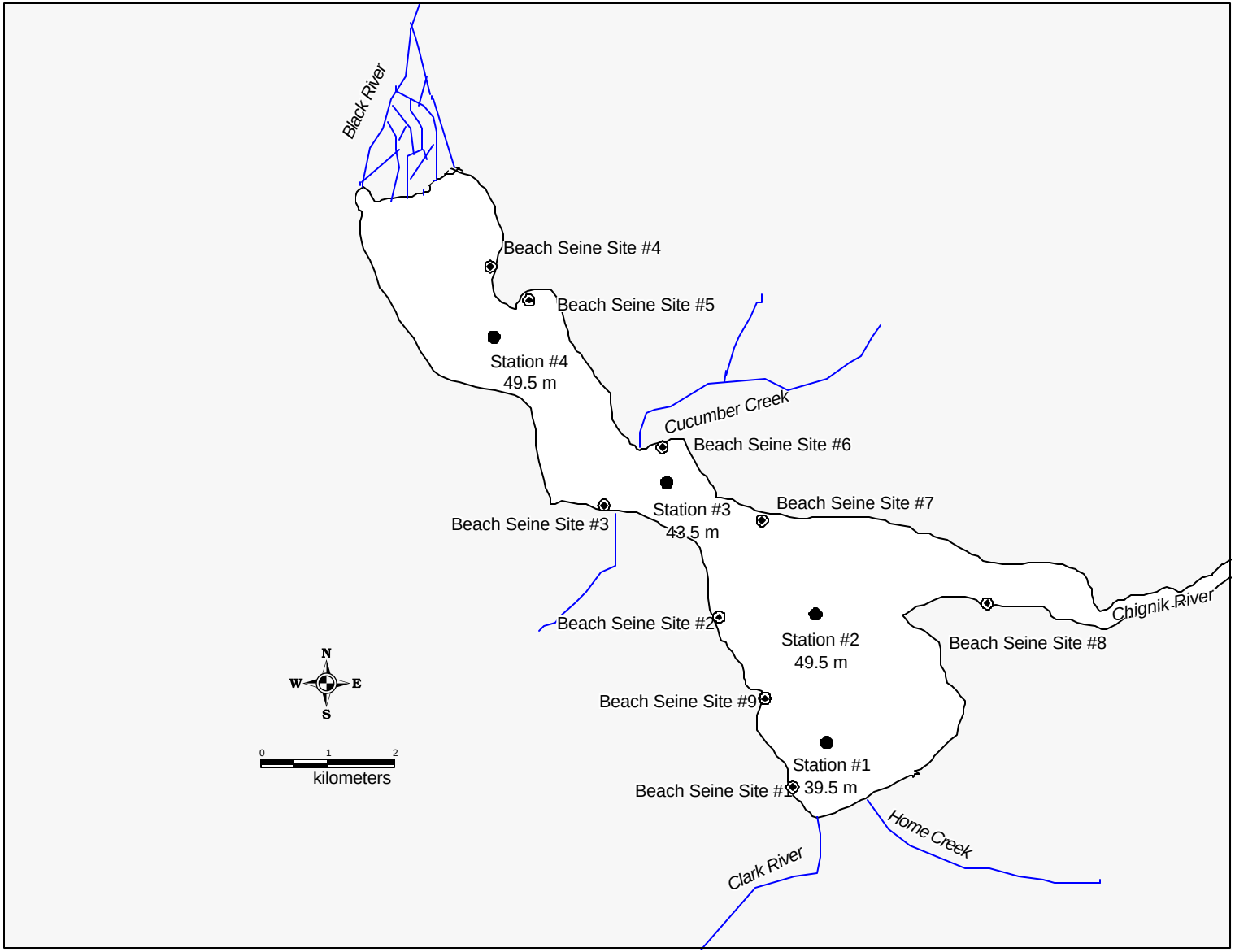


Figure 2. Map of Chignik Lake showing the limnology stations and the approximate locations of the beach seine sites.

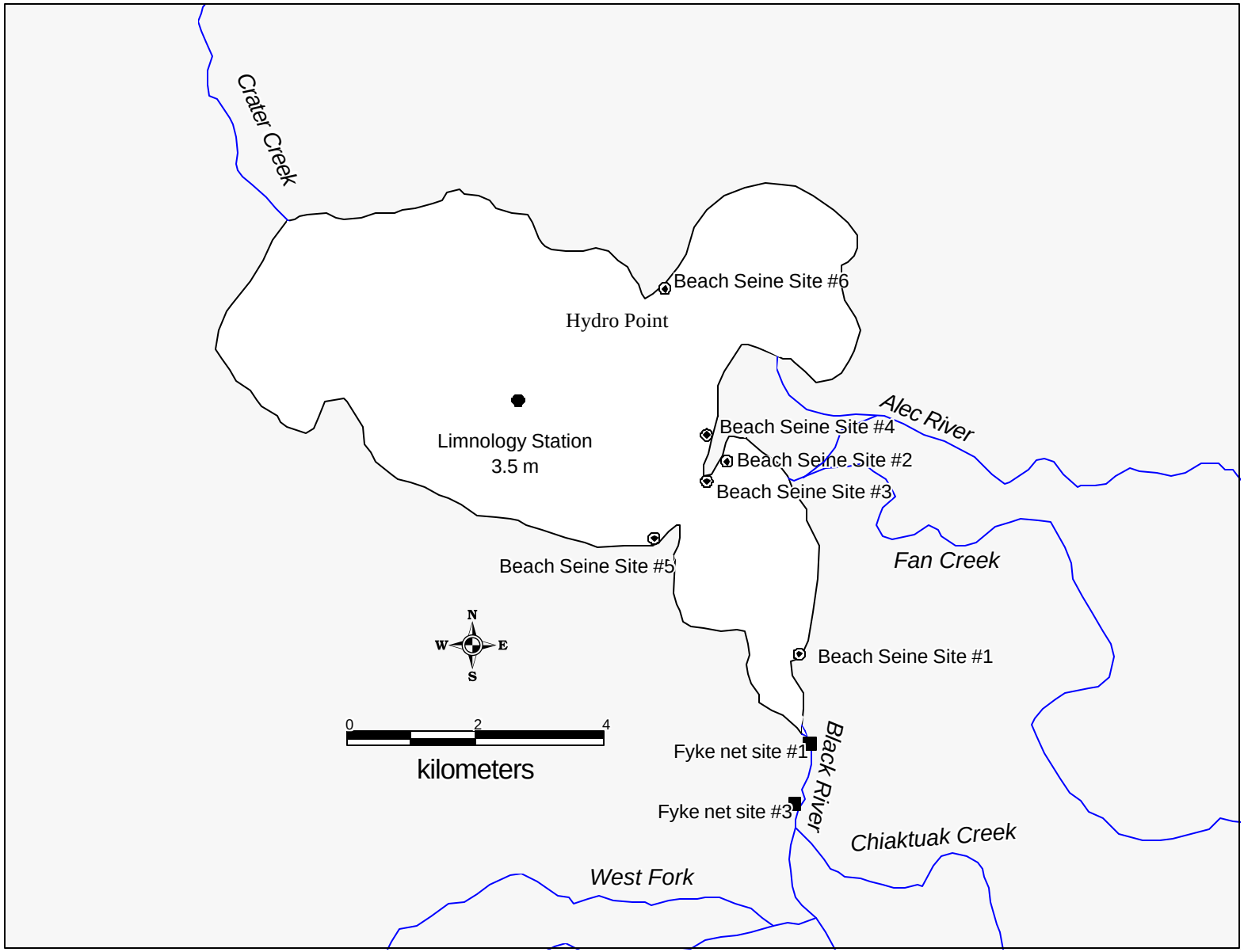


Figure 3. Map of Black Lake showing the limnology station and the approximate locations of the beach seine sites.

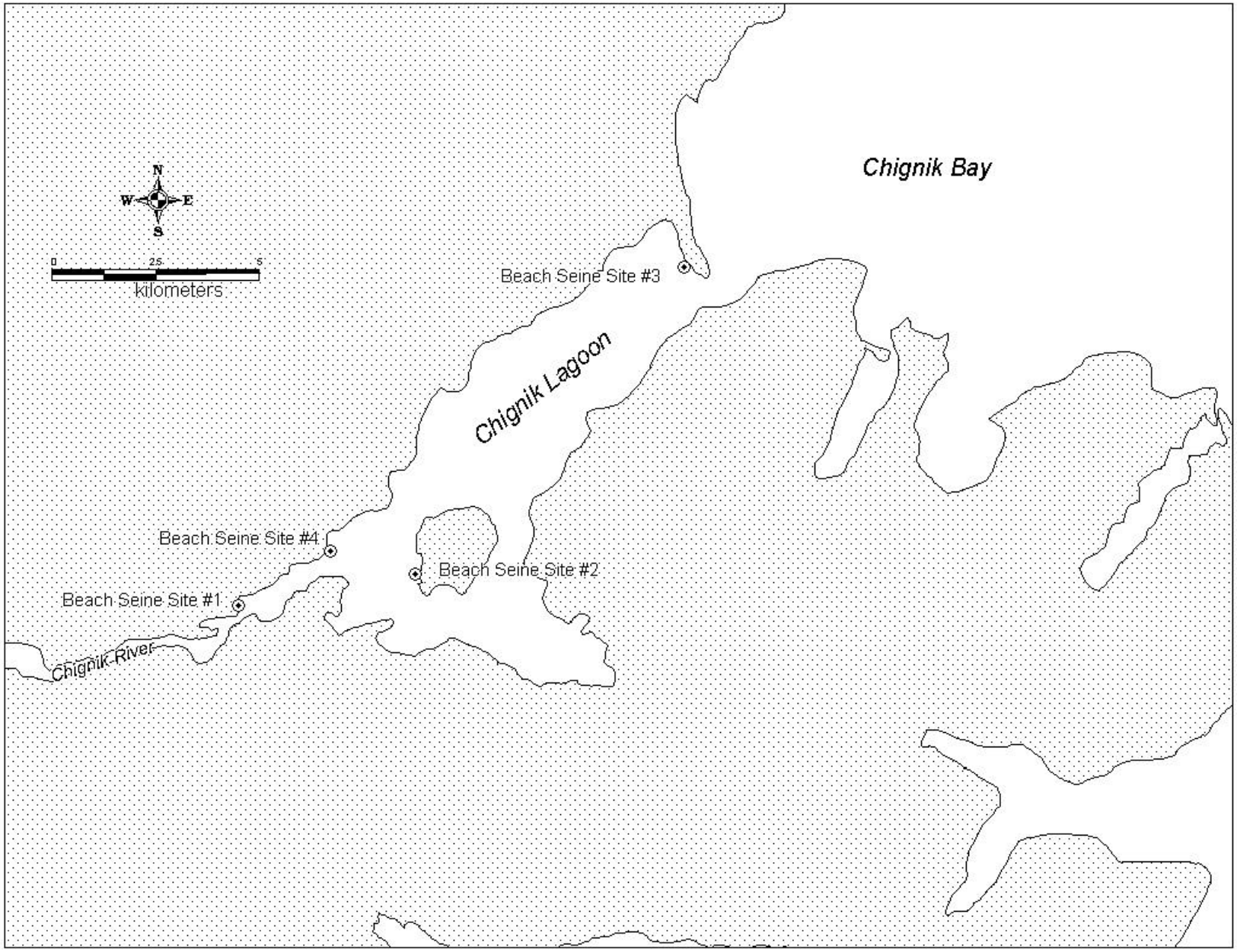


Figure 4. Map of Chignik Lagoon showing the approximate locations of the beach seine sites.

Detailed Lake Survey Form Comm. Fish Division, Limnology Section

Lake Station Bottom depth (m)

Weather and lake surface conditions

Date Name (s) of sampling personnel Time

Physical Parameters

Depth (m)	Temperature (^{o}C)	Dissolved Oxygen (mg/l)	Depth (m)	Solar Illuminance (Foot Candles) UP
Incidence			Incidence	
Surface			Surface	
0.5			0.5	
1.0			1.0	
1.5			1.5	
2.0			2.0	
2.5			2.5	
3.0			3.0	
3.5			3.5	
4.0			4.0	
4.5			4.5	
5.0			5.0	
6.0			6.0	
7.0			7.0	
8.0			8.0	
9.0			9.0	
10.0			10.0	
11.0			11.0	
12.0			12.0	
13.0			13.0	
14.0			14.0	
15.0			15.0	
16.0			16.0	
17.0			17.0	
18.0			18.0	
19.0			19.0	
20.0			20.0	
21.0			21.0	
22.0			22.0	
23.0			23.0	
24.0			24.0	
25.0			25.0	
30.0			26.0	
35.0			27.0	
40.0			28.0	
45.0			29.0	
50.0			30.0	

Hand held temp. water: air:

DO Meter Light Meter

Water samples:

were / were not collected for lab analysis.

Depths of samples: (m), (m) and (m)

Samples were filtered in the lab.

Zooplankton:

One Vertical tow was taken at each station.

Station No. Bottom depth (m)

Zooplankton tow depth (m)

Station No. Bottom depth (m)

Zooplankton tow depth (m)

Net size was **20cm x 153u.**

Each tow was preserved separately in 10% Buffered Formalin.

Secchi disk:

disappeared: (m)

reappeared: (m)

Mean disk reading: (m)

Comments:

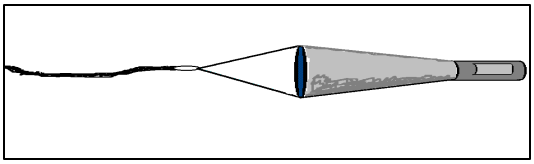


Figure 5. Detailed Lake Survey Form.

Chignik Limnology Beach Seine Data Form

#	Sockeye AWL #	Sockeye FL(mm)	Sockeye Wt (g)	Sockeye Cont. FL(mm)	Chinook FL(mm)	Coho FL(mm)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

Comments:

Personnel: _____

Date: _____

Location: _____

Site: _____

Time Set: _____

Air Temp: _____

H20 Temp: _____

WX: _____

Total Catch	
Coho	
Dolly	
Flounder	
Chinook	
Pond Smelt	
Sculpin	
Sockeye > 45 mm	
Sockeye < 45 mm	
Stickleback	

Figure 6. Beach Seine Data Form.

Chignik Limnology Fyke Net Data Form

#	Sockeye AWL #	Sockeye FL(mm)	Sockeye Wt (g)	Sockeye Cont. FL(mm)	Chinook FL(mm)	Coho FL(mm)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

Comments:

Personnel: _____

Date: _____

Location: _____

Coordinates: _____

Time Set: _____

Time Pulled: _____

Air Temp: _____

H20 Temp: _____

WX: _____

Total Catch	
Coho	
Dolly	
Flounder	
Chinook	
Pond Smelt	
Sculpin	
Sockeye > 45 mm	
Sockeye < 45 mm	
Stickleback	

Figure 7. Fyke Net Data Form.

Chignik Limnology Trawl Data Form

#	Sockeye AWL #	Sockeye FL(mm)	Sockeye Wt (g)	Sockeye Cont. FL(mm)	Chinook FL(mm)	Coho FL(mm)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

Comments:

Personnel: _____

Date: _____

Location: _____

Transect: _____

Depth: _____

Start Coordinates: _____

End Coordinates: _____

Start Time: _____

End Time: _____

Air Temp: _____

H20 Temp: _____

WX: _____

Wave ht(cm): _____

Boat Speed: _____

Total Catch	
Coho	
Dolly	
Flounder	
Chinook	
Pond Smelt	
Sculpin	
Sockeye > 45 mm	
Sockeye < 45 mm	
Stickleback	

Figure 8. Trawl Data Form.

APPENDIX

Appendix A.1. Smolt age-weight-length (AWL) sampling materials and methods.

All AWL data will be recorded in a field notebook dedicated to smolt sampling. Each species will have its own AWL sample number series that runs sequentially throughout the season. Up to 40 individual fish per smolt day may be included in one AWL sample. If more than 40 fish are sampled in a single smolt day, then multiple AWL numbers will be used on that day. For example, if 70 sockeye salmon smolt are sampled in a single day (day 1), the AWL numbers will be AWL # 001 (fish 1-40; 8 slides) and AWL # 002 (fish 1-30; 6 slides). The next day will start with AWL # 003. Each day's sample will start with a new AWL number.

The AWL data will then be transferred from the field notebook to the AWL forms. The AWL forms will be treated carefully; the scanner in the Kodiak office cannot read damaged forms. The forms should not be stapled, bent, paper-clipped or folded. Specific instructions for completing AWL forms are listed in Appendix A.2.

Smolt will be sampled as soon as possible after they are captured. The smolt will be transported in clean, 5-gallon buckets to the sampling area. An additional bucket of water will be used as a recovery bucket. Buckets containing smolt will be filled with fresh, clean water and aerated. The buckets will be covered when possible to avoid stress on the fish.

Tricane Methanesulfate (MS-222) will be used to anesthetize the smolt; latex gloves will be worn to prevent direct exposure to the anesthetic. The use of this chemical will be demonstrated by experienced personnel. A small amount (approximately 1 g) of MS-222 and a small amount of baking soda will be dissolved in approximately 2 L of cold water. The amount of anesthetic used will vary depending on the water temperature, freshness of the chemical, and size of the smolt. A few smolt will be placed in the anesthetic solution until subdued to a point where they can no longer flex their axial musculature but can still ventilate their gills. The concentration of the solution should be such that it immobilizes the fish in 2-3 minutes. After the fish are anesthetized, it is important to sample them quickly and place them in a recovery container to prevent mortality. No more than 80 smolt will be anesthetized with one batch of solution.

After the smolt have been immobilized, excess water will be removed from the fish using a paper towel or a wet sponge as a blotter. The fork length of the smolt (Appendix A.4) will be measured to the nearest 1 mm, and the weight will be measured to the nearest 0.1 g.

Place the fish on its right side to sample the left side. On salmon species, the preferred scale is located where a straight line between the posterior insertion of the dorsal fin and the anterior insertion of the anal fin crosses the second scale row dorsal to the lateral line. In smolt, the area directly around this scale is considered the preferred area (Appendix A.4). If scales are not present in this area then scales should be taken from the secondary location, which is the same area on the right side of the fish.

A scalpel will be used to remove 5-10 scales from the preferred area. These scales will be mounted on a glass slide using a probe to position the scales. Scales from five fish will be mounted on each slide. The scalpel will be wiped clean of scales and slime between fish.

-Continued-

The left portion of each slide will be labeled with: AWL number, sample location, species, date, and inclusive fish numbers. A diagram of a properly labeled slide with scales mounted correctly is located in Appendix A.5. After sampling, fish will be held in a recovery container until they are swimming normally and then released downstream of the trapping location.

Appendix A.2. Information necessary for completing AWL forms.

The AWL forms are used to convert hand written data into an electronic form. At this time, there is no dedicated smolt AWL form; therefore, an adult salmon AWL form will be used. Some of the data fields on the adult form are not intuitive for smolt data. All data will be entered using a #2 pencil, and each circle will be darkened completely. The following information will be entered in each field:

***Upper margin*:** Project location, species, and samplers.

***Card*:** The AWL sample number will be entered here. The number begins at 001 and continues sequentially through the season for each series.

***Day, Month, and Year*:** This date will correspond with the smolt day (noon to noon, with the date being the date of the noon to midnight period) the fish were captured.

***District, Subdistrict, and Stream*:** This information will be made available through the Project Biologist.

***Location*:** See Appendix A. 6. for site listings.

***Period*:** This number will correspond with the statistical week listed in Appendix A.3.

***Project*:** 8

***Gear*:** 20 for fyke net, 02 for beach seine, and 21 for townet.

***Mesh*:** This field will be left blank.

***Type of length Measurement*:** Enter "1" for tip of snout to fork of tail.

***Number of scales/fish*:** Enter "1" for 1 scale smear.

***# of cards*:** Enter "1".

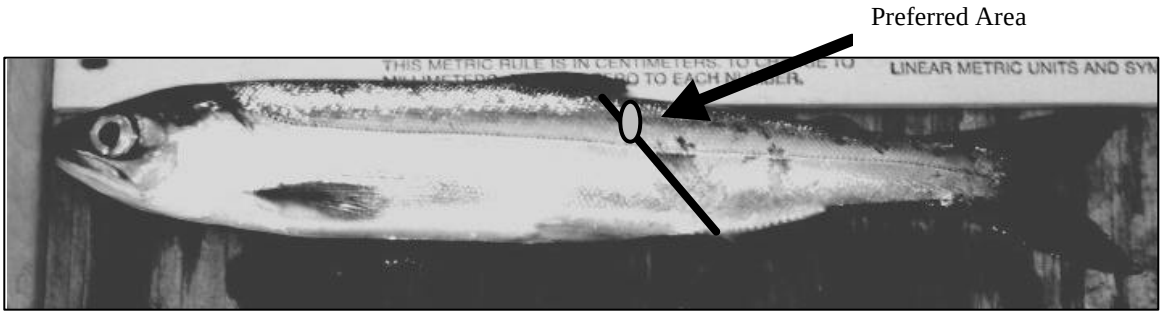
The code that has been pre-darkened on the left side of the front side of the form will be transferred to the corresponding field on the backside of the form. Lengths will be entered to the nearest 1mm on the front side of the form under the appropriate heading. Weight will be entered to the nearest 0.1 gram on the backside of the form in the rightmost three columns. Both length and weight will be reported with three digits with the decimal dropped (e.g. 102 for 10.2 g or 094 for 9.4 g).

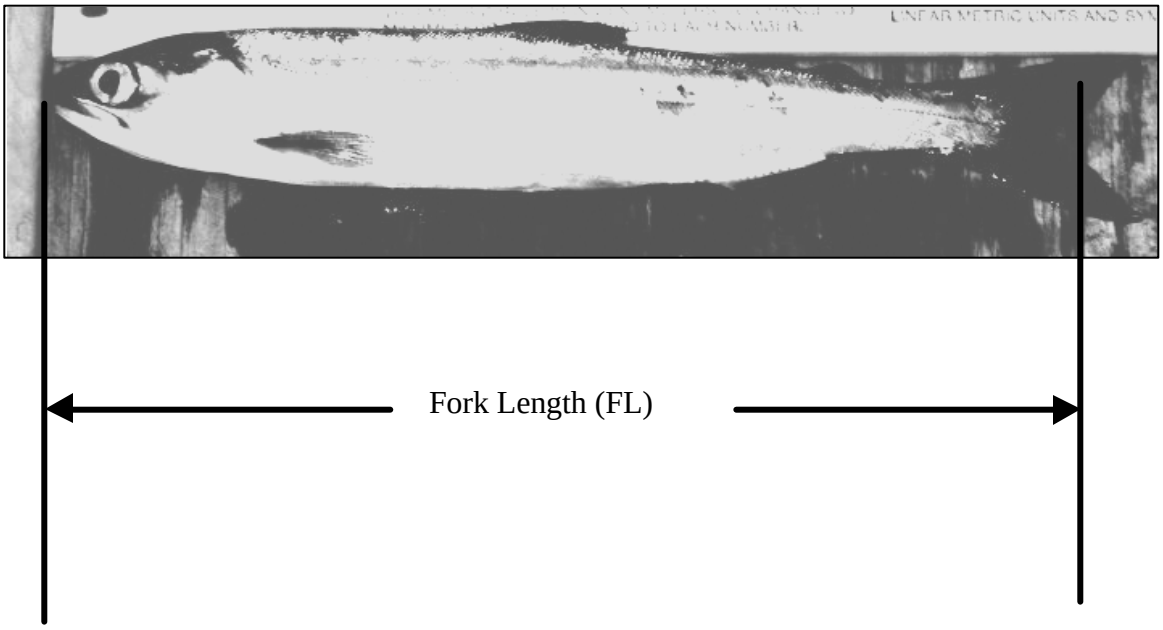
The crew leader will edit and review all forms and data before sending them to town, and be responsible for the content of the forms. The project supervisor will be notified prior to shipping the forms. This responsibility will be taken seriously.

Appendix A.3. Statistical week calendar.

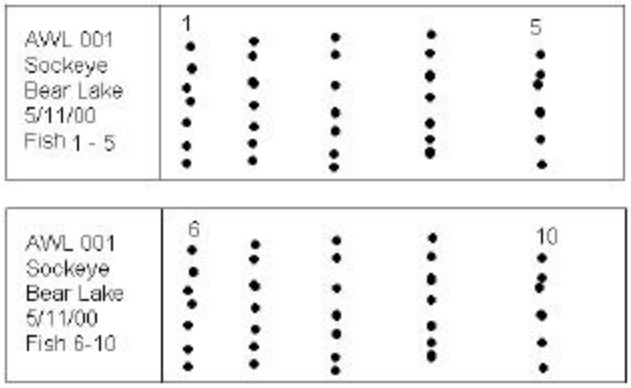
Week	Begins	Ends	Week	Begins	Ends
16	12-Apr	18-Apr	29	12-Jul	18-Jul
17	19-Apr	25-Apr	30	19-Jul	25-Jul
18	26-Apr	2-May	31	26-Jul	1-Aug
19	3-May	9-May	32	2-Aug	8-Aug
20	10-May	16-May	33	9-Aug	15-Aug
21	17-May	23-May	34	16-Aug	22-Aug
22	24-May	30-May	35	23-Aug	29-Aug
23	31-May	6-Jun	36	30-Aug	5-Sep
24	7-Jun	13-Jun	37	6-Sep	12-Sep
25	14-Jun	20-Jun	38	13-Sep	19-Sep
26	21-Jun	27-Jun	39	20-Sep	26-Sep
27	28-Jun	4-Jul	40	27-Sep	3-Oct
28	5-Jul	11-Jul	41	4-Oct	10-Oct

Appendix A.4. Photo of a smolt with the preferred area highlighted.





Appendix A.5. An example of correctly labeled smolt AWL slides.



Appendix A.6. Chignik gear, project, and location AWL database codes.

