Fishery Data Series No. 07-51

Goodnews River Salmon Monitoring and Assessment, 2006

Annual Report for Project FIS 04-312
USFWS Office of Subsistence Management
Fisheries Information Services Division

by

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and

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September 2007

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
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

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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The Division of Sport Fish Fishery Data Series was established in 1987 for the publication of technically oriented results for a single project or group of closely related projects. Since 2004, the Division of Commercial Fisheries has also used the Fishery Data Series. Fishery Data Series reports are intended for fishery and other technical professionals. Fishery Data Series reports are available through the Alaska State Library and on the Internet: http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm This publication has undergone editorial and peer review.

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ABSTRACT

Salmon returning to the Goodnews River support subsistence, commercial, and sport fisheries each summer near the community of Goodnews Bay in Southwest Alaska (Burkey et al. 1999). Because the Goodnews River is the primary salmon spawning drainage in the area and provides an important subsistence fishery resource for residents of the communities of Goodnews Bay and Platinum, the Alaska Department of Fish and Game (ADF&G), in cooperation with the U.S. Fish and Wildlife Service (USFWS), operates a resistance board weir to enumerate five species of Pacific salmon and Dolly Varden *Salvelinus malma* returning to the Middle Fork Goodnews River. In 2006, a total of 4,559 Chinook salmon *Oncorhynchus tshawytscha*, 126,772 sockeye salmon *O. nerka*, 54,699 chum salmon *O. keta*, 18,432 pink salmon *O. gorbuscha*, 15,969 coho salmon *O. kisutch*, and 1,858 Dolly Varden *Salvelinus malma* were estimated as they passed through the weir from 26 June through 18 September. Chinook, sockeye, chum, and coho salmon sustainable escapement goals were either achieved or exceeded in 2006. Escapements for sockeye and chum salmon were record highs, Chinook salmon were above average, and coho salmon escapement was below average. A live trap was used to collect samples from Chinook, sockeye, chum, and coho salmon throughout their respective runs to estimate the age, sex, and length composition of each population. The sockeye salmon run was 42.9% male and 70.4% age-1.3 fish. The chum salmon run was 46.1% male and 69.7% age-0.3 fish. The coho salmon run was 52.2% male and 78.3% age-2.1 fish. Sex and length estimates were not made for Chinook salmon because insufficient samples were collected. Aerial surveys were conducted for the entire North Fork Goodnews River drainage and only partially for the Middle Fork Goodnews River in 2006 due to inclement weather. Sockeye salmon run abundance was estimated based on the recent 5-year average aerial survey proportions between Middle Fork and North Fork aerial survey estimates, while Chinook run abundance was estimated using 2006 partial aerial survey estimate proportions.

Key words: Goodnews River, Kuskokwim Area, Kuskokwim Bay, resistance board weir, escapement monitoring, Chinook salmon, *Oncorhynchus tshawytscha*, sockeye salmon, *O. nerka*, chum salmon, *O. keta*, pink salmon, *O. gorbuscha*, coho salmon *O. kisutch.*, Dolly Varden *Salvelinus malma.*

INTRODUCTION

Salmon returning to the Goodnews River support subsistence, commercial, and sport fisheries each summer near the community of Goodnews Bay in Southwest Alaska. The Alaska Department of Fish and Game (ADF&G), in cooperation with the U.S. Fish and Wildlife Service (USFWS), operates a resistance board weir to enumerate by species returning adult salmon on the Middle Fork Goodnews River (Middle Fork) in an effort to ensure future sustainability of this resource.

The Goodnews River watershed drains an area of nearly 1,000 mi^2 (2,589.9 km^2) along the west side of the Togiak National Wildlife Refuge (Figure 1). It flows a distance of 60 river miles (96.6 river kilometers) along its main stem, from the Ahklun Mountains southwest into Goodnews Bay. Two major tributaries, the Middle Fork and South Fork Goodnews rivers, join the main stem a few miles from its mouth and are included within its drainage. In order to differentiate between them, the Goodnews River refers to all 3 drainages, and the main stem Goodnews River upstream of its confluence with the Middle Fork will be referred to as the North Fork Goodnews River or North Fork.

SALMON FISHERIES

The Goodnews River is the primary salmon spawning drainage in the area and provides a vital subsistence fishery resource for residents of the communities of Goodnews Bay and Platinum. Subsistence fishing is allowed throughout the Goodnews River drainage and in Goodnews Bay. Fish are primarily harvested with drift and set gillnets. ADF&G has quantified subsistence salmon harvests in the communities of Goodnews Bay and Platinum since 1977. Harvest

estimates are determined from interviews with subsistence fishers in October and November (Ward et al. 2003; Whitmore et al. *In prep*). Sockeye salmon *Oncorhynchus nerka* are the most utilized subsistence salmon species in the Goodnews Bay area over the past 10 years followed by Chinook salmon *O. tshawytscha*, coho salmon *O. kisutch*, and chum salmon *O. keta* (Appendix A1). From 1996 to 2005, annual subsistence harvests from the communities of Goodnews Bay and Platinum have averaged 747 Chinook, 861 sockeye, 259 chum, and 687 coho salmon. Dolly Varden *Salvelinus malma* and Arctic Char *Salvelinus alpinus* are also harvested for subsistence use, although harvest estimates have not been well quantified (Wolfe et al. 1984). The 2006 subsistence survey results were unavailable at the time this report was written; however, in 2005, 63 households were contacted for a survey of subsistence use in the villages of Goodnews Bay and Platinum. They estimated 868 Chinook, 1,233 sockeye, 209 chum, and 839 coho salmon were used for subsistence purposes. The number of people using salmon for subsistence in Goodnews and Platinum exceeds the 29 permit holders participating in the local commercial fishery (Whitmore et al. *In prep*).

Commercial salmon fishing occurs in Goodnews Bay within the boundaries of District W-5 (Figure 2). Commercial fishing has occurred annually in District W-5 since it was established in 1968 by ADF&G. This is the southern most district in the Kuskokwim Area which includes districts in Kuskokwim Bay and the Kuskokwim River. Permit holders have unrestricted movement between commercial fishing districts within the Kuskokwim Area and fishers from distant communities often participate in the District W-5 commercial fishery. In 2004, the Alaska Board of Fisheries moved the District W-5 western boundary from a line between the northernmost tip of the north spit and the southernmost tip of the south spit to a line between regulatory markers placed outside Goodnews Bay approximately 2 mi along the edge of the north and south spit.

The commercial fishery is primarily directed toward harvesting sockeye and coho salmon and is conducted from skiffs using hand-pulled gillnets. Pink salmon *O. gorbuscha* are the least valuable species commercially and have not been targeted in recent years. ADF&G has collected harvest data from fish buyers and processors since the district was created. The average harvests for these species from 1996 through 2005 were 2,193 Chinook, 25,573 sockeye, 7,738 chum, and 14,647 coho salmon (Appendix A1). ADF&G also collects and analyzes age, sex, and length (ASL) data from commercially caught salmon in an effort to determine population characteristics and trends.

Sport fishing occurs throughout the Goodnews River drainage. Pacific salmon, rainbow trout *O. mykiss*, Dolly Varden, Arctic char, and Arctic grayling *Thymallus arcticus* are targeted. Many sport fishers take commercially guided or unguided float trips from lakes in the headwaters to the mouth at Goodnews Bay. There is currently one commercially operated lodge with a semi-permanent camp in the drainage that offers fishing from powered skiffs. ADF&G has been estimating sport fish harvests consistently since 1991. From 1996 through 2005, average sport fishing harvests were 162 Chinook, 159 sockeye, 27 chum, and 708 coho salmon (Appendix A1). The 2006 sport fish harvest report was not available at time of publication.

PROJECT HISTORY

ADF&G's Division of Commercial Fisheries has operated a salmon escapement monitoring project on the Middle Fork Goodnews River since 1981 (Appendix B1). The project was initiated as a counting tower in 1981 and was operated through 1990 (Burkey 1989, 1990;

Schultz 1982, 1984a, b, 1985, 1987; Schultz and Burkey 1989) targeting counts of Chinook, sockeye, and chum salmon. Although successful, the tower was limited by problems with species apportionment and high labor costs (Menard 1999). In 1991, resources were redirected towards a fixed-picket weir to reduce labor costs and improve species identification. The fixed-picket weir was operated from 1991 through mid season of 1997, approximately 250 yd (229 m) downstream of the former tower site. Species identification improved with the weir, as the observer was now just a few feet from fish passing upstream. Labor costs were also reduced with the weir. Fish passage could be controlled, eliminating the need for hourly monitoring and increasing the efficiency of live fish capture to collect ASL information. Personnel were reduced from 3 crew members to 2. Flood events were a problem if the weir could not be removed in time. The weir would rapidly collect debris, damming the flow until it failed and washed downstream. This occurred several times during the early 1990s.

In the mid 1990s, ADF&G began cooperating with the USFWS and the Togiak National Wildlife Refuge to build a resistance board weir and extend the project's operational period to include the coho salmon run in August and September. In July 1997, the fixed-picket weir was replaced with the resistance board weir, designed to shed debris loads by sinking under high water conditions. The resistance board weir has allowed the project to remain operational at higher water levels compared to the fixed-picket weir. The resistance board weir design can be rendered inoperable during extreme high water events, but the design can remain operational at higher water levels compared to the fixed picket design and can regain operations quicker once flood waters subside.

Extended operation of the weir has also allowed biologists to monitor the migration of smaller Dolly Varden, believed to be a pre-spawning population over wintering in the drainage (Lisac 2003). Dolly Varden contribute to the overall subsistence harvest of the residents of the Goodnews Bay area (Wolfe et al. 1984). However, information about their life history and abundance is limited. Dolly Varden runs in the Middle Fork Goodnews River have ranged from 1,800 to 6,600 fish (Estensen 2003; Lisac *In prep* a).

ESCAPEMENT MONITORING AND ESCAPEMENT GOALS

The Middle Fork Goodnews River weir serves primarily as a management tool for the commercial and subsistence salmon fisheries in the Goodnews Bay area, but also generates data relevant to the Goodnews River drainage as a whole. These data are used to make inseason management decisions, estimate drainage wide escapement, and develop both Sustainable Escapement Goals (SEG) and Biological Escapement Goals (BEG). The project also serves as a platform for other studies in the drainage, such as collecting samples for genetic stock identification, and tagging Dolly Varden to study run timing and seasonal distribution (Lisac *In prep* b).

Salmon escapement objectives for the Middle Fork counting tower were initially established in 1984 as ranges set at 3,000–4,000 Chinook, 35,000–45,000 sockeye, and 13,000–18,000 chum salmon (Schultz 1984b). An escapement objective was not established for coho salmon as the project typically ceased operation in mid August (the coho salmon run in the Middle Fork extends through September). In 1989, the escapement objective range for sockeye salmon was lowered to 20,000–30,000 fish. An evaluation of the sockeye salmon exploitation rate in previous years indicated that historical harvest levels could be maintained with a reduced escapement objective (Burkey 1990). These ranges remained in place when the tower was replaced with the fixed-picket weir in 1991.

In 1992, weir based SEGs were first established for Chinook, sockeye, and chum salmon (Buklis 1993). The respective SEGs were set as the midpoints of tower escapement objective ranges: 3,500 Chinook, 25,000 sockeye, and 15,000 chum salmon. In 2004, evaluation of Arctic-Yukon-Kuskokwim (AYK) Region escapement goals resulted in establishment of revised SEGs for the Middle Fork Goodnews River weir (ADF&G 2004). The revised goals, described as ranges or thresholds, were 2,000–4,500 Chinook salmon, 23,000–58,000 sockeye salmon, and greater than 12,000 chum salmon. An SEG threshold was also established for coho salmon at greater than 12,000. Recently, ADF&G recommended that a BEG be established for Middle Fork Goodnews River Chinook and sockeye salmon starting in 2007, as sufficient data had been collected for both species to conduct a stock-recruit analysis and create brood tables used in determining BEGs (Tables 1 and 2; Molyneaux and Brannian 2006).

Goodnews River drainage salmon escapements have also been monitored by aerial survey since 1962 (Appendix C1). Aerial survey escapement assessment can be subject to variability depending on viewing conditions and survey observers; however, when observers, timing, and methods are standardized to the extent feasible and survey conditions meet acceptable criteria, the resulting counts are considered an index of escapement. Procedures established in recent years have increased the annual consistency of Goodnews River aerial surveys through the creation of an aerial survey location database, intensive preflight planning, and establishment of dedicated aerial survey project staff. Additionally, variability between observers and methods has been addressed through standardized training and consistency of observers, pilots, and aircraft used.

Aerial surveys are best directed at indexing spawning populations of sockeye and Chinook salmon because these species are typically more visible than chum and coho salmon. Chum salmon have protracted run timing requiring multiple surveys throughout their runs to ensure accuracy of the index. Chum salmon aerial surveys have been discontinued as an escapement index until survey methods can be improved or funding can be secured to allow for multiple aerial surveys of chum salmon populations throughout the duration of their runs. Additionally, Goodnews River coho salmon have been difficult to survey because of recurrent poor fall weather conditions. Coho salmon aerial surveys have been conducted when funding and weather conditions allow.

North Fork Goodnews River aerial survey escapement goals were initially established in 1992 and set at 1,600 Chinook, 15,000 sockeye, 17,000 chum, and 15,000 coho salmon (Buklis 1993). Middle Fork Goodnews River aerial survey escapement goals were also initially established in 1992 at 800 Chinook, 5,000 sockeye, 4,000 chum, and 2,000 coho salmon. In 2004, evaluation of AYK Region escapement goals resulted in establishment of revised SEGs for Goodnews River aerial surveys (ADF&G 2004). The revised SEGs represent ranges or thresholds and were set at 640–3,300 Chinook salmon and 5,500–19,500 sockeye salmon on the North Fork Goodnews River only. The North Fork chum and coho salmon aerial survey escapement goals set in 1992 were discontinued because of poor data quality. The aerial survey escapement goals set for the Middle Fork Goodnews River in 1992 were discontinued in deference to the revised SEGs set for the Middle Fork Goodnews River weir in 2004.

AGE, SEX, AND LENGTH COMPOSITION ESTIMATES

Salmon ASL information has been collected from the weir project since 1984 and from District W-5 commercial harvest since 1985. Annual ASL composition estimates of escapement are used

to develop stock-recruitment models, in turn providing information used for projecting future run sizes. Historical summaries of existing ASL information for salmon returning to the Goodnews River drainage can be found in Molyneaux et al. (2006).

SITE DESCRIPTION

The Middle Fork parallels the North Fork and flows a distance of approximately 45 river miles (72.4 river kilometers) before joining the main stem. The weir project is located approximately 10 river miles (16.1 river kilometers) from the village of Goodnews Bay on the Middle Fork at latitude N 59 09.595, longitude W 161 23.287 (Figure 1). The weir is located at the downstream end of an approximately 150 yd (137.2 m) long stretch of straight channel. The channel at the weir location is 200 ft (61.0 m) wide, has a regular profile from 1 to 4 ft deep which tapers to low cut banks on either side and flows 2 to 4 ft per second during average water conditions. The river substrate is primarily cobblestone, gravel, and sand. The upstream half of the channel is characterized by deep water along a steep cut bank approximately 20 ft (6.1 m) in height on the left bank (as looking downstream) tapering to a gravel bar on the right bank. The project camp site is located on the left bank approximately 50 yd (45.7 m) upstream and 30 yd (27.4 m) inland from the weir location. Weir materials are stored over the winter on the left and right banks, approximately 30 yd (27.4 m) inland and parallel to the weir location.

OBJECTIVES

The annual objectives for the Middle Fork Goodnews River weir project are to:

1. Estimate Chinook, sockeye, chum, and coho salmon escapement in Middle Fork Goodnews River.
2. Estimate run timing of Chinook, sockeye, chum, and coho salmon and Dolly Varden to the Middle Fork Goodnews River.
3. Estimate escapement of Chinook, sockeye, chum, and coho salmon to Goodnews River drainage.
4. Estimate Chinook, sockeye, chum, and coho salmon ASL composition of Middle Fork Goodnews River escapement.
5. Estimate Chinook, sockeye, chum, and coho salmon ASL composition in the District W-5 commercial fishery.
6. Estimate Dolly Varden passage at the Middle Fork Goodnews River weir.
7. Serve as a platform to collect genetic samples of salmon stocks at the Middle Fork Goodnews weir.
8. Serve as a platform for tagging Dolly Varden at the Middle Fork Goodnews weir.
9. Record atmospheric and hydrologic conditions at the weir site.
10. Record carcasses washed up on the weir and passed downstream.

METHODS

RESISTANCE BOARD WEIR

Methods for the design, construction, and installation of the resistance board weir followed those described in Stewart (2002, 2003), and Tobin (1994). The approximately 200 ft (60.9 m) weir used at the Middle Fork Goodnews River site was comprised of two principle components: the substrate rail and the resistance board panel sections. During weir operations, picket spacing of the weir panels allowed for a complete census of all but the smallest returning Chinook, sockeye, chum, and coho salmon. The picket interval of the Middle Fork Goodnews River weir was 2.6 in, which left a gap of 1.3 in between pickets. The picket spacing allowed smaller fish such as pink salmon and other non salmon species to pass upstream and downstream through the weir between pickets. Further details of resistance board weir components used for the Goodnews River weir are described in Stewart (2004).

Two fish passage chutes were installed on the weir, one approximately 50 ft (15.2 m) from the left bank (as looking downstream), the other approximately 15 ft (4.57 m) from the left bank. A 10 ft (3 m) by 15 ft (4.6 m) live trap used to collect fish for ASL sampling was installed directly upstream of the passage chute located closest to the left bank. Gates were attached on both chutes to control fish passage.

Boats passed at a designated boat gate located in the center of the weir and boat operators were able to pass with little or no involvement by the weir crew. The boat gate consisted of boat passage panels described in Estensen and Diesigner (2004). Weight of a passing boat temporarily submerged the boat passage panels, allowing boats to pass over the weir. Boats with jet-drive engines were common and could pass upstream and downstream over the boat gate at reduced speed. Rafts could pass downstream by submerging the boat passage panels and drifting over the weir. Boats with propeller-drive engines were uncommon and were towed across the weir by crew members when passing upstream.

AERIAL SURVEYS

Aerial surveys were flown during peak spawning periods for each species in order to maximize the number of observable fish on the spawning grounds. Peak spawning periods were developed from run timing estimates and vary by species. Aerial surveys were numerically ranked on a scale of 1 = good, 2 = fair, and 3 = poor. Ranking criteria were based on survey method, weather and water conditions, time of survey, and spawning stage. Only surveys with rankings of fair and good (1 and 2) that were conducted within the peak spawning period were included as part of the Goodnews River aerial survey database.

Chinook and coho salmon aerial surveys were focused on the main river channel and larger tributaries while sockeye salmon aerial surveys were focused on the main river channel, larger tributaries and lakes, and larger lake tributaries. Aerial survey counts were tallied to derive a total count of observable fish in the North Fork and Middle Fork of the Goodnews River. These counts were used along with Middle Fork Goodnews River weir escapement estimates to derive drainage escapement estimates for the Goodnews River.

ESCAPEMENT MONITORING AND ESTIMATES

The target operational period for the Middle Fork Goodnews River weir in 2006 was 26 June through 18 September. To determine salmon escapement past the weir, fish passage counts were

made daily during the operational period of the project. Passage counts occurred regularly throughout the day, typically for 1–2 h periods, beginning in the morning and continuing as late as the light permitted. During counting periods, the passage chute gate was opened to pass fish through the weir. Crew members identified and enumerated all fish by species as they exited the passage chute. Any fish observed traveling downstream through the fish passage chutes were subtracted from the count tally. Spawned out salmon and carcasses of dead salmon (both hereafter referred to as carcasses) that washed up on the weir were counted by species and passed downstream.

For various reasons, fish sometimes migrated downstream and required an avenue for safe passage over the weir. This behavior was especially common among non salmon species such as rainbow trout, Dolly Varden, and whitefish species *Coregonus spp.* The resistance board weir provided a means of accommodating downstream fish passage through incorporation of downstream passage chutes. Each chute consisted of a single panel set to allow some water to flow over the distal end of the panel. Further details of downstream passage chutes are described in Linderman et al. (2002). Fish do not typically pass upstream over these chutes and they are only set during periods of active downstream fish migration. Downstream passage chutes were not used during periods of strong upstream salmon passage. Downstream fish passage over these chutes was not enumerated.

Salmon escapements were estimated for periods when a breach occurred in the weir. Estimates were assumed to be zero if passage was considered negligible based on historical data and run timing indicators. Breach event estimates were calculated as the average observed passage 2 days before and after the day a breach occurred multiplied by the hourly proportion of the breach duration in a 24 h day using the following formulas:

$$\hat{n}_d = n_d \cdot \frac{t_b}{T_d} \tag{1}$$

and

$$n_d = \left(\frac{\left(\bar{n}_{d-1 \to d-2}\right) + \left(\bar{n}_{d+1 \to d+2}\right)}{2} \right) \tag{2}$$

where:

$\hat{n}_d$ = passage estimate for the day a weir breach occurred,

n_d = average passage from the 2 days before and after the day a weir breach occurred,

t_b = time period (in hours) the weir was breached,

T_d = number of hours in a day (24),

$\bar{n}_{d-1 \to d-2}$ = average passage from 2 days before the day a weir breach occurred, and

$\bar{n}_{d+1 \to d+2}$ = average passage from 2 days after the day a weir breach occurred.

Daily estimated salmon passage then became the sum of any observed passage from the day the weir breach occurred and the breach estimate.

Weir escapement was also estimated for periods when the weir was not operational but within the targeted operational dates. Estimates were calculated based on the proportional relationship between observed weir counts at the Middle Fork Goodnews River weir and weir counts from a model data set. The model data set could be from a different year at Goodnews River or from the same year at a neighboring weir project. The model data set was selected based on the strongest (Pearson) correlation between observed passage during the operational period at Middle Fork Goodnews River weir and observed passage from a model data set during the same time period. Daily passage estimates were the result of daily passage proportions of the model data set relative to the observed weir counts minus any observed passage from the day being estimated, and were calculated using the formula:

$$\breve{n}_d = \frac{\left(n_{d_c} \times \left(\sum_{d_z}^{d_a} y_e\right)\right)}{\left(\left(\sum_{d_z}^{d_a} y_c\right) - n_{d_e}\right)} \tag{3}$$

where:

$\breve{n}_d$ = passage estimate for the day weir was not operational,

n_{d_c} = the number of fish per species that passed the weir on that day from the model data set,

$\sum_{d_z}^{d_a} y_e$ = the sum of all daily counts per species for the year being estimated,

$\sum_{d_z}^{d_a} y_c$ = the corresponding sum of all daily counts per species from the model data set, and

n_{d_e} = the number of fish per species that passed the weir on that day for the year being estimated.

Drainage escapement was estimated by summing the weir escapement count with the estimated escapement of fish in the North Fork. North Fork sockeye salmon escapement was calculated by applying the recent 5-year average proportion of fish observed during Middle Fork and North Fork aerial surveys to the weir escapement. Drainage escapement estimates for sockeye salmon were calculated using the following formula:

$$N_d = \left(\left[\frac{n_{a_{nf}}}{n_{a_{mf}}}\right] n_{w_2}\right) + n_{w_2} \tag{4}$$

where:

N_d = total drainage escapement estimate,

$n_{a_{nf}}$ = recent 5-year average aerial survey count from the North Fork Goodnews River,

$n_{a_{mf}}$ = recent 5-year average aerial survey count from the Middle Fork Goodnews River, and

n_{w_2} = final weir escapement count including any estimates.

To estimate Chinook salmon drainage escapement, North Fork Chinook salmon escapement was calculated by applying the proportion of fish observed between the Middle Fork and North Fork aerial surveys in 2006 to the weir escapement. The Middle Fork Goodnews River aerial survey was incomplete in 2006 as only index area 101 was completed. As a result, the aerial survey proportion between the Middle Fork and North Fork was truncated to the number of fish counted in index area 101 in the Middle Fork and the number of fish counted in index areas 101 and 102 on the North Fork (Figure 3). The Chinook salmon drainage escapement estimate was calculated using the following formula:

$$N_d = \left(\left[\frac{n_{a_{nf}}}{n_{a_{mf}}} \right] n_{w_2} \right) + n_{w_2} \qquad (5)$$

where:

N_d = total drainage escapement estimate,

$n_{a_{nf}}$ = the sum of aerial survey counts from index areas 101 and 102 of the North Fork Goodnews River,

$n_{a_{mf}}$ = aerial survey count from index area 101 of the Middle Fork Goodnews River, and

n_{w_2} = final weir escapement count including any estimates.

To ensure the proportion of truncated aerial survey counts would be representative of the proportion of total aerial survey counts, years when all survey index areas were completed were used to test for any significant difference between truncated and total aerial survey proportions. This was tested using analysis of variance (ANOVA) between the truncated and total aerial survey proportions with 95% CI, $p \leq 0.01$.

