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Review of Salmon Escapement Goals in the Kodiak Management Area, 2013

by

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

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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)

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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ABSTRACT

In April 2013, an interdivisional team of staff from the Alaska Department of Fish and Game reviewed existing Pacific salmon *Oncorhynchus* spp. escapement goals in the Kodiak Management Area (KMA) for the purpose of making recommendations to the directors of the divisions of Commercial and Sport Fisheries. The KMA salmon escapement goals had previously been reviewed in 2010. The staff team recommended changing one goal. One goal was recommended for elimination, and none were recommended to be added for systems currently without escapement goals.

The team recommended increasing the Buskin River coho *O. kisutch* biological escapement goal (BEG) of 3,200 to 7,200 fish to a BEG of 4,700 to 9,600 fish. The staff team recommended eliminating the sockeye salmon *O. nerka* escapement goal for Little River.

When combined with existing escapement goals, these staff recommendations to the directors of the divisions of Commercial and Sport Fisheries result in 24 escapement goals for the KMA in 2014: 13 for sockeye salmon, 2 for Chinook salmon *O. tshawytscha*, 4 for coho salmon, 3 for pink salmon *O. gorbuscha*, and 2 for chum salmon *O. keta*.

Key words: Pacific salmon, *Oncorhynchus*, escapement goal, Kodiak, stock status

INTRODUCTION

This report documents the 2013 review of salmon escapement goals in the Kodiak Management Area (KMA) based on the Alaska Board of Fisheries (board) *Policy for the management of sustainable salmon fisheries* (SSFP; 5 AAC 39.222) and the *Policy for statewide salmon escapement goals* (5 AAC 39.223). Recommendations from this review are made to the directors of the divisions of Commercial and Sport Fisheries of the Alaska Department of Fish and Game (department), and are intended to take effect for salmon stocks returning in 2014. Salmon escapement goals in the KMA were last reviewed in 2010 (Nemeth et al. 2010).

Two important terms defined in the SSFP are:

- "*biological escapement goal* (BEG): the escapement that provides the greatest potential for maximum sustained yield (MSY); …" and
- "*sustainable escapement goal* (SEG): a level of escapement, indicated by an index or an escapement estimate, that is known to provide for sustained yield over a 5- to 10-year period, used in situations where a BEG cannot be estimated or managed for…"

A report documenting the established escapement goals for stocks of 5 Pacific salmon species (Chinook *O. tshawytscha*, sockeye *O. nerka*, coho *O. kisutch*, pink *O. gorbuscha*, and chum *O. keta* salmon) spawning in the Kodiak, Chignik, Alaska Peninsula, and Aleutian Islands management areas of Alaska was prepared in 2001 (Nelson and Lloyd 2001). Most of the escapement goals documented in the 2001 report were based on average escapement estimates and spawning habitat availability, and had been implemented in the early 1970s and 1980s.

Since 2001, escapement goals for the KMA have gone through board review 3 times (2005, 2007, and 2010; Nelson et al. 2005; Honnold et al. 2007; Nemeth et al. 2010).

In April 2013, the Salmon Escapement Goal Interdivisional Review Team (hereafter referred to as the team) was formed to review the existing KMA salmon escapement goals and recent escapements for stocks with escapement goals. The team included staff from the Division of Commercial Fisheries and the Division of Sport Fish.

For this review, the team 1) determined the appropriate goal type (BEG or SEG) for each KMA salmon stock with an existing goal, based on the quality and quantity of available data;

2) determined the most appropriate methods to evaluate the escapement goal ranges; 3) estimated the escapement goal for each stock and compared these estimates with the current goal; 4) determined if a goal could be developed for any stocks or stock-aggregates that currently have no goal; 5) developed recommendations for each goal evaluated to present to the directors of the divisions of Commercial Fisheries and Sport Fish for approval; and 6) reviewed recent escapements to all stocks with escapement goals.

STUDY AREA

The KMA comprises the waters of the western Gulf of Alaska surrounding the Kodiak Archipelago, and along that portion of the Alaska Peninsula that drains into the Shelikof Strait between Cape Douglas and Kilokak Rocks (Figure 1).

The Kodiak Island archipelago extends from Shuyak Island south to Tugidak Island, a distance of approximately 240 km (150 miles). The Mainland portion of the KMA is about 256 km (160 miles) long and is separated from the archipelago by Shelikof Strait, which averages 48 km (30 miles) in width. Chirikof Island, located approximately 64 km (40 miles) south southwest of Tugidak Island, is also included in the KMA (Figure 1).

The KMA is divided into 7 commercial fishing districts: Afognak, Northwest Kodiak, Southwest Kodiak, Alitak, Eastside Kodiak, Northeast Kodiak, and Mainland districts (Jackson et al. 2012; Figure 1). These are further subdivided into sections, each of which is composed of smaller statistical areas, including terminal or special harvest areas. For commercial salmon fisheries, legal gear in districts or sections can consist of purse seines, hand purse seines, beach seines, or set gillnets. Subsistence and sport fisheries occur throughout the KMA.

Commercial fisheries in the KMA primarily target sockeye salmon from June through early July; some early chum salmon stocks may influence management in localized areas (Jackson et al. 2012). Pink salmon stocks are targeted from early July through mid-August, with some areas managed specifically for local sockeye or chum salmon stocks. Late-run sockeye, coho, and late returning chum salmon are targeted from mid-August through early September; coho salmon are the targeted species in late September and October.

METHODS

During the review process, escapement goals were evaluated for 2 Chinook, 14 sockeye, and 4 coho salmon stocks (Table 1). In addition, 3 pink and 2 chum salmon stock-aggregate goals were reviewed (Table 1). We conducted our review similarly to the 2010 review (Nemeth et al. 2010), primarily examining recent (2010–2012) data and updating previous analyses. We did not review or analyze data for most stocks in which goals were eliminated in 2010. A formal meeting, via teleconference, to discuss and develop recommendations was held on April 2, 2013. The team also communicated on a regular basis by telephone and email.

Available escapement, harvest, and age data associated with each stock or combination of stocks to be examined were compiled from research reports, management reports, and unpublished historical databases. Limnological and spawning habitat data were compiled for each system when available. The team evaluated the type, quality, and amount of data for each stock

according to criteria described in Bue and Hasbrouck.[1] This evaluation was used to assist in determining the appropriate type of escapement goal to apply to each stock, as defined in the SSFP and the *Policy for statewide salmon escapement goals*.

Biological Escapement Goal

In Alaska, most salmon BEGs are developed using Ricker (1954) spawner-recruit models (Munro and Volk 2010). As defined in the SSFP (5 AAC 39.222), BEGs are estimates of the number of spawners that provide the greatest potential for maximum sustained yield (S_{MSY}). For this review, ranges surrounding S_{MSY} were calculated as the escapement estimates that produced yields of at least 90% of MSY (CTC 1999; Hilborn and Walters 1992). The carrying capacity was estimated by the Ricker model as the escapement level which will provide an equivalent level of return or replacement (Quinn and Deriso 1999). Carrying capacity is defined as S_{EQ} and is the expected annual abundance of spawners when the stock has not been exploited. Estimates of S_{MSY} and S_{EQ} were not used if the model fit the data poorly or if model assumptions were violated. Hilborn and Walters (1992), Quinn and Deriso (1999), and the Chinook Technical Committee (CTC; 1999) provide good descriptions of the Ricker model and diagnostics to assess model fit. All Ricker models assumed a multiplicative error structure and were tested for residual autocorrelation, which was not corrected for if present (in non-Bayesian models) based on the recommendations of Korman et al. (1995) for Alaskan sockeye salmon stocks. When auxiliary data were available (e.g., limnology and/or smolt abundance, age, and size) they were summarized and biological trends were compared to estimates of adult production.