Project code additions: 8 – smolt
9 – juvenile assessment

Location codes:
210 – Chignik Lake, site 1
211 – Chignik Lake, site 2
212 – Chignik Lake, site 3
213 – Chignik Lake, site 5
214 – Chignik Lake, site 7
215 – Chignik Lake, site 8
216 – Chignik Lake, site 9
217 – Chignik Lake, transect 1-2
218 – Chignik Lake, transect 2-3
219 – Chignik Lake, transect 3-4

220 – Black Lake, site 1
221 – Black Lake, site 2
223 – Black Lake, site 4
224 – Black Lake, site 5
225 – Black Lake, FRI tow 1
226 – Black Lake, FRI tow 2
227 – Black River

230 – Chignik River, site 1
231 – Chignik River, site 2
232 – Chignik River, site 3
234 – Chignik River, below weir
235 – Chignik River, smolt trap

240 – Chignik Lagoon, site 1
241 – Chignik Lagoon, site 2
242 – Chignik Lagoon, site 3
243 – Chignik Lagoon, site 4

Appendix B. Timeline of periodic sampling events.

	May	June	July	August
Week 1		Leads Project Sonar Project	BS Lag, CR, CL Tow CL	BS BL Fyke BR
Week 2	Arrive Chignik Limno CL BL	Limno CL BL BS Lag, CR, CL Tow CL	Limno CL BL BS BL Fyke BR	Limno CL BL Sonar Project Leads Project
Week 3	Limno Bear BS Lag, CR, CL Tow CL	Limno Bear BS BL Fyke BR	Limno Bear Sonar Project	Limno Bear BS Lag, CR, CL Tow CL
Week 4	BS BL Fyke BR	Sonar Project Leads Project	BS Lag, CR, CL Tow CL	BS BL Fyke BR

Abbreviations:
Beach Seine = BS

Black Lake = BL
Chignik Lake = CL
Chignik River = CR
Chignik Lagoon = Lag
Black River = BR

CHIGNIK RIVER SMOLT ENUMERATION PROJECT
OPERATIONAL PLAN, 2003

By

Kenneth A. Bouwens

and

Eric J. Newland

Alaska Department of Fish and Game
Division of Commercial Fisheries
211 Mission Road
Kodiak, AK 99615

May 2003

TABLE OF CONTENTS

	Page
LIST OF FIGURES	i
LIST OF APPENDICES	i
INTRODUCTION	1
GOAL	1
Objectives	1
Tasks	2
SUPERVISION	2
METHODS	3
Trap Installation	3
Smolt Trapping and Enumeration	3
Smolt Age, Weight, and Length Sampling	4
Mark-Recapture Experiments	4
Mark Retention/Delayed Mortality Experiments	6
Physical Data	7
SAFETY	7
REPORTING	7
TIMESHEETS	8
LITERATURE CITED	9
FIGURES	10
APPENDICES	18

LIST OF FIGURES

Figure		Page
1.	Map of the Chignik River watershed	10
2.	Location of the traps and release site of marked fish on the Chignik River, Alaska	11
3.	Daily Smolt Catch Reporting Form	12
4.	Sockeye Salmon Smolt Reporting Form	13
5.	Catch-Weight Worksheet	14
6.	Smolt Dye Release Form	15
7.	Delayed Mortality/Mark-Retention Form	16
8.	Daily Physical Observation Form	17

LIST OF APPENDICES

Appendix		Page
A.	Smolt identification key	19
B.1	Smolt age-weight-length (AWL) sampling materials and methods	24
B.2	Information necessary for completing AWL forms	25
B.3	Statistical week calendar	26
B.4	Photo of a smolt with the preferred area highlighted	27
B.5	An example of correctly labeled smolt AWL slides	28
C.	Proposed work schedule for the Chignik Smolt Project	29
D.1	Instructions for filling out a timesheet	30
D.2	Example of a completed timesheet	31

INTRODUCTION

Economically, sockeye salmon *Oncorhynchus nerka* is the most important commercial salmon species in the Chignik Management Area (CMA). The Chignik River watershed is the primary sockeye salmon producer in the CMA (Figure 1). Over the last 10 years, annual runs to the Chignik River have ranged from 1.6 to 4.4 million adult sockeye salmon (Witteveen et al. *in press*). There are two rearing lakes and two distinct sockeye salmon runs in the Chignik River watershed. Sockeye salmon that spawn in Black Lake and its tributaries return from about May through July, and those that spawn in Chignik Lake and its tributaries return from about July through September (Witteveen and Botz 2002). The freshwater interaction between the juveniles of these two runs is poorly understood.

This project provides information on the Chignik River juvenile salmon population size and dynamics and the physical health of the smolt. Coupled with basic limnology data, this information may allow the modeling of potential juvenile sockeye salmon rearing capacity of the Chignik River watershed. This information will be used for evaluating current escapement goals, forecasting future adult returns, and estimating ocean survival.

Smolt population abundance data, by age, has been collected annually since 1994. Additional years' data in the smolt database will provide increasing insight into run size fluctuations and lead to more accurate forecasting.

GOAL

The project goal is to evaluate and document the Chignik River watershed sockeye salmon smolt production trends.

Objectives

(1) Estimate the total number of emigrating sockeye salmon smolt, by age class, from the Chignik River system;

(2) Describe sockeye salmon smolt emigration timing and growth characteristics (length, weight, and condition factor), by age class, for the Chignik River system;

(3) Continue to build a smolt database to estimate smolt-to-adult survival and to forecast future runs;

(4) Summarize the 2003 smolt emigration data in a report.

Tasks

1. Install, operate, and maintain a rotary screw smolt trap array to capture a portion of the sockeye salmon smolt outmigration.
   Target date: April 24 through July 12.

2. Enumerate the daily smolt trap catch by species.

3. Collect weekly samples of 200 sockeye salmon smolt (40 smolt per day for five consecutive days) for age, weight, and length (AWL) data.

4. Perform mark-recapture experiments on 3,000 (1,000 minimum) sockeye salmon smolt every 5 days, using Bismark Brown-Y dye, to estimate trap efficiency and the total smolt outmigration. In conjunction with each mark-recapture experiment, a mark-retention/delayed mortality experiment will be conducted.

5. Collect physical data daily: air temperature, water temperature, relative water depth, cloud cover, precipitation, and wind direction and velocity.

6. Inventory and store equipment, and close camp.
   Target date: July 15.

7. Write Project Summary Report.
   Final report due date: December 30.

SUPERVISION

Project Biologist:	Ken Bouwens – Fisheries Biologist II
Crew Leader:	Eric Newland - Fisheries Biologist I
Crewmember:	Hector Bravo – Fish and Wildlife Technician II

The crew leader will schedule daily tasks and will oversee and participate in all field operations regarding the smolt project. The crewmember will assist the crew leader in all assigned tasks and field operations. The Project Biologist will oversee the study, and provide logistical and technical support. All project members will work as a team to complete the project's goal. Technical or policy questions will be directed to the Project Biologist. George Pappas, Chignik Area Management Biologist, oversees and is responsible for all ADF&G operations at Chignik. The smolt project research staff will work cooperatively with management staff and the public.

METHODS

Trap Installation

Two rotary screw traps (1.5 m and 2.4 m cone diameter) will be positioned in the Chignik River at the same location as in previous years (Figure 2). The traps will be marked clearly to avoid conflicts with boat traffic. The traps will be operated in tandem (small trap closer to shore) perpendicular to the stream flow and attached to the shore. The water velocity should be approximately 5 ft/s (~1.5 m/s) at the trap location to provide a trap operating speed of about 5-8 rpm. To reduce smolt avoidance, each trap will be relocated laterally (as the river flow fluctuates), to fish as far offshore as possible without jeopardizing the trapping equipment. After the traps are installed, a river depth profile at the trapping site (1 m intervals) and a schematic diagram will be completed.

Smolt Trapping and Enumeration

The screw traps will operate continuously throughout the season. A trapping day will be defined as a 24-hour period from NOON to NOON, with the date corresponding to the calendar date of the first 12-hour period. Time will be recorded in military (24-hour) format. The traps will be checked hourly during dark hours, and approximately every six hours during the day. The traps will be checked, cleaned, and emptied daily at noon. It is extremely important to monitor the traps closely because smolt migration rates are variable and unpredictable; excessive mortality can occur quickly if smolt are crowded in the trap. The traps will be kept clear of debris, as increased flows and detritus may cause death or injury to captured smolt.

Each time the traps are checked, all species will be identified and counted. Various identification keys (e.g. Pollard et al. 1997; Appendix A) will be available and care will be taken to ensure proper identification. If identification by external characters proves difficult, a small number of fish will be sacrificed and internal characters will be examined. All fish of each species will be counted using a hand counter to facilitate accuracy. Each time the trap is checked, all counts, including mortalities, will be recorded on the DAILY SMOLT TRAP CATCH REPORTING FORM (Figure 3). If it becomes necessary to count continuously because of high fish abundance, the tally will end for each species at the end of each hour. The data will be recorded, and a new tally will begin for the next hour. All counts will be summarized on the SOCKEYE SALMON SMOLT REPORTING FORM (Figure 4) on a daily basis.

If direct counting is impossible because of high smolt catches, it will be necessary to estimate trap catch using the catch-weight method. The crew will be prepared to estimate catch using this method well before large migrations begin; there will be no time to prepare when catch numbers become large. It may not be necessary to use the catch-weight method on both traps simultaneously; it is desirable to count individual fish when possible. It is also desirable to keep an individual tally for each trap during catch-weight enumeration. The methods for the catch-weight estimation technique are:

1. A sample of approximately 150 fish will be dipnetted from the trap(s) and weighed. This sample should be representative of the fish in the trap. This weight will be the

reference weight for the next samples. The weight of the sample will be recorded in a field notebook.

2. The sample will be enumerated, by species, and any marked fish will be noted. These data will be recorded in a field notebook and the fish will then be released.

3. Subsequent samples will be taken from the trap(s). The weight of these samples will be measured and recorded, and the fish will be released.

4. A new reference weight will be taken every 10^{th} sample or earlier if size or species compositions obviously change.

5. These data will be transferred to the CATCH-WEIGHT WORKSHEET (Figure 5) when passage rates slow down.

Any data generated by this method will be clearly marked on the data sheets.

Smolt Age, Weight, and Length Sampling

A sample of 40 sockeye salmon smolt will be collected for five consecutive days per statistical week and sampled for AWL data (Appendix B.1 through B.5). All smolt sampling data will reflect the smolt day in which the fish were captured, and samples will not be mixed between days. If less than 40 sockeye salmon smolt are captured in a day, all available smolt will be sampled for AWL data. If greater than 40 smolt are captured, a sample of smolt will be collected hourly throughout the night's migration and held in an instream live box. The number of fish sampled hourly will be proportional to the migration strength. At the end of the smolt day, 40 smolt will be randomly collected from the live box and sampled. The remaining smolt will be released. It is important that the smolt sample represent the entire night's migration. These data are used to reconstruct the age class component of the emigration, and smolt of different sizes and ages may travel in separate schools throughout the night.

The age of the sampled fish will be estimated postseason by interpreting the growth patterns on their scales.

Mark-Recapture Experiments

Trap efficiency estimates will be made every five days to estimate the number of sockeye salmon smolt emigrating from the Chignik River, or sooner if the trap is moved. Bismark Brown-Y dye will be used to mark a sample of fish. The marked fish will be transported upstream of the trap at the release site (Figure 2). All smolt caught in the trap will be examined for marks, unless high catch volumes require the use of the catch-weight method. The proportion of recaptured fish will be used to estimate the proportion of the total run that is captured in the trap. The assumptions for mark-recapture experiments are:

1. Mortality rates are equal between marked and unmarked fish.

2. All recaptured fish are recognized as such and fish do not lose their marks.

3. Marked and unmarked fish behave similarly.

Every effort will be made to conform to these assumptions. The marking process can be very stressful for smolt, and care will be taken to avoid stress when possible. The primary causes of mortality are excessive handling, high water temperatures, low levels of dissolved oxygen, and exposure to the dye. The marked smolt will be released into the river at a point far enough upstream to ensure mixing with the unmarked populations at a time when the migration for the evening is imminent.

The following methods will be used for marking and releasing smolt:

1. All data will be recorded on the SMOLT DYE RELEASE FORM (Figure 6).

2. Every 5 days, a sample of approximately 3,000 sockeye salmon smolt will be collected for marking. If run strength is not sufficient to capture all the smolt in one day, smolt will be held in an instream live box for up to three days. After the third evening, all smolt collected will be marked. Marked fish will not be sampled for AWL information.

3. The fish will be transferred from the instream live box to two 20-gallon transport/marking containers. The containers will then be covered. A water pump will be used to gently exchange the water in the containers. The smolt will be allowed to rest in the container for at least 30 minutes.

4. The circulation pumps will be turned off, and a solution of 3.8 g of Bismark Brown-Y dye will be dissolved in each container. Three to four aerator units will be placed in the marking containers and will operate continuously during the dyeing period. After 15 minutes in the dye, the pump will be restarted and the containers will be flushed with fresh water. The dye solution should be extremely dilute after 20 minutes of flushing.

5. Following the dye treatment, the containers will be flushed with fresh water for a minimum of 90 minutes. Smolt displaying abnormal behavior will not be released.

6. Smolt showing normal behavior will be dipnetted from the recovery containers, counted, transferred to 5-gallon buckets equipped with aerators and transported upstream to the release site (Figure 2). At the release site, the smolt will be evenly distributed across the stream by slowly pouring the smolt out of the 5-gallon buckets. It is imperative that the smolt are released on the downstream side of the boat to reduce the probability of propwash mortality or injury. The dye treatment and recovery process should be timed so that the release takes place at approximately 2300 hrs.

7. The smolt trap will be monitored for recaptured marked fish beginning the day of release and continue through the next marking event. The number of marked fish will be observed and recorded on the DAILY SMOLT CATCH REPORTING FORM (Figure 3)

and the SALMON SMOLT SUMMARY FORM (Figure 4). The number of smolt examined will equal the number of marked smolt plus the number of unmarked smolt caught each day. The daily smolt catch will not include marked smolt, since these fish have been previously counted when they were collected to be marked.

8. In the event that it is necessary to use the catch-weight method to count smolt during a dye test period, the number of fish examined for marks will be the number of fish counted in the reference weight samples only. The total number of marked fish recovered will be extrapolated from the catch weight method. Data generated from the catch-weight method will be clearly marked.

Trapping conditions will be held constant between marking events. Modifications to the trap, including adjustments in lighting and trap location, will be made immediately before a marking event. If major changes in river flow rates or smolt migration patterns are noticed, a new marking event will follow as soon as possible. The Project Biologist will be consulted before any trap modifications are made unless immediate modifications are necessary to prevent loss of equipment or to prevent major smolt mortality. Any changes will be clearly documented in the daily log and in the comments section of the data forms.

Mark Retention/Delayed Mortality Experiments

A random subsample of 200 sockeye salmon smolt will be taken from the fish retained for marking for use in a combined mark retention and delayed mortality experiment. This experiment will be performed in conjunction with every dye test unless otherwise advised by the Project Biologist.

Before marking fish, 100 of the sockeye salmon smolt will be removed from the transport container and placed in one side of a divided instream live box. These fish will be handled the same as the fish that are marked, except they will not be placed in the dye solution. After the marking and recovery period, an additional 100 marked smolt will be placed in the other side of the live box. These smolt will be examined daily for mortalities. The number of mortalities from each group will be recorded on the DELAYED MORTALITY / MARK-RETENTION FORM (Figure 7). These smolt will be released at the beginning of a new mark-recapture test or after five days, whichever is first.

Additionally, a sample of five marked and five unmarked smolt will be used to conduct daily identification trials. The purpose of these tests is <u>not</u> to evaluate field personnel's identification ability, but to evaluate the mark-recapture assumptions. One crewmember will examine smolt and the other will present the smolt. The duties will switch the next day. The examiner will not look at the smolt before the trial. The presenter will, at random, select a smolt from the live box, present it in a dip net to the examiner for approximately one second, and immediately release the fish back to the appropriate side of the live box. The examiner will determine whether the smolt was marked or not; the presenter will record whether the examiner was correct. The presenter will not inform the examiner of the accuracy of his determinations until all 10 fish have been examined. It is desirable to mimic actual counting conditions as much as possible when conducting these trials; they should be performed under low light conditions. Results of this

experiment will be recorded on the DELAYED MORTALITY / MARK-RETENTION FORM (Figure 7). When the experiment is finished, the smolt are counted and released.

Physical Data

Air and water temperature, cloud cover, wind direction and velocity, trap rpm, and relative stream height will be measured twice daily (NOON and MIDNIGHT) throughout the season. This information will be recorded on the DAILY PHYSICAL OBSERVATION FORM (Figure 8).

SAFETY

Safety will be the highest priority of this project. State safety regulations and Standard Operating Procedures (SOP) will be followed at all times. All staff are personally responsible for assessing unsafe situations and will exercise caution when weighing safety issues. Employees may be subject to disciplinary action without warning, including termination, for noncompliance to State safety regulations.

Employees are expected to review the following SOPs before beginning work:

111-700 Safety Policies and Standards;
111-710 Office/Warehouse Safety;
111-720 Field Camp Safety;
111-730 Aircraft Safety for Passengers;
111-740 Boating Safety;
111-750 Vehicle Safety;
111-760 Laboratory Safety;
111-780 Firearm/Bear Safety.

In addition, all employees are expected to hold a current American Red Cross First Aid/CPR certification. The Department will hold First Aid/CPR classes in Kodiak prior to the field season; if the employee is unable to attend the classes in Kodiak, obtaining the proper instruction will be the employee's responsibility.

A U.S. Coast Guard approved personal flotation device will be worn at all times while boating and while working on the smolt traps. A survival kit including matches, a hand-held VHF radio, a flair gun, a GPS unit, spare motor parts, and a first aid kit will be in the boat at all times.

REPORTING

The crew leader will compile a daily log. This log will be submitted to the Project Biologist at the end of the field season. The crew leader will contact the project biologist daily at 1:00 PM by telephone (wk 486-1805; hm 486-5337). The crew leader will record daily smolt emigration

counts, water level, water temperature, and trap rpm in the management office every morning by 7:30 AM. The crew leader is also responsible for compiling a weekly field report and for co-authoring a season summary. The crew leader is also responsible for completing a comprehensive equipment inventory at the end of the season.

It is desirable for the field crews to photograph all aspects of the fieldwork. The Project Biologist will provide film to field crews to use in their personal cameras, and will pay for developing the film. A copy of the prints will be given to the crewmember, and a copy will become the property of the State of Alaska.

TIMESHEETS

The crew leader is responsible for scheduling daily tasks. Tasks will be scheduled to minimize overtime. Overtime is limited to 30 hours/month (7.5 hours/week) per person, unless otherwise pre-authorized. A proposed work schedule is described in Appendix C. The crew leader will document, as part of the daily log, all tasks that are performed and the actual hours worked to complete those tasks.

Timesheets will be completed and faxed to Kodiak before the 15th and last day of each month as possible. If timesheets must be sent in early, amended timesheets can be sent to a field office if the hours actually worked differ from the hours submitted on the original timesheet. Explicit directions for completing timesheets are located in Appendix D.1 and D.2.

LITERATURE CITED

Pollard, W.R. G.F. Hartman, C. Groot, and P. Edgell. 1997. Field Identification of Coastal Juvenile Salmonids. Harbour Publishing. British Colombia, Canada.

Witteveen, M.W., S. Schrof, K.A. Bouwens, N. Sagalkin, M.B. Foster, R. T. Baer, and D. Aro. *in press.* Westward Region Salmon Run Reconstruction for the 2002 Season and Forecasting for the 2003 Season. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division.

Witteveen, M.W. and J.C. Botz. 2003. Chignik Lakes Scale Pattern Analysis, Run Apportionment, and Sockeye Salmon Catch Sampling Results, 2002. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division. Regional Information Report No. 4K03-1. Kodiak.

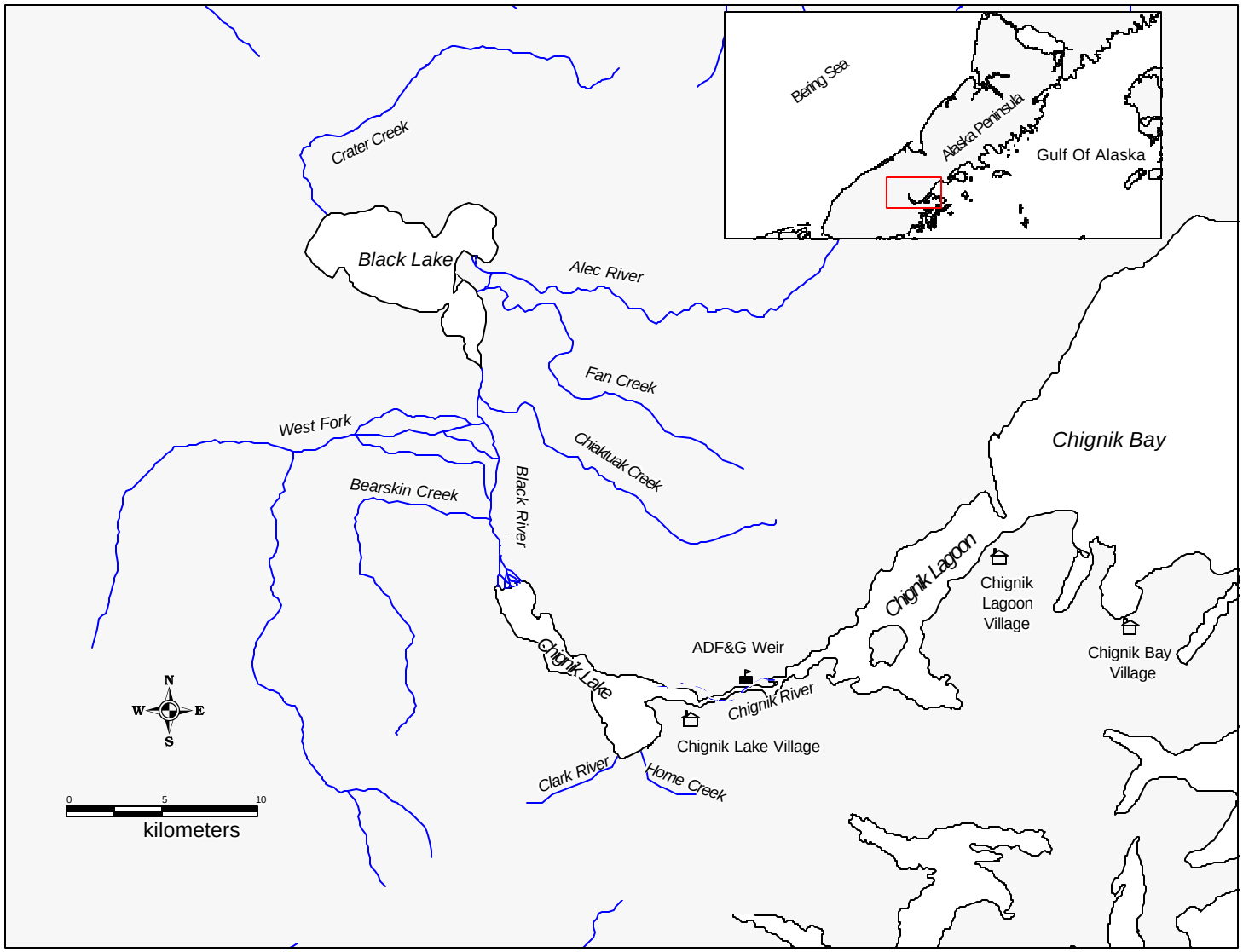


Figure 1. Map of the Chignik River watershed.

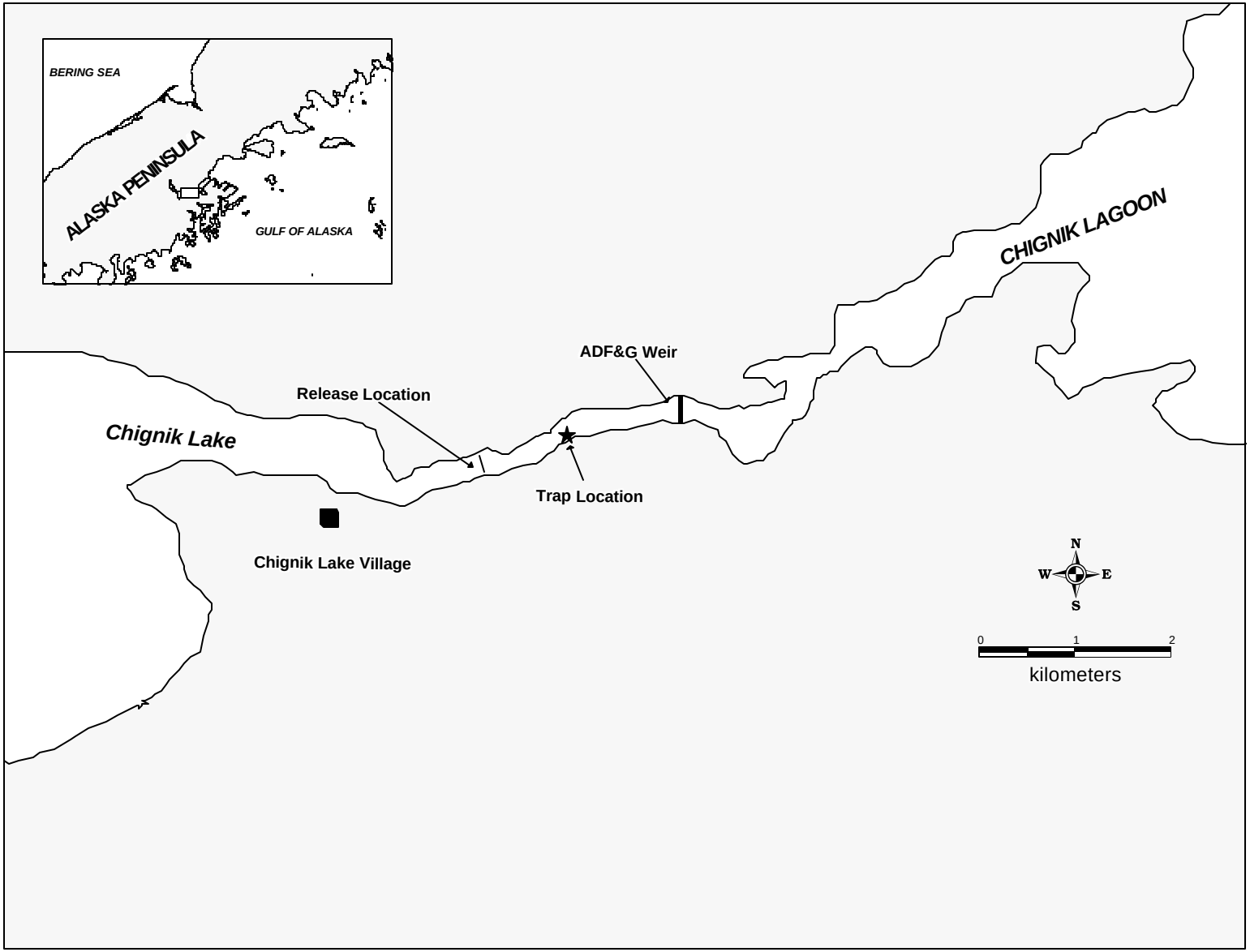


Figure 2. Location of the traps and release site of marked fish on the Chignik River, Alaska.