AGE, SEX, AND LENGTH ESCAPEMENT SAMPLING

Escapement sampling for Chinook, sockeye, and chum salmon ASL composition estimates was conducted based on the pulse sampling design of Molyneaux et al. (2006). Each pulse consisted of intensive sampling for 1 to 3 day intervals followed by a few days without sampling. The goal for each pulse was to collect samples from 210 Chinook, 210 sockeye, 200 chum, and 170 coho salmon. These sample sizes were selected for simultaneous 95% confidence interval estimates of age composition ± 0.1 and were adjusted from sample sizes recommended by Bromaghin (1993) to account for regenerated and otherwise unreadable scales. The minimum number of pulse samples was one per species from each third of the run.

Salmon were sampled from a fish trap installed in the weir. The general practice was to open the entrance gate and leave the exit gate closed allowing fish to accumulate inside the holding pen. The holding pen was typically allowed to fill with fish and sampling was done during scheduled counting periods.

Scales were removed from the preferred area of the fish (INPFC 1963). A minimum of 3 scales were taken from each fish and mounted on numbered and labeled gum cards. Sex was determined by visually examining external morphology, keying on the development of the kype, roundness of the belly, and the presence or absence of an ovipositor. Length was measured to the

nearest millimeter from mideye to tailfork. After each fish was sampled, it was released into a recovery area upstream of the weir. After sampling was completed, relevant information such as sex, length, date, and location was copied from hardcopy forms to computer mark-sense forms. The completed gum cards and data forms were sent to the Bethel and Anchorage ADF&G offices for processing. Further details of sampling procedures can be found in Molyneaux et al. (2006) and Stewart (2004).

AGE, SEX, AND LENGTH COMMERCIAL HARVEST SAMPLING

Commercial catch sampling for Chinook, sockeye, chum, and coho salmon ASL composition estimates was conducted based on the pulse sampling design of Molyneaux et al. (2006). Each pulse sample was taken from a single commercial period, which was determined based on the number of commercial periods that occurred in a given week. The primary goal was to characterize the ASL composition of the entire commercial harvest for each species. Pulse samples were collected from a minimum of three commercial openings per species, each representing a third of the total harvest per species. The goal for each pulse was to collect samples from 210 Chinook, 210 sockeye, 200 chum, and 170 coho salmon.

Salmon were sampled from the Quinhagak dock area where a tender from District W-5 unloaded the catch to the on site processor. ADF&G partnered with Coastal Villages Region Fund (CVRF) staff in 2006 to hire and train student interns in District W-4 and W-5 commercial ASL and genetics sample collection. This partnership was pursued in an effort to mitigate recurring logistical difficulties in achieving adequate commercial ASL samples. An area was set aside for the sampling crew and processor workers supplied the crew with totes of iced fish for sampling. Fish were sampled as efficiently and carefully as possible to reduce processing delays and prevent bruising. Sampled fish were returned to iced totes in an ongoing effort to preserve quality.

Scales were removed from the preferred area of the fish (INPFC 1963). A minimum of 3 scales were taken from each fish and mounted on numbered and labeled gum cards. All sampled fish were sex determined by visual inspection of internal gonads. Length was measured to the nearest millimeter from mideye to tail fork. The completed gum cards and data forms were returned to the Bethel ADF&G offices for data transfer to computer mark-sense forms and sample processing. Further details of sampling procedures can be found in Molyneaux et al. (2006).

AGE, SEX, AND LENGTH COMPOSITION ESTIMATES

ADF&G staff in Bethel and Anchorage aged scales, processed the ASL data, and generated data summaries (Molyneaux et al. 2006). These procedures generated two types of summary tables for each species; one described the age and sex composition and the other described length statistics. These summaries account for ASL composition changes over the season by first partitioning the season into temporal strata based on pulse sample dates, applying age and sex composition of individual pulse samples to the corresponding temporal strata, and finally summing the strata to generate the estimated age and sex composition for the season. This procedure ensured ASL composition estimates were weighted by fish abundance in the escapement or harvest rather than fish abundance in the samples. Likewise, estimated mean length composition was calculated by weighting sample mean lengths from each stratum by the escapement or harvest of salmon during that stratum. Similar procedures were used for coho salmon; however, sample design modifications implemented in 2004 and 2005 reduced the

ability to estimate changes in ASL composition through the season in favor of estimating ASL composition for the entire run or harvest.

Ages were reported in tables using European notation. European notation is composed of two numerals separated by a decimal, where the first numeral indicates the number of winters spent by the juvenile fish in fresh water and the second numeral indicates the number of winters spent in the ocean (Groot and Margolis 1991). Total age is equal to the sum of these two numerals plus one to account for the single winter of egg incubation in the gravel. For example, a Chinook salmon described as an age 1.4 fish under European notation has a total age of 6 years.

The original ASL gum cards, acetates, and mark-sense forms were archived at the ADF&G office in Anchorage. The computer files were archived by ADF&G in the Anchorage and Bethel offices.

ATMOSPHERIC AND HYDROLOGICAL MONITORING

Atmospheric and hydrological conditions were recorded around noon each day. Cloud cover was judged from clear to overcast; wind speed was recorded in miles per hour (mph) and direction was noted; precipitation was measured in mm per 24 hours. Daily high and low air and water temperatures were recorded in degrees Celsius. The river gauge height was recorded daily and was pegged to a benchmark established in 1997 representing a river stage of 150 cm. The benchmark is a 0.75 in diameter steel length of rebar driven into the bank along a steep grade downstream of the field camp. The river gauge is a steel rule installed near shore in the river and is set level with the top of the benchmark at 150 cm.

ESCAPEMENT GOAL ANALYSIS

The analyses used to develop BEGs for the Middle Fork Goodnews River used Ricker two parameter spawner-recruit models to estimate the escapement that produces maximum sustained yield (MSY). The number of spawners expected to produce MSY is indicated as S_{MSY}. A range of escapements that produce 90% or more of MSY or represent the 90% credible bounds for spawners at MSY was used as the range for the BEG. Estimates of total run and stock specific age composition and harvest data are necessary in order to develop brood tables and give a complete picture of the total returns from each brood year. Brood tables were developed using Goodnews River total run reconstruction and exploitation, Middle Fork Goodnews River weir Chinook and sockeye salmon escapement estimates, and ASL composition estimates of Middle Fork Goodnews River escapements and District 5 commercial harvests. For years when adequate ASL composition of escapement estimates were not available, ASL composition of commercial harvest estimates were used to reconstruct ASL composition of escapement. Further details of methods used to determine BEGs for Middle Fork Goodnews River Chinook and sockeye salmon can be found in Molyneaux and Brannian 2006 and Brannian et al. 2006.

RESULTS

SALMON FISHERIES

Subsistence, commercial, and sport fishing activities occurred in District W-5, Goodnews Bay, and within the Goodnews River drainage in 2006. At the time of publication, 2006 subsistence harvest estimates for the communities of Goodnews Bay and Platinum were not final though discussions with participants inseason indicated subsistence needs were met and catches were

average. A total of 24 permit holders fished commercially in District W-5 for total harvests of 2,892 Chinook, 29,857 sockeye, 11,568 chum, and 12,436 coho salmon (Table 3). No pink salmon were commercially harvested in 2006. Exvessel value by species was $21,314 for Chinook, $87,966 for sockeye, $4,368 for chum, and $27,587 for coho salmon for a total exvessel value of $141,235. Sport fish harvest estimates for Goodnews River in 2006 were not available for this report.

PROJECT OPERATIONS

The target operational period of 26 June to 18 September was not achieved in 2006 as the weir was only operational from 26 June to 7 September. A breach in the weir caused by dislodged weir and trap panels occurred for 12 hrs on 15 August. A high water event beginning on 8 September rendered the weir inoperable through 18 September and the decision was made to discontinue operations for the remainder of the season. The weir crew began weir disassembly and camp closure once water levels receded to a workable level on 27 September.

WEIR ESCAPEMENT

The 2006 Middle Fork Goodnews River Chinook salmon escapement was estimated to be 4,559 fish during the target operational period (Table 4). A total of 4,554 Chinook salmon were observed passing upstream through the weir and 5 fish (<1%) were estimated to have passed upstream during breach events and inoperable periods. Chinook salmon escapement exceeded the upper end of the SEG range of 2,000–4,500 fish (Table 5). The first Chinook salmon was observed on 26 June, the first day of operation, and the last Chinook salmon was observed on 5 September. Based on the target operational period and inclusive of estimated passage, the median passage date was 18 July and the central 50% of the run occurred between 8 July and 23 July (Table 6).

The 2006 Middle Fork Goodnews River sockeye salmon escapement was estimated to be 126,772 fish during the target operational period (Table 4). A total of 126,734 sockeye salmon were observed passing upstream through the weir and 38 fish (<1%) were estimated to have passed upstream during breach events and inoperable periods. Sockeye salmon escapement exceeded the upper end of the SEG range of 23,000–58,000 fish (Table 5). The first sockeye salmon was observed on 26 June, the first day of operation, and the last sockeye salmon was observed on 7 September, the last day of operation. Based on the target operational period and inclusive of estimated passage, the median passage date was 10 July and the central 50% of the run occurred between 4 July and 16 July (Table 6).

The 2006 Middle Fork Goodnews River chum salmon escapement was estimated to be 54,699 fish during the target operational period (Table 4). A total of 54,599 chum salmon were observed passing upstream through the weir and 100 fish (<1%) were estimated to have passed upstream during breach events and inoperable periods. Chum salmon escapement exceeded the SEG threshold of 12,000 fish (Table 5). The first chum salmon was observed on 26 June, the first day of operation, and the last chum salmon was observed on 7 September, the last day of operation. Based on the target operational period and inclusive of estimated passage, the median passage date was 19 July and the central 50% of the run occurred between 11 July and 26 July (Table 6).

The 2006 Middle Fork Goodnews River coho salmon escapement was estimated to be 15,969 fish (Table 4). A total of 13,062 Coho salmon were observed passing upstream through the weir and 2,907 fish (18%) were estimated to have passed upstream during breach events and

inoperable periods. Coho salmon escapement exceeded the SEG threshold of 12,000 fish (Table 5). The first coho salmon was observed on 29 July and the last coho salmon was observed on 7 September the last day of operation. Based on the target operational period and inclusive of estimated passage, the median passage date was 2 September and the central 50% of the run occurred between 29 August and 7 September (Table 6).

The 2006 Middle Fork Goodnews River total pink salmon count was 18,432 fish (Table 7). No escapement estimate was made for pink salmon in 2006 because spacing between the weir panel pickets allows all but the largest pink salmon to pass through the weir unobserved and they are not a species targeted for escapement estimation. The first pink salmon was observed on 26 June, the first day of operation, and the last pink salmon was observed on 7 September, the last day of operation.

The 2006 Middle Fork Goodnews River total count of Dolly Varden was 1,858 fish (Table 7). Similar to pink salmon, no passage estimates were made for Dolly Varden because spacing between the weir panel pickets allows smaller Dolly Varden to pass through the weir unobserved. The first Dolly Varden was observed on 27 June, the second day of operation, and the last Dolly Varden was observed on 7 September, the last day of operation. The median passage date was 26 July and the central 50% of the run occurred between 16 July and 29 July (Table 6).

Whitefish and rainbow trout were also observed passing the weir in 2006 but were not enumerated. No passage estimates were made for whitefish and rainbow trout in 2006 because spacing between the weir panel pickets allows smaller fish of these species to freely pass through the weir unobserved.

CARCASS COUNTS

Fish carcasses were cleaned off the weir throughout weir operations (Table 8). A total of 279 Chinook, 761 sockeye, 6,529 chum, 3,145 pink, and 24 coho salmon carcasses were counted during project operations. Additionally, 1 whitefish, 2 rainbow trout, and 12 Dolly Varden carcasses were counted.

AERIAL SURVEYS

Aerial surveys of the Goodnews River drainage were conducted on 2 August in 2006. The North Fork Goodnews River aerial survey was completed under excellent conditions, allowing all index areas to be surveyed (Figure 3). The counts for the North Fork were 4,159 Chinook salmon and 78,100 sockeye salmon. The Middle Fork Goodnews River aerial survey was not completed because of high crosswinds near the mountains, creating unsafe conditions. Only index area 101 was surveyed under excellent conditions. The counts for index area 101 of the Middle Fork were 1,342 Chinook salmon and 4,700 sockeye salmon.

DRAINAGE ESCAPEMENT

Goodnews River drainage escapement was estimated for Chinook and sockeye salmon in 2006. North Fork Chinook salmon escapement was estimated by applying the proportion of aerial survey counts between index areas 101 and 102 on the North Fork and index area 101 on the Middle Fork to weir escapement (Table 9). ANOVA determined no significant difference ($p=0.0007$) between North Fork and Middle Fork proportions from all index areas and truncated proportions from index areas 101 and 102 on the North Fork, and index area 101 on the Middle Fork. North Fork sockeye salmon escapement was estimated based on the 5-year average

proportion (1.19) between North Fork and Middle Fork aerial survey counts. North Fork Chinook salmon escapement was estimated to be 11,704 fish and North Fork sockeye salmon escapement was estimated to be 151,288 fish (Table 5; Appendix D1). Escapement to the Goodnews River drainage was estimated to be 16,263 for Chinook salmon and 278,060 for sockeye salmon. The resulting exploitation rate was 19% for Chinook salmon and 10% for sockeye salmon (Table 5; Appendix D1).

AGE, SEX, AND LENGTH COMPOSITION ESTIMATES

Middle Fork Goodnews River Escapement

Scale samples, sex, and length were collected from 73 Chinook salmon at the weir in 2006 (Table 10). Samples were collected from 3 pulses ranging in size from 16 to 40 fish per pulse. The samples did not achieve the minimum sample objectives and were not adequate for estimating ASL composition of weir escapement. Age was determined for 57 of the 73 fish sampled (78.1 %). Applied to aged samples, age-1.4 Chinook salmon were the most abundant age class (36.8%), followed by age-1.2 (33.3%), age-1.3 (26.3%), age-1.5 (1.8%), and age-1.1 (1.8%) fish. Sex composition applied to aged samples was 51.4% males and 48.6% females. Mean male length of the samples by age class was 375 mm for age-1.1 fish, 555 mm for age-1.2 fish, 682 mm for age-1.3 fish, and 859 mm for age-1.4 fish (Table 11). Mean female length of the samples by age class was 613 mm for age-1.2 fish, 743 mm for age-1.3 fish, 851 mm for age-1.4 fish, and 900 for age-1.5 fish. Overall, male sample lengths ranged from 360 to 940 mm and female sample lengths ranged from 605 to 955 mm.

Scale samples, sex, and length were collected from 751 sockeye salmon at the weir in 2006 (Table 12). Samples were collected from 4 pulses ranging in size from 155 to 240 fish per pulse. The samples achieved the minimum sample objectives and were adequate for estimating ASL composition of weir escapement. Age was determined for 576 of the 751 fish sampled (76.7%). Escapement was partitioned into 4 temporal strata based on sample dates. Applied to escapement, age-1.3 sockeye salmon were the most abundant age class (70.4%), followed by age-1.2 (18.7%), age-2.3 (4.3%), age-1.4 (3.5%), age-0.3 (2.4%), and age-2.2 (0.7%) fish. Sex composition of escapement was estimated to include 54,376 males (42.9%) and 72,396 females (57.1%). Mean male length by age class was 549 mm for age-0.3 fish, 503 mm for age-1.2 fish, 566 mm for age-1.3 fish, 550 mm for age-2.2 fish, 588 mm for age-1.4 fish, and 558 mm for age-2.3 fish (Table 13). Mean female length by age class was 524 mm for age-0.3 fish, 480 mm for age-1.2 fish, 526 mm for age-1.3 fish, 516 mm for age-2.2 fish, 541 mm for age-1.4 fish, and 527 mm for age-2.3 fish. Overall, male lengths ranged from 430 to 615 mm and female lengths ranged from 415 to 590 mm.

Scale samples, sex, and length were collected from 847 chum salmon at the weir in 2006 (Table 14). Samples were collected from 5 pulses ranging in size from 65 to 200 fish per pulse. The samples achieved the minimum sample objectives and were adequate for estimating ASL composition of weir escapement. Age was determined for 776 of the 847 fish sampled (91.6 %). Escapement was partitioned into 5 temporal strata based on sample dates. Applied to escapement, age-0.3 chum salmon was the most abundant age class (69.7%), followed by age-0.4 (28.6%), age-0.2 (1.3%) and age-0.5 (0.3%) fish. Sex composition of escapement was estimated to include 25,193 males (46.1%) and 29,506 females (53.9%). Mean male length by age class was 527 mm for age-0.2 fish, 589 mm for age-0.3 fish, and 599 mm for age-0.4 fish (Table 15). Mean female length by age class was 534 mm for age-0.2 fish, 557 mm for age-0.3 fish, 564 mm

for age-0.4 fish, and 528 for age-0.5 fish. Overall, male lengths ranged from 500 to 685 mm and female lengths ranged from 440 to 645 mm.

Scale samples, sex, and length were collected from 446 coho salmon at the weir in 2006 (Table 16). Samples were collected from 3 pulses ranging in size from 103 to 173 fish per pulse. The samples achieved the minimum sample objectives and were adequate for estimating ASL composition of weir escapement. Age was determined for 343 of the 446 fish sampled (76.9 %). Escapement was partitioned into 3 temporal strata based on sample dates. Applied to escapement, age-2.1 coho salmon was the most abundant age class (78.3%), followed by age-1.1 (20%), and age-3.1 (1.7%) fish. Sex composition of escapement was estimated to include 8,328 males (52.2%) and 7,640 females (47.8%). Mean male length of the samples by age class was 571 mm for age-1.1 fish, 560 mm for age-2.1 fish, and 550 mm for age-3.1 fish (Table 17). Mean female length of the samples by age class was 554 mm for age-1.1 fish, 567 mm for age-2.1 fish, and 563 mm for age-3.1 fish. Overall, male sample lengths ranged from 440 to 665 mm and female sample lengths ranged from 440 to 625 mm.

District W-5 Commercial Harvest

Scale samples, sex, and length were collected from 233 Chinook salmon harvested in the 2006 District W-5 commercial fishery (Table 18). Samples were collected from one pulse. The samples did not achieve the minimum sample objectives and were not adequate for estimating ASL composition of District W-5 commercial harvest. Age was determined for 182 of the 233 fish sampled (78.1 %). Applied to aged samples, age-1.3 Chinook salmon were the most abundant age class (45.1%), followed by age-1.2 (33.0%), age-1.4 (20.3%), and age-1.5 (1.6%) fish. Sex composition applied to aged samples was 82.4% males and 17.6% females. Mean male length of the samples by age class was 553 mm for age-1.2 fish, 689 mm for age-1.3 fish, and 770 mm for age-1.4 fish, and 935 mm for age-1.5 fish (Table 19). Mean female length of the samples by age class was 750 mm for age-1.3 fish and 825 mm for age-1.4 fish. There was one age-1.2 fish in the sample with a length of 556 mm. Overall, male sample lengths ranged from 451 to 975 mm and female sample lengths ranged from 556 to 882 mm.

Scale samples, sex, and length were collected from 140 sockeye salmon harvested in the 2006 District W-5 commercial fishery (Table 20). Samples were collected from one pulse. The samples did not achieve the minimum sample objectives and were not adequate for estimating ASL composition of District W-5 commercial harvest. Age was determined for 95 of the 140 fish sampled (67.9 %). Applied to aged samples, age-1.3 sockeye salmon were the most abundant age class (74.7%), followed by age-0.3 (8.4%), age-1.2 (8.4%), age-2.3 (5.3%), and age-1.4 (3.2%) fish. Sex composition applied to aged samples was 67.4% males and 32.6% females. Mean male length of the samples by age class was 551 mm for age-0.3 fish, 504 mm for age-1.2 fish, 555 mm for age-1.3 fish, 568 mm for age-1.4 fish, and 599 mm for age-2.3 fish (Table 21). Mean female length of the samples by age class was 503 mm for age-1.2 fish, 543 mm for age-1.3 fish, and 533 mm for age-2.3 fish. There was one age-0.3 at 521 mm and one age-1.4 female fish at 571 mm in the sample. Overall, male sample lengths ranged from 430 to 627 mm and female sample lengths ranged from 494 to 581 mm.

Scale samples, sex, and length were collected from 210 chum salmon harvested in the 2006 District W-5 commercial fishery (Table 22). Samples were collected from one pulse. The samples did not achieve the minimum sample objectives and were not adequate for estimating ASL composition of District W-5 commercial harvest. Age was determined for 193 of the 210

fish sampled (91.9 %). Applied to aged samples, age-0.3 chum salmon were the most abundant age class (59.1%), followed by age-0.4 (40.9%) fish. Sex composition applied to aged samples was 61.1% males and 38.9% females. Mean male length of the samples by age class was 570 mm for age-0.3 fish and 577 mm for age-0.4 fish (Table 23). Mean female length of the samples by age class was 555 mm for age-0.3 fish and 567 mm for age-0.4 fish. Overall, male sample lengths ranged from 510 to 671 mm and female sample lengths ranged from 509 to 609 mm.

No scale samples, or sex and length data were collected from coho salmon harvested in the 2006 District W-5 commercial fishery because of logistical difficulties in gaining access to the District 5 coho salmon harvest for sample collection.

ATMOSPHERIC AND HYDROLOGICAL MONITORING

Atmospheric and hydrological observations were recorded daily from 25 June through 16 September (Table 24). Air temperatures ranged from 1 to 20˚ C. Water temperature was more consistent ranging from 5 to 13.5˚ C. Several rain events resulted in daily accumulations from trace amounts up to 210 mm in a 24 h period. Water level ranged from 11 to 98 cm.

ESCAPEMENT GOAL ANALYSIS

BEGs were determined for the Middle Fork Goodnews River Chinook and sockeye salmon using Ricker two parameter stock-recruit model with upper and lower bounds of the BEG determined by establishing the range of escapements that produce 90% or more of MSY, or represent the 90% credible bounds for spawners at MSY. Middle Fork Goodnews River Chinook and sockeye salmon brood tables were developed from Goodnews River total run reconstruction and exploitation, Middle Fork Goodnews River escapement, and ASL composition of escapement and commercial harvest estimates (Tables 1 and 2). The BEG range established for Middle Fork Goodnews River Chinook salmon was 1,500–2,900 Chinook, with S_{MSY} = 1,771 (Table 25). The BEG range established for Middle Fork Goodnews River sockeye salmon was 18,000–40,000 sockeye, with S_{MSY} = 20,889 (Table 26).

DISCUSSION

PROJECT OPERATIONS

Operation of the weir in 2006 was successful with a nearly complete enumeration of Chinook, sockeye, chum, and coho salmon escapement, and Dolly Varden migration past the weir. The majority of project objectives were achieved with the exception of Chinook salmon escapement ASL estimates and commercial ASL estimates for all salmon species. The project continues to add to the long-term escapement, run timing, and ASL database for salmon runs at the Goodnews River and serves as a platform for the study of other anadromous and resident freshwater species.

Average water levels through July and the first half of August contributed towards uninterrupted weir operations in 2006 and did not appear to hamper fish passage through the weir. However, from mid August thought the end of September the Goodnews River drainage experienced persistent rain events which raised water levels and caused the premature termination of project operations on 8 September.

Achieving the Chinook salmon ASL sample objectives continues to be problematic. Low daily abundance, migration patterns, and behavior at the weir have made sample collection difficult over the years. Even with the higher relative abundance seen in 2006, the Chinook salmon sample objectives were not achieved. Chinook salmon tend to migrate through the weir in large pulses so that passage will be slow for a period of days then suddenly peak. Coordinating ASL sampling to coincide with these pulses is difficult because timing of the pulses cannot be accurately predicted. An active sampling strategy of capturing Chinook salmon individually or in small groups as other species are allowed to pass freely through the trap has improved sample sizes, but the fish trap used at the weir does not present the best platform for active sampling. This strategy can work well, but is time intensive and Chinook salmon are often hesitant to approach the trap in its current fixed location and when there is increased activity around the trap. In an effort to achieve Chinook salmon sample objectives, active sampling will continue to be conducted at the weir and a new live trap will be employed in 2007 to allow for increased sampling opportunity.

Achieving the District W-5 commercial ASL sample objectives has continued to prove problematic as well. Although the partnership between ADF&G and CVRF to collect commercial ASL samples in Quinhagak has met with overall success in achieving adequate commercial ASL sample goals from District 4, achieving sample goals for the District 5 commercial harvest remained difficult. The commercial catch is tendered from Goodnews Bay to Quinhagak and does not arrive until the day following each commercial opening. The tender's arrival at the Quinhagak dock is dependent upon tidal cycles at the mouth of the Kanektok River. Although the CVRF sampling crew was based in Quinhagak, coordinating sample crew availability with tender arrival in Quinhagak remained difficult. Delays between sampling crew implementation and tender arrivals coupled with the relatively small District W-5 commercial harvest typically resulted in the catch being processed before sampling could occur. Additionally, the tender would sometimes arrive at the Quinhagak dock in the early morning hours when the sampling crew was not available. ADF&G plans to work with CVRF staff and the Quinhagak processing plant manager this coming season to collect District 5 commercial ASL samples from the tender in Goodnews Bay during commercial openings. Barring any unforeseen logistical problems, this sampling strategy should allow for achieving commercial ASL sample goals from the District 5 commercial catch.

