

**Fishery Data Series No. 08-57**

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**Salmonid Escapements at Kwiniuk, Niukluk and  
Nome Rivers, 2007**

by

**Scott Kent,**

**Gary Knuefer,**

and

**Larry Neff**

November 2008

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Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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<b>Weights and measures (metric)</b>		<b>General</b>		<b>Measures (fisheries)</b>	
centimeter	cm	Alaska Administrative Code	AAC	fork length	FL
deciliter	dL			mid-eye to fork	MEF
gram	g	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	mid-eye to tail fork	METF
hectare	ha			standard length	SL
kilogram	kg			total length	TL
kilometer	km	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.		
liter	L			<b>Mathematics, statistics</b>	
meter	m			<i>all standard mathematical signs, symbols and abbreviations</i>	
milliliter	mL	at	@		
millimeter	mm	compass directions:		alternate hypothesis	H <sub>A</sub>
		east	E	base of natural logarithm	<i>e</i>
<b>Weights and measures (English)</b>		north	N	catch per unit effort	CPUE
cubic feet per second	ft <sup>3</sup> /s	south	S	coefficient of variation	CV
foot	ft	west	W	common test statistics	(F, t, $\chi^2$ , etc.)
gallon	gal	copyright	©	confidence interval	CI
inch	in	corporate suffixes:		correlation coefficient	
mile	mi	Company	Co.	(multiple)	R
nautical mile	nmi	Corporation	Corp.	correlation coefficient	
ounce	oz	Incorporated	Inc.	(simple)	r
pound	lb	Limited	Ltd.	covariance	cov
quart	qt	District of Columbia	D.C.	degree (angular)	°
yard	yd	et alii (and others)	et al.	degrees of freedom	df
		et cetera (and so forth)	etc.	expected value	<i>E</i>
<b>Time and temperature</b>		exempli gratia		greater than	>
day	d	(for example)	e.g.	greater than or equal to	≥
degrees Celsius	°C	Federal Information Code	FIC	harvest per unit effort	HPUE
degrees Fahrenheit	°F	id est (that is)	i.e.	less than	<
degrees kelvin	K	latitude or longitude	lat. or long.	less than or equal to	≤
hour	h	monetary symbols		logarithm (natural)	ln
minute	min	(U.S.)	\$, ¢	logarithm (base 10)	log
second	s	months (tables and figures): first three letters	Jan,...,Dec	logarithm (specify base)	log <sub>2</sub> , etc.
<b>Physics and chemistry</b>				minute (angular)	'
all atomic symbols		registered trademark	®	not significant	NS
alternating current	AC	trademark	™	null hypothesis	H <sub>0</sub>
ampere	A	United States (adjective)	U.S.	percent	%
calorie	cal	United States of America (noun)	USA	probability	P
direct current	DC	U.S.C.	United States Code	probability of a type I error (rejection of the null hypothesis when true)	$\alpha$
hertz	Hz	U.S. state	use two-letter abbreviations (e.g., AK, WA)	probability of a type II error (acceptance of the null hypothesis when false)	$\beta$
horsepower	hp			second (angular)	"
hydrogen ion activity (negative log of)	pH			standard deviation	SD
parts per million	ppm			standard error	SE
parts per thousand	ppt, ‰			variance	
volts	V			population	Var
watts	W			sample	var

***FISHERY DATA SERIES NO. 08-57***

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RIVERS, 2007**

by  
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## ABSTRACT

The Alaska Department of Fish and Game (ADF&G) operated counting tower projects on the Kwiniuk and Niukluk Rivers and a weir project on the Nome River during the 2007 season. Runs of chum salmon *Oncorhynchus keta*, pink salmon *O. gorbuscha*, Chinook salmon *O. tshawytscha*, sockeye salmon *O. nerka*, coho salmon *O. kisutch*, and Dolly Varden *Salvelinus malma* were enumerated. Objectives of the projects were to obtain daily and seasonal estimates of the timing and magnitude of salmon escapements and to collect biological data (age, sex, and length) from chum salmon and coho salmon.

Expanded tower counts at Kwiniuk River were 27,756 chum salmon, 54,255 pink salmon, 258 Chinook salmon, 9,429 coho salmon, and 2,412 Dolly Varden. Expanded tower counts at Niukluk River were 50,994 chum salmon, 43,617 pink salmon, 30 Chinook salmon, 3,498 coho salmon, and 2,229 Dolly Varden. Total cumulative counts at the Nome River weir were: 7,034 chum salmon, 24,395 pink salmon, 13 Chinook salmon, 2,437 coho salmon, 534 sockeye salmon, and 2,534 Dolly Varden. Chinook salmon escapement was weak at the Kwiniuk River and the lower end of the Sustainable Escapement Goal (SEG) range (300–550) was not reached for the second consecutive year. Chum salmon escapement goals were exceeded at all 3 projects. The Nome River chum salmon escapement was record setting and more than twice the historical average. Coho salmon escapements were below their respective historical averages at all 3 rivers.

Predominant age compositions during 2007 for the sampled chum salmon escapements by river were: Kwiniuk River 40% age-0.3 and 58% age-0.4, Niukluk River 54% age-0.3 and 41% age-0.4, and Nome River 58% age-0.3 and 38% age-0.4. Most of the coho salmon escapement samples were age class 2.1 representing 60% from Kwiniuk River and 67% from the Nome River. Coho salmon age, sex, and length data were not collected at the Niukluk River in 2007.

Key words: Kwiniuk, Niukluk, Nome, Optimal Escapement Goal (OEG), Sustainable Escapement Goal (SEG), escapement, salmon, *Oncorhynchus tshawytscha*, *O. nerka*, *O. keta*, *O. kisutch*, *O. gorbuscha*.

## INTRODUCTION

The Norton Sound Salmon Management District includes all waters between the latitude of Point Romanof in the south and north to the latitude of Cape Douglas. This district includes 6 commercial salmon fishing subdistricts. All 5 species of Pacific salmon (*Oncorhynchus* spp.) return to natal rivers in Norton Sound and numerous anadromous streams are located within district boundaries (Figure 1). Current salmonid enumeration programs operated by the Alaska Department of Fish and Game (ADF&G) in this district include 2 counting towers located on the Kwiniuk River, which drains into Subdistrict 3 (Moses Point), and Niukluk River, a tributary of the Fish River, which empties into Subdistrict 2 (Golovin), one weir project located on the Nome River, east of the city of Nome, in Subdistrict 1, and one test fish project on the Unalakleet River in Subdistrict 6. Additionally, 6 escapement counting projects are operated by cooperating agencies. Kawerak Inc. operates 2 weir projects in Subdistrict 1, on the Eldorado River and the Snake River, and a weir on the Pilgrim River in the Port Clarence District to the north, and an enumeration tower on the Pikmiktalik River near Stebbins. Unalakleet IRA council operates a tower project on the North River, an important salmon tributary of the Unalakleet River, which drains into Subdistrict 6 (Unalakleet). U.S. Bureau of Land Management (BLM) operated a weir on Glacial Creek, a tributary of the Sinuk River, which empties into the northwestern portion of Norton Sound Subdistrict 1 from 2001–2005. Since 2006, the Glacial Creek weir has been a cooperative project between Norton Sound Economic Development Corporation (NSEDC) and ADF&G. Returns of chum salmon *Oncorhynchus keta*, pink salmon *O. gorbuscha*, Chinook salmon *O. tshawytscha*, sockeye salmon *O. nerka*, coho salmon *O. kisutch*, and Dolly Varden *Salvelinus malma* are enumerated at ADF&G and cooperative projects. ADF&G personnel also conduct numerous inseason aerial surveys on selected district rivers to monitor adult salmon

escapements and assess run timing. Some aerial surveys are conducted on rivers with enumeration projects to ground truth and calibrate survey counts and to correlate data with historical data. This report summarizes 2007 data from ADF&G tower and weir projects.

The Kwiniuk River drains into Norton Sound just east of Moses Point, approximately 160 km east of Nome (Figures 1 and 2). Kwiniuk and Tubutulik Rivers are the primary salmon spawning tributaries in Subdistrict 3 (Moses Point). In 1962, commercial salmon fishing began in Subdistrict 3, primarily targeting chum, pink and coho salmon. No significant chum salmon commercial harvest has occurred since 1988 (Bue and Lean 1997). In 2007, there were 4,567 chum salmon, 1,648 pink salmon, and 5,908 coho salmon harvested by 11 permits holders (Soon et al. 2008). Prior to the 2007 season, commercial salmon fishing had not occurred in Subdistrict 3 since 2001. Subsistence fisheries also occur in both drainages and in marine waters in Subdistrict 3. Subsistence permits for salmon fishing have been required in this subdistrict since 2004. In previous years, harvest data was gathered through ADF&G Division of Subsistence village surveys. Since 1965, a salmon counting tower has operated on the Kwiniuk River enumerating chum, pink, and Chinook salmon runs, but only since 2001 has the tower operated through the coho salmon run (Lean 1994; Kent 2006, 2007; Kohler 2000a, 2003; Kohler and Knuepfer 2001a, 2002a; Kohler and Todd 2003; Menard and Kent 2005; Rob 1996a, b, 1997a, 1998b, 1999c). The project provides fish passage data, age, sex, and length (ASL) data, and allows management biologists to calibrate aerial surveys.

The Niukluk River is a major tributary of the Fish River drainage and enters the Fish River approximately 16 km above the village of White Mountain (Figures 1 and 2). The Fish River empties into Golovnin Bay (Subdistrict 2) on the north coast of Norton Sound, and is the primary salmon spawning drainage in this subdistrict. Council, a seasonal village, is located on the Niukluk River approximately 20 km above the confluence with Fish River. A road provides access from Nome to the Niukluk River at Council. As in the Moses Point Subdistrict, subsistence permits for salmon fishing have been required since 2004 in the Golovnin Bay Subdistrict. Subsistence and sport fisheries occur on the Niukluk and Fish Rivers for all salmon species, Arctic grayling *Thymallus arcticus*, whitefish species *Prosopium* spp. and *Coregonus* spp., and Dolly Varden. Commercial salmon fishing has occurred sporadically in Subdistrict 2, and no commercial fisheries occurred during 2007.

The Niukluk River counting tower has successfully operated since 1995 (Jones and Knuepfer 2002; Kent 2006, 2007; Kohler 2000b, 2001, 2003; Kohler and Todd 2003; Menard and Kent 2005; Rob 1995b, 1997c, 1998c, 1999b), and previously operated for approximately 3 weeks during 1979 (Schaefer 1979). The project is operated to obtain escapement information, ASL data, and as a means to calibrate the accuracy of aerial surveys to other tributaries in the Fish River drainage.

Nome River flows approximately 50 km south from the Kigluaik Mountains and drains into Norton Sound approximately 5 km east of Nome (Figures 1 and 2). Commercial fishing has been progressively reduced through regulatory restrictions since the late 1970s and marine waters near the mouth (Subdistrict 1) have been closed since 1984. Sport and subsistence fishing in Nome River have been restricted for many years because of low salmon returns (primarily chum salmon) and Arctic grayling population concerns. Subsistence and sport fisheries are currently managed similar to a commercial fishery, with emergency orders regulating restrictions and fishing periods. Improvements in recent years of salmon runs have resulted in a lessening of restrictions on the subsistence salmon fishery. For the second consecutive year, the Nome

Subdistrict was not under Tier II fishing restrictions for chum salmon. A Tier I subsistence permit/catch calendar was required when subsistence fishing in the Nome Subdistrict in 2007. Subsistence harvests are reported to ADF&G Division of Commercial Fisheries through returned catch calendars.

A salmon counting tower was first operated on the Nome River in 1993 (Bue 1994; Rob 1995a,c). Beginning in 1996, a weir replaced the counting tower and the camp/enumeration location was moved down river approximately 5 km to the current site. The 2007 season was the 12<sup>th</sup> year of weir operations (Kent 2006, 2007, Kohler 2000c, 2003; Kohler and Knuepfer 2001b, 2002b; Kohler and Todd 2003; Menard and Kent 2005, Rob 1997b, 1998a, 1999a).

All ADF&G enumeration projects, and cooperative projects, operate as a means to obtain timely and accurate escapement information and for the collection of biological data (ASL) spread throughout salmon runs. Daily count totals by species are relayed to the Nome ADF&G office via single sideband (UHF), marine (VHF) radio or satellite phone.

## **OBJECTIVES**

The objectives of these projects were to:

1. Obtain daily and seasonal estimates of timing and magnitude of salmon and Dolly Varden escapements to the Kwiniuk, Niukluk, and Nome Rivers.
2. Sample chum and coho salmon runs and collect ASL data for development of brood tables and age, sex, and length frequencies for comparison of seasonal and yearly variations.

## **METHODS**

Tower project crews enumerate fish passage up and down river from a tower in timed periods. Usually, counts are conducted for a 20 minute period each hour and the counts are expanded to the whole hour; count times three equals one hour (20 min x 3 = 60 min). If all periods for 24 hours each day are counted, further expansion is not necessary and the expanded hourly total counts are summed to produce a daily total. Negative count numbers signify down river passage. For days in which counts did not occur, the preceding day's count for a particular hour was added to the following day's count for the same hour and the total was divided by 2. If 2 days of counts for a particular hour were missed, the 2 preceding day's counts for that hour and the following 2 day's counts for that same hour were added and the total divided by 4. Small adjustments were made to account for rounding to whole numbers. There were no days in which missed counts occurred in 2007 at any of the enumeration project sites, and thus no further expansion of counts was required.

A tower or scaffold made of wood, aluminum or steel is placed on the bank next to the river where an observer sits or stands on the elevated platform to count fish. Guy wires are attached to the tower and staked to the ground or cabled to trees to stabilize the tower. A flash panel (usually white plastic, vinyl, or canvas) is placed across the river bottom perpendicular to the river at the tower site and is anchored in place with sand bags and stakes. A flash panel provides a contrasting background to aid identification and count of passing fish. Partial (diversion) weirs

are placed from the river bank(s) toward mid channel over the panel ends to force migrating fish over the panel for easy observation. The Alaska Department of Natural Resources issued permits for all weirs and partial weirs. To count fish during darkness, lights are placed on the tower. Either a 12-volt battery system or 120-volt generator system is used to provide power for lighting.

Weirs are built across the entire river and do not allow unmonitored fish passage. The Nome River weir has aluminum weir stringers, top and bottom, that span the river and are supported by metal “A” frames. Metal conduit pickets are placed in the stringer holes and pounded into the bottom substrate effectively blocking fish passage. Picket spacing determines the size of fish to be passed and enumerated. Fish are enumerated through the weir by opening a gate or pulling weir pickets and counting the fish as they migrate through the opening. The weir has a “boat gate” that allows the weir to be quickly opened between two “A” frames to allow for boat passage. Lighting systems similar to tower projects are used to illuminate the weir area for counting fish passage at night.

ASL samples at tower projects are collected from chum and coho salmon by seining in the river with a beach seine. At weir sites, fish are normally caught in a live box; the live box is installed and built into the upstream face of the weir. However, fish are seined near the weir if the live box does not effectively capture fish. In 2007, the chum salmon sampling goal for the Niukluk and Kwiniuk projects was to sample 3 pulses of 160 and at the Nome River, the goal was to sample in proportion to chum salmon run strength. At tower sites, every effort was made to have seine events coincide with dates of chum salmon average run-timing quartiles. That is, one pulse would be collected near the time of the first quarter-point, one near the mid-point, and one near the third quarter-point. At Nome River weir, fish were sampled daily from the trap with the intention of having approximately 160 samples by the historical average quarter-point of the run, 320 by the mid-point, and 480 by the third quarter-point. For coho salmon, the goal was to collect one pulse of 160 at the Kwiniuk River, and at Nome River weir the goal was to obtain 200 samples distributed throughout the run in a manner similar to that described for chum salmon sampling at the weir. Commercial age, sex, and length data were also collected from chum and coho salmon harvested in the Moses Point Subdistrict commercial fishery. Commercial samples were collected by the ADF&G Unalakleet River test net crew as the Subdistrict 3 commercial catch was tendered to Unalakleet for processing.

Scales were taken for age determination, sex was determined by visually examining external characteristics (such as body symmetry, kype development and presence of an ovipositor), and fork lengths were measured on all sampled fish. Scales were removed from the left side of the fish in an area 2–3 scale rows above the lateral line crossed by a diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin. Once cleansed of slime, scales were mounted on gummed cards, and impressions were later made in cellulose acetate cards with a scale press for age determination. Scale impressions were read with the aid of a microfiche reader and ages were reported in European notation where the first digit denotes the freshwater age excluding the year spent in the gravel, and the second digit refers to the ocean age (Koo 1962a,b). Fish length was measured to the nearest 0.5 cm from mid eye to tail fork (METF). Tower project ASL samples for chum salmon were divided into 3 segments (3 samples of 160) by time and the Nome River weir samples were divided according to chum salmon average run-timing quartiles in order to track changes in age and sex composition.

## **KWINIUK RIVER TOWER**

Kwiniuk River tower camp is located approximately 6 km upstream from the mouth of the Kwiniuk River, on land leased to ADF&G by Hans Jemewouk of Moses Point (Figure 2). Access to the site is by jet outboard riverboat from the seasonal village of Moses Point where aircraft deliver personnel, supplies, and equipment. Additional ADF&G staff from Nome helped during tower installation and set up. A 15 m vinyl flash panel was used at the Kwiniuk site and covered approximately half the width of the river. One 6 m high aluminum scaffold tower was used for counting and the diversion weir extended from midstream (end of the flash panel) to the shore opposite the tower. A 12-volt battery lighting system illuminated the flash panel during dark counting periods.

Counting began on 21 June at 1800 hours and ended after the 0200 hour count on 10 September 2007. The 3-person crew counted one 20 minute period each hour for 24 hours, from midnight to midnight the following day. Daily counts presented in this report ran from midnight to midnight the following day.

## **NIUKLUK RIVER TOWER**

Niukluk River tower camp is located approximately 1.5 km upstream from the confluence of the Fish and Niukluk Rivers (Figure 2). A 5-year land-use permit from the Council Native Corporation permits ADF&G to use their lands to conduct the tower operation. Access to this site is via road to Council and by jet outboard riverboat from Council to the tower. In 2007, the counting tower, partial weir, and flash panel were installed using the same methods as reported in detail in the 1995 Niukluk project report (Rob 1995b). Additional ADF&G staff provided assistance during project installation and set up. A 120-volt generator lighting system was installed on the tower to illuminate the flash panel during dark periods.

Counting began at 0000 hours on 1 July, and ended after the 2300 count on 4 September 2007. One 20 minute period was counted each hour for 24 hours, from midnight to midnight the following day.

## **Full-Hour Count Comparison Study**

When counting towers are used to estimate salmon escapements, crewmembers count passing salmon for the first 20 minutes of each hour, 24 hours a day. These 20 minute counts are then multiplied by an expansion factor of 3 to estimate salmon passage for the entire hour. Hourly estimates are then summed to obtain the daily escapement for each species. This methodology assumes that a 20 minute sub sample is representative of the entire hour. Preferably, expanded count estimates should vary no more than 10% from the actual tower passage for that particular salmon species' yearly migration. A 2-week study was conducted to investigate the validity and accuracy of expanded tower counts in comparison to actual full-hour counts at the Niukluk River counting tower in 2007.