Sustainable Escapement Goal

Sustainable escapement goals (SEGs) were developed using several methods, depending on the system, species, and type of data available. For this review, most SEGs were determined using the percentile method (Bue and Hasbrouck unpublished), risk analysis (Bernard et al. 2009), or spawner-recruit model (Ricker 1954; described above). Other methods used were the yield analysis (Hilborn and Walters 1992), euphotic volume model (Koenings and Kyle 1997), and zooplankton forage model (Koenings and Kyle 1997). These latter two habitat-based models were used only for sockeye salmon to assess the likely number of fish that can be supported given available habitat or food. Escapement goals were generally not based on results from these models, but results were instead used as a secondary, alternative analysis that was less dependent on fish count data. When used, results from the euphotic volume and zooplankton forage models were reported as generally corroborating or not corroborating the primary analysis.

The percentile approach followed the methods of Bue and Hasbrouck (unpublished), whereby the contrast of the escapement data (i.e., ratio of the highest observed escapement to the lowest observed escapement) and the exploitation rate of the stock were used to select the percentiles of observed annual escapements to be used for estimating the SEG. Low contrast (<4) implies that stock productivity is known for only a limited range of escapements. According to this approach, percentiles of the total range of observed annual escapements that are used to estimate an SEG for a stock with low contrast should be relatively wide, in an attempt to improve future knowledge of stock productivity. In cases where data contrast was less than 4 and the exploitation rate was low, the lower end of the SEG was the 15th percentile of the escapement

[1] Bue, B. G., and J. J. Hasbrouck. *Unpublished*. Escapement goal review of salmon stocks of Upper Cook Inlet. Alaska Department of Fish and Game, Report to the Alaska Board of Fisheries, November 2001 (and February 2002), Anchorage. Subsequently referred to as "Bue and Hasbrouck unpublished."

data and the upper end of the SEG was the maximum observed escapement estimate. Alternately, in cases where contrast was larger, the percentiles of observed annual escapements used to estimate an SEG were narrowed. For stocks with high contrast and at least moderate exploitation, the lower end of the SEG was increased from the 15th to the 25th percentile as a precautionary measure for stock protection. The percentiles used at different levels of contrast were:

Escapement Contrast and Exploitation	SEG
Low Contrast (<4)	15th Percentile to max. observation
Medium Contrast (4 to 8)	15th to 85th Percentile
High Contrast (>8); Low Exploitation	15th to 75th Percentile
High Contrast (>8); At least Moderate Exploitation	25th to 75th Percentile

The risk analysis (Bernard et al. 2009) was used to establish a lower bound SEG, in the form of a precautionary reference point, from a time series of observed escapement estimates using probability distributions. This method is based on estimating the risk of management error and is particularly appropriate in situations where a stock (or stock aggregate) is not "targeted" and observed escapement estimates are the only reliable data available. In essence, this analysis estimates the probability of detecting escapement falling below the SEG in a predetermined number of consecutive years (*k*). For example, if we believe there is cause for concern when escapement falls below the SEG for 3 consecutive years, *k* would be equal to 3. Simultaneously, a second probability is estimated, that is the probability of taking action (e.g., closing a fishery to protect the stock) for three consecutive years when no action was needed. This analysis assumes that escapement observations follow a lognormal distribution and have a stationary mean (i.e., no temporal trend).

The yield analysis was similar to that used by Hilborn and Walters (1992), and entailed applying a tabular approach to examine escapement versus yield relationships. Escapements were arranged into size-intervals. Multiple ranges for the size intervals were used, to provide varying aggregations of escapements. For each escapement interval, several measures of yield from the observed escapements in that interval were calculated. Specifically, the average and median return-per-spawner, average and median surplus yield (estimated as the return minus parental spawning escapement), and average and median observed harvest. The average and median were both calculated because averages are highly influenced by large or small values.

The euphotic volume (EV) model followed the methods of Koenings and Kyle (1997) and estimated adult escapement in part by determining the volume of lake water capable of primary production that could sustain a rearing population of juvenile sockeye salmon. The euphotic volume indicated a level of phytoplankton forage (primary production) available to zooplankton, and thus a level of zooplankton forage available for rearing juvenile fish. The model assumed that shallower light penetration would result in lower adult production compared to lakes with deeper light penetration because the shallower lakes would not have the primary production necessary to sustain a larger rearing population. The EV model assumes there is no primary productivity below depths at which light has been attenuated by 99%.

The zooplankton model, as described in Witteveen et al. (2005), estimated smolt production based on an available zooplankton biomass fed upon by smolt of a targeted threshold size, in a lake of known size (Koenings and Kyle 1997). The zooplankton model, like the EV model, uses

the premise that the availability of forage could impact survival of juvenile fish and subsequent adult production. Adult production was calculated using species fecundity and marine survival rates. The zooplankton model assumes zooplankton is the only available forage.

CHINOOK SALMON

Ayakulik and Karluk Rivers

The Ayakulik and Karluk rivers are both located on southwestern Kodiak Island and support the two largest Chinook salmon stocks in the KMA. The Ayakulik River drains Red Lake, then flows into Shelikof Strait in the area designated as Inner Ayakulik Section of Southwest Kodiak District (Jackson et al. 2012; Figures 1 and 2).The Karluk River drains Karluk Lake, then flows into the Shelikof Strait in the area designated as Inner Karluk Section of Southwest Kodiak District (Jackson et al. 2012; Figures 1 and 2).

Biological escapement goals have been developed for Ayakulik and Karluk river Chinook salmon stocks. Chinook salmon returning to each system are counted using weirs (Fuerst 2013). Annual Chinook salmon escapements for Ayakulik and Karluk rivers were estimated by subtracting estimates of recreational and subsistence harvest from the inriver run counted at a weir on both systems (Tracy et al. 2012). Weir counts at the Ayakulik River were available from 1972 to 2012, although data from 1972 to 1976 were excluded because the weir was upstream of some Chinook salmon spawning locations in those years. Counts for 1980 and 1982 were expanded based on average run timing to the weir to account for days the weir was not operational. Weir counts were available from 1976 to 2012 for the Karluk River. Karluk Lake served as the broodstock for Chinook salmon stocking projects on the road system; brood was collected from 2000–2004.

