

**Operational Plan: Sockeye Salmon Counting Towers,  
Bristol Bay, 2016**

by

**Charles Brazil**

and

**Paul Salomone**

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February 2016

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Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



## Symbols and Abbreviations

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Weights and measures (metric)		General		Mathematics, statistics		
centimeter	cm	Alaska Administrative Code	AAC	all standard mathematical signs, symbols and abbreviations		
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	alternate hypothesis	H <sub>A</sub>	
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	base of natural logarithm	<i>e</i>	
hectare	ha			catch per unit effort	CPUE	
kilogram	kg			coefficient of variation	CV	
kilometer	km	at compass directions:	@	common test statistics	(F, t, $\chi^2$ , etc.)	
liter	L			confidence interval	CI	
meter	m			correlation coefficient (multiple)	R	
milliliter	mL	east	E	correlation coefficient (simple)	r	
millimeter	mm	north	N	covariance	cov	
Weights and measures (English)		south	S	degree (angular )	°	
	cubic feet per second	ft³/s	west	degrees of freedom	df	
	foot	ft	copyright	expected value	<i>E</i>	
	gallon	gal	corporate suffixes:	greater than	>	
	inch	in	Company	greater than or equal to	≥	
	mile	mi	Corporation	harvest per unit effort	HPUE	
	nautical mile	nmi	Incorporated	less than	<	
	ounce	oz	Inc.	less than or equal to	≤	
	pound	lb	Ltd.	logarithm (natural)	ln	
	quart	qt	District of Columbia	D.C.	logarithm (base 10)	log
yard	yd	et alii (and others)	et al.	logarithm (specify base)	log <sub>2</sub> , etc.	
Time and temperature		et cetera (and so forth)	etc.	minute (angular)	'	
		exempli gratia		not significant	NS	
	day	d	(for example)	e.g.	null hypothesis	H <sub>0</sub>
	degrees Celsius	°C	Federal Information Code	FIC	percent	%
	degrees Fahrenheit	°F	id est (that is)	i.e.	probability	P
	degrees kelvin	K	latitude or longitude	lat. or long.	probability of a type I error (rejection of the null hypothesis when true)	$\alpha$
	hour	h	monetary symbols (U.S.)	\$, ¢	probability of a type II error (acceptance of the null hypothesis when false)	$\beta$
	minute	min	months (tables and figures): first three letters	Jan,...,Dec	second (angular)	"
	second	s	registered trademark	®	standard deviation	SD
	Physics and chemistry		trademark	™	standard error	SE
all atomic symbols			United States (adjective)	U.S.	variance	
alternating current		AC	United States of America (noun)	USA	population sample	Var
ampere		A	U.S.C.	United States Code		var
calorie		cal	U.S. state	use two-letter abbreviations (e.g., AK, WA)		
direct current		DC				
hertz		Hz				
horsepower		hp				
hydrogen ion activity (negative log of)		pH				
parts per million		ppm				
parts per thousand	ppt, ‰					
volts	V					
watts	W					

***REGIONAL OPERATIONAL PLAN CF.2A.2016.03***

**OPERATIONAL PLAN: SOCKEYE SALMON COUNTING TOWERS,  
BRISTOL BAY, 2016**

by

Charles Brazil and Paul Salomone

Alaska Department of Fish and Game  
Division of Commercial Fisheries, Publications Section  
333 Raspberry Rd, Anchorage, Alaska, 99518  
February 2016

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## Signature Page

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Plan Type: Category I

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## Approval

Title	Name	Signature	Date
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## PURPOSE

The Alaska Department of Fish and Game (ADF&G), Division of Commercial Fisheries, monitors annual escapements of sockeye *Oncorhynchus nerka* salmon returning the major drainages in Bristol Bay, Alaska. Tower counts, are used to develop escapement estimates of sockeye, Chinook *O. Tshawytscha*, chum *O. keta*, coho *O. kisutch*, and pink *O. gorbuscha* salmon into the Ugashik, Egegik, Naknek, Alagnak, Kvichak, Wood, Igushik, and Togiak rivers. Tower escapement estimates are used for inseason management of commercial fisheries in the Ugashik, Egegik, Naknek/Kvichak, Nushagak, and Togiak districts. Estimates of species composition, age, sex, and length, are derived from samples obtained with beach seines. This report provides operational guidelines for the Bristol Bay Counting Tower projects, estimation of salmon escapement, sampling procedures, and general camp policies.

Key words: Bristol Bay, Ugashik, Egegik, Naknek/Kvichak, Alagnak, Nushagak, Togiak districts, Pacific salmon, sockeye salmon, Chinook salmon, chum salmon, coho salmon, pink salmon, tower counts, beach seine, escapement, age composition, sex composition, fisheries management, operational plan

## BACKGROUND

The Bristol Bay Management Area of Alaska supports the largest sockeye salmon (*Oncorhynchus nerka*) fishery in the world and encompasses all waters east of a line from Cape Newenham to Cape Menshikof (Figure 1). Bristol Bay rivers producing major salmon runs include: Alagnak, Egegik, Igushik, Kvichak, Naknek, Nushagak, Nuyakuk, Togiak, Ugashik, and Wood.

Counting towers and associated sampling programs have been used to estimate sockeye salmon spawning escapements by age, sex, and length (ASL) in Bristol Bay since the early 1950s (Figure 1) and have a combined annual operating budget of approximately \$ 241,000 (from FY 16 blue book)(Table 1). When combined with commercial catch-at-age information, escapement data is used to append existing brood tables, which are used to determine spawning escapement goals and forecast future returns.

Prior to 1957, large weirs were installed by the United States Fish and Wildlife Service (USFWS) in the major drainages of Bristol Bay to count sockeye salmon escapements (Anderson 2000). These weir projects were very costly because they required large pieces of equipment, crews of up to a dozen seasonal employees, and supplies to feed and lodge these crews for the summer season. They were also difficult to maintain and subject to damage during high water flows.

After only a few years of operating weirs to estimate escapement, W.F. Thompson with the Fisheries Research Institute (FRI) of the University of Washington (FRI), proposed making visual counts of migrating salmon from observation towers (Thompson 1962). The initial experiment to count sockeye salmon from towers was conducted on the Wood River in 1953 and 1954. Counting towers were set up on the Kvichak River in 1955 and the Egegik River had towers in 1956. By 1957, sockeye escapements in a majority of the major river systems in Bristol Bay were being estimated with counting towers. There are 8 counting tower projects in Bristol Bay: Egegik, Kvichak, Alagnak, Naknek, and Ugashik rivers on the eastside, and Igushik, Togiak, and Wood rivers on the westside.

## OBJECTIVES

1. Estimate the number of adult sockeye salmon that pass into 8 major systems in Bristol Bay from mid-June to early August such that the escapement estimates are within +/- 5% of the true value 95% of the time.

2. Estimate the sex compositions of the escapements of adult sockeye salmon to 8 major systems in Bristol Bay such that all estimates are within +/- 10% of the true value 95% of the time.
3. Estimate the mean length by age of the escapements of sockeye salmon into 8 major systems such that the estimates are within +/- 10% of the true value 95% of the time.
4. Estimate the proportion of each of the major age classes in each of the 8 major systems to within 5% of the true proportion 90% of the time.

Additional tasks to be accomplished:

- a. Collect weather observations (water and air temperature, precipitation, water clarity, etc.) on a daily basis at each of the tower sites.

## **METHODS**

### **ESCAPEMENT ESTIMATION**

#### **Study Site**

All tower sites are located near the outlet of rearing lakes (see Figure 1). A detailed site description for each tower project is outlined in Anderson (2000). GPS (Global Positioning System) coordinates for each tower are presented in Table 2.

#### **Equipment**

Aluminum scaffold towers will be erected on each river bank (Left and Right) at each tower site. Left and right bank is determined when facing downstream. Several counting aids will be used to assist the tower personnel in getting an accurate escapement estimate. Artificial substrates of metal grating painted gray or white will be positioned on the river bottom to aid in silhouetting and deflecting fish closer to shore. "Riffle dampeners" will be deployed to smooth the water surface during windy conditions. A standard white automobile headlight powered by a 12 volt battery will be placed atop each tower to aid in night counts. Specific equipment design and setup is outlined in Anderson (2000) and Tilly.<sup>1</sup> Additional site and equipment specific information is also found in each project's "Field Camp Manual" three-ring binder that is taken to the field camps each season.