From 17 August through 30 August, fish passage was enumerated for the entire hour, 24 hours a day. Although coho salmon was the target species, chum salmon, pink salmon, and Dolly Varden passage was also recorded. The normal crew of 3 remained on their regular 8 hour shift, but counted for an additional 10 minutes each hour, for a total of 30 minutes. Two additional crewmembers each worked a 12 hour shift, counting the last 30 minutes of each hour.

Cumulative counts were recorded at 20, 30, 40, and 60 minutes for each hour. Timers were used to indicate stop times and tally counters used to log fish passage. All numbers were recorded in Rite in the Rain<sup>1</sup> notebooks. One crewmember started at the top of the hour and recorded the number of each species counted at 20 minutes and 30 minutes after the hour. The second crewmember would take over simultaneously as the first one stopped at half past the hour. This person would record cumulative fish passage at 40 minutes after the hour and 20 minutes later, at the top of the hour. Recording fish passage at these time intervals provided data to allow comparison of the normal 20 minute expanded count estimates to the full-hour ‘real time’ counts, as well as 30 minute expanded count estimates, and 2 additional 20 minute expanded count estimates.

## **NOME RIVER WEIR**

Nome River weir camp is located approximately 5 km upstream from the mouth of the river on land that ADF&G leases from Sitnasuak Native Corporation (Figure 2). The weir is made of a series of 3.2 cm (1¼”) pipes assembled in pairs using locking metal brackets. Aluminum stringers 5.6 m (12’) long connect the pairs of pipes horizontally. Metal conduit pipes of varying lengths, depending on water depth, are inserted vertically in holes drilled in the stringers on 4.5 cm (1¾”) centers. Pipes in the weir are removed to create openings that allow fish to pass through and be enumerated by staff. The weir was designed to be easily cleaned, allow no unmonitored escapement of fish, and be quickly removed in the event of a flash flood.

The project crew, with the help of additional ADF&G staff, began installing the weir on 2 July and the weir was in operation from 4 July through 16 September, 2007.

# **RESULTS AND DISCUSSION**

## **ESCAPEMENT**

### **Kwiniuk River Tower**

Kwiniuk River expanded daily and cumulative total counts by species for 2007 are shown in Table 1. Expanded cumulative counts were: 27,756 chum salmon, 54,255 pink salmon, 258 Chinook salmon, 9,429 coho salmon, and 2,412 Dolly Varden. The chum salmon passage was well above the upper end of the current optimal escapement goal (OEG) range of 11,500–23,000 fish (Figure 3), and was the seventeenth highest count on record (1965–2007) (Appendix A1). The pink salmon cumulative passage of 54,255 fish was the seventh highest in the project’s history for odd-numbered year runs, but below the historical odd-numbered year average (1965–2005) (Figure 4, Appendix A1). For the second consecutive year, the Chinook salmon passage fell short of the lower end of the sustainable escapement goal range (SEG) (300–550), and was the fifth poorest since 1985, when ADF&G began expanding Chinook counts at this project (Figure 5, Appendix A1). Counting tower operations continued through the coho salmon run for the seventh consecutive year, due in large part to a resurgence in commercial salmon fishing in the Moses Point Subdistrict. The coho salmon passage of 9,429 was below the historical average (2001–2006) of 11,335, and was the third lowest since the project began counting the majority of

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<sup>1</sup> Product names used in this report are included for scientific completeness, but do not constitute a product endorsement.

the coho salmon run in 2001 (Figure 6, Appendix A1). However, the average includes the 2006 record escapement of 22,341 coho salmon, and the 2007 run was likely stronger than coho returns from 2004–2005, when no commercial salmon fishing occurred.

### **Niukluk River Tower**

Niukluk Tower expanded cumulative counts for 2007 were: 50,994 chum salmon, 43,617 pink salmon, 30 Chinook salmon, 3,498 coho salmon, and 2,229 Dolly Varden (Table 2). Chum salmon passage was 26% above the historical average (1995–2006) and the fourth largest since the project's inception in 1995 (Figure 7, Appendix A2). Moreover, the 2007 chum passage was a 155% increase from the 20,018 chum salmon counted during the 2003 brood year, the second worst escapement on record, and a 44% increase from the 35,307 chum salmon counted during the 2002 brood year. The pink salmon escapement estimate was 40% below the historical odd-numbered year average (1995–2005), although this average includes the record odd-year passage of 270,424 pink salmon in 2005 (Figure 8, Appendix A2). Chinook passage at the Niukluk River tower was 83% below the historical average (1995–2006) (Figure 9, Appendix A2). Chinook escapement has been well below average at the Niukluk River since 2004. Coho salmon passage was 41% below the historical average (1995–1997 and 1999–2006) and the fifth lowest since 1995 during years in which the majority of the coho return has been enumerated (Figure 10, Appendix A2). However, the 2007 coho return increased nearly threefold from the record low passage estimate of 1,282 coho salmon counted in 2003, the major brood year for the 2007 return.

#### ***Full-Hour Count Comparison Study***

The study period ran from 17 August through 30 August to coincide with the peak of coho salmon migration. However, it was later determined that 57% of the total coho salmon escapement estimate had already migrated by the tower prior to conducting full-hour counts (Table 2). Coho salmon were chosen as the study species because of large fluctuations observed in hourly passage in comparison with other Pacific salmon species.

Table 3 and Figure 11 summarize and illustrate the comparison of the different expanded coho salmon counts (first 20 minutes, second 20 minutes, third 20 minutes, and first 30 minutes) with the actual full-hour coho salmon count observed during the 14 day study period. A total of 1,268 coho salmon were enumerated during the continuous full-hour counts compared to expanded coho passage estimates of 1,236, 1,275, 1,293 and 1,254 from the first 20 minutes, second 20 minutes, third 20 minutes, and first 30 minutes, respectively. The coho salmon full-hour cumulative passage differed from expanded passage estimates of the first 20 minutes, second 20 minutes, third 20 minutes, and first 30 minutes by 2.5%, 0.6%, 2.0%, and 1.1%, respectively. Expanded estimates from the first 20 minutes and first 30 minutes underestimated the actual passage whereas the expanded counts from the second and third 20 minutes overestimated the passage. The first 20 minute expanded passage estimate has been used at the Niukluk River tower since the project's inception in 1995, and it represented the largest deviation from the actual passage. However, being within 2.5% is acceptable given that a 10% deviation has been considered acceptable. Fishery managers therefore have confidence in coho salmon passage estimates obtained from the standard first 20 minute expanded counts at the Niukluk River counting tower.

Daily differences between the first 20 minute expanded counts and full-hour counts ranged from underestimates of 43 coho salmon (-54.4%) to overestimates of 37 coho salmon (+46.3%) (Table

3, Figure 12). Daily tower estimates were less than actual counts on 7 days and more than actual counts on 7 days. The second and third 20 minute and first 30 minute daily expanded estimates for coho salmon are illustrated in Figures 13–15. Additionally, a total of 795 chum salmon, 594 pink salmon, and 432 Dolly Varden were also counted during the continuous full-hour counts and comparisons with expanded estimates are summarized in Appendices A3–A5.

### **Nome River Weir**

Total cumulative counts at the Nome River weir for 2007 were: 7,034 chum salmon, 24,395 pink salmon, 13 Chinook salmon, 2,437 coho salmon, 534 sockeye salmon, and 2,534 Dolly Varden (Table 4). Like the Kwiniuk and Niukluk Rivers, strong chum runs and below-average pink and coho salmon runs were observed at the Nome River weir. The 2007 chum salmon escapement shattered last year's record run of 5,677 chum salmon, and was more than double the historical average (1994–2006) (Appendix A6). It also represented a three-fold increase from the poor chum escapements observed from 2002–2003, primary brood years for the 2007 run. In addition, 2007 was the fourth consecutive year in which the SEG range (2,900–4,300) was either reached or exceeded at the Nome River (Figure 16, Appendix A6). Pink salmon escapement was about half the odd-numbered year historical average (1993–2005) (Figure 17, Appendix A6). However, the 2007 escapement is nearly three times the previous odd-numbered year average (1993–2003) that does not incorporate the record odd-year pink return of 285,759 pink salmon observed in 2005. For the first time since 2003, Chinook salmon escapement at the weir was below average (Figure 18, Appendix A6). Like the Niukluk River, coho salmon escapement was below the historical average, but over 400% above the record low 548 coho salmon enumerated in 2003, the brood year that comprises the majority of the 2007 return (Figure 19, Appendix A6). A record-setting sockeye salmon escapement was also recorded at the Nome River in 2007, and was more than 5 times the historical average (1999–2007) (Figure 20, Appendix A6).

## **AGE AND SEX COMPOSITION AND LENGTH FREQUENCY**

### **Chum Salmon**

Chum salmon age and sex composition during 2007 for the Kwiniuk River samples (506) was 40% age-0.3, 58% age-0.4 and 3% age-0.5 fish, and 54% females (Table 5). By comparison, commercial samples (270) from the Moses Point Subdistrict were comprised of 1% age-0.2, 60% age-0.3, 34% age-0.4, 4% age-0.5, and  $\leq 1\%$  age-0.6, and 43% females (Table 6). Niukluk River chum salmon samples (571) were comprised of  $\leq 1\%$  age-0.2, 54% age-0.3, 41% age-0.4, and 5% age-0.5, and sex composition was 45% female (Table 7). Chum salmon samples (678) from Nome River had age and sex composition that was 58% age-0.3, 38% age-0.4, and 4% age-0.5, and 55% female (Table 8).

Kwiniuk River samples mean lengths (METF) of age-0.3 males was 572 mm and females averaged 548 mm, whereas age-0.3 chum mean lengths were 599 mm for males and 562 mm for females (Table 5). Niukluk age-0.3 chum salmon were 582 mm for males and 550 mm for females, and age-0.4 chum were 589 mm for males and 558 mm for females (Table 6). Nome River age-0.3 males were 579 mm and females 540 mm, and age-0.4 males were 590 mm and age 0.4 females were 546 mm (Table 8).

Kwiniuk River samples had only 40% age-0.3 fish, the lowest when compared to the Moses Point commercial samples and the Niukluk and Nome Rivers which had 60%, 54%, and 58% respectively. The 2007 Kwiniuk River samples had the third highest percentage of age-0.4 on record (1983–2007) (Appendix B1). However, at the Kwiniuk River, the majority of samples were

collected during the first half of the chum salmon run from 26 June to 6 July (Table 1), whereas the Moses Point commercial samples were obtained during the latter half of the run. Moreover, sampling was more evenly distributed throughout the run at the Niukluk and Nome Rivers. Therefore, the relatively large percentage of age-0.4 fish in the Kwiniuk samples may be the result of sampling more heavily during the first half of the run, when older fish tend to comprise the majority of the return. The 2007 age composition in conjunction with the historical age composition at the three rivers, particularly the Niukluk and Nome Rivers, suggests that the 2001 brood year experienced good survival. Nome, Kwiniuk and Niukluk Rivers had their second, third, and fourth highest percentages of age-0.5 fish, respectively (Appendices B1–B3).

### **Coho Salmon**

Coho salmon escapement samples (106) from the Kwiniuk River were comprised of 37% age-1.1, 60% age-2.1, and 3% age-3.1, and 45% females (Table 9). By comparison, commercial samples from the Moses Point Subdistrict were 21% age-1.1, 78% age-2.1, and 1% age-3.1 and 46% female (Table 10). Nome River age and sex composition was 24% age-1.1, 67% age-2.1, and 9% age-3.1 and 52% female (Table 11). There were no coho salmon sampled for age, sex and length data at the Niukluk River in 2007. Record percentages of age-1.1 fish present in the Kwiniuk River (Appendix B4) and Nome River (Appendix B5) samples suggest that rearing conditions were favorable in the spring of 2006. In 2005, record to near record-setting odd-numbered year pink salmon returns were observed at the Nome and Kwiniuk Rivers (Appendices A1 and A6). Perhaps age-1 coho salmon smolt went to sea at a larger size and had high survival because they were able to forage on prodigious numbers of emerging pink salmon fry prior to emigrating from these drainages.

Mean lengths by age group for all samples collected ranged from 533 mm for age-3.1 males in the Moses Point commercial samples (Table 10) to 629 mm for age-1.1 males from the Kwiniuk River samples (Table 9). Kwiniuk River mean lengths for males and females were the second largest since 2001 and were larger when compared to all age classes at the Nome River in 2007 (Appendices B4–5).

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## **TABLES**

Table 1.--Expanded daily and cumulative (Cum.) migration of all salmonid species past Kwiniuk River counting tower, Norton Sound, 2007.

Date	Daily Chum Salmon	Cum. Chum Salmon	Daily Pink Salmon	Cum. Pink Salmon	Daily Chinook Salmon	Cum. Chinook Salmon	Daily Coho Salmon	Cum. Coho Salmon	Daily Dolly Varden	Cum. Dolly Varden
6/21	0	0	0	0	0	0	0	0	0	0
6/22	0	0	0	0	0	0	0	0	-39	-39
6/23	0	0	3	3	0	0	0	0	0	-39
6/24	3	3	6	9	0	0	0	0	15	-24
6/25	123	126	0	9	0	0	0	0	12	-12
6/26	348	474	6	15	-3	-3	0	0	0	-12
6/27	12	486	6	21	3	0	0	0	27	15
6/28	243	729	0	21	12	12	0	0	3	18
6/29	276	1,005	0	21	-3	9	0	0	3	21
6/30	495	1,500	12	33	0	9	0	0	0	21
7/01	1,149	2,649	24	57	6	15	0	0	3	24
7/02	2,118	4,767	21	78	6	21	0	0	0	24
7/03	3,645	8,412	87	165	24	45	0	0	3	27
7/04	3,156	11,568	438	603	27	72	0	0	3	30
7/05	1,188	12,756	150	753	9	81	0	0	-6	24
7/06	1,239	<b>13,995</b>	315	1,068	21	102	0	0	0	24
7/07	762	14,757	495	1,563	24	126	0	0	0	24
7/08	879	15,636	1,017	2,580	6	<b>132</b>	0	0	3	27
7/09	582	16,218	447	3,027	6	138	0	0	6	33
7/10	1,587	17,805	579	3,606	12	150	0	0	0	33
7/11	1,710	19,515	1,728	5,334	9	159	0	0	3	36
7/12	513	20,028	1,881	7,215	9	168	0	0	0	36
7/13	1,269	21,297	3,621	10,836	15	183	0	0	9	45
7/14	339	21,636	282	11,118	3	186	3	3	3	48
7/15	639	22,275	1,560	12,678	12	198	3	6	6	54
7/16	237	22,512	1,875	14,553	3	201	0	6	0	54
7/17	399	22,911	1,302	15,855	3	204	3	9	9	63
7/18	1,104	24,015	4,896	20,751	9	213	33	42	78	141
7/19	375	24,390	2,331	23,082	3	216	30	72	39	180
7/20	408	24,798	3,462	26,544	6	222	3	75	51	231
7/21	159	24,957	1,821	<b>28,365</b>	0	222	24	99	60	291
7/22	27	24,984	300	28,665	0	222	9	108	18	309
7/23	669	25,653	3,060	31,725	0	222	66	174	39	348
7/24	441	26,094	2,661	34,386	12	234	105	279	27	375
7/25	504	26,598	5,757	40,143	0	234	150	429	69	444
7/26	222	26,820	3,519	43,662	9	243	129	558	42	486
7/27	234	27,054	4,476	48,138	3	246	171	729	60	546
7/28	48	27,102	444	48,582	3	249	27	756	21	567
7/29	21	27,123	309	48,891	0	249	123	879	36	603
7/30	57	27,180	303	49,194	0	249	132	1,011	66	669
7/31	33	27,213	288	49,482	3	252	156	1,167	144	813
8/01	168	27,381	975	50,457	3	255	204	1,371	207	1,020
8/02	33	27,414	348	50,805	0	255	222	1,593	177	1,197
8/03	69	27,483	813	51,618	0	255	318	1,911	177	1,374
8/04	39	27,522	546	52,164	0	255	237	2,148	261	1,635
8/05	18	27,540	420	52,584	0	255	213	2,361	456	2,091
8/06	42	27,582	252	52,836	0	255	180	2,541	519	2,610

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Table 1.–Page 2 of 2.

Date	Daily Chum Salmon	Cum. Chum Salmon	Daily Pink Salmon	Cum. Pink Salmon	Daily Chinook Salmon	Cum. Chinook Salmon	Daily Coho Salmon	Cum. Coho Salmon	Daily Dolly Varden	Cum. Dolly Varden
8/07	21	27,603	183	53,019	3	258	54	2,595	204	2,814
8/08	12	27,615	240	53,259	0	258	222	2,817	249	3,063
8/09	12	27,627	219	53,478	0	258	228	3,045	546	3,609
8/10	27	27,654	180	53,658	0	258	222	3,267	90	3,699
8/11	18	27,672	171	53,829	0	258	378	3,645	606	4,305
8/12	3	27,675	186	54,015	0	258	978	4,623	219	4,524
8/13	6	27,681	-18	53,997	0	258	-36	4,587	234	4,758
8/14	0	27,681	15	54,012	0	258	66	4,653	552	5,310
8/15	9	27,690	30	54,042	0	258	63	<b>4,716</b>	582	5,892
8/16	12	27,702	33	54,075	0	258	36	4,752	429	6,321
8/17	3	27,705	42	54,117	0	258	237	4,989	432	6,753
8/18	0	27,705	15	54,132	0	258	237	5,226	642	7,395
8/19	0	27,705	21	54,153	0	258	78	5,304	63	7,458
8/20	0	27,705	15	54,168	0	258	54	5,358	318	7,776
8/21	6	27,711	12	54,180	0	258	459	5,817	276	8,052
8/22	0	27,711	15	54,195	0	258	153	5,970	183	8,235
8/23	18	27,729	6	54,201	0	258	786	6,756	159	8,394
8/24	0	27,729	6	54,207	0	258	135	6,891	33	8,427
8/25	0	27,729	3	54,210	0	258	45	6,936	51	8,478
8/26	0	27,729	6	54,216	0	258	162	7,098	93	8,571
8/27	0	27,729	0	54,216	0	258	189	7,287	108	8,679
8/28	3	27,732	6	54,222	0	258	90	7,377	3	8,682
8/29	0	27,732	3	54,225	0	258	-120	7,257	36	8,718
8/30	3	27,735	9	54,234	0	258	-264	6,993	-135	8,583
8/31	3	27,738	3	54,237	0	258	570	7,563	-141	8,442
9/01	0	27,738	9	54,246	0	258	246	7,809	36	8,478
9/02	3	27,741	3	54,249	0	258	198	8,007	-276	8,202
9/03	0	27,741	6	54,255	0	258	117	8,124	-2,358	5,844
9/04	9	27,750	-3	54,252	0	258	171	8,295	-2,202	3,642
9/05	0	27,750	3	54,255	0	258	18	8,313	-1,116	2,526
9/06	0	27,750	0	54,255	0	258	81	8,394	-78	2,448
9/07	6	27,756	0	54,255	0	258	645	9,039	-18	2,430
9/08	0	27,756	0	54,255	0	258	300	9,339	-30	2,400
9/09	0	27,756	0	54,255	0	258	102	9,441	12	2,412
9/10	0	27,756	0	54,255	0	258	-12	9,429	0	2,412
<b>Total</b>	<b>27,756</b>		<b>54,255</b>		<b>258</b>		<b>9,429</b>		<b>2,412</b>	

Note: The box within the column indicates the first to third quartiles of cumulative fish passage whereas the midpoint of the cumulative passage is indicated by the bold box.