Daily Smolt Catch Reporting Form

Trap: _____

Project:_____ Smolt date:_____ Page ____of ____

Time (military)	Sockeye (numbers)				Other (numbers)				Comments[3]
	Catch[1]	Examined for Marks[2]	Marked Recoveries	Trap Mortality	Sockeye Fry	Coho	Dolly V.	Stickleback	
Daily Total:									

[1] Catch includes all trap mortalities, but <u>not</u> marked fish.

[2] This number should equal the catch column unless the catch weight method is used or some other circumstance prevents the examination of all captured smolt.

[3] Include weather changes, water level changes, counts of species not included in columns, and any other significant information.

Figure 3. Daily Smolt Catch Reporting Form.

Sockeye Salmon Smolt Reporting Form

Project:_____ Year:_____ Page ____of ____

Smolt Date	Catch (both traps combined)			AWL Sample		Mark-Recapture[2]				Comments
	Daily	Cumulative	Mortalities[1]	Daily	Cumulative	# Released	Daily Recaptures	Cumulative Recaptures	%[3]	

[1] Included in daily count.

[2] Cumulative and % begin over with each release.

[3] Calculated by: % = (cumulative recaptured / #released) * 100

Figure 4. Sockeye Salmon Smolt Reporting Form.

Catch-Weight Worksheet

Smolt Date_____ Page____of ____

Time	Weight	Number of Fish[a] Sockeye	Sockeye Fry	DV	Stick	Coho	Sockeye Recaps[b]
	Total:						

[a] Number of fish in reference sample is from actual counts. Number of fish in subsequent samples is calculated by: $S_c = (S_r * W_s) / W_r$

Where: S_c = Calculated number of fish of each species.

S_r = Number of fish of each species in the reference sample.

W_s = Weight of subsequent sample.

W_r = Weight of reference sample.

[b] Recapture numbers are <u>not</u> included in the number of sockeye column.

Figure 5. Catch-Weight Worksheet.

Smolt Dye Release Form

Smolt Day:_____

Grams Dye:_____
Tote Volume:_____

	Time (military)	H_2O Temp.	Comments
Fish into Container			
Begin recovery water exchange			
Addition of dye			
Begin water exchange			
Begin transport			
Release			

Number released:_____

Number held for mark retention experiments:_____

Number of mortalities:_____

Comments (include comments on fish vigor, areas of mortality, how well marked the fish were, etc.):

Personnel:

Figure 6. Smolt Dye Release Form.

Delayed Mortality/Mark-Retention Form

Date/time fish were marked:_____ Grams dye:_____

Water temp. when fish were marked:_____ Water volume:_____

No. marked fish retained:_____ No. unmarked fish retained:_____

Delayed Mortality

Date	Time	H_2O Temp.	# of mortalities	
			Marked	Unmarked

Mark-Retention

Date	Time	Observer	# Correctly Identified	
			Marked	Unmarked
			5	5
			5	5
			5	5
			5	5
			5	5
			5	5
			5	5

Comments:

Figure 7. Delayed Mortality/Mark-Retention Form.

Daily Physical Observation Form

PROJECT_____

YEAR_____ LOCATION _____

DATE	TIME	TEMPERATURE (C)		CLOUD	WIND		Trap RPM		GAUGE	COMMENTS (i.e., rain, drizzle, etc...)
		Air	Water	COVER (%)	DIRECTION	VEL (kts)	Small	Large	HEIGHT (cm)	

Figure 8. Daily Physical Observation Form.

APPENDIX

Appendix A. Smolt identification key.

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

By

ROBERT J. McCONNELL and GEORGE R. SNYDER

National Marine Fisheries Service
Northwest Fisheries Center
2725 Montlake Boulevard East
Seattle, Washington 98102

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 [1] 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 alternative 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.

[1] Especially adult smelt, family Osmeridae.

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

-Continued-

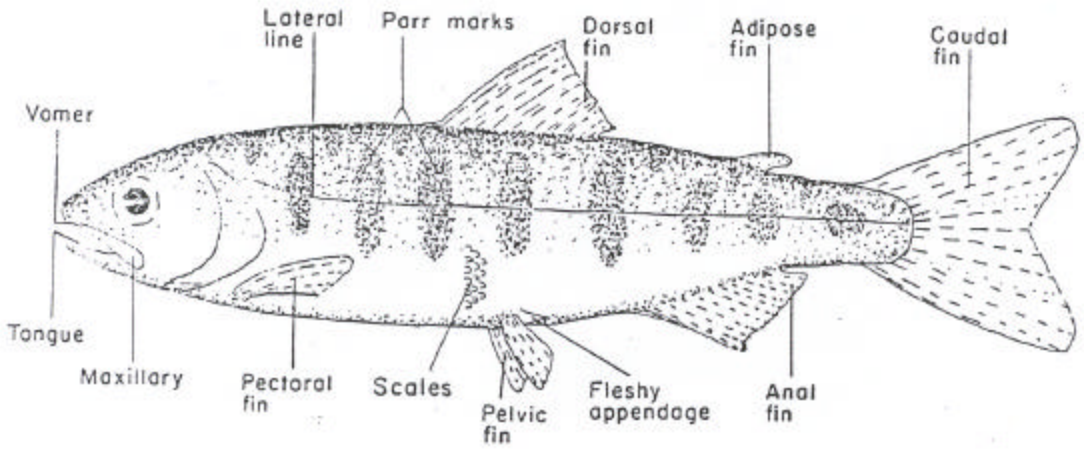


Figure 1.—A hypothetical salmonid showing external characteristics.

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)

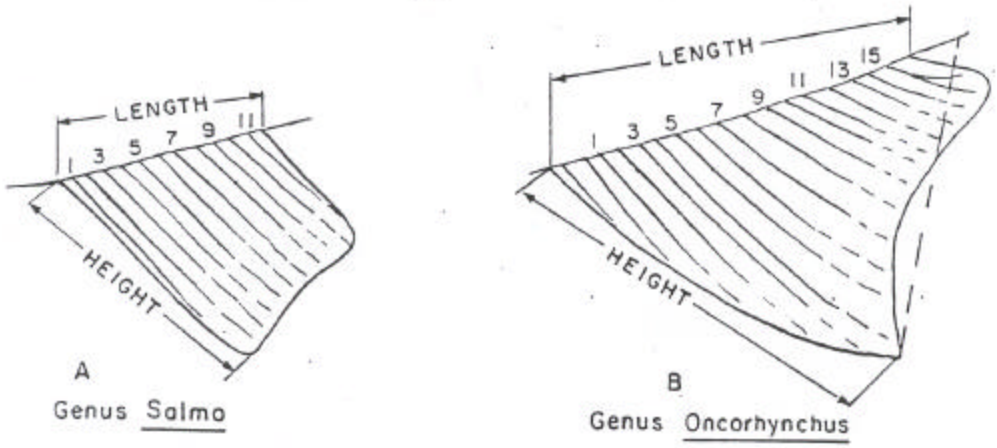


Figure 2.—Anal fins: (A) Trout, genus *Salmo;* (B) Pacific salmon, genus *Oncorhynchus.* The two drawings show differences in structure and fin ray count. (Note that the length of the anal fin is its overall basal length, and its height is that distance from the origin of the fin to the tip of the anterior 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.)

-Continued-

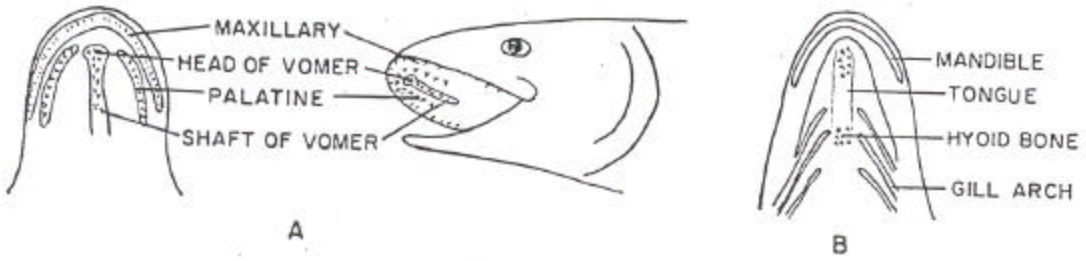
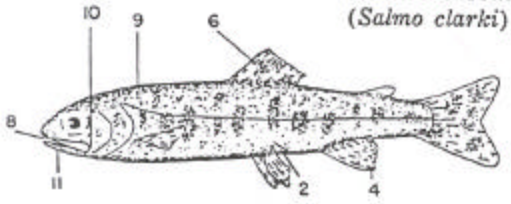


Figure 3.—Location of dentition in (A) the roof and (B) the floor of the mouth of salmonid fishes. (Presence or absence of teeth on the vomer or tongue may be determined by use of the little finger or a blunt instrument. The small hyoid teeth at the base of the tongue are located between the gill arches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

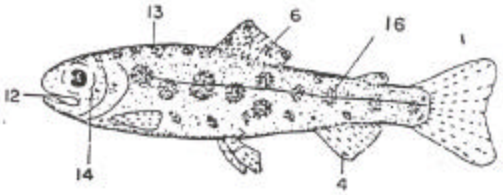
6. (18) Dorsal fin with large dark spots.
Trout
Genus *Salmo*

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*)



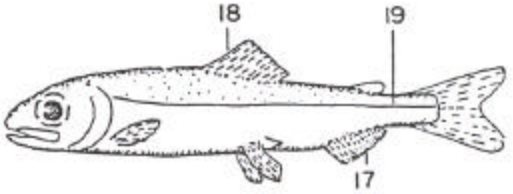
12. (8) *No teeth at base of tongue.
13. (9) Five to 10 parr marks along mid-dorsal ridge ahead of dorsal fin.
14. (10) Maxillary short, not reaching past posterior margin of eye.
15. (11) No hyoid mark under lower jaw. Few or no spots on tail.

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*

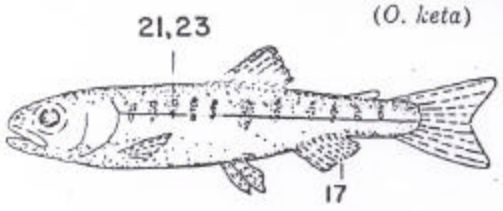
19. (20) No parr marks. Fry leave fresh water while small—approximately 1.75 inches (45 mm) long.
Pink salmon
(*O. gorbuscha*)



-Continued-

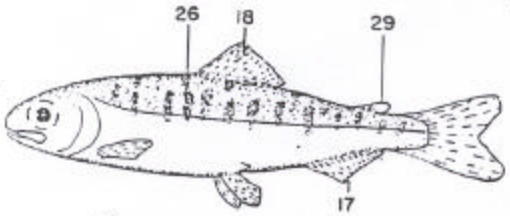
20. (16) Parr marks present as vertical bars or oval spots.
21. (30) Parr marks short, extending little, if any, below lateral line.
22. (25) Gill rakers on first arch, 19 to 26. ** Pyloric caeca, 140 to 186.
23. (26) Parr marks faint. Sides below lateral line iridescent green.
24. (27) Small when migrating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

Chum salmon
(*O. keta*)



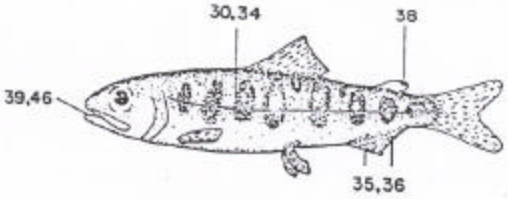
25. (22) Gill rakers on first arch, 30 to 40. **Pyloric caeca 60 to 115.
26. (23) Parr marks usually sharply defined. Sides below lateral line silvery, not iridescent green.
27. (24) Relatively large when migrating from fresh water, approximately 3 to 5 inches (80 to 126 mm) long.
28. (31) Gill rakers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

Sockeye salmon
(*O. nerka*)



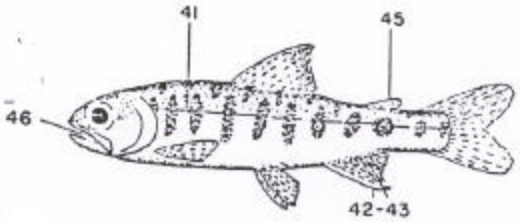
30. (21) Parr marks large, vertical bars centered by lateral line.
31. (28) **Gill rakers short and thick, fewer than 29 on first arch.
32. (29) Adipose fin at least partially pigmented.
33. (40) **Pyloric caeca more than 90.
34. (41) Parr marks broader than interspaces.
35. (42) Anterior rays of anal 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*)



-Continued-

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*)

ACKNOWLEDGMENTS

We especially thank Dr. Arthur D. Welander, Professor of Fisheries, and Dr. Bruce S. Miller, Research Biologist, College of Fisheries, University of Washington, Seattle, for their valuable suggestions. We also thank Galen H. Maxfield, Fishery Biologist, and Dr. Alan J. Beardsley, Fishery Biologist, both from the NMFS Northwest Fisheries Center, Seattle.

BIBLIOGRAPHY

Alaska

MEEHAN, W. R., and J. S. VANIA.
1961. An external characteristic to differentiate between king and silver salmon juveniles in Alaska. Alaska Dep. Fish Game, Inf. Leafl. 1. 5 p. (Processed.)

WILIMOVSKY, N. J.
1958. Provisional keys to the fishes of Alaska. U.S. Fish Wildl. Serv., Fish. Res. Lab., Juneau, Alaska. 113 p. (Processed.)

California

SHAPOVALOV, LEO.
1947. Distinctive characters of the species of anadromous trout and salmon found in California. Calif. Fish Game 33: 185-190.

Canada

CARL, G. CLIFFORD, W. A. CLEMENS, and C. C. LINDSEY.
1967. The fresh-water fishes of British Columbia. B. C. Prov. Mus., Dep. Recreation Conserv., Handb. 5. 192 p.

CLEMENS, W. A.
1935. The Pacific salmon in British Columbia waters. B. C., Rep. Comm. Fish. 1934: K103-K105.

CLEMENS, W. A., and G. V. WILBY.
1946. Fishes of the Pacific Coast of Canada. Fish. Res. Board Can., Bull. 68. 368 p.

FOERSTER, R. E., and A. L. PRITCHARD.
1935. The identification of the young of the five species of Pacific salmon, with notes on the fresh-water phase of their life-history. B. C., Rep. Comm. Fish. 1934: K106-K116.

SCOTT, W. B.
1958. A checklist of the freshwater fishes of Canada and Alaska. R. Ont. Mus., Div. Zool. Palaeontol. 30 p.

Montana

WEISEL, G. F.
1957. Fish guide for intermountain Montana. Mont. State Univ. Press, Missoula. 88 p.

Oregon

BOND, CARL E.
1961. Keys to Oregon fresh-water fishes. Oreg. State Univ., Agric. Exp. Stn., Tech. Bull. 58. 42 p.

Pacific Northwest

BURGNER, R. L. (edited by William A. Smoker).
1955. Preliminary key for identification of salmon fry, juveniles, and adults. State of Wash., Dep. Fish. 8 p. (Processed.)

Appendix B.1. Smolt age-weight-length (AWL) sampling materials and methods.

All AWL data will be recorded in a field notebook dedicated to smolt sampling. Each species will have its own AWL sample number series that runs sequentially throughout the season. Up to 40 individual fish per smolt day may be included in one AWL sample. If more than 40 fish are sampled in a single smolt day, then multiple AWL numbers will be used on that day. For example, if 70 sockeye salmon smolt are sampled in a single day (day 1), the AWL numbers will be AWL #001 (fish 1-40; 8 slides) and AWL #002 (fish 1-30; 6 slides). The next day will start with AWL #003. Each day's sample will start with a new AWL number.

The AWL data will then be transferred from the field notebook to the AWL forms. The AWL forms will be treated carefully; the scanner in the Kodiak office cannot read damaged forms. The forms should not be stapled, bent, paper-clipped or folded. Specific instructions for completing AWL forms are listed in Appendix B.2.

Smolt will be sampled as soon as possible after they are captured. The smolt will be transported in clean, 5-gallon gallon buckets to the sampling area. An additional bucket of water will be used as a recovery bucket. Buckets containing smolt will be filled with fresh, clean water and aerated. The buckets will be covered when possible to avoid stress on the fish.

Tricane Methanesulfate (MS-222) will be used to anesthetize the smolt; latex gloves will be worn to prevent direct exposure to the anesthetic. The use of this chemical will be demonstrated by experienced personnel. A small amount (approximately 1 g) of MS-222 and a small amount of baking soda will be dissolved in approximately 2 L of cold water. The amount of anesthetic used will vary depending on the water temperature, freshness of the chemical, and size of the smolt. A few smolt will be placed in the anesthetic solution until subdued to a point where they can no longer flex their axial musculature but can still ventilate their gills. The concentration of the solution should be such that it immobilizes the fish in 2-3 minutes. After the fish are anesthetized, it is important to sample them quickly and place them in a recovery container to prevent mortality. No more than 80 smolt will be anesthetized with one batch of solution.

After the smolt have been immobilized, excess water will be gently removed from the fish using a paper towel or a wet sponge as a blotter. The length of the smolt will be measured to the nearest 1 mm, and the weight will be measured to the nearest 0.1 g.

Place the fish on its right side to sample the left side. On salmon species, the preferred scale is located where a straight line between the posterior insertion of the dorsal fin and the anterior insertion of the anal fin crosses the second scale row dorsal to the lateral line. In smolt, the area directly around this scale is considered the preferred area (Appendix B.4). If scales are not present in this area then scales should be taken from the secondary location, which is the same area on the right side of the fish.

A scalpel will be used to remove 5-10 scales from the preferred area. These scales will be mounted on a glass slide using a probe to position the scales. Scales from five fish will be mounted on each slide. The scalpel will be wiped clean of scales and slime between each fish.

The left portion of each slide will be labeled with: AWL number, sample location, species, date, and inclusive fish numbers. A diagram of a properly labeled slide with scales mounted correctly is located in Appendix B.5. After sampling, fish will be held in a recovery container until they are swimming normally and then released downstream of the trapping location.

Appendix B.2. Information necessary for completing AWL forms.

The AWL forms are used to convert hand written data into an electronic form. At this time, there is no dedicated smolt AWL form; therefore, an adult salmon AWL form will be used. Some of the data fields on the adult form are not intuitive for smolt data. All data will be entered using a #2 pencil, and each circle will be darkened completely. The AWL forms will be placed on a smooth, hard surface (not another sheet of paper) while the circles are being darkened. The following information will be entered in each field:

Upper margin: Project location, species, and samplers.

Card: The AWL sample number will be entered here.

Day, Month, and Year: This date will correspond with the smolt day (noon to noon, with the date being the date of the noon to midnight period) the fish were captured.

District, Subdistrict, and Stream: For the Chignik Smolt Project, these numbers are 271, 10, and 310, respectively.

Location: 235

Period: This number will correspond with the statistical week listed in Appendix A.3.

Project: "8" (for smolt project).

Gear: Generally, for smolt projects this will be "00" for trap. If other gear types are used, consult the project biologist.

Mesh: This field will be left blank.

Type of length Measurement: Enter "1" for tip of snout to fork of tail.

Number of scales/fish: Enter "1" for 1 scale smear.

# of cards: Enter "1".

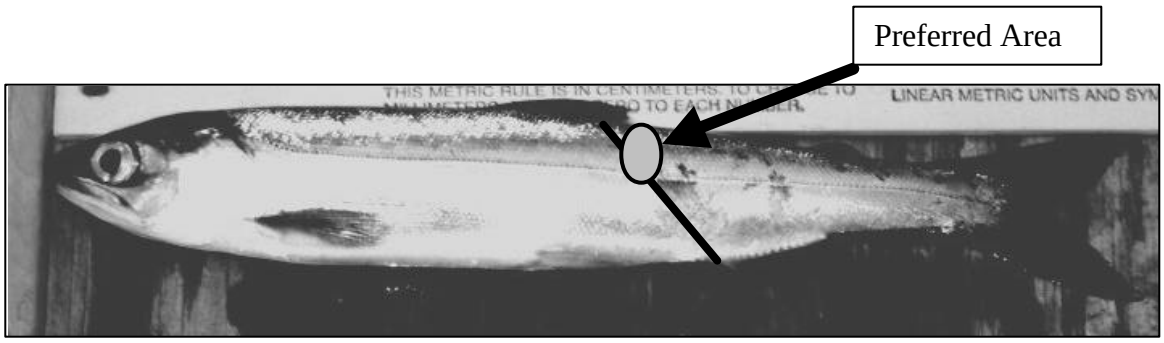
The code that has been pre-darkened on the left side of the front side of the form will be transferred to the corresponding field on the back side of the form. Lengths will be entered to the nearest 1 mm on the front side of the form under the appropriate heading. Weight will be entered to the nearest 0.1 g on the back side of the form in the right-most three columns. Both length and weight will be reported to three significant digits (e.g. 101 or 098 mm; 10.1 or 09.4 g). The decimal point will be dropped when entering weights (e.g., a 10.1 g fish will be entered as 101 on the form).

The crewleader will edit and review all forms and data before sending them to town, and is responsible for the content of the forms. This responsibility will be taken seriously.

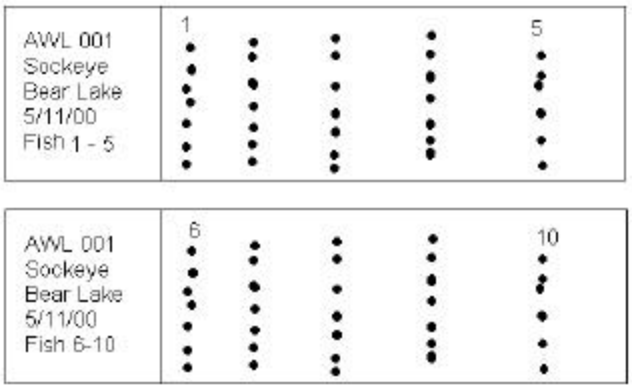
Appendix B.3. Statistical week calendar.

Week	Begins	Ends	Week	Begins	Ends
16	12-Apr	18-Apr	29	12-Jul	18-Jul
17	19-Apr	25-Apr	30	19-Jul	25-Jul
18	26-Apr	2-May	31	26-Jul	1-Aug
19	3-May	9-May	32	2-Aug	8-Aug
20	10-May	16-May	33	9-Aug	15-Aug
21	17-May	23-May	34	16-Aug	22-Aug
22	24-May	30-May	35	23-Aug	29-Aug
23	31-May	6-Jun	36	30-Aug	5-Sep
24	7-Jun	13-Jun	37	6-Sep	12-Sep
25	14-Jun	20-Jun	38	13-Sep	19-Sep
26	21-Jun	27-Jun	39	20-Sep	26-Sep
27	28-Jun	4-Jul	40	27-Sep	3-Oct
28	5-Jul	11-Jul	41	4-Oct	10-Oct

Appendix B.4. Photo of a smolt with the preferred area highlighted.



Appendix B.5. An example of correctly labeled smolt AWL slides.



Appendix C. Proposed work schedule for the Chignik Smolt Project.

Employee	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
FB I	0000-0400 1200-1300 2130 - 2359 **7.5**	0000-0530 1200-1400 **7.5**	0000-0530 1200-1400 **7.5**	0000-0530 1200-1400 **7.5**	0000-0530 1200-1400 **7.5**	1200-1300 1800-1900 **RDO** **2**	0000-0530 **RDO** **5.5**
FWT II	0000-0400 1700-1800 2130 - 2359 **7.5**	0000-0530 1600-1800 **7.5**	0000-0530 1600-1800 **7.5**	0000-0530 1600-1800 **7.5**	0000-0530 1600-1800 **7.5**	0000-0530 **RDO** **5.5**	1200-1300 1800-1900 **RDO** **2**
Activities	Dye Test Sample	Sample	Sample	Sample	Sample		

Appendix D.1. Instructions for filling out a timesheet.

All ADF&G employees must fill out a time sheet biweekly and these timesheets must be turned in to the Administrative staff in Kodiak in a timely manner. Please follow these instructions when filling out your time sheets to avoid payroll problems. When a flight comes out to drop off groceries, or for any other reason, near the end of a pay period, camp personnel need to send in their timesheets. Fill in the time sheet up to the day you send them in and attempt to project your remaining hours worked.

Fill out each of the following on the top of the timesheet:

Pay period: pay periods start on the 1st or 16th of each month and end on the 15th or end of the month (example: June 1-15 or June 16-30).

SSN: your social security number

Name: full name

Division: Commercial Fish

In the actual timesheet table fill in the following:

Day: Monday, Tuesday, etc.

Date: 6/16, 6/17, etc.