ESCAPEMENT MONITORING AND ESTIMATES

Chinook Salmon

The 2006 Chinook salmon weir escapement of 4,559 fish was the sixth highest escapement since 1981, and only 74 fish less than escapement in 2005 (Figure 4; Appendix B1). Chinook salmon escapement was 1.31% above the upper end of the SEG range and was 26.6% higher than the recent 10-year average from 1996 through 2005. The general trend of Chinook salmon escapement in the Middle Fork Goodnews River since 1981 indicates fluctuations of abundance and a recent higher relative abundance since 1992; however, it should be noted that the later trend may be affected by the 1991 change in methodology from counting tower to weir-based escapement estimates.

Sockeye Salmon

The 2006 sockeye salmon weir escapement of 126,772 fish was the highest escapement since Middle Fork Goodnews River escapement assessment projects were initiated in 1981 (Figure 4;

Appendix B1). Sockeye salmon escapement in 2006 was 11.4% higher than the next highest escapement of 113,809 in 2005, and was 163% higher than the recent 10-year average of sockeye salmon escapement from 1996 through 2005. Sockeye salmon escapement in 2006 exceeded the upper end of the SEG range by 119%. The general trend of Middle Fork Goodnews River sockeye salmon escapement since 1981 indicates fluctuations of abundance and a higher relative abundance over the last 3 years. Similar to Chinook salmon, these trends may be affected by the 1991 change in methodology from counting tower to weir based escapement estimates; however, the sockeye salmon escapement in 2006 was unprecedented and indicates a high level of production compared to prior year escapements.

Chum Salmon

The 2006 chum salmon weir escapement of 54,699 fish was the highest escapement since Middle Fork Goodnews River escapement assessment projects were initiated in 1981 (Figure 4; Appendix B1). Chum salmon escapement in 2006 was 35.2% higher than the next highest escapement of 40,450 in 1996, and was 113% higher than the recent 10-year average of chum salmon escapement from 1996 through 2005. The general trend of chum salmon escapement into the Middle Fork Goodnews River since 1981 suggest fluctuations in abundance and a higher relative abundance since 1992; however, it should be noted, again, that the 1991 change in methodology from counting tower to weir-based escapement estimates may have caused inaccuracies in chum salmon escapement estimates prior to 1991.

Coho Salmon

The 2006 coho salmon weir escapement of 15,969 fish was below the average escapement since the project was extended to count coho salmon in 1997 (Figure 4; Appendix B1). Weir escapement in 2006 was 39.8% lower than the historical average from 1997 through 2005. The weir discontinued operations on September 8 because of high water. Historically, this time period has coincided with a high abundance of coho salmon counted through the weir; however, the historical median passage has achieved the 80% point by this date (Table 6; Figure 5). Alternatively, coho salmon migration timing has been shown to coincide with rising water levels (Linderman et al. 2003a). During their inriver spawning migration, coho salmon typically move in pulses that are triggered by even small increases in water level. Water levels were very low at the beginning of August in 2006, which may have reduced the frequency of pulses in migration that coho salmon typically exhibit resulting in delayed overall run timing. Coho salmon run timing in 2006 was delayed by approximately 2 days compared to the historical median. Additionally, the fish were moving through the weir in large pulses lasting from 1 to 2 days and would then taper off. Given this trend and the relationship between coho salmon migration and water level, another pulse may have coincided with the weir becoming inoperable for the remainder of the season. The weir escapement estimate reported here should be viewed as an index of coho salmon escapement in 2006. Actual escapement past the weir may have been higher.

Dolly Varden

Complete Dolly Varden counts at the Middle Fork Goodnews River weir date back to 1997 (Appendix B1). The 2006 Dolly Varden count of 1,858 fish was 35.5% below the average of 2,880 from 1996 to 2005. Dolly Varden passage in 2006 exhibited a bell shaped distribution throughout the majority of July, with small increases in passage in early July, compared to the bimodal separation between passage in July and August exhibited in 2000, 2001, and 2004

(Figure 6). Additional details and analysis of Goodnews River Dolly Varden populations can be found in Lisac (2003) and Lisac (*In prep* a, b).

The Dolly Varden counts generated by the weir project represent an unknown proportion of the overall Dolly Varden migration within the Middle Fork Goodnews River. The current spacing between weir panel pickets was chosen for optimal weir operations during high water events and for generating escapement counts of Chinook, sockeye, chum, and coho salmon. Findings from Lisac (2003) suggest that the weir count is size selective for larger Dolly Varden and it is believed younger and smaller fish pass through the weir unobserved. The Dolly Varden counts generated at the weir should continue to be considered an index of Dolly Varden populations in the Middle Fork Goodnews River.

RUN TIMING ESTIMATES

Chinook salmon run timing in 2006 was later than the historical median by approximately 7 days (Table 6; Figure 5). Sockeye salmon run timing in 2006 was later than the historical median by approximately 2 days. Chum salmon run timing was also late by approximately 2 days compared to the historical median. Coho salmon run timing in 2006 was later compared to the historical median by approximately 2 days. The inter-annual run timing pattern between these species has varied. For example, in 2004 Chinook and sockeye were slightly early compared to the historical median, chum salmon started out early and became late, and coho salmon were late overall. Dolly Varden Run timing in 2006 was a week later overall compared to the historical median (Figures 4 and 5).

CARCASS COUNTS

The use of carcass counts for estimating stream life of Chinook and chum salmon has been abandoned because this analysis is believed unreliable (Linderman et al. 2003a, b). Stream life estimates from carcass counts are unreliable because of the small percentage of carcasses recovered relative to total escapement, annual variability of carcass to escapement percentages, and potential biases in sex ratios between carcasses and escapement. Carcass counts have continued to be collected to satisfy grant objectives through the 2006 season, but will be discontinued starting in 2007.

RUN ABUNDANCE

Salmon spawn primarily in the North Fork and Middle Fork Rivers of the Goodnews River drainage and their associated lakes. It is thought that less than 10% of salmon returning to the Goodnews River spawn in the South Fork and no estimate is made for this portion of the drainage. Chinook and sockeye salmon escapements were estimated for the North Fork in 2006; however, because aerial surveys were incomplete and no lakes were surveyed in the Middle Fork, the recent 5-year average proportion between North Fork and Middle Fork aerial surveys was used to estimate North Fork sockeye salmon escapement (Table 5). Chinook salmon escapement was estimated for the North Fork using the proportion of aerial survey counts truncated to index areas 101 and 102 in the North Fork, and index area 101 in the Middle Fork for 2006. We believe this method was valid as no significant difference was found between proportions from the truncated aerial surveys and proportions of total aerial survey counts in prior years when aerial surveys were completed for all index areas.

The combined escapement estimates from the North Fork and Middle Fork weir are used to characterize Goodnews River drainage escapement (Table 5; Figure 7). Harvest and escapement

estimates are combined to estimate total run abundance and exploitation for the Goodnews River drainage (Table 5; Appendix D1 and D2). Chum salmon run abundance for the Goodnews River drainage was not characterized for 2006, as aerial survey counts have been discontinued for chums. Chum salmon are difficult to observe from the air and their run timing is very protracted. The extended peak spawning periods of chum salmon, the current "snapshot" aerial surveys used in the Goodnews River drainage are not viable as an index of chum salmon abundance. Even if multiple surveys were flown, it is unknown whether the resulting survey counts would be an accurate index of chum salmon abundance.

It is difficult to assess the quality or any directional bias of the estimates of total abundance and exploitation. Three main issues affect these estimates: 1) lack of 2006 estimates of subsistence and sport fish harvests, 2) lack of escapement monitoring in the South Fork of the Goodnews River drainage, and 3) the comparability of aerial surveys between the middle and north forks. Use of 5-year average sport and subsistence harvests should not have a large affect on estimates of total abundance and exploitation. Sockeye salmon subsistence and sport harvest represent only 4% of the total harvest on average, and use of a historic mean will have little effect on the estimate. In contrast, on average 22% of the Chinook harvest is taken by subsistence and sport fishers and the coefficient of variation for these Chinook harvests are 22% and 60% respectively.

The direction of the bias in total abundance and exploitation rates is known for the omission of South Fork Chinook and sockeye salmon. The estimates of total abundance will be biased low and the exploitation will be biased high. The bias is thought to be small and in a direction that leads managers to account for its potential effect when making management decisions.

An assumption necessary for an unbiased estimate of total escapement, abundance, and exploitation is that the proportion of observable salmon is equal between aerial surveys conducted upriver from the weir on the Middle Fork and on the North Fork. Differences could arise with differences in environmental conditions or salmon run timing. If a higher proportion of observable salmon are counted above the weir compared to the North Fork, total escapement and abundance will be underestimated and exploitation will be biased high. The reverse will occur if a lower proportion of observable salmon are counted during the aerial survey above the weir compared to the North Fork survey.

Experienced staff have not described any gross differences affecting aerial surveys between forks. Overall depth, water color, riparian vegetation, and substrate type is nearly identical between them, although the Middle Fork drainage is shorter than the North Fork. Aerial surveys of the North Fork and Middle Fork are typically conducted on the same day so conditions and methods used during each survey are also similar. Additionally, it is likely that surveys would be conducted by the same observer on each fork in a given year. These factors combined reduce the possibility of bias caused by differences in environmental conditions, methods, or different observers employed between both forks.

A different proportion of observable fish between forks may arise if spawning time is not the same or the area surveyed differs. For Chinook and coho salmon, these factors are not as pronounced because they are primarily main channel spawners, their peak spawning period is consistent between areas, and similar areas are surveyed. In contrast, sockeye salmon are primarily lake and lake tributary spawners. The time frame when sockeye salmon enter the lakes and later move into lake tributaries to spawn is a critical factor for sockeye salmon aerial surveys. If few sockeye salmon are observed in the Middle Fork lakes and the lake tributaries are

not surveyed, it will be unknown whether abundance was actually low or if the majority of sockeye salmon had already moved into the lake tributaries to spawn. Alternatively, if large numbers of sockeye salmon were observed in North Fork lakes and lake tributaries were not surveyed, it will be unknown whether abundance was high compared to the Middle Fork lakes or if North Fork sockeye salmon had not yet moved into lake tributaries to spawn. In order to reduce this potential for bias, sockeye salmon aerial surveys should be conducted around the perimeter of the lakes but also on the lake spawning tributaries on a consistent annual basis for both forks. Historically, it is unclear whether sockeye aerial surveys of the Goodnews River drainage have consistently included lake tributaries. This uncertainty has been addressed in recent years through improvements and standardization of the Kuskokwim Area aerial survey program and the inclusion of lake spawning tributaries in all sockeye salmon aerial surveys.

There is also potential for directional bias of exploitation rate in 2006 with use of average aerial survey proportions to estimate North Fork sockeye salmon escapement. The current methodology employed to estimate North Fork escapement uses aerial survey counts to determine the proportion of fish escaping to each fork and applying that proportion to the known Middle Fork weir escapement. In the absence of complete aerial survey proportions in 2006 for sockeye salmon, an average aerial survey proportion was applied to weir escapement to generate the North Fork escapement estimate. If the average aerial survey proportion was lower than the actual proportion, exploitation would be biased high. Conversely, if the average aerial survey proportion was higher than the actual proportion, exploitation would be biased low. It is unclear in what direction average aerial survey proportions may be biasing total abundance and exploitation. However, it can be assumed that 2006 returns were not overexploited given the relatively high escapements of Chinook and most notably sockeye salmon in 2006 and the relatively low trends in exploitation rates of Goodnews River stocks. On the contrary, any classification of Goodnews River salmon exploitation in 2006 would most likely be underutilized.

An additional potential for directional bias of exploitation rate in 2006 for Chinook salmon was the use of partial aerial survey proportions to estimate North Fork escapement. Even though no significant difference was found between proportions of partial aerial survey counts and total aerial survey counts in years when aerial surveys were complete, proportions from partial aerial surveys were slightly higher on average. If this held true for 2006, it would bias the North Fork Chinook estimate high, which, in turn would bias exploitation low. It is believed that any potential bias is small and would have a negligible effect on total run and exploitation estimates.

ESCAPEMENT GOAL ANALYSIS

The escapement goals for Middle Fork Chinook and sockeye salmon were recently revised from SEGs to BEGs. An evaluation of data initially analyzed to determine the BEGs revealed that important escapement and harvest estimates were incorrect. Further analysis was conducted to correct the brood tables and recalculate S_{MSY} for this report. These corrections did not have a major affect on the Chinook and sockeye BEGs. S_{MSY} for Chinook salmon decreased by 42 fish from 1,813 to 1,771, and S_{MSY} for sockeye salmon decreased by 1,001 fish from 21,890 to 20,889. This reduction had no affect on originally established BEG ranges as the decreases in S_{MSY} were within rounding errors of the calculated BEG ranges.

Escapement and ASL data was analyzed to estimate the productivity of Chinook and sockeye salmon stocks in the Goodnews River drainage and develop of brood tables for both species

(Tables 1 and 2). ADF&G staff generally uses a Ricker-type spawner-recruit model to estimate the number of spawners that provide MSY, total return at MSY, and the resulting exploitation fraction. The number of Chinook salmon spawners that provide for MSY is 1,771, with a return of 3,964 resulting in an exploitation fraction of 55% (Table 1; Figure 8). The number of sockeye salmon spawners that provide for MSY is 20,889, with a return of 55,081 resulting in an exploitation fraction of 62% (Table 2; Figure 9). Exploitation at MSY for 26 Chinook salmon stocks in Oregon, Washington, and Alaska averaged 67% (C. Parkin, Department of Fisheries and Oceans Canada; personal communication). Exploitation at MSY for Bering Sea Chinook salmon from Salcha, Chena (Evenson 2002), and Nushagak Rivers (Fair et al. 2004) averaged 75%. Similarly derived estimates of exploitation at MSY for 9 sockeye stocks in Bristol Bay averaged 65% (Fair et al. 2004) and ranged from 49% for the least productive Kvichak River off-peak runs to 77% for Ugashik sockeye salmon.

Exploitation levels of Goodnews River Chinook and sockeye salmon have historically been below the level providing MSY. Exploitation of both species has decreased in recent years. The historical exploitation of Goodnews Chinook is 37%, the 10-year average is 26%, and the 5-year average is 21% (Appendix D1). The historical exploitation of Goodnews sockeye is 31%, the 10-year average is 23%, and the 5-year average is 14% (Appendix D2). In 2006, exploitation was estimated to be 19% for Chinook salmon and 10% for sockeye salmon, well below the exploitation at MSY for both species. This was caused in large part to the strong run of Chinook and record run of sockeye salmon coupled with low commercial fishing effort, which has been decreasing over the last 10 years.

Compared to the previously established SEGs for Middle Fork Chinook and sockeye salmon, the newly established BEGs represent an overall reduction in escapements needed to sustain these stocks for maximum yield. These results coupled with current and historical exploitation rates on Middle Fork Middle Fork Chinook and sockeye salmon stocks indicate an overall higher level of exploitation can be sustained on Goodnews River Chinook and sockeye salmon stocks and may result in higher overall yields through time.

AGE, SEX, AND LENGTH COMPOSITION ESTIMATES

The following discussion focuses on describing ASL trends seen within Middle Fork Goodnews River weir escapement and District W-5 commercial harvest during 2006. Some comparisons are made indicating similarities and differences between the weir escapement and commercial harvest ASL estimates both for 2006 and historical ASL data. Given District W-5 samples were not adequate to estimate ASL composition of commercial harvest in 2006, additional comparisons were made between the commercial samples collected and ASL composition of weir escapement estimates. Probably the greatest value in collecting ASL information is for continued development of spawner-recruit models and future evaluation or revision of established escapement goals. This information can also be used for forecasting future runs, maintenance and revision of brood tables, and to illustrate long-term trends in ASL composition (for example, Bigler et al. 1996).

Chinook Salmon

Although sample objectives were not achieved for both the escapement and commercial Chinook salmon ASL estimates in 2006, some inferences can be made based on the samples that were collected. Age-1.4 Chinook salmon were the dominant age class for the aged escapement while age-1.3 Chinook were the dominant age class for the aged commercial ASL samples (Tables 10

and 18). The aged escapement samples are consistent with the majority of age-1.3 Chinook salmon observed in 2005. This trend in age composition is also encouraging for future returns as relatively high percentages of age-1.3 fish in 2006 combined with an above average Chinook salmon escapement in 2006 indicates a good return of larger age-1.4 fish in 2007. Males were dominant in both the weir and commercial samples in 2006 which is consistent with historical trends in Chinook salmon sex ratios (Molyneaux et al. 2006*)*.

Sockeye Salmon

Age-1.3 sockeye salmon were the dominant age class in the 2006 escapement ASL estimates (Table 12; Figure 10). This is consistent with the aged commercial samples, although commercial ASL sample goals were not achieved (Table 20). Age class percentages between ASL escapement estimates and aged commercial samples were relatively consistent across all age classes. This indicates that 2006 escapement ASL estimates could be used as a surrogate for commercial samples if necessary. Male to female percentages for 2006 escapement ASL estimates were 42.9% for males and 57.1% for females which is in contrast with commercial ASL samples which exhibited a split of 67.4% males and 32.6% females. Males and females exhibited modest length partitioning by age class for escapement ASL estimates in 2006, which was again consistent with the aged commercial ASL samples (Figures 11 and 12). Mean male and female lengths by age class were similar between shared age classes in the escapement ASL estimates and aged commercial samples. These age and length trends are consistent with the total for both escapement ASL estimates and aged commercial samples; however, it should be noted that the aged commercial samples did not span the same number of age classes as the 2006 escapement ASL estimates.

Chum Salmon

Age-0.3 chum salmon were the dominant age class for escapement ASL estimates in 2006 (Table 14; Figure 10). This is consistent with the aged commercial samples, although commercial ASL sample goals were not achieved (Table 22). Age class percentages between ASL escapement estimates and aged commercial samples were relatively consistent across all age classes. This indicates that 2006 escapement ASL estimates could be used as a surrogate for commercial samples if necessary. Male to female percentages were near 50–50, at 46% to 54%, for the escapement ASL estimates in 2006 which is consistent with historical totals for escapement and commercial ASL estimates. Mean male and female lengths by age class in the 2006 escapement ASL estimates and the aged commercial samples indicated modest length partitioning by age class which is again consistent with totals for both escapement and commercial ASL estimates (Figures 11 and 12). Similar to sockeye salmon, it should be noted that the aged commercial samples did not span the same number of age classes as the 2006 escapement ASL estimates.

Coho Salmon

Age-2.1 coho salmon were the dominant age class for escapement ASL estimates which is consistent with historical trends in coho salmon escapement (Table 16; Figure 10). Male to female percentages were near 50–50 at 52% to 48% for the escapement ASL estimates in 2006 which is consistent with historical totals for escapement and commercial ASL estimates. The escapement ASL estimates do not indicate length partitioning by age class for male or female fish (Figures 11 and 12).

CONCLUSIONS

WEIR OPERATIONS

Since the extension of project operations into the coho season in 1997 the project has:

1. Demonstrated the ability to successfully install and operate a weir in Middle Fork Goodnews River during the targeted time frame.
2. Demonstrated the ability to achieve its annual objectives with the exception of ASL sample objectives in specific years.
3. Provided escapement, run timing, and passage information for Middle Fork Goodnews River salmon and Dolly Varden populations.
4. Provided a platform for the collection of ASL information from the salmon escapement and Dolly Varden migration past the weir.

ESCAPEMENT AND RUN ABUNDANCE

Salmon escapement at the weir achieved or exceeded all SEGs in 2006.

Estimated Chinook, sockeye, and chum salmon weir escapements were above the recent 10-year averages. Estimated coho salmon weir escapement was below the historical average since coho operations were fully implemented in 1997.

Aerial surveys for Chinook and sockeye salmon were successful for the North Fork Goodnews River and incomplete for the Middle Fork Goodnews River in 2006, while chum salmon aerial surveys have been discontinued. Goodnews River Chinook salmon drainage escapement was estimated based on the proportion of truncated 2006 aerial survey counts between the North and Middle Forks, while sockeye salmon drainage escapement was estimated using the 5-year average aerial survey proportions.

AGE, SEX, AND LENGTH COMPOSITION

Chinook salmon escapement, and commercial Chinook, sockeye, chum, and coho salmon commercial ASL samples did not achieve sample objectives and no ASL estimates were made for these categories in 2006.

Sockeye, chum and coho salmon escapement ASL estimates in 2006 were consistent with historical escapement and commercial ASL estimates and trends. Aged Chinook salmon escapement and commercial samples and aged sockeye and chum salmon commercial samples were also consistent with historical ASL estimates and trends.

The current procedures for collecting commercial ASL samples from the District 5 fishery are inadequate to achieve sample goals.

RECOMMENDATIONS

Annual operation of the Middle Fork Goodnews River weir should continue indefinitely. As the only ground based monitoring project in District W-5 (Goodnews Bay District), the project provides valuable inseason and postseason information about Chinook, sockeye, chum, and coho salmon that are critical for sustainable salmon management practices.

WEIR OPERATIONS AND ASL SAMPLING

After the season, the substrate rail should be left in the deeper portion of the channel to speed spring installation and startup and be removed from the shallower portion to avoid scouring over the winter. The shallow portion currently extends 80 ft from the north bank. This portion of the river goes dry in the winter and is subject to frost heaving, which displaces the rail and causes scouring during the spring flood.

Active sampling for Chinook salmon should continue in order to meet ASL sample size goals and additional live traps should be deployed when time and funding allows to accommodate additional Chinook salmon ASL sample collection.

Commercial ASL sampling should be conducted on the commercial tender in District 5 during commercial openings to aid in achieving ASL sample objectives. It is recommended that ADF&G staff work closely with the local buyer to gain access to the tender inseason in order to collect ASL samples on site within the district. As of this writing, plans are being developed to put such a sampling program in place during the 2007 season.

FISH PASSAGE AND ESCAPEMENT ESTIMATION

Additional efforts are recommended to obtain aerial survey information for coho salmon on the Middle Fork and North Fork Rivers of the Goodnews drainage to estimate total escapement.

Additional efforts are recommended to generate more accurate Dolly Varden weir counts. This is difficult to achieve as the current spacing between weir panel pickets was chosen for optimal weir operations during high water events and escapement counts of Chinook, sockeye, chum, and coho salmon which are larger in size overall compared to Dolly Varden. Major modifications to the weir would be required that will reduce its effectiveness during higher water levels. A methodology supplementing the current weir is needed to achieve more accurate assessments of Middle Fork Goodnews River Dolly Varden populations.

Implementing a target operational period and developing methods for estimating salmon passage missed during this period as described in Linderman et al. (2004) is also recommended.

HARVEST AND EXPLOITATION

Results of brood table analysis and development of BEGs for Middle Fork Chinook and sockeye salmon has indicated Goodnews River Chinook and sockeye salmon stocks can be sustained at higher levels of exploitation. Management actions that could be taken to increase harvest include more frequent openings, longer openings, and increasing net lengths from one to two shackles. Increasing harvest is difficult in district W-5 however, as fishing effort is near historical lows and low processor capacity currently limits the amount of fish that can be harvested.

HISTORICAL DATA EVALUATION

There is a need to revisit historical data regarding the Goodnews River drainage and verify data to check for correctness, consistency, and completion. An evaluation of aerial surveys was done for this report to look into comparing partial survey proportions to total survey proportions, which revealed problems with the data, and as a result revisions were made. Inconsistencies in survey dates, ratings, and completion of surveys were observed causing some survey counts to be eliminated or revised. Also, evaluation of data used to determine escapement goals for the Middle Fork Goodnews River weir revealed incorrect escapement and harvest data, resulting in minor revisions to S_{MSY} for both Chinook and sockeye salmon, but no change to BEG ranges.

Further evaluation is also needed for Middle Fork Goodnews River weir escapement estimates, as target operational dates are inconsistent between years and some years lack estimates when the weir was not operational. The lack of expansion and estimates in a given year has caused staff to underestimate the number of salmon that escape into the Middle Fork Goodnews River weir. This in turn could result in over estimates of exploitation, less accurate escapement goals, and affect management decisions.

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TABLES AND FIGURES

Table 1.–Brood table for Middle Fork Goodnews River Chinook salmon.

Year	Escapement	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Total Recruits	Yield	Recruits/ Spawner
1981	3,688	0	7	1,232	1,968	2,370	599	0	6,176	2,488	1.7
1982	1,395	0	30	489	1,306	2,554	228	0	4,609	3,214	3.3
1983	6,027	0	15	495	1,209	2,136	264	9	4,128	-1,899	0.7
1984	3,260	0	16	681	1,615	2,386	271	0	4,969	1,709	1.5
1985	2,831	0	0	242	899	971	109	0	2,221	-610	0.8
1986	2,080	0	14	1,846	984	1,712	207	0	4,762	2,682	2.3
1987	2,272	0	26	578	1,231	1,561	604	0	4,000	1,728	1.8
1988	2,712	0	0	628	964	2,614	49	1	4,256	1,544	1.6
1989	1,915	0	41	949	1,781	3,846	201	0	6,817	4,902	3.6
1990	3,636	0	17	427	1,080	1,722	10	0	3,256	-380	0.9
1991	1,952	0	65	1,643	1,100	1,167	275	0	4,250	2,298	2.2
1992	1,905	0	0	781	358	2,034	93	0	3,267	1,362	1.7
1993	2,349	0	30	2,114	4,044	2,743	65	0	8,997	6,648	3.8
1994	3,856	0	24	786	606	1,048	234	0	2,698	-1,158	0.7
1995	4,836	0	142	1,156	3,073	4,568	145	0	9,084	4,248	1.9
1996	2,931	0	23	813	1,278	1,526	138	0	3,778	847	1.3
1997	2,937	0	28	351	1,021	1,129	42	0	2,571	-366	0.9
1998	4,584	0	51	1,309	1,272	1,024	9	0	3,666	-918	0.8
1999	3,221	0	7	526	1,251	1,285	107	0	3,177	-44	1.0
2000	2,500	0	81	2,886	3,366	1,859	0	0	8,192		
2001	5,351	0	124	1,084	1,575	0	0	0	2,783		
2002	3,085	0	6	2,033	0	0	0	0	2,039		
2003	2,389	0	67	0	0	0	0	0	67		
2004	4,388	0	0	0	0	0	0	0	0		
2005	4,633	0	0	0	0	0	0	0	0		
2006	4,559	0	0	0	0	0	0	0	0		
Average											1.7

Note: Only data bordered by black line were used in spawner-recruit analysis.