Table 2.—Expanded daily and cumulative (Cum.) migration of all salmonid species past Niukluk River counting tower, Norton Sound, 2007.

Date	Daily Chum Salmon	Cum. Chum Salmon	Daily Pink Salmon	Cum. Pink Salmon	Daily Chinook Salmon	Cum. Chinook Salmon	Daily Coho Salmon	Cum. Coho Salmon	Daily Dolly Varden	Cum. Dolly Varden
7/01	42	42	18	18	0	0	0	0	117	117
7/02	282	324	69	87	3	3	0	0	123	240
7/03	975	1,299	156	243	6	9	0	0	108	348
7/04	2,133	3,432	564	807	3	12	0	0	114	462
7/05	1,653	5,085	735	1,542	0	12	0	0	84	546
7/06	1,797	6,882	900	2,442	0	12	0	0	57	603
7/07	1,341	8,223	810	3,252	0	12	0	0	39	642
7/08	3,279	11,502	918	4,170	0	12	0	0	42	684
7/09	3,495	14,997	1,899	6,069	0	12	0	0	45	729
7/10	2,433	17,430	1,251	7,320	3	15	0	0	33	762
7/11	3,015	20,445	2,769	10,089	0	15	0	0	75	837
7/12	1,878	22,323	1,074	11,163	9	24	0	0	114	951
7/13	1,827	24,150	5,088	16,251	0	24	0	0	36	987
7/14	1,101	25,251	789	17,040	0	24	0	0	0	987
7/15	765	26,016	462	17,502	0	24	0	0	-9	978
7/16	201	26,217	42	17,544	0	24	0	0	12	990
7/17	1,056	27,273	225	17,769	0	24	0	0	15	1,005
7/18	7,524	34,797	1,794	19,563	3	27	0	0	27	1,032
7/19	1,344	36,141	1,065	20,628	0	27	0	0	21	1,053
7/20	597	36,738	1,326	21,954	0	27	0	0	27	1,080
7/21	228	36,966	216	22,170	0	27	9	9	15	1,095
7/22	402	37,368	174	22,344	0	27	21	30	27	1,122
7/23	1,524	38,892	1,479	23,823	0	27	27	57	54	1,176
7/24	1,911	40,803	1,836	25,659	0	27	33	90	63	1,239
7/25	1,512	42,315	2,967	28,626	0	27	18	108	30	1,269
7/26	1,224	43,539	3,093	31,719	0	27	21	129	27	1,296
7/27	705	44,244	1,929	33,648	0	27	33	162	6	1,302
7/28	345	44,589	462	34,110	0	27	27	189	21	1,323
7/29	606	45,195	1,065	35,175	0	27	18	207	27	1,350
7/30	492	45,687	849	36,024	0	27	27	234	12	1,362
7/31	723	46,410	1,170	37,194	0	27	42	276	30	1,392
8/01	357	46,767	804	37,998	0	27	30	306	39	1,431
8/02	153	46,920	537	38,535	0	27	24	330	33	1,464
8/03	306	47,226	645	39,180	0	27	63	393	33	1,497
8/04	318	47,544	621	39,801	0	27	111	504	27	1,524
8/05	339	47,883	567	40,368	0	27	93	597	33	1,557
8/06	195	48,078	309	40,677	0	27	39	636	18	1,575
8/07	213	48,291	483	41,160	3	30	60	696	6	1,581
8/08	378	48,669	429	41,589	0	30	132	828	12	1,593
8/09	228	48,897	288	41,877	0	30	123	951	12	1,605
8/10	189	49,086	195	42,072	0	30	138	1,089	6	1,611
8/11	297	49,383	174	42,246	0	30	93	1,182	15	1,626
8/12	135	49,518	141	42,387	0	30	150	1,332	6	1,632
8/13	123	49,641	96	42,483	0	30	99	1,431	9	1,641
8/14	231	49,872	216	42,699	0	30	252	1,683	6	1,647
8/15	126	49,998	123	42,822	0	30	192	1,875	12	1,659
8/16	120	50,118	117	42,939	0	30	114	1,989	9	1,668

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Table 2.–Page 2 of 2.

Date	Daily Chum Salmon	Cum. Chum Salmon	Daily Pink Salmon	Cum. Pink Salmon	Daily Chinook Salmon	Cum. Chinook Salmon	Daily Coho Salmon	Cum. Coho Salmon	Daily Dolly Varden	Cum. Dolly Varden
8/17	150	50,268	48	42,987	0	30	126	2,115	18	1,686
8/18	99	50,367	105	43,092	0	30	156	2,271	48	1,734
8/19	48	50,415	84	43,176	0	30	36	2,307	51	1,785
8/20	12	50,427	42	43,218	0	30	108	2,415	30	1,815
8/21	144	50,571	93	43,311	0	30	174	2,589	27	1,842
8/22	66	50,637	84	43,395	0	30	105	2,694	72	1,914
8/23	69	50,706	24	43,419	0	30	48	2,742	12	1,926
8/24	45	50,751	63	43,482	0	30	93	2,835	45	1,971
8/25	63	50,814	60	43,542	0	30	69	2,904	42	2,013
8/26	33	50,847	9	43,551	0	30	117	3,021	0	2,013
8/27	45	50,892	12	43,563	0	30	57	3,078	42	2,055
8/28	21	50,913	3	43,566	0	30	84	3,162	33	2,088
8/29	9	50,922	3	43,569	0	30	51	3,213	6	2,094
8/30	3	50,925	6	43,575	0	30	12	3,225	9	2,103
8/31	21	50,946	3	43,578	0	30	42	3,267	27	2,130
9/01	18	50,964	9	43,587	0	30	54	3,321	27	2,157
9/02	21	50,985	24	43,611	0	30	72	3,393	18	2,175
9/03	0	50,985	0	43,611	0	30	42	3,435	39	2,214
9/04	9	50,994	6	43,617	0	30	63	3,498	15	2,229
Total	50,994		43,617		30		3,498		2,229	

Note: The box within the column indicates the first to third quartiles of cumulative fish passage whereas the midpoint of the cumulative passage is indicated by the bold box.

Table 3.—Comparison of daily expanded 20 and 30 minute tower count estimates and actual full-hour counts of coho salmon, Niukluk River counting tower, Fish River drainage, 17-30 August, 2007.

Date	1st 20 Min x 3	2nd 20 Min x 3	3rd 20 Min x 3	1st 30 Min x 2	Full Hour Counts	Percent Difference (1st 20 Min)	Percent Difference (2nd 20 Min)	Percent Difference (3rd 20 Min)	Percent Difference (1st 30 Min)
17-Aug	126	186	183	152	165	-23.6	12.7	10.9	-7.9
18-Aug	156	108	102	156	122	27.9	-11.5	-16.4	27.9
19-Aug	36	90	111	36	79	-54.4	13.9	40.5	-54.4
20-Aug	108	87	132	118	109	-0.9	-20.2	21.1	8.3
21-Aug	174	132	162	152	156	11.5	-15.4	3.8	-2.6
22-Aug	105	177	129	132	137	-23.4	29.2	-5.8	-3.6
23-Aug	48	99	78	60	75	-36.0	32.0	4.0	-20.0
24-Aug	93	72	81	80	82	13.4	-12.2	-1.2	-2.4
25-Aug	69	45	72	60	62	11.3	-27.4	16.1	-3.2
26-Aug	117	90	33	112	80	46.3	12.5	-58.8	40.0
27-Aug	57	84	24	62	55	3.6	52.7	-56.4	12.7
28-Aug	84	36	78	62	66	27.3	-45.5	18.2	-6.1
29-Aug	51	60	75	52	62	-17.7	-3.2	21.0	-16.1
30-Aug	12	9	33	20	18	-33.3	-50	83.3	11.1
Season Totals	1,236	1,275	1,293	1,254	1,268	-2.5	+0.6	+2.0	-1.1

Table 4.—Daily and cumulative (Cum.) passage of all salmonid species at Nome River weir, Norton Sound, 2007.

Date	Daily Chum Salmon	Cum. Chum Salmon	Daily Pink Salmon	Cum. Pink Salmon	Daily Chinook Salmon	Cum. Chinook Salmon	Daily Coho Salmon	Cum. Coho Salmon	Daily Sockeye Salmon	Cum. Sockeye Salmon	Daily Dolly Varden	Cum. Dolly Varden
7/04	0	0	1	1	0	0	0	0	0	0	5	5
7/05	1	1	0	1	0	0	0	0	0	0	15	20
7/06	5	6	1	2	0	0	0	0	0	0	25	45
7/07	7	13	1	3	0	0	0	0	0	0	6	51
7/08	23	36	3	6	0	0	0	0	0	0	18	69
7/09	366	402	34	40	1	1	0	0	4	4	21	90
7/10	28	430	6	46	0	1	0	0	1	5	8	98
7/11	195	625	80	126	0	1	0	0	10	15	13	111
7/12	541	1,166	1,024	1,150	0	1	0	0	2	17	20	131
7/13	227	1,393	830	1,980	0	1	0	0	2	19	1	132
7/14	207	1,600	998	2,978	0	1	0	0	0	19	1	133
7/15	111	1,711	350	3,328	0	1	0	0	0	19	6	139
7/16	68	1,779	77	3,405	0	1	0	0	0	19	0	139
7/17	108	1,887	235	3,640	1	2	0	0	0	19	5	144
7/18	227	2,114	304	3,944	0	2	0	0	0	19	1	145
7/19	651	2,765	1,301	5,245	1	3	0	0	4	23	6	151
7/20	3	2,768	3	5,248	0	3	0	0	0	23	3	154
7/21	37	2,805	25	5,273	0	3	0	0	0	23	4	158
7/22	132	2,937	228	5,501	0	3	0	0	0	23	34	192
7/23	717	<b>3,654</b>	1,423	6,924	0	3	0	0	1	24	126	318
7/24	164	3,818	1,901	8,825	0	3	0	0	1	25	27	345
7/25	8	3,826	134	8,959	0	3	0	0	0	25	1	346
7/26	133	3,959	1,740	10,699	0	3	1	1	2	27	12	358
7/27	97	4,056	935	11,634	0	3	0	1	0	27	8	366
7/28	77	4,133	382	<b>12,016</b>	0	3	0	1	5	32	5	371
7/29	636	4,769	4,423	16,439	0	3	10	11	9	41	19	390
7/30	126	4,895	664	17,103	1	4	6	17	27	68	3	393
7/31	66	4,961	219	17,322	0	4	2	19	1	69	9	402
8/01	87	5,048	854	18,176	0	4	1	20	2	71	9	411
8/02	84	5,132	391	18,567	0	4	6	26	1	72	15	426
8/03	310	5,442	1,864	20,431	0	4	98	124	2	74	39	465
8/04	223	5,665	1,053	21,484	0	4	25	149	3	77	33	498
8/05	109	5,774	345	21,829	0	4	21	170	2	79	7	505
8/06	95	5,869	139	21,968	0	4	3	173	4	83	15	520
8/07	87	5,956	175	22,143	1	5	27	200	2	85	49	569
8/08	44	6,000	129	22,272	0	5	3	203	3	88	51	620
8/09	46	6,046	96	22,368	0	5	8	211	0	88	60	680
8/10	156	6,202	527	22,895	0	5	97	308	6	94	283	963
8/11	89	6,291	679	23,574	0	5	186	494	4	98	5	968
8/12	18	6,309	156	23,730	0	5	43	537	3	101	13	981
8/13	105	6,414	216	23,946	0	5	390	927	11	112	26	1,007
8/14	22	6,436	43	23,989	0	5	9	936	2	114	28	1,035
8/15	21	6,457	53	24,042	0	5	2	938	6	120	46	1,081
8/16	43	6,500	33	24,075	0	5	7	945	3	123	96	1,177
8/17	92	6,592	66	24,141	0	5	97	1,042	21	144	190	1,367
8/18	22	6,614	38	24,179	0	5	37	1,079	4	148	74	1,441
8/19	28	6,642	26	24,205	0	5	8	1,087	9	157	179	1,620
8/20	23	6,665	38	24,243	1	6	38	1,125	17	174	262	1,882
8/21	17	6,682	26	24,269	1	7	24	1,149	5	179	100	1,982

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Table 4.–Page 2 of 2.

Date	Daily Chum Salmon	Cum. Chum Salmon	Daily Pink Salmon	Cum. Pink Salmon	Daily Chinook Salmon	Cum. Chinook Salmon	Daily Coho Salmon	Cum. Coho Salmon	Daily Sockeye Salmon	Cum. Sockeye Salmon	Daily Dolly Varden	Cum. Dolly Varden
8/22	37	6,719	17	24,286	0	7	69	<b>1,218</b>	15	194	114	2,096
8/23	13	6,732	5	24,291	0	7	11	1,229	3	197	17	2,113
8/24	17	6,749	10	24,301	2	9	32	1,261	4	201	10	2,123
8/25	36	6,785	16	24,317	0	9	47	1,308	6	207	43	2,166
8/26	14	6,799	7	24,324	0	9	24	1,332	2	209	16	2,182
8/27	11	6,810	7	24,331	0	9	84	1,416	8	217	36	2,218
8/28	9	6,819	2	24,333	0	9	5	1,421	1	218	9	2,227
8/29	10	6,829	2	24,335	0	9	11	1,432	4	222	29	2,256
8/30	6	6,835	2	24,337	0	9	13	1,445	6	228	4	2,260
8/31	14	6,849	4	24,341	0	9	13	1,458	23	251	8	2,268
9/01	20	6,869	8	24,349	0	9	6	1,464	23	274	21	2,289
9/02	23	6,892	2	24,351	1	10	69	1,533	24	298	45	2,334
9/03	11	6,903	2	24,353	0	10	60	1,593	33	331	33	2,367
9/04	5	6,908	5	24,358	3	13	84	1,677	35	366	56	2,423
9/05	3	6,911	9	24,367	0	13	58	1,735	6	372	14	2,437
9/06	9	6,920	3	24,370	0	13	30	1,765	2	374	33	2,470
9/07	28	6,948	3	24,373	0	13	182	1,947	24	398	14	2,484
9/08	15	6,963	4	24,377	0	13	117	2,064	4	402	17	2,501
9/09	25	6,988	9	24,386	0	13	239	2,303	97	499	11	2,512
9/10	5	6,993	1	24,387	0	13	27	2,330	6	505	10	2,522
9/11	7	7,000	0	24,387	0	13	17	2,347	3	508	5	2,527
9/12	12	7,012	0	24,387	0	13	36	2,383	3	511	2	2,529
9/13	6	7,018	3	24,390	0	13	11	2,394	0	511	1	2,530
9/14	5	7,023	2	24,392	0	13	23	2,417	14	525	2	2,532
9/15	8	7,031	3	24,395	0	13	8	2,425	8	533	0	2,532
9/16	3	7,034	0	24,395	0	13	12	2,437	1	534	2	2,534
<b>Total</b>	<b>7,034</b>		<b>24,395</b>		<b>13</b>		<b>2,437</b>		<b>534</b>		<b>2,534</b>	

Note: The box within the column indicates the first to third quartiles of cumulative fish passage whereas the midpoint of the cumulative passage is indicated by the bold box.

Table 5.—Chum salmon age and sex composition and mean length (mm) by sampling period, Kwiniuk River, Norton Sound, 2007.

		Brood Year and (Age Group)			
		2003	2002	2001	Total
		(0.3)	(0.4)	(0.5)	
Sampling Dates:	6/26-7/04				
Sample Size:	229				Stratum 1
Male	Percent of Samples	12.2	33.6	3.1	48.9
	Number of Samples	28	77	7	112
	Mean Length <sup>a</sup>	580.5	608.8	630.0	603.1
Female	Percent of Samples	9.6	39.7	1.7	51.1
	Number of Samples	22	91	4	117
	Mean Length <sup>a</sup>	561.8	571.8	603.8	571.0
Total	Percent of Samples	21.8	73.4	4.8	100.0
	Number of Samples	50	168	11	229
	Mean Length <sup>a</sup>	572.3	588.8	620.5	586.7
Sampling Dates:	7/06-7/08				
Sample Size:	104				Stratum 2
Male	Percent of Samples	23.1	26.0		49.0
	Number of Samples	24	27		51
	Mean Length <sup>a</sup>	563.1	580.7		572.5
Female	Percent of Samples	25.0	26.0		51.0
	Number of Samples	26	27		53
	Mean Length <sup>a</sup>	547.9	557.4		552.7
Total	Percent of Samples	48.1	51.9		100.0
	Number of Samples	50	54		104
	Mean Length <sup>a</sup>	555.2	569.1		562.4

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Table 5.–Page 2 of 2.

		Brood Year and (Age Group)			Total
		2003	2002	2001	
		(0.3)	(0.4)	(0.5)	
Sampling Dates:	7/14-7/23				
Sample Size:	173		Stratum 3		
Male	Percent of Samples	24.9	14.5	0.6	39.88
	Number of Samples	43	25	1	69
	Mean Length <sup>a</sup>	571.9	590.2	635.0	579.4
Female	Percent of Samples	33.5	25.4	1.2	60.12
	Number of Samples	58	44	2	104
	Mean Length <sup>a</sup>	542.3	545.5	567.5	544.1
Total	Percent of Samples	58.4	39.9	1.7	100.0
	Number of Samples	101	69	3	173
	Mean Length <sup>a</sup>	554.9	561.7	590.0	558.2
Sampling Dates:	6/26-7/23				
Sample Size:	506		Season Total		
Male	Percent of Samples	18.8	25.5	1.6	45.8
	Number of Samples	95	129	8	232
	Mean Length <sup>a</sup>	572.2	599.3	630.6	558.4
Female	Percent of Samples	20.9	32.0	1.2	54.2
	Number of Samples	106	162	6	274
	Mean Length <sup>a</sup>	547.7	562.2	591.7	583.4
Season Total <sup>b</sup>	Percent of Samples	39.7	57.5	2.8	100.0
	Number of Samples	201	291	14	506
	Mean Length <sup>a</sup>	559.3	578.7	613.9	572.0

<sup>a</sup> Length was measured from mid eye to tail fork (METF).