Hours worked box: start and stop time in military time

Code 1: fill in the number of hours worked for that day (see example in Appendix X.2.).

Work hours and Code 1 Totals should both equal the sum of daily hours worked. If your time sheet is sent in before the end of the pay period, project your time for the remaining days so you can total your columns.

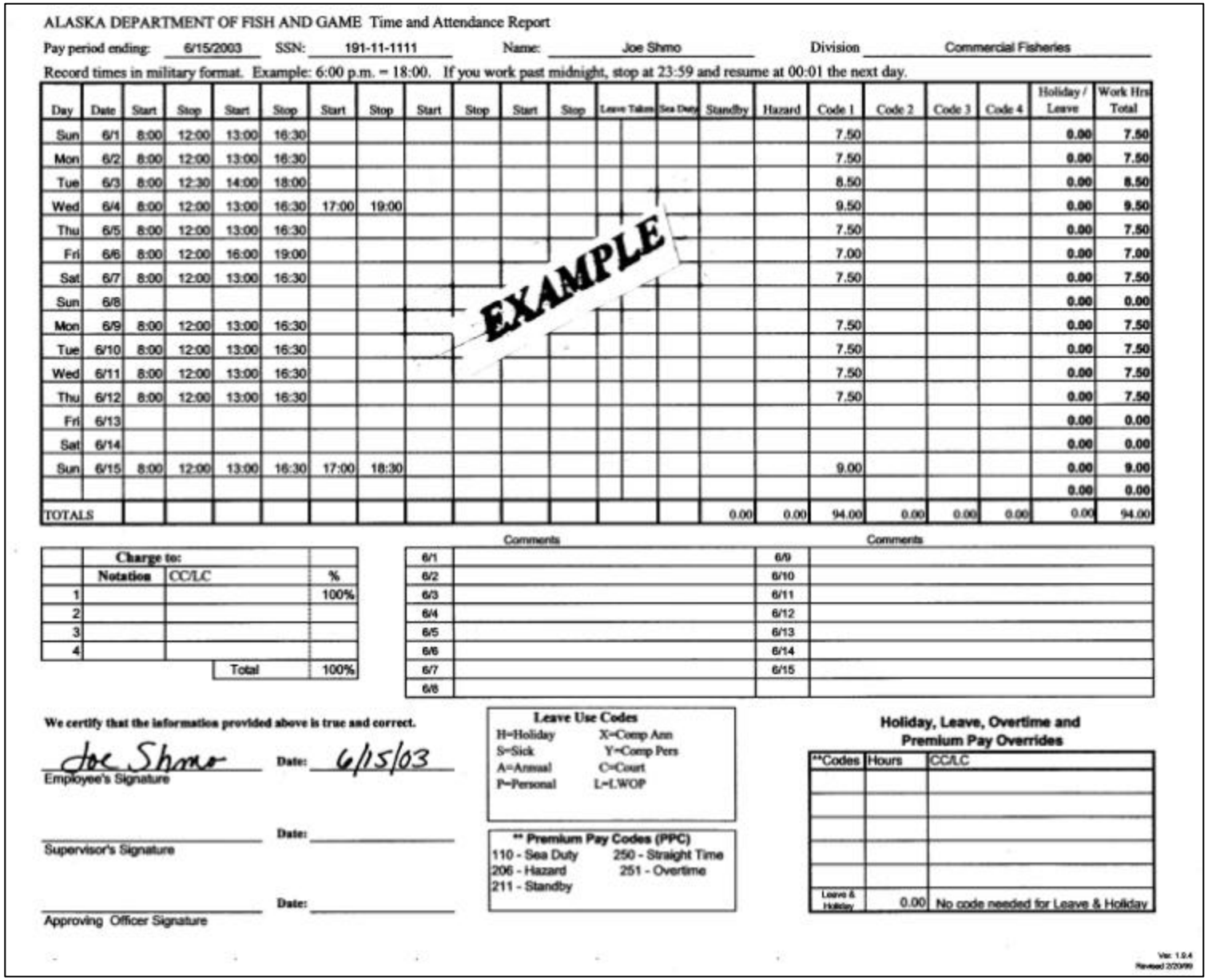
Charge to Table located on the bottom left hand side of the time sheet should be left blank unless otherwise instructed by your project supervisor.

Comments Table located on the bottom right hand side of the time sheet should be left blank unless otherwise instructed by your project supervisor.

Employee's signature and date: Be sure to sign and date your timesheet.

Crew leaders are responsible for reviewing each crew member's timesheet before sending them to town to ensure that they are properly filled out.

Appendix D.2. Example of a completed timesheet.



ALASKA DEPARTMENT OF FISH AND GAME Time and Attendance Report

Pay period ending: 6/15/2003 SSN: 191-11-1111 Name: Joe Shmo Division Commercial Fisheries

Record times in military format. Example: 6:00 p.m. = 18:00. If you work past midnight, stop at 23:59 and resume at 00:01 the next day.

Day	Date	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Leave Taken	Sea Duty	Standby	Hazard	Code 1	Code 2	Code 3	Code 4	Holiday / Leave	Work Hrs Total
Sun	6/1	8:00	12:00	13:00	16:30											7.50				0.00	7.50
Mon	6/2	8:00	12:00	13:00	16:30											7.50				0.00	7.50
Tue	6/3	8:00	12:30	14:00	18:00											8.50				0.00	8.50
Wed	6/4	8:00	12:00	13:00	16:30	17:00	19:00									9.50				0.00	9.50
Thu	6/5	8:00	12:00	13:00	16:30											7.50				0.00	7.50
Fri	6/6	8:00	12:00	16:00	19:00											7.00				0.00	7.00
Sat	6/7	8:00	12:00	13:00	16:30											7.50				0.00	7.50
Sun	6/8																			0.00	0.00
Mon	6/9	8:00	12:00	13:00	16:30											7.50				0.00	7.50
Tue	6/10	8:00	12:00	13:00	16:30											7.50				0.00	7.50
Wed	6/11	8:00	12:00	13:00	16:30											7.50				0.00	7.50
Thu	6/12	8:00	12:00	13:00	16:30											7.50				0.00	7.50
Fri	6/13																			0.00	0.00
Sat	6/14																			0.00	0.00
Sun	6/15	8:00	12:00	13:00	16:30	17:00	18:30									9.00				0.00	9.00
																				0.00	0.00
TOTALS														0.00	0.00	94.00	0.00	0.00	0.00	0.00	94.00

EXAMPLE

	Charge to:		
	Notation	CC/LC	%
1			100%
2			
3			
4			
		Total	100%

Comments		Comments	
6/1		6/9	
6/2		6/10	
6/3		6/11	
6/4		6/12	
6/5		6/13	
6/6		6/14	
6/7		6/15	
6/8			

We certify that the information provided above is true and correct.

Joe Shmo Date: 6/15/03
Employee's Signature

Date:
Supervisor's Signature

Date:
Approving Officer Signature

Leave Use Codes

H=Holiday	X=Comp Ann
S=Sick	Y=Comp Pers
A=Annual	C=Court
P=Personal	L=LWOP

**** Premium Pay Codes (PPC)**

110 - Sea Duty	250 - Straight Time
206 - Hazard	251 - Overtime
211 - Standby	

Holiday, Leave, Overtime and Premium Pay Overrides

**Codes	Hours	CC/LC
Leave & Holiday	0.00	No code needed for Leave & Holiday

Ver. 1.0.4
Revised 2/20/99

CHIGNIK RIVER WATERSHED SOCKEYE SALMON CATCH AND ESCAPEMENT SAMPLING AND RUN APPORTIONMENT OPERATIONAL PLAN, 2003

By

Mark J. Witteveen
and
Philip Tschersich

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

May 2003

TABLE OF CONTENTS

	Page
LIST OF TABLES	i
LIST OF FIGURES	i
LIST OF APPENDICES	ii
INTRODUCTION	1
OBJECTIVES	1
TASKS	2
MODEL OVERVIEW	2
SAMPLE COLLECTION	3
Escapement Sampling	4
Catch Sampling	4
Weir Sampling	5
AGE DETERMINATION	6
GROWTH MEASUREMENT	7
FILE FORMATTING AND DIRECTORY LOCATION	8
ANALYSIS IN SAS	9
LITERATURE CITED	10
TABLES	11
FIGURES	14
APPENDICES	15

LIST OF TABLES

Table		Page
1.	Age composition of Black Lake sockeye salmon escapement samples, 2002	11
2.	Age composition of Chignik Lagoon sockeye salmon commercial catch and test fishery samples by day, 2002	12
3.	Age composition of size selected Chignik Lagoon sockeye salmon commercial catch samples by day, 2002	13

LIST OF FIGURES

Figure		Page
1.	Map of the Alaska Peninsula illustrating the relative locations of the Chignik, Kodiak, and Alaska Peninsula-Aleutian Islands Management Areas	14

LIST OF APPENDICES

Appendix		Page
A.1.	Procedure for sampling adult salmon for age, length, and sex	16
A.2.	Completed adult salmon AWL form (front side) and associated gum card	22
A.3.	Completed adult salmon AWL form (front side) and associated gum card when sampling two scales per fish	23
A.4.	Assigned port and weir location codes	24
A.5.	Sampling weeks and associated calendar dates, 2003	25
A.6.	Measuring fish length from mid eye to tail fork	26
A.7.	Removal and mounting of the preferred salmon scale	27
A.8.	Scale orientation on the salmon scale gum card	28
B.1.	Manual for conducting scale pattern analysis within the Westward Region	29
B.2.	Guidelines for file formatting and directory location	37
B.3.	Example and explanation of SAS commands required to set up standard and unknown files	39
B.4.	SAS commands to run a stepwise variable selection analysis	41
B.5.	SAS program for conducting both linear and quadratic discriminate functions analysis.	42

INTRODUCTION

Commercial salmon fishery openings in the Chignik Bay and Central Districts of the Chignik Management Area (CMA; Figure 1) are fundamentally based on achieving Chignik River watershed sockeye salmon *Oncorhynchus nerka* interim escapement objectives throughout the season. Sockeye salmon escapement to the Chignik River watershed is composed of several distinct genetic groups (Templin et al. 1999).However, for management purposes, these groups are generalized into two distinct runs: the Black Lake early run and the Chignik Lake late run. Because the run timing of these distinct runs overlaps, accurate individual run strength estimates are necessary for fishery management to be conducted without jeopardizing escapement goals for either run.

Scale pattern analysis (SPA), based on differential freshwater scale growth between rearing lakes, is used to provide estimates of individual run timing and strength.SPA is used inseason for management decisions and postseason for run reconstruction.

Prior to the present methods of SPA, an average time of entry (ATOE) curve, based on tagging studies (Dahlberg 1968), was used to apportion the run into early and late run components. This method remains in use, providing an analytical tool to be used prior to the establishment of the SPA model. Historical ATOE curves are used to identify past years that may resemble the current year's run. The SPA model is utilized as the primary tool in stock separation for management decisions once it accurately apportions the respective components of the sockeye salmon run. If there is uncertainty with the performance of the SPA model in apportioning the run, historic ATOE curves are utilized as a primary tool in management decisions.

The Alaska Department of Fish and Game (ADF&G) Genetics Program has evaluated the feasibility of genetic stock identification (GSI) for stock separation at Chignik. Baseline samples from Chignik and Black Lakes have been collected and analyzed. Templin et al. (1999) describes the results of GSI baseline investigations; however, costs and logistics currently prevent the use of GSI as an inseason management tool.

The goal of this project is to use SPA to accurately apportion escapement past the Chignik weir into the Black Lake and Chignik Lake stocks. The apportioned escapement is used inseason to manage the fishery so that escapement objectives are met for each run and the surplus is harvested. The apportioned escapement is used postseason to reconstruct the total escapement and harvest of each run to allow forecasts to be calculated.

OBJECTIVES

1. Estimate age class composition of the Chignik Bay District sockeye salmon catch and escapement.

2. Estimate the strength of the early and late Chignik River sockeye salmon runs using SPA and a discriminant analysis model.

TASKS

Objective 1

1. Collect sockeye salmon scale samples from the Chignik Lagoon fishery weekly and once every three days during the overlap period (June 26 through July 9).

2. Collect sockeye salmon scale samples from Black Lake escapement near the outlet of Black Lake.

3. Age scale samples and develop age composition summaries.

Objective 2

1. Digitally measure escapement scales and late catch scale samples (from the previous season for inseason analysis, current season for postseason analysis) to develop baseline scale measurements.

2. Develop a discriminant analysis model with baseline scale measurements using SAS that establishes criteria to characterize unknown catch samples into one of the baseline stocks.

3. Measure catch sample scales and apply them to the model to estimate proportions of each stock.

4. Apply logistic curve to smooth the apportionment estimates.

5. Apply logistic curve results to the escapement (and catch postseason) to estimate escapement to each stock.

MODEL OVERVIEW

Chignik sockeye salmon run timing estimates are derived from a discriminant analysis model based on the studies of Conrad (1983 and 1984) and Swanton (1992). The model is based on measurements of freshwater scale growth characteristics (focus to each circulus of freshwater growth), and is commonly referred to as SPA. This modeling is conducted both inseason and postseason on the two age classes that typically predominate (age 1.3 and age 2.3 fish) the Chignik River system sockeye salmon escapement. The inseason model of age 1.3 or 2.3 fish is used throughout the season for management of the commercial fishery, while postseason models of both age 1.3 and 2.3 fish are used for run reconstruction. Models of alternative minor age classes (i.e., age 2.2 fish) have been considered; however, low numbers fish from these age classes do not provide a suitable sample to meet the modeling needs.

The development of both models require two initial data sets, one to represent each of the two runs present in the escapement. These data sets are established with attempts to provide “pure” data from each stock of origin and are referred to as standards, or knowns. The standard data

files are age class specific and are composed of measurements of freshwater growth characteristics from 200 individuals from each of the two runs. Early run standards come from age 1.3 or 2.3 fish sampled at the outlet of Black Lake, and late run standards come from age 1.2 or 2.2 fish sampled during the prior year's late season (late July to early September) Chignik Bay District fishery. The use of the late season catch as a Chignik Lake standard is based on Conrad (1983 and 1984) which respectively used post July 24 and 27 Chignik Lagoon catch samples the Chignik Lake standard. This was based on the assumption that the Black Lake run is completed by late July. The Chignik Lake late run model is also based on the assumption that age 1.2 and 2.2 fish from one year and age 1.3 and 2.3 fish from the subsequent year have similar freshwater growth patterns.

For postseason run reconstruction, scales for the early run standard come from the Black Lake escapement sample described above. However, unlike the inseason model, scales for the late run standard come from age 1.3 or 2.3 fish collected in August from the current season's catch.

After the standard file measurements are completed, a discriminant analysis model is developed using SAS ™ software. To test the accuracy of the model, SAS treats the standard files as unknowns and reapplies them to the previously established model. By doing so, the proportion of correctly categorized scale measurements can be estimated and the accuracy of the model can be determined.

Once the model is established and found to successfully categorize scale measurements, it is then applied to mixed stock, or unknown data sets. Each unknown data set consists of age class specific measurements of 100 individuals randomly sampled from the commercial catch from the Chignik Bay District, which are assumed to be fish that will escape to the Chignik River system. The fishery catch is sampled (and *unknown* SPA data file recorded) at regular intervals throughout the season. Sampling frequency varies, ranging from once every two to three days during the period of transition between the two runs (i.e., June 26 to July 9), to once each week at the beginning and end of the season. These mixed run fishery files are analyzed throughout the season. Results provide estimates of percent composition of Black Lake early run and Chignik Lake late run. Estimates of run contribution are established and maintained as the season progresses.

SAMPLE COLLECTION

To ensure that appropriate numbers of individuals for each age class are obtained, extensive sampling must be performed. Samples are to be collected in the standard manner described in Appendix A.

For the Black Lake (early run) standard, samples from approximately 2,000 individuals are obtained annually at the outlet of Black Lake. This number has been the functional goal as it has consistently achieved the necessary 200 measurable scales of each age class modeled. The Chignik Lake standard file (age 1.2 and 2.2 fish) is developed from the Chignik Lagoon commercial fishery samples collected during August of the previous season (usually several 600 fish samples) with a sample goal of 200 measurable scales. The mixed run fishery file typically

requires scales from 600 individuals to achieve the goal of 100 measurable age class specific scales (both age 1.3 and 2.3).

Escapement Sampling

The Black Lake standard scale samples come from adult sockeye salmon beach seined at the outlet of Black Lake. Sampling efforts will begin once a suitable number of adults are present at the outlet. Typically, this occurs after June 20. Escapement counts and aerial survey observations substantiate appropriate numbers for sampling purposes.

The primary obstacle to accessing Black Lake is navigating skiffs through the rivers' delta in Chignik Lake, which is very shallow with inconsistent channels. Jet skiffs are required. Careful attention must be given to proper function of outboard water pumps, as silt and sand from the delta tends to clog the cooling system. Passage through the delta often requires disassembly of the water jacket and thermostat for cleaning clogged silts, and may require cleaning the water intake passages on the lower shaft bearing housing. Appropriate tools will always be carried including a short length of wire to unclog the water circulation outlet hose.

A crew of three will establish a temporary camp at Black Lake. A rough shell structure, which usually requires annual repair by the crew, is used as housing during sampling operations. The land and structure are leased from a private landowner. Sockeye salmon will be captured with a 100 ft. beach seine equipped with a 50-100 ft. rope lead on each end. The seine is laid out from the bow of a jet skiff, drifted down with the current, hooked around to shore with the skiff end, and then pulled in by hand at the leads.

Fish captured in the beach seine will be netted and placed on a V-shaped measuring table. The preferred scale will be removed from the fish and mounted on a gum card (Appendix A.7 and A.8). Length in millimeters (mid eye to tail fork [METF]) and sex will be recorded to correspond to each specific scale for the first 400 samples (Appendix A.6). Each adult sockeye salmon sampled will be marked with an adipose fin clip to prevent resampling. Sampling approximately 2,000 adult sockeye salmon has typically been completed within three to five days.

Catch Sampling

Early season samples are obtained each year from the ADF&G's test fish operations before the start of the commercial fishing operations. The test fishery occurs in a similar location and manner to that of the commercial fishery of the Chignik Bay District. For stock separation and management purposes, the samples from the test fishery are considered comparable to samples of the commercial catch. Samples are obtained from the commercial catch when the season is open or from the ADF&G's test fishery throughout the season. The harvest methods used by the new cooperative (co-op) fishery will affect how the fishery is prosecuted and subsequently affect how commercial catch samples are obtained. Although the specific effects of the co-op fishery are still largely unknown, the ADF&G anticipates that scale samples will be readily available from the commercial catch.

Sampling frequency ranges from two to seven days, based on management needs and the stage of each run. Sampling typically begins the second week of June at a frequency of once every three

to five days. The frequency then shifts to once every two to three days during the period of run transition from early to late run fish, which typically occurs during late June through mid July. Results of stock composition estimates have often changed erratically and rapidly during the transition period. Thus, the increase in sampling frequency is vital to account for these fluctuations. Once the run transition and stock composition estimates have stabilized, the frequency of sampling then shifts to once every seven days. Actual sampling dates will be determined inseason through a cooperative decision-making process between research and management staff. Local shore-based processing facilities are contacted daily by the sampling crew leader to determine delivery times and catch origin of fish being delivered. The facility where the sample will be collected on any given day depends on the catch origin of fish being delivered and the facility utilized for the previous sample. The crew will travel to the processing facilities via skiff or plane, depending on the tide and the equipment available at the time of sampling.

The crew must first validate proper location of catch; for modeling purposes, the catch must comprise 100% Chignik Bay District fish. Cannery workers sort the catch by species and set aside at least 600 sockeye salmon for sampling purposes; however, the crew must verify the species identification before scales are collected. These fish are assumed to be representative of the commercial catch and the fish escaping to the Chignik River. Fish are sampled by the crew in a non-selective manner. The preferred scale will be removed and mounted on a gum card in the standard manner (Appendix A.7 and A.8). Length (METF) in millimeters and sex should be recorded for the first 200 individuals to correspond to each specific scale for at least one sample per week (Appendix A.1, A.3, and A.6).

Weir Sampling

During the 2002 field season, a pilot project was instituted to collect scale samples at the Chignik weir. This project will continue during the 2003 season. The objectives of the weir sampling project are:

1. Test different sampling trap designs to maximize capture efficiency.

2. Investigate possible bias associated with the sampling trap (i.e. compare scales collected at the weir to commercial catch and fish holding at the weir).

3. Evaluate the utility of replacing or supplementing commercial catch sampling with weir escapement samples for estimating age composition and use in SPA analysis.

Historically, sampling traps have been installed at the weir with little success in capturing and retaining fish. Therefore, the sampling trap was adjusted and modified throughout the season to incorporate successful design ideas and account for factors such as tide level, river level, and number of fish passing the weir. Depending on the success of continued sampling efforts at the weir, weir scale samples will either supplement or replace the commercial catch samples from the Chignik Bay District in future years.

During the evaluation period of the weir sampling project, scales collected at the weir will not be used for SPA modeling. Before scales from fish captured at the weir can be used in SPA

analysis, potential bias in the sampling trap capture method needs to be investigated, such as the trap exhibiting size selectivity for certain age fish or behavioral selectivity for fish from a certain run. Therefore, after commercial catch samples are collected, a goal of approximately 240 scales will be collected at the weir on the following day, based on the assumed travel time of one day from Chignik Lagoon to the Chignik Weir. Comparisons of age compositions, size, sex, and scale patterns of each sample will be made to determine if the samples are comparable. Additionally, multiple samples will be taken during the run transition period (late June through mid July) and scales will be collected from the weir sampling trap and from a random sample of fish collected downstream from the weir with a beach seine. Comparisons of age composition and scale patterns of each sample will be made to determine if the samples are significantly different. In 2002, preliminary comparisons done between fish sampled from commercial catch and those from the weir trap showed some differences between the two sampling locations in terms of fish size during the Chignik Lake (late) run. However, due to the small sample size obtained from the weir trap, these results are inconclusive. Efforts in catching fish behind the weir with a beach seine to compare to fish caught in the trap were unsuccessful.

The ADF&G expects that sampling live fish at the weir will require approximately the same amount of time as sampling the commercial catch at the processing facility, considering the logistics and travel time involved with traveling to the processors in Chignik Bay. Therefore, it is anticipated that this sampling method can achieve the total sampling goals described above for catch samples (i.e., one sample [600 scales] every 3-5 days early in the season, one sample every 2-3 days during the transition period, and one sample per week near the end of the season). These theses, and others that may develop inseason, will be tested during the pilot project to determine if escapement sampling at the weir would be more efficient and eventually replace the current catch sampling program at the Chignik Bay processing facilities.

Fish captured in the weir sampling trap are netted and placed on a V-shaped measuring table. The preferred scale will be removed from the fish and mounted on a gum card in the standard manner (Appendix A.7 and A.8). Length and sex data is recorded to determine if a capture bias is associated with the sampling trap; the actual number of fish per sample to be utilized for length and sex data will be determined inseason as the trap and sampling crew efficiency are identified. Each adult sockeye sampled from the trap will be released upstream of the weir and samples taken with a beach seine behind the weir will be marked with an adipose fin clip to prevent resampling.

AGE DETERMINATION

Once the scales arrive at the office, they are imprinted to acetates using a scale press. This is to be done immediately upon the arrival of samples at the Chignik office. Proper settings for the Chignik press are as follows: upper and lower thermometer reading $\geq 200°F$; pressure = 2500 psi; and time = 2.0 to 2.5 minutes. Three cards at a time can be pressed, and scale locations on the cards should all be centrally located on the press platform, as the outer edges tend to receive less pressure. Acetate cards are labeled and scale impressions are numbered to match the gum cards. Acetates are then placed in a microfiche reader at suitable magnification and ages are interpreted by the project biologist following designation criteria established by Mosher (1968).

Age class composition data will be promptly evaluated and transferred to AWL forms. Age class data will also be recorded into table format and provided to the management biologist in spreadsheet form (Tables 1 and 2).
Age interpretation should be consistent with Region standards. A scale aging "test" is administered each spring to calibrate consistency between those individuals conducting age determinations.

GROWTH MEASUREMENT

Measurements of scale growth characteristics are collected using the Biosonics© Optical Pattern Recognition System (OPRS). As with age interpretation, the collection of scale measurement data should be conducted by one individual to increase consistency. A general set of guidelines for operating the OPRS is provided in Appendix B.1.; however, several modifications will be made prior to the season. The configuration file titled "foster1" is utilized for set up of the system parameters. Magnification parameters in the program setup must match those in use on the microscope (typically- 10X ocular, 1.0X lens changer value). The magnification parameter setting should be consistent throughout all scale measurements.

Variables measured for SPA include the distances from the center of the focus to each of the circuli of the freshwater growth area. A count of the total number of circuli measured and the maximum freshwater growth are also used as a variables in the model.

Scales should be aligned horizontally, with the bases of the circuli arches at the bottom of the screen. The measurement line is then drawn in at a 90° orientation, beginning at the focal center and extending to the last circulus of freshwater growth. Although the OPRS will automatically install measurement points on this axis, they must be manually edited to match only one mark for each true circulus. For interpreting questionable circuli, additional insight may be obtained by varying the focus on the microscope to view the "ridge", as opposed to the "valley" of the circuli formations. However, all measurements should be recorded from the same focal surface. The focal surface with the sharpest edges has historically been used for all measurements. Measurement marks must be recorded in a consistent manner between all data sets used in, and applied to, the model.

A consistent manner of interpreting and measuring the first circulus is of critical concern when using the model. The focus often transitions to circuli in an indiscriminant manner. Model performance will inevitably be affected as a result of this inconsistent growth formation. There is often uncertainty interpreting where the first circulus is. This uncertainty affects not only the first circulus measurement, but also the measurements of all other circuli and the circuli count variable. To reduce associated modeling errors, the individual digitizing scales must strive to establish a consistent method of measuring this first circulus. Similar consistency should be applied to the measurement of annuli "check" marks and to the designation of the end of freshwater growth.