Table 2.–Brood table for Middle Fork Goodnews River sockeye salmon.

Year	Escapement	Age 3	Age 4	Age 5	Age 6	Age 7	Total Recruits	Yield	Recruits/Spawner
1981	49,108	41	8,929	64,113	1,155	21	74,258	25,150	1.5
1982	56,255	31	4,111	40,635	1,423	0	46,200	-10,055	0.8
1983	25,816	0	3,114	32,033	2,213	0	37,360	11,544	1.4
1984	32,053	0	2,994	30,857	5,585	0	39,435	7,382	1.2
1985	24,131	21	2,159	34,837	3,806	209	41,032	16,901	1.7
1986	51,069	0	14,232	63,441	4,008	209	81,890	30,821	1.6
1987	28,871	539	6,084	29,112	5,351	57	41,142	12,271	1.4
1988	15,799	265	17,596	38,795	7,039	0	63,695	47,896	4.0
1989	21,186	1,817	20,045	82,777	5,620	36	110,295	89,109	5.2
1990	31,679	353	5,686	49,954	4,387	260	60,640	28,961	1.9
1991	47,397	0	7,390	68,200	8,064	65	83,718	36,321	1.8
1992	27,268	0	5,446	35,537	6,551	145	47,679	20,411	1.7
1993	26,452	82	11,125	51,444	4,729	0	67,378	40,926	2.5
1994	50,801	150	13,136	49,823	2,399	0	65,508	14,707	1.3
1995	39,009	0	9,292	51,716	4,208	78	65,295	26,286	1.7
1996	58,290	0	3,214	23,942	2,537	0	29,694	-28,596	0.5
1997	35,530	0	837	10,369	3,777	0	14,983	-20,547	0.4
1998	49,513	0	13,027	46,901	5,612	0	65,540	16,027	1.3
1999	48,205	0	4,840	40,651	6,118	0	51,609	3,404	1.1
2000	32,341	0	20,946	101,610	11,086	0	133,642	101,301	4.1
2001	21,024	0	17,555	100,664	0	0	118,219		
2002	22,101	0	29,117	0	0	0	29,117		
2003	44,387	0	0	0	0	0	0		
2004	55,926	0	0	0	0	0	0		
2005	113,809	0	0	0	0	0	0		
2006	126,772	0	0	0	0	0	0		
Average									1.9

Note: Only data bordered by black line were used in spawner-recruit analysis.

Table 3.–District W-5 commercial harvest by period and exvessel value, 2006.

Date	Permits	Chinook		Sockeye		Chum		Coho	
Caught	Fished	Harvest	Pounds	Harvest	Pounds	Harvest	Pounds	Harvest	Pounds
22-Jun	14	767	10,830	959	6,586	2,169	15,848	0	0
27-Jun	16	477	7,253	2,509	17,076	2,282	18,144	0	0
30-Jun	16	734	9,948	3,477	22,802	2,401	17,583	0	0
3-Jul	14	154	2,313	2,864	18,981	244	1,807	0	0
5-Jul	13	105	1,597	2,611	17,584	389	2,895	0	0
7-Jul	12	124	1,885	2,773	18,384	487	3,493	0	0
10-Jul	15	125	1,959	2,915	19,026	403	2,899	0	0
17-Jul	12	34	554	1,596	10,332	266	1,809	3	18
19-Jul	16	99	1,828	2,750	17,236	828	5,896	5	36
21-Jul	18	86	1,493	2,494	15,754	894	5,983	7	51
24-Jul	14	49	766	1,402	9,091	457	3,130	21	131
26-Jul	10	24	421	605	3,956	253	1,766	13	86
31-Jul	8	17	328	263	1,538	81	529	119	826
2-Aug	6	13	203	182	1,165	53	363	131	857
4-Aug	8	10	134	373	2,247	95	585	197	1,270
7-Aug	8	10	157	289	1,785	60	386	480	3,321
9-Aug	11	5	99	193	1,206	51	325	582	4,192
11-Aug	8	8	87	225	1,408	40	264	1,321	9,716
14-Aug	10	6	107	124	755	28	198	1,508	11,189
16-Aug	9	8	144	171	1,165	28	194	1,280	9,462
18-Aug	5	3	33	93	700	13	91	858	6,408
21-Aug	5	6	90	145	949	5	27	817	6,188
23-Aug	6	11	121	217	1,456	10	76	1,526	11,672
25-Aug	4	4	90	197	1,328	6	39	985	7,438
28-Aug	9	7	116	202	1,401	11	68	1,001	7,525
30-Aug	4	3	36	136	935	7	50	917	6,826
1-Sep	6	3	35	92	633	7	44	665	5,050
Total	24	2,892	42,627	29,857	195,479	11,568	84,492	12,436	92,262
Avg. Wt.		14.7		6.5		7.3		7.4	
Avg. Price		$0.50		$0.45		$0.05		$0.30	
Exvessel Value		$21,314		$87,966		$4,368		$27,587	
								Total Fish	56,753
								Total Pounds	414,860
								Total Exvessel Value	$141,235

Table 4.–Daily and cumulative Chinook, sockeye, chum, and coho salmon passage, Middle Fork Goodnews River weir, 2006.

	Chinook		Sockeye		Chum		Coho	
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
6/26	1	1	270	270	32	32	0	0
6/27	14	15	924	1,194	86	118	0	0
6/28	12	27	1,376	2,570	141	259	0	0
6/29	49	76	1,798	4,368	140	399	0	0
6/30	85	161	3,662	8,030	324	723	0	0
7/01	74	235	3,904	11,934	695	1,418	0	0
7/02	140	375	4,930	16,864	1,099	2,517	0	0
7/03	79	454	5,949	22,813	901	3,418	0	0
7/04	192	646	10,881	33,694	1,754	5,172	0	0
7/05	117	763	4,688	38,382	1,004	6,176	0	0
7/06	104	867	2,716	41,098	1,259	7,435	0	0
7/07	175	1,042	4,653	45,751	2,411	9,846	0	0
7/08	83	1,125	4,713	50,464	543	10,389	0	0
7/09	35	1,160	4,502	54,966	403	10,792	0	0
7/10	121	1,281	8,564	63,530	2,139	12,931	0	0
7/11	72	1,353	5,059	68,589	1,369	14,300	0	0
7/12	154	1,507	6,759	75,348	4,211	18,511	0	0
7/13	127	1,634	4,039	79,387	1,945	20,456	0	0
7/14	61	1,695	4,536	83,923	485	20,941	0	0
7/15	75	1,770	4,922	88,845	866	21,807	0	0
7/16	105	1,875	6,079	94,924	1,165	22,972	0	0
7/17	152	2,027	3,750	98,674	1,584	24,556	0	0
7/18	410	2,437	4,484	103,158	1,858	26,414	0	0
7/19	380	2,817	2,936	106,094	3,228	29,642	0	0
7/20	213	3,030	2,377	108,471	1,588	31,230	0	0
7/21	232	3,262	2,371	110,842	2,232	33,462	0	0
7/22	113	3,375	2,977	113,819	1,711	35,173	0	0
7/23	74	3,449	2,212	116,031	3,065	38,238	0	0
7/24	247	3,696	1,840	117,871	1,812	40,050	0	0
7/25	51	3,747	519	118,390	557	40,607	0	0
7/26	63	3,810	956	119,346	1,316	41,923	0	0
7/27	73	3,883	726	120,072	660	42,583	0	0
7/28	52	3,935	475	120,547	833	43,416	0	0
7/29	91	4,026	580	121,127	812	44,228	5	5
7/30	22	4,048	460	121,587	819	45,047	3	8
7/31	133	4,181	535	122,122	577	45,624	4	12
8/01	67	4,248	501	122,623	797	46,421	13	25
8/02	42	4,290	518	123,141	1,083	47,504	13	38
8/03	55	4,345	547	123,688	1,148	48,652	16	54

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Table 4.–Page 2 of 3.

	Chinook		Sockeye		Chum		Coho	
Date	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**
8/04	34	4,379	319	124,007	705	49,357	6	60
8/05	9	4,388	192	124,199	535	49,892	8	68
8/06	6	4,394	199	124,398	497	50,389	3	71
8/07	21	4,415	198	124,596	451	50,840	11	82
8/08	12	4,427	228	124,824	320	51,160	5	87
8/09	8	4,435	125	124,949	203	51,363	3	90
8/10	7	4,442	214	125,163	605	51,968	7	97
8/11	28	4,470	354	125,517	949	52,917	118	215
8/12	14	4,484	232	125,749	345	53,262	128	343
8/13	14	4,498	118	125,867	342	53,604	127	470
8/14	19	4,517	102	125,969	252	53,856	109	579
8/15	9 [a]	4,526	123 [a]	126,092	320 [a]	54,176	156 [a]	735
8/16	6	4,532	38	126,130	85	54,261	185	920
8/17	2	4,534	49	126,179	117	54,378	157	1,077
8/18	3	4,537	69	126,248	46	54,424	126	1,203
8/19	0	4,537	82	126,330	33	54,457	124	1,327
8/20	3	4,540	35	126,365	34	54,491	120	1,447
8/21	1	4,541	25	126,390	17	54,508	82	1,529
8/22	1	4,542	40	126,430	50	54,558	183	1,712
8/23	4	4,546	27	126,457	7	54,565	124	1,836
8/24	1	4,547	43	126,500	31	54,596	228	2,064
8/25	2	4,549	27	126,527	33	54,629	266	2,330
8/26	0	4,549	24	126,551	5	54,634	208	2,538
8/27	2	4,551	44	126,595	14	54,648	869	3,407
8/28	1	4,552	53	126,648	8	54,656	436	3,843
8/29	1	4,553	18	126,666	8	54,664	478	4,321
8/30	1	4,554	16	126,682	12	54,676	1,705	6,026
8/31	1	4,555	9	126,691	4	54,680	1,017	7,043
9/01	0	4,555	7	126,698	1	54,681	309	7,352
9/02	2	4,557	18	126,716	2	54,683	709	8,061
9/03	0	4,557	9	126,725	1	54,684	402	8,463
9/04	0	4,557	14	126,739	4	54,688	597	9,060
9/05	2	4,559	19	126,758	2	54,690	976	10,036
9/06	0	4,559	8	126,766	4	54,694	1,019	11,055
9/07	0	4,559	6	126,772	5	54,699	2,079	13,134
9/08	0 [b]	4,559	0 [b]	126,772	0 [b]	54,699	357 [b]	13,492
9/09	0 [b]	4,559	0 [b]	126,772	0 [b]	54,699	31 [b]	13,522
9/10	0 [b]	4,559	0 [b]	126,772	0 [b]	54,699	68 [b]	13,590
9/11	0 [b]	4,559	0 [b]	126,772	0 [b]	54,699	110 [b]	13,701
9/12	0 [b]	4,559	0 [b]	126,772	0 [b]	54,699	1,484 [b]	15,185

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	Chinook		Sockeye		Chum		Coho	
Date	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**
9/13	0 [b]	4,559	0 [b]	126,772	0 [b]	54,699	404 [b]	15,589
9/14	0 [b]	4,559	0 [b]	126,772	0 [b]	54,699	160 [b]	15,748
9/15	0 [b]	4,559	0 [b]	126,772	0 [b]	54,699	105 [b]	15,854
9/16	0 [b]	4,559	0 [b]	126,772	0 [b]	54,699	72 [b]	15,926
9/17	0 [b]	4,559	0 [b]	126,772	0 [b]	54,699	27 [b]	15,953
9/18	0 [b]	4,559	0 [b]	126,772	0 [b]	54,699	16 [b]	15,969
Total	4,559		126,772		54,699		15,969	
Observed	4,554		126,734		54,599		13,062	
Estimated	5		38		100		2,907	
% Observed	99.89		99.97		99.82		81.80	

[a] Daily passage was estimated because of a breach in the weir.

[b] The weir was not operational; daily passage was estimated.

Table 5.–Escapement summary for the Goodnews River, 2006.

Middle Fork Goodnews River escapement estimate

	Chinook	Sockeye	Chum	Coho
2006 weir count	4,559	126,772	54,699	15,969
Weir (SEG)	2,000–4,500	23,000–58,000	>12,000	>12,000
10-year average (1996–2005)	3,602	48,113	25,702	26,540
2006 aerial survey count	[a]	[a]	[b]	[b]

North Fork Goodnews River escapement estimate

	Chinook	Sockeye	Chum	Coho
2006 escapement estimate [c]	0	151,288	[b]	[b]
10-year average (1996–2005)	5,575	44,936	[b]	[b]
2006 aerial survey count	4,159	78,100	[b]	[b]
Aerial Survey (SEG)	640–3,300	5,500–19,500	[c]	[c]

Goodnews River (total drainage) escapement estimate

	Chinook	Sockeye	Chum	Coho
2006	4,559	278,060	[b]	[b]
10-year average (1996–2005)	12,279	119,642	[c]	[c]

Total Run and Exploitation

	Chinook	Sockeye	Chum	Coho
District W-5 Commercial Harvest	2,892	29,857	7,450	15,531
Subsistence Harvest [d]	747	861	259	687
Sport Fishing Harvest [d]	162	159	27	708
Total Run Estimate	8,360	308,938	[b]	[b]
Harvest Exploitation (%)	45.5	10.0	[b]	[b]

[a] Survey was incomplete.

[b] No estimate was made.

[c] Escapement goal discontinued in 2004.

[d] Official estimates not available at time of publication, numbers shown are the recent 10 year averages (1996–2005) of Goodnews Bay area subsistence and Goodnews River sport fishing harvest.

Table 6.–Chinook, sockeye, chum, and coho salmon and Dolly Varden cumulative percent passage, Middle Fork Goodnews River weir, 2006 and historical median.

	Chinook Salmon		Sockeye Salmon		Chum Salmon		Coho Salmon		Dolly Varden	
Date	2006	Median[a]	2006	Median[b]	2006	Median[c]	2006	Median[d]	2006	Median[e]
6/26	0	4	0	9	0	1	0	0	0	0
6/27	0	7	1	11	0	2	0	0	0	0
6/28	1	8	2	13	0	2	0	0	0	0
6/29	2	10	3	17	1	3	0	0	1	0
6/30	4	14	6	20	1	4	0	0	3	1
7/01	5	17	9	24	3	6	0	0	7	1
7/02	8	21	13	28	5	6	0	0	10	3
7/03	10	24	18	28	6	8	0	0	11	5
7/04	14	28	27	33	9	11	0	0	13	0
7/05	17	35	30	39	11	13	0	0	14	0
7/06	19	37	32	44	14	14	0	0	15	1
7/07	23	38	36	49	18	17	0	0	17	1
7/08	25	41	40	55	19	19	0	0	19	1
7/09	25	47	43	56	20	22	0	0	20	3
7/10	28	49	50	62	24	26	0	0	22	4
7/11	30	56	54	67	26	28	0	0	22	5
7/12	33	60	59	71	34	32	0	0	22	9
7/13	36	64	63	74	37	36	0	0	23	13
7/14	37	68	66	78	38	39	0	0	23	18
7/15	39	70	70	80	40	42	0	0	24	23
7/16	41	73	75	82	42	46	0	0	25	27
7/17	44	75	78	84	45	52	0	0	28	34
7/18	53	77	81	87	48	55	0	0	31	43
7/19	62	81	84	89	54	60	0	0	34	51
7/20	66	82	86	90	57	63	0	0	39	57
7/21	72	84	87	92	61	65	0	0	42	67
7/22	74	85	90	93	64	69	0	0	43	74
7/23	76	85	92	94	70	73	0	0	45	80
7/24	81	88	93	94	73	74	0	0	47	83
7/25	82	90	93	95	74	77	0	0	48	88
7/26	84	91	94	96	77	81	0	0	51	89
7/27	85	91	95	96	78	82	0	0	57	89
7/28	86	93	95	98	79	83	0	0	70	90
7/29	88	94	96	98	81	86	0	0	78	90
7/30	89	95	96	98	82	88	0	0	80	91
7/31	92	95	96	98	83	90	0	0	82	92
8/01	93	96	97	99	85	92	0	0	84	92
8/02	94	96	97	99	87	93	0	0	88	93
8/03	95	97	98	99	89	94	0	0	89	94
8/04	96	98	98	99	90	95	0	0	90	94
8/05	96	98	98	99	91	95	0	0	91	94
8/06	96	98	98	99	92	96	0	0	92	95
8/07	97	98	98	99	93	97	1	0	93	95
8/08	97	98	98	99	93	97	1	1	93	95
8/09	97	98	99	99	94	98	1	1	94	96
8/10	97	98	99	99	95	98	1	1	94	96

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	Chinook Salmon		Sockeye Salmon		Chum Salmon		Coho Salmon		Dolly Varden	
Date	2006	Median[a]	2006	Median[b]	2006	Median[c]	2006	Median[d]	2006	Median[e]
8/11	98	98	99	99	97	98	1	1	94	96
8/12	98	99	99	99	97	98	2	2	95	96
8/13	99	99	99	99	98	99	3	2	96	96
8/14	99	99	99	99	98	99	4	2	96	96
8/15	99	99	99	100	99	99	4	3	96	96
8/16	99	99	99	100	99	99	5	4	96	96
8/17	99	100	100	100	99	99	6	5	96	96
8/18	100	100	100	100	100	99	7	6	96	97
8/19	100	100	100	100	100	99	7	7	96	97
8/20	100	100	100	100	100	100	8	8	96	97
8/21	100	100	100	100	100	100	9	11	96	98
8/22	100	100	100	100	100	100	10	12	97	98
8/23	100	100	100	100	100	100	11	14	97	98
8/24	100	100	100	100	100	100	12	16	97	98
8/25	100	100	100	100	100	100	14	18	97	98
8/26	100	100	100	100	100	100	15	24	97	99
8/27	100	100	100	100	100	100	20	27	97	99
8/28	100	100	100	100	100	100	23	34	98	99
8/29	100	100	100	100	100	100	26	34	98	99
8/30	100	100	100	100	100	100	37	44	98	99
8/31	100	100	100	100	100	100	43	51	98	99
9/01	100	100	100	100	100	100	45	57	99	99
9/02	100	100	100	100	100	100	50	58	99	99
9/03	100	100	100	100	100	100	52	60	100	99
9/04	100	100	100	100	100	100	56	67	100	99
9/05	100	100	100	100	100	100	62	73	100	99
9/06	100	100	100	100	100	100	69	75	100	99
9/07	100	100	100	100	100	100	82	82	100	99
9/08	100	100	100	100	100	100	84	83	100	100
9/09	100	100	100	100	100	100	84	84	100	100
9/10	100	100	100	100	100	100	85	85	100	100
9/11	100	100	100	100	100	100	86	86	100	100
9/12	100	100	100	100	100	100	95	91	100	100
9/13	100	100	100	100	100	100	98	94	100	100
9/14	100	100	100	100	100	100	99	95	100	100
9/15	100	100	100	100	100	100	99	96	100	100
9/16	100	100	100	100	100	100	100	97	100	100
9/17	100	100	100	100	100	100	100	98	100	100
9/18	100	100	100	100	100	100	100	99	100	100
9/19	100	100	100	100	100	100	100	99	100	100
9/20	100	100	100	100	100	100	100	100	100	100

Note: boxes represent the central 50% of the run and median date of passage. Shaded areas represent the central 80% of the run.

[a] Historical median for years: 1981, 1990 through 1997, 1999, and 2001 through 2005.

[b] Historical median for years: 1981, 1984, 1992 through 1997, 1999, and 2002 through 2005.

[c] Historical median for years: 1981, 1991 through 1997, 1999, and 2001 through 2005.

[d] Historical median for years: 1997 through 2005.

[e] Historical median for years: 1997 through 2005.

Table 7.–Daily and cumulative pink salmon and Dolly Varden passage, Middle Fork Goodnews River weir, 2006.

	Pink Salmon		Dolly Varden	
Date	**Daily**	**Cum.**	**Daily**	**Cum.**
6/26	1	1	0	0
6/27	1	2	1	1
6/28	3	5	1	2
6/29	10	15	13	15
6/30	21	36	39	54
7/01	16	52	67	121
7/02	36	88	70	191
7/03	104	192	21	212
7/04	173	365	32	244
7/05	77	442	22	266
7/06	180	622	11	277
7/07	169	791	38	315
7/08	119	910	45	360
7/09	65	975	10	370
7/10	156	1,131	30	400
7/11	94	1,225	8	408
7/12	179	1,404	5	413
7/13	200	1,604	9	422
7/14	59	1,663	9	431
7/15	75	1,738	22	453
7/16	95	1,833	17	470
7/17	84	1,917	42	512
7/18	119	2,036	64	576
7/19	85	2,121	58	634
7/20	69	2,190	81	715
7/21	144	2,334	55	770
7/22	50	2,384	16	786
7/23	140	2,524	46	832
7/24	95	2,619	33	865
7/25	28	2,647	22	887
7/26	149	2,796	52	939
7/27	95	2,891	111	1,050
7/28	96	2,987	242	1,292
7/29	138	3,125	150	1,442
7/30	65	3,190	45	1,487
7/31	122	3,312	29	1,516
8/01	96	3,408	43	1,559
8/02	100	3,508	63	1,622
8/03	91	3,599	27	1,649
8/04	68	3,667	16	1,665
8/05	57	3,724	18	1,683
8/06	172	3,896	13	1,696
8/07	380	4,276	26	1,722
8/08	522	4,798	5	1,727
8/09	240	5,038	6	1,733

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	Pink Salmon		Dolly Varden	
Date	**Daily**	**Cum.**	**Daily**	**Cum.**
8/10	549	5,587	3	1,736
8/11	1,954	7,541	13	1,749
8/12	1,515	9,056	15	1,764
8/13	1,018	10,074	15	1,779
8/14	595	10,669	5	1,784
8/15	448 [a]	11,117	0 [a]	1,784
8/16	461	11,578	0	1,784
8/17	1,052	12,630	5	1,789
8/18	1,008	13,638	0	1,789
8/19	451	14,089	0	1,789
8/20	486	14,575	3	1,792
8/21	349	14,924	0	1,792
8/22	665	15,589	2	1,794
8/23	279	15,868	0	1,794
8/24	448	16,316	1	1,795
8/25	382	16,698	5	1,800
8/26	175	16,873	2	1,802
8/27	277	17,150	4	1,806
8/28	111	17,261	6	1,812
8/29	184	17,445	4	1,816
8/30	209	17,654	4	1,820
8/31	100	17,754	6	1,826
9/01	93	17,847	7	1,833
9/02	161	18,008	10	1,843
9/03	74	18,082	7	1,850
9/04	95	18,177	2	1,852
9/05	92	18,269	2	1,854
9/06	73	18,342	3	1,857
9/07	90	18,432	1	1,858
9/08	[b]	18,432	[b]	1,858
9/09	[b]	18,432	[b]	1,858
9/10	[b]	18,432	[b]	1,858
9/11	[b]	18,432	[b]	1,858
9/12	[b]	18,432	[b]	1,858
9/13	[b]	18,432	[b]	1,858
9/14	[b]	18,432	[b]	1,858
9/15	[b]	18,432	[b]	1,858
9/16	[b]	18,432	[b]	1,858
9/17	[b]	18,432	[b]	1,858
9/18	[b]	18,432	[b]	1,858
Total	18,432		1,858	

[a] Partial day counts because of a breach in weir, no estimates were made.

[b] The weir was not operational; daily passage was not estimated.

Table 8.–Daily fish carcass count, Middle Fork Goodnews River weir, 2006.