#### **Enumeration**

Sockeye salmon escapement estimates will be based on visual counts made from counting towers on the banks of the Egegik, Igushik, Kvichak, Naknek, Alagnak, Togiak, Ugashik, and Wood rivers. A three-person crew will work at each tower project with each crewmember working an 8-hour counting shift so counts are conducted 24 hours a day. Counts occur for 10 minutes every hour on each riverbank. Counting begins on one bank at the start of each hour for 10 minutes, followed by counting on the opposite bank for another 10 minutes. Each 10-minute count is

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<sup>1</sup> Unpublished. Summary of instructions for Bristol Bay eastside tower projects, updated August 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

expanded into an hourly estimate (10-minute count times six) and summed to arrive at a total daily escapement estimate. Dates of counting by tower site are provided in Table 2.

### **Process Error**

This is the error associated with sampling. A systematic sampling design with a sampling rate of 0.167 (10 min out of every hour) will be used. Variance estimators based on random sampling which were used in early analyses (Becker 1962) are biased (Cockran 1977). More robust estimators of variances are based on overlapping differences in systematic counts (Wolter 1985). Reynolds et al. (2007) has shown, in simulations, that a 10 min count per hour sampling design with Wolter's (1985) V4 estimator to be the most efficient.

### **Age, Sex, and Length Compositions**

Age, sex, and length (ASL) data will be collected from sockeye salmon migrating past each tower site. This information is used by management and research biologists for: 1) forecasting returns, 2) setting desired escapement goals, 3) examining the productivity of each river system, 4) analyzing salmon growth, 5) estimating in-season run strength, 6) allocating catch based on age composition, and 7) better understanding the biology of each stock. The usefulness of ASL data depends on its accuracy.

Sample sizes are selected to ensure that with repeated sampling, each major age group (Objective 4) in each stratum will be estimated within 5% of its true value 90% of the time, based on Thompson's work (1987) on the "worst-case" parameter value for the multinomial distribution. Sample size goals for escapement data sets are 500 fish per time stratum and will be stratified into 2 or three proportional time periods, depending on historical run timing (Table 4). In general, ASL sampling will occur every other day. Samples from successive dates will be combined into the same time stratum when there are significant ( $\alpha = 0.05$ ) differences in age composition among consecutive dates. These sample sizes will allow for achievement of objective criteria associated with Objectives 2 and 3 as well.

### **CLIMATOLOGICAL DATA**

Weather observations of cloud cover, precipitation, air temperature, water temperature, wind direction and velocity, and water clarity will be recorded twice daily.

## **DATA COLLECTION**

### **ESCAPEMENT ESTIMATION**

#### **Enumeration**

Counting will begin at the start of each hour and last for 10 minutes. Next, the crewmember will travel to the other bank and count for an additional 10 minutes. As many as three hand tally counters will be used for each counting season; one to count sockeye salmon migrating upstream, one to count sockeye salmon moving downstream, and one to count other salmon species. An audible timer will be used to delineate counting intervals. Polarized glasses will be used during day counts to improve visibility through water surface glare.

Counts will be recorded in a Rite-In-the Rain® notebook in the field after each count and transferred to the Salmon Enumeration Log form at the end of each hour (Appendix A.1). In addition to sockeye salmon, visual counts of Chinook, chum, and pink salmon will be recorded

on the Salmon Enumeration Log form. Detailed weather conditions and other factors affecting the count will be recorded on the Salmon Enumeration Log. It is extremely important to provide a detailed description on the enumeration log if the crewmember believes they are missing fish because of weather conditions or if a count was missed. Examples of useful information to record are provided in see Tilly (unpublished).

Each tower will report the following information to ADF&G Offices in King Salmon and Dillingham up to 4 times daily:

1. Daily cumulative sockeye salmon tower count estimate through 0600, 1000, 1400, or 1800 hours, and daily and cumulative tower count estimate to date;
2. The number of sockeye salmon sampled for age, sex, and length compositions;
3. The number of male and female sockeye salmon in the ASL sample; and
4. Water temperature (measured at 0800 and 1800 hours).

Each crewmember is responsible for keeping an accurate log and double checking daily calculations before reporting to the area field office.

### **Measurement Error**

Paired tower count sample start and expected end dates are presented in Table 3. Both crewmembers will count from the same tower using the same audible timer. It is important that counts are done independently without each other's knowledge of fish counts. Each person will use a hand tally counter to conduct the count and record the data in a Rite-In-the Rain® notebook to be later transferred to the Paired Tower Count Log form (Appendix A.2). The counts from the crewmember starting their shift will also be recorded on the Salmon Enumeration Log form to be used for the daily escapement estimate. The Paired Tower Count Log form will be sent to King Salmon for processing at seasons end. The crew leader is responsible for making sure forms are filled out legibly and sent to the area office.

### **Age, Sex, and Length Compositions**

A 2-person crew will use a beach seine to catch live sockeye salmon to sample for age, sex, and length data. A "live box" will be used to hold the fish during sampling and fish are released after the data are collected. One crewmember determines sex and measures the fish while the other takes a fish scale and records the corresponding sex and length data.

One scale will be collected from the left side of the fish approximately 2 rows above the lateral line in the area crossed by a diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin (INPFC 1963; Appendix B.1). Scales will be mounted on gum cards, covered with wax paper after drying, and pressed under high pressure to keep from curling. Salmon will be measured to the nearest mm from the middle-of-the-eye to the fork-of-the-tail (Appendix B.1). External physical characteristics, such as kype development, or a protruding ovipositor will determine sex (Groot and Margolis 1991).

Corresponding sex and length data will be recorded in Rite-In-the Rain® notebooks or 8 ½" x 11" Mylar sheets while sampling and later transferred to standard age, sex, and length (ASL) version 2.1 mark-sense forms (Appendix B.1) or an MS Access database. Gum cards and ASL forms will be sent to King Salmon for aging on scheduled supply flights throughout the season.

The crew leader is responsible for ensuring ASL data are collected accurately and sent to the ADF&G field office for processing in a timely manner.

## **Climatological Data**

Weather data will be collected twice daily, at approximately 0800 and 2000. These observations will be recorded on the standard climatological and stream observation form BB-00-02 (Appendix B). Collection of climatological data is the responsibility of the crewmember that is on shift. It is the responsibility of the crew leader to make sure the data are recorded daily and accurately.

# **DATA REDUCTION AND ANALYSIS**

## **DATA COLLECTION**

### **Enumeration**

The 10 minute counts from each bank are summed to produce a cumulative daily total for each bank. Each cumulative total is summed to produce the total daily raw tower count. This count is multiplied by 6 to produce the daily escapement estimate. Individual hourly counts may also be multiplied by 6 and summed to verify escapement estimates. Each daily estimate is summed to produce the cumulative estimate for the year. The Salmon Enumeration Log forms will be periodically sent to King Salmon or Dillingham to be edited by the field camp coordinator and archived in each field office. Daily and hourly counts will be entered into an electronic database for use with age composition data to complete the total run tables.

### **Age, Sex, and Length Compositions**

Field crews will record sex and length data in a Rite-In-the-Rain® notebook or on Mylar sheets with an ASL form while sampling and later will transfer the data onto age, sex, and length (ASL) version 2.1 mark-sense forms (Appendix B.2) or an MS Access database. ASL sample sizes will be 500 per period. Mark-sense forms will be sent to King Salmon for processing. Cathy Tilly (Fish and Wildlife Tech III) will correct any errors and enter the ages on the forms. The mark-sense forms will be scanned into an electronic text file, and the resulting file will be archived on the Region II Commercial Fisheries network drive in a text file. A copy of the text file will also be maintained on the assistant research biologist's (Fred West) personal computer in the Anchorage office. The data will be entered into the Bristol Bay salmon database and processed to complete the total run tables.

Impressions of the gum cards will be made on cellulose acetate cards with a heated hydraulic press (Clutter and Whitesel 1956). Ages for sockeye salmon will be determined by examining the scale impressions formed in the cellulose acetates (Mosher 1968). European notation (e.g., 2.2; Koo 1962) will be used to record ages; numerals preceding the decimal refer to the number of freshwater annuli and numerals following the decimal refer to the number of marine annuli. Total age of the fish from the time of egg deposition equals the sum of these numbers plus one.

## **DATA ANALYSIS**

The basic sampling design is to estimate escapement by age, sex, and by period. There will be 2-3 periods and are defined for each tower site (Table 2).

Age and sex composition will be estimated as a series of proportions  $p_{ijt}$  defining a multinomial distribution for sockeye salmon. The marginal proportion will be estimated for each combination of age and sex along with estimates of the proportions' variance (Cochran 1977):

$$\hat{p}_{ijt} = n_{ijt} / n_t \quad (1)$$

$$Var(\hat{p}_{ijt}) = \frac{\hat{p}_{ijt}(1 - \hat{p}_{ijt})}{n_t - 1} \quad (2)$$

where,  $n_t$  is the number in the t-th period, sample and  $n_{ijt}$  the number in the t-th period sample of age  $i$  sex  $j$ .