The initial file to be digitized is the Chignik Lake standard file. This is composed of the age 2.2 fish (or age 1.2 depending on availability in the standards) from post-July 31 catch samples

collected the previous season. Additionally, small, size selected sockeye salmon samples were taken from the catches during August of 2002 in an attempt to obtain a higher number of the age x.2 fish (Table 3). The selection of individual samples to measure is determined by review of catch and escapement data for the late season time period for which samples were taken. These calculations are recorded in an EXCEL© worksheet, labeled *late2203.xls* (directory location in following section). Measuring the samples for this file should be delayed until late May or early June, just prior to the digitizing of the Black Lake standard file to maintain consistent methods.

The Black Lake standard file is then formed with the age class 2.3 individuals (or age 1.3 if sufficient numbers are available) as soon as the escapement samples are obtained. With this step, a complete model can be formed in SAS ™ as detailed in the following pages.

The next measurements occur on age 2.3 individuals (or age 1.3 depending on the age classes used for the standards) of the test fish and/or commercial catch samples early in the present season. These measurements are the unknown files and are subsequently applied to the model from which a stock proportion of that sample is produced.

For the postseason models, the Chignik Lake standard files of age class 1.3 and 2.3 are formed, as is the Black Lake age-1.3 standard file. These postseason standard files are formed in the same manner as in the inseason model.

Starting in 2002, digitizing responsibilities for Chignik River sockeye salmon runs have been assumed by research biologists on-site at the Chignik weir. Scales samples collected from early season test fisheries, commercial catch, or at the Chignik weir will be pressed and aged in Chignik by research biologists.

Research biologists will travel to Chignik in mid June; their arrival will be coordinated with the completion of the Black Lake escapement sample and the beginning of the transition from early to late run. Research biologists will remain stationed at the Chignik field office approximately through the transition from early to late run. The Black Lake escapement sample (i.e., Black Lake standard) and scale samples collected during this time period will be pressed, aged, and measured in Chignik by research biologists. After the transition from early to late run, scale samples will be pressed in Chignik by management biologists; acetates and copies of the AWL forms will be sent to Kodiak research biologists via commercial air carrier or the United States Postal Service. These scale samples will be aged and measured by the Chignik research biologists in the Kodiak office.

FILE FORMATTING AND DIRECTORY LOCATION

The modeling process requires a vast array of files. Organized management of these files is a must. A consistent file naming system has been established in recent years and file name formats are described in Appendix B.2.

ANALYSIS IN SAS

Once the model standard files are complete, the freshwater growth characteristics are checked for normal distribution. This is done by importing the standard file into an EXCEL worksheet where each growth characteristic is then individually run through the data analysis "histogram" function. This provides a visual image of the frequency of the measurement variables which is used to estimate distribution.

The maximum number of variables to include in the model is limited by the lower of the minimum number of variables present in either of the standard files. Thus, if a standard data set contained one scale with the minimum of only 9 freshwater circuli, then the maximum number of variables for that standard set would be 11; 9 circuli distances, 1 circuli count, and 1 maximum freshwater growth measurement.

The next step is to combine both standard files into one Excel worksheet and reformat the resultant Excel file (*.xls*) so that it can be imported into SAS. The first row in the Excel file should identify the contents of each column (e.g. stock of origin, AWL number, fish number, variable type) . The Excel file is then imported into SAS for model development. The model is developed in SAS using the new *.sas* file and a series of commands specified in Appendix B.1.

With the model established, the first unknown data file is then applied to the model through the DISCRIM command. The parameters of this program must be adjusted to specify the number of variables to be included in the model. This process should be performed in both the linear and the quadratic discriminant analysis mode (Swanton 1992; Appendix B). The analysis with the highest classification accuracy is then selected for the season's model.

The DISCRIM command output is then subjected to a misclassification correction (Cook and Lord 1978). A program for this process is initialized with the appropriately labeled icon on the WINDOWS© screen. When prompted for: Intermediate Results, enter "n"; Number of Groups, enter "2"; Names, not necessary, press "enter"; and First Row, Second Row, and Size entries are obtained from the resubstitution matrix of the SAS model output.

The stock proportion data estimated from SPA is then fit to the common logistic function (Quinn and Deriso 1999). A nonlinear weighted (by sample size) least squares optimizing scheme is used in Excel to fit the model to the Chignik stock proportion data (assuming approximately 100% Chignik run by 31 July as per past seasons). Stock proportion data is fit to the logistic function and the resulting model is used to estimate the actual daily stock proportions. As incoming data is analyzed via SPA, the logistic model will be refit to the entire data set and a new logistic curve utilized to estimate the daily stock proportions between the date of the previous sample and the date of the most current sample. Results are recorded in a table format and provided to the management biologist.

Unknown data files are analyzed as the season progresses. The postseason model is typically developed in September, as the late run standard file requires the August catch.

LITERATURE CITED

Conrad, R.H. 1983. Management applications of scale pattern analysis methods for the sockeye salmon runs to Chignik, Alaska. M.S. Thesis, University of Washington, Seattle.

Conrad, R.H. 1984. Stock composition of the 1983 sockeye salmon (*Onchorhyncus nerka*) run to the Chignik Lakes estimated using scale patterns and linear discriminant functions. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

Cook, R.C. and G.A. Lord. 1978. Identification of Bristol Bay sockeye salmon by evaluating scale patterns with a polynomial discriminant method. U.S. Fish and Wildlife Service, Fisheries Bulletin 76(2):415-423.

Dahlberg, M.L. 1968. Analysis of the dynamics of sockeye salmon returns to the Chignik Lakes, Alaska. Ph.D. Dissertation, University of Washington, Seattle.

Mosher, K. H. 1968. Photographic atlas of sockeye salmon scales. Bureau of the U.S. Fish and Wildlife Service. Fishery Bulletin 67(2):243-280.

Quinn, T. J., II, and R. B. Deriso. 1999. Quantitative fish dynamics. Oxford University Press, New York.

Swanton, C.O. 1992. Stock interrelationships of sockeye salmon runs, Alitak Bay District, Kodiak Island, Alaska. M.S. Thesis, University of Washington, Seattle.

Templin, W., L. Seeb, P. Crane, and J. Seeb. 1999. Genetic analysis of sockeye salmon populations from the Chignik watershed. Regional Information Report No. 5J99-08, Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

Table 1. Age composition of Black Lake sockeye salmon escapement samples, 2002.

Date		Ages											Total[a]
		0.2	0.3	1.1	1.2	1.3	1.4	2.2	2.3	2.4	3.2	3.3	
22-Jun	Numbers	1	0	0	60	145	4	28	40	0	0	0	250
	Percent	0	0	0	24	58	2	8	16	0	0	0	
23-Jun	Numbers	7	1	2	313	373	11	12	124	0	1	0	844
	Percent	1	0	0	37	44	1	1	15	0	0	0	
24-Jun	Numbers	4	2	0	89	148	3	2	47	1	0	0	296
	Percent	1	1	0	30	50	1	1	16	0	0	0	
25-Jun	Numbers	3	1	0	123	154	5	14	52	0	0	1	353
	Percent	1	0	0	35	44	1	4	15	0	0	0	
Total	Numbers	14	4	2	585	820	23	28	263	2	1	1	1,743
	Percent	1	0	0	34	47	1	2	15	0	0	0	

[a] Percentages may not total to 100% due to errors in rounding.

Table 2. Age composition of Chignik Lagoon sockeye salmon commercial catch and test fishery samples by day, 2002.

		Ages														
Period		0.2	0.3	0.4	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	3.2	3.3	Total[a]
9-Jun	Numbers	2	1	0	0	136	309	4	1	0	0	67	0	0	0	520
	Percent	0	0	0	0	26	59	1	0	0	0	13	0	0	0	
13-Jun	Numbers	3	2	0	0	84	336	12	0	0	6	71	0	0	0	514
	Percent	1	0	0	0	16	65	2	0	0	1	14	0	0	0	
17-Jun	Numbers	0	2	0	0	163	195	11	0	0	32	88	0	0	1	492
	Percent	0	0	0	0	33	40	2	0	0	7	18	0	0	0	
20-Jun	Numbers	1	1	0	0	129	230	3	0	0	22	152	0	0	0	538
	Percent	0	0	0	0	24	43	1	0	0	4	28	0	0	0	
25-Jun	Numbers	0	2	0	0	79	244	5	0	0	20	171	0	0	1	522
	Percent	0	0	0	0	15	47	1	0	0	4	33	0	0	0	
28-Jun	Numbers	0	1	0	0	119	236	1	0	0	37	133	2	1	0	530
	Percent	0	0	0	0	22	45	0	0	0	7	25	0	0	0	
1-Jul	Numbers	0	1	0	0	60	260	4	0	0	18	194	0	0	0	537
	Percent	0	0	0	0	11	48	1	0	0	3	36	0	0	0	
3-Jul	Numbers	1	2	0	0	68	229	4	0	0	9	213	0	1	1	528
	Percent	0	0	0	0	13	43	1	0	0	2	40	0	0	0	
6-Jul	Numbers	1	1	0	1	78	174	4	0	0	51	193	3	2	0	508
	Percent	0	0	0	0	15	34	1	0	0	10	38	1	0	0	
9-Jul	Numbers	3	0	0	0	39	188	8	0	0	27	268	3	2	2	540
	Percent	1	0	0	0	7	35	1	0	0	5	50	1	0	0	
12-Jul	Numbers	0	3	0	0	41	165	8	0	0	47	247	3	0	0	514
	Percent	0	1	0	0	8	32	2	0	0	9	48	1	0	0	
15-Jul	Numbers	1	1	1	0	21	143	9	0	0	47	308	9	3	2	545
	Percent	0	0	0	0	4	26	2	0	0	9	57	2	1	0	
18-Jul	Numbers	0	4	1	0	20	130	5	0	0	50	325	7	1	4	547
	Percent	0	1	0	0	4	24	1	0	0	9	59	1	0	1	
23-Jul	Numbers	0	0	0	0	13	128	5	0	0	53	333	2	3	8	545
	Percent	0	0	0	0	2	23	1	0	0	10	61	0	1	1	
30-Jul	Numbers	0	2	0	0	18	70	4	0	0	72	336	5	1	16	524
	Percent	0	0	0	0	3	13	1	0	0	14	64	1	0	3	
6-Aug	Numbers	0	0	1	0	18	60	2	0	0	81	361	13	2	18	556
	Percent	0	0	0	0	3	11	0	0	0	15	65	2	0	3	
13-Aug	Numbers	1	0	0	0	5	22	2	0	0	72	386	14	3	8	513
	Percent	0	0	0	0	1	4	0	0	0	14	75	3	1	2	
20-Aug	Numbers	0	0	0	0	8	25	2	0	1	44	279	4	2	3	368
	Percent	0	0	0	0	2	7	1	0	0	12	76	1	1	1	
31-Aug	Numbers	0	1	0	0	7	16	0	0	0	47	168	8	3	8	258
	Percent	0	0	0	0	3	6	0	0	0	18	65	3	1	3	
Total	Numbers	13	24	3	1	1,106	3,160	93	1	1	735	4,293	73	24	72	9,599
	Percent	0	0	0	0	12	33	1	0	0	8	45	1	0	1	

[a] Percentages may not total to 100% due to errors in rounding.

Table 3. Age composition of size selected Chignik Lagoon sockeye salmon commercial catch samples by day, 2002.

		Ages											
Date		0.2	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	Total
6-Aug	Numbers	0	23	4	1	0	184	48	0	0	3	3	266
	Percent	0.0	8.6	1.5	0.4	0.0	69.2	18.0	0.0	0.0	1.1	1.1	
13-Aug	Numbers	0	15	2	0	1	116	17	1	0	4	0	156
	Percent	0.0	9.6	1.3	0.0	0.6	74.4	10.9	0.6	0.0	2.6	0.0	
20-Aug	Numbers	1	6	1	0	1	52	17	0	0	1	0	79
	Percent	1.3	7.6	1.3	0.0	1.3	65.8	21.5	0.0	0.0	1.3	0.0	
27-Aug	Numbers	1	16	2	1	0	140	34	0	1	5	0	200
	Percent	0.5	8.0	1.0	0.5	0.0	70.0	17.0	0.0	0.5	2.5	0.0	
31-Aug	Numbers	0	1	0	0	0	10	0	0	0	0	0	11
	Percent	0.0	9.1	0.0	0.0	0.0	90.9	0.0	0.0	0.0	0.0	0.0	
Total	Numbers	2	61	9	2	2	502	116	1	1	13	3	712
	Percent	0.3	8.6	1.3	0.3	0.3	70.5	16.3	0.1	0.1	1.8	0.4	

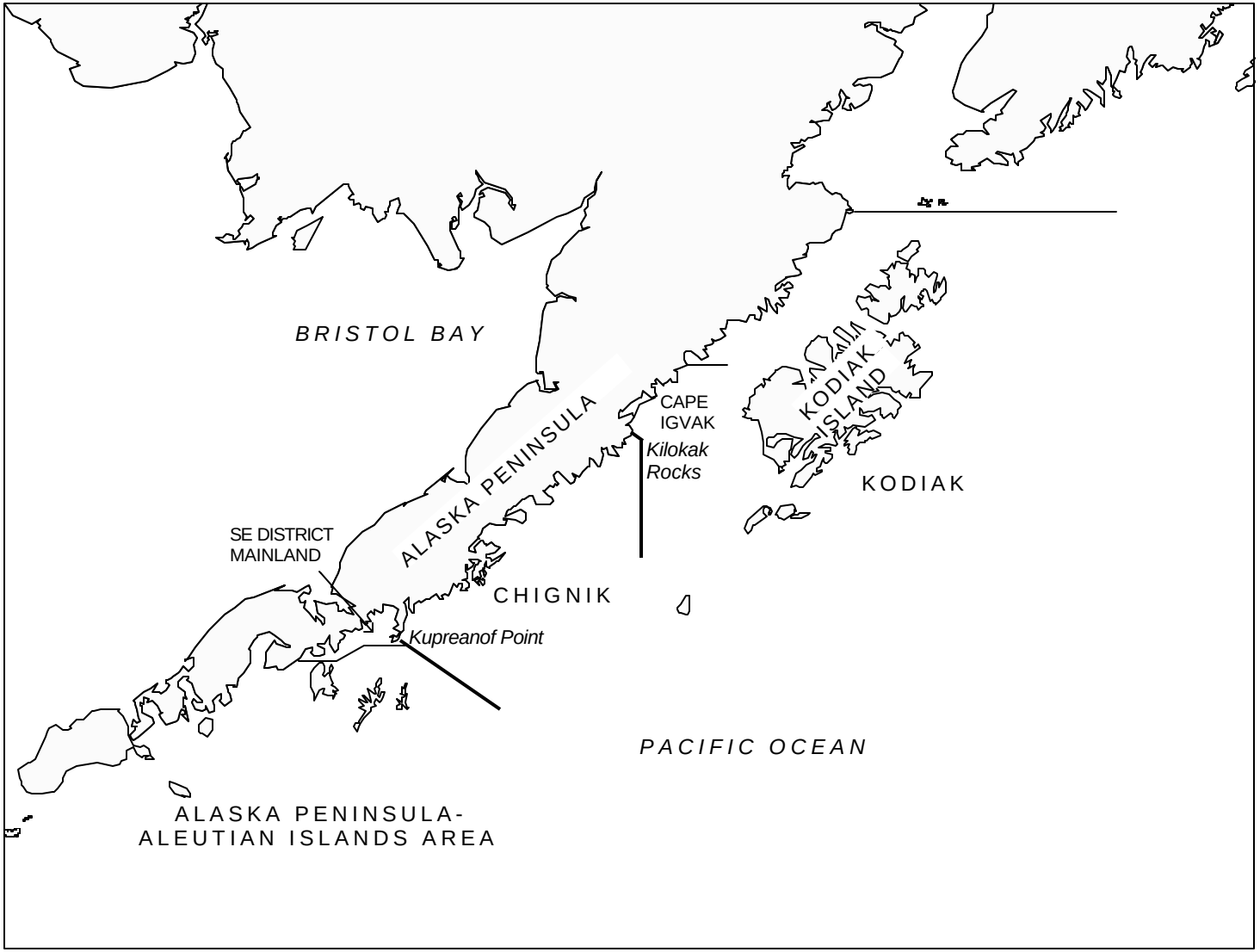


Figure 1. Map of the Alaska Peninsula illustrating the relative locations of the Chignik, Kodiak, and Alaska Peninsula-Aleutian Islands Management Areas.

APPENDIX

Appendix A.1. Procedure for sampling adult salmon for age, length, and sex.

Annually, salmon escapements and catches are sampled for age (scales), length, and sex by field crews throughout the state. This database is essential for sound management of the State's salmon resources.

To be useful, data must be recorded on the age, weight, length (AWL) optical scanning (opscan) forms neatly and accurately. In addition, scale samples must be collected and mounted properly to ensure accurate age determination. The following procedures are to be strictly adhered to when sampling adult salmon for age, length, and sex.

Procedures

COMPLETING THE OPSCAN AWL FORMS:

New **green** AWL forms have been developed which have Y2K date capabilities. Before transcribing any information, make sure the correct form is being used. The department no longer uses the outdated red or blue forms.

A completed AWL form and accompanying scale gum card for sampling sockeye salmon are shown in Appendix A.2. When collecting two scales per fish, as with coho salmon sampling, follow the procedure illustrated in Appendix A.3.

Complete each section on the left side of the AWL form using a No.2 pencil and darken the corresponding circles as shown in the figures. Make every effort to darken the entire circle as the optical scanner, which reads and records the data from the AWL forms, may not recognize partially filled circles. Label only one form at a time to avoid a "carbon paper effect" resulting in stray marks. Special care should be used to ensure that stray marks do not occur on either side of the AWL form. Stray marks and scuffed AWL forms can severely hamper scanning.

Fill out each of the following:

Description

Record the following: species/area/catch or escapement/gear type (if applicable)/samplers.

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, district, and geographic location. Consult your crew leader for the current card number. Sockeye salmon scale samples will have only one gum card per AWL form as shown in Appendix A.2.

Species

Refer to the reverse side of the AWL form for the correct one-digit code (e.g., sockeye = 2).

-Continued-

Day, Month, Year

Escapement sampling: Use appropriate digits for the date the fish are sampled.

Catch sampling: Use the date the fish were caught. If this differs from the sample date, note the sample date in the top margin.

District

List all districts in which the fish were caught. Consult your area statistical map or project leader for the appropriate district. If more than one district is represented, darken the corresponding circles of the district representing most of the catch and note the other catch areas in the top margin.

Subdistrict (Section)

List all subdistricts in which the fish were caught. If the catch represents more than one section, list each section but do not darken the corresponding circles. Leave blank if the section is unknown.

Stream

Leave blank for catch sampling;

Consult area statistical map for the appropriate stream number when collecting escapement samples.

Location

List the appropriate code associated with the area the fish were sampled as shown in Appendix A.4. For example, if the fish were sampled in the Port of Kodiak, the location code would be 031.

Period

Escapement sampling: List the sample week in which the fish were sampled (Appendix A.5.).

Catch sampling: List the sample week in which the fish were caught. If this differs from the week the fish were sampled, note this in the top margin.

Project and Gear

Refer to the reverse side of the AWL form for the correct code. For example, escapement samples collected at a weir would have a project code of 3 and a gear code of 19.

Mesh

Leave blank unless specifically instructed by supervisor to do otherwise.

Type of length measurement

Refer to the reverse side of the AWL form for the correct code (e.g., mid eye to tail fork = 2). Refer to Appendix A.6.

Number of scales per fish

Fill in the number of scales collected per fish. For sockeye, one scale per fish is collected unless otherwise instructed by supervisor.

-Continued-

# of cards

# of cards always = 1 (each AWL form is individually numbered).

If possible, keep the AWL form litho codes in numerical order throughout the season and keep all forms flat, dry, and clean. Fish gurry and water curling may cause data to be misinterpreted by the optical scanning machine. **It is the responsibility of the crew leader to make sure that all forms are carefully edited before returning them to their supervisor.**

SCALE GUM CARDS

A completed AWL form and accompanying gum card for sampling sockeye salmon are shown in Appendix A.2. When collecting two scales per fish, as with coho salmon sampling, follow the procedure illustrated in Appendix A.3. Be sure to fill out the gum cards in pencil as shown in Appendix A.2 and A.3.

Species

Write out completely (e.g., sockeye).

Locality

Escapement sampling: Include the weir site followed by "escapement" (e.g., Karluk River escapement).

Catch sampling: Include the area(s) where the fish were caught followed by "catch" (e.g., Uganik Bay catch).

Statistical Area Code

Fill in the appropriate digits from the AWL form. If catch samples are from a variety of statistical areas be sure to list each statistical area and approximate percentage from each (if available).

Sampling date

Escapement sampling: Fill in the date the fish were sampled.

Catch sampling: Fill in the date the fish were caught. The sample date, if different from the catch date, may be noted in "remarks".

Gear

Write out completely. If catch samples include multiple gear types, be sure to list each gear and approximate percentage from each (if available).

Collector(s)

Record the last names of each person collecting the sample.

Remarks

Record any pertinent information such as the number of scales per fish sampled, processing facility where the sampling took place, vessel/tender name, etc. Be sure to transfer this information to the top margin of the AWL form.

-Continued-

SAMPLING PROCEDURE

1. Place the fish on its right side to sample the left side.

2. Determine the sex of the fish (escapement sampling only) and darken M or F in the sex columns. If any difficulty is encountered with this procedure, write "I had trouble sexing these fish" on the top margin of the AWL form and ask your supervisor for help as soon as possible before sexing additional fish.

3. Measure fish length in millimeters from mid eye to tail fork (escapement sampling only; Appendix A.6). Record length by blackening the appropriate column circles on the AWL form. Column 3 on the AWL form is used for fish with a length greater than 999 millimeters (Chinook). Measure all species of salmon to the nearest mm. When collecting length data, take care to ensure that each length corresponds to the appropriate scale mounted on the gum card, as length-at-age is evaluated for each sample.

4. Remove the "preferred scale" from the fish by grasping the scale's exposed posterior edge with forceps and pulling free (Appendix A.7). Remove all slime, grit, and skin from the scale (neoprene wristers work well for this). 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 the other side of the fish. If no scales are present in the preferred area on either side 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. Do not select a scale located on the lateral line.

5. It is important to take care that scales adhere to the gum card, rough side up. Therefore, without turning the forceps over, clean, moisten, and mount the scale on the gum card with your thumb or forefinger. Exert just enough pressure to spread and smooth the scales directly over the number as shown in Appendix A.7. The ridges on the sculptured side can be felt with a fingernail or forceps. Mount the scale with the anterior end oriented toward top of gum card. All scales should be correctly oriented on the card in the same direction (Appendix A.8.).

6. Repeat steps 1 through 4 for up to 40 fish on each AWL form.

7. When sampling at weirs you may use "Rite in the Rain"® books to record the data. Keep the AWL forms in camp where they will be clean, dry, and flat. After sampling is done for the day, transfer the data to the AWL forms. **Each length, sex, and scale must correspond to a single fish! It is the responsibility of the crew leader to be sure the data has been transcribed correctly and the AWL forms filled out completely. Log books containing length and sex data should be returned to Matt Foster at the end of the season**. These are considered raw data and need to be archived. If you choose to record raw data on tape, these tapes must be returned to Matt Foster.

-Continued-

SAMPLING CHECKLIST

OPERATIONAL PLAN	PENCILS (NO. 2)
GUM CARDS	FORCEPS
AWL FORMS (**GREEN**)	PLASTIC CARD HOLDERS
NEOPRENE WRISTERS	CLIPBOARD
MEASURING BOARD	LOG BOOK

SOME REMINDERS

1. For greater efficiency in scale reading, mount scales with anterior end toward top of gum card.

2. AWL forms should be carefully edited. Remember to use the new AWL forms (green) as the red and blue forms are outdated. Re-check header information on AWL forms; make sure all available information is filled in. Take extra care to use the correct period code (sampling week) for the sampling or catch date. AWL form numbers should not be repeated; a frequent error is to begin a week's sample with the last AWL number used the week before. This is particularly important if the data is regularly sent to town; it is easy to forget which AWL form numbers were used. Crew leaders should take time to ensure that the circles are being blackened correctly. If the circles are sloppily marked, the optical scanner records the information incorrectly or misses it entirely.

3. Transfer important comments from the gum cards to the AWL forms. After pressing scales, the cards are seldom referred to again, and important remarks can be lost. Write comments in the top right margin. If there is not room on the AWL form to completely explain the remarks, use a separate piece of paper.

4. Never put data from different dates on one AWL form or one gum card. Even if only one scale is collected that day, begin a new AWL form and gum card the next day.

5. If weights are taken, they may be noted in the right margin of the AWL form during sampling, but be sure to transfer the weights and litho code to the appropriate columns on the reverse of the AWL form before submitting it to your supervisor.

6. Try to keep the litho codes (located in the left margin of the AWL form) in numerical order. This should not be hard to do if they are arranged that way before page numbering. When sampling different areas throughout the season, arrange the litho codes in order before each sample is taken.

-Continued-

7. If AWL forms get wrinkled or splotched the data should be transcribed onto a new AWL form prior to sending in. The optical scanning computer will misread or reject torn or wrinkled sheets. Do not use paperclips on AWL forms.