Date	Chinook	Sockeye	Chum	Pink	Coho	Other [a]
6/26	0	0	1	0	0	0
6/27	0	0	1	0	0	0
6/28	0	0	0	0	0	0
6/29	0	0	1	0	0	0
6/30	0	0	0	0	0	0
7/01	0	1	2	0	0	0
7/02	0	0	3	0	0	0
7/03	0	0	3	0	0	0
7/04	0	3	9	0	0	0
7/05	0	4	11	1	0	0
7/06	0	4	12	0	0	0
7/07	0	14	15	2	0	0
7/08	2	14	14	2	0	1DV
7/09	0	15	17	1	0	0
7/10	0	23	31	2	0	0
7/11	0	19	25	2	0	0
7/12	1	10	54	1	0	0
7/13	1	4	22	2	0	0
7/14	2	7	38	1	0	1DV
7/15	1	9	53	1	0	1DV
7/16	2	17	57	2	0	0
7/17	0	3	42	0	0	0
7/18	4	7	36	3	0	1DV
7/19	0	0	87	0	0	0
7/20	0	0	0	0	0	0
7/21	1	37	85	8	0	2DV
7/22	2	13	72	5	0	3DV
7/23	0	0	0	0	0	0
7/24	3	7	90	4	0	1DV
7/25	0	8	194	3	0	0
7/26	0	0	0	0	0	0
7/27	0	0	0	0	0	0
7/28	5	12	148	8	0	0
7/29	0	3	135	7	0	0
7/30	1	2	179	11	0	0
7/31	0	2	142	12	0	0
8/01	1	6	236	15	0	0
8/02	0	4	201	10	0	0
8/03	0	0	0	0	0	0
8/04	3	4	186	14	0	0
8/05	6	4	220	13	0	0
8/06	6	8	399	36	0	0

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Date	Chinook	Sockeye	Chum	Pink	Coho	Other [a]
8/07	5	2	272	38	0	1DV
8/08	6	4	184	14	0	0
8/09	9	3	160	21	0	0
8/10	7	1	412	34	0	0
8/11	13	5	466	38	0	0
8/12	10	6	211	27	0	0
8/13	15	6	264	25	0	0
8/14	13	34	336	27	0	0
8/15	17	12	101	13	0	0
8/16	18	12	245	26	0	0
8/17	22	18	246	21	1	0
8/18	18	26	175	34	1	0
8/19	14	17	123	27	3	0
8/20	13	21	95	39	1	0
8/21	12	19	59	32	1	0
8/22	8	15	44	7	0	0
8/23	6	34	77	47	0	0
8/24	7	23	54	75	1	0
8/25	6	21	32	55	0	0
8/26	9	32	38	78	3	1RBT
8/27	2	22	22	112	1	1WF
8/28	1	21	14	109	1	0
8/29	3	18	13	158	0	0
8/30	0	15	9	139	0	1DV
8/31	2	28	22	226	2	0
9/01	0	26	4	245	0	0
9/02	2	14	4	269	2	1RBT
9/03	0	14	6	262	1	0
9/04	0	3	4	247	0	0
9/05	0	7	6	233	2	0
9/06	0	10	6	206	2	0
9/07	0	8	4	95	2	0
Total	279	761	6,529	3,145	24	12DV, 2RBT, 1WF

[a] DV - Dolly Varden, RBT - Rainbow trout, WF - White fish spp.

Table 9.–Select Chinook salmon aerial survey counts by index area, Goodnews River drainage, 1983–2006.

		Index Area					Proportion	
Year	Drainage	101	102	103	104	105	Truncated [a]	Total [b]
1983	North Fork	1,450	250	900	0	[c]	0.93	1.04
	Middle Fork	1,820	290	20	250	120		
1984	North Fork	1,185	1,690	370	0	[c]	2.13	1.68
	Middle Fork	1,348	0	100	462	20		
1984	North Fork	366	1,058	638	0	[c]	1.87	1.68
	Middle Fork	760	0	145	287	38		
1985	North Fork	810	2,358	367	0	[c]	2.16	1.72
	Middle Fork	1,465	0	585	0	0		
1985	North Fork	296	1,624	353	0	[c]	1.43	1.27
	Middle Fork	1,344	0	0	433	7		
1986	North Fork	155	613	300	0	[c]	1.17	0.86
	Middle Fork	655	0	0	594	0		
1986	North Fork	1,060	1,008	176	0	[c]	1.30	1.01
	Middle Fork	1,592	0	135	495	0		
1989	North Fork	215	368	68	0	[c]	0.61	0.51
	Middle Fork	954	0	32	291	0		
1997	North Fork	[d]	3,340	271	0	[c]	2.61	2.50
	Middle Fork	1,278	0	4	163	2		
1997	North Fork	[d]	3,039	197	0	[c]	2.75	2.58
	Middle Fork	1,105	0	0	148	0		
1998	North Fork	168	367	43	0	[c]	0.83	0.79
	Middle Fork	642	0	9	80	0		
2001	North Fork	1,864	1,204	493	0	[c]	1.22	1.27
	Middle Fork	2,506	30	30	233	0		
2002	North Fork	330	1,140	0	0	[c]	1.29	1.23
	Middle Fork	1,137	0	18	40	0		
2003	North Fork	1,812	1,803	320	0	[c]	2.07	1.85
	Middle Fork	1,747	0	6	378	0		
2004	North Fork	3,402	3,329	731	0	[c]	3.09	2.85
	Middle Fork	2,177	0	0	440	0		
2006	North Fork	1,460	1,980	717	0	[c]	2.57	---
	Middle Fork	1,340	[e]	[e]	[e]	[e]		

[a] Proportion = North Fork (101+102)/Middle Fork (101).

[b] Proportion = North Fork (Total)/Middle Fork (Total).

[c] No index area 105 in North Fork drainage.

[d] Combined with index area 102 total.

[e] Survey area was not flown.

Table 10.–Age and sex composition of Chinook salmon escapement, Middle Fork Goodnews River weir, 2006.

Sample Dates (stratum)	Pulse Sample Size	Aged Sample Size	Sex	Age Class 1.1 Esc.	1.1 %	1.2 Esc.	1.2 %	1.3 Esc.	1.3 %	1.4 Esc.	1.4 %	1.5 Esc.	1.5 %	Total Esc.	Total %
7/7	17	15	M		0.0		26.6		0.0		6.7		0.0		33.3
(6/26–7/11)			F		0.0		6.7		20.0		33.3		6.7		66.7
			Subtotal		0.0		33.3		20.0		40.0		6.7	1,353	100.0
7/15	40	28	M		3.6		42.9		14.3		3.5		0.0		64.3
(7/12–22)			F		0.0		0.0		7.1		28.6		0.0		35.7
			Subtotal		3.6		42.9		21.4		32.1		0.0	2,022	100.0
7/29	16	14	M		0.0		7.2		21.5		21.5		0.0		50.0
(7/23–9/18)			F		0.0		7.1		21.4		21.4		0.0		50.0
			Subtotal		0.0		14.3		42.9		42.9		0.0	1,184	100.0
Season [a]	73	57	M												51.4
			F												48.6
			Total		1.8		33.3		26.3		36.8		1.8	4,559	100.0
Grand		1,083	M	123	0.8	4,137	26.3	3,377	21.4	2,398	15.2	74	0.5	10,117	64.2
Total [b]			F	0	0.0	56	0.4	1,129	7.2	4,238	26.9	231	1.5	5,642	35.8
			Total	123	0.0	4,193	26.6	4,505	28.6	6,636	42.1	305	1.9	15,760	100.0

Note: The numbers of fish in each stratum age and sex category are derived from the sample percentages; discrepancies are attributed to rounding errors.

[a] Samples did not achieve minimum sample objectives and were not applied to sample totals.

[b] The number of fish in "Grand total" are the sum of historical "Season" totals; percentages are derived from those sums. Years included are 1991, 1995, 1997, 2000, 2002 and 2003.

Table 11.–Mean length (mm) of Chinook salmon escapement, Middle Fork Goodnews River weir, 2006.

Sample Dates (Stratum Dates)	Sex		Age Class 1.1	1.2	1.3	1.4	1.5
7/7 (6/26–7/11)	M	Mean Length		516		880	
		SE		53		-	
		Range		360–590		880–880	
		Sample Size	0	4	0	1	0
	F	Mean Length		620	730	799	900
		SE		-	40	27	-
		Range		620–620	660–800	720–865	900–900
		Sample Size	0	1	3	5	1
7/15 (7/12–22)	M	Mean Length	375	567	668	870	
		SE	-	13	25	-	
		Range	375–375	480–635	620–720	870–870	
		Sample Size	1	12	4	1	0
	F	Mean Length			749	861	
		SE			29	25	
		Range			720–777	740–930	
		Sample Size	0	0	2	8	0
7/29 (7/23–9/18)	M	Mean Length		590	698	848	
		SE		-	51	73	
		Range		590–590	640–800	705–940	
		Sample Size	0	1	3	3	0
	F	Mean Length		605	753	918	
		SE		-	45	37	
		Range		605–605	690–840	845–955	
		Sample Size	0	1	3	3	0
Season	M	Mean Length	375	555	682	859	
		Range	375–375	360–635	620–800	705–940	
		Sample Size	1	17	7	5	0
	F	Mean Length		613	743	851	900
		Range		605–620	660–840	720–955	900–900
		Sample Size	0	2	8	16	1
Grand Total [a]	M	Mean Length	386	546	714	852	886
		Range	240–550	445–850	550–910	680–1,035	700–990
		Sample Size	12	233	260	157	6
	F	Mean Length		610	788	858	898
		Range		540–670	560–880	470–1,005	705–990
		Sample Size	0	3	90	302	18

[a] "Grand Total" mean lengths are simple averages of historical "Season" mean lengths. Years included are 1991, 1995, 1997, 2000, and 2002–2003.

Table 12.–Age and sex composition of sockeye salmon escapement, Middle Fork Goodnews River weir, 2006.

Sample Dates (Stratum)	Pulse Sample Size	Aged Sample Size	Sex	Age Class 0.3 Esc.	0.3 %	1.2 Esc.	1.2 %	1.3 Esc.	1.3 %	2.2 Esc.	2.2 %	1.4 Esc.	1.4 %	2.3 Esc.	2.3 %	Total Esc.	Total %
7/6–7	200	197	M	323	0.5	1,290	2.0	21,929	34.5	323	0.5	1,613	2.6	1,290	2.1	26,766	42.1
(6/26–7/10)			F	967	1.5	8,707	13.7	24,187	38.1	322	0.5	1,612	2.5	967	1.5	36,764	57.9
			Subtotal	1,290	2.0	9,997	15.7	46,116	72.6	645	1.0	3,225	5.1	2,257	3.6	63,530	100.0
7/13–15	240	156	M	254	0.6	2,540	6.4	15,496	39.1	0	0.0	254	0.7	508	1.3	19,052	48.1
(7/11–18)			F	508	1.3	5,081	12.8	12,955	32.7	0	0.0	762	1.9	1,270	3.2	20,576	51.9
			Subtotal	762	1.9	7,621	19.2	28,451	71.8	0	0.0	1,016	2.6	1,778	4.5	39,628	100.0
7/21–22	156	115	M	265	1.7	1,324	8.7	3,709	24.3	0	0.0	0	0.0	0	0.0	5,298	34.8
(7/19–25)			F	397	2.6	3,179	20.9	5,430	35.7	265	1.7	0	0.0	662	4.3	9,934	65.2
			Subtotal	662	4.3	4,503	29.6	9,139	60.0	265	1.7	0	0.0	662	4.3	15,232	100.0
7/28–29	155	108	M	233	2.8	388	4.6	2,173	25.9	0	0.0	78	1.0	388	4.6	3,260	38.9
(7/28–9/18)			F	155	1.8	1,164	13.9	3,415	40.8	0	0.0	77	0.9	310	3.7	5,122	61.1
			Subtotal	388	4.6	1,552	18.5	5,588	66.7	0	0.0	155	1.9	698	8.3	8,382	100.0
Season	751	576	M	1,074	0.8	5,543	4.4	43,307	34.1	323	0.2	1,944	1.5	2,186	1.7	54,376	42.9
			F	2,028	1.6	18,130	14.3	45,987	36.3	587	0.5	2,452	2.0	3,210	2.6	72,396	57.1
			Total	3,102	2.4	23,673	18.7	89,294	70.4	910	0.7	4,396	3.5	5,396	4.3	126,772	100.0
Grand Total [a]		7,189	M	7,424	1.2	33,208	5.5	214,935	35.8	5,049	0.8	9,229	1.5	13,341	2.2	283,915	47.3
			F	4,881	0.8	65,102	10.8	219,559	36.6	6,596	1.1	7,438	1.2	12,038	2.0	316,314	52.7
			Total	12,305	2.0	98,310	16.4	434,494	72.4	11,645	1.9	16,667	2.8	25,379	4.2	600,226	100.0

Note: The numbers of fish in each stratum category are derived from sample percentages; sum discrepancies are attributed to rounding errors. The numbers of fish in "Season" are the strata sums; "Season" percentages are derived from the sums.

[a] The number of fish in the "Grand total" are the sum of historical "Season" totals; percentages are derived from those sums. Years included are 1987, 1990, 1995, 1997, and 1999 through 2006.

Table 13.–Mean length (mm) of sockeye salmon escapement, Middle Fork Goodnews River weir, 2006.

Sample Dates (Stratum Dates)	Sex		Age Class 0.3	1.2	1.3	2.2	1.4	2.3
7/6–7	M	Mean Length	515	508	566	550	585	554
(6/26–7/10)		SE	-	15	3	-	7	22
		Range	515–515	470–535	475–615	550–550	560–600	490–595
		Sample Size	1	4	68	1	5	4
	F	Mean Length	512	487	523	505	541	528
		SE	9	5	2	-	11	12
		Range	495–525	440–545	470–580	505–505	510–570	510–550
		Sample Size	3	27	75	1	5	3
7/13–15	M	Mean Length	565	502	566		605	558
(7/11–18)		SE	-	9	3		-	23
		Range	565–565	460–560	500–615		605–605	535–580
		Sample Size	1	10	61	0	1	2
	F	Mean Length	533	468	527		540	535
		SE	23	4	3		20	7
		Range	510–555	430–500	445–565		520–580	520–555
		Sample Size	2	20	51	0	3	5
7/21–22	M	Mean Length	565	501	568			
(7/19–25)		SE	-	9	4			
		Range	565–565	440–530	520–610			
		Sample Size	2	10	28	0	0	0
	F	Mean Length	527	477	530	529		518
		SE	7	5	4	24		11
		Range	515–540	415–540	420–565	505–552		490–540
		Sample Size	3	24	41	2	0	5
7/28–29	M	Mean Length	558	503	560		590	572
(7/28–9/18)		SE	32	6	7		-	11
		Range	495–595	485–520	430–605		590–590	540–605
		Sample Size	3	5	28	0	1	5
	F	Mean Length	568	483	533		555	514
		SE	23	9	4		-	10
		Range	545–590	440–555	450–585		555–555	485–525
		Sample Size	2	15	44	0	1	4
Season	M	Mean Length	549	503	566	550	588	558
		Range	495–595	440–560	430–615	550–550	560–605	490–605
		Sample Size	7	29	185	1	7	11
	F	Mean Length	524	480	526	516	541	527
		Range	495–590	415–555	420–585	505–552	510–580	485–555
		Sample Size	10	86	211	3	9	17
Grand Total [a]	M	Mean Length	580	528	579	537	602	576
		Range	568–568	525–610	425–630	560–645	470–700	499–602
		Sample Size	42	442	2,506	70	114	159
	F	Mean Length	544	493	544	492	553	534
		Range	470–470	429–597	415–595	575–595	438–635	450–545
		Sample Size	42	921	2,523	121	93	126

[a] "Grand Total" mean lengths are simple averages of historical "Season" mean lengths. Years included are 1987, 1990, 1995, 1997, and 1999 through 2006.

Table 14.–Age and sex composition of chum salmon escapement, Middle Fork Goodnews River weir, 2006.

Sample Dates (Stratum)	Pulse Sample Size	Aged Sample Size	Sex	Age Class 0.2 Esc.	0.2 %	0.3 Esc.	0.3 %	0.4 Esc.	0.4 %	0.5 Esc.	0.5 %	Total Esc.	Total %
7/6–7	200	186	M	0	0.0	3,546	27.4	2,224	17.2	0	0.0	5,770	44.6
(6/26–7/10)			F	0	0.0	4,727	36.6	2,364	18.3	70	0.5	7,161	55.4
			Subtotal	0	0.0	8,273	64.0	4,588	35.5	70	0.5	12,931	100.0
7/13–15	194	179	M	76	0.6	4,444	33.0	2,787	20.7	0	0.0	7,306	54.2
(7/11–18)			F	75	0.5	3,239	24.0	2,862	21.2	0	0.0	6,177	45.8
			Subtotal	151	1.1	7,683	57.0	5,649	41.9	0	0.0	13,483	100.0
7/21–22	188	174	M	163	1.1	4,649	32.8	1,794	12.7	0	0.0	6,607	46.6
(7/19–25)			F	82	0.6	6,281	44.2	1,224	8.6	0	0.0	7,586	53.4
			Subtotal	245	1.7	10,930	77.0	3,018	21.3	0	0.0	14,193	100.0
7/28–29	200	178	M	0	0.0	2,712	33.7	542	6.7	0	0.0	3,254	40.4
(7/26–8/3)			F	136	1.7	3,706	46.1	949	11.8	0	0.0	4,791	59.6
			Subtotal	136	1.7	6,418	79.8	1,491	18.5	0	0.0	8,045	100.0
8/7	65	59	M	0	0.0	2,050	33.9	205	3.4	0	0.0	2,255	37.3
(8/4–9/18)			F	205	3.4	2,767	45.8	717	11.9	102	1.7	3,792	62.7
			Subtotal	205	3.4	4,817	79.7	922	15.3	102	1.7	6,047	100.0
Season	847	776	M	238	0.4	17,401	31.8	7,554	13.8	0	0.0	25,193	46.1
			F	498	0.9	20,720	37.9	8,116	14.8	172	0.3	29,506	53.9
			Total	736	1.3	38,121	69.7	15,670	28.6	172	0.3	54,699	100.0
Grand		7,295	M	1,443	0.5	93,403	32.1	48,404	16.6	1,070	0.4	144,317	49.6
Total [a]			F	2,354	0.8	101,495	34.9	42,473	14.6	400	0.1	146,725	50.4
			Total	3,797	1.3	194,898	67.0	90,876	31.2	1,470	0.5	291,042	100.0

Note: The numbers of fish in each stratum category are derived from sample percentages; sum discrepancies are attributed to rounding errors. The numbers of fish in "Season" are the strata sums; "Season" percentages are derived from the sums.

[a] The number of fish in the "Grand total" are the sum of historical "Season" totals; percentages are derived from those sums. Years included are 1990 through 1991, 1997 through 1999, and 2001 through 2006.

Table 15.–Mean length (mm) of chum salmon escapement through the Middle Fork Goodnews River weir, 2006.

Sample Dates (Stratum Dates)	Sex		Age Class 0.2	0.3	0.4	0.5
7/6–7	M	Mean Length		599	603	
(6/26–7/10)		SE		4	4	
		Range		550–680	545–665	
		Sample Size	0	51	32	0
	F	Mean Length		550	570	540
		SE		3	5	-
		Range		505–620	475–620	540–540
		Sample Size	0	68	34	1
7/13–15	M	Mean Length	525	586	603	
(7/11–18)		SE	-	3	6	
		Range	525–525	525–635	525–685	
		Sample Size	1	59	37	0
	F	Mean Length	535	551	565	
		SE	-	4	5	
		Range	535–535	510–610	505–635	
		Sample Size	1	43	38	0
7/21–22	M	Mean Length	528	587	597	
(7/19–25)		SE	13	3	7	
		Range	515–540	500–640	535–640	
		Sample Size	2	57	22	0
	F	Mean Length	570	561	556	
		SE	-	4	8	
		Range	570–570	440–630	495–600	
		Sample Size	1	77	15	0
7/28–29	M	Mean Length		598	590	
(7/26–8/3)		SE		5	9	
		Range		525–670	535–635	
		Sample Size	0	60	12	0
	F	Mean Length	525	563	561	
		SE	13	3	5	
		Range	505–550	505–645	525–605	
		Sample Size	3	82	21	0
8/7	M	Mean Length		575	565	
(8/4–9/18)		SE		7	5	
		Range		530–645	560–570	
		Sample Size	0	20	2	0
	F	Mean Length	525	561	559	520
		SE	15	6	11	-
		Range	510–540	500–610	505–600	520–520
		Sample Size	2	27	7	1

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Sample Dates (Stratum Dates)	Sex		Age Class 0.2	0.3	0.4	0.5
Season	M	Mean Length	527	589	599	
		Range	515–540	500–680	525–685	
		Sample Size	3	247	105	0
	F	Mean Length	534	557	564	528
		Range	505–570	440–645	475–635	520–540
		Sample Size	7	297	115	2
Grand Total [a]	M	Mean Length	552	590	613	629
		Range	495–585	480–685	515–710	605–640
		Sample Size	47	2177	1210	29
	F	Mean Length	534	558	576	588
		Range	510–560	475–640	470–675	640–645
		Sample Size	91	2469	1064	8

[a] "Grand Total" mean lengths are simple averages of historical "Season" mean lengths. Years included are 1990 through 1991, 1997 through 1999, and 2001–2006.

Table 16.–Age and sex composition of coho salmon escapement, Middle Fork Goodnews River weir, 2006.

Sample Dates (Stratum)	Pulse Sample Size	Aged Sample Size	Sex	Age Class 1.1 Esc.	1.1 %	2.1 Esc.	2.1 %	3.1 Esc.	3.1 %	Total Esc.	Total %
8/18–19,21	103	73	M	187	11.0	657	38.4	0	0.0	844	49.3
(6/26–8/22)			F	141	8.2	703	41.1	23	1.4	868	50.7
			Subtotal	328	19.2	1,360	79.5	23	1.4	1,712	100.0
8/24–26	173	140	M	228	10.7	868	40.7	46	2.2	1,142	53.6
(8/23–28)			F	213	10.0	761	35.7	15	0.7	989	46.4
			Subtotal	441	20.7	1,629	76.4	61	2.9	2,131	100.0
8/30–9/1	170	130	M	1,399	11.5	4,943	40.8	0	0.0	6,343	52.3
(8/29–9/18)			F	1,026	8.5	4,570	37.7	187	1.5	5,783	47.7
			Subtotal	2,425	20.0	9,513	78.5	187	1.5	12,126	100.0
Season [a]	446	343	M	1,815	11.4	6,467	40.5	46	0.3	8,328	52.2
			F	1,380	8.6	6,035	37.8	225	1.4	7,640	47.8
			Subtotal	3,195	20.0	12,502	78.3	271	1.7	15,969	100.0
Grand		3,342	M	9,890	4.2	105,074	44	4,700	2.0	119664.1	50.82
Total [b]			F	8,203	3.5	104,688	44	5,185	2.2	118074.9	49.18
			Total	18,093	7.6	209,582	88	9,885	4.2	237739	100

Note: The number of fish in each stratum category are derived from sample percentages; sum discrepancies are attributed to rounding errors.

[a] Samples did not achieve minimum sample objectives and were not applied to sample totals.

[b] The number of fish in "Grand total" are the sum of historical "Season" totals; percentages are derived from those sums. Years included are 1998–2004, and 2006.

Table 17.–Mean length (mm) of coho salmon escapement, Middle Fork Goodnews River weir, 2006.

Sample Dates (stratum Dates)	Sex		Age Class 1.1	2.1	3.1
8/18–19,21	M	Mean Length	571	551	
(6/26–8/22)		SE	16	9	
		Range	530–635	445–635	
		Sample Size	8	28	0
	F	Mean Length	530	553	450
		SE	14	5	-
		Range	480–565	500–620	450–450
		Sample Size	6	30	1
8/24–26	M	Mean Length	557	555	550
(8/23–28)		SE	12	6	20
		Range	450–605	455–640	530–590
		Sample Size	15	57	3
	F	Mean Length	560	557	525
		SE	8	6	-
		Range	505–615	440–620	525–525
		Sample Size	14	50	1
8/30–9/1	M	Mean Length	573	562	
(8/29–9/18)		SE	8	6	
		Range	515–620	440–665	
		Sample Size	15	53	0
	F	Mean Length	556	571	580
		SE	9	4	10
		Range	500–605	505–625	570–590
		Sample Size	11	49	2
Season	M	Mean Length	571	560	550
		Range	450–635	440–665	530–590
		Sample Size	38	138	3
	F	Mean Length	554	567	563
		Range	480–615	440–625	450–590
		Sample Size	31	129	4
Grand Total [a]	M	Mean Length	560	584	592
		Range	467–658	435–707	575–675
		Sample Size	131	1,550	64
	F	Mean Length	584	590	588
		Range	518–677	400–680	420–625
		Sample Size	95	1,441	61

[a] "Grand Total" mean lengths are simple averages of historical "Season" mean lengths. Years included are 1998–2004, and 2006.

Table 18.–Age and sex composition of Chinook salmon harvest, District W-5 commercial fishery, 2006.

Sample Dates (Stratum)	Pulse Sample Size	Aged Sample Size	Sex	Age Class 1.1 Catch	1.1 %	1.2 Catch	1.2 %	1.3 Catch	1.3 %	1.4 Catch	1.4 %	1.5 Catch	1.5 %	Total Catch	Total %
6/22,7/10	233	182	M				32.4		39.6		8.8		1.6		82.4
(6/22–9/1)			F				0.6		5.5		11.5		0.0		17.6
Season [a]			Subtotal				33.0		45.1		20.3		1.6	2,892	100.0
Grand		2,075	M	107	0.5	4,962	21.5	5,761	25	2,200	9.5	149	0.6	13,223	57.3
Total [b]			F	0	0	463	2	4,408	19.1	4,623	20.1	276	1.2	9,833	42.7
			Total	83	0.4	5,425	23.5	10,169	44.1	6,824	29.6	425	1.8	23,055	100.0

Note: The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies are attributed to rounding errors.