Standard error of length by age, sex, and period of fish sampled in the escapement will be calculated as

$$se(\bar{\ell}_{ijt}) = \frac{1}{n_{ijt}} \sqrt{\frac{\sum_{k=1}^{n_{ijt}} (\ell_{ijk} - \bar{\ell}_{ijt})^2}{n_{ijt} - 1}} \quad (3)$$

where,  $\bar{\ell}_{ijt}$  = mean length for age  $i$ , sex  $j$ , and period  $t$ ,  $\ell_{ijk}$  = length of fish  $k$  of age  $i$ , sex  $j$ , and period  $t$ , and  $n_{ijt}$  = number of fish of age  $i$ , sex  $j$ , and period  $t$ .

Estimates of escapement ( $E_{bt}$ ) will be stratified by period (t) and by river bank (b):

$$\hat{E}_{bt} = \sum_{k=1}^{n_{bt}} 6Y_{btk} \quad (4)$$

where  $Y_{btk}$  = 10-minute count on bank  $b$  and time period  $t$  for hour  $k$ ,  $n_{bk}$  is total number of 10-minute-count occasions.

The between 10-minute count variance will be calculated based on Wolter's V5 estimator for systematic sampling scheme. This is the least biased and most efficient estimator for tower counting (Reynolds et al. 2007):

$$Var(\bar{Y}_{bt}) = \frac{(1-f)}{n_{bt}(3.5(n_{bt}-4))} \sum_{k=1}^{n_{bt}} \left( \frac{Y_{ibk}}{2} - Y_{ibk-1} + Y_{ibk-2} - Y_{ibk-3} + \frac{Y_{ibk-4}}{2} \right)^2 \quad (5)$$

where,  $f$  = sampling rate. We have:

$$Var(\hat{E}_{bt}) = Var\left(\sum_{k=1}^{n_{bt}} 6\bar{Y}_{bt}\right) = Var(6n_{bt}\bar{Y}_{bt}) = 36n_{bt}^2 Var(\bar{Y}_{bt}) \quad (6)$$

Age and sex composition will be used to apportion the t-th period escapement estimate into age and sex classes:

$$\hat{E}_{ijt} = \hat{p}_{ijt} \sum_{b=1}^2 \hat{E}_{bt} \quad (7)$$

The estimate and variance (Goodman 1960) of t-th period escapement by age and sex  $E_{ij}$  is

$$Var(\hat{E}_{ijt}) = \hat{p}_{ijt}^2 \sum_{b=1}^2 Var(\hat{E}_{bt}) + \left[ \sum_{b=1}^2 \hat{E}_{bt} \right]^2 Var(\hat{p}_{ijt}) - Var(\hat{p}_{ijt}) \sum_{b=1}^2 Var(\hat{E}_{bt}). \quad (19)$$

## CLIMATOLOGICAL DATA

Observations collected will be entered electronically and summarized in the annual Fishery Management Report Series.

## SCHEDULE AND DELIVERABLES

Individual tower project operation dates have varied over the years. Data collection from tower projects typically begins in mid-June and ends in early August. Data analysis will be completed by December 15 and the data will be archived by December 31. Information on daily and cumulative salmon passage will be communicated to fishery management staff on a daily basis. Age, sex, and length data will be forwarded to the ADF&G office in King Salmon weekly throughout the season for analysis. Data collected will be analyzed and reported in an annual Bristol Bay Area Management Report. Estimates of escapement by age and associated variances will be included in a triennial ADF&G peer reviewed Fishery Data Series Report.

## RESPONSIBILITIES

Travis Ellison, Area Management Biologist, Naknek-Kvichak District, Bristol Bay, ADF&G. Duties: Project manager. Oversee tower budgets on the eastside of Bristol Bay.

Paul Salomone, Area Management Biologist, Egegik and Ugashik districts, Bristol Bay, ADF&G. Duties: Project manager. Oversee hiring and supervise tower camp coordinator on the eastside of Bristol Bay.

Tim Sands, Area Management Biologist, Nushagak and Togiak districts, Bristol Bay, ADF&G. Duties: Project manager. Oversee tower budgets on the westside of Bristol Bay.

Matt Jones, Assistant Area Management Biologist, Nushagak and Togiak Districts, Bristol Bay, ADF&G. Duties: Project manager. Oversee hiring and supervise tower camp coordinator on the westside of Bristol Bay.

Jack Erickson, Regional Research Biologist, ADF&G. Duties: Review and approve tower project operational plan.

Charles Brazil, Bristol Bay Area Research Biologist, ADF&G. Duties: Assists in preparation of the project operational plan. Review and approve progress and final reports.

Fred West, Bristol Bay Assistant Area Research Biologist, ADF&G. Duties: Analyzes age, sex, length information for inclusion in the AMR and catch/escapement report.

Xinxian Zhang, Biometrician, ADF&G. Duties: Provide statistical supervision and assist in project design. Provide statistical review of data analysis. Provide biometric review of reports.

Tower Coordinator (East and Westside), Fish and Wildlife Tech III, ADF&G. Duties: Oversee daily operations of Bristol Bay tower projects. Maintain daily contact with the field crews and provide assistance and direction when needed. Facilitate tower deployments, operations, and terminations. Oversee daily reporting and summarization of data.

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## **TABLES AND FIGURES**

Table 1.– Counting tower project operating budgets, Bristol Bay, 2016.

Budget Line Items (thousands of dollars)							
Tower Location	Approximate dates of operation	100	200	300	400	500	Total
Alagnak River	6/19-7/22	80	10	20	17		127
Egegik River	6/16-7/18	61	0	4	3		68
Igushik River	6/19-7/24	46	0	2	2		50.5
Kvichak River	6/20-7/22	41	0.5	5	3.5		49.5
Naknek River	6/18-7/20	54.5	0	4.5	3.5		62.5
Togiak River	7/01-8/08	28	0	2	1.5		31.5
Ugashik River	6/26-7/24	43.5	0	7	2		52.5
Wood River	6/15-7/19	40	0.5	2	3.5		46
Total		314	1	26.5	19		360.5

Table 2.– Location of tower projects, Bristol Bay, 2016.

Tower Project		Riverbank <sup>b</sup>	GPS <sup>a</sup> Coordinates	
			Latitude	Longitude
Alagnak River	<sup>c</sup>	Left	N 59° 04.418'	W 156° 29.291'
		Right	N 59° 04.410'	W 156° 29.369'
Egegik River		Left	N 58° 03.583'	W 156° 53.255'
		Right	N 58° 03.522'	W 156° 53.239'
Igushik River		Left	N 59° 02.744'	W 159° 16.026'
		Right	N 59° 02.705'	W 159° 16.069'
		ASL Sampling Site	N 59° 02.846'	W 159° 16.225'
Kvichak River		Left	N 59° 19.13'	W 155° 55.09'
		Right	N 59° 19.36'	W 155° 55.05'
Naknek River		Left	N 58° 36.375'	W 156° 29.969'
		Right	N 58° 37.014'	W 156° 30.050'
Nuyakuk River	<sup>c</sup>	Left	N 59° 52.914'	W 157° 33.593'
		Right	N 59° 52.913'	W 157° 33.745'
		ASL Sampling Site	N 59° 52.914'	W 157° 33.593'
Togiak River		Left	N 59° 31.831'	W 159° 42.635'
		Right	N 59° 31.859'	W 159° 42.701'
		ASL Sampling Site	N 59° 31.873'	W 159° 42.541'
Ugashik River		Left	N 57° 33.854'	W 157° 00.063'
		Right	N 57° 33.860'	W 157° 00.022'
Wood River		Left	N 59° 16.256'	W 158° 34.834'
		Right	N 59° 16.268'	W 158° 35.033'
		ASL Sampling Site	N 59° 16.207'	W 158° 34.902'

<sup>a</sup> GPS = Global positioning System. GPS coordinates are generally considered accurate to 17 meters.

<sup>b</sup> Left and right bank as facing downstream.

<sup>c</sup> Tower project terminated due to budget shortfalls.

Table 3.–Paired tower count dates, Bristol Bay, 2016.

Tower Project	Project start date <sup>a</sup>	Project end date <sup>b</sup>	Total days	Expected # of paired counts <sup>c</sup>
Alagnak River <sup>d</sup>	6/19	7/22	34	78
Egegik River	6/16	7/18	33	108
Igushik River <sup>e</sup>	6/19	7/24	36	108
Kvichak River	6/20	7/22	31	102
Naknek River	6/18	7/20	33	108
Togiak River <sup>e</sup>	7/1	8/8	39	114
Ugashik River	6/26	7/24	29	78
Wood River	6/15	7/19	35	102

<sup>a</sup> Paired counts takes place at the beginning of the season.