<sup>b</sup> The number of fish in total are the stratum sums; total percentages and mean lengths are derived from the sums.

Table 6.—Commercial chum salmon age, sex, and mean length (mm), Moses Point Subdistrict, Norton Sound, 2007.

		Brood Year and (Age Group)					
		<u>2004</u>	<u>2003</u>	<u>2002</u>	<u>2001</u>	<u>2000</u>	Total
		(0.2)	(0.3)	(0.4)	(0.5)	(0.6)	
Sampling Dates:	7/15-7/28						
Sample Size:	270						Season Total
Male	Percent of Samples	0.7	35.6	17.4	3.3	0.4	57.4
	Number of Samples	2	96	47	9	1	155
	Mean Length <sup>a</sup>	524.5	572.7	581.3	619.6	653.0	577.9
Female	Percent of Samples	0.4	24.4	17.0	0.7	0.0	42.6
	Number of Samples	1	66	46	2	0	115
	Mean Length <sup>a</sup>	545.0	552.1	558.9	578.0	0.0	555.2
Total	Percent of Samples	1.1	60.0	34.4	4.1	0.4	100.0
	Number of Samples	3	162	93	11	1	270
	Mean Length <sup>a</sup>	531.3	564.3	570.2	612.0	653.0	574.5

<sup>a</sup> Length was measured from mid eye to tail fork (METF).

Table 7.—Chum salmon age and sex composition and mean length (mm) by sampling period, Niukluk River, Norton Sound, 2007.

		Brood Year and (Age Group)				Total
		2004 (0.2)	2003 (0.3)	2002 (0.4)	2001 (0.5)	
Sampling Date:	7/07					
Sample Size:	198			Stratum 1		
Male	Percent of Samples		23.7	27.3	3.5	54.5
	Number of Samples		47	54	7	108
	Mean Length <sup>a</sup>		579.9	590.9	605.7	587.1
Female	Percent of Samples		21.7	20.7	3.0	45.5
	Number of Samples		43	41	6	90
	Mean Length <sup>a</sup>		553.0	557.9	581.2	557.1
Total	Percent of Samples		45.5	48.0	6.6	100.0
	Number of Samples		90	95	13	198
	Mean Length <sup>a</sup>		567.0	576.7	594.4	573.5
Sampling Dates:	7/14-7/15					
Sample Size:	188			Stratum 2		
Male	Percent of Samples		31.9	20.7	2.1	54.8
	Number of Samples		60	39	4	103
	Mean Length <sup>a</sup>		581.9	582.4	583.5	582.1
Female	Percent of Samples		23.4	19.7	2.1	45.2
	Number of Samples		44	37	4	85
	Mean Length <sup>a</sup>		545.3	555.0	578.0	551.1
Total	Percent of Samples		55.3	40.4	4.3	100.0
	Number of Samples		104	76	8	188
	Mean Length <sup>a</sup>		566.4	569.1	580.8	568.1

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Table 7.–Page 2 of 2.

		Brood Year and (Age Group)				
		<u>2004</u>	<u>2003</u>	<u>2002</u>	<u>2001</u>	Total
		(0.2)	(0.3)	(0.4)	(0.5)	
Sampling Date:	7/21					
Sample Size:	185			Stratum 3		
Male	Percent of Samples		34.1	20.0	1.6	55.7
	Number of Samples		63	37	3	103
	Mean Length <sup>a</sup>		582.3	593.5	584.7	564.2
Female	Percent of Samples	0.5	28.1	13.5	2.2	44.3
	Number of Samples	1	52	25	4	82
	Mean Length <sup>a</sup>	547.0	550.2	563.9	570.5	531.2
Total	Percent of Samples	0.5	62.2	33.5	3.8	100.0
	Number of Samples	1	115	62	7	185
	Mean Length <sup>a</sup>	547.0	567.8	581.6	576.6	572.6
Sampling Dates:	7/07-7/21					
Sample Size:	571			Season Total		
Male	Percent of Samples		29.8	22.8	2.5	55.0
	Number of Samples		170	130	14	314
	Mean Length <sup>a</sup>		581.5	589.1	594.9	585.2
Female	Percent of Samples	0.2	24.3	18.0	2.5	45.0
	Number of Samples	1	139	103	14	257
	Mean Length <sup>a</sup>	547.0	549.5	558.3	577.2	554.5
Season Total <sup>b</sup>	Percent of Samples	0.2	54.1	40.8	4.9	100.0
	Number of Samples	1	309	233	28	571
	Mean Length <sup>a</sup>	547.0	567.1	575.5	586.0	571.4

<sup>a</sup> Length was measured from mid eye to tail fork (METF).

<sup>b</sup> The number of fish in total are the stratum sums; total percentages and mean lengths are derived from the sums.

Table 8.—Chum salmon age and sex composition, and mean length (mm) by sampling period, Nome River, Norton Sound, 2007.

		Brood Year and (Age Group)			Total
		2003 (0.3)	2002 (0.4)	2001 (0.5)	
Sampling Dates:	7/09-7/17				
Sample Size:	183				Stratum 1
Male	Percent of Samples	29.0	29.5	2.7	61.2
	Number of Samples	53	54	5	112
	Mean Length <sup>a</sup>	583.0	596.0	611.0	590.5
Female	Percent of Samples	20.8	15.8	2.2	38.8
	Number of Samples	38	29	4	71
	Mean Length <sup>a</sup>	550.1	559.7	580.0	555.7
Total	Percent of Samples	49.7	45.4	4.9	100.0
	Number of Samples	91	83	9	183
	Mean Length <sup>a</sup>	569.3	583.3	597.2	577.0
Sampling Dates:	7/19-7/29				
Sample Size:	166				Stratum 2
Male	Percent of Samples	22.3	21.7	0.6	44.6
	Number of Samples	37	36	1	74
	Mean Length <sup>a</sup>	577.0	577.5	560.0	577.0
Female	Percent of Samples	31.9	19.9	3.6	55.4
	Number of Samples	53	33	6	92
	Mean Length <sup>a</sup>	537.1	544.3	572.5	542.0
Total	Percent of Samples	54.2	41.6	4.2	100.0
	Number of Samples	90	69	7	166
	Mean Length <sup>a</sup>	553.5	561.6	570.7	557.6

-continued-

Table 8.–Page 2 of 3.

		Brood Year and (Age Group)			
		2003	2002	2001	Total
		(0.3)	(0.4)	(0.5)	
Sampling Dates:	7/30-8/04				
Sample Size:	163		Stratum 3		
Male	Percent of Samples	23.3	11.7	1.2	36.2
	Number of Samples	38	19	2	59
	Mean Length <sup>a</sup>	580.1	582.1	595.0	581.3
Female	Percent of Samples	42.3	20.2	1.2	63.8
	Number of Samples	69	33	2	104
	Mean Length <sup>a</sup>	539.6	534.4	530.0	537.7
Total	Percent of Samples	65.6	31.9	2.5	100.0
	Number of Samples	107	52	4	163
	Mean Length <sup>a</sup>	554.0	551.8	562.5	553.5
Sampling Dates:	8/05-9/06				
Sample Size:	166		Stratum 4		
Male	Percent of Samples	19.9	16.3	1.8	38.0
	Number of Samples	33	27	3	63
	Mean Length <sup>a</sup>	575.6	598.1	625.0	587.6
Female	Percent of Samples	43.4	16.3	2.4	62.0
	Number of Samples	72	27	4	103
	Mean Length <sup>a</sup>	536.5	549.3	573.8	541.3
Total	Percent of Samples	63.3	32.5	4.2	100.0
	Number of Samples	105	54	7	166
	Mean Length <sup>a</sup>	548.8	573.7	595.7	558.9

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Table 8.–Page 3 of 3.

		Brood Year and (Age Group)			Total
		2003 (0.3)	2002 (0.4)	2001 (0.5)	
Sampling Dates:	7/09-9/06				
Sample Size:	678	Season Total			
Male	Percent of Samples	23.7	20.1	1.6	45.4
	Number of Samples	161	136	11	308
	Mean Length <sup>a</sup>	579.4	589.6	607.3	584.9
Female	Percent of Samples	34.2	18.0	2.4	54.6
	Number of Samples	232	122	16	370
	Mean Length <sup>a</sup>	539.8	546.4	569.4	543.2
Season Total <sup>b</sup>	Percent of Samples	58.0	38.1	4.0	100.0
	Number of Samples	393	258	27	678
	Mean Length <sup>a</sup>	578.6	552.0	0.0	562.2

<sup>a</sup> Length was measured from mid eye to tail fork (METF).

<sup>b</sup> The number of fish in total are the stratum sums; total percentages are derived from the sums.

Table 9.—Coho salmon age and sex composition, and mean length (mm), Kwiniuk River, Norton Sound, 2007.

		Brood Year and (Age Group)			Total
		2004	2003	2002	
		(1.1)	(2.1)	(3.1)	
Sampling Dates:	8/13-8/26				
Sample Size:	106				
Male	Percent of Samples	17.9	34.9	1.9	54.7
	Number of Samples	19	37	2	58
	Mean Length <sup>a</sup>	629.2	605.9	600.0	613.4
Female	Percent of Samples	18.9	25.5	0.9	45.3
	Number of Samples	20	27	1	48
	Mean Length <sup>a</sup>	618.5	605.6	615.0	611.1
Season Total	Percent of Samples	36.8	60.4	2.8	100.0
	Number of Samples	39	64	3	106
	Mean Length <sup>a</sup>	623.7	605.8	605.0	612.4

<sup>a</sup> Length was measured from mid eye to fork-of-tail (METF).

Table 10.—Commercial coho salmon age and sex composition, and mean length (mm), Moses Point Subdistrict, Norton Sound, 2007.

		Brood Year and (Age Group)			Total
		2004	2003	2002	
		(1.1)	(2.1)	(3.1)	
Sampling Dates:	7/26-8/30				
Sample Size:	443				
Male	Percent of Samples	13.5	39.7	1.1	54.4
	Number of Samples	60	176	5	241
	Mean Length <sup>a</sup>	595.4	589.4	532.5	591.3
Female	Percent of Samples	7.0	38.4	0.2	45.6
	Number of Samples	31	170	1	202
	Mean Length <sup>a</sup>	601.9	593.9	605.0	589.0
Total	Percent of Samples	20.5	78.1	1.3	100.0
	Number of Samples	91	346	6	443
	Mean Length <sup>a</sup>	597.6	588.0	610.2	590.3

<sup>a</sup> Length was measured from mid eye to fork-of-tail (METF).

Table 11.—Coho salmon age and sex composition, and mean length (mm), Nome River, Norton Sound, 2007.

		Brood Year and (Age Group)			Total
		2004 (1.1)	2003 (2.1)	2002 (3.1)	
Sampling Dates:	7/31-9/12				
Sample Size:	104				
Male	Percent of Samples	11.5	31.7	4.8	48.1
	Number of Samples	12	33	5	50
	Mean Length <sup>a</sup>	572.1	570.9	593.0	573.4
Female	Percent of Samples	12.5	35.6	3.8	51.9
	Number of Samples	13	37	4	54
	Mean Length <sup>a</sup>	542.7	568.6	586.3	563.7
Total	Percent of Samples	24.0	67.3	8.7	100.0
	Number of Samples	25	70	9	104
	Mean Length <sup>a</sup>	556.8	569.7	590.0	568.4

<sup>a</sup> Length was measured from mid eye to fork of tail (METF).

## **FIGURES**

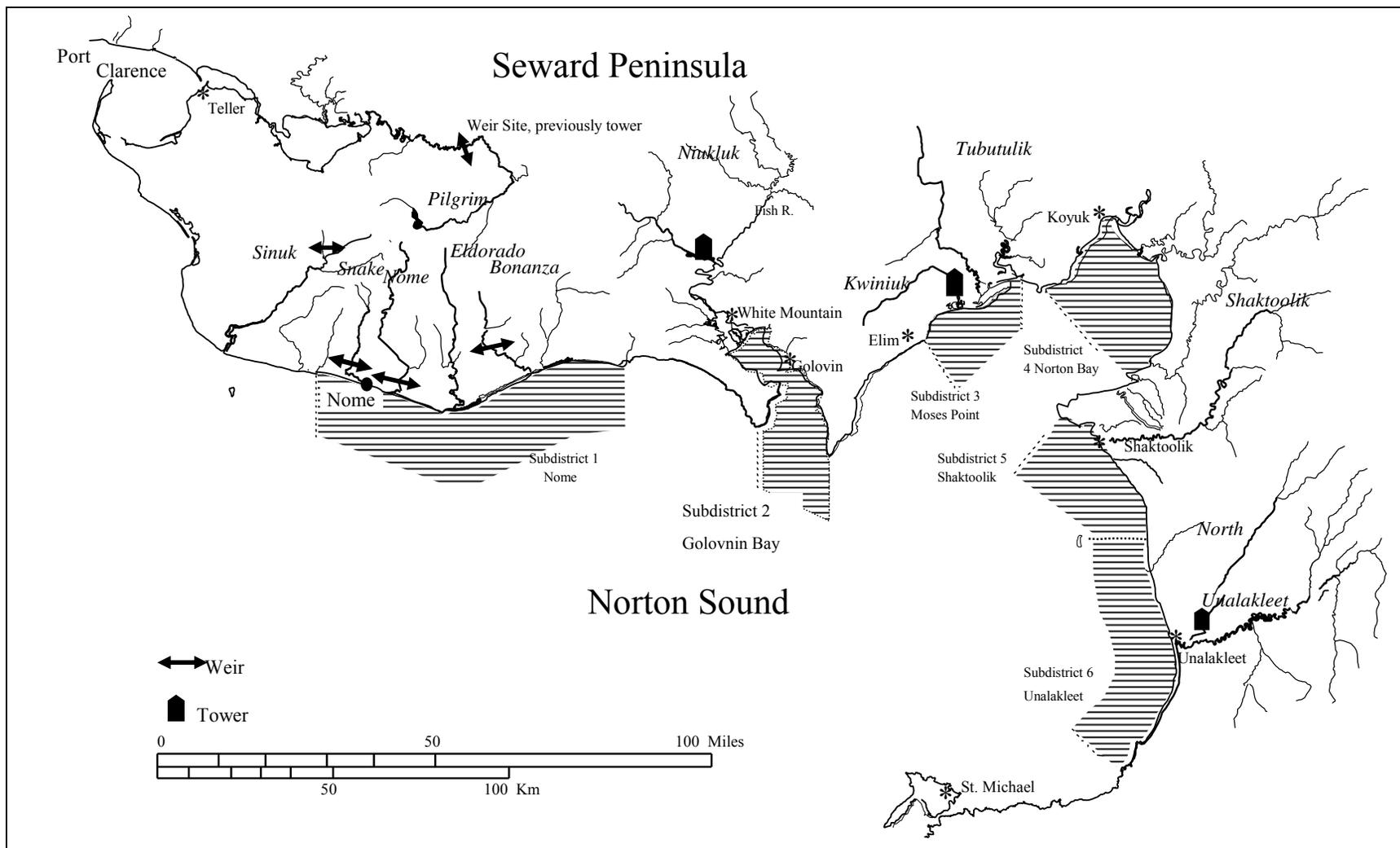


Figure 1.—Norton Sound and southern Seward Peninsula, Alaska, showing commercial fishery subdistricts and tower or weir enumeration project locations.

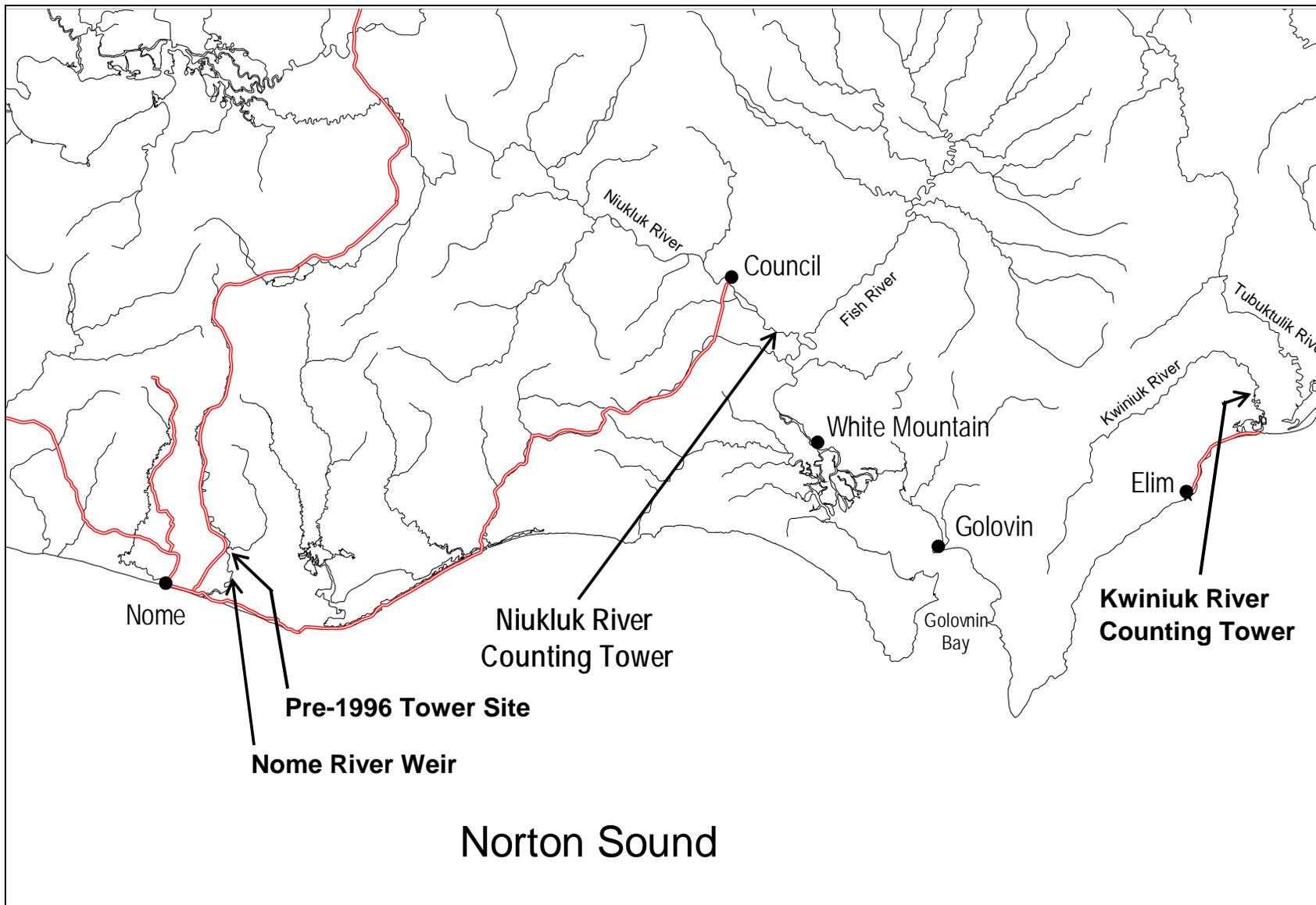


Figure 2.—ADF&G escapement project sites; Kwiniuk and Niukluk counting towers and Nome River weir and previous tower site, Norton Sound.