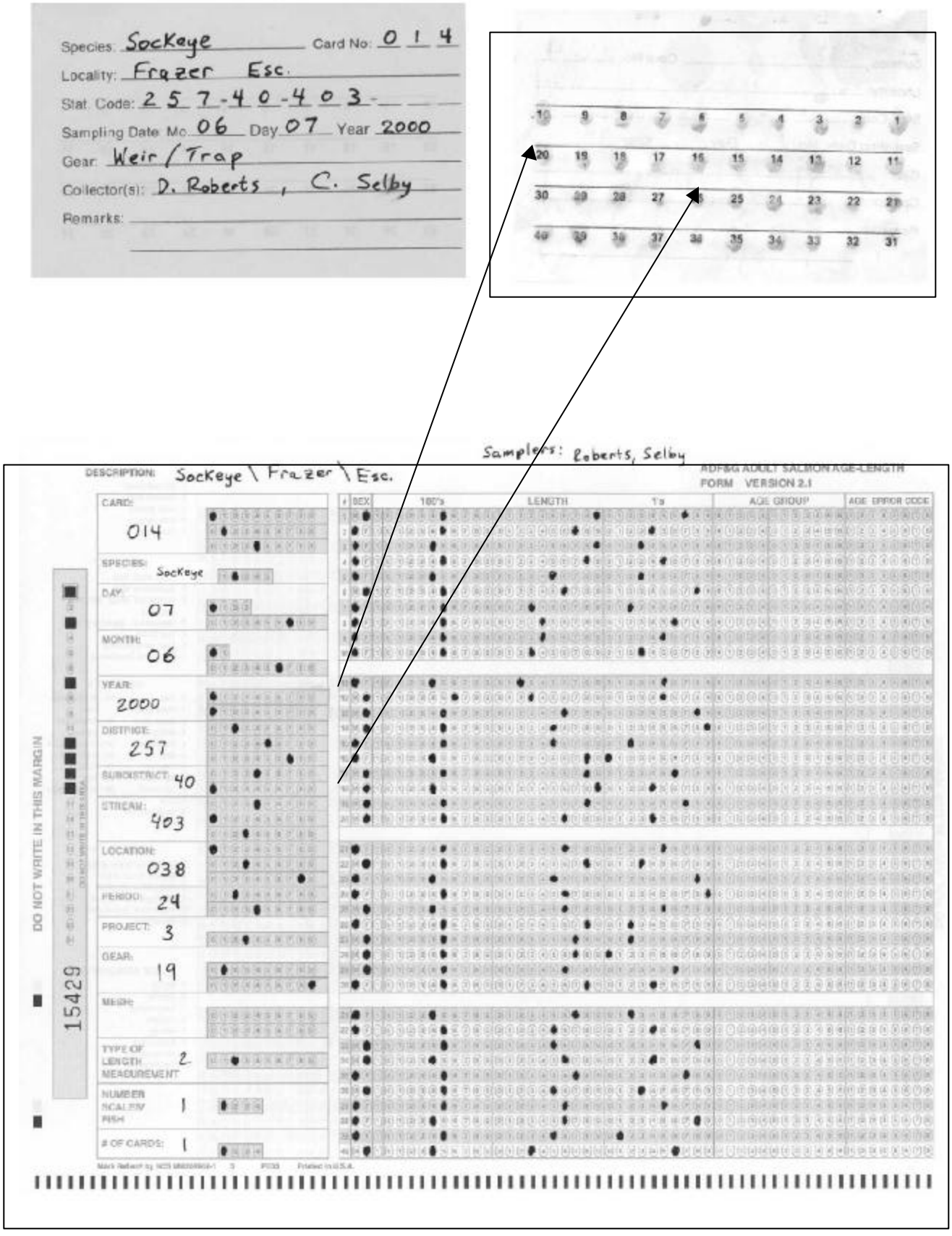
8. Be careful when collecting and mounting scales in wet conditions (rain, high humidity, etc.). If glue dries on top of the scale, it often obscures scale features, resulting in an unreadable scale. In addition, scales frequently adhere poorly to a wet gum card. Protect the cards and keep them dry to avoid having to remount the scales on a new card. If the cards get wet, try to dry them in a protected area or remount if necessary. Remember, use a pencil when filling out gum cards, because ink will come off during pressing.

9. Visually scan all AWL forms for mistakes. A common error occurs, for instance, in placing both the 4 and 7 of a 475mm fish in the 100s column with nothing in the 10s column.

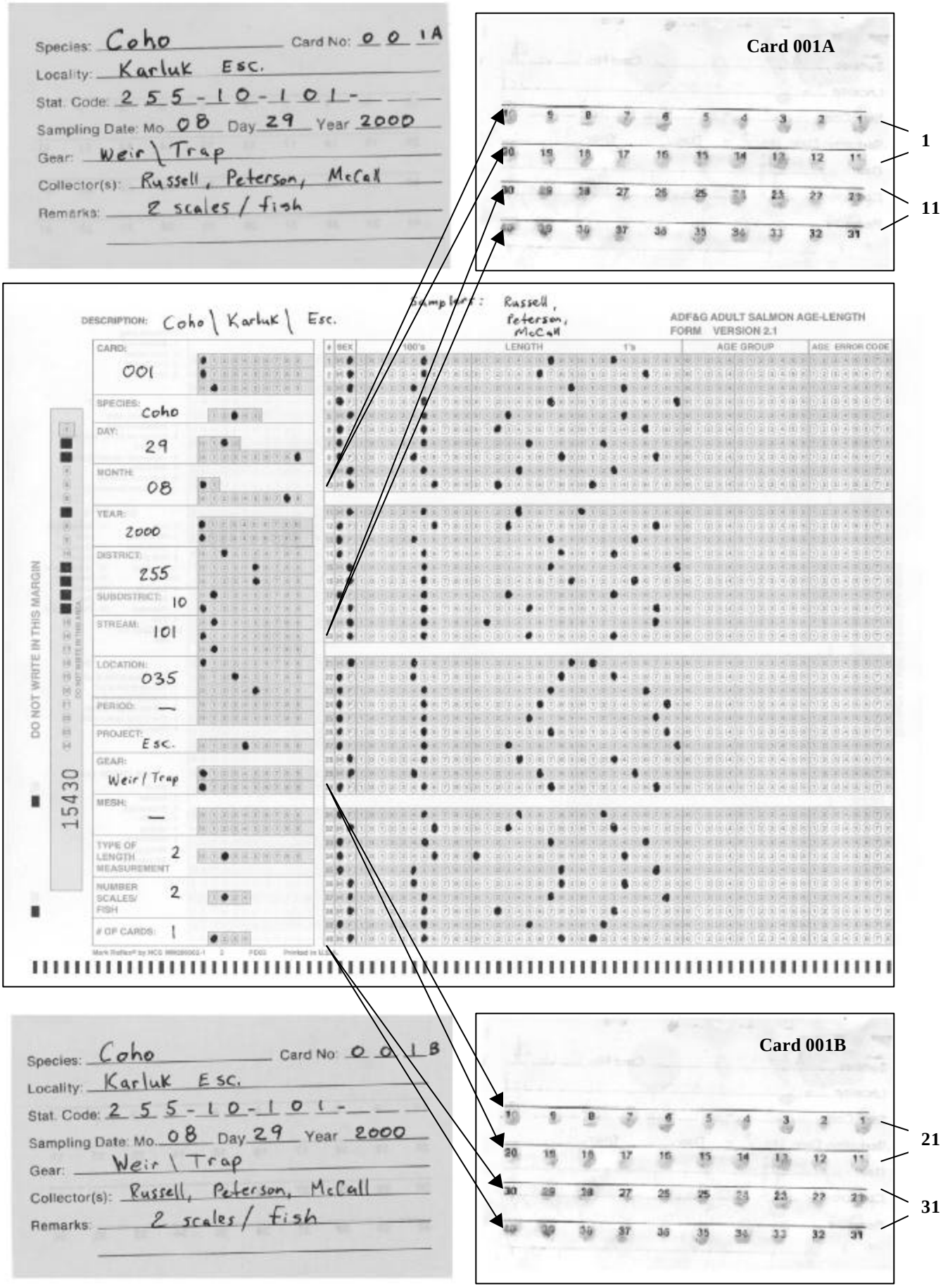
10. Avoid accumulation of incomplete AWL forms. In previous years, there have been cases where individuals have completed several samples before transcribing the information on the AWL forms. This may lead to an increase in errors. After a sample has been completed, try to get the AWL forms filled out as soon as possible. This will ensure more accurate information, as any problems or abnormalities concerning the sample (e.g., many jacks in sample, many fish lacking preferred scale, number of scales do not match number of lengths recorded, etc.) will be fresh in your mind.

11. Responsibility for accuracy lies first with the primary data collector(s) and finally with the crew leader. Sloppy or incomplete data forms or gum cards will be returned to individual collectors for correction.

Appendix A.2. Completed adult salmon AWL form (front side) and associated gum card.



Appendix A.3. Completed adult salmon AWL form (front side) and associated gum card when sampling 2 scales per fish.



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

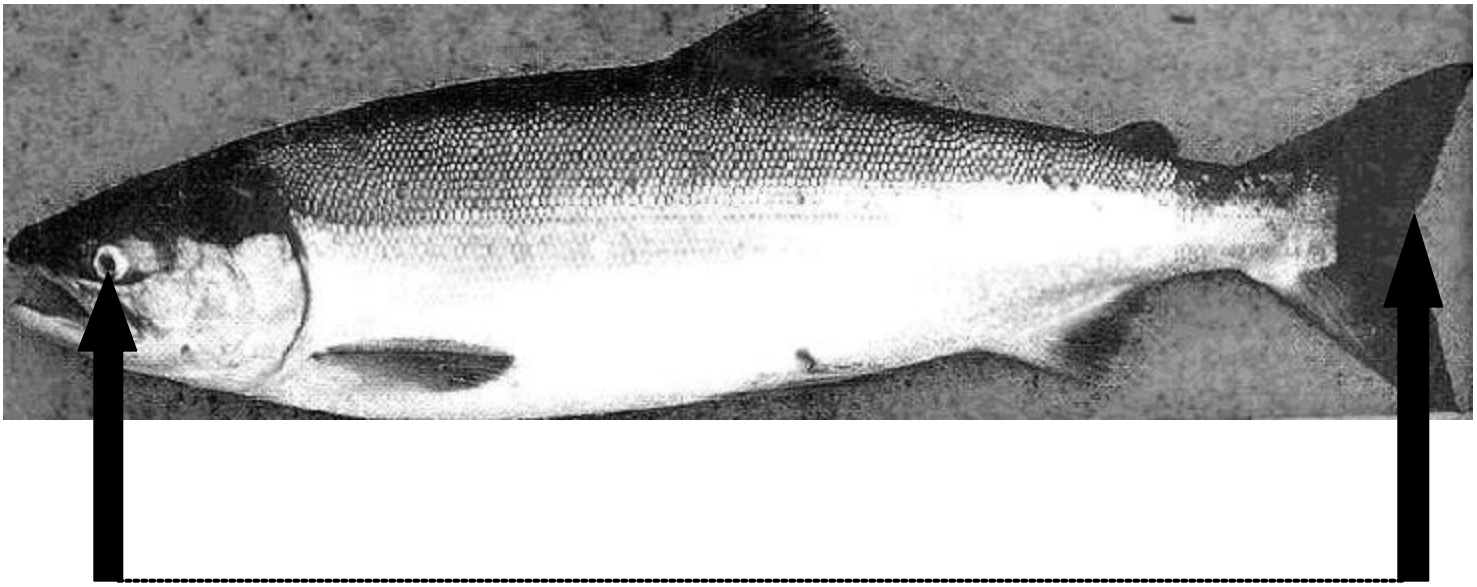
Port and Location Codes

029	Uganik
030	Lazy Bay
031	Port of Kodiak
032	Pauls Lake
033	Thorsheim
034	Afognak River
035	Karluk River
036	Ayakulik (Red River)
037	Upper Station
038	Frazer Lake
039	Dog Salmon
040	Akalura River
041	Uganik River
042	Malina Creek
043	Portage Lake
044	Foul Bay (FBTHA)
045	Larsen Bay
046	Spiridon (SLTHA)
047	Little Kitoi
048	Waterfall Bay (WBTHA)
049	Little River
050	King Cove
051	Port Moller
052	Dutch Harbor
053	Akutan
054	Sand Point
055	Bear River
056	Nelson River
057	Canoe Bay
058	Ilnik Lagoon
059	Orzinski River
060	Sandy River
061	Thin Point Lagoon
062	Middle Lagoon
070	Black Lake
071	Chignik Weir
072	Chignik (Processing facilities)

Appendix A.5. Sampling weeks and associated calendar dates, 2003.

Week	Calendar Dates	Week	Calendar Dates
1	01-Jan to 03-Jan	28	05-Jul to 11-Jul
2	04-Jan to 10-Jan	29	12-Jul to 18-Jul
3	11-Jan to 17-Jan	30	19-Jul to 25-Jul
4	18-Jan to 24-Jan	31	26-Jul to 01-Aug
5	25-Jan to 31-Jan	32	02-Aug to 08-Aug
6	01-Feb to 07-Feb	33	09-Aug to 15-Aug
7	08-Feb to 14-Feb	34	16-Aug to 22-Aug
8	15-Feb to 21-Feb	35	23-Aug to 29-Aug
9	22-Feb to 28-Feb	36	30-Aug to 05-Sep
10	01-Mar to 07-Mar	37	06-Sep to 12-Sep
11	08-Mar to 14-Mar	38	13-Sep to 19-Sep
12	15-Mar to 21-Mar	39	20-Sep to 26-Sep
13	22-Mar to 28-Mar	40	27-Sep to 03-Oct
14	29-Mar to 04-Apr	41	04-Oct to 10-Oct
15	05-Apr to 11-Apr	42	11-Oct to 17-Oct
16	12-Apr to 18-Apr	43	18-Oct to 24-Oct
17	19-Apr to 25-Apr	44	25-Oct to 31-Oct
18	26-Apr to 02-May	45	01-Nov to 07-Nov
19	03-May to 09-May	46	08-Nov to 14-Nov
20	10-May to 16-May	47	15-Nov to 21-Nov
21	17-May to 23-May	48	22-Nov to 28-Nov
22	24-May to 30-May	49	29-Nov to 05-Dec
23	31-May to 06-Jun	50	06-Dec to 12-Dec
24	07-Jun to 13-Jun	51	13-Dec to 19-Dec
25	14-Jun to 20-Jun	52	20-Dec to 26-Dec
26	21-Jun to 27-Jun	53	27-Dec to 31-Dec
27	28-Jun to 04-Jul		

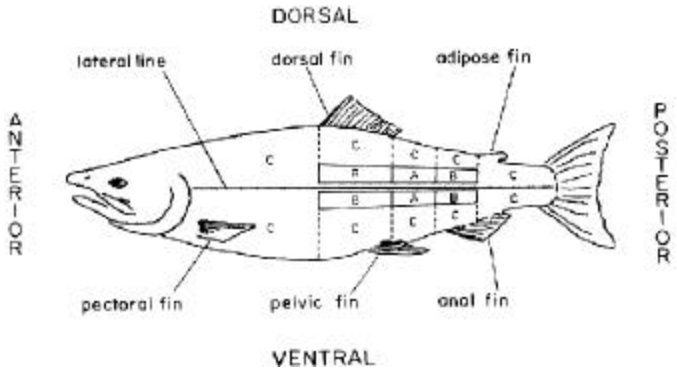
Appendix A.6. Measuring fish length from mid eye to tail fork.



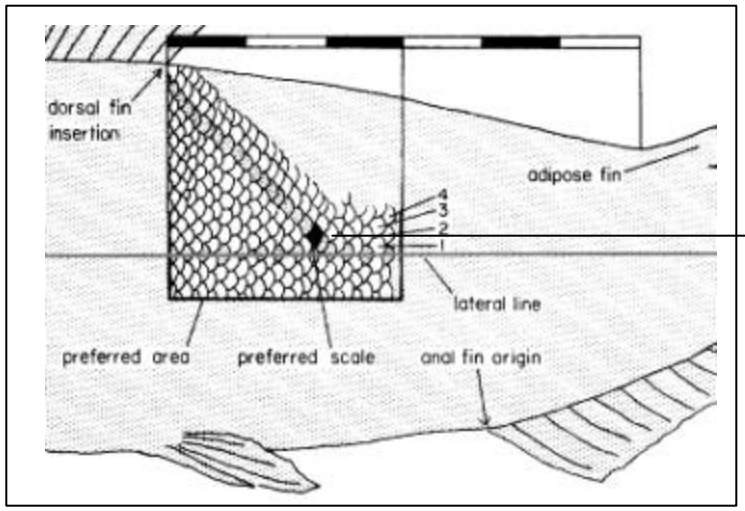
Adult salmon length is measured from mid eye to tail fork because the shape of the salmon's snout changes as it approaches sexual maturity. The procedure for measuring by this method is as follows.

1) Place the salmon flat on its right side (on the measuring board) with its head to your left and the dorsal fin away from you.
2) Slide the fish in place so that the middle of the eye is in line with the edge of the meter stick and hold the head in place with your left hand.
3) Flatten and spread the tail against the board with your right hand.
4) Read and record the mid eye to tail fork length to the nearest millimeter.

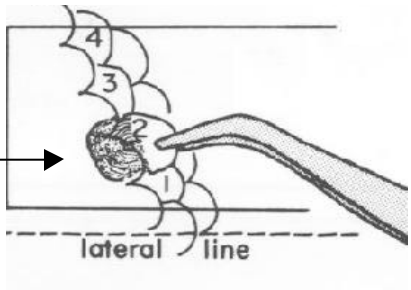
Appendix A.7. Removal and mounting of the preferred salmon scale.

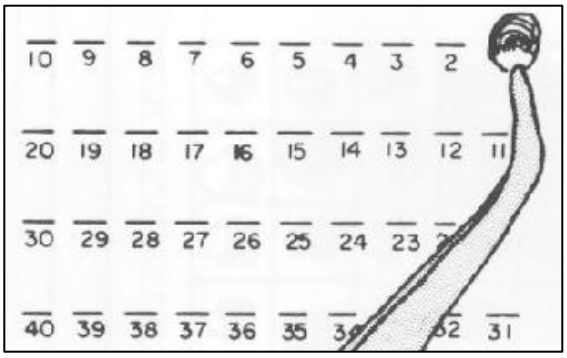


INPFC rated areas for scale removal. Area A is the preferred area. If scales on the left side are missing, try the right side. Area B is the second choice if there are no scales in area A on either side of the fish. Area C designates non preferred areas.



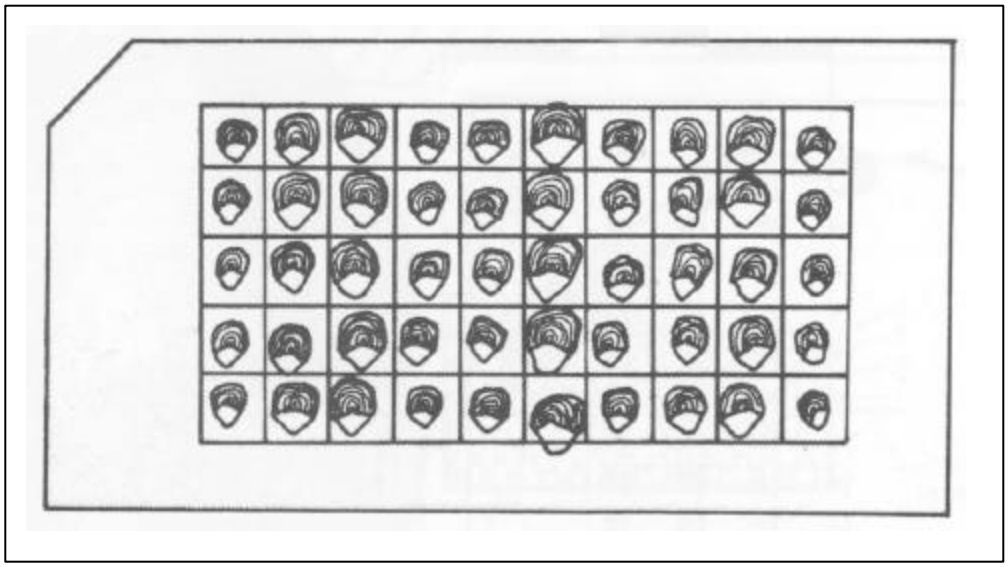
Do not turn scale over.



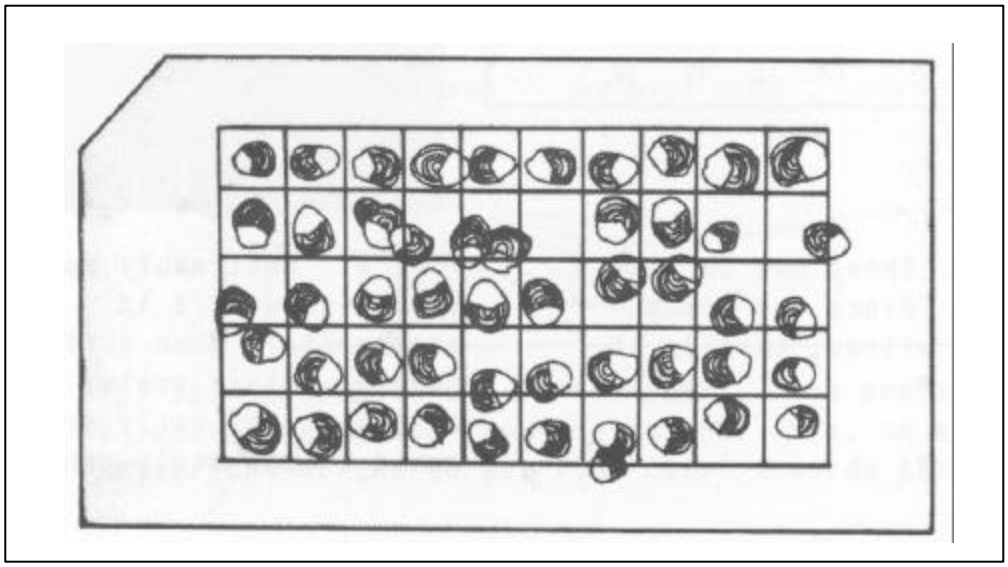


The preferred scale in this diagram is solid black. It is located 2 rows up from the lateral line, on a diagonal from the insertion (posterior) of the dorsal fin "back" toward the origin of the anal fin.

Appendix A.8. Scale orientation on the salmon scale gum card.



The scales are all correctly oriented on the card in the same direction, with the anterior portion of the scale pointed toward the top of the card and the posterior portion (which is that portion of the scale held in the forceps) pointed toward the bottom of the card.



The scales are incorrectly oriented in different directions. This increases the time spent to age samples.

Appendix B.1. Manual for conducting scale pattern analysis within the Westward Region.

PART I. INSTRUCTIONS FOR THE OPRS SYSTEM STEPS:

1) At C-prompt type: start (i.e. C:>start) then hard return (enter key).
   Voila.. you should have before your eyes a MENU which at the top says "BATCH FILE FOR OPRS". If not... PANIC.... no just get back to the C-Prompt and do a C:>cd\ then repeat (1) from above.

2) At the menu type: 1 for "load OPRS SYSTEM", and then hard return.

   What you should observe now is a bunch of colors, logos... etc. flashing before you.. then after all the excitement the logo page stays and at the bottom the prompt to hit any key to continue... do so

   a) Now in front of you should appear a spectrum of windows with a prompt at the top of the page to select a window.

      THE ONLY WINDOWS OF CONCERN TO YOU ARE:

      CONFIGURATION
      QUIT
      PAGE
      LENS CALIBRATION
      DIRECTORIES AND PATHNAMES

      WARNING: IF YOU KNOW WHAT'S GOOD FOR YOU AND YOUR PRODUCTIVE TIME, TAKE SOME GOOD ADVICE AND LEAVE THE OTHER ONES ALONE!!!!!!

   b) Hit the red mouse button and using the mouse move to the configuration page and cover the load choice and hit the red mouse button again (within this step you will have depressed the red button twice).

      The machine response will be a flashing signal at the top of the page, regardless of what is there type: **foster1** making sure that there is no trailing suffix, if so remove it.

      NOTE: The **foster1** file is a configuration file (set up previously) that defines all needed parameters allowing for consistent scale measurements to be collected and sets calibration rulers and screen color.

3) Turn on video (T.V.) screen (Green button), compound microscope (Black button bottom left), and video camera (Button on top left of tower)

-Continued-

NOTE: The video screen should be a purple color, if not go back and repeat step 2b (Load Function and check for a trailing suffix after **foster1**).

4) Move mouse to the PAGE window, cover the RAD page, then click the red mouse key.

NOTE: You should observe in front of you the RAD (Radial Adjusted Distance) page with RUN window on top left, followed by FILE to the right.

*******THE PAGES OF CONCERN HERE ARE*******
RUN
FILE
PAGE
LENS CALIBRATION
****

a) Move the mouse to the file page and cover FILE:TESTDATA.DAT and type in your file specification.

Examples of file specs are:
1) Nelson Lagoon 1990 age 1.2: nl9012.dat
2) Frazer Lake 1994 age 2.1: FZ9421.dat

b) Imperative to organizing files generated is keeping records of those created at each step. Regardless of whether files are standards or unknowns, write down dates samples were measured from, sample size, and file names and suffixes. This is important so that you can keep track of raw, ascii, reformatted, and SAS files, all of which will be created.

c) Place acetate in card holder, and using the ocular, lens changer (black wafer looking thing), horizontal-vertical and focus knobs, bring a premarked (age of interest) scale into focus. IT SHOULD APPEAR ON THE VIDEO SCREEN. Adjust the ocular and lens changer powers so that the freshwater zone is as large as possible, without loosing any of the circuli of interest from the screen.

NOTE: You may want to go through several acetate cards of different stocks and years to get an idea of the variability within an age class which would require changing the ocular or lens changer powers i.e. from 10X to 4X or 1.0 to 1.5 ect. Also, make sure that the lenses are well seated when you move them, otherwise you will get a gray screen.

5) With the mouse move to the RUN page and cover ACQUIRE then click the red mouse key. The screen will blink and double right facing arrows should appear to the left of your choice.

-Continued-

NOTE: Whenever you make a choice of the various functions, double arrows will appear to the left of your selection.

a) Move mouse to LENS CALIBRATION WINDOW and choose the ruler having the description of your ocular and lens changer power's, using the red key for selection.