[a] Samples did not achieve minimum sample objectives and were not applied to sample totals.

[b] The number of fish in the "Grand total" are the sum of historical "Season" totals; percentages are derived from those sums. The 2006 "Season" is not included in "Grand Total".

Table 19.–Mean length (mm) of Chinook salmon harvest, District W-5 commercial fishery, 2006.

Sample Dates (Stratum Dates)	Sex		Age Class 1.1	1.2	1.3	1.4	1.5
6/22,7/10 (6/22–9/1)	M	Mean Length		553	689	770	935
		Range		451–695	481–827	608–852	891–975
		Sample Size	0	59	72	16	3
Season	F	Mean Length		556	750	825	
		Range		556–556	643–804	747–882	
		Sample Size	0	1	10	21	0
Grand Total [a]	M	Mean Length	404	541	694	837	913
		Range	325–464	455–711	539–876	623–1,030	935–1,000
		Sample Size	10	437	442	167	8
	F	Mean Length		635	759	855	881
		Range		505–650	657–995	620–970	819–980
		Sample Size	0	12	194	361	15

[a] "Grand Total" mean lengths are simple averages of the "Season" mean lengths. The 2006 "Season" is not included in "Grand Total".

Table 20.–Age and sex composition of sockeye salmon harvest, District W-5 commercial fishery, 2006.

Sample Dates (Stratum)	Pulse Sample Size	Aged Sample Size	Sex	Age Class 0.3 Catch	0.3 %	1.2 Catch	1.2 %	1.3 Catch	1.3 %	1.4 Catch	1.4 %	2.3 Catch	2.3 %	Total Catch	Total %
6/27	140	95	M		7.4		5.3		50.5		2.1		2.1		67.4
(6/22–9/1)			F		1.0		3.1		24.2		1.1		3.2		32.6
Season [a]			Subtotal		8.4		8.4		74.7		3.2		5.3	29,857	100.0
Grand		9,363	M	8,576	1.6	36,349	6.8	207,009	38.9	6,604	1.2	22,253	4.2	293,044	55.1
Total [b]			F	8,329	1.6	23,926	4.5	174,473	33.7	4,955	0.9	14,639	2.8	239,088	44.9
			Total	16,905	3.2	60,275	11.3	386,483	72.6	11,559	2.2	36,892	6.9	532,132	100.0

Note: The numbers of fish in each stratum age and sex category are derived from the sample percentages; discrepancies are attributed to rounding errors.

[a] Samples did not achieve minimum sample objectives and were not applied to sample totals.

[b] The numbers of fish in the "Grand total" are the sum of historical "Season" totals; percentages are derived from those sums. The 2006 "Season" is not included in "Grand Total".

Table 21.–Mean length (mm) of sockeye salmon harvest, District W-5 commercial fishery, 2006.

Sample Dates (Stratum Dates)	Sex		Age Class 0.3	1.2	1.3	1.4	2.3	
6/27	M	Mean Length	551	504	555	568	599	
(6/22–9/1)		Range	503–592	430–532	500–608	555–580	571–627	571–627
		Sample Size	7	5	48	2	2	
Season	F	Mean Length	521	503	543	571	533	
		Range	521–521	494–509	507–581	571–571	525–542	525–542
		Sample Size	1	3	23	1	3	
Grand	M	Mean Length	584	543	592	560	600	
Total [a]		Range	488–660	390–678	440–683	427–643	540–700	
		Sample Size	105	664	3770	149	120	
	F	Mean Length	552	518	561	519	573	
		Range	490–610	350–611	440–695	452–565	511–690	
		Sample Size	94	468	3231	82	111	

[a] "Grand Total" mean lengths are simple averages of the "Season" mean lengths. The 2006 "Season" is not included in "Grand Total".

Table 22.–Age and sex composition of chum salmon harvest from the District W-5 commercial fishery, 2006.

Sample Dates (Stratum)	Pulse Sample Size	Aged Sample Size	Sex	Age Class 0.2 Catch	0.2 %	0.3 Catch	0.3 %	0.4 Catch	0.4 %	0.5 Catch	0.5 %	Total Catch	Total %
6/27	210	193	M		0.0		40.9		20.2		0.0		61.1
(6/22–9/1)			F		0.0		18.2		20.7		0.0		38.9
Season [a]			Subtotal		0.0		59.1		40.9		0.0	11,568	100.0
Grand		6,641	M	470	0.3	48	26.3	39,644	21.8	1,062	0.6	89,030	48.8
Total [b]			F	249	0.1	46,982	25.8	45,309	24.9	690	0.4	93,230	51.2
			Total	720	0.4	94,839	52.0	84,954	46.6	1,752	1.0	182,255	100.0

Note: The numbers of fish in each stratum age and sex category are derived from the sample percentages; discrepancies are attributed to rounding errors.

[a] Samples did not achieve minimum sample objectives and were not applied to sample totals.

[b] The numbers of fish in the "Grand total" are the sum of historical "Season" totals; percentages are derived from those sums. The 2006 "Season" is not included in "Grand Total".

Table 23.–Mean length (mm) of chum salmon harvest, the District W-5 commercial fishery, 2006.

Sample Dates (Stratum Dates)	Sex		Age Class 0.2	0.3	0.4	0.5
6/27	M	Mean Length		570	577	
(6/22–9/1)		Range		510–671	513–621	
		Sample Size	0	79	39	0
Season	F	Mean Length		555	567	
		Range		527–584	509–609	
		Sample Size	0	35	40	0
Grand	M	Mean Length	540	590	610	621
Total [a]		Range	515–593	488–704	498–725	560–703
		Sample Size	21	1677	1259	23
	F	Mean Length	547	567	582	605
		Range	522–568	430–700	491–680	565–658
		Sample Size	10	1839	1486	21

[a] "Grand Total" mean lengths are simple averages of the "Season" mean lengths. The 2006 "Season" is not included in "Grand Total".

Table 24.–Daily weather and hydrological observations, Middle Fork Goodnews River weir site, 2006.

Date	Wind (Dir./Speed)	Precipitation mm/24hr	Air Temp. °C	Water Temp °C	Cloud Cover % / altitude	Water Level (cm)
6/22	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS
6/23	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS
6/24	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS
6/25	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS	50.0
6/26	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS	49.0
6/27	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS	49.0
6/28	S/5	0.0	11	11	3	48.0
6/29	S/8–12	0.0	10	11	4	47.0
6/30	SW/5–10	0.0	7	NO OBS	4	46.0
7/01	SW/7	0.0	16	NO OBS	1	45.0
7/02	W/3	0.0	12	NO OBS	4	42.0
7/03	W/3	0.0	19	12	1	41.0
7/04	NE/2	0.0	16	12	1	40.0
7/05	0	0.0	8	12.5	5	39.0
7/06	W/3	0.0	11	NO OBS	5	36.5
7/07	0	0.0	11	12.5	4	34.0
7/08	0	0.0	8	10	4	34.0
7/09	N/3–5	0.0	13	10	4	33.0
7/10	0	0.0	12	11.5	3	32.0
7/11	0	0.0	10	11	3	30.5
7/12	W/15	0.0	20	13.5	2	29.0
7/13	NO OBS	0.0	NO OBS	NO OBS	4	26.0
7/14	NO OBS	0.0	NO OBS	9	4	25.0
7/15	W/5	0.2	8	9	4	25.0
7/16	SW//10	1.0	12	9	4	25.0
7/17	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS
7/18	E/9	1.0	11	10	3	23.0
7/19	N/2	2.0	9	10	4	23.0
7/20	0	0.0	6	11	3	22.0
7/21	SW/3	0.0	4.5	12	3	20.5
7/22	NE/4	2.5	14	12	1	20.0
7/23	SE/8	8.0	14	12	4	19.0
7/24	SE/9	7.5	15	12	4	18.0
7/25	SE/5	0.5	6	12	4	21.0
7/26	SW/7	2.0	8	10	5	21.0
7/27	E/8	0.0	11	11	4	19.0
7/28	E/7	1.0	10	11	5	19.0
7/29	SW/11	0.5	9	10	4	18.0
7/30	SW/7	6.5	9	9	4	19.0
7/31	S/2	1.5	8	10	4	20.0
8/01	S/1	2.5	1	6	4	20.0
8/02	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS
8/03	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS
8/04	SW/3	0.0	9	10	3	19.0
8/05	W/5	0.0	15	10	3	15.0
8/06	W/12	0.0	16	12	2	14.0
8/07	SW/4	0.0	9	13	4	14.0

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Date	Wind (Dir./Speed)	Precipitation mm/24hr	Air Temp. °C	Water Temp °C	Cloud Cover %/altitude	Water Level (cm)
8/08	0	0.0	9	13	4	11.0
8/09	0	10.0	9	11	4	11.0
8/10	E/4	30.0	10	10	4	22.0
8/11	S/3	50.0	9	10	4	28.0
8/12	N/3	0.0	8	10	3	32.0
8/13	SW/10	50.0	9	9.5	5	29.0
8/14	E/11	210.0	9	10	5	34.0
8/15	0	0.0	9	10	3	44.0
8/16	0	0.0	8	11	5	40.0
8/17	S/20	7.0	10	10	4	39.0
8/18	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS	NO OBS
8/19	0	0.0	8	10	2	40.0
8/20	0	0.0	6.5	9	1	37.0
8/21	N/5	0.0	4.5	9.5	4	34.0
8/22	SW/10	11.0	7	8.5	NO OBS	35.0
8/23	0	0.0	16	11.5	1	34.0
8/24	W/20	0.0	14.4	11.5	2	32.0
8/25	NE/5	0.0	7	9.5	4	31.0
8/26	S/5	2.0	7.5	8.5	1	31.0
8/27	W/7	0.0	11	NO OBS	4	28.0
8/28	0	0.0	7	9.5	4	28.0
8/29	W/4	0.0	8	10	4	26.0
8/30	0	12.5	9	10	4	26.0
8/31	W/20	0.0	8	8.5	1	32.0
9/01	W/5	0.0	5	8	1	28.0
9/02	S/3	0.0	9.5	9	3	26.0
9/03	0	0.0	1.5	5	5	24.0
9/04	0	0.0	2.5	8	1	23.0
9/05	0	3.1	7.5	10	4	23.0
9/06	0	0.0	8	9.5	4	24.0
9/07	S/20	3.5	10	9	4	29.0
9/08	SE/20	22.0	12	9	4	76.0
9/09	0	1.5	7.5	8	3	98.0
9/10	0	3.0	8.5	9	4	93.0
9/11	0	7.1	3	7.5	1	85.0
9/12	E/3	0.0	7	8	5	74.0
9/13	0	0.0	13	8	2	66.0
9/14	SE/10–15	15.0	11.5	9	4	64.0
9/15	E/15	8.0	11	NO OBS	4	82.0
9/16	S/5	10.0	9	NO OBS	4	97.0

Note: Cloud cover refers to 1=<10%, 2=<50%, 3=>50%, 4=100%, and 5=fog.

Table 25.–Results of Chinook salmon biological escapement goal analysis using Ricker two-parameter spawner recruit model for estimating maximum sustainable yield (S_{MSY}).

	Mean	SE
ln(alpha)	1.355	0.28
beta	3.10E-04	8.56E-05
sigma2	0.0325	
alpha	3.88	1.32
S_{MSY}	1,771	
R_{MSY}	3,964	
MSY	2,194	
Sk	4,370	
Contrast	4.32	<10
Durbin-Watson	3.01	>du=1.37

BEG Range	
Lower	1,500
S_{MSY}	1,771
Upper	2,900

SUMMARY STATISTICS

Regression Statistics	
Multiple R	0.6602
R Square	0.4358
Adjusted R Square	0.4026
Standard Error	0.4247
Observations	19

ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	2.3686	2.3686	13.1329	0.0021
Residual	17	3.0661	0.1804		
Total	18	5.4347			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.3387	0.2804	4.7744	0.0002	0.7471	1.9302	0.7471	1.9302
X Variable 1	-0.0003	0.0001	-3.6239	0.0021	-0.0005	-0.0001	-0.0005	-0.0001

Table 26.–Results of sockeye salmon biological escapement goal analysis using Ricker two-parameter spawner recruit model for estimating maximum sustainable yield (S_{MSY}).

	Mean	SE
ln(alpha)	1.587	0.36
beta	2.95E-05	9.08E-06
sigma2	0.0649	
alpha	4.89	1.43
S_{MSY}	20,889	
R_{MSY}	55,081	
MSY	34,192	
Sk	53,709	
Contrast	3.69	<10
Durbin-Watson	1.68	>du=1.37

BEG Range	
Lower	18,000
S_{MSY}	20,889
Upper	40,000

SUMMARY STATISTICS

Regression Statistics	
Multiple R	0.6084
R Square	0.3701
Adjusted R Square	0.3351
Standard Error	0.5047
Observations	20

ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	2.6936	2.6936	10.5757	0.0044
Residual	18	4.5846	0.2547		
Total	19	7.2783			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.5542	0.3592	4.3270	0.0004	0.7996	2.3089	0.7996	2.3089
X Variable 1	0.0000	0.0000	-3.2520	0.0044	0.0000	0.0000	0.0000	0.0000

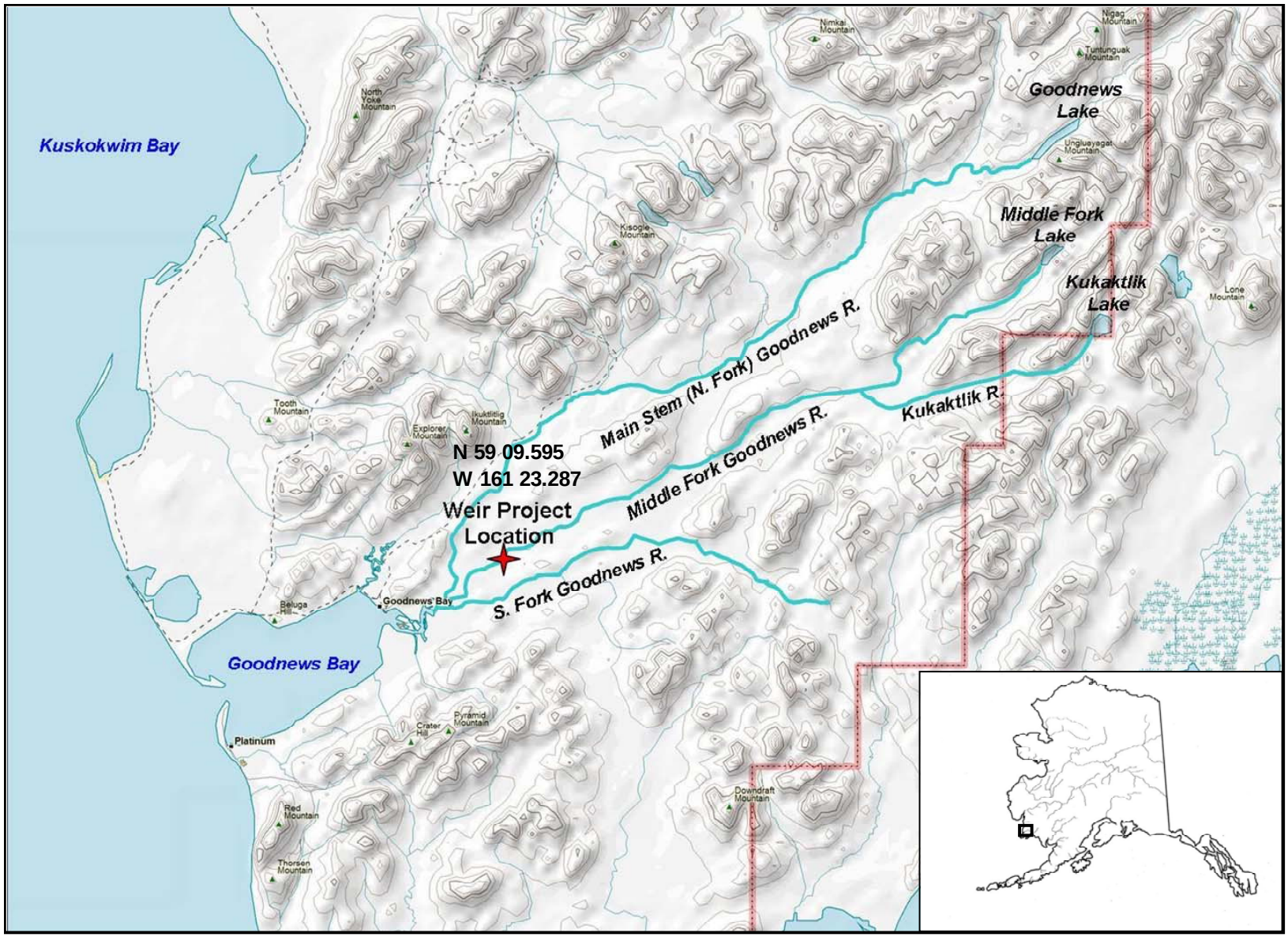


Figure 1.–Goodnews River drainage, Kuskokwim Bay, Alaska.

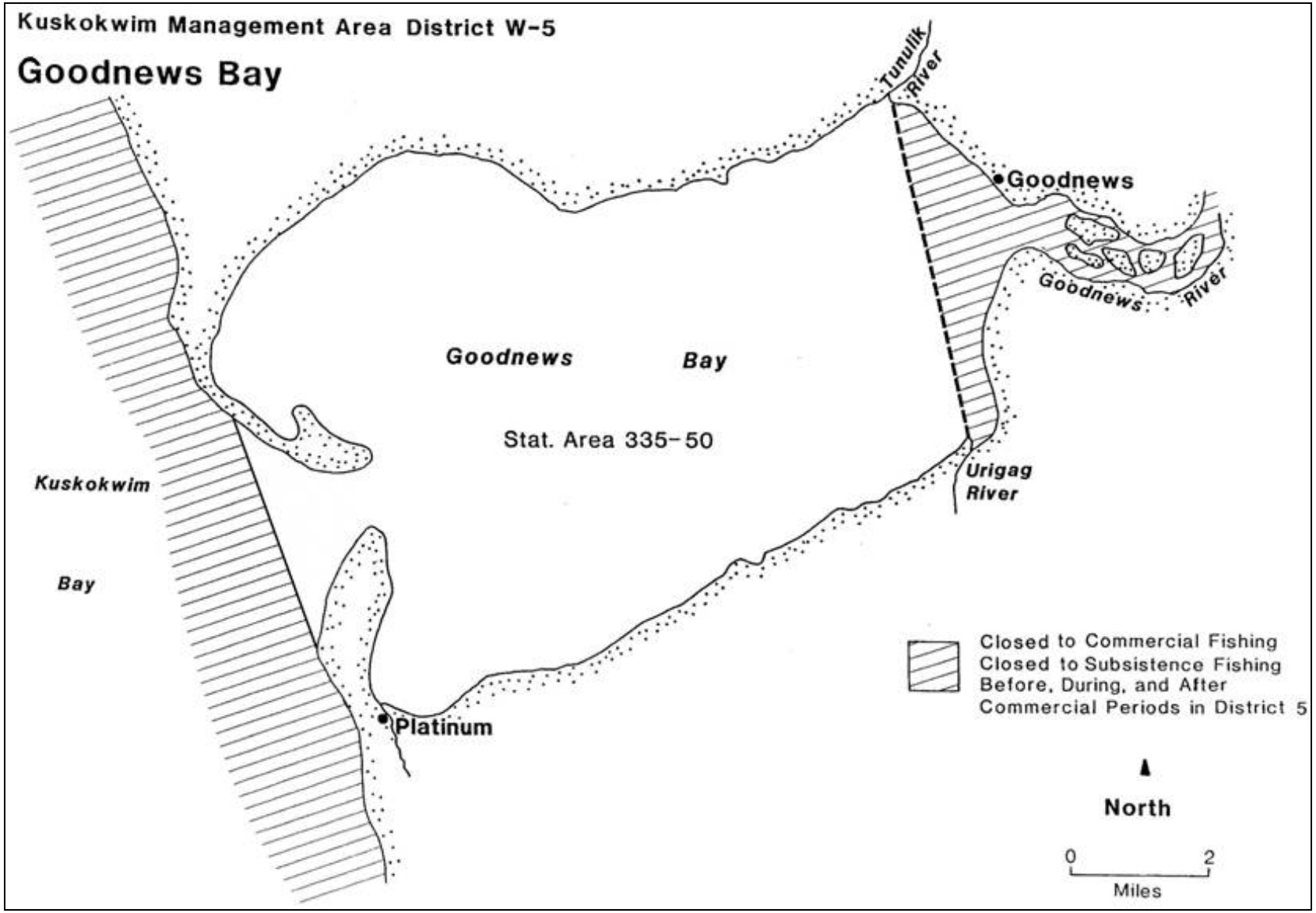


Figure 2.–Commercial fishing District W-5 (Goodnews Bay), Kuskokwim Bay, Alaska, 2006.

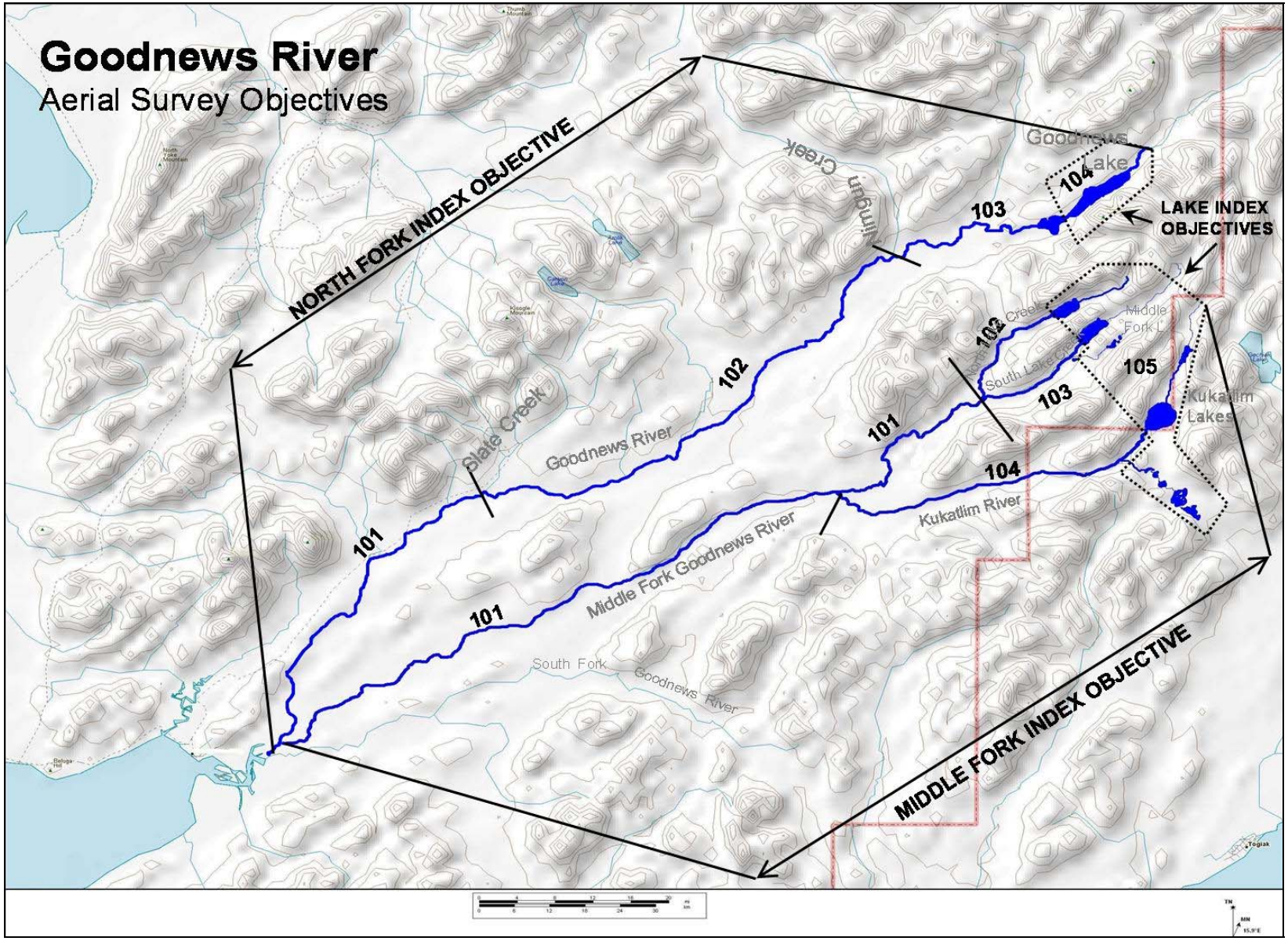


Figure 3.–Map of index areas used for aerial surveys on the Goodnews River drainage.