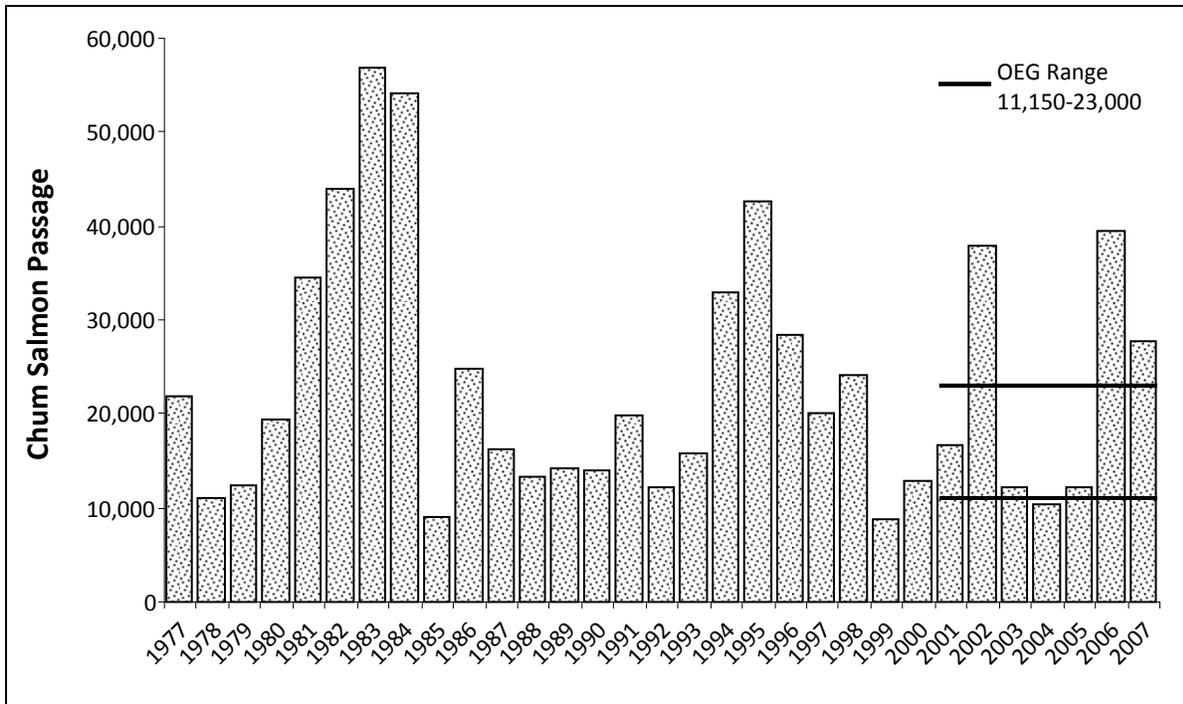


Figure 3.—Annual chum salmon passage compared to the optimal escapement goal (OEG) range at the Kwiniuk River counting tower, 1977-2007, Norton Sound.

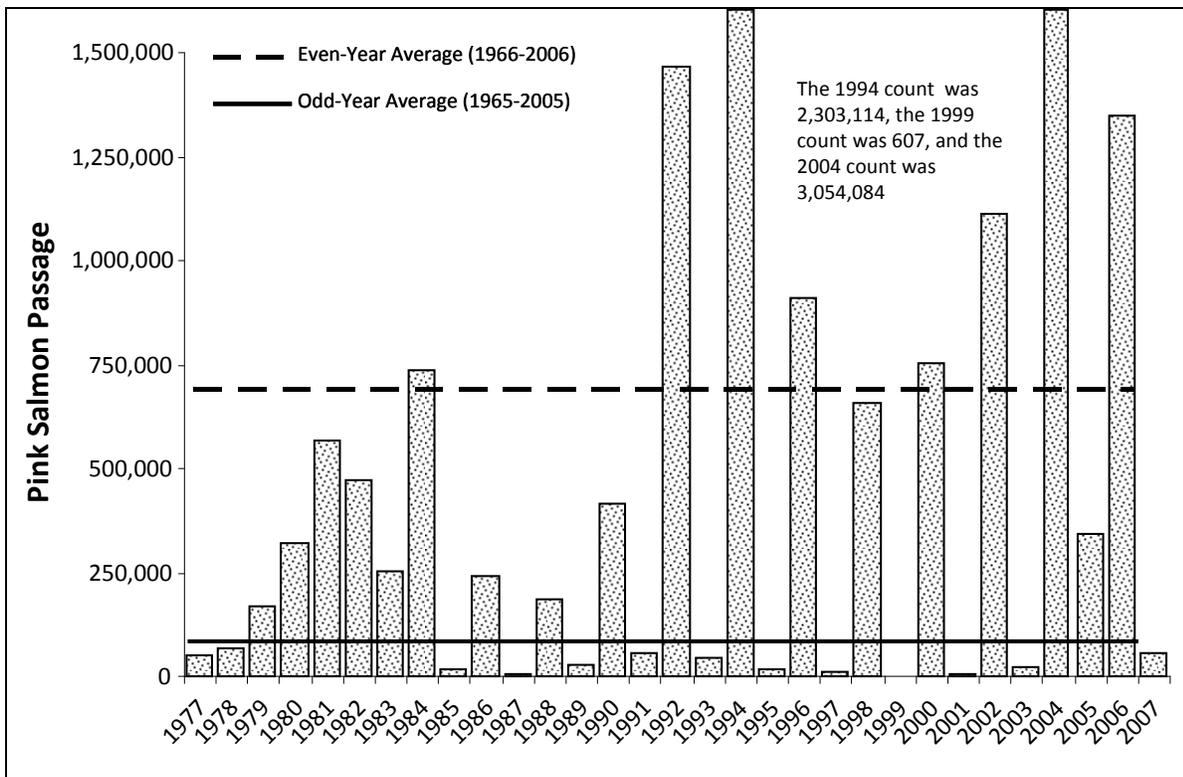


Figure 4.—Annual pink salmon passage and historical odd and even-year averages at the Kwiniuk River counting tower, 1977-2007, Norton Sound.

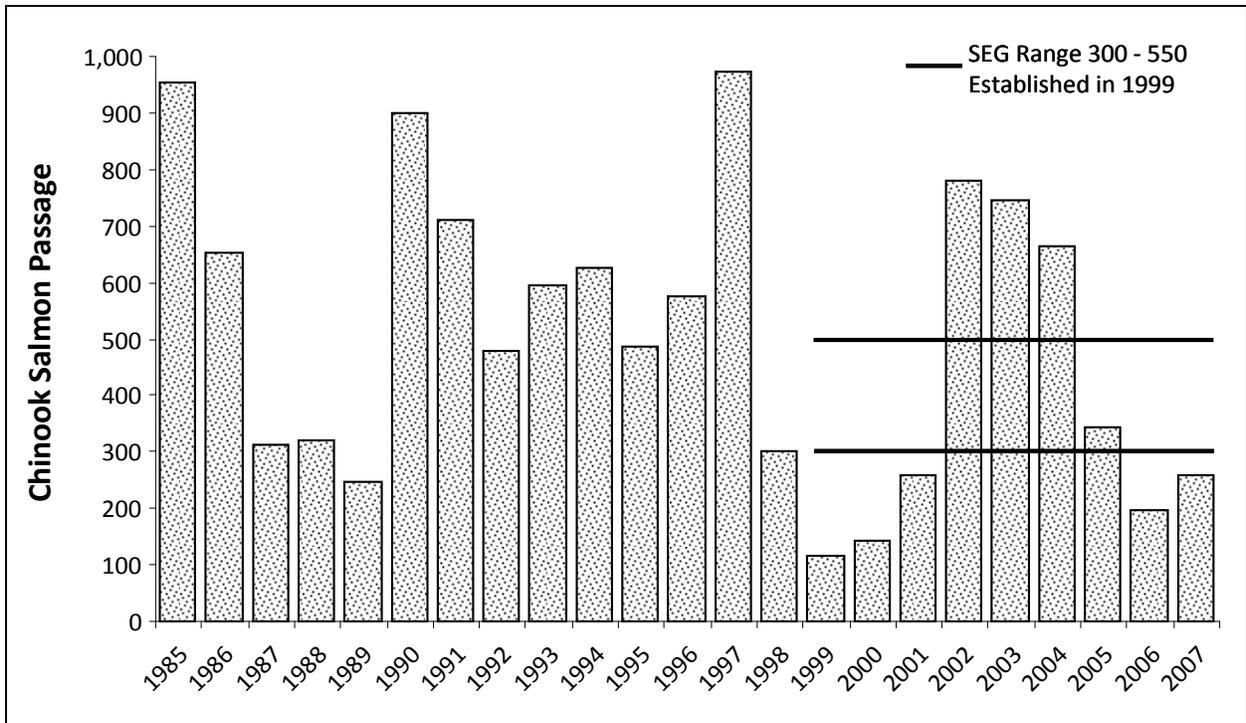


Figure 5.—Annual Chinook salmon passage compared to the sustainable escapement goal (SEG) range at the Kwiniuk River counting tower, 1985-2007, Norton Sound.

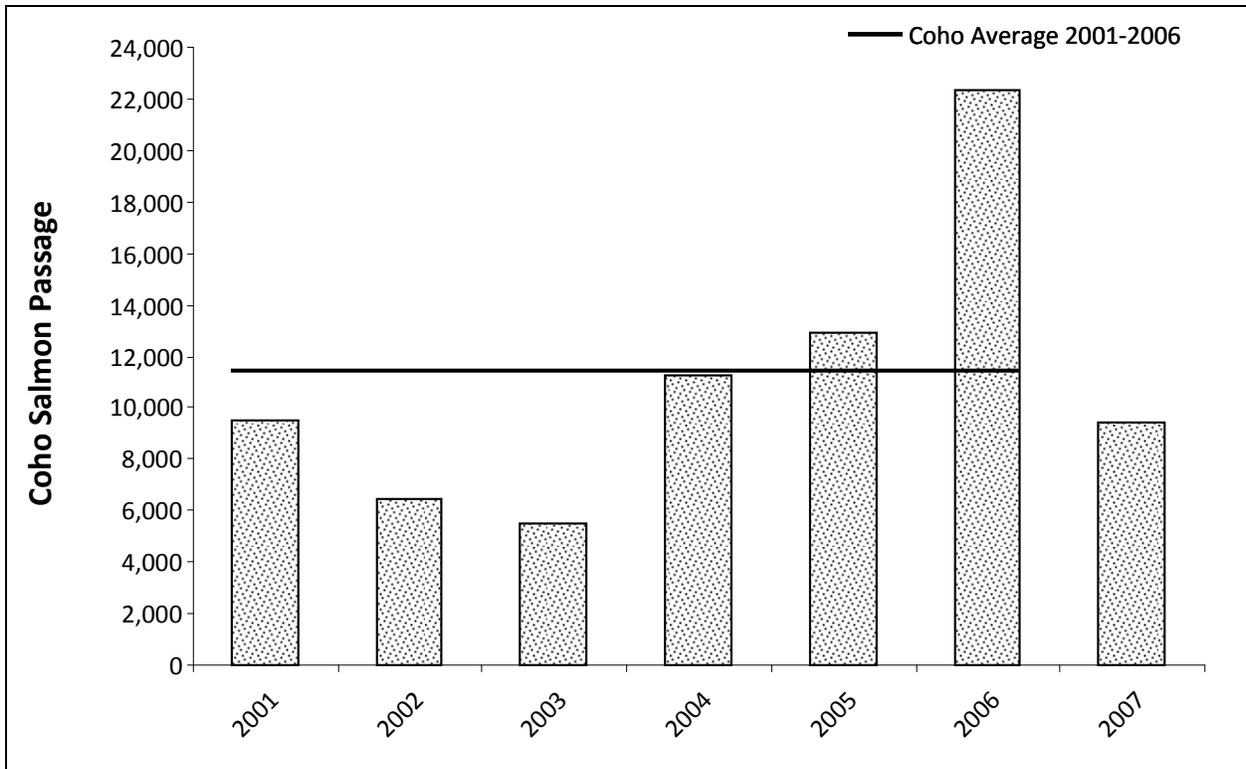


Figure 6.—Annual coho salmon passage and historical average at the Kwiniuk River counting tower, 2001-2007, Norton Sound.

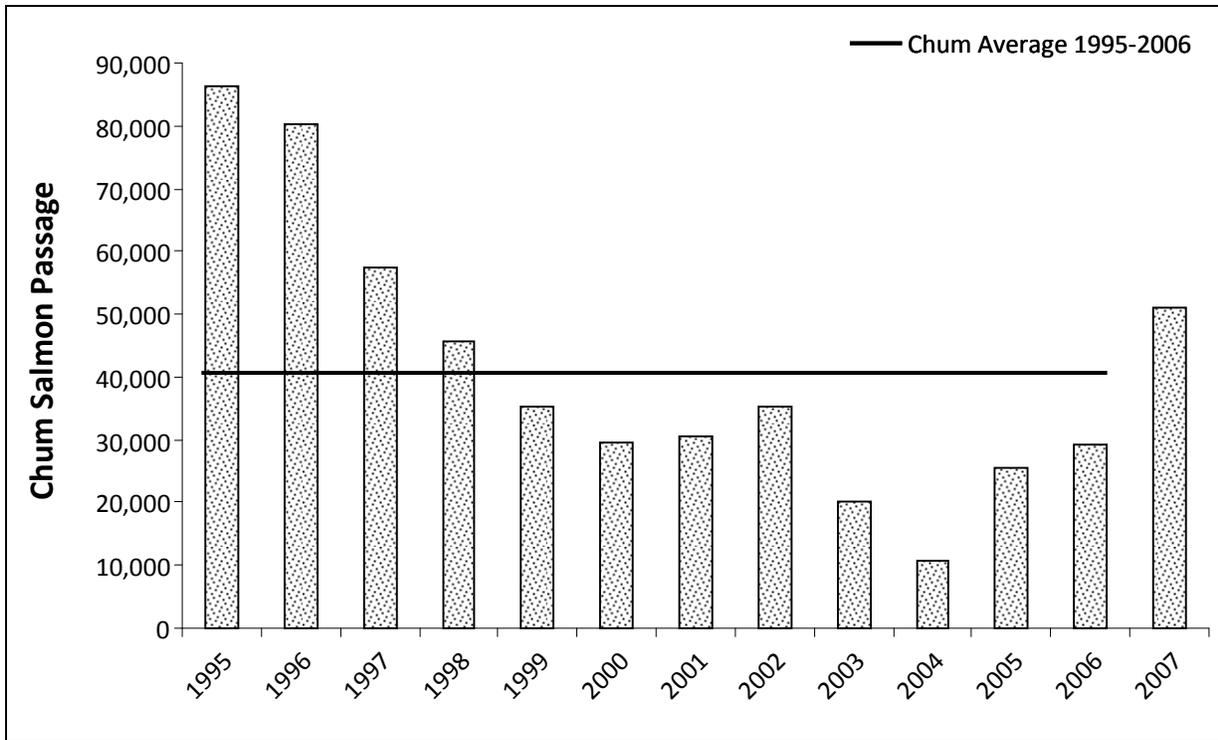


Figure 7.—Annual chum salmon passage and historical average at the Niukluk River counting tower 1995–2007, Norton Sound.

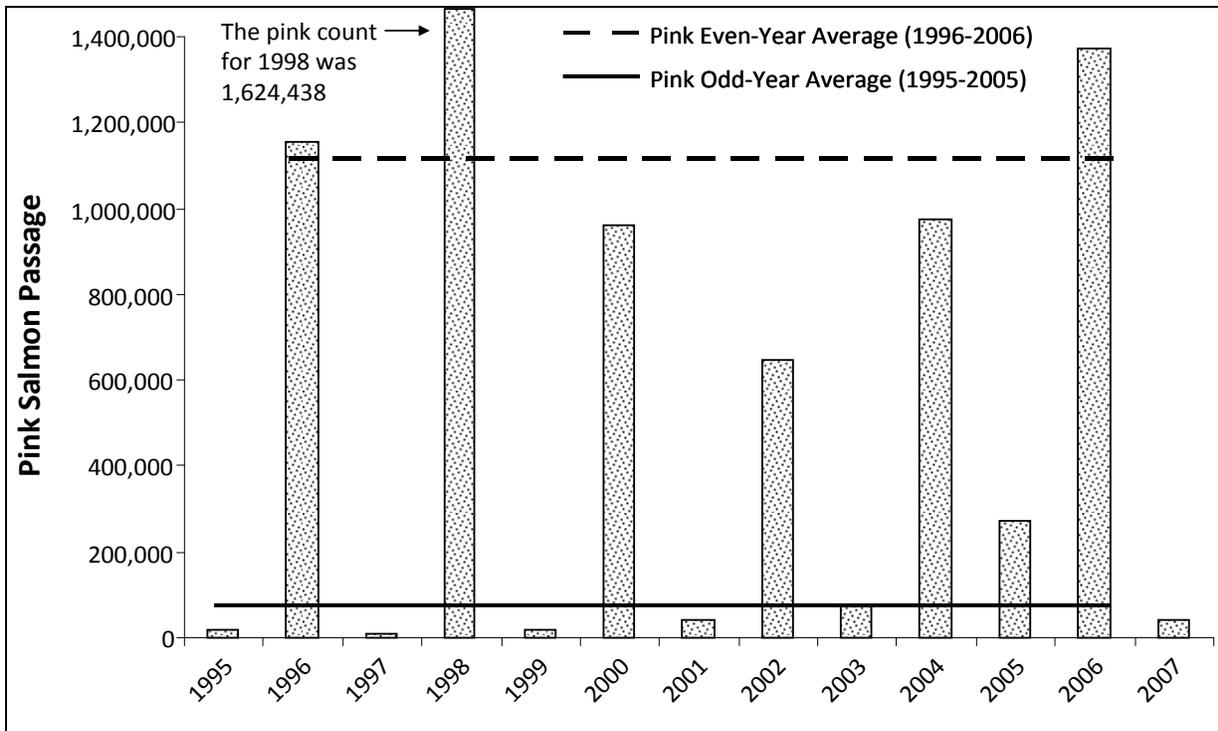


Figure 8.—Annual pink salmon passage and the historical odd and even-year averages at the Niukluk River counting tower 1995–2007, Norton Sound.