Sport harvests for Chinook salmon in both drainages were estimated by the Statewide Harvest Survey (Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, 2007, 2009a-b, 2010a-b, 2011a-b, *In prep* a-b).[2] Commercial harvests were tallied from the Division of Commercial Fisheries Statewide Harvest Receipt (fish ticket) database. Because stock-specific harvests by the commercial fishery are not available, all Chinook salmon in the Inner (256-15) and Outer (256-20) Ayakulik sections from June 1 through July 15 were assumed to be of Ayakulik River origin. Harvests occurring from June 1 through July 15 were used to most closely match traditional run timing of both Chinook salmon stocks. Similarly, total commercial harvests of Chinook salmon in Inner (255-10) and Outer (255-20) Karluk sections from June 1 through July 15 were assumed to be Karluk River fish. Annual subsistence harvests were estimated from returns of completed permits received by the Division of Commercial Fisheries.

Scales were collected from Chinook salmon sampled at weirs operated on both drainages to estimate age composition of the run. Age composition of the commercial harvest was assumed the same as that observed at the weir. Age data were only available from 1993 to 2009. Age compositions of runs prior to 1993 were estimated using the average age composition of runs in known years.

Brood tables were developed for Ayakulik River returns beginning in 1977 and for Karluk River returns beginning in 1976. A brood table was constructed from returns by year and age

[2] This set of citations is subsequently referred to as "Statewide Harvest Survey" within this report and its appendices.

composition. Total run by age was estimated by multiplying total run and age composition of Chinook salmon sampled at the weirs. Age-specific returns were summed for each brood year to estimate total return by brood year. Return-per-spawner was then estimated as the total return from each brood year divided by the escapement for that brood year.

Escapement Goal Background and Previous Review

An initial Ayakulik River Chinook salmon SEG of 6,500 to 10,000 fish was established based on average historical escapements providing harvestable surpluses (Nelson and Lloyd 2001). During the 2001–2002 board meeting cycle, a BEG of 4,800 to 9,600 fish was established based on a spawner-recruit analysis[2]. The BEG was reevaluated in 2005 using an updated Ricker analysis, but was subsequently left unchanged (Nelson et al. 2005). The BEG was evaluated again in 2007, with the conclusion that the most recent 3 years of data would not substantially change the results of previous analyses (Honnold et al. 2007). An analysis in 2010 changed the BEG to 4,000 to 7,000 fish (Nemeth et al. 2010).

In 1996, a Karluk River Chinook salmon SEG of 4,500 to 8,000 fish was established based on average historical escapements providing harvestable surpluses (Nelson and Lloyd 2001). During the 2001–2002 Alaska Board of Fisheries (board) meeting cycle, a BEG of 3,600 to 7,300 spawners was established based on a spawner-recruit analysis (Hasbrouck and Clark[3] *unpublished*). The BEG was reevaluated in 2005 using an updated Ricker analysis, but was subsequently left unchanged (Nelson et al. 2005). The BEG was evaluated again in 2007, with the conclusion that addition of the most recent 3 years of data would not substantially change the results of previous analyses (Honnold et al. 2007). An analysis in 2010 changed the BEG to 3,000 to 6,000 fish (Nemeth et al. 2010).

2013 Review

The team reviewed the most recent escapement data available for both stocks. The team concluded that these data would not substantially affect the results of previous escapement goal analyses and thus, recommended no further analysis of the escapement goals.

SOCKEYE SALMON

The team added escapement data from 2010 through 2012 to the existing data sets for sockeye salmon stocks in the KMA (Table 1). Six out of the 14 stocks with escapement goals in the KMA were reevaluated.

Afognak Lake

Afognak Lake is located on the southeast side of Afognak Island and has supported one of the largest sockeye salmon runs on the island (Schrof and Honnold 2003; Nelson et al. 2005). The lake drains (via the Afognak River) into Afognak Bay, which is located within the Southeast Afognak Section of the Afognak District (Jackson et al. 2012; Figures 1 and 2). A counting weir was established in 1921 at the lake outlet and run intermittently through 1977. From 1978 through the present escapement monitoring has been continuous, although the weir was moved in 1986 from the lake outlet to 200 meters upstream from the mouth of the Afognak River (Thomsen and Richardson 2013). In response to declining adult returns in 1987, ADF&G in

[3] Hasbrouck, J. J., and R. A. Clark. Unpublished. Escapement Goal Review of Chinook Salmon in the Ayakulik, Chignik, and Karluk Rivers. Alaska Department of Fish and Game, Report to the Board of Fisheries 2002, Anchorage.

cooperation with the Kodiak Regional Aquaculture Association (KRAA) initiated pre-fertilization investigations (Honnold and Schrof 2001). Results of these investigations resulted in fertilizing Afognak Lake from 1990–2000 (White et al. 1990), and backstocking in 1991, 1993, 1995, 1996, and 1997. Afognak Lake has been a brood source for KRAA stocking projects since 1991.

Escapement Goal Background and Previous Review

The first published escapement goal for Afognak Lake was developed in 1988 and set at 20,000 to 40,000 sockeye salmon (Nelson and Lloyd 2001). Escapement goal reviews of this system were conducted in 2004, 2007, and 2010. All available stock assessment data were analyzed using a spawner-recruit analysis, the percentile method, euphotic volume analysis, and smolt biomass as a function of zooplankton (Nelson et al. 2005). The 2004 review resulted in changing the Afognak Lake SEG to a BEG of 20,000 to 50,000 sockeye salmon (starting in the 2005 season). The 2007 and 2010 reviews indicated that no changes were warranted to the Afognak Lake BEG (Honnold et al. 2007; Nemeth et al. 2010).

2013 Review

The Afognak sockeye salmon escapement goal was last reviewed in 2010. Recent escapement data were examined to determine if a change in the escapement goal was justified and the team agreed that no further analysis was necessary.

Ayakulik River

The Ayakulik River drainage is the second largest river system on Kodiak Island and drains approximately 500 km^2 of land on southwest Kodiak Island, including Red Lake (Hander 1997; Figures 1 and 2). The Ayakulik River sockeye salmon run extends from late May until September. Most sockeye salmon spawning is believed to occur in Red Lake or its associated tributaries.

Escapement Goal Background and Previous Review

The original sockeye salmon SEG of 200,000 to 300,000 fish for the Ayakulik River was established in 1983 based on spawning habitat observations of different run segments, historical escapement numbers, and recommendations from previous fishery managers (Nelson and Lloyd 2001). Prior to 1989, Ayakulik River sockeye salmon was divided into early and late segments with separate escapement goals. Review in 2004, using all available stock assessment data in spawner-recruit, yield analysis, euphotic volume, and zooplankton biomass models, led to changing the Ayakulik River SEG to 200,000–500,000 fish (Nelson et al. 2005). The 2007 escapement goal review team recommended no change to the Ayakulik River sockeye salmon SEG. In 2010, the team recommended reinstituting separate early- and late-run goals for Ayakulik sockeye salmon; this was based on run-timing curves and new genetics data (Gomez-Uchida et al. 2012). An early-run SEG of 140,000 to 280,000 fish through July 15 and a late-run SEG of 60,000 to 120,000 fish after July 15 was adopted based on zooplankton biomass models and historical escapement goals (Table 1; Nemeth et al. 2010).

2013 Review

The Ayakulik River sockeye salmon escapement goal was last reviewed in 2010. Recent escapement data were examined to determine if a change in the escapement goal was justified and the team agreed that no further analysis was necessary.