<sup>b</sup> Project end dates are finalized inseason. When tower counts are less than 1% of the total escapement for 3-consecutive days the project is terminated.

<sup>c</sup> Number of samples based on 6 paired tower count samples per day (2 at every shift change).

<sup>d</sup> Tower project no longer operated due to budget shortfalls.

<sup>e</sup> Tower project likely to be discontinued in 2016 as a result of budget short falls.

Table 4.–Age, sex, and length sampling goals for the tower projects, Bristol Bay, 2016.

River System <sup>a</sup>	Number of strata	Sampling goal per strata	Total sample
Alagnak <sup>b</sup>	3	500	1,500
Egegik <sup>c</sup>	3	500	1,500
Igushik <sup>b</sup>	2	500	1,000
Kvichak <sup>c</sup>	3	500	1,500
Naknek <sup>d</sup>	3	500	1,500
Nuyakuk <sup>f</sup>	2	500	1,000
Togiak <sup>b</sup>	2	500	1,000
Ugashik <sup>d</sup>	3	500	1,500
Wood <sup>d</sup>	3	500	1,500

<sup>a</sup> Sampling Strategies do not have to be strictly followed.

<sup>b</sup> Do not sample if daily passage is < 2,000 fish.

<sup>c</sup> Do not sample if daily passage is < 10,000 fish.

<sup>d</sup> Do not sample if daily passage is < 5,000 fish.

<sup>e</sup> Do not sample if daily passage is < 1,000 fish.

<sup>f</sup> Tower project terminated due to budget shortfalls.



Figure 1.—Major river systems, escapement enumeration projects, and commercial fishing districts.

## **APPENDIX A: EXAMPLE LOG FORMS**

Appendix A1.-Example completed Salmon Enumeration Log Form.

BB-CF/403

ALASKA DEPARTMENT OF FISH AND GAME  
DIVISION OF COMMERCIAL FISHERIES

-Salmon Enumeration Log-

Location: Wood River

Date: 06/24/04

ACTUAL COUNT - LEFT BANK  
(facing downstream)

ACTUAL COUNT - RIGHT BANK  
(facing downstream)

Time	Reds	Kings	Chums	Pinks	Obsv. Init.	Reds	Kings	Chums	Pinks
00-01	275				AS	18			
01-02	53					12			
02-03	40					52			
03-04	36					79			
04-05	20				AS	54			
05-06	64					179			
06-07	81					74			
07-08	88					212			
08-09	119				JW	136			
09-10	232					116			
10-11	112					50			
11-12	306					323			
12-13	63				JW	324			
13-14	84					0			
14-15	103					6			
15-16	5					180			
16-17	20				DM	196			
17-18	50					240			
18-19	101					136			
19-20	149					104			
20-21	49				DM	29			
21-22	196					76			
22-23	63					67			
23-24	97					0			
Totals	2406					2663			

	Reds	Kings	Chums	Pinks
(1.) Actual daily count - L + R bank	5069			
(2.) Factor*	x 6			
(3.) Estimated daily total (line 2x1)	30,414			
(4.) Previous days cumulative total	151,392			
(5.) Cumulative total	181,806			

(\* Factor = 1/fraction of hour during which fish were counted)

Remarks (Factors influencing counting):  $6:00 \text{ LB } 569 + \text{RB } 468 = 1037 \times 6 = 6222$   
 $10:00 \text{ LB } 1120 + \text{RB } 982 = 2102 \times 6 = 12612$   
 $14:00 \text{ LB } 1676 + \text{RB } 1635 = 3311 \times 6 = 19866$   
 $18:00 \text{ LB } 1852 + \text{RB } 2387 = 4239 \times 6 = 25434$   
 Daily  $\text{LB } 2406 + \text{RB } 2663 = 5069 \times 6 = 30,414$



ALASKA DEPARTMENT OF FISH AND GAME  
DIVISION OF COMMERCIAL FISHERIES

Project: Naknek Tower

Year: 2005

[illegible]

17



## **APPENDIX B: AGE, SEX, LENGTH SAMPLING PROCEDURE MANUAL**

***Procedures for Sampling Salmon Age, Sex, and Length  
(ASL) Data with Mark-Sense Forms in Bristol Bay***



## INTRODUCTION

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

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

*SCALE SAMPLE* - A data set collected from a specific sampling location, containing scales and data from a single species, collected during a single year from fish caught using the same fishing gear. All data forms and scale cards of a single SAMPLE have the same statistical code. Age-Sex-Length (ASL) and scale card numbers in a sample are consecutively and chronically ordered.

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

**To be useful, data must be recorded on the mark-sense forms neatly and accurately.** Please adhere to the following procedures when sampling fish for length, sex, and age using mark-sense ASL forms.

## COMPLETING THE FORMS

A completed mark-sense ASL form and accompanying scale gum card for sampling commercial or escapement catches of sockeye and chum salmon are shown in Appendix B—Figure 1. A completed ASL form and accompanying scale gum cards for sampling commercial or escapement catches of chinook and coho salmon is shown in Appendix B—Figure 2.

### Mark-Sense Form

Complete each section of the left side of the mark-sense form using a soft No. 1 or 2 pencil and darken the corresponding ovals as shown in the figures. Make every effort to **darken the entire oval** because the optical scanner, which reads and records the data from the mark-sense ASL forms, will often miss partially filled ovals. Label only one form at time to avoid "the carbon paper effect" and resulting stray marks. It is paramount to keep the mark-sense forms flat, dry, and clean. Fish gurry and water curling will cause data to be misinterpreted by the optical scanning reader machine. The following is a description pertaining to each field on the mark-sense form.

#### Description:

1. For commercial catch sampling: Species/District-Subdistrict/Comm Catch
2. For escapement sampling: Species/Location/Capture Method/Esc

Note: Write out the species completely using American Fisheries Society (AFS) standards listed on the reverse of the ASL form.

**Card:**

The ASL forms and corresponding scale gum cards are numbered sequentially by date throughout the season starting with 001. A separate numbering sequence will be used for each species, gear type, district, and geographic location. Consult your data notebook or supervisor for the current card number. Sockeye and chum salmon samples will have only 1 card per ASL form as shown in Appendix B–Figure 1. Coho and chinook samples will contain up to 4 cards per ASL form as shown in Appendix B–Figure 2.

**Species:**

Refer to the reverse side of the ASL form for the correct digit. (1-Chinook, 2-Sockeye, 3-Coho, 5-Chum)

**Day: Month: Year:**

In the Bristol Bay area, use the appropriate digits for the date the fish are caught; do not write the date the fish were sampled unless the catch date and the sampling date are the same.

**District:**

List only one district. Refer ASL form example for correct district, sub-district, stream, and location codes.

**Subdistrict:**

List a single subdistrict if it is known and all the fish sampled were from that single subdistrict. Leave blank if more than one subdistrict is involved or if the subdistrict is unknown. Subdistrict should be completed for all escapement samples.

**Stream:**

This field is used to designate individual rivers within a district and sub-district ( e.g. Kvichak and Alagnak rivers).

**Location:**

For catch sampling - list the port code to example.

For escapement sampling - use the tower/testfish code.

**Period:**

Not used in Bristol Bay. Leave blank.

**Project:**

Refer to the reverse side of the ASL form for the correct code. (1-Comm catch, 3-Esc (tower, weir, sonar) 5-Test fishing)

**Gear:**

Refer to the reverse side of the ASL form. (2-Beach Seine, 3-Drift Gillnet, 4-Set Gillnet)

**Mesh:**

Leave blank unless specifically instructed by supervisor to do otherwise.

**Type of Length Measurement:**

Use 2 (mid-eye to fork of tail) unless specifically instructed to do otherwise. Refer to Appendix B–Figure 3.

### **Number of Scales/Fish:**

Record the number of scales taken from each fish (e.g. one scale per sockeye or chum salmon and three scales per chinook or coho salmon).

### **Number of Cards:**

Mark 1 when sampling sockeye and chum salmon (Appendix B–Figure 1). Mark 1, 2, 3, or 4 when sampling chinook and coho salmon and write the card numbers perpendicular to the left of the fish number column as shown in Appendix B–Figure 2. Mark the number of cards that are actually included in the mark sense forms.

### **Sex:**

Mark the sex for each fish sampled. M is for male and F is for female.

### **Length:**

Record length by blackening the appropriate column on the data form. For fish under 999mm fill in the 100's, 10's and 1's with the corresponding value. If fish are over 999mm use the column directly following the sex column to record the 1,000's place.

### **Age Group:**

## **USED BY THE INDIVIDUAL AGING THE FISH**

### **Error Code:**

Mark an eight (8) in this field if the scale(s) was **not** taken from the preferred area. Mark a five (5) if the scale is missing on the gum card. The individual aging the fish also uses this field.