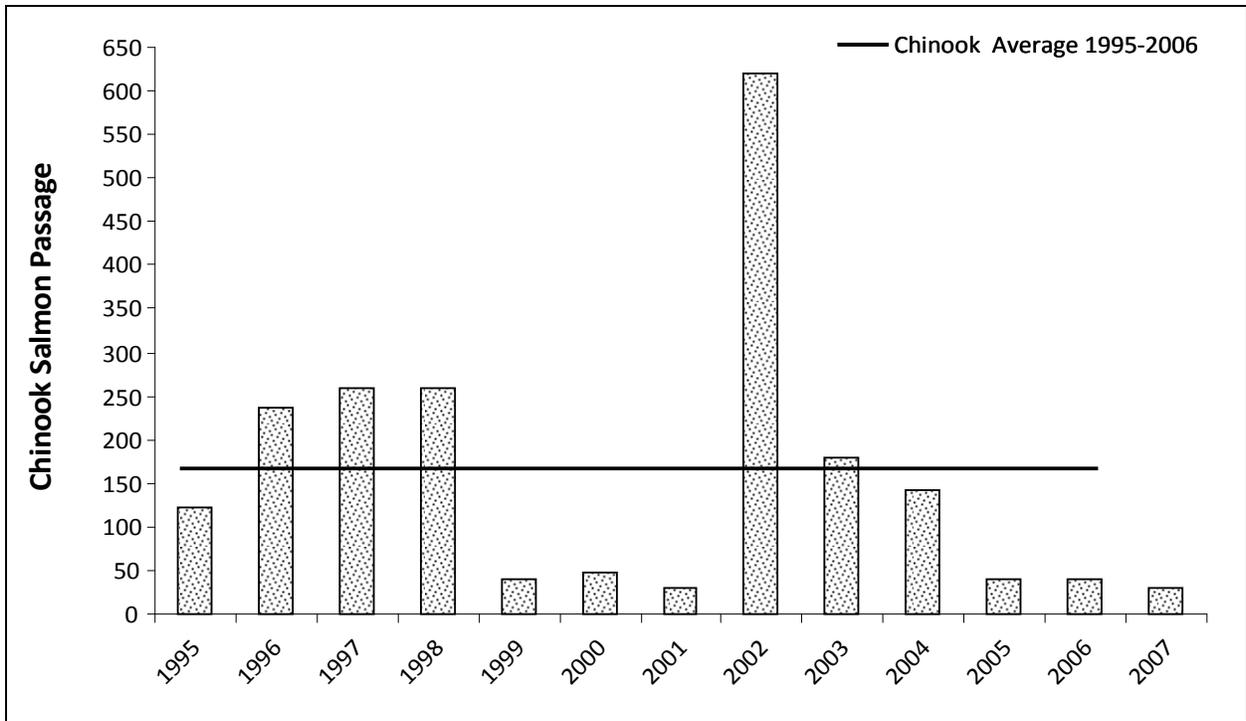


Figure 9.—Annual Chinook salmon passage and historical average at the Niukluk River counting tower 1995-2007, Norton Sound.

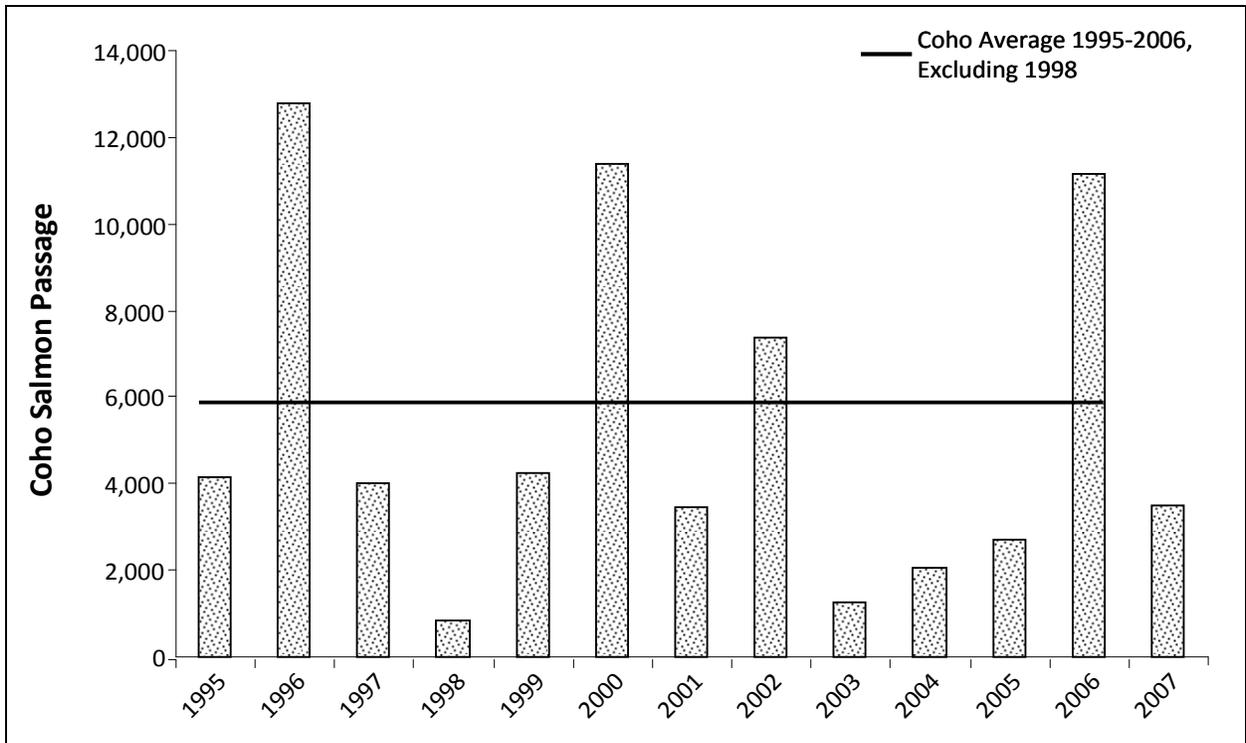


Figure 10.—Annual coho salmon passage and historical average at the Niukluk River counting tower 1995-2007, Norton Sound.

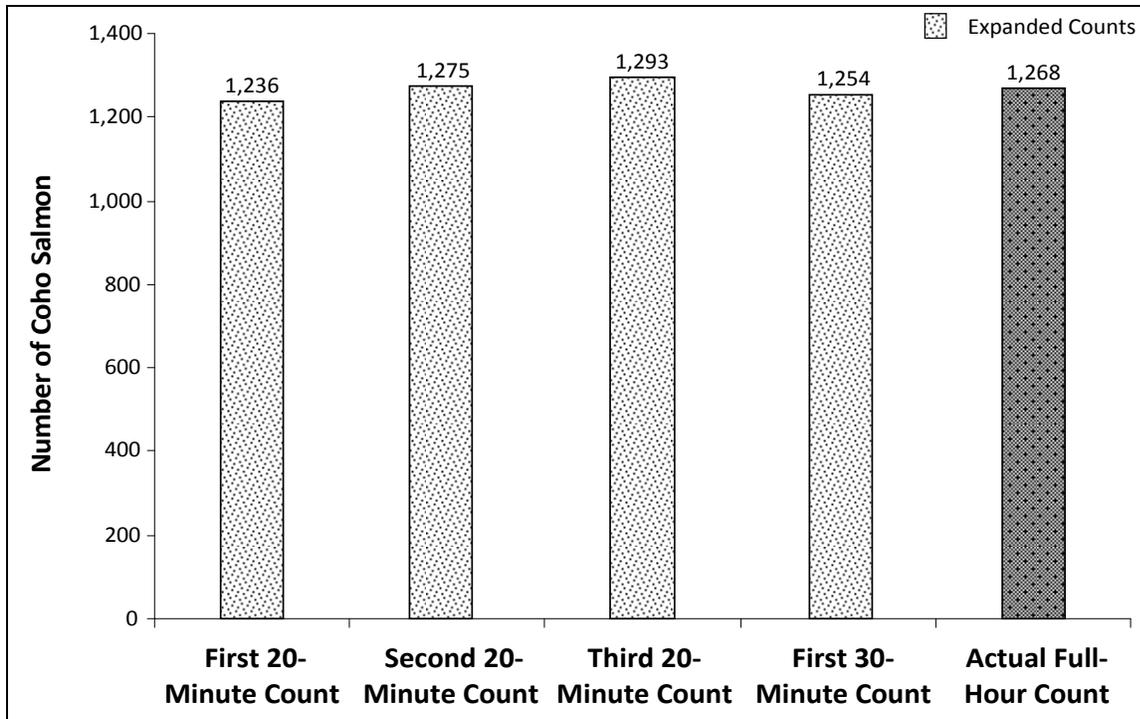


Figure 11.—Comparison of coho salmon cumulative expanded passage estimates with the actual cumulative coho salmon passage derived from full-hour counts, Niukluk River counter tower, Fish River drainage, 17-30 August, 2007.

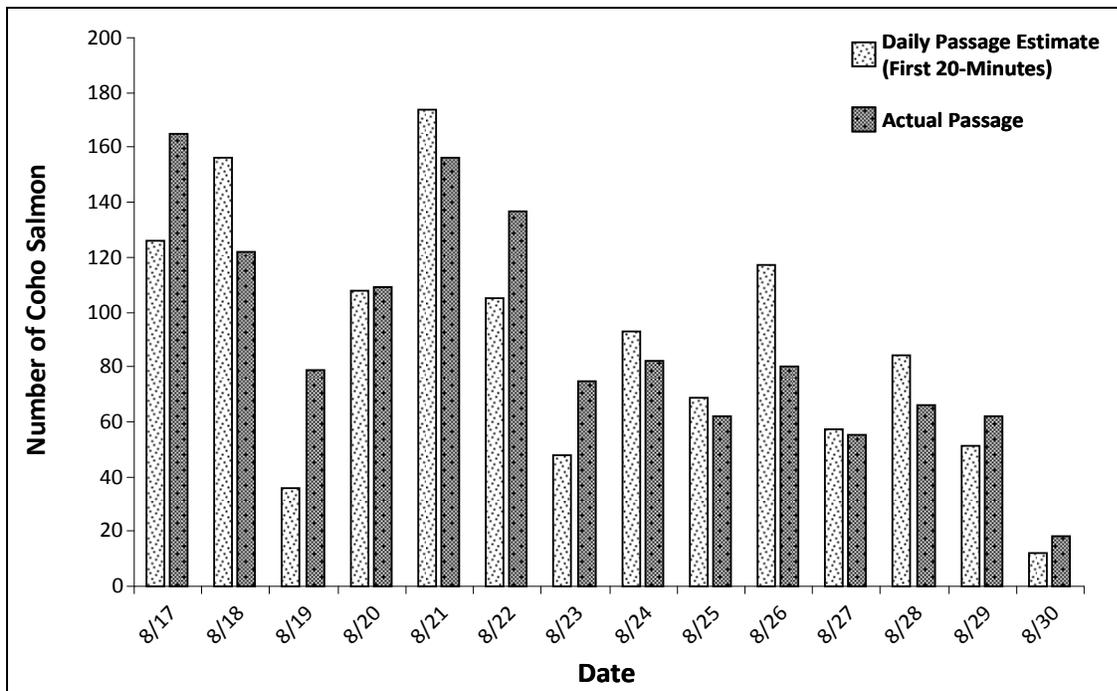


Figure 12.—Comparison of coho salmon daily passage estimates (summation of coho salmon counts from the first 20 minutes of each hour multiplied by 2) with actual coho salmon passage, Niukluk River counting tower, Fish River drainage, 17-30 August, 2007.

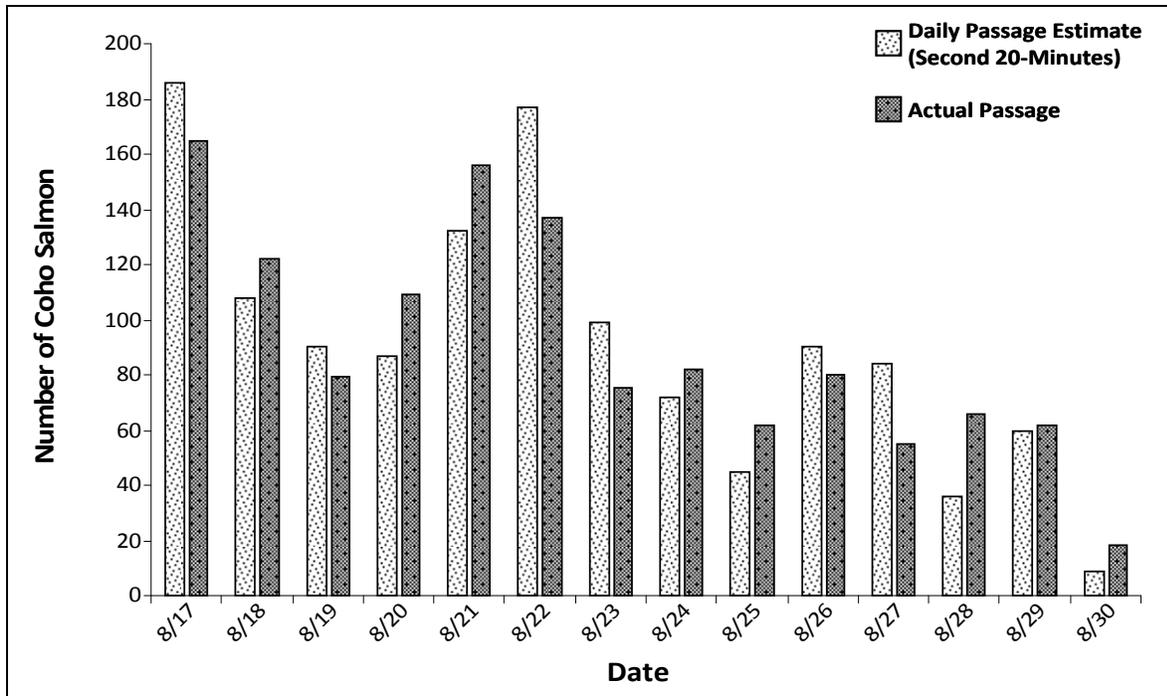


Figure 13.—Comparison of coho salmon daily passage estimates (summation of coho salmon counts from the second 20 minutes of each hour multiplied by 3) with actual coho salmon passage, Niukluk River counting tower, Fish River drainage, 17-30 August, 2007.

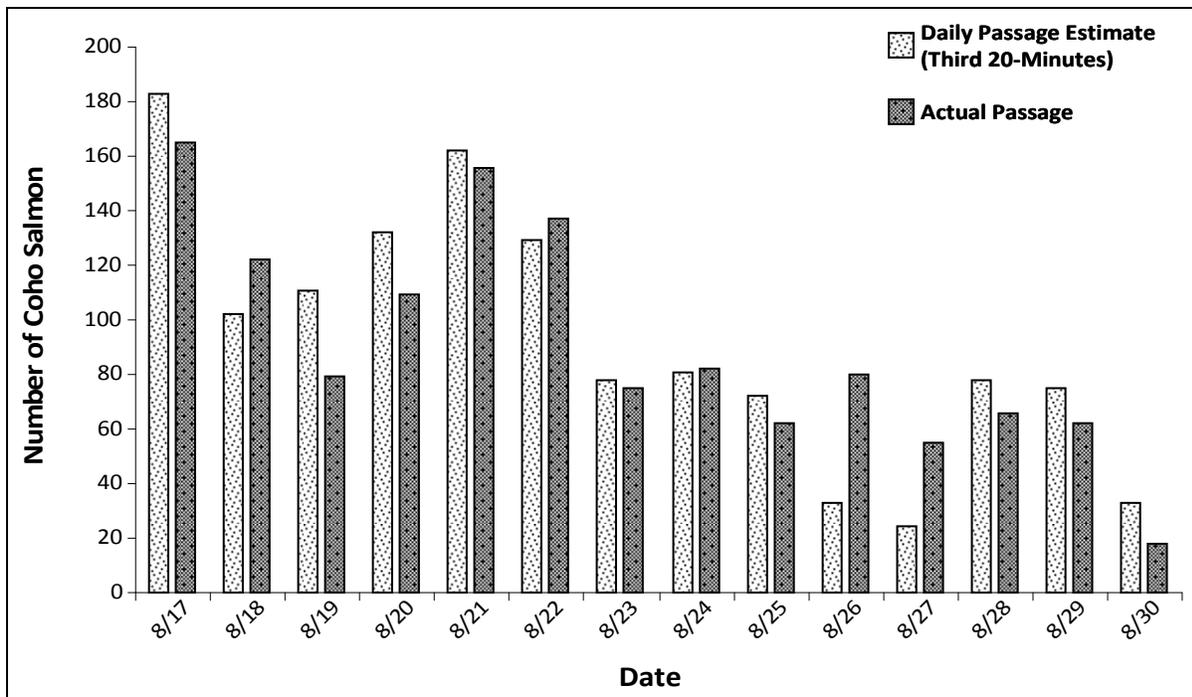


Figure 14.—Comparison of coho salmon daily passage estimates (summation of coho salmon counts from the third 20 minutes of each hour multiplied by 3) with actual coho salmon passage, Niukluk River counting tower, Fish River drainage, 17-30 August, 2007.

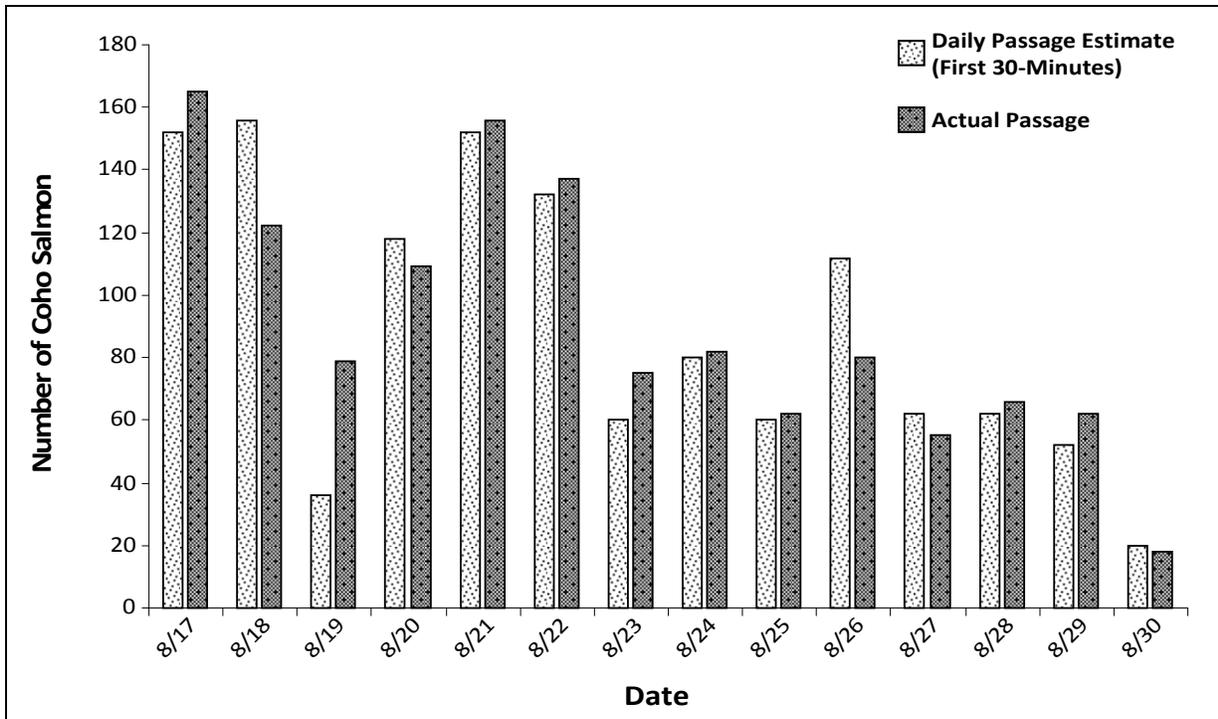


Figure 15.—Comparison of coho salmon daily passage estimates (summation of coho salmon counts from the first 30 minutes of each hour multiplied by 3) with actual coho salmon passage, Niukluk River counting tower, Fish River drainage, 17-30 August, 2007.