Buskin River

The Buskin River is located on the northeast side of Kodiak Island and flows into Chiniak Bay near the city of Kodiak (Figure 1). Annual escapement of sockeye salmon to the Buskin River watershed has been counted at a weir since 1985 (Schmidt and Evans 2010). Until 1990, the Buskin River weir was located about 2.5 km upstream of the river mouth. In 1990, the weir was relocated to the outlet of Buskin Lake due to numerous washouts caused by high water conditions. In most years, the weir was operated at this site from late May through late July or early August for sockeye salmon, then moved downstream to count coho salmon through September (Fuerst 2013).

Annual subsistence harvests of Buskin River sockeye salmon are estimated from returns of completed permits received by the Division of Commercial Fisheries. Approximately 90% of completed permits are returned annually (J. Shaker, Alaska Department of Fish and Game, Kodiak, personal communication), and likely account for most of the annual subsistence harvest.

Stock-specific harvest estimates were available for the Buskin River sockeye salmon fisheries from 1990 through 2012. Sport harvests of Buskin River sockeye salmon are estimated by the Statewide Harvest Survey, while commercial harvests are tallied from the Division of Commercial Fisheries Statewide Harvest Receipt (fish ticket) database, and include catches for the Woman's Bay (259-22) and Buskin River sections (259-26).

Age composition of Buskin River sockeye salmon are estimated from escapement and subsistence harvests (Schmidt and Evans 2010). Age composition of commercial and sport harvests is assumed to be the same as the escapement. Age composition data were available for all years analyzed except 1999, when age composition was estimated using the average from 1996 through 1998.

Escapement Goal Background and Previous Review

A Buskin Lake sockeye salmon SEG of 8,000 to 13,000 fish was developed in 1996, based on historical weir counts (Nelson and Lloyd 2001). The SEG was reevaluated in 2005; at that time, spawner-recruit data did not provide adequate information to develop a BEG for this stock, although the model suggested that a point estimate of S_{MSY} may be lower than the 8,000 to 13,000 SEG (Nelson et al. 2005). The SEG was reevaluated again in 2007 and left unchanged (Honnold et al. 2007). In 2010, the analysis was updated again and the SEG was changed to a BEG and lowered to 5,000 to 8,000 (Nemeth et al. 2010).

2013 Review

With only 3 years of additional data since the 2010 review, the team agreed no further analysis was necessary.

Frazer Lake

Frazer Lake is located on the southwest side of Kodiak Island and supports one of the largest sockeye salmon runs in the Kodiak Archipelago (Jackson et al. 2012). Sockeye salmon were introduced into the previously barren lake from 1951 through 1971 (Blackett 1979). The major donor stocks for Frazer were the nearby Red (Ayakulik River drainage) and Karluk lakes. Frazer Lake's outlet creek, Dog Salmon Creek, flows into Olga Bay. The Olga Bay and Dog Salmon Flats sections within the Alitak District are the nearest fisheries management sections (Figures 1 and 2). A fish pass was constructed in 1962 to allow sockeye salmon to migrate around the

barrier falls and into the lake. Frazer Lake was fertilized from 1988 to 1992 because of concerns about low escapement and poor smolt production.

Escapement Goal Background and Previous Review

The Frazer Lake sockeye salmon escapement goal, which initially did not have a range, was 175,000 sockeye salmon from the 1950s through the 1970s while the run was in development.[4] In 1981, the Frazer Lake escapement goal was changed to 350,000 to 400,000 sockeye salmon based upon rearing capacity and spawning habitat calculations (Nelson and Lloyd 2001). The goal range was lowered to 200,000 to 275,000 fish in 1986, with a BEG of 140,000 to 200,000 fish established in 1988.

Subsequent escapement goal reviews of this system were conducted during 2004 and 2007. All available stock assessment data were analyzed using the spawner-recruit analysis, percentile method, euphotic volume analysis, smolt biomass as a function of zooplankton biomass, and spawning habitat models (Nelson et al. 2005). The 2004 review team recommended decreasing the Frazer Lake BEG to 70,000 to 150,000 fish based on a spawner-recruit analysis, excluding data from years affected by fertilization. The recommendation was adopted by the department and the new BEG went into effect in 2005. The 2007 review resulted in changing the BEG to 75,000 to 170,000 fish (Honnold et al. 2007). In 2010, the spawner-recruit analysis was updated again, and based on the results, the team recommended no change to the BEG (Nemeth et al. 2010).

2013 Review

The team recognized that the Frazer Lake escapement goal was just reviewed in 2010 and available data was unlikely to result in a change. The same is true for the Upper Station escapement goal which will be discussed later in this report. However, the team recognized that the Upper Station escapement goal may be a topic of discussion at the 2014 board meeting and an updated review may assist in those discussions. Management of Upper Station and Frazer Lake are closely related, so the team felt that accompanying the update to the Upper Station escapement goal review should be an updated review of the Frazer Lake escapement goal. Sockeye salmon escapements into Frazer Lake have been counted since 1956 (Appendices F1–F3). Stock-specific harvest estimates were available for the Frazer Lake sockeye salmon fisheries from 1974 to 2012.

Spawner-recruit relationships were estimated for the run by analyzing spawning stock and recruitment data from brood years 1966 to 2005 (Appendix F5) using a Ricker spawner-recruit model (Eggers 2001; Hilborn and Walters 1992; Ricker 1954) with a multiplicative error structure (Quinn and Deriso 1999). Spawner-recruit data not affected by fertilization of Frazer Lake (excluding brood year data from 1985 to 1991) was used. If a Ricker spawner-recruit model was significant, S_{MSY} was estimated, along with the range of escapements that would produce 90% to 100% of MSY. Residuals were examined for autocorrelation, temporal trends, and potential bias due to lake fertilization.

Limnology data from 1985 to 1997 and from 2001 to 2012 were analyzed using zooplankton biomass and euphotic volume models to assess optimal escapement levels.

[4] Sagalkin, N.H. Unpublished. Frazer Lake escapement goal history through 1998. Alaska Department of Fish and Game, unpublished memorandum, Kodiak.

Karluk Lake

Karluk Lake is located on the west side of Kodiak Island and supports the largest sockeye salmon run in the KMA (Jackson et al. 2012). The lake's outlet stream, the Karluk River, flows into Shelikof Strait in the area designated as the Inner Karluk Section of the Southwest Kodiak District (Jackson et al. 2012). Two temporally distinct sockeye salmon runs return to Karluk Lake (Barrett and Nelson 1994). The early run returns from late May until mid-July and the late run returns from mid-July through September. Karluk Lake was fertilized from 1986 to 1990, and sockeye salmon fry were backstocked into the Upper Thumb River from 1979 to 1987.