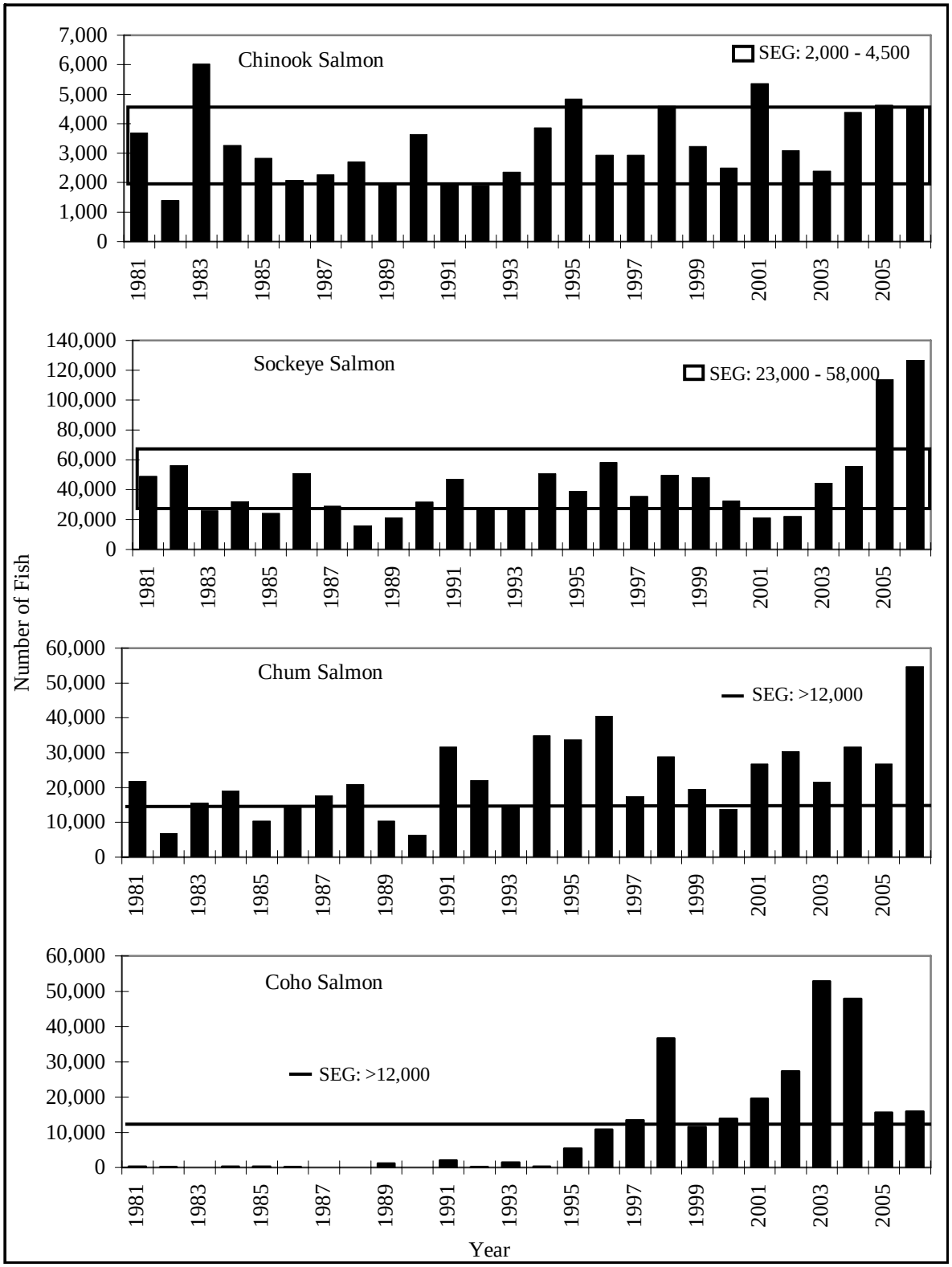


Figure 4.–Historical Chinook, sockeye, chum, and coho salmon escapement estimates, Middle Fork Goodnews River weir, 1981 through 2006.

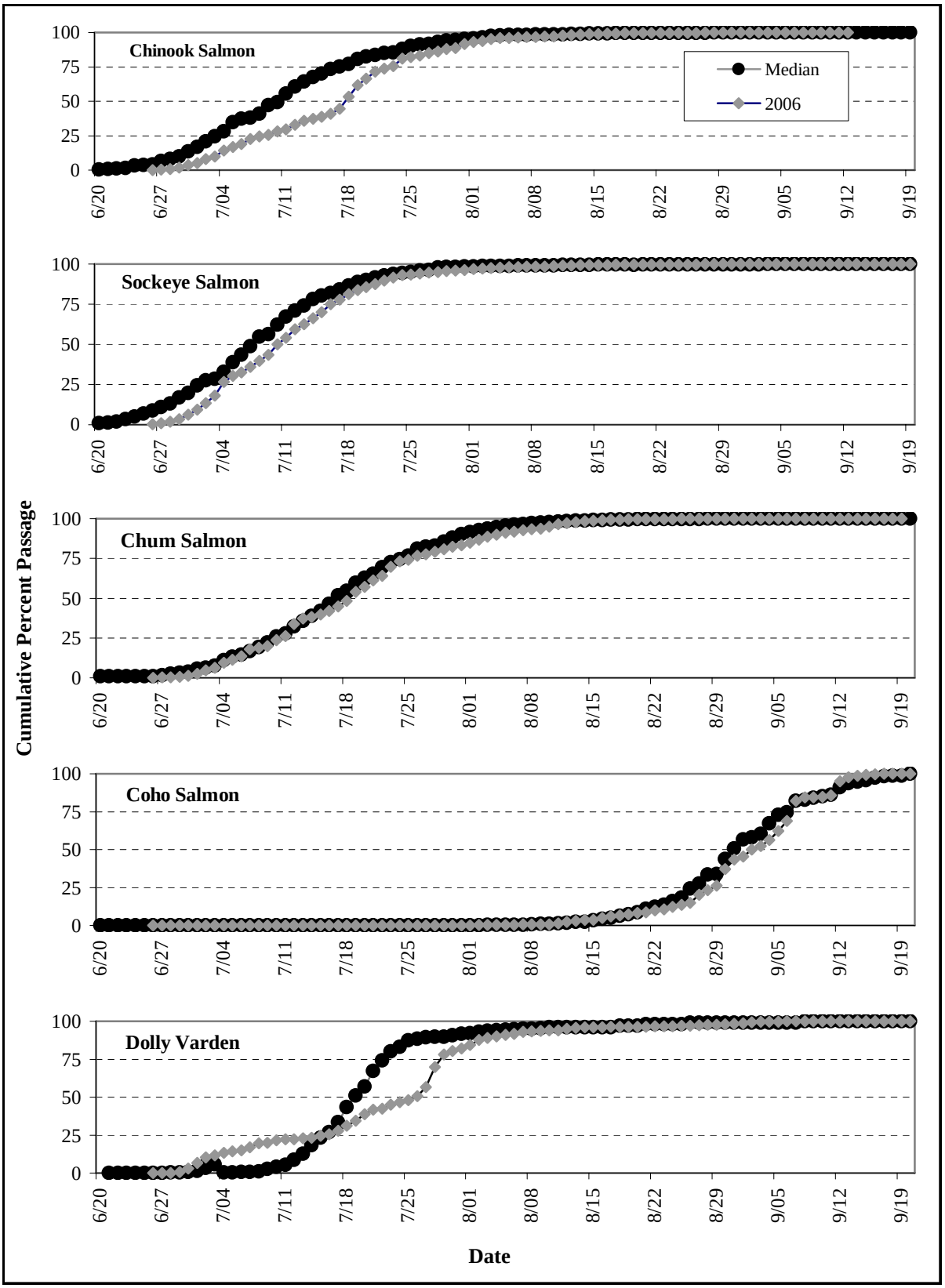


Figure 5.–Cumulative percent passage of Chinook, sockeye, chum, and coho salmon and Dolly Varden, 2006 and historical median, Middle Fork Goodnews River weir.

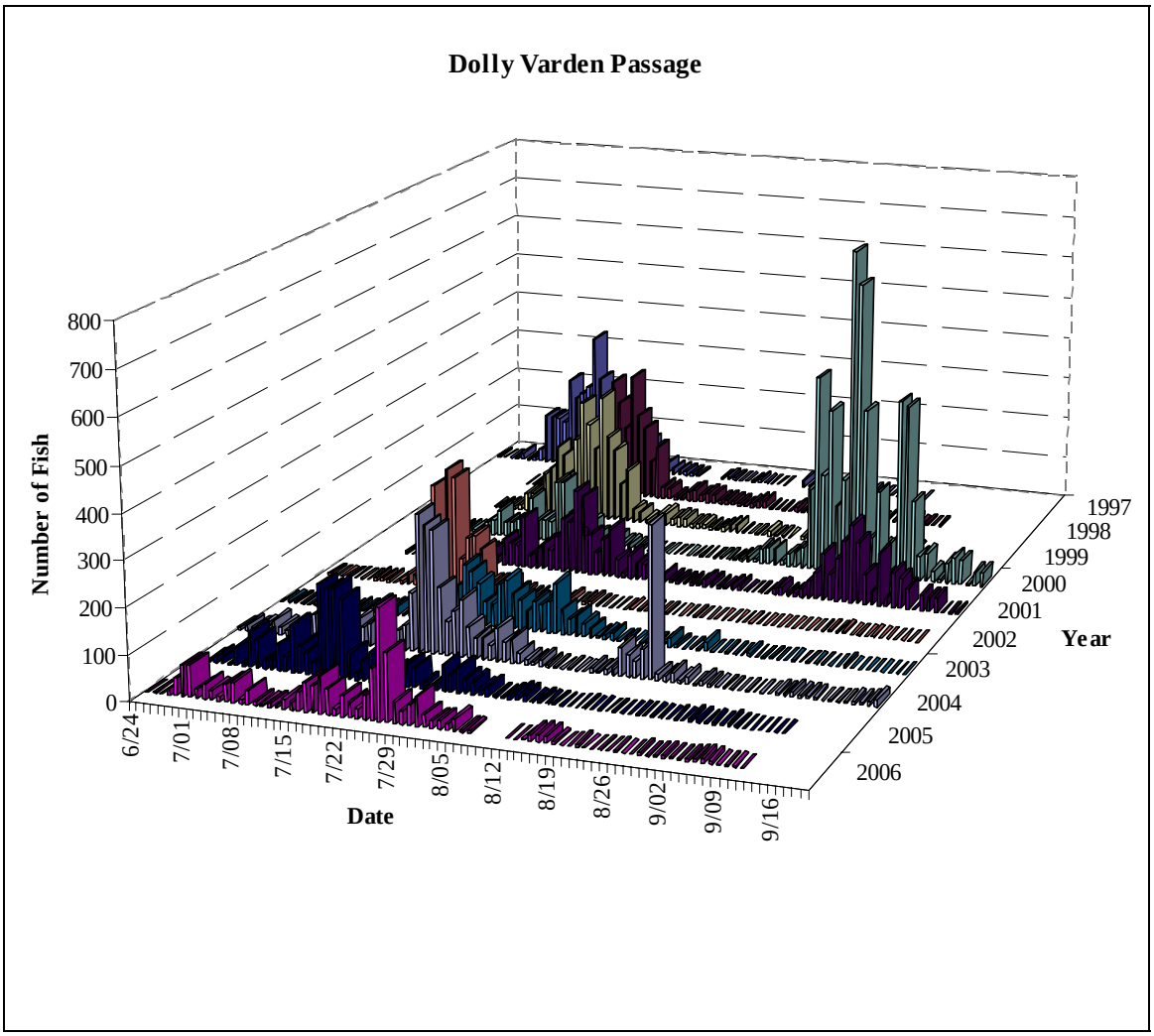


Figure 6.–Historical daily Dolly Varden passage, Middle Fork Goodnews River weir.

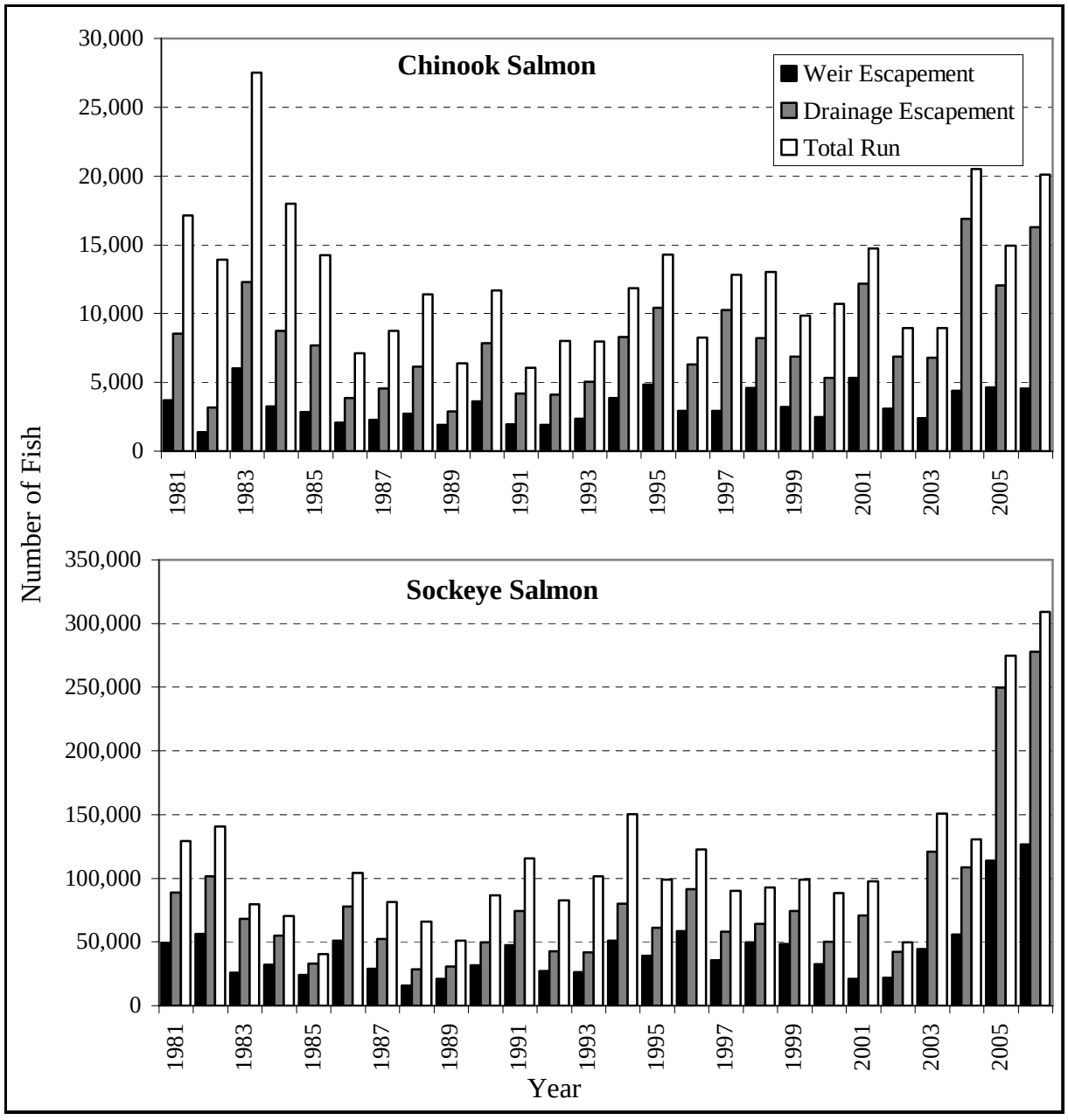


Figure 7.–Historical Chinook and sockeye salmon escapement estimates and total run, Middle Fork Goodnews River weir and Goodnews River drainage.

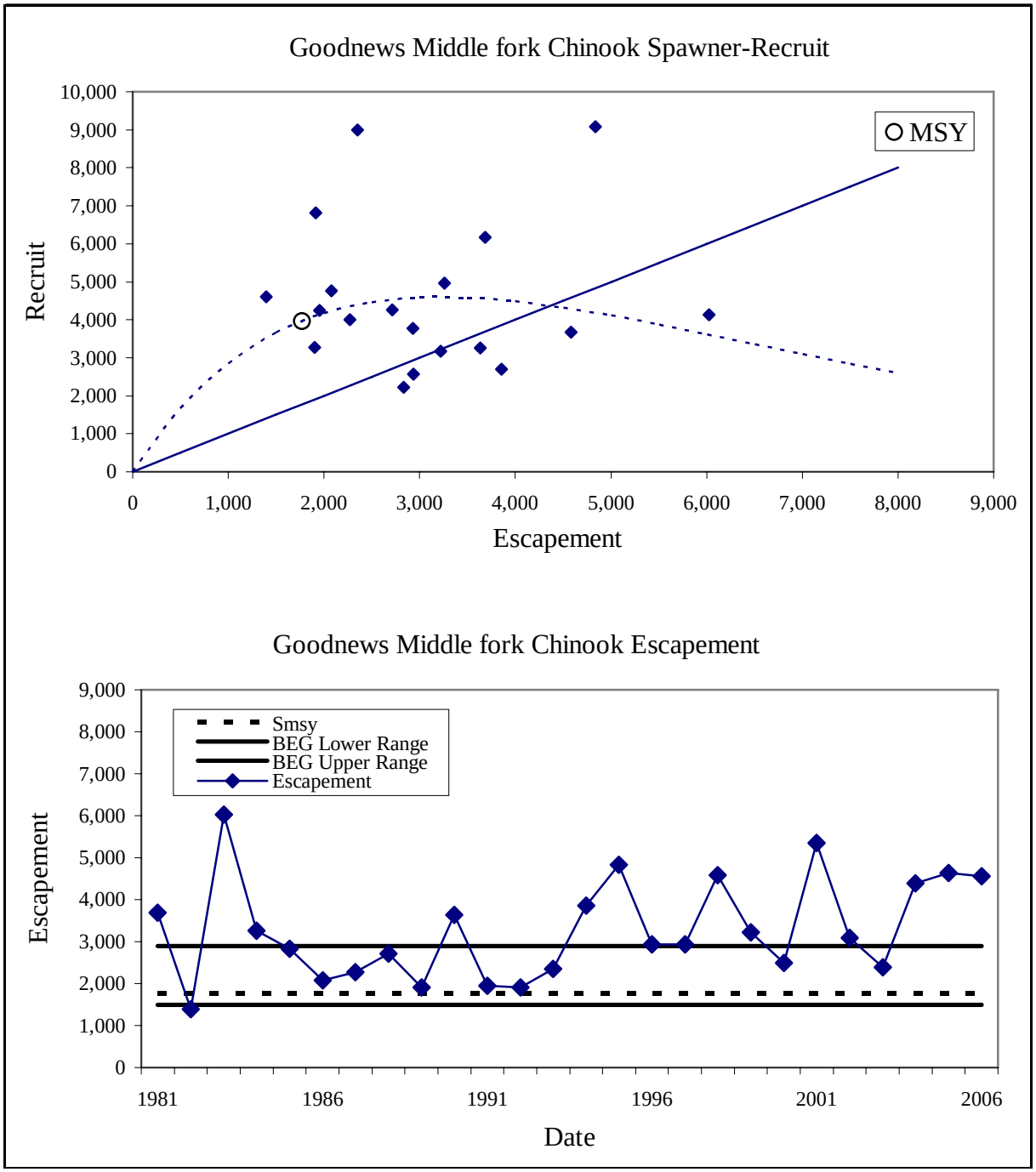


Figure 8.–Ricker two parameter spawner-recruit model (top) and biological escapement goal compared to historical escapement (bottom) for Middle Fork Goodnews River Chinook salmon.

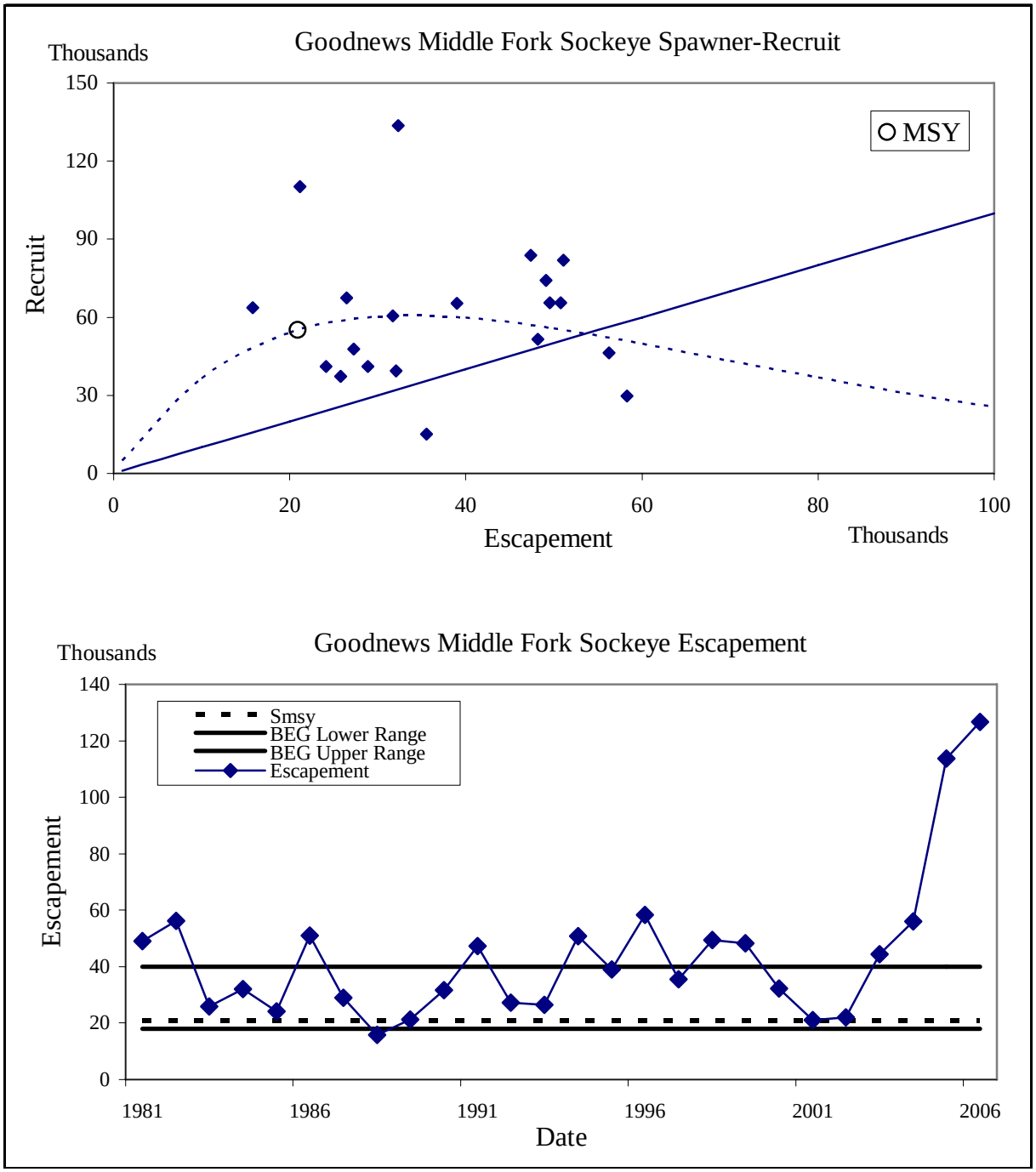
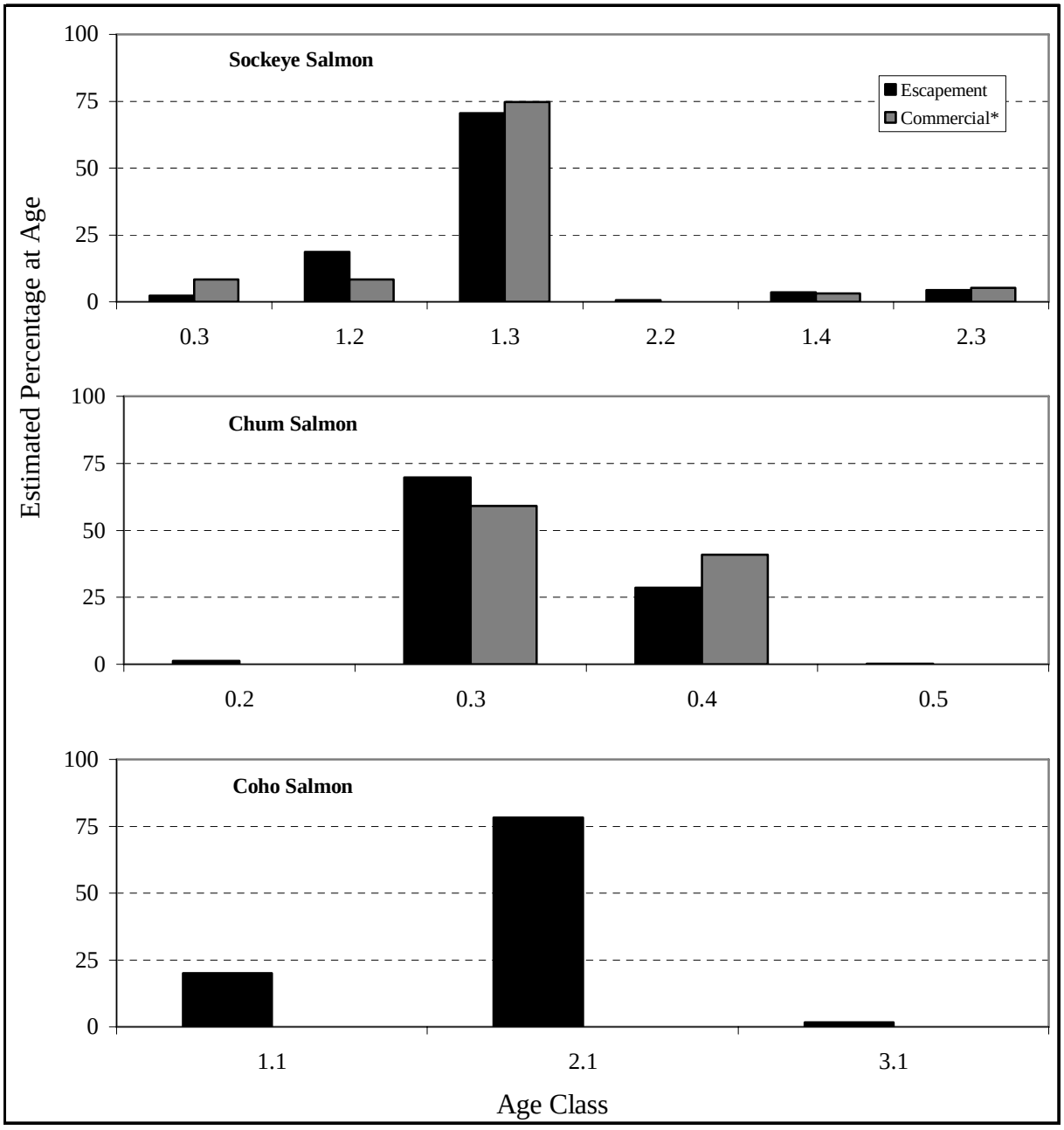
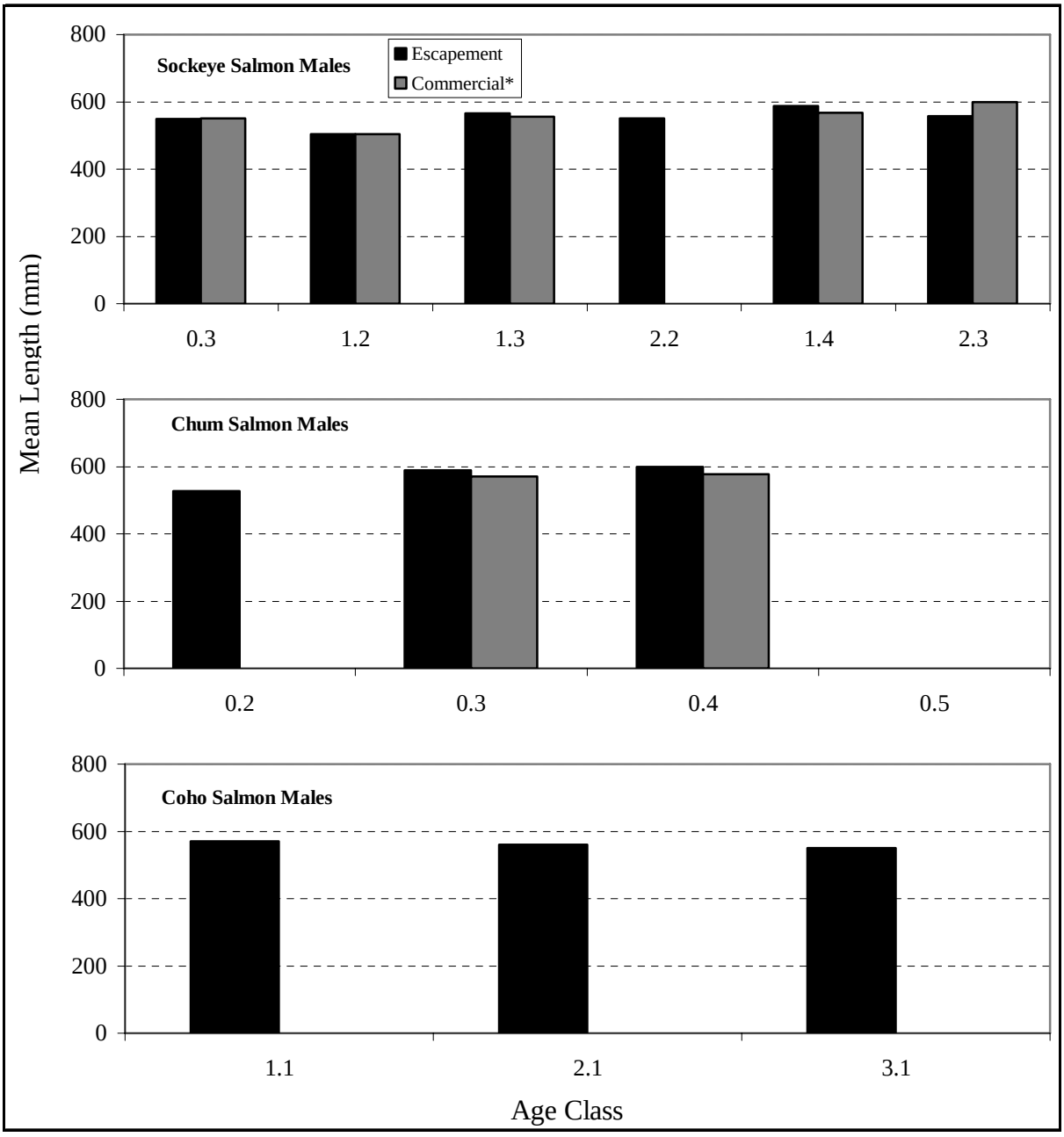