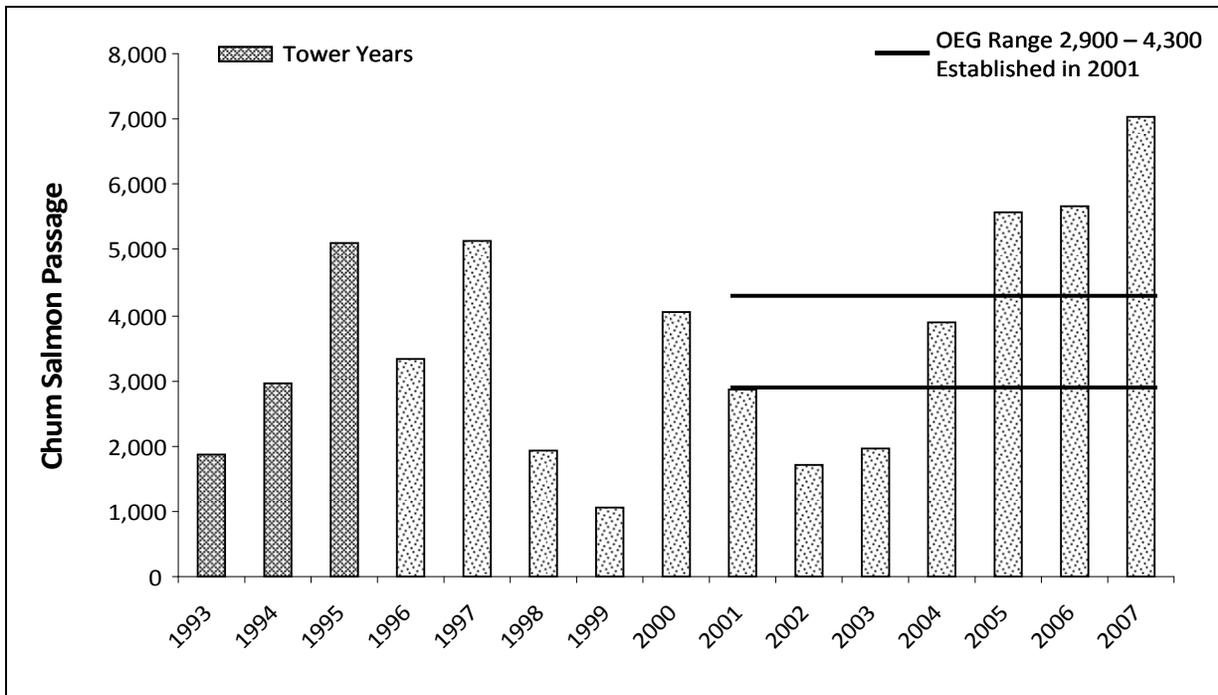


Figure 16.—Annual chum salmon passage compared to the sustainable escapement goal (SEG) range at the Nome River tower and weir 1993-2007, Norton Sound.

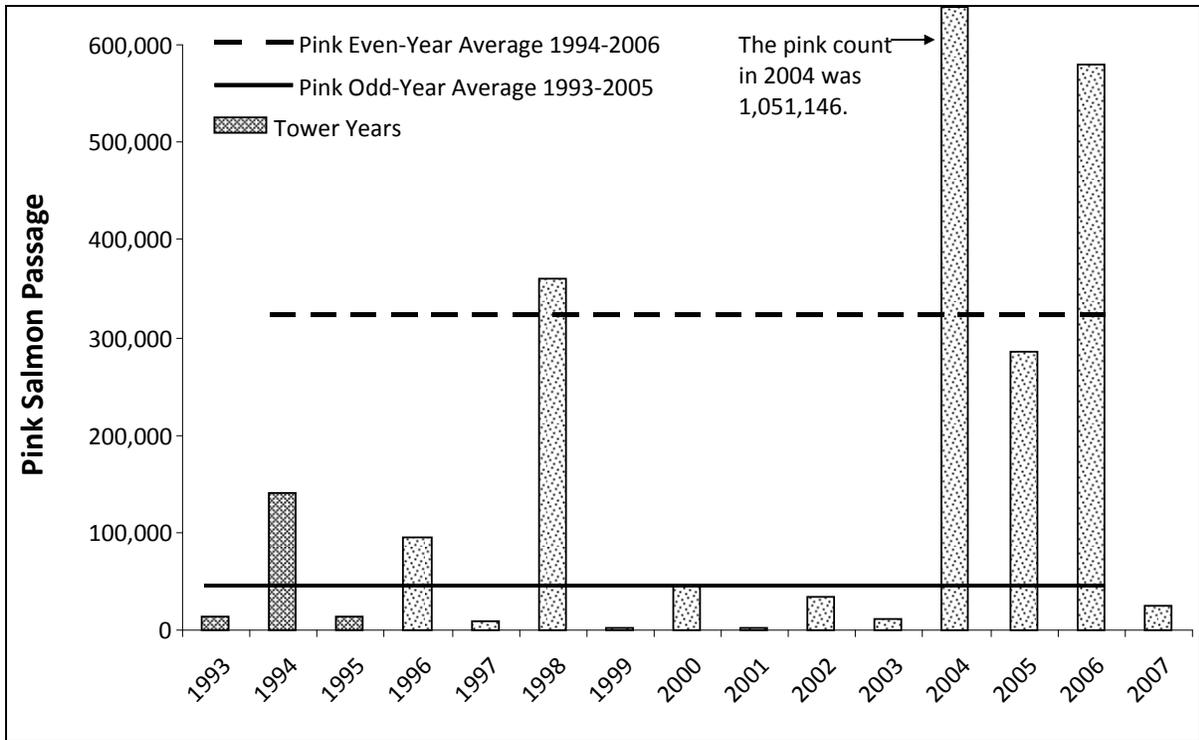


Figure 17.—Annual pink salmon passage and the historical odd and even-year averages at the Nome River tower and weir 1993-2007, Norton Sound.

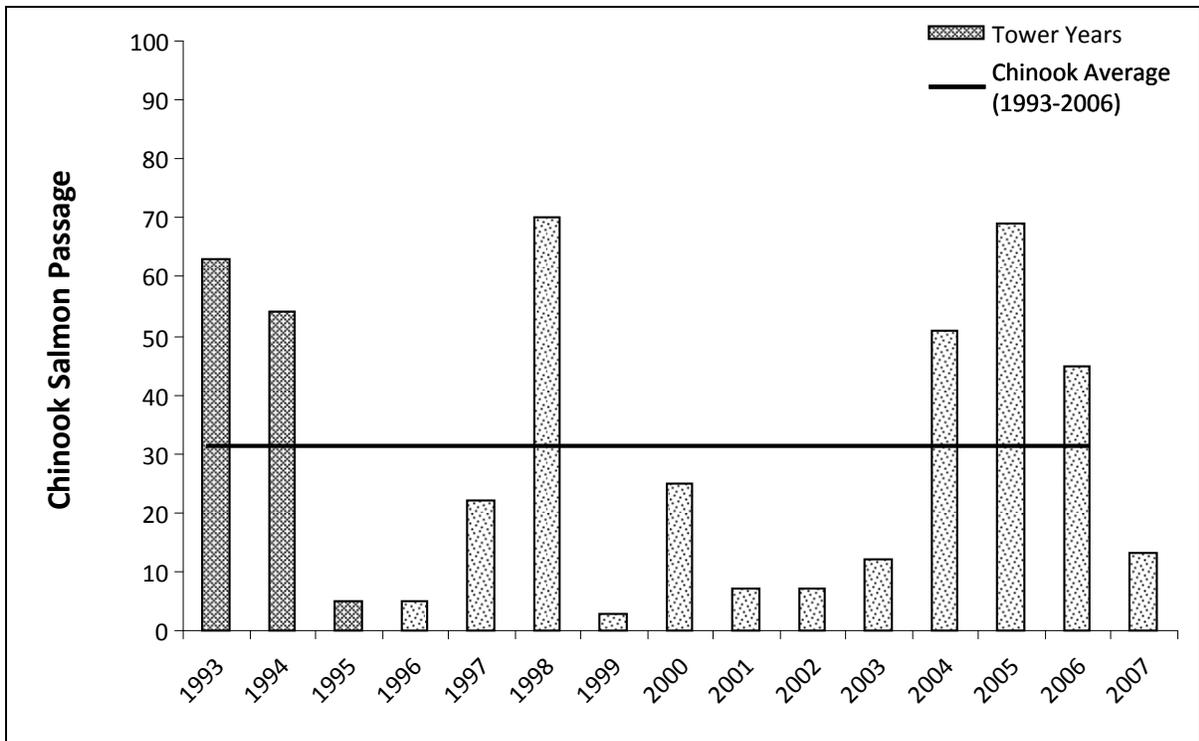


Figure 18.—Annual Chinook salmon passage and historical average at the Nome River tower and weir 1993-2007.

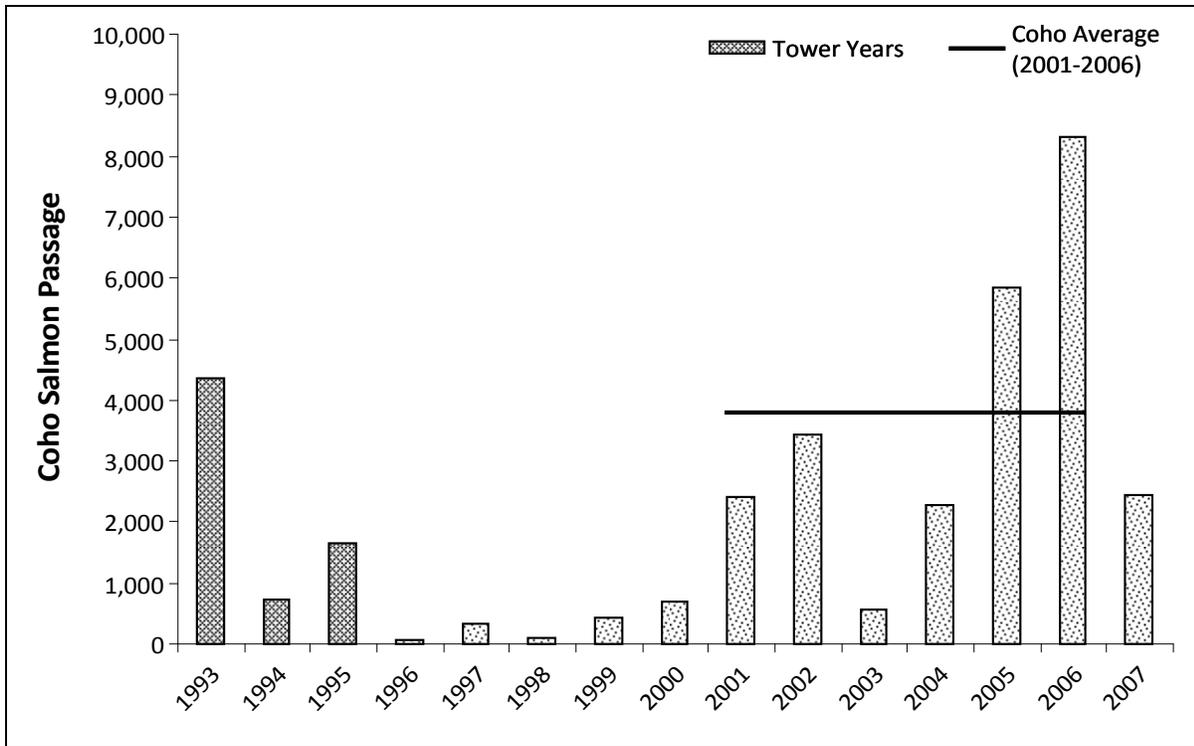


Figure 19.—Annual coho salmon passage and historical average at the Nome River tower and weir 1993-2007.

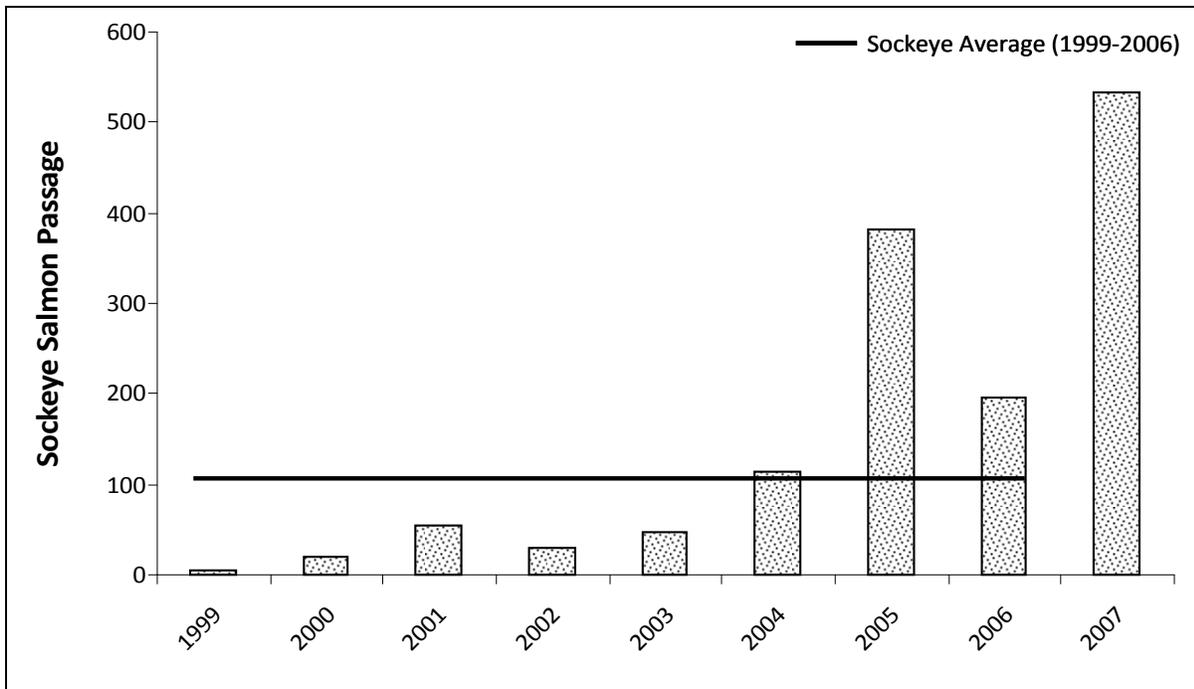


Figure 20.—Annual sockeye salmon passage and historical average at the Nome River weir 1999-2007, Norton Sound.

## **APPENDIX A: ESCAPEMENT**

Appendix A1.–Historical salmon escapements at Kwiniuk River counting tower, 1965–2007.

Year <sup>a</sup>	Operating period	Chum	Pink	Chinook	Coho
1965	June 18-Jul 19	32,861	8,668	19	
1966	June 19-Jul 28	32,786	10,629	7	
1967	June 18-Jul 28	26,661	3,587	13	
1968	June 18-Jul 24	19,976	129,052	27	
1969	June 26-Jul 26	19,687	56,683	12	
1970	June 25-Jul 29	66,604	226,831		
1971	June 29-Jul 29	38,679	16,634		
1972	June 28-Jul 27	30,686	62,461	65	
1973	June 25-Jul 25	28,029	37,070	57	
1974	June 20-Jul 26	35,161	39,375	62	
1975	July 04-Jul 26	14,049	55,293	44	
1976	July 04-Jul 25	8,508	35,226	12	
1977	June 26-Jul 25	21,798	47,934		
1978	Jul 04-Jul 22	11,049	70,148		
1979	June 28-Jul 25	12,355	167,492	107	
1980	June 22-Jul 28	19,374	319,363	177	
1981	June 19-Aug 02	34,565	566,534	136	
1982	June 21-Jul 26	44,099	469,674	138	
1983	June 19-Jul 27	56,907	251,965	267	
1984	June 19-Jul 25	54,043	736,544	736	
1985	June 26-Jul 28	9,013	18,237	955	
1986	June 19-Jul 26	24,700	241,446	654	
1987	June 25-Jul 23	16,133	5,566	317	
1988	June 18-Jul 26	13,303	187,907	321	
1989	June 27-Jul 27	14,529	27,488	248	
1990	June 21-Jul 25	13,957	416,512	900	
1991	June 18-Jul 27	19,801	53,499	708	
1992	June 27-Jul 28	12,077	1,464,716	479	
1993	June 27-Jul 27	15,824	43,063	600	
1994	June 23-Aug 09	33,012	2,303,114	625	2,547
1995	June 21-Jul 26	42,500	17,511	498	114
1996	June 20-Jul 25	28,493	907,893	577	461
1997	June 18-Jul 27	20,119	9,535	974	
1998	June 18-Jul 27	24,247	655,934	303	
1999	June 25-Jul 28	8,763	607	116	
2000	June 22-Jul 27	12,879	750,173	144	41
2001	June 27-Sept 15	16,598	8,423	261	9,532
2002	June 17-Sept 11	37,995	1,114,410	778	6,459
2003	June 15-Sept 15	12,123	22,329	744	5,490
2004	June 16-Sept 14	10,362	3,054,684	663	11,240
2005	June 18-Sept 12	12,083	341,048	342	12,950
2006	June 22-Sept 12	39,519	1,347,090	195	22,341
2007	June 21- Sept 10	27,756	54,255	258	9,429
Average 1965-2006 <sup>b, c</sup>		24,903	83,770	518	11,335

<sup>a</sup> Counts from 1965–1994 taken from the original project reports, counts for 1995–2003 are from Kohler 2003.

<sup>b</sup> Chinook salmon counts from 1965–1984 are not expanded. Chinook salmon counts in 1985 and after were expanded. Chinook salmon average is from 1985–2006.

<sup>c</sup> Coho salmon average is from 2001–2006 as the majority of the run has been counted only since 2001. Pink salmon historical average is comprised of odd-numbered years, 1965-2005.

Appendix A2.–Historical salmon escapements at Niukluk River counting tower, 1995–2007.