### **Weight:**

Commercial catch only. Weight data is recorded on the backside of the mark-sense form. escapement projects are not collecting weight data. Weight data should be recorded to the nearest 0.01 kilogram. There are 6 vertical columns for data on this form, however only the first 4 columns are used for weight data. From left to right,

1. The first column (with choices from 0 to 9) is for tens (10) of kilograms. If the weight of the fish is below 10 kilograms (most salmon other than chinook), you will mark the zero in the tens column.
2. The second column (with choices from 0 to 9) is for units (1) of kilograms.
3. The third column (with choices from 0 to 9) is the tenths (0.1) of kilograms.
4. The fourth column (with choices from 0 to 9) is for hundredths (0.01) of kilograms.

## **GUM CARD(S)**

Fill out the gum cards as shown in Appendix B–Figures 1-4.

### **Species:**

Write out completely (ie. Chinook, sockeye, etc).

**Locality:**

1. For catch sampling write down port followed by the word catch (ie. Egegik Catch)
2. For escapement sampling write the location followed by the abbreviation Esc. (ie. Naknek Tower Esc.)

**Stat Code: and Sampling date:**

Transfer the appropriate digits from the ASL form.

**Gear:**

Write out completely.

**Collector(s):**

Record the initials of all collectors.

**Remarks:**

List the processor name, tender name, and the period the fish were caught.

## **SAMPLING**

**GENERAL(processing plant)**

1. Sex the fish and darken M or F in the sex columns. Use external physical characteristics, such as kype development, or a protruding ovipositor to determine sex.
2. Measure all species' length in millimeters from the middle of the eye to the fork of the tail; refer to Appendix B—Figure 3. Record length by blackening the appropriate column blocks of the ASL form. Column 3 on the ASL form is used for fish over 999 millimeters long. Measure all species of salmon to the nearest millimeter. Handle fish gently- **Do not lift fish by the tail without supporting the rest of the body.** Lifting fish by only the tail will pop the backbone and break blood vessels along the spine, significantly lowering product quality.
3. Pluck the "preferred scale" from the fish using forceps. Remove all slime, grit, and skin from the scale by moistening and rubbing between fingers. The "preferred scale" is located on the left side of the fish, 2 rows above the lateral line on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin; refer to Appendix B—Figure 4. If the "preferred scale" is missing, select a scale within the preferred area on either the left or right side of the fish. If no scales are present in the "preferred area" on either the left or right side of the fish and sufficient numbers of fish are available for sampling, disregard the fish. If the number of fish is limited and scales are absent in the "preferred area": on both sides of the fish, sample a scale as close to the preferred area as possible.
4. Clean, moisten, and mount scale on gum card directly over number 1 as shown in Appendix B—Figure 4. The easiest way to moisten a clean scale is to lick it (if scales are not moistened properly, they will fall off the gum cards after the first pressing or sooner). The side of the scale facing up on the gum card should be the same side of the scale facing up when it was adhered to the fish. This outward facing side is referred to as the "sculptured" side of the scale. The ridges on this sculpture side can be felt with a fingernail



or forceps. There are no ridges on the opposite side so an inverted scale cannot be aged. **Make sure to orient all scales in the same direction when mounting on the gum card.** When scales are placed randomly on the gum card, aging becomes more difficult.

5. When sampling sockeye and chum salmon repeat steps 1 through 4 for up to 40 fish on each ASL form.
6. When taking 3 scales per fish as with Chinook and coho salmon sample the "preferred scale" and scale # 2 and scale # 3 as shown in Appendix B–Figure 4. Scale # 2 is one inch to the left of the "preferred scale", scale # 3 is located one inch to the right, and both are 2 rows above the lateral line. Mount the 3 scales from fish # 1 over 1, 11, and 21 on the gum card as shown in Appendix B–Figure 2. Continuing, mount the 3 scales from fish #2 over 2, 12, and 22, etc.
7. Cover the completed gum card with wax paper. If the gum card is very wet, it is best to let it dry as much as possible before covering loosely with the wax paper. After gum cards are dry, it helps to press them between some plywood or cardboard to prevent the cards from curling.
8. When sampling at an escapement project, use Rite-In-the-Rain® notebooks or Mylar sheets to record the data. Keep the mark-sense forms in camp where they will be clean, dry, and flat. After sampling is done for the day transfer the data to the mark-sense forms. It is the responsibility of the data collector to transcribe the data before turning it over to the supervisor.
9. General Reminders:
  - a) When scales are sampled in wet conditions it is difficult to mount scales in a fashion so as to result in a good scale impression being made. Glue often obscures scale features and scales frequently adhere poorly to the card. In this situation the scales should be remounted.
  - b) For adipose clipped fish record the head tag number on the corresponding row in the first 5 columns on the reverse side of the ASL.
  - c) Visually scan the form from 2 angles after the data has been recorded to pick up any glaring mistakes. A common error occurs, for instance, in placing both the 4 and 7 of a 475 mm fish in the 100's column with nothing in the 10's column.
  - d) Keep all fish gurry off forms and erase any stray marks on the forms before turning them in to your supervisor.
  - e) Write in all comments explicitly and completely under remarks.
  - f) Responsibility for accuracy lies first with the primary data collector(s). The crew leader will return sloppy or incomplete data to individual collectors.

## **SAMPLING SCENARIOS:**

### **1. Differing size crews:**

#### **a) One person:**

Wrestle the fish onto the measuring board, wearing a glove on one hand. Measure the fish and write the sex and length down on the measuring board to be transferred to the ASL after 10 fish have been measured. Next, pluck the preferred scale(s), clean, and mount on the gum card that is taped to the ASL in the clipboard that is sitting on the end of the measuring board. After 10 fish

have been processed, remove the glove and record the sexes and lengths on the ASL with your clean hand. A slime rag may be helpful.

b) 2 persons:

- 1) When sampling one scale per fish, one person wrestles the fish while the other plucks the scales and records the data.
- 2) When sampling more than one scale per fish one person can wrestle the fish and record data while the other plucks and mounts scales. The wrestler needs to wear a glove that he can slip off his writing hand to record the sex and length data on the ASL form.

c) Three persons:

One person wrestles the fish, one plucks and mounts the scales, and the third records the data.

2. Sampling tote to tote:

- a) When sampling for 3 scales per fish (Chinook and coho) use 2 persons.
- b) When sampling for 1 scale per fish (sockeye and chum) use three persons.

3. Sampling on a table connected to a vat:

Use three people for one scale per fish; one recorder, one wrestler, and one plucker. The wrestler lays out and measures 10 fish at a time. The plucker samples these 10 fish, placing the scales on his fingers in a systematic manner before cleaning and mounting them on the gum card.

## SCALE SAMPLING CHECKLIST

Clipboard	Wax paper inserts
Gum Cards	Gloves
AWL's	Measuring board or tape
Pencils (No. 1)	Sampling Manual
Forceps	
Write-In-the-Rain notebook or Mylar sheets	

## REMEMBER

### DO'S

- 1) Do - Carefully and completely label each gum card and its corresponding ASL form.
- 2) Do - Number gum cards and ASL's sequentially throughout the season for each sampling location (port, river, lake) for each species.
- 3) Do - Take the preferred scale if available.
- 4) Do - Clean the scale thoroughly before mounting.
- 5) Do - Mount scales sculptured side up in straight rows and columns.

- 6) Do - Carefully store and protect completed gum cards and ASL's.
- 7) Do - Remount rain-soaked or damaged gum cards.
- 8) Do - Transcribe all ASL data (including comments) onto mark- sense forms.

### **DON'TS**

- 1) Don't - Turn in messy mark-sense forms. Transcribe data if necessary.
- 2) Don't - Put scales from different locations, dates or species on one gum card.
- 3) Don't - Take scales from other than the preferred area.
- 4) Don't - Mount dirty or damaged scales.
- 5) Don't - Accept rides from strangers.