Escapement Goal Background and Previous Review

Published escapement goals for Karluk Lake date back to the 1970s. Many of the early goals are split into months (Nelson and Lloyd 2001). From 1988 to 1991, there was an early-run escapement goal of 250,000 to 350,000 fish and a late-run escapement goal of 310,000 to 550,000 fish. In 1992, spawner-recruit analyses were used to develop BEGs of 150,000 to 250,000 fish for the Karluk Lake early run and 400,000 to 550,000 fish for the Karluk Lake late run (Nelson and Lloyd 2001). Escapement goals were reviewed again in 2004, when all available stock assessment data were evaluated using a spawner-recruit analysis, euphotic volume analysis, and smolt biomass as a function of zooplankton biomass. The review resulted in changing the BEG for the Karluk Lake sockeye salmon stocks to 100,000 to 210,000 fish for the early run and to 170,000 to 380,000 fish for the late run (Nelson et al. 2005). After the next review by Honnold et al. in 2007, the early-run BEG was changed to 110,000 to 250,000 sockeye salmon (based on spawner-recruit analysis with the inclusion of recent strong brood-year returns) and the late-run BEG was left at 170,000 to 380,000 fish (Honnold et al. 2007). The goals were reviewed again in 2010 and left unchanged (Nemeth et al. 2010).

2013 Review

The early- and late-run sockeye salmon Karluk Lake escapement goals were last reviewed in 2010. Recent escapement data were examined to determine if a change in the escapement goal was justified and the team agreed that no further analysis was necessary.

Little River

The Little River is located on the northwest side of Kodiak Island. The river drains Little River Lake, then flows into Shelikof Strait in the Central Section of the Northwest Kodiak District (Jackson et al. 2012; Figures 1 and 2).

Escapement Goal Background and Previous Review

The first published escapement goal for Little River Lake was developed in 1988 and set at 15,000 to 25,000 sockeye salmon (Nelson and Lloyd 2001).

An escapement goal review of this system was conducted in 2004. All available stock assessment data were analyzed using the risk analysis and the percentile methods (Nelson et al. 2005). The review team ultimately recommended eliminating the Little River sockeye salmon SEG due to incomplete escapement data and the inability to actively manage escapements to this system. Both of these limitations were expected to remain in the future. Thus, the SEG was eliminated in 2005.

The 2007 escapement goal review team concluded that an escapement goal on Little River Lake sockeye salmon was warranted because the stock was located within a large commercial fishery

section and thus, potentially subject to high exploitation. After conducting a risk analysis using aerial survey and weir data, the team recommended a lower-bound SEG of 3,000 sockeye salmon that was then implemented in 2008 (Honnold et al. 2007). In 2010, the SEG was reviewed again and the team recommended no change to the SEG (Nemeth et al. 2010).

2013 Review

Escapements 2010–2012 were above the lower-bound SEG, ranging from 3,200 to 6,300 fish. While the SEG was reviewed recently in 2010, the team recognized that aerial surveys for the system were low priority because no management actions are based upon the SEG. As a result, the team recommended further review of the goal.

Malina Creek

Malina Creek is located on the southwest side of Afognak Island in the Kodiak Archipelago. The creek drains two lakes (Upper and Lower Malina lakes), then flows westerly into Malina Bay, in the Southwest Afognak Section of the Afognak District (Figures 1 and 2). The system supports a small run of sockeye salmon. Malina Lake is used as a backup brood source by KRAA for early-run stocking projects; broodstock was obtained from Malina Lake in 2004 and 2005. To increase the natural production of sockeye salmon into the system, Upper Malina Lake was fertilized from 1991 through 2001, and Lower Malina Lake was fertilized from 1996 through 2001. The lakes were backstocked with juvenile sockeye fry from 1992 to 1999 (Schrof and Honnold 2003).

Escapement Goal Background and Previous Review

The first published escapement goal for Malina Creek was developed in 1988 and was set at 5,000 to 10,000 sockeye salmon based on historical aerial survey indexed escapements and, to a lesser extent, cursory spawning habitat evaluations (Nelson and Lloyd 2001). The SEG was revised to 10,000 to 20,000 in 1992, based on further limnological studies and rehabilitation investigations (Kyle and Honnold 1991). A review in 2004 recommended reducing the SEG to 1,000 to 10,000 fish; this recommendation was based on the results of the percentile approach and zooplankton biomass model. With 3 years of additional data, the 2007 escapement goal review team determined that the additional stock assessment data would not substantially affect the results of previous escapement goal analyses. Thus, the Malina Creek sockeye salmon SEG was left unchanged in 2007 (Honnold et al. 2007). A review in 2010 with updated limnology and aerial survey corroborated the SEG, and the team recommended no change (Nemeth et al. 2010).

2013 Review

The Malina Lake sockeye salmon escapement goal was last reviewed in 2010. Recent escapement data were examined to determine if a change in the escapement goal was justified and the team agreed that no further analysis was necessary.

Pasagshak River

The Pasagshak River, which drains from Lake Rose Tead into Ugak Bay of the Eastside Kodiak District. The system is also located on the Kodiak Island road system and supports one of the largest sockeye salmon subsistence fisheries for Kodiak Island residents (Figures 1 and 2). Historically, escapement was estimated using aerial and foot surveys of the spawning grounds, but there has been a weir since the 2011 season.

Escapement Goal Background and Previous Review

The first Pasagshak River sockeye salmon escapement goal was 1,000 to 5,000 fish and was established in 1988 (Nelson and Lloyd 2001) based on historical aerial survey index counts and, to a lesser extent, cursory spawning habitat evaluations. Nelson and Lloyd (2001) noted that this goal may be too low. In 2004, the SEG was revised to 3,000 to 12,000 fish, based on the percentile approach and a risk analysis (Nelson et al. 2005). This goal was assessed again in 2010 and a lower-bound SEG of 3,000 fish was implemented in 2011(Nemeth et al. 2010).

2013 Review

The Pasagshak River sockeye salmon escapement goal was last reviewed in 2010. Recent escapement data were examined to determine if a change in the escapement goal was justified and the team agreed that no further analysis was necessary.

Saltery Lake

Saltery Lake is located southwest of the city of Kodiak and is one of the most productive sockeye salmon systems on the east side of Kodiak Island (Honnold and Sagalkin 2001; Jackson et al. 2012). The Inner Ugak Bay Section of the Eastside Kodiak District is the nearest fisheries management area to the confluence of the lake's outlet creek (Saltery Creek) and Ugak Bay (Figures 1 and 2). Saltery Lake is the primary brood source for fry stocked into Spiridon Lake by the KRAA. Sockeye salmon escapements to Saltery Lake were estimated using aerial surveys from 1976 through 1986, 1992, and 2004 through 2007; escapements were estimated using weirs from 1986 to 1991, 1993 to 2003, and 2008 to 2012.

Escapement Goal Background and Previous Review

The first published escapement goal for Saltery Lake was developed in 1988 and set at 20,000 to 40,000 sockeye salmon (Nelson and Lloyd 2001). In 2001, the SEG was changed to a BEG of 15,000 to 30,000 fish, based upon spawner-recruit data, euphotic zone depth and volume, smolt biomass as a function of zooplankton biomass, smolt biomass as a function of lake rearing availability, and spawning habitat availability analyses (Honnold and Sagalkin 2001). The goal was reviewed again in 2004 and left unchanged, with the review team recommending that S_{MSY} (23,000), or the lower end of goal, be targeted in the short term, citing decreased biomass of zooplankton in the lake. In 2007, the consensus of the review team was to change the Saltery Lake sockeye salmon escapement goal from a BEG of 15,000 to 30,000 to an SEG of 20,000 to 50,000, based on a percentile analysis of aerial survey data (Honnold et al. 2007). At the time of the 2007 review, Saltery Lake sockeye escapement was estimated only by aerial survey and no age data were collected. There was no indication of any future plan to operate a weir, and the team decided that using only aerial survey data in a percentile analysis was a more appropriate method (Honnold et al. 2007).