Year	Operating period	Chum	Pink	Chinook	Coho
1995	June 29-Sept 12	86,332	17,088	123	4,713
1996	June 23-Sept 12	80,178	1,154,922	243	12,781
1997	June 28-Sept 09	57,305	10,468	259	3,994
1998	July 04-Aug 09	45,588	1,624,438	260	840
1999	July 04-Sept 04	35,239	20,351	40	4,260
2000	July 04-Aug-27	29,573	961,603	48	11,382
2001	July 10-Sept 08	30,662	41,625	30	3,468
2002	June 25-Sept 10	35,307	645,141	621	7,391
2003	June 25-Sept 10	20,018	75,855	179	1,282
2004	June 25-Sept 08	10,770	975,895	141	2,064
2005	June 28-Sept 09	25,598	270,424	41	2,727
2006	June 28-Sept 08	29,199	1,371,919	39	11,169
2007	July 01- Sept 04	50,994	43,617	30	3,498
Average 1996-2006 <sup>a,b</sup>		40,481	72,635	169	5,930

<sup>a</sup> Coho salmon average excludes 1998 because the majority of the run was not counted that year.

<sup>b</sup> Pink salmon historical average is comprised of odd-numbered years, 1995-2005.

Appendix A3.–Comparison of daily expanded 20 minute tower count estimates and actual full-hour counts of chum salmon, Niukluk River counting tower, Fish River drainage, 17-30 August, 2007.

Date	1st 20 Min x 3	2nd 20 Min x 3	3rd 20 Min x 3	Full Hour Counts	Percent Difference (1st 20 Min)	Percent Difference (2nd 20 Min)	Percent Difference (3rd 20 Min)
17-Aug	150	105	195	150	0.0	-30.0	30.0
18-Aug	99	78	180	119	-16.8	-34.5	51.3
19-Aug	48	51	12	37	29.7	37.8	-67.6
20-Aug	12	93	108	71	-83.1	31.0	52.1
21-Aug	144	60	57	87	65.5	-31.0	-34.5
22-Aug	66	90	78	78	-15.4	15.4	0.0
23-Aug	69	87	33	63	9.5	38.1	-47.6
24-Aug	45	63	51	53	-15.1	18.9	-3.8
25-Aug	63	3	36	34	85.3	-91.2	5.9
26-Aug	33	36	39	36	-8.3	0.0	8.3
27-Aug	45	24	24	31	45.2	-22.6	-22.6
28-Aug	21	12	-3	10	110.0	20.0	-130.0
29-Aug	9	15	33	19	-52.6	-21.1	73.7
30-Aug	3	6	12	7	-57.1	-14.3	71.4
Season Totals	807	723	855	795	+2.0	-9.0	+8.0

Appendix A4.–Comparison of daily expanded 20 minute tower count estimates and actual full-hour counts of pink salmon, Niukluk River counting tower, Fish River drainage, 17-30 August, 2007.

Date	1st 20 Min x 3	2nd 20 Min x 3	3rd 20 Min x 3	Full Hour Counts	Percent Difference (1st 20 Min)	Percent Difference (2nd 20 Min)	Percent Difference (3rd 20 Min)
17-Aug	48	117	105	90	-46.7	30.0	16.7
18-Aug	105	102	78	95	10.5	7.4	-17.9
19-Aug	84	24	30	46	82.6	-47.8	-34.8
20-Aug	42	111	90	81	-48.1	37.0	11.1
21-Aug	93	48	24	55	69.1	-12.7	-56.4
22-Aug	84	57	51	64	31.3	-10.9	-20.3
23-Aug	24	54	45	41	-41.5	31.7	9.8
24-Aug	63	42	36	47	34.0	-10.6	-23.4
25-Aug	60	9	-6	21	185.7	-57.1	-128.6
26-Aug	9	0	3	4	125.0	-100.0	-25.0
27-Aug	12	30	27	23	-47.8	30.4	17.4
28-Aug	3	15	-6	4	-25.0	275.0	-250.0
29-Aug	3	9	33	15	-80.0	-40.0	120.0
30-Aug	6	3	15	8	-25.0	-62.5	87.5
Season Totals	636	621	525	594	+7.0	+5.0	-12.0

Appendix A5.–Comparison of daily expanded 20 minute tower count estimates and actual full-hour counts of Dolly Varden, Niukluk River counting tower, Fish River drainage, 17-30 August, 2007.

Date	1st 20 Min x 3	2nd 20 Min x 3	3rd 20 Min x 3	Full Hour Counts	Percent Difference (1st 20 Min)	Percent Difference (2nd 20 Min)	Percent Difference (3rd 20 Min)
17-Aug	18	60	108	62	-71.0	-3.2	74.2
18-Aug	48	45	24	39	23.1	15.4	-38.5
19-Aug	51	33	30	38	34.2	-13.2	-21.1
20-Aug	30	42	42	38	-21.1	10.5	10.5
21-Aug	27	39	54	40	-32.5	-2.5	35.0
22-Aug	72	15	9	32	125.0	-53.1	-71.9
23-Aug	12	33	39	28	-57.1	17.9	39.3
24-Aug	45	39	27	37	21.6	5.4	-27.0
25-Aug	42	15	15	24	75.0	-37.5	-37.5
26-Aug	0	0	36	12	-100.0	-100.0	200.0
27-Aug	42	33	24	33	27.3	0.0	-27.3
28-Aug	33	39	15	29	13.8	34.5	-48.3
29-Aug	6	3	21	10	-40.0	-70.0	110.0
30-Aug	9	15	6	10	-10.0	50.0	-40.0
Season Totals	435	411	450	432	+1.0	-5.0	+4.0

Appendix A6.—Historical salmon escapements at Nome River counting tower, 1993 - 1995, and weir 1996-2007.

Year	Operating period	Chum	Pink	Chinook	Coho	Sockeye
1993	July 25-Aug 28	1,859	13,036	63	4,349	
1994	June 24-Aug 15	2,969	142,604	54	726	
1995	June 22-Sept 06	5,093	13,893	5	1,650	
1996	June 26-July 23	3,339	95,681 <sup>a</sup>	5	66	
1997	June 27-Aug 27	5,147	8,035	22	321	
1998	July 01-Aug 11	1,930	359,469	70	96	
1999	July 02-Aug 25	1,048	2,033	3	417	6
2000	June 29-Aug 25	4,056	41,673	25	698	19
2001	July 08-Sept 11	2,859	3,138	7	2,418	55
2002	June 29-Sept 11	1,720	35,057	7	3,418	29
2003	July 05-Sept 10	1,957	11,402	12	548	47
2004	June 25-Sept 08	3,903	1,051,146	51	2,283	114
2005	June 27-Sept 11	5,584	285,759	69	5,848	381
2006	July 02-Sept 07	5,677	578,555	43	8,308	196
2007	July 04-Sept 16	7,034	24,395	13	2,437	534
Average 1993-2006 <sup>b, c, d</sup>		3,483	54,043	31	3,804	106

<sup>a</sup> In 1996 the majority of pink salmon escaped through the pickets and were not counted.

<sup>b</sup> Coho salmon average is from 2001–2006 as the majority of the run has been counted only since 2001.

<sup>c</sup> Sockeye salmon average is from 1999-2006.

<sup>d</sup> The chum count of 1993 was not used in the average because of the late start date.



## **APPENDIX B: AGE, SEX & LENGTH**

Appendix B1.—Comparison of chum salmon age, sex and mean length (METF in mm) composition by year for the Kwiniuk River counting tower, 1983, 1985-1986, and 1995-2007.

Year	Sampling Date(s)	Sample Size		Sex		Age Group					
				Male	Female	(0.2)	(0.3)	(0.4)	(0.5)	(0.6)	
1983	a	446	Percent of Samples	49.6	50.4	0.4	62.6	36.1	0.9		
			Mean Length (mm)	597	578	540	580	600	638		
1985	7/06-7/25	146	Percent of Samples	37.2	62.7		81.8	17.5	0.7		
			Mean Length (mm)	570	534		551	571	548		
1986	7/06-7/10	43	Percent of Samples	55.8	44.2		86.1	13.9			
			Mean Length (mm) <sup>a</sup>								
1995	6/30-7/25	341	Percent of Samples	52.2	47.8	0.3	56.0	39.6	4.1		
			Mean Length (mm) <sup>b</sup>	590	561	530	571	583	588		
1996	7/03-7/13	57	Percent of Samples	38.6	61.4		45.6	49.1	5.3		
			Mean Length (mm) <sup>b</sup>	606	557		565	608	585		
1997	7/04-7/24	409	Percent of Samples	41.1	58.9		53.1	45.7	1.0	0.2	
			Mean Length (mm) <sup>b</sup>	587	558		553	588	599	610	
1998	6/26-7/24	499	Percent of Samples	52.3	47.7	0.6	79.6	19.2	0.6		
			Mean Length (mm) <sup>b</sup>	586	553	542	566	587	625		
1999	7/01-7/23	247	Percent of Samples	48.6	51.4	0.4	47.0	51.8	0.8		
			Mean Length (mm) <sup>b</sup>	599	551	575	564	586	613		
2000	6/28-7/27	308	Percent of Samples	43.0	57.0		87.0	12.7	0.3		
			Mean Length (mm) <sup>b</sup>	595	566		577	591	620		
2001	6/30-8/14	763	Percent of Samples	46.0	54.0	3.5	9.3	86.1	1.0		
			Mean Length (mm) <sup>b</sup>	617	581	535	568	603	609		
2002	6/19-7/21	484	Percent of Samples	43.2	56.8	0.2	92.1	6.6	1.0		
			Mean Length (mm) <sup>b</sup>	626	607	575	615	625	611		
2003	6/25-7/24	473	Percent of Samples	46.6	53.5	0.3	34.3	64.3	0.6		
			Mean Length (mm) <sup>b</sup>	604	571	546	566	597	633		
2004	6/23-8/02	302	Percent of Samples	42.7	57.3	4.3	64.6	29.1	2.0		
			Mean Length (mm) <sup>b</sup>	588	555	542	562	587	575		

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Year	Sampling Date(s)	Sample Size		Sex		Age Group			
				Male	Female	(0.2)	(0.3)	(0.4)	(0.5)
2005	6/29-7/27	434	Percent of Samples	42.7	57.3	4.3	64.6	29.1	2.0
			Mean Length (mm) <sup>b</sup>	579	544	527	551	575	558
2006	6/28-7/14	474	Percent of Samples	51.3	48.7	0.2	75.1	24.3	0.4
			Mean Length (mm) <sup>c</sup>	585	564	540	571	585	585
2007	6/26-7/23	506	Percent of Samples	45.8	54.2		39.7	57.5	2.8
			Mean Length (mm) <sup>c</sup>	558	583		559	579	614

<sup>a</sup> Data unavailable

<sup>b</sup> The number of fish in total are the stratum sums; total percentages derived from stratum sums, but mean length data by sex and age class were unavailable for the season total. Reported mean lengths were derived from the weighted averages of the stratum sums.

<sup>c</sup> The number of fish in total are the stratum sums; total percentages and mean lengths are derived from the sums.

Appendix B2.—Comparison of chum salmon age, sex, and mean length (METF in mm) composition by year for the Niukluk River counting tower, 1995-2007.

Year	Sampling Date(s)	Sample Size		Sex		Age Group				
				Male	Female	(0.2)	(0.3)	(0.4)	(0.5)	(0.6)
1995	7/05-8/10	770	Percent of Samples	58.3	41.7	0.4	51.4	42.2	6.0	
			Mean Length (mm)	587	559	527	571	580	586	
1996	7/14-9/10	352	Percent of Samples <sup>a</sup>	46.0	54.0	0.6	33.5	52.0	13.4	0.6
			Mean Length (mm) <sup>a</sup>	608	570	580	570	594	596	643
1997	7/05-8/29	628	Percent of Samples	49.7	50.3	2.7	54.6	41.1	1.3	0.3
			Mean Length (mm) <sup>b</sup>	601	566	549	571	600	601	603
1998	7/04-7/20	138	Percent of Samples	43.5	56.5	1.4	60.1	34.8	3.6	
			Mean Length (mm) <sup>b</sup>	613	570	563	589	603	625	
1999	7/19-8/29	350	Percent of Samples	47.4	52.6	1.2	67.4	31.4		
			Mean Length (mm) <sup>b</sup>	604	567	577	579	597		
2000	7/09-8/26	154	Percent of Samples	49.4	50.6	3.9	78.6	16.9	0.6	
			Mean Length (mm) <sup>b</sup>	605	565	571	581	605	555	
2001	7/10-7/30	695	Percent of Samples	62.3	37.7	1.2	15.7	82.3	0.9	
			Mean Length (mm) <sup>b</sup>	610	581	562	583	603	615	
2002	7/03-7/26	446	Percent of Samples	54.5	45.5	0.2	76.0	16.8	7.0	
			Mean Length (mm) <sup>b</sup>	593	565	557	575	594	608	
2003	7/05-8/01	417	Percent of Samples	58.5	41.5	0.3	50.8	47.7	1.0	0.2
			Mean Length (mm) <sup>b</sup>	600	557	588	568	597	568	625
2004	7/05-7/26	373	Percent of Samples	52.0	48.0	9.1	40.0	50.1	0.8	
			Mean Length (mm) <sup>b</sup>	585	552	528	564	581	562	
2005	7/07-7/30	625	Percent of Samples	49.8	50.2	2.2	89.9	7.0	0.8	
			Mean Length (mm) <sup>b</sup>	586	551	551	563	579	600	
2006	7/05-7/20	425	Percent of Samples	46.6	53.4	0.2	44.9	54.1	0.7	
			Mean Length (mm) <sup>c</sup>	591	557	520	561	583	557	
2007	7/07-7/21	571	Percent of Samples	55.0	45.0	0.2	54.1	40.8	4.9	
			Mean Length (mm) <sup>c</sup>	585	555	547	567	575	586	

<sup>a</sup> Age, sex, and length data was collected from carcasses.

<sup>b</sup> The number of fish in total are the stratum sums; total percentages derived from stratum sums, but mean length data by sex and age class were unavailable for the season total. Reported mean lengths were derived from the weighted averages of the stratum sums.

<sup>c</sup> The number of fish in total are the stratum sums; total percentages and mean lengths are derived from the sums.

Appendix B3.—Comparison of chum salmon age, sex and mean length (METF in mm) composition by year for the Nome River counting tower, 1995, and weir, 1997, 2001-2007.

Year	Sampling Date(s)	Sample Size		Sex		Age Group				
				Male	Female	(0.2)	(0.3)	(0.4)	(0.5)	(0.6)
1995	7/20-8/29	1,272	Percent of Samples	49.4	50.6	2.0	56.2	39.8	1.8	0.2
			Mean Length (mm) <sup>a</sup>	602	572	558	583	593	601	620
1997	7/25-7/31	173	Percent of Samples	46.2	53.2	0.6	36.4	60.7	2.3	
			Mean Length (mm) <sup>a</sup>	605	569	555	576	590	620	
2001	7/16-8/22	529	Percent of Samples	44.8	55.2	1.1	13.8	84.1	0.9	
			Mean Length (mm) <sup>a</sup>	624	580	560	576	604	600	
2002	7/04-8/22	440	Percent of Samples	46.4	53.6	0.7	64.5	29.5	5.2	
			Mean Length (mm) <sup>a</sup>	605	563	541	573	600	604	
2003	7/07-8/23	158	Percent of Samples	54.4	45.6		82.9	15.2	1.9	
			Mean Length (mm) <sup>a</sup>	595	559		580	567	608	
2004	7/14-8/06	158	Percent of Samples	43.0	57.0	7.0	49.4	43.7		
			Mean Length (mm) <sup>a</sup>	572	543	521	546	572		
2005	7/03-9/04	326	Percent of Samples	38.3	61.7	1.2	89.6	7.4	1.8	
			Mean Length (mm) <sup>a</sup>	589	550	561	563	579	606	
2006	7/02-8/22	458	Percent of Samples	47.4	52.6	1.7	52.8	45.4		
			Mean Length (mm) <sup>b</sup>	578	546	519	555	570		
2007	7/09-9/06	678	Percent of Samples	45.4	54.6		58.0	38.0	4.0	
			Mean Length (mm) <sup>b</sup>	585	543		579	552	585	

<sup>a</sup> The number of fish in total are the stratum sums; total percentages derived from stratum sums, but mean length data by sex and age class were unavailable for the season total. Reported mean lengths were derived from the weighted averages of the stratum sums.

<sup>b</sup> The number of fish in total are the stratum sums; total percentages are derived from the sums.

Appendix B4.–Comparison of coho salmon age, sex and mean length (METF in mm) composition by year for the Kwiniuk River counting tower, 2001-2007.

Year	Sampling Date(s)	Sample Size		Sex		Age Group		
				Male	Female	(1.1)	(2.1)	(3.1)
2001	7/30-9/09	211	Percent of Samples	46.0	54.0	27.0	66.8	6.2
			Mean Length (mm)	625	615	615	622	617
2002	8/03-8/23	157	Percent of Samples	60.5	39.5	7.6	87.9	4.5
			Mean Length (mm)	597	601	561	602	600
2003	7/21-9/08	384	Percent of Samples	49.7	50.3	25.8	63.3	10.9
			Mean Length (mm)	588	604	591	599	590
2004	7/26-8/10	152	Percent of Samples	53.9	46.1	11.8	88.2	
			Mean Length (mm)	542	563	531	554	
2005	7/20-8/20	154	Percent of Samples	38.3	61.7	19.5	79.9	0.7
			Mean Length (mm)	592	582	575	588	610
2006	8/13-8/26	182	Percent of Samples	43.4	56.6	22.5	74.7	2.7
			Mean Length (mm)	550	560	537	562	545
2007	8/13-8/26	106	Percent of Samples	54.7	45.3	36.8	60.4	2.8
			Mean Length (mm)	613	611	624	606	605

Appendix B5.—Comparison of coho salmon age, sex and mean length (METF in mm) composition by year for the Nome River weir, 2001-2007.

Year	Sampling Date(s)	Sample Size		Sex		Age Group			
				Male	Female	(1.1)	(2.1)	(3.1)	(4.1)
2001	8/09-9/06	442	Percent of Samples	51.3	48.7	9.9	89.6	0.6	
			Mean Length (mm)	586	581	581	584	617	
2002	8/11-8/28	139	Percent of Samples	51.1	48.9	1.4	80.6	17.3	0.7
			Mean Length (mm)	589	571	503	576	604	638
2003	8/04-9/07	143	Percent of Samples	55.2	44.8	14.7	79.0	6.3	
			Mean Length (mm)	602	580	578	594	593	
2004	8/23-8/27	151	Percent of Samples	65.6	34.4	23.8	72.2	4.0	
			Mean Length (mm)	569	570	549	576	583	
2005	7/26-9/04	158	Percent of Samples	44.9	55.1	8.2	90.5	1.3	
			Mean Length (mm)	581	586	580	584	605	
2006	7/24-9/02	191	Percent of Samples	39.3	60.7	8.4	87.4	4.2	
			Mean Length (mm)	549	543	441	536	529	
2007	7/31-9/12	104	Percent of Samples	48.1	51.9	24.0	67.3	8.7	
			Mean Length (mm)	573	564	557	570	590	