DESCRIPTION: *Egegik Dist Catch / Ocean Beauty / Lady Alaska* ADF&G ADULT SALMON AGE-LENGTH FORM VERSION 2.1

**CARD:**  
A  
021

**SPECIES:**  
2

**DAY:**  
23

**MONTH:**  
06

**YEAR:**  
04

**DISTRICT:**  
322

**SUBDISTRICT:**

**STREAM:**

**LOCATION:**

**PERIOD:**

**PROJECT:**  
1

**GEAR:**  
03

**MESH:**

**TYPE OF LENGTH MEASUREMENT:**  
2

**NUMBER SCALES/FISH:**  
1

**# OF CARDS:**  
1

#	SEX	100's	LENGTH	1's	AGE GROUP	AGE ERROR CODE
1	M	01	23	4	01	23
2	M	01	23	4	01	23
3	M	01	23	4	01	23
4	F	01	23	4	01	23
5	M	01	23	4	01	23
6	M	01	23	4	01	23
7	M	01	23	4	01	23
8	M	01	23	4	01	23
9	M	01	23	4	01	23
10	M	01	23	4	01	23
11	M	01	23	4	01	23
12	M	01	23	4	01	23
13	F	01	23	4	01	23
14	M	01	23	4	01	23
15	M	01	23	4	01	23
16	F	01	23	4	01	23
17	M	01	23	4	01	23
18	F	01	23	4	01	23
19	M	01	23	4	01	23
20	F	01	23	4	01	23
21	M	01	23	4	01	23
22	M	01	23	4	01	23
23	M	01	23	4	01	23
24	M	01	23	4	01	23
25	F	01	23	4	01	23
26	F	01	23	4	01	23
27	F	01	23	4	01	23
28	F	01	23	4	01	23
29	M	01	23	4	01	23
30	M	01	23	4	01	23
31	M	01	23	4	01	23
32	M	01	23	4	01	23
33	M	01	23	4	01	23
34	M	01	23	4	01	23
35	F	01	23	4	01	23
36	F	01	23	4	01	23
37	M	01	23	4	01	23
38	M	01	23	4	01	23
39	F	01	23	4	01	23
40	M	01	23	4	01	23

Species: *Sockeye* Card No: *021*

Locality: *Egegik*

Stat. Code: *322-00-000-000*

Sampling Date: Mo. *06* Day *23* Year *04*

Gear: *03*

Collector(s): *AR, LM*

Remarks: *OB, Lady Alaska*

Appendix B—Figure 1.—Standard Age Sex Length form and gum card for sampling one scale per fish.



DESCRIPTION: *Nush. Sonar Chinook*

ADF&G ADULT SALMON AGE-LENGTH FORM VERSION 2.1

CARD: *016-18*

SPECIES: *1*

DAY: *19*

MONTH: *6*

YEAR: *04*

DISTRICT: *325*

SUBDISTRICT: *30*

STREAM: *700*

LOCATION: *107*

PERIOD:

PROJECT: *3*

GEAR: *3*

MESH:

TYPE OF LENGTH MEASUREMENT: *2*

NUMBER SCALES/FISH: *3*

# OF CARDS: *3*

38259

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS AREA

SEX	100's	LENGTH	1's	AGE GROUP	AGE ERROR CODE
1	F	1	1	1	1
2	F	1	1	1	1
3	F	1	1	1	1
4	F	1	1	1	1
5	F	1	1	1	1
6	F	1	1	1	1
7	F	1	1	1	1
8	F	1	1	1	1
9	F	1	1	1	1
10	F	1	1	1	1
11	F	1	1	1	1
12	F	1	1	1	1
13	F	1	1	1	1
14	F	1	1	1	1
15	F	1	1	1	1
16	F	1	1	1	1
17	F	1	1	1	1
18	F	1	1	1	1
19	F	1	1	1	1
20	F	1	1	1	1
21	M	1	1	1	1
22	M	1	1	1	1
23	M	1	1	1	1
24	M	1	1	1	1
25	M	1	1	1	1
26	M	1	1	1	1
27	M	1	1	1	1
28	M	1	1	1	1
29	M	1	1	1	1
30	M	1	1	1	1
31	M	1	1	1	1
32	M	1	1	1	1
33	M	1	1	1	1
34	M	1	1	1	1
35	M	1	1	1	1
36	M	1	1	1	1
37	M	1	1	1	1
38	M	1	1	1	1
39	M	1	1	1	1
40	M	1	1	1	1

Species: *Chinook* Card No: *17*

Locality: *Nush. Sonar*

Start Date: *6-19-04* Day: *19* Year: *2004*

Sampling Date: *6-19-04* Day: *19* Year: *2004*

Gear: *3*

Collector(s): *17*

Remarks:

Species: *Chinook* Card No: *15*

Locality: *Nush. Sonar*

Start Date: *6-19-04* Day: *19* Year: *2004*

Sampling Date: *6-19-04* Day: *19* Year: *2004*

Gear: *3*

Collector(s): *15*

Remarks:

Species: *Chinook* Card No: *15*

Locality: *Nush. Sonar*

Start Date: *6-19-04* Day: *19* Year: *2004*

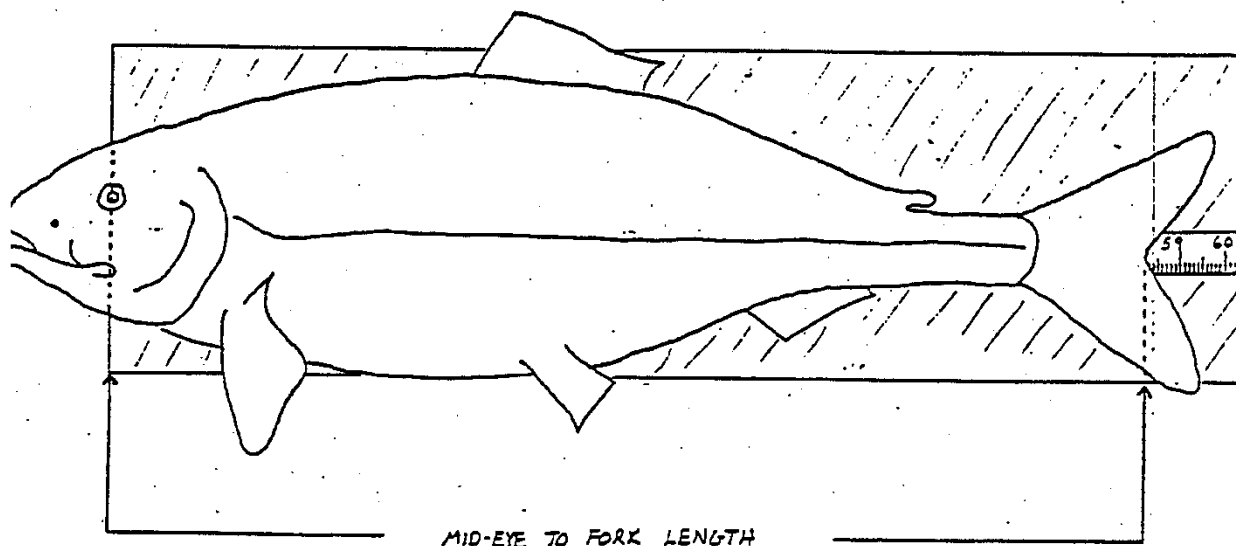
Sampling Date: *6-19-04* Day: *19* Year: *2004*

Gear: *3*

Collector(s): *15*

Remarks:

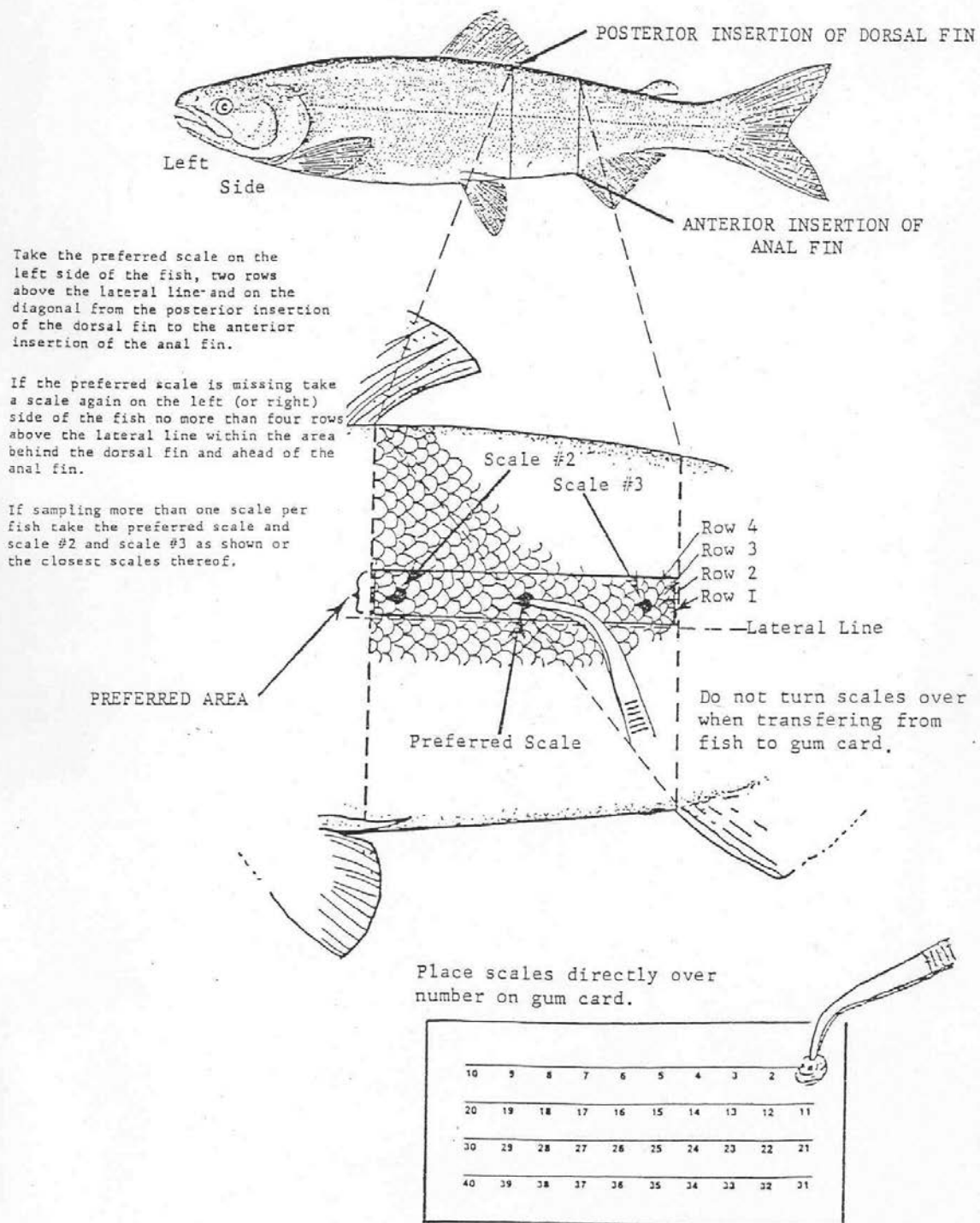
Appendix B—Figure 2.—Standard Age Sex Length form and gum cards for sampling three scales per fish.