In early 2008, the goal was reanalyzed when KRAA agreed to operate a weir project at Saltery Lake. The team recommended retaining the prior BEG of 15,000 to 30,000, used to manage the stock since 2001, because the 2007 review team's recommended change to an SEG (of 20,000 to 50,000 fish) was predicated on escapement assessments by aerial survey only. In addition, the team determined that the "weir only" spawner-recruit analysis was similar to the "combination weir/aerial survey" spawner-recruit analysis that resulted in the current BEG, and the zooplankton data indicated that habitat limitations still existed in Saltery Lake. The goal was reanalyzed again in 2010 resulting in a change to a BEG of 15,000 to 35,000 fish (Nemeth et al. 2010).

2013 Review

The Saltery Lake sockeye salmon escapement goal was last reviewed in 2010. Recent escapement data were examined to determine if a change in the escapement goal was justified and the team agreed that no further analysis was necessary.

Uganik Lake

Uganik Lake is located on the west side of Kodiak Island and is a moderate producer of sockeye salmon (Booth 1993). Uganik River flows from the lake into the East Arm of Uganik Bay, which is part of the Inner Uganik Bay Section of the Northwest Kodiak District (Jackson et al. 2012; Figures 1 and 2).

Escapement Goal Background and Previous Review

The first published escapement goal for Uganik Lake was developed in 1988 and set at 40,000 to 60,000 sockeye salmon (Nelson and Lloyd 2001). An escapement goal review of this system conducted during 2004 resulted in eliminating the Uganik Lake sockeye salmon SEG due to incomplete escapement data and the inability to actively manage escapements to this system (Nelson et al. 2005).

The 2007 escapement goal review of Uganik Lake sockeye salmon utilized aerial survey and weir count estimates with the percentile approach. This analysis lead the review team to recommend establishing a lower-bound SEG of 24,000 sockeye salmon, which was implemented in 2008 (Honnold et al. 2007). The goal was reviewed again in 2010 resulting in no change.

2013 Review

The Uganik Lake sockeye salmon escapement goal was last reviewed in 2010. Recent escapement data were examined to determine if a change in the escapement goal was justified and the team agreed that no further analysis was necessary.

Upper Station

The Upper Station system, also referred to as South Olga lakes, is composed of 2 major lakes located on the southern end of Kodiak Island and drains into Inner Upper Station Section of the Alitak District (Figures 1 and 2). The system supports one of the largest sockeye salmon runs in the Kodiak Archipelago (Jackson et al. 2012). Two temporally distinct sockeye salmon runs return to Upper Station (Barrett and Nelson 1994). The early run returns from late May through mid-July; the late run returns from mid-July through September. Sockeye salmon escapements at Upper Station have been enumerated through the weir since 1969 for the early run and 1966 for the late run (Appendices M1–M3); counts through July 15 are attributed to the early run and counts after July 15 to the late run.

Escapement Goal Background and Previous Review

From 1978 to 1982, the Upper Station sockeye salmon stock was managed for one escapement goal, with a range of 100,000 to 180,000 fish that was stratified by month. Early- and late-runs were not identified, but the escapement goals were for July and August. In 1983, the department increased the escapement goal to 150,000 to 250,000 fish and extended goals into June (presumably for the early run); this goal remained in place through 1987 (Nelson and Lloyd 2001). In 1988, the goal was split into separate SEGs of 50,000 to 75,000 fish for the early run and 150,000 to 200,000 fish for the late run (Nelson and Lloyd 2001). An optimal escapement

goal (OEG) of 25,000 fish was established for the early Upper Station run by the board in 1999. During the 2004 review, the team recommended changing the current Upper Station early-run sockeye SEG to 30,000 to 65,000 fish based on the percentile approach and changing the late-run sockeye SEG to a BEG of 120,000 to 265,000 fish (S_{MSY} =186,000) based on a significant Ricker spawner-recruit relationship. No change was recommended to either goal during the 2007 escapement goal review (Honnold et al. 2007). In 2010, both goals were reviewed, and the Upper Station early run goal was changed to a BEG of 43,000–-93,000. There was no change recommended to the Upper Station late run.

2013 Review

The Upper Station escapement goal was just reviewed in 2010 and very little new additional data is available that would likely result in an estimate different than the prior review. However, the team recognized that the escapement goal (and OEG) of Upper Station would likely be a topic at the board meeting and felt an updated analysis might assist the discussion. Stock-specific estimates of harvest for Upper Station sockeye salmon were available from 1970 to 2012. Spawner-recruit relationships were estimated for the early, late, and combined runs by analyzing spawning stock and recruitment data from brood years 1975 to 2006 (Appendices M4–M6) using a Ricker spawner-recruit model (Eggers 2001; Hilborn and Walters 1992; Ricker 1954) with a multiplicative error structure (Quinn and Deriso 1999). If a Ricker spawner-recruit model was significant, then S_{MSY} was estimated, along with the range of escapements that would produce 90% to 100% of MSY. Residuals were examined for autocorrelation, temporal trends, and potential bias.

Zooplankton and light penetration data from 1990 to 1993, 1995, 1999, 2000, and 2009 through 2012 were used to assess optimal escapement levels via zooplankton biomass and euphotic volume models.

COHO SALMON

American, Buskin, Olds, and Pasagshak Rivers

Coho salmon escapement goals have been established for 4 rivers in the KMA, all of which are located on the road system in the northeast corner of Kodiak Island (Figure 1). The American, Old, and Buskin rivers empty into Chiniak Bay, in the Inner Chiniak Bay Section (Figure 2). The Pasagshak River empties into Ugak Bay, in the Outer Ugak Bay Section (Figure 2).

Escapement to the American, Olds, and Pasagshak rivers are estimated via surveys by foot. The surveys have been conducted annually since 1980, and are done in October and early November to coincide with peak spawning periods (as determined through a combination of factors, including timing of past escapement surveys, inseason anecdotal reports of spawning activity, and preference for optimal water levels and viewing conditions). Foot survey routes were standardized for each stream using periodically updated GPS waypoints to identify starting and stopping destinations, as well as tributary and stream branch confluence locations. The count for a stream survey is interpreted as a minimum number of salmon escaping to that stream and therefore, is viewed as an index of total escapement. The highest number (peak count) of coho salmon observed during a single foot survey has been used as the annual index of abundance for that stream.

The fourth system in the KMA with a coho salmon escapement goal is the Buskin River, on which returning coho salmon are counted with a weir operated at various sites since 1985.

Buskin River has served as a brood source for a number of Sport Fish Division stocking projects in the KMA since 1993.