EXAMPLE: If you have 10X ocular and 1.0X lens changer values selected then you would use ruler #1, again double arrows appear.

b) If at any time you change the ocular or lens changer for measurement of a larger or smaller scale impression, you need to also change the ruler in the lens calibration window. Additionally, you may have to modify and describe your new ruler.

c) With the mouse go to the top of the RAD page and click the red key while covering ACQUIRE, now move to the RUN window and cover REFLN (REFERENCE LINE) and click red key again.

NOTE: A green arrow should appear on the screen, move it with the mouse to the bottom left corner while keeping it visible and click the red key. The reference line is now anchored on the left, drag the line to the right corner while making sure that the line is perfectly horizontal, then click the red key.

The reference line is for all subsequent measurements made for the predefined data file that has been set up. It allows proper orientation of scale impressions for measures, as you will see it tells you the angle you are measuring on. It will need to be reset for each file that you are working on whether it is a standard or unknown.

6) Now move to DRAW RADIAL within the RUN page and click the red key.

a) ON T.V. screen will appear a scale image, the reference line, and a green arrow. If not then go back to (5c) and repeat steps.

b) Place arrow at the center of scale focus, click the red Key, and drag the line (while watching the right hand corner of the screen) to the last circulus that you want to include as freshwater growth. Before clicking the red mouse key, make sure that the angle of measure is either 90 or 73 degrees. We have in the past used both within the Westward Region. Then click the red mouse key.

-Continued-

c) Tick marks should appear at the outer edge of each circuli and in a few places where they should not be. To remove unwanted tick marks use the blue key and to add tick marks use the green key. When tick marks are set where you want them, depress the white mouse key, which returns you to the RUN PAGE.

d) Now cover the SAVE TO FILE under the run page, you should hear a beep, which means that the scale measures were saved to the specified data file. After which, repeat all of STEP 6 until you have either met the desired sample size for either the standard or unknown file.

7) After all measures are completed for a file (say 200 for a standard) the raw (***.dat) data needs to be converted from binary (anything generated with the OPRS with a .dat suffix) to ASCII. You should only do this after you have completed the file thus eliminating file stage confusion.

a) Go to the PAGE, cover edit (EDT) and click on the red mouse key; proceed to record (top left) cover and click red key, numbers should be scrolling by, with the final number being the sample size for that file.

b) Now look at the INPUT and OUTPUT file pages; the input data file should be the one you are interested in converting, if not go back to the CON page and start again; if it is cover the OUTPUT data file and type A: or B: ***.ASC; move to convert to ASCII page, cover output data and headers and click red key. You should hear the drive A or B working and data being converted onto your diskette. When this has been successfully completed, ITEM will appear on the top right above all the pages.

c) Now go to CON page, click and exit system. Keep in mind that an unconverted binary data file is saved within the system so for additional backup you should copy these files onto a backup diskette labeled appropriately.

8) If you previously only partially completed a data file and now want to finish adding data records (scale measures) to it complete the following steps.

a) Go through start up procedures (STEPS 1-4) and at step 4a bring up the unfinished file. Now go to the EDIT (EDT) page and cover record, and click red key to bring up all previously saved scale records for that file. Then proceed with steps 5-6 as before. Note that you have to do this every time that you want to add data records to an old file, otherwise the file will only have in it the number of scales previously measured. They also will not be consecutively numbered and will have to be added to the original file for processing. This could induce errors or duplicate scale measures.

-Continued-

CAUTIONARY NOTES:

1) When measuring make sure you periodically check the file under the file page, that is the one you want scale measures to go to.

2) Every so often, glance at the lens calibration page to make sure the lens description is the one you are using.

3) Go through a preparatory exercise of all previous and following steps prior to actually measuring scales and conducting any type of analysis.

PART II. REFORMATTING AND DATA EDITING

1) Get into the C:\stcksep directory and call up program REFORM1 by typing it in and then hard return. This program is user interactive and very simple.

   a) A prompt will request the file specification for the ASCII formatted scale data file (From OPRS system) which you want to reformat. Also, you will be requested to state a drive and file name for where the reformatted data is to go. Reformatting will need to be performed on both standard and unknown files.

      NOTE: File names should have a suffix that identifies them as reformatted, and will hopefully provide for minimal file confusion.

Examples:

A) Reformatted Chignik Lake 1991 age 2.2: Chg9122.s, where the S signifies it as a standard file.

B) Reformatted Chignik Lagoon catch 1991 age 2.3: CL91231.k, where the 1 following the age is the first fishing period or whatever and the K represents that the file is an unknown.

   Note: Throughout this manual reformatted standard and unknown files will be referred to as S and K files.

   The reformatting process using this program is structuring the data records such that all header line information (measurement parameters, axis...ect), and scale measurement data are all on a horizontal axis for each scale measured, rapping around as one continuous line when printed.

-Continued-

2) After S and K files are developed editing is the next step. Editing consists of scanning all data records for errors which occurred during the measurement process. Common errors are 1) scale measurements collected on an axis other than 90 or 73 degrees, and 2) scale data records with only several measures saved.

   If questions arise during editing, consult the manual. Any erroneous data records such as those mentioned above should be removed from the data file. We have used plus or minus 2 degrees as the criteria for erroneous axis measures. Additionally, for all following procedures the header line (top line of the file) with a file specification and other descriptive information must be removed. The final edited version of the file will have no header line (Do not confuse this with the parameters which start each data record) and should be saved on diskette using the S and K suffixes.

PART III. CONSTRUCTING STANDARD AND UNKNOWN SAS FILES

1) The first step is understanding SAS and it's idiosyncrasies and requirements. Within C:> are two directories of interest SAS and DATA.

   a) Prior to beginning your SAS session you need to copy all edited S and K files into the DATA directory. This directory is used for formatted and edited data only!!!

   b) Once your files are in the DATA directory, combine both standard files into one Excel worksheet and reformatting the resultant Excel file (*.xls*) so that it can be imported into SAS. The first row in the Excel file should identify the contents of each column. The Excel file is then imported into SAS for model development. The model is developed in SAS using the new *.sas* file and a series of commands specified in Appendix B.3.

   c) Once your files are in the DATA directory, you can start your SAS session by constructing STANDARD AND UNKNOWN FILES for a particular age class. Get in by C:>cd\sas then hard return and typing SAS. Before your eyes should be three windows OUTPUT (AT TOP OF SCREEN), LOG, AND PROGRAM EDITOR. With command below the page designation.

   d) From Appendix B.3. you will find instructions for constructing sas data files both standards and unknown files) with descriptions of what is going on at each step. Also included are actual SAS commands that if followed while modifying the variable formats to match those that have come from the Excel file will allow you to create both standard and unknown files within sas. Again these should be followed exactly as given and then submitted using the F10 key. The created files will be automatically saved within the C:\sas\chig02 subdirectory with an SSD suffix. However it will not save the output, whereby if you want the output printed in hard copy form then use the file 'prn' command line of any of the three pages.

-Continued-

PART IV. MODEL BUILDING USING SAS

1) The first step used should be screening (frequency histograms) of all constructed variables from each stock for the analysis. Using lotus 2.2 or similar spread sheet construct frequency histograms for all variables for each stock being considered for inclusion within each standard. All variables should be approximately univariate normal. Only those variables that are approximately normal should be included, while those that show departures from normality excluded. In some cases it is informative to look at pairwise bivariate plots which may provide qualitative incite into what one might perceive to be multivariate normality.

2) After variables have been screened the next step is to conduct stepwise variable selection for standard file construction. This is easily completed within SAS using PROC STEPDISC Appendix B.2). I have used the default values provided within SAS for defining the F-to-enter and remove values. These correspond to ? =0.1 which I have been using to retain a majority of variables constructed. Other approaches have used ? =0.05 as an F-to-enter along with including variables which are negatively correlated with variables already in the model, these methods are not included within this manual.

3) The SAS program and associated commands for completing the discriminant analyses are given in Appendix B.3. Note that within the command lines POOL=YES employs a linear discriminant function while POOL=NO uses a quadratic function. With large per stock sample sizes (N=200) the quadratic and linear functions are similar in results with the quadratic function providing slightly higher classification accuracy and balance in misclassification error rates.

PART V. USING THE COOK AND LORD (1978) CLASSIFICATION MATRIX CORRECTION PROCEDURE

1) Within the C:\stcksep directory is located a program called SCOTT.EXE, this is the program used for correcting raw stock composition estimates from unknowns for misclassification error rates.

2) First type SCOTT.EXE at the prompt within the STCKSEP directory and it will come up with the question intermediate results?, type N and hard return.

3) The program will come back with the question Number of Stocks here type in the number of stocks within the standard file.

4) Next it will come back with model name here make sure that you give it a name which stands out with little confusion.

-Continued-

5) Now it will respond with "INPUT TEST CLASSIFICATION MATRIX IN NUMBER OF FISH". This information should be from your SAS SPA analysis results titled resubstitution results and will be the number of fish correctly classified to stock of origin followed by a comma then return and do the same for the next stock. Remember to keep track of the stock that you typed in first. Prior to running this analysis hit the Control key and P key at the same time to get a continuous print of the results.

6) Now type in the sample sizes for all stocks with a comma separating each stock.

7) Response will be "unknown name" here type whatever you want say for example Cape Alitak June 9-10 Age 2.2 unknown or alike.

8) The program will come back with first order estimates in number of fish. Here go again to the output from the SAS discriminant analysis and get the first order estimates from the end of the printed output. Example: with a mixed stock sample size of 100 of which 87 were classified to stock 1 and 17 to stock 2, then type in these numbers separated by a comma and then hard return. Make sure that your printer is turned on and that it is printing every time that you hit the return key, if not then hit the Control and P keys again.

   Now the output should be printing with first and second order estimates. The second order estimates are the ones that have been corrected for misclassification error and should be the ones that are used in subsequent analysis or reporting. Note that with only two stocks in the analysis you can put confidence intervals around the estimates by assuming normality and using the appropriate tabled values. With greater than two stocks the Chi-square approximation holds and you should go to this table for critical values.

Appendix B.2. Guidelines for file formatting and directory location.

FILE FORMATTING AND DIRECTORY LOCATION

The modeling process requires a vast array of files. Organized management of these files is a must. A consistent file naming system has been established in recent years. File name formats are described below:

Chignik Lake standard file:

scl0022 s=*standard*, cl=Chignik Lake, 00=2000, 22=age class 2.2.

Black Lake standard file:

sbl0123 s=*standard*, bl=Black Lake, 01=2001, 23=age class 2.3.

Model file:

s0123 s=*standard*, 01=2001, 23=age class 2.3. This is the model file, created from both of the above *standards*. Postseason model file is indicated with "ps" following the age class.

Unknown fishery files:

la012301 la=Chignik Lagoon, 01=2001, 23=age class 2.3, 01=file number, beginning with 01, and increasing throughout the season.

EXCEL tables and files:

agecom01.xls	Fishery age composition table.
blkage01.xls	Black Lake age entry file, including calculations of age comps.
chgage01.xls	Chignik Lake age entry file, including calculations of age comps.
modtbl01.xls	Stock composition table.
late2200.xls	Calculations of proportional selection of individuals for Chignik Lake *standard* files.

File Extensions:

.dat	OPRS digitized data files.
.asc	Format transition files.
.k	Editable format transition files.
.ssd	SAS operating system files.
.xls	Excel worksheets.

Prior to the modeling process, the digitized data file must undergo a series of reformats. The OPRS operates with *.dat* format files, while the SAS modeling program operates with *.ssd* format. In addition to these files, both *.asc* and *.k* files are also generated and stored. Directory locations are described below:

-continued-

C:

- ***data:***
  - ***scales:*** Storage of SAS modeling programs.
    - ***2002:*** Working files of the season (age and stock comp. tables and proportional determination of age class individuals for late season *standard* files).
  - ***spa:*** Archive of past years' modeling data.
    - ***spa98:*** 1998 data.
    - ***spa99:*** 1999 data.
    - ***spa00:*** 2000 data.
  - ***spa02:*** Storage of present years' model data.
    - ***ascfiles:*** Output of *.asc* files, from reformats.
    - ***datfiles:*** *.dat* files, once archived.
    - ***kfiles:*** Output of *.k* files, from reformats.
    - ***modeling:*** Storage of EXCEL files of normal distribution.
    - ***ssdfiles:*** *.ssd* files, once archived.
- ***sas:*** SAS program.
- ***sas-old:*** Directory route to SAS output files and old data files.
  - ***kdk:*** Output files of SAS modeling programs. (This could be relocated to C:\data\spa01\ssdfiles; however, directives in SAS programs would need to be edited accordingly).
- ***video:***
  - ***digdat:*** Working files of the OPRS.

The first step of the reformatting process is done while operating in OPRS; convert *.dat* to *.asc.* This is accomplished by specifying the output directory and file name. Once this reformat has been performed, exit OPRS to the WINDOWS screen. The *.asc* format is then converted to *.k* format. Double-click the icon for this program (labeled "REFORMAT ASC-K") to initialize this conversion. Click on "Run", "Start", and follow the steps as prompted.

Next, open the *.k* file with the NOTEPAD editor program. Delete the entire first line that is the title. Check all entries for consistent magnification and orientation variables. Delete any records that indicate entry error, by these standards. Save the file. The conversion of the *.k* file to *.ssd* format will be described in the following analysis section.

Appendix B.3. Example and explanation of SAS commands required to set up standard and unknown files.

To import the standards file into SAS, a library is set up in SAS by entering the following command into the program editor:

libname *librarynameofyourchoice* 'c:*locationoflibrary*\';

The data is then imported using the *Import Data* function under the *File* heading. The function will prompt the user for the location of the file, which library to use (use the library just created), and what and where to save the resultant *.sas* file. Name the file *knowns*.

The next step is to create the model using the following commands in the program editor:

libname *librarynameofyourchoice* 'c:*locationoflibrary*

proc discrim data=*librarynameofyourchoic.knowns* method=normal pool=NO crossvalidate;
class system;
var NUMCIRC V2 V3 V4 V5 V6 V7 V8 V9;
run;

The variables specified after the "var" command will be the same as the first row in the Excel file.

NOTE: That you will have to figure out what the maximum number of variables will be by determining the maximum and minimum number of circuli are for a given scale within each of your measured stock specific files. EXAMPLE: If you have an age-2.2 scale within a standard which has only 12 circuli and this is the fewest for all scales measured for that standard, then the maximum number of variables for that standard will be 13, one circuli count and 12 incremental circuli distances. The variables listed defined as var1-circuli count (irrespective of age) and var2-var13 being consecutive incremental distance measures. If you have a total of say 19 circuli you can figure out the remaining format string by starting with var14 as 107-109 etc... The variable string is usually three columns long but bring up the file in notepad and count just to make sure... If you misplace or miscount columns at this point your SAS program to create these files will BLOW UP.....

THE FOLLOWING IS HOW AN UNKNOWN FILE IS TO BE CREATED.

The unknown file is imported into Excel and formatted similarly to the known file with the exception that the first column that identifies "system" is excluded. The procedure for importing the unknown file into SAS is also similar to that of the known files. A library is set up in SAS by entering the following command into the program editor:

libname *librarynameofyourchoice* 'c:*locationoflibrary*\';

-Continued-

The file is then imported using the *Import Data* function under the *File* heading. The function will prompt the user for the location of the file, which library to use (use the *WORK* library), and what and where to save the resultant *.sas* file. Name the file as approriate. The following commands are then used to create the unknown *.sas file.*

data *libraryofyourchoice.nameofunknown*;
set *nameofunknown*;
keep NUMCIRC V3 V4 V5 V6 V7 V8 V9;
run;

Appendix B.4. SAS commands to run a stepwise variable selection analysis.

This will all be typed within the Program Editor page of SAS

libname *librarofyourchoice* 'c:\ *locationoflibrary* \';
proc stepdisc data=*librarofyourchoice*.knowns maxstep=10 short;
class system;
var NUMCIRC V3 V4 V5 V6 V7 V8 V9;
run;

To submit this to SAS you will have to use the F10 key, once it has been typed the output will appear within the OUTPUT page of the SAS screen. To print the output go to the OUTPUT page by either the arrow keys or using F5, and then following a space type **file 'prn'** then a hard return.

Appendix B.5. SAS program for conducting both linear and quadratic discriminant function analysis.

This will all be typed within the Program Editor page of SAS

libname *librarofyourchoice* 'c:\ *locationoflibrary* \';

data *librarofyourchoice*. *nameofunknown*;
set unk17;
keep NUMCIRC V3 V4 V5 V6 V7 V8 V9;
run;

proc discrim data=*librarofyourchoice*.knowns testdata= *libraryofyourchoice.nameofunknown* method=normal pool=no crossvalidate;
class system;
var NUMCIRC V3 V4 V5 V6 V7 V8 V9;
run;

Again to submit one of these for analysis use the F10 key, to print output use the file 'prn' command at the Output command line. The output using this program will provide constants, classification and misclassification accuracy from both resubstitution and crossvalidation approaches. I have used the resubstitiution results solely. The only part of this program which will need changing in "REAL LIFE" will be the number and name of variables actually used.

CHIGNIK LAGOON SOCKEYE SALMON TEST FISHERY OPERATIONAL PLAN, 2003

By
George Pappas

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

May 2003

TABLE OF CONTENTS

	Page
LIST OF TABLES	i
LIST OF FIGURES	i
ABSTRACT	1
INTRODUCTION	2
TEST FISH PROGRAM OBJECTIVES	2
TEST FISHING PROCEDURES	3
Test Fishing Scheduling	3
Seining Procedures	3
PROCEDURES AND REQUIREMENTS FOR VESSEL SELECTION	3
Requirements for Charter Contract	3
Establishment of Charter Vessel Selection List	4
Fiscal Requirement of Each Charter	4
DEPARTMENT TEST FISHERY BUDGET	4
SCALE SAMPLING PROCEDURES	4
ABUNDANCE ESTIMATES FOR CHIGNIK LAGOON	4
2003 PLANNED CHANGES	5
Deployment Options	5
LITURATURE CITED	6
TABLES	7
FIGURES	9

LIST OF TABLES

Table		Page
1.	Chignik Lagoon test fishery dates by each year, 1974-2002	7
2.	Summary of the Chignik test fishery projected expenditures and revenues	8

LIST OF FIGURES

Figure		Page
1.	Chignik Lagoon test fishing locations	9

ABSTRACT

Commercial salmon fishery openings in the Chignik Management Area (CMA) are primarily based on achieving the Chignik River system sockeye salmon *Oncorhynchus nerka* interim escapement objectives throughout the season. There are two runs of sockeyes salmon to the Chignik River system: Black Lake early run and Chignik Lake late run. To ensure that the established escapement goals of both runs are met, the department evaluates escapement via weir counts, commercial catch data, and abundance estimates of salmon in the Chignik Lagoon from the test fishery program. A test fishery program is incorporated to evaluate inseason run strength and to obtain samples and funding necessary to estimate, both inseason and postseason, the total run (catch and escapement) to Chignik and Black Lakes.

The Alaska Board of Fisheries adopted the Chignik Area Cooperative Purse Seine Salmon Fishery Management Plan at the December 2002 meeting. The adoption of the new plan effected the 2002 CMA test fishery program. Consequently, the 2003 test fishery program operation plan was modified to meet the need of the new CMA management plan.

INTRODUCTION

Commercial fishery openings in the Chignik Bay and Central Districts of the Chignik Management Area (CMA) are primarily based on achieving the Chignik River watershed sockeye salmon *Oncorhynchus nerka* interim escapement objectives throughout the season. The sockeye salmon escapement to the Chignik River system is split into two distinct runs, the Black Lake early run and Chignik Lake late run.

To ensure that the escapement goals of both runs are met, the department evaluates escapement via weir counts, commercial catch data, and abundance estimates of salmon in the Chignik Lagoon from the test fishery program. Test fisheries have been utilized to assess sockeye salmon run strength in Chignik Lagoon since 1974 although data is only available since 1988 (Table 1). The test fishery program is used to evaluate inseason run strength in the Chignik Lagoon, obtain sockeye salmon scale samples (which are used to apportion the escapement to Chignik or Black Lakes), and generate funds to estimate the total runs (catch and escapement) to each lake (Appendix A).

During the December 2002 Board of Fisheries (BOF) meeting, the BOF repealed the requirement for a significant buildup of sockeye salmon in the Chignik Lagoon as annually determined by a test fishery prior to the first commercial salmon fishery opening in the CMA. Changes to the historic method of obtaining abundance estimates in the test fishery are expected for the 2003 season. Changes to the 2003 CMA salmon management plan could eliminate the need for a test fishery during June in the Chignik Bay and Central Districts.

In addition to providing biological information, the test fishery is also a source of revenue to the department. The operation of the Chignik Lagoon Scale Pattern Analysis (SPA) project is reliant upon revenues generated from the test fish catches. Without the revenues from this program, the department would be unable to produce run strength estimates, which are vital for the management of the fishery.

TEST FISH PROGRAM OBJECTIVES

The CMA test fishery program has the following objectives:

1. Provide reliable estimates of sockeye salmon run strength in the Chignik Lagoon when commercial catch information is not available.

2. Provide timely inseason sockeye salmon age and stock composition estimates used to apportion fish to either the Black Lake or Chignik Lake run. The test fishery may be the only source of scales used for SPA when samples from the commercial catch are not available.

3. Secure revenue from the test fishery for the SPA modeling project. This includes expenses for personnel, facilities, and equipment necessary to collect sockeye salmon scale samples from the Chignik Lagoon commercial fishery and the Black Lake escapement. This revenue also pays for the test fishing charters.

TEST FISHING PROCEDURES

Test Fishing Scheduling

The department will schedule the 2003 sockeye salmon test fishery (time and date) based upon the need for management data and funding needs. Test fishing may also be necessary during extended fishery closures, during times when fishers strike, or during very weak sockeye returns.

Seining Procedures

The test fishery seine set locations are distributed throughout Chignik Lagoon (Figure 1). Typically, sets begin at Mensis Point (1) and end at Ocean Beach (8). Department staff will meet the charter vessel near the location of the first set on a morning flood tide. The seine will be fished for 10 minutes (estimated from separation of the purse seine vessel and skiff to time when the seine is pursed closed), and the skipper and the biologist onboard will estimate the number of sockeye salmon caught. The biologist onboard will record the estimate of catch at each location. All fish delivered to a processor will be accurately counted and used to increase the accuracy of estimated numbers of salmon released in other sets.

Fish are iced or tanked in refrigerated seawater (RSW) to provide a high quality product. Fish in excess of biological (sample size of 600 sockeye salmon per daily charter) and/or revenue needs are released immediately after being estimated.

Upon completion of the final set, the vessel will transport the catch to a processor. Deliveries will be alternated between interested processors. A total of 600 sockeye salmon will be randomly selected from the delivered catch and will be sampled for age, sex, and length by ADF&G personnel.

All fish are sold using the department's test fish permit card and the revenue will be deposited into the Chignik Test Fish Account. Vessel skippers are required to complete the following forms: 1) State of Alaska Short Term Vessel Charter Agreement, and 2) Field Purchase Order and Invoice. These signed forms are forwarded to the appropriate Kodiak department personnel.

PROCEDURES AND REQUIREMENTS FOR VESSEL SELECTION

Requirements for Charter Contract

Fishermen wishing to participate in the department's test fishing program must meet minimum requirements and agree to the terms of the department's short term vessel charter contract. Seine gear legal to fish Chignik Lagoon is required, as is vessel compliance to U.S. Coast Guard safety regulations. The permit holder is not required to be on board as the department is chartering the vessel and operating under the department's test fishing permit.

Establishment of Charter Vessel Selection List

Each season, a list is established of vessels wishing to participate in the program. The initial enrollment period opens on May 1 and it remains opens until just prior to the first test fishing date. At the close of this initial enrollment period, the department performs a random drawing to determine the sequence of the participating vessels. This sequential list is maintained throughout the season. Additional vessels may enroll after the initial enrollment and drawing; however, these vessels are placed at the end of the established list, in the order in which they are received.

Fiscal Requirement of Each Charter

The fiscal goal of the test fishery is to provide revenue to meet the department's needs above the cost of the charters. Once the department meets its revenue goals, only enough fish are retained to provide abundance, stock, and age information.

DEPARTMENT TEST FISHERY BUDGET

The State of Alaska fiscal year runs from July 1 to June 30. The Chignik test fishery budget is outlined in Table 2.

SCALE SAMPLING PROCEDURES

Usually, for each test fishery a total of 2-3 thousand sockeye salmon are caught. All sockeye salmon used in scale collections are randomly selected from the total catch. Scale collection methods will follow those outlined in the Catch Sampling Operational Plan (Witteveen 2003). A total of 600 scales per daily test fishery will be collected for subsequent inseason and postseason SPA.

ABUNDANCE ESTIMATES FOR CHIGNIK LAGOON

Chignik management biologists use the information collected from the test fishery in conjunction with escapement data to estimate sockeye salmon abundance.

The following factors are considered when estimating abundance from test fishery results:

- Environmental and tidal conditions
- Presence of sockeye salmon jumping and finning during the test fishery
- Qualitative abundance estimate from the vessel skipper and onboard biologist
- Test fishery abundance estimates from previous years.

2003 PLANNED CHANGES

At the December 2002 BOF meeting, the regulation requiring a significant build up of sockeye salmon in the Chignik Lagoon as indicated by the test fishery prior to the first commercial fishery in the CMA was repealed. The second repealed regulation was the requirement of 40,000 sockeye salmon to have pass through the Chignik weir prior to the first commercial fishery. These changes have provided ADF&G with several new ways to operate the Chignik Lagoon test fishery program.

During 2002, the cooperative fleet agreed to daily harvest limits when requested by ADF&G. Harvest limits were utilized to control the harvest of sockeye salmon surplus to escapement needs on a daily basis. During the 2002 season, assigning daily harvest limits in early June of 1,000 sockeye salmon per day allowed the fishery to meet the three objectives of the test fish program without requiring a department test fishery. Daily harvest limits will be assigned to the cooperative fleet during the 2003 commercial salmon season as harvest and escapements necessitate.