Figure 9.–Ricker two parameter spawner-recruit model (top) and biological escapement goal compared to historical escapement (bottom) for Middle Fork Goodnews River sockeye salmon.



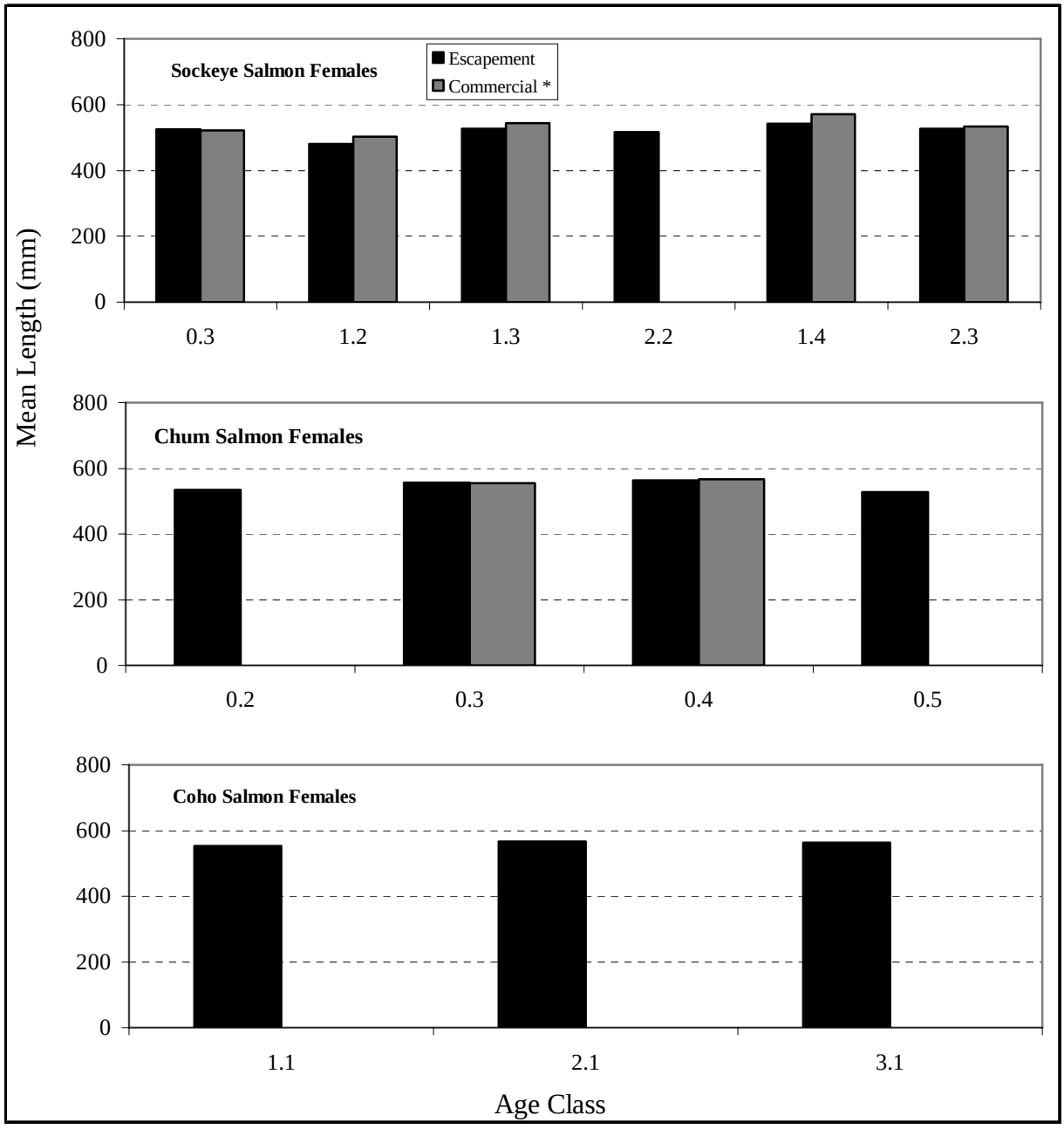
Note: ***** indicates percentages do not represent total commercial catch as the number of samples collected was inadequate.

Figure 10.–Estimated age class percentages for sockeye, chum, and coho salmon from Middle Fork Goodnews River weir escapement and District W-5 commercial harvest, 2006.



Note: * indicates mean lengths do not represent total commercial catch as the number of samples collected was inadequate.

Figure 11.–Mean length by age class for male sockeye, chum, and coho salmon, Middle Fork Goodnews River weir escapement and District W-5 commercial harvest, 2006.



Note: * indicates mean lengths do not represent total commercial catch as the number of samples collected was inadequate.

Figure 12.–Mean length by age class for female sockeye, chum, and coho salmon, Middle Fork Goodnews River weir escapement and District W-5 commercial harvest, 2006.

APPENDIX A. SALMON HARVESTS OF GOODNEWS BAY AREA

Appendix A1.–Historical commercial, subsistence, and sport fishing harvest of Chinook, sockeye, coho, and chum salmon, Goodnews Bay area, 1968–2006.

	Chinook			Sockeye			Chum			Coho		
Year	Commercial	Subsistence	Sport	Commercial	Subsistence	Sport	Commercial	Subsistence	Sport	Commercial	Subsistence	Sport
1968										5,458		
1969	3,978			6,256			5,006			11,631		
1970	7,163			7,144			12,346			6,794		
1971	477			330			301			1,771		
1972	264			924			1,331			925		
1973	3,543			2,072			15,781			5,017		
1974	3,302			9,357			8,942			21,340		
1975	2,156			9,098			5,904			17,889		
1976	4,417			5,575			10,354			9,852		
1977	3,336	574[a]		3,723			6,531			13,335		
1978	5,218			5,412			8,590			13,764		
1979	3,204	338		19,581			9,298			42,098		
1980	2,331	690		28,632			11,748			43,256		
1981	7,190	1,409		40,273			13,642			19,749		
1982	9,476	1,236		38,877			13,829			46,683		
1983	14,117	1,066	31	11,716		14	6,766		10	19,660		168
1984	8,612	629		15,474			14,340			71,176		
1985	5,793	426	323	6,698	704	75	4,784	348	124	16,498	221	386
1986	2,723	555		25,112	943	122	10,355	191		19,378	8[b]	
1987	3,357	816		27,758	955	266	20,381	578		29,057	43[b]	
1988	4,964	310		36,368	1,065		33,059	448		30,832	1,162	
1989	2,966	468	68	19,299	861	146	13,622	784	0	31,849	907	224
1990	3,303	539		35,823	1,123		13,194	332		7,804	1,646	
1991	912	917	26	39,838	1,282	63	15,892	149	189	13,312	1,828	297
1992	3,528	374	23	39,194	826	8	18,520	1,006	0	19,875	1,353	138
1993	2,117	708	81	59,293	836	53	10,657	188	156	20,014	1,226	189
1994	2,570	784	163	69,490	770	70	28,477	470	15	47,499	512	170
1995	2,922	883	41	37,351	253	34	19,832	156	0	17,875	305	114
1996	1,375	415	157	30,717	418	87	11,093	219	0	43,836	352	466
1997	2,039	449	86	31,451	609	61	11,729	133	24	2,983	397	855
1998	3,675	718	431	27,161	508	502	14,155	316	50	21,246	331	574
1999	1,888	871	223	22,910	872	561	11,562	281	47	2,474	582	789

-continued-

Appendix A1.–Page 2 of 2.

Year	Chinook			Sockeye			Chum			Coho		
	Commercial	Subsistence	Sport	Commercial	Subsistence	Sport	Commercial	Subsistence	Sport	Commercial	Subsistence	Sport
2000	4,442	703	243	37,252	1,205	82	7,450	364	12	15,531	517	795
2001	1,519	895	147	25,654	974	108	3,412	226	21	9,275	616	822
2002	979	857	224	6,304	1,050	149	3,799	407	99	3,041	297	429
2003	1,412	737	10	29,423	783	42	5,593	176	14	12,658	1,319	681
2004	2,565	954	100	20,922	960	0	6,014	257	0	23,690	1,617	622
2005	2,035	868	0	23,933	1,233	0	2,568	209	0	11,735	839	1,046
2006	2,892	[c]	[c]	29,857	[c]	[c]	11,568	[c]	[c]	12,436	[c]	[c]
10-Year Average [d]	2,193	747	162	25,573	861	159	7,738	259	27	14,647	687	708
Historical Average[e]	2,512	692	126	32,910	868	123	12,813	340	39	18,641	878	513

Note: Commercial harvest from District W-5, combined subsistence harvest by the communities of Goodnews Bay and Platinum, subsistence harvest estimates prior to 1988 are based on a different formula and are not comparable with estimates from 1988 to present.

[a] Subsistence harvest estimate in 1977 was for Goodnews Bay only.

[b] Subsistence harvest estimates are for the community of Platinum only.

[c] Not available at time of publication.

[d] 10 year average from 1996 through 2005.

[e] Historical average of subsistence harvest from 1988 through 2005.

APPENDIX B. GOODNEWS ESCAPEMENT

Appendix B1.–Historical escapement, Middle Fork Goodnews River escapement projects, 1981–2006.

Year	Method	Dates of Operation	Chinook	Sockeye	Chum	Pink[a]	Coho	Dolly Varden
1981	Counting Tower[b]	6/13–8/9	3,688	49,108	21,827	[c]	356 [d]	[c]
1982	Counting Tower[b]	6/23–8/3	1,395	56,255	6,767	[c]	91 [d]	[c]
1983	Counting Tower[b]	6/11–7/28	6,027	25,816	15,548	[c]	0 [d]	[c]
1984	Counting Tower[b]	6/15–7/31	3,260	32,053	19,003	[c]	249 [d]	[c]
1985	Counting Tower[b]	6/27–7/31	2,831	24,131	10,367	[c]	282 [d]	[c]
1986	Counting Tower[b]	6/16–7/24	2,080	51,069	14,764	[c]	163 [d]	[c]
1987	Counting Tower[b]	6/22–7/30	2,272	28,871	17,517	[c]	62 [d]	[c]
1988	Counting Tower[b]	6/23–7/30	2,712	15,799	20,799	[c]	6 [d]	[c]
1989	Counting Tower[b]	6/27–7/31	1,915	21,186	10,380	[c]	1,212 [d]	[c]
1990	Counting Tower[b]	6/20–7/31	3,636	31,679	6,410	[c]	0 [d]	[c]
1991	Fixed Picket Weir[e]	6/29–8/23	1,952	47,397	31,644	1,428	1,978 [d]	[c]
1992	Fixed Picket Weir[e]	6/21–8/4	1,905	27,268	22,023	22,601	150 [d]	[c]
1993	Fixed Picket Weir[e]	6/23–8/18	2,349	26,452	14,952	318	1,451 [d]	[c]
1994	Fixed Picket Weir[e]	6/23–8/9	3,856	50,801	34,849	38,705	309 [d]	[c]
1995	Fixed Picket Weir[e]	6/19–8/28	4,836	39,009	33,699	330	5,415 [d]	[c]
1996	Fixed Picket Weir[e]	6/19–8/23	2,931	58,290	40,450	20,105	10,869 [d]	1,829 [d]
1997	Fixed/R. Board Weir	6/12–9/17	2,937	35,530	17,369	940	13,413	2,808
1998	R. Board Weir	7/4–9/17	4,584 [d]	49,513 [d]	28,832 [d]	10,376	36,596	2,915
1999	R. Board Weir	6/25–9/26	3,221	48,205	19,513	914	11,545	1,761
2000	R. Board Weir	7/2–8/27	2,500 [d]	32,341 [d]	13,791 [d]	0	13,907	6,616
2001	R. Board Weir	6/26–9/30	5,351	21,024	26,820	5,405	19,626	3,535
2002	R. Board Weir	6/25–9/18	3,085	22,101	30,300	0	27,364	1,770
2003	R. Board Weir	6/18–9/18	2,389	44,387	21,637	1,921	52,810	1,949
2004	R. Board Weir	6/21–9/20	4,388	55,926	31,616	21,633	47,917	3,492
2005	R. Board Weir	6/26–9/8	4,633	113,809	26,690	5,926	15,683	2,128
2006	R. Board Weir	6/26–9/7	4,559	126,772	54,699	18,432	15,969	1,858
10-year average (1996–2005)			3,602	48,113	25,702	6,722	26,540 [f]	2,880
Historical Average			3,229	40,321	21,503	8,707	26,540 [f]	2,880

[a] Picket spacing of the weir panels allows pink salmon to freely pass through the weir unobserved.

[b] Project located approximately 500 yd upriver from the current weir location.

[c] Species not enumerated during project operations.

[d] No counts or incomplete counts as the project was not operational during a large portion of species migration. These years not included in the historical average.

[e] Fixed picket weir operated in the same location as the current weir.

[f] Average (1997–2005). Coho operations started in 1997.

APPENDIX C. GOODNEWS AERIAL SURVEYS

Appendix C1.–Historical aerial survey counts by species, Goodnews River drainage, 1980–2006.

	North Fork Goodnews River and Lakes				Middle Fork Goodnews River and Lakes			
Year	**Chinook**	**Sockeye**	**Chum**	**Coho**	**Chinook**	**Sockeye**	**Chum**	**Coho**
1980	[a]	[a]	[a]	[a]	[a]	18,926	[a]	[a]
1981	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
1982	1,990	19,160	9,700	[a]	1,546	[a]	6,300	[a]
1983	2,600	9,650	[a]	[a]	2,500	5,900	[a]	[a]
1984	3,245	9,240	17,250	[a]	1,930	12,897	9,172	[a]
1985	3,535	2,580	4,415	[a]	2,050	7,211	3,593	[a]
1986	1,068	8,960	11,850	[a]	1,249	16,990	7,645	[a]
1987	2,244	19,786	12,103	[a]	2,222	24,505	9,696	[a]
1988	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
1989	651	3,605	[a]	[a]	1,277	8,044	2,922	[a]
1990	626	27,689	[a]	[a]	[a]	[a]	[a]	[a]
1991	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
1992	[a]	10,397	[a]	[a]	[a]	[a]	[a]	[a]
1993	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
1994	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
1995	3,314	[a]	[a]	[a]	[a]	[a]	[a]	[a]
1996	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
1997	3,611	12,610	[a]	[a]	1,447	19,843	[a]	[a]
1998	578	3,497	2,743	[a]	731	11,632	3,619	[a]
1999	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
2000	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
2001	3,561	29,340	7,330	[a]	2,799	12,383	6,945	[a]
2002	1,470	[a]	3,075	[a]	1,195	[a]	1,208	[a]
2003	3,935	50,140	[a]	[a]	2,131	29,150	[a]	[a]
2004	7,462	31,695	[a]	[a]	2,617	33,670	[a]	[a]
2005	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
2006	4,159	78,100	[a]	[a]	[a]	[a]	[a]	[a]
SEG	640–3,300	5,500–19,500	[b]	[b]	[b]	[b]	[b]	[b]
10-Year Average [c]	2,937	27,453	8,558		1,772	18,159	5,678	

[a] Survey was either not flown or not rated as acceptable.

[b] Aerial survey SEG was discontinued in 2004.

[c] Most Recent 10 year average from years with acceptable data..

APPENDIX D. GOODNEWS TOTAL RUN AND EXPLOITATION

Appendix D1.–Historical Chinook salmon total run estimates and exploitation rates, Goodnews River drainage, 1981–2006.

	Escapement		Harvest				
Year	Middle Fork	North Fork [a]	Commercial	Subsistence	Sport	Total Run	Annual Exploitation
1981	3,688	4,859 [b]	7,190	1,409		17,146	0.50
1982	1,395	1,796	9,476	1,236		13,903	0.77
1983	6,027	6,268	14,117	1,066	31	27,509	0.55
1984	3,260	5,481	8,612	629		17,982	0.51
1985	2,831	4,882	5,793	426	323	14,255	0.46
1986	2,080	1,779	2,723	555		7,137	0.46
1987	2,272	2,294	3,357	816		8,739	0.48
1988	2,712	3,423	4,964	310		11,409	0.46
1989	1,915	976	2,966	468	68	6,393	0.55
1990	3,636	4,204	3,303	539		11,682	0.33
1991	1,952	2,257	912	917	26	6,063	0.31
1992	1,905	2,202	3,528	374	23	8,033	0.49
1993	2,349	2,716	2,117	708	81	7,970	0.36
1994	3,856	4,458	2,570	784	163	11,831	0.30
1995	4,836	5,591	2,922	883	41	14,272	0.27
1996	2,931	3,389	1,375	415	157	8,266	0.24
1997	2,937	7,329	2,039	449	86	12,840	0.20
1998	4,584	3,625	3,675	718	431	13,032	0.37
1999	3,221	3,647	1,888	871	223	9,850	0.30
2000	2,500	2,831	4,442	703	243	10,719	0.50
2001	5,351	6,808	1,519	895	147	14,720	0.17
2002	3,085	3,795	979	857	224	8,939	0.23
2003	2,389	4,411	1,412	737	10	8,959	0.24
2004	4,388	12,512	2,565	954	100	20,520	0.18
2005	4,633	7,405	2,035	868	0	14,941	0.19
2006	4,559	11,704 [c]	2,892	862 [d]	96 [d]	20,113	0.19
						Historical Average	0.37
						20-year average	0.32
						15-year average	0.28
						10-year average	0.26
						5-year average	0.21

[a] North Fork estimate calculated using aerial survey proportions from concurrent years or most recent 5-year averages when aerial surveys were not flown or were incomplete.

[b] North Fork estimate calculated using 5-year average from aerial survey proportions from 1982–1986.

[c] North Fork estimate calculated using partial aerial survey proportions from 2006.

[d] 5-year average (2001–2005).

Appendix D2.–Historical sockeye salmon total run estimates and exploitation rates, Goodnews River drainage, 1981–2006.

	Escapement		Harvest				
Year	Middle Fork	North Fork [a]	Commercial	Subsistence	Sport	Total Run	Annual Exploitation
1981	49,108	39,724 [b]	40,273			129,105	0.31
1982	56,255	45,506 [b]	38,877			140,638	0.28
1983	25,816	42,224	11,716		14	79,770	0.15
1984	32,053	22,964	15,474			70,491	0.22
1985	24,131	8,634	6,698	704	75	40,242	0.19
1986	51,069	26,932	25,112	943	122	104,178	0.25
1987	28,871	23,311	27,758	955	266	81,161	0.36
1988	15,799	12,780	36,368	1,065		66,012	0.57
1989	21,186	9,495	19,299	861	146	50,986	0.40
1990	31,679	18,103	35,823	1,123		86,728	0.43
1991	47,397	27,085	39,838	1,282	63	115,665	0.36
1992	27,268	15,582	39,194	826	8	82,878	0.48
1993	26,452	15,116	59,293	836	53	101,749	0.59
1994	50,801	29,030	69,490	770	70	150,161	0.47
1995	39,009	22,291	37,351	253	34	98,938	0.38
1996	58,290	33,309	30,717	418	87	122,822	0.25
1997	35,530	22,579	31,451	609	61	90,230	0.36
1998	49,513	14,885	27,161	508	502	92,570	0.30
1999	48,205	26,214	22,910	872	561	98,762	0.25
2000	32,341	17,587	37,252	1,205	82	88,467	0.44
2001	21,024	49,814	25,654	974	108	97,574	0.27
2002	22,101	20,161	6,304	1,050	149	49,765	0.15
2003	44,387	76,349	29,423	783	42	150,984	0.20
2004	55,926	52,646	20,922	960	0	130,454	0.17
2005	113,809	135,820	23,933	1,233	0	274,795	0.09
2006	126,772	151,290	29,857	1,000 [c]	60 [c]	308,980	0.10
						Historical Average	0.31
						20-year average	0.33
						15-year average	0.30
						10-year average	0.23
						5-year average	0.14

[a] North Fork estimate calculated using aerial survey proportions from concurrent years or most recent 5-year averages when aerial surveys were not flown or were incomplete.

[b] North Fork estimate calculated using 5-year average from aerial survey proportions from 1983–1987.

[c] 5-year average (2001–2005).