Escapement Goal Background and Previous Review

The existing coho salmon escapement goals in the KMA were first established in 1999 (Nelson and Lloyd 2001). The first American River coho salmon SEG was 300 to 400 fish, then changed to 400 to 900 fish in 2005 (Clark et al. 2006). The first Olds River SEG was 450 to 675 fish (Nelson and Lloyd 2001), then changed to 1,000 to 2,200 fish in 2005 (Clark et al. 2006). The first Pasagshak River coho salmon SEG was 1,500 to 3,000 fish (Nelson and Lloyd 2001), then changed to 1,200 to 3,300 fish in 2005 (Clark et al. 2006). The first Buskin River coho salmon SEG was 6,000 to 9,000 fish (Nelson and Lloyd 2001). In 2005, the SEG was changed to a BEG of 3,200 to 7,200 fish (Clark et al. 2006), and was meant to explicitly take into account 20% of the sport harvest that occurs upstream of the weir. The BEG was based on updated brood table and spawner-recruit analysis.

In 2007, the review team concluded that the addition of 3 years of escapement data would not substantially affect the results of previous analysis of any of the 4 goals, which were thus left unchanged (Honnold et al. 2007). In 2011, the upper bounds of the escapement goals for the American, Olds, and Pasagshak rivers were removed due to the lack of inseason management for the upper ends of the goals (Nemeth et al. 2010).

2013 Review

The team reviewed the most recent escapement data available for KMA coho salmon stocks, which consisted of 3 years of foot survey data from the American, Olds, and Pasagshak rivers, and 3 years of weir data from the Buskin River. The team concluded that these data would not substantially affect the results of previous escapement goal analyses for the American, Olds, and Pasagshak rivers, and thus recommended no further analysis of these goals.

The team decided to evaluate the Buskin River coho BEG because it was last reviewed in 2005, and the team felt the updated brood table may provide additional information on coho productivity.

PINK SALMON

Kodiak Archipelago and Mainland District Aggregates

There are 2 escapements goals for pink salmon in the KMA, both of which are SEGs based on aggregates of escapements to multiple streams estimated from aerial surveys of spawning fish from fixed-wing aircraft (Figure 3; Jackson et al. 2012). The Mainland District aggregate goal is derived entirely from these aerial surveys; the Kodiak Archipelago aggregate goal is derived from aerial surveys supplemented by counts from weirs on Kodiak Island streams. Each year since 1964, pink salmon have been counted during one or more flights over a standardized subset of streams in the Kodiak Archipelago and across Shelikof Strait in the Mainland District (Figure 1). The highest number (peak count) of pink salmon observed during a single flight has been used as an annual index of abundance for that stream. Pink salmon from a given brood year mature in the same calendar year, 2 years after birth, leading to separate populations in odd and even years that do not interbreed (Heard 1991).

Escapement Goal Background and Previous Review

The first KMA district wide pink salmon escapement goals were published in 1978 (Nelson and Lloyd 2001). The peak counts were summed over streams within 7 districts: Eastside, Northeast Kodiak, Afognak, Northwest Kodiak, Southwest Kodiak, Alitak Bay, and Mainland. Annual counts were averaged to produce SEGs for each district and for the Kodiak Archipelago as a whole, separately for even and odd years (Nelson and Lloyd 2001).

In 2005, the Mainland District SEG was retained as its own discrete goal, while the other 6 districts were combined to form the Kodiak Archipelago goal (Nelson et al. 2005). Also, separate goals for even and odd years were eliminated and replaced by an overall goal for both years combined. The newly-created Kodiak Archipelago SEG was set at 2,000,000 to 5,000,000 fish and the Mainland District SEG was revised to 250,000 to 750,000 fish (Nelson et al. 2005). Pink salmon escapement goals were reevaluated during the 2007 review and left unchanged (Honnold et al. 2007). Goals were evaluated in 2010, and the team recommended changing the Kodiak Archipelago pink salmon SEG of 2,000,000 to 5,000,000 fish to an odd-year SEG of 2,000,000 to 5,000,000 and an even-year SEG of 3,000,000 to 7,000,000 pink salmon (Table 1). The team also recommended changing the Kodiak Mainland pink salmon SEG of 250,000 to 750,000 fish to an SEG of 250,000 to 1,000,000 fish.

2013 Review

Pink salmon escapement goals were last reviewed in 2010. Recent escapement data were examined to determine if a change in the escapement goal was justified and the team agreed that no further analysis was necessary.

CHUM SALMON

Kodiak Archipelago and Mainland District Aggregates

There are 2 aggregate escapements goals for chum salmon in the KMA, one for the Mainland District and one for the Kodiak Island Archipelago (Figure 3). Both escapement goals are SEGs based on aggregates of escapements to multiple streams estimated from aerial surveys of spawning fish from fixed-wing aircraft (Jackson et al. 2012). Peak counts of chum salmon from a single flight are used as the annual index of abundance for that stream.

Escapement Goal Background and Previous Review

Chum salmon escapement goals by district were established in 1988 (Nelson and Lloyd 2001), based on historic production. Goals were set for individual districts as follows: Mainland District - 133,000 to 399,000 fish; Northwest District - 46,000 to 138,000 fish; Southwest District - 25,000 to 75,000 fish; Alitak District - 26,000 to 78,000 fish; Eastside District - 35,000 to 105,000 fish; and Northeast District - 8,000 to 24,000 fish. In 2004, the goals were revised to be lower-bound SEGs (termed SEG thresholds at the time), and set at 153,000 fish for the Mainland District, 53,000 fish for the Northwest District, 7,300 fish for Southwest District, 28,000 fish for the Alitak District, 50,000 fish for the Eastside District, and 9,000 fish for the Northeast District. These lower-bound SEGs were implemented in 2005 (Honnold et al. 2007).

In 2007, the review team reanalyzed chum salmon escapement goals for the KMA. The lower-bound SEG for Mainland District chum salmon was reduced to 104,000 fish. The escapement goals for the remaining 6 districts (all on Kodiak Island) were aggregated into a single lower-

bound SEG known as the Kodiak Archipelago goal. This goal was set at 151,000 fish (Honnold et al. 2007). Goals were reevaluated in 2010, and the team recommended no changes.

2013 Review

Chum salmon escapement goals were last reviewed in 2010. Recent escapement data were examined to determine if a change in the escapement goal was justified and the team agreed that no further analysis was necessary.

RESULTS

The team reviewed stock assessment data for 2 Chinook salmon, 14 sockeye salmon, 4 coho salmon, 2 chum salmon aggregate stocks, and 3 pink salmon aggregate stocks with existing goals (Table 1). Initial efforts concentrated on reviewing data from 2010 through 2012, determining if previous analyses (from the review in 2010) should be updated or if additional analyses were necessary, and identifying any management concerns with the existing goals.

The team concluded that the 3 additional years of data would not affect the existing escapement goals, except for Upper Station (early- and late-run), Frazer Lake, and Little River sockeye salmon and Buskin River coho salmon. The team elected to formally analyze these 5 stocks, using a combination of new escapement and brood year data available since the last review (Nemeth et al. 2010).

The team agreed to recommend to the directors of the divisions of Commercial and Sport Fisheries that changes be made to 2 of the 5 goals analyzed: eliminating the escapement goal for Little River sockeye salmon and changing the Buskin River coho BEG from 3,200 to 7,200 fish to 4,700 to 9,600 fish (Table 1).

CHINOOK SALMON

Ayakulik River

Stock Status

Ayakulik River Chinook salmon escapements averaged 9,758 fish (range: 935 to 24,425) from 1977 through 2012 (Appendix B2) and total returns averaged 13,890 fish (range: 2,079 to 30,765) for brood years 1977 through 2003. Since the current BEG of 4,000 to 7,000 fish was implemented in 2011, escapements were within the BEG in 2011 and 2012 (Appendix B2).

Escapement Goal Staff Recommendation to Directors

The BEG was reevaluated in 2010 (using data through 2009) and a new goal was implemented in 2011. The three additional years of information does not indicate a substantial change in stock productivity, and the team agreed that the goal should remain unchanged (Table 1).

Karluk River

Stock Status

Karluk River Chinook salmon escapements averaged 7,700 (range: 752 to 13,742) fish from 1976 through 2012 and total returns averaged 9,159 (range: 893 to 16,351) fish for brood years 1976 through 2005. The current BEG of 3,000 to 6,000 fish was implemented in 2011. Escapements were within the goal range in 2011 and 2012 (Appendices A2 and A3). Karluk

River Chinook salmon were designated a stock of concern during the 2010 Kodiak board meeting.

Escapement Goal Staff Recommendation to Directors

The BEG was reevaluated in 2010 (using data through 2009) and a new goal was implemented in 2011. The three additional years of information does not indicate a substantial change in stock productivity, and the team agreed that the goal should remain unchanged (Table 1).

SOCKEYE SALMON

Afognak Lake

Stock Status

Escapements have been within the escapement goal range each year since the current BEG was implemented in 2005, except 2010 when it was exceeded (Appendix C3). The returns for 1999 and 2001 brood years were the lowest in the 1978 to 2004 time series (Appendix C4), and were possibly reduced by top-down effects from high escapements from 1995 through 1999 (Appendices C2 and C3).

Escapement Goal Staff Recommendation to Directors

Given that escapements have been within or above the BEG since its establishment (2005), and current information does not indicate a substantial change in stock productivity or utilization, the team agreed that the goal should remain unchanged (Table 1).

Ayakulik River

Stock Status

The Ayakulik River sockeye salmon SEG was split into early-run (140,000 to 280,000 fish) and late-run (60,000 to 120,000 fish) goals in 2011 (Table 1; Appendix D1). Sockeye salmon returns have been in decline since brood year 1994, but have recently shown signs of stabilizing or increasing (Appendix D4). Department researchers theorize that the decline was likely due to the high escapements from 1989 to 1998, when escapements averaged about 400,000 fish, increasing competition among rearing fish and ultimately decreasing the size of outmigrating smolt. Escapements have been within the current SEG since it was implemented (Appendix D2).

Escapement Goal Staff Recommendation to Directors

The SEG was reevaluated in 2010 (using data through 2009) and new goals were implemented in 2011. The three additional years of information does not indicate a substantial change in stock productivity, and the team agreed that the goal should remain unchanged (Table 1).

Buskin River

Stock Status

The Buskin River sockeye salmon escapement goal was assessed in 2010 and changed from an SEG (8,000 to 13,000 fish) to a BEG (5,000 to 8,000 fish) for the 2011 season. Returns have ranged from 9,724 fish (2008) to 37,544 fish (2003). Escapements have been above the current BEG the last three years (Table 1).

Escapement Goal Staff Recommendation to Directors

The BEG was reevaluated in 2010 (using data through 2009) and a new goal was implemented in 2011. The three additional years of information does not indicate a substantial change in stock productivity, and the team agreed that the goal should remain unchanged (Table 1).

Frazer Lake

Stock Status

Sockeye salmon escapements have been within the current BEG of 75,000 to 170,000 fish since its inception in 2008 (Honnold et al. 2007; Appendices F2 and F3). Returns have ranged from 39,910 (1966) when the stock was being developed to over 2 million fish (1986; Appendix F5)

Evaluation of Recent Data

A Ricker spawner-recruit model was fit to the Frazer Lake fully-recruited brood year spawner-recruit data from 1966 to 2005 (excluding the brood years of 1985 to 1991 where fertilization directly affected production; Appendices F4 and F5). The contrast of the Frazer Lake escapement data was 30.7 (Appendix F1), which was above the recommended minimum contrast of 4 (CTC 1999). The multiplicative error model was significant (P<0.001), S_{MSY} was estimated at 117,000 (90% S_{MSY} range of 75,000 to 167,000), and S_{EQ} was estimated at 319,000 fish (Appendix F4). Presence of autocorrelation (lag-1) was calculated and found not statistically significant. Fertilization of Frazer Lake has not occurred for 20 years.

New bathymetry data collected in 2009 were employed in calculating the euphotic volume model for Frazer Lake: the optimal escapement to Frazer Lake was estimated to be 224,497 adult sockeye salmon. The zooplankton biomass model estimated the optimal escapement to Frazer Lake to be 114,982 sockeye salmon.

Escapement Goal Staff Recommendation to Directors

The team recommended no change to the Frazer Lake sockeye salmon BEG of 75,000 to 170,000 fish (Table 1). The addition of 3 more years of spawner-recruit data yielded little change in the estimates of productivity; similarly, the zooplankton biomass model corroborated the current BEG.

Karluk Lake

Stock Status – Early Run

Since the establishment of the current BEG (110,000 to 250,000 fish) in 2008, escapement of early-run Karluk River sockeye salmon have been above the upper goal in one year (2012) and below the lower goal in 4 years (2008–2011; Appendices G2 and G4). The recent 10-year average return is 428,222 fish (Appendix G6); recent returns (brood years 2003-2005) have been well below average.

Stock Status – Late Run

Since the establishment of the current BEG (170,000 to 380,000 fish) in 2005, escapement of late-run Karluk River sockeye salmon has met or been above the upper goal, except for 2008, when it was below the lower goal (Appendix G3 and G5). The recent 10-year average return is 666,142 fish (Appendix G7); recent returns (brood years 2003-2005) have been well below average.

Escapement Goal Staff Recommendation to Directors

The BEG for both runs were reevaluated in 2010 (using data through 2009) and both goals were left unchanged. The three additional years of information does not indicate a substantial change in stock productivity, and the team agreed that the goal should remain unchanged (Table 1).

Little River

Stock Status

The current lower-bound SEG for Little River Lake sockeye salmon is 3,000 fish (Table 1; Appendix H1). The goal was reevaluated in 2007 and implemented in 2008. Escapements were below the goal in both 2008 and 2009, but were above the goal 2010–2012 (Appendix H2).

Evaluation of Recent Data

Recent escapement estimates via aerial survey have been above the goal, but this system is a low priority to survey and the assessment may no longer adequately index or monitor trends in escapement.

Escapement Goal Staff Recommendation to Directors

The team recommended removing the Little River lower-bound SEG of 3,000 fish, (Table 1).

Malina Creek

Stock Status

Escapements have been within the current SEG (1,000 to 10,000 fish) since it was implemented in 2005 (Appendix I2).

Escapement Goal Staff Recommendation to Directors

The