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

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

Appendix B—Figure 3.—Measuring fish length.



Appendix B—Figure 4.—Scale sampling procedure showing the preferred area.

Appendix B–Table 1.–Bristol Bay District ASL sampling codes.

Description	Codes				Comments
	District	Sub District	Stream	Location	
<b>Catch</b>					
Shumagin Islands	282	00	000	150	South Peninsula
South Unimak - Ikatan Bay	284	90	000	050	South Peninsula
Cape Lazaref	285	20	000	050	South Peninsula
Cape Lutke	285	30,40	000	050	South Peninsula
Outer General District	320	05	000	000	
Northern General District	320	10	000	000	
Central General District	320	20	000	000	
Southern General District	320	30	000	000	
Ugashik Drift	321	00	000	000	
Ugashik Set	321	10 - 70	000	000	Sub-dist (10,20,30,40,50,60,70)
Ugashik Drift URSHA	321	05	000	000	
Ugashik Set URSHA	321	80	000	000	
Egegik Drift	322	00	000	000	
Egegik Set	322	10 - 70	000	000	Sub-dist (10,20,30,40,50,60,70)
Egegik River (SHA)	322	00	100	000	
Naknek-Kvichak District Drift	324	00	000	000	
Kvichak Section Drift	324	10	000	000	
Kvichak Section Set, NW marker to Copenhagen Cr.	324	11	000	000	
Kvichak Section Set, Copenhagen Cr. To SW marker	324	12	000	000	
Kvichak Section Set, Graveyard to Libbyville	324	13	000	000	
Naknek Section Drift	324	20	000	000	
Naknek Section Set, S. Naknek Pt. To Johnson Hill	324	21	000	000	
Naknek Section Set, Pederson Pt. To N Naknek Pt.	324	22	000	000	
Naknek Section Set, Libbyville to Pederson Pt.	324	23	000	000	
Naknek SHA Drift	324	25	000	000	USE
Naknek SHA Set	324	26	000	000	USE
Naknek SHA	324	20	600	000	DO NOT USE
Naknek (Margot Ck)	324	20	000	101	Special sampling location
Brooks (Up-A-Tree)	324	20	000	102	Special sampling location
Nushagak District Drift	325	00	000	302	
Igushik Section Set	325	11	000	302	
Igushik Section Drift	325	10	000	302	
Nushagak Section Drift	325	30	000	302	
Nushagak Section Set, Combine Flats	325	31	000	302	
Nushagak Section Set, Queens Slough	325	32	000	302	
Nushagak Section Set, Clark's point	325	33	000	302	
Nushagak Section Set, Eluk/Flounder Flats	325	34	000	302	
Nushagak Section Set, Coffee Pt.	325	35	000	302	
Wood River SHA Drift	325	40	000	302	
Wood River SHA Set	325	41	000	302	
Togiak River Sect. Drift	326	70	000	303	
Togiak River Sect. Set East	326	71	000	303	
Togiak River Sect. Set West	326	72	000	303	
Kulukak Section Drift	326	10	000	303	
Kulukak Section Set	326	11	000	303	
Matogak Section Drift	326	20	000	303	
Matogak Section Set	326	21	000	303	
Osviak Section Drift	326	30	000	303	
Osviak Section Set	326	31	000	303	

-continued-



Appendix B–Table 1. Page 2 of 2.

<b>Escapement</b>					
Kvichak River Tower	324	10	100	101	
Alagnak (Branch) River Tower	324	10	500	101	Project not in operation
Alagnak Tributary - Moraine Creek	324	10	500	200	Otolith Sampling
Alagnak Tributary - Funnel Creek	324	10	500	201	Otolith Sampling
Alagnak Tributary - Spectacle Creek	324	10	500	202	Otolith Sampling
Alagnak Tributary - Battle River	324	10	500	210	Otolith Sampling
Alagnak Tributary - Battle Lake	324	10	500	211	Otolith Sampling
Alagnak Tributary - Nanuktuk Creek	324	10	500	220	Otolith Sampling
Alagnak Tributary - Kulik River	324	10	500	230	Otolith Sampling
Naknek River Tower	324	20	600	101	
Ugashik River Tower	321	00	100	101	
Egegik River Tower	322	00	100	101	
Igushik River Tower	325	10	100	101	
Snake River Tower	325	20	200	101	Project not in operation
Wood River Tower	325	30	300	101	
Nushagak-Mulchatna River Sonar	325	30	700	101	
Nuyakuk River Tower	325	30	800	101	Project not in operation
Togiak River Tower	326	70	600	101	
<b>Test Fish</b>					
Port Moller Test Station 2	314	00	000	002	
Port Moller Test Station 4	314	00	000	004	
Port Moller Test Station 6	314	00	000	006	
Port Moller Test Station 8	314	00	000	008	
Port Moller Test Station 10	314	00	000	010	
Port Moller Test Station 12	314	00	000	012	
Igushik Test Fish	325	10	100	401	Project not in operation
Ugashik River Test Fish	321	00	100	401	
Egegik River Test Fish	322	00	100	401	
Kvichak River Test Fish	324	10	100	401	
<b>Subsistence</b>					
Nushagak - Lewis Point	325	00	000	501	Project not in operation

<b>Location</b>	<b>Code</b>
Area	032
Counting Tower	101
Spawning Grounds	102
Test Fish	401
Other (Special Locations)	501
Westside Catch (Peter Pan)	302
Togiak Catch	303



## **APPENDIX C: GENERAL EQUIPMENT, CAMP MAINTENANCE, AND CAMP POLICY**

## **EQUIPMENT MAINTENANCE**

Equipment maintenance is one of the most important operations performed during the field season. The outboard motors, generators, and other equipment must be kept in good operating condition.

It will be the crew leader's responsibility to see that all equipment is kept in good operating condition.

## **ENGINE CARE AND OUTBOARD OPERATION**

If outboard uses mixed fuel, the correct outboard motor fuel mixture is 50:1. The newer Precision Blend outboards mix the 2-cycle oil and gas automatically, but older engines will need to have their fuels pre-mixed. Always pour the oil into the tank first, then add 2 or 3 gallons of gas and mix thoroughly, then fill tank to capacity always using a large funnel and filter. Some outboards may be 4-stroke engines, which need to have oil level checked routinely. Always mix fuel tanks or equipment under cover to prevent water contamination and always use a funnel and filter. Note that some chainsaws have a fuel mixture of 25:1, but some newer models (e.g., Stihls) use a 50:1 mix. Chainsaw gas should be mixed in a separate can and clearly marked that it is chainsaw fuel to avoid accidentally being used in outboards.

Always place outboard motors in neutral when starting and always make sure a safety line is attached between the boat and motor. Perform a check daily of the clamp screws “dog ears” that hold the outboard to the transom. Also routinely check the motor for loose screws and bolts, cracks, and breaks, especially in the area of the lower unit.