Deployment Options

Three options will be considered for the 2003 Chignik Lagoon test fishery program. The first option is to deploy a chartered vessel with department staff onboard to conduct a traditional test fishery where ADF&G retains all of the funds generated from the sale of the catch. The department staff will direct the vessel to fish all seven designated stations in the Chignik Lagoon. Delivery of the catch will be alternated between interested processors The chartered vessel will be paid a set amount for the daily charter. This option will be identified as a department test fishery.

The second option that will be considered during 2003, is to deploy a chartered vessel with department staff onboard to conduct a test fishery where the vessel retains all of the funds from the sale of the catch. The department staff will direct the vessel to fish seven stations in the Chignik Lagoon. Delivery of catch will be alternated between interested processors. The chartered vessel will be paid for the daily charter. The vessel will be assigned a harvest limit prior to deployment. This option will be identified as a commercial Chignik Lagoon test fishery.

The third option to be considered is to deploy a chartered vessel with department staff to harvest salmon to generate funds for the department. The vessel will be instructed to harvest a predetermined amount of salmon (as department budgets require) and deliver the catch to a pre-determined processor. ADF&G will retain all funds generated from the sale of harvested salmon. This option will be identified as a department cost recovery test fishery.

LITERATURE CITED

Witteveen, M. J. and P. Tschersich. 2003. Chignik River watershed sockeye salmon catch and escapement sampling and run apportionment operational plan, 2003. Regional Information Report No. 4K03-xx, Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak In press.

Table 1. Chignik Lagoon test fishery dates by year, 1974-2002.

Year	Test Fishery Dates	First Day of Commercial Fishery	First Day's Fishery Sockeye Catch
1974 -1987 - Data not available			
1988	6/11[a], 6/15[a], 6/20[a], 6/25[a]	30-Jun	22,975
1989	6/8[a], 6/11[a], 6/15[a], 6/17[a], 6/20[a], 6/25[a], 7/18	26-Jun	64,638
1990	6/10[a], 6/14[a], 6/19, 6/21, 6/26[a], 7/9[a]	16-Jun	43,749
1991	6/9[a], 7/15[a], 7/17[a], 7/19[a], 7/22[a],7/25	11-Jun	72,241
1992	6/10, 6/12, 6/14, 6/16[a], 6/22 , 7/16[a], 7/18[a], 7/24	17-Jun	113,458
1993	6/9[a], 6/10, 6/12, 6/15[a]	19-Jun	26,134
1994	6/12[a], 6/14[a], 6/16[a], 6/18[a], 6/20[a], 7/17[a]	25-Jun	172,940
1995	6/8[a], 6/10, 6/18, 6/20[a], 6/30[a]	11-Jun	53,309
1996	6/5[a], 6/8[a], 6/16, 6/21[a]	10-Jun	26,890
1997	6/13[a], 6/15[a], 6/18[a], 6/20, 6/22[a], 6/25[a]	27-Jun	49,091
1998	6/11[a], 6/12, 6/15[a], 6/19, 6/23[a], 6/26[a]	29-Jun	25,969
1999	6/9[a], 6/11[a]	13-Jun	232,645
2000[b]	6/8[a], 6/10[a],6/12[a],6/23[a],6/30[a],7/13[a],7/20[a]	11-Jun	135,244
2001	6/6[a],6/9[a],6/11[a],6/13[a],6/19[a],6/28[a],7/01[a],7/17[a],7/20[a],7/25[a]	14-Jun	0 [c]
2002[d]	6/5[a], 6/9[a]	5-Jun [d]	320

[a] Samples from test fishery were used to apportion stocks to either Black or Chignik Lake.

[b] Weir was blown out by high water event 6/8-7/11/00.

[c] Fleet went on strike and only limited harvests took place from 6/16-7/2/01.

[d] New cooperative purse seine management plan was in use. Traditional department test fishery efforts were altered as result of the new plan. New commercial Chignik Lagoon test fishery was deployed on June 5 and 9. Fish harvested during the commercial test fisheries were retained by the vessel but fishing activities were controlled (vessel fished 7 historic stations) to be compatible with historic data bases.

Table 2. Summary of the Chignik test fishery projected expenditures and revenues.

Chignik Test Fishing Budget	
Line Item	Amount
Personnel	$38,700
Contractual	$13,900
Equipment	$8,000
Total Allowable	$61,600
Estimated charter costs	$13,900
Total Revenues Used At Chignik Weir	$47,700

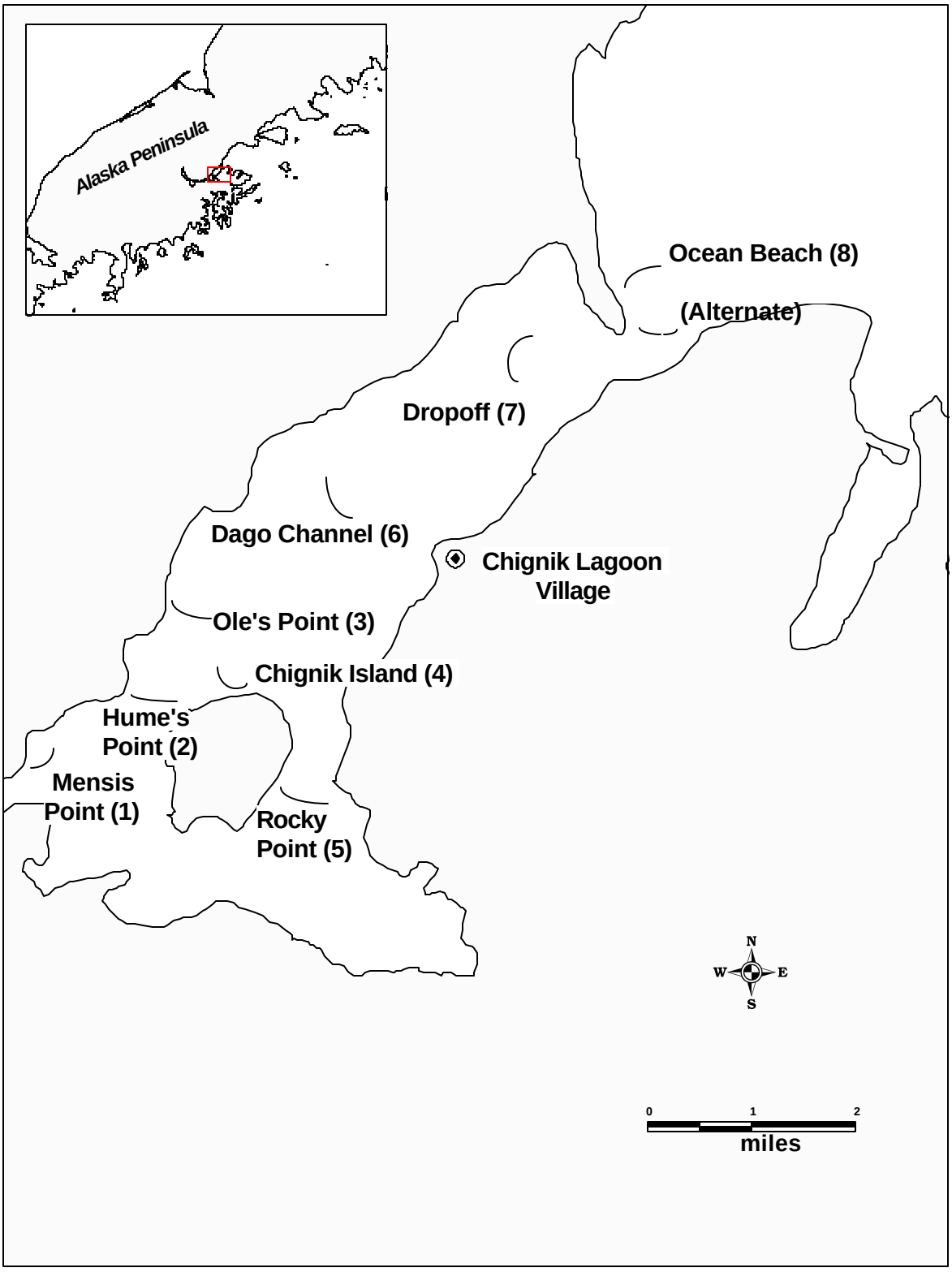


Figure 1. Chignik Lagoon test fishing locations.

CHIGNIK FIXED-LEADS MONITORING PROJECT
OPERATIONAL PLAN, 2003

By

Kenneth A. Bouwens

and

Kevin Clark

Alaska Department of Fish and Game
Division of Commercial Fisheries
211 Mission Road
Kodiak, AK 99615

May 2003

TABLE OF CONTENTS

	Page
LIST OF FIGURES	i
INTRODUCTION	1
GOAL	1
Objectives	1
Tasks	1
SUPERVISION	3
METHODS	3
Mapping	3
Photo Documentation	4
Video Documentation	5
Visual Monitoring	5
Birds	6
Mammals	6
Fish	6
CONFIDENTIALITY	7
REPORTING	7
SAFETY	7
FIGURES	8

LIST OF FIGURES

Figure		Page
1.	Map of the Chignik River watershed	8
2.	Chignik leads monitoring form	9

INTRODUCTION

Sockeye salmon *Oncorhynchus nerka* is the most economically important commercial salmon species in the Chignik Management Area (CMA). The Chignik River watershed is the primary sockeye salmon producer in the CMA (Figure 1). In January of 2002, the Alaska Board of Fisheries (BOF) approved a management plan to allow a cooperative fishery in the CMA. The goals of this plan were to increase product quality while decreasing harvesting costs to the fishermen. In December of 2002 the BOF revisited the Chignik Cooperative Fishery Management Plan after its first season of operation. The BOF approved the use of fixed leads by the cooperative fleet slightly upstream of the Mensis Point markers in the upper Chignik Lagoon/Lower Chignik River (in the area known as Pillar Rock) to further increase harvesting efficiency.

GOAL

The goal of this project is to assess potential impacts of fixed leads and commercial fishing activities in the area of Pillar Rock.

Objectives

1) Map the area from the location known as the jaws (about ½ mile upstream from Pillar Rock) to the Mensis Point markers.
2) Photo document changes in habitat in the area around the leads.
3) Video document fishing activity around the leads.
4) Visually monitor and record the interactions of local biota with the leads and associated fishing activity at Pillar Rock.
5) Summarize the data in a report.

Tasks

Objective #1 - Map the area from the location known as the jaws (about ½ mile upstream from Pillar Rock) to the Mensis Point markers.

1) Take Global Positioning System (GPS) readings around the perimeter of the lagoon/river in the area.

2) Using aerial photography and ground surveys, map the substrate in the area and classify as mud, sand, gravel, cobble, eelgrass, etc.

3) Combine GPS, substrate, and aerial photography data onto a map.

Objective #2 - Photo document changes in habitat in the area around the leads.

1) Identify three separate monitoring stations, one at the leads site, one at the Mensis Point markers, and one in a similar habitat in the Chignik River/Lagoon located far enough upstream from the leads to ensure the fishing activity at the leads is not impacting the habitat.

2) Take standardized photographs at low tide at each location every week.

3) Take standardized aerial photographs of the same monitoring stations every two weeks.

4) Opportunistically photograph other relevant interactions or habitat changes.

Objective #3- Video document fishing activity around the leads.

1) Document, with a video camera, fishing activities at the leads often enough to sufficiently describe the typical fishing patterns at the leads.

2) Document, with a video camera, fishing activity at locations away from the leads often enough to sufficiently describe traditional fishing patterns at Chignik.

3) Document, with a video camera, the leads at different tide stages and at different times of the season (in conjunction with Objective #4).

4) Opportunistically document, with a video camera, other relevant interactions or habitat changes.

5) Document, with a video camera, the physical interactions of the leads with the environment (e.g., debris collection, tide changes, etc.).

Objective #4 - Visually monitor and record the interactions of local biota with the leads and associated fishing activity at Pillar Rock.

1) Establish a monitoring station at the leads site, including a finite area around the leads, to observe wildlife interactions with the leads.

2) Establish a sampling design to visually monitor the area, considering fishing activity, time of day, and tide.

3) Weekly, (or more often, if necessary) walk the leads at low tide to observe potential entanglement of fish, birds, and mammals in the leads.

Objective #5 - Summarize the data in a report.

1) The Project and Co-Project Biologists will author a report summarizing the data collected as part of this project.
2) The target completion date of this report is November 2003.

SUPERVISION

Project Biologist:	Ken Bouwens – Fisheries Biologist II
Co-Project Biologist:	Kevin Clark – Fisheries Biologist II
Field Biologist:	Heather Finkle– Fisheries Biologist I
Field Biologist:	Eric Newland - Fisheries Biologist I

The Project Biologists will oversee the study, and provide logistical and technical support. Kevin Clark will oversee the monitoring portion of the study. Heather Finkle will oversee the photo- and video documentation portion of the study. Eric Newland will oversee the mapping of the area. Ken Bouwens will take the lead in drafting the report. All project members will work as a team to complete the project's goal. Technical or policy questions will be directed to the Project Biologists. George Pappas, Chignik Area Management Biologist, oversees and is responsible for all ADF&G operations at Chignik.

METHODS

Mapping

A comprehensive habitat map is not available for the area of the upper Chignik Lagoon and the Lower Chignik River. This portion of the project is designed to create such a map.

A base map will be created using GPS technology. The perimeter of the lower Chignik River and upper Chignik Lagoon will mapped. The high tide line (as indicated by the debris line) will be walked from the area known as the "jaws" to the commercial fishing markers at Mensis Point on both banks. GPS readings will be taken using a hand-held GPS unit and recorded in a field notebook every 20 m or closer if a change in direction is necessary.

The benthic habitat (substrate) of the area will also be determined and added to the map. Aerial photographs will be taken at low tide and compared to observations and measurements taken on the ground. The substrate will be classified into the following categories:

- Bedrock outcropping – Large, solid rock
- Boulder – Greater than 256 mm in diameter
- Cobble – 64 to 256 mm in diameter
- Pebble – 4 to 64 mm in diameter
- Granule - 2 to 4 mm in diameter
- Sand – 0.06 to 4 mm in diameter

- Mud – Less than 0.06 mm in diameter (silt and clay)

In addition, the epiphytic vegetation type of the area will also be described and mapped. Aerial photographs will be taken at low tide and compared to observations and measurements taken on the ground. Vegetation will be classified into the following categories:

- *Zostera sp*. – Eelgrasses
- Other vascular plants
- Brown algae – Kelps
- Green Algae
- Red Algae

The GPS readings along with the substrate and vegetation data will be entered into Geographic Information System (GIS) software to create a map of the area.

Photo Documentation

Changes in the habitat in the area around the leads will be photographed and compared to locations that are not impacted by fishing activity. Three separate monitoring stations will be identified. One monitoring site will be located at the leads site. This location is defined as an area 15 m downstream to 15 m upstream of the leads across the entire river. The other monitoring site will be located downstream of the leads at the Mensis Point markers. These markers were the upstream most markers in past years and will continue to serve as the upstream most markers for the competitive fleet in 2003. The third area, identified in the field, will be located a short distance upstream of the leads. The habitat in this area should be very similar to the area where the leads are located, but not directly impacted by commercial fishing activities.

Weekly, at low tide, digital photographs will be taken of the benthic habitat of all three locations. The area photographed at each location will be consistent between weeks so that comparisons can be made through time. The specific dates the photographs are taken will be contingent upon photographing the lowest tides possible.

Every two weeks, standardized aerial photographs will be taken of the same three monitoring stations. These photographs will also be taken at the lowest tides possible.

Other relevant images will also be photographed as part of this project. Some examples of relevant images include wildlife interactions with the leads, fishing activity at and away from the leads, and unexpected habitat impacts either at or away from the leads.

A systematic file naming convention will be used to store the digital images. The file names will begin with CL, the next four digits will be the date, and the next two digits will be the chronological photo number for that day. The digit groups will be separated by an underscore (_). For example, if four photographs are taken on June 1, then the first will be named CL_0601_001 and the next will be named CL_0601_002, and so on. The first photograph on June 2 will be named CL_0602_001. A photo log listing the file names, dates and times the photographs were taken, the subjects or locations, and the photographers will be kept and

updated daily. The digital images will be transferred from the 3 ½" floppy disk in the camera (they corrupt easily) to a hard drive or Zip disk as soon as possible.

Video Documentation

Relevant activities will also be videotaped. Fishing activities at the leads will be videotaped to sufficiently describe the typical fishing patterns at the leads. Fishing activity at locations away from the leads (both cooperative and traditional fleets) will be videotaped to sufficiently describe the fishing patterns in Chignik Lagoon.

The physical interactions of the leads with the environment (e.g., debris collection, tidal changes, etc.) will also be videotaped at different tide stages and at different times of the season. Other relevant images will also be videotaped. Some examples of relevant images include wildlife interactions with the leads or unexpected habitat impacts either at or away from the leads.

A systematic convention will be used to archive videotape data. The date, time, location, and observer will be verbally stated on the videotape at the beginning of each video session. The Super 8 tape will be transferred to VHS tape as soon as possible. The date and time function on the video camera will be turned on so that these attributes are recorded on the image. A video log listing the counter number on the tape, the dates and times the footage was taken, the subjects or locations, and the photographers will be kept and updated daily.

Visual Monitoring

A monitoring station will be established at the shoreward terminal ends of the leads. The study area will be defined as a three-dimensional space with a horizontal component measuring 15m from both the upstream and downstream sides of the lead and vertically 15 m above the lead. The horizontal boundaries of the study area will be marked with flagging tape.

ADF&G technicians will monitor leads study area on a predetermined schedule. The study area will be monitored for two 45-minute periods per day in June, one 45-minute period per every other day in July, and one 45-minute period per day in August. The specific times of the day the leads will be monitored will be semi-randomly drawn from the hours between 6:00 AM and 10:00 PM; the hours corresponding with the higher tidal stages will be twice as likely to be monitored than the hours corresponding with the lower tidal stages.

Information collected will include climatic conditions, fishing activity, wildlife interactions (both active and passive), and possible habitat changes. This information will be recorded on the *Chignik Leads Monitoring Form* (Figure 2) and backed up utilizing digital cameras and videotape as necessary. These data will be recorded regardless of the actual presence of leads to quantify the possible effects of the leads on wildlife behaviors.

All wildlife interactions with the leads will be recorded by species when possible. Difficulties in identifying birds may require the grouping of some species. Birds not identified to species should be grouped as follows:

- Loons
- Dabbling Ducks
- Diving Ducks
- Falcons
- Shorebirds
- Gulls
- Swallows
- Songbirds

The leads will be physically checked at low tide on a weekly basis to look for and identify entangled wildlife. Consistent terms will be used when describing the behavior of wildlife and are defined as follows:

Birds

- **"Passing Through"** - when a bird is flying over and through the monitoring area.
- **"Near the Lead"** - when a bird is on the water surface in the monitoring area.
- **"Feeding"** - when a bird is actively feeding within the monitoring area, from the water surface or air. Brief notes will be kept on these interactions and video or photographs should be taken.
- **"Entangled"** - when a bird that is in physical contact with the lead and delayed because of interaction with the lead. Detailed notes on "Entangled" birds will be kept describing the degree of entanglement and the result of the entanglement and video or photographs should be taken. Any observed bird mortality caused by interaction with the lead will be collected for species verification.

Mammals

- **"Near the Lead"** - when a mammal is located within the monitoring area.
- **"Feeding"** - when a mammal is observed to be actively feeding within the monitoring area. Detailed notes on "feeding" mammals should be taken and video or photographs should be taken.
- **"Entangled"** - when a mammal is in contact with the lead and delayed for any time by the interaction with the lead. Detailed notes on "entangled" mammals should be taken and video or photographs should be taken. The carcass of any mammal mortality caused by interaction with the lead will be collected if possible.

Fish

- **"Holding"** - when fish are slowed or their upstream migration is stopped within the monitoring area.
- **"Entangled"** - when a fish is in contact with the lead and delayed for any time by the interaction with the lead. Detailed notes on "entangled" fish should be taken and video or photographs should be taken. Any fish mortality caused by interaction with the lead will be noted and collected, if practical.

CONFIDENTIALITY

Due to the sensitive nature of some of the data that will be collected as part of this project, all data collected will be considered confidential until published as a final report. Any questions regarding confidentiality rules will be directed to Regional Supervisory Staff.

REPORTING

Daily, a copy of the completed *Chignik Leads Monitoring Form* will be faxed to the Regional office at 486-1841 attn: Ken Bouwens, followed up with an explanatory E-mail. A final report will be compiled and published by November 2003.

SAFETY

Safety will be the highest priority of this project. State safety regulations and Standard Operating Procedures (SOP) will be followed at all times. All staff are personally responsible for assessing unsafe situations and will exercise caution when weighing safety issues. Employees may be subject to disciplinary action without warning, including termination, for noncompliance to State safety regulations.

Employees are expected to review the following SOPs before beginning work:

111-700 Safety Policies and Standards;
111-710 Office/Warehouse Safety;
111-720 Field Camp Safety;
111-730 Aircraft Safety for Passengers;
111-740 Boating Safety;
111-750 Vehicle Safety;
111-760 Laboratory Safety;
111-780 Firearm/Bear Safety.

In addition, all employees are expected to hold a current American Red Cross First Aid/CPR certification. The department will hold First Aid/CPR classes in Kodiak prior to the field season; if the employee is unable to attend the classes in Kodiak, obtaining the proper instruction will be the employee's responsibility.

A U.S. Coast Guard approved personal flotation device will be worn at all times while boating. A hand-held VHF radio and shotgun loaded with slugs will be carried to the monitoring site.

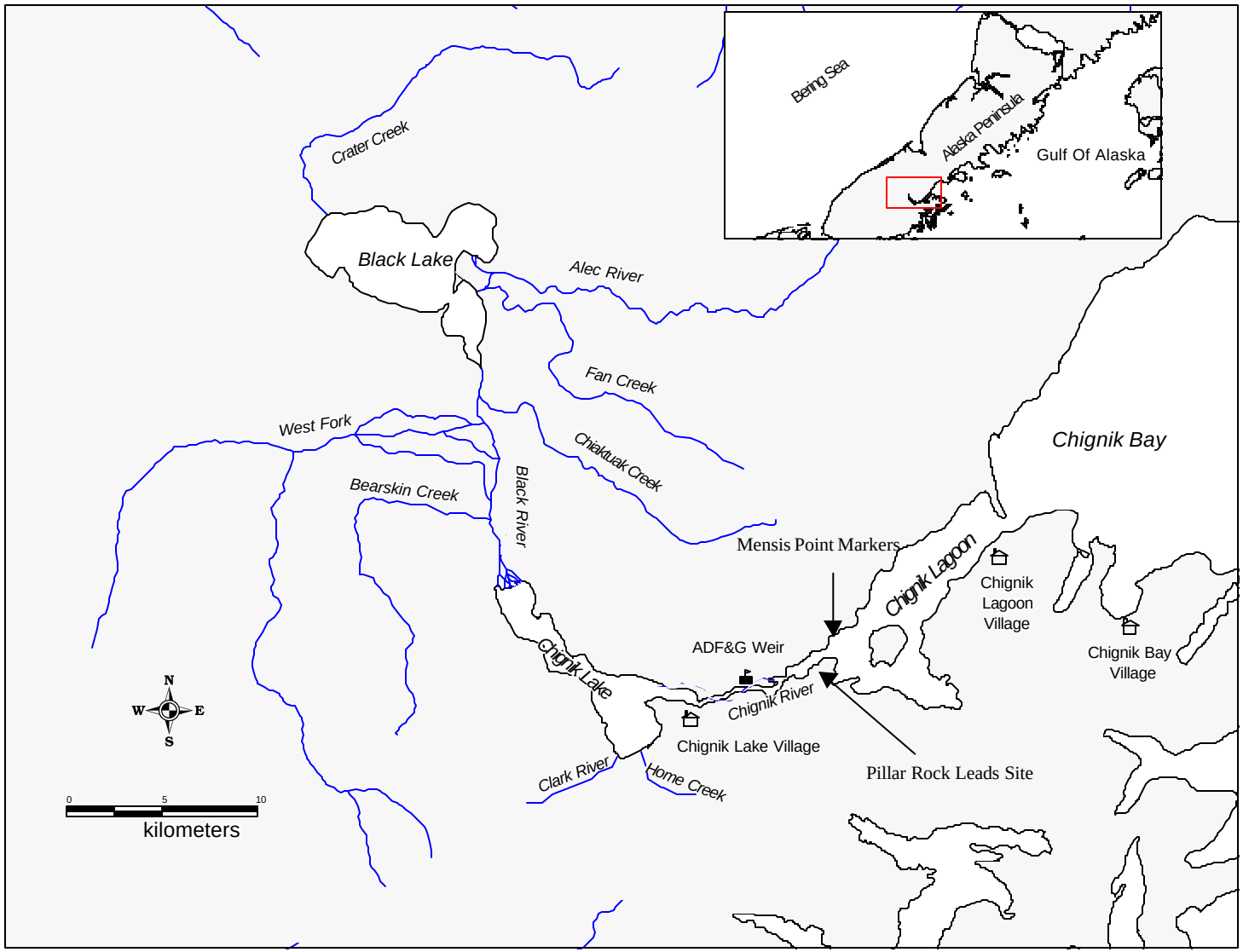


Figure 1. Map of the Chignik River watershed.

Chignik Leads Monitoring Form

Date: **Tide Status:** **Kod High:** **Kod Low:** **Initials:**

Wind		**Sky**		**Time Start:**
Direction:	Velocity:	% Cover:	Elevation:	**Time Stop:**

Fishing Activity

Boat Name	# Hauls	Catch/Haul

Comments:

Barrier Seine Entanglement

Fish		Birds		Other	
Species	Number	Species	Number	Species	Number

Comments:

** Only complete this box if you physically examined the leads**

Visual Monitoring

Birds

Species	Number	Behavior

Comments:

Mammals

Species	Number	Behavior

Comments:

Fish

Species	Number	Behavior

Comments:

Photos taken? _____
Photo File names: CL03- thru CL03-
Comments:

Specimens taken? _____
Tag # _____
Comments:

Figure 2. Chignik leads monitoring form.