In the normal operation of an outboard, a stream of water is discharged from a hole in the bottom edge of the cowling or from the back of the shaft. If this stream of water stops, the water pump may not be working and the motor should be shut off. On propeller outboards, the side plate over the water intake can be removed for cleaning as it may be plugged. If the pump continues not to function, the outboard should not be run, and a report to base camp should be made. On jet units, a cover on the side of the cylinder head through which water circulates can be removed and cleaned, and the cover over the temperature sensor (thermostat) can also be cleaned to restore flow. Take along a piece of bailing wire to dislodge sand from the small water discharge tube under the cowling.

Check the gear oil in the lower unit of the outboard once a week and drain and replace the gear oil at the end of the season and every 50 hours of operation. Jet units must be greased daily. This is crucial. Grease guns will be provided.

If the prop, skeg or jet unit hits bottom, check the screws to make sure they are still secure and there is no damage to the lower unit. Also, remove any rocks stuck between the grates on the jet unit.

All outboards are to be tilted in the up position when moored to preclude silt accumulation in the jet unit or water pump and skeg or housing damage.

If your outboard will not start, check the following:

- Check to make sure the kill switch is clipped to the engine properly.
- Check to see if the fuel line is connected properly to the motor and the tank and not pinched or kinked, and that the air vent on the tank is open.

- Check to see if there is water in the gasoline.
- If the engine is flooded, wait 5 minutes for the plugs to dry before attempting to start again.
- Check the spark plugs and spark plug wires as they may be fouled or defective (replace if needed).

## **BOATS**

Boats are to be kept clean and free of loose tools and debris, and moored at locations where they are not subject to damage by other traffic or through contact with the river bottom in rock laden areas. Boats must be bailed regularly of rainwater to keep them from sinking.

Further responsibility includes maintaining a bow line on each assigned craft and ensuring that each boat is properly moored at the end of each work day to preclude possible loss or damage.

## **GENERATORS**

Portable generators may be supplied to field camps. Their maintenance is important. Since most of the generators have 4-cycle engines, mixed gas must not be used. The crankcase oil reservoir should be checked daily and maintained at the full level. At the end of the season, or after 25 hours of operation, the oil should be changed. Spark plugs should be checked at every oil change for fouling and gap.

## **CAMP MAINTENANCE**

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

Maintaining a clean and efficient field camp is required. Maintenance of living accommodations and other installations will be performed as necessary. All materials necessary will be provided.

Grounds will be kept free of litter. All garbage will be burned or bagged up and disposed of in town. Special precautions should be observed to ensure that garbage does not attract bears and other scavenger species. Dirty dishes should be washed daily and kept inside the cabin, not left in the yard or outdoors where it will attract bears.

Upon completion of the summer season, all camp equipment will be cleaned prior to winter storage. All sampling nets, tarps and life jackets must be dry before being stored. All skiffs will be brought back to the ADF&G compound.

The crew leader at the close of the field season will take a complete equipment inventory. A report detailing the equipment and storage locations will be submitted at the end of the season to the supervisor. A list of equipment needing replacement or repair will also be submitted, along with an equipment need list for next season.

## **CAMP POLICY**

No alcoholic beverages are to be stored in areas open to public view. If alcohol is consumed at a camp an employee must be of legal age and off duty and under no circumstances shall he or she engage in the operation of any State equipment or firearms. Employees will not return to duty status under the influence of alcohol.

The crew leader of each camp shall establish a policy on living standards and personnel behavior in accordance with State guidelines. Time off for individual crew members must be scheduled by the supervisor. All employees will be required to act in a professional manner at all times and shall be especially courteous to the public.

It will be the responsibility of the crew leader to prevent any abuse of State equipment. The crew leader will report within 24 hours to the supervisor any damaged or lost equipment.

### **FOOD ORDERS**

ADF&G will provide all food and non-alcoholic beverages while working in the field. Groceries will be purchased by either the field crew when in town or by available office personnel. It is useful to keep an on-going grocery list so you know what is needed or not needed since fridge and freezer space is limited.

### **COMMUNICATION**

Scheduled calls are used to pass on pertinent information to/from the field offices. It is expected that all employees will participate in these schedules to get familiar with the procedure. The morning schedule is used for relaying the daily species count and high priority business only as the King Salmon and Dillingham office personnel attempt to get counts from all field camps at the same time. Keep the conversations short so we do not hold up others using the same channel.

Any employees performing job duties away from the field camp (such as boating trips up/downriver) or hiking/sport fishing/etc. on their own time are required to let others know their plans such as where they are going and when they are expected to return. All employees should be aware of the gear in the camp and should request additional safety/survival items if needed or missing. Employees with any questions or concerns are asked to pass them on to their supervisor.

### **FIREARMS**

A State firearm will be provided at this field camp. Training will be provided for all field crews prior to deployment. Loaded guns are prohibited inside the camp facilities. Anyone handling a firearm should always treat it as if it were loaded. Guns should be kept clean and oiled daily if used and at the end of the project. Any horseplay or misuse of firearms while working for the Department of Fish and Game will not be tolerated and may be grounds for immediate dismissal. Completely unload a firearm of all rounds before cleaning or transporting back to town.

### **BEARS**

Do not encourage bears to come around camp by leaving food or unburned garbage around. Do not shoot at a bear unless, in your best judgment, it is endangering someone's life or damaging personal or state property. Use your best judgment on whether to shoot a bear if property is at stake. When trying to frighten a bear away by shooting, do not fire toward it. You may wound it by pulling the shot, ricochets, etc. Do not use cracker shells at close distance (<30'). If a cracker shell hits a bear at close range, it may penetrate the body cavity and explode inside the bear, killing it.

### **GARBAGE**

Burn garbage as needed, and box up any non-burnable trash to haul back to town. Be sure all burn barrels have proper grates or covers to prevent grass fires from sparks. Never leave a fire unattended and always have adequate fire extinguishing materials handy. Food that is discarded

should be contained in a “slop bucket” inside the cabin. As needed, the bucket can be then be dumped into the river downstream of the project. This should be done in the evenings when there are no sport fishermen down river.

## **FISH AND WILDLIFE VIOLATIONS**

This is not intended as an inclusive procedure for handling violations. Below are guidelines for obtaining the necessary information and/or evidence to document a violation. It is important to be familiar with the commercial fishing, subsistence fishing, sport fishing, and hunting regulations in your area. Violation reporting procedures are printed on the back cover of the commercial fishing regulation book. Request the regulation book if your camp does not have one.

The use of the “4 Ws” can greatly aid the Fish & Wildlife Protection officer in obtaining sufficient evidence for a case.

- What is the violation?
- When did the violation occur (e.g., date, time, tide condition, etc.)?
- Where did the violation occur?
- Who is in violation and who are witnesses?

It is important that specifics about the event be documented so the appropriate officer can follow-up and contact those involved. If you have a camera available, pictures are extremely valuable in prosecuting offenders. Collect as much information as possible and contact your supervisor or a State Trooper from the Alaska Wildlife Troopers Division immediately. If you do not feel comfortable, or your personal safety may be in danger, do not pursue the violation. Contact your supervisor and they will handle the situation. Be aware that you do not have the power to arrest somebody or seize equipment. Just limit yourself to documenting the event as safely as possible.

## **TRANSPORTATION**

Do not endanger life or property by using the skiff in rough water conditions. If you are unfamiliar with running boats in marine waters and/or on rivers, it is imperative to inform the crew leader of this and proper training should occur. All personnel must wear a Coast Guard approved life jacket when out on any water. Be conservative and use good judgment: if you think it is dangerous, don't go out on the water.

A boat box equipped with all the necessary tools for the outboard should be in the boat at all times and kept as dry as possible. Necessary tools include pliers, wrenches, screw drivers, spark plugs, spark plug wrench, an extra boat plug, and baling wire. Oars and a bilge pump should also be in the boat. A life jacket is mandatory while operating the boat and handheld VHF and flares should also be carried. In case travel at night becomes necessary, carry a flashlight.

State-owned vehicles will be provided for work purposes and used **only** in the conduct of state business. Use of state-owned property for personal convenience is expressly prohibited. Individuals other than those on official state business shall not be permitted to travel in or operate state owned equipment. An official state credit card will be used to fuel up vehicles. Oil levels in the vehicles should be checked frequently. Use of state-owned vehicle, vessels, and equipment after consuming alcohol is explicitly prohibited.

## **FIRE AND FIRST AID**

All remote employees should have up to date First Aid and CPR certificates. The Nusahgak River is considered remote, therefore; it is required for this project. Make an effort to avoid intestinal parasites such as *Giardia*. When in doubt, boil your drinking water for 15 minutes.

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

## **COMPATIBILITY OF FIELD PERSONNEL**

If you find yourself unable to get along with your camp mate, notify your supervisor and an attempt will be made to resolve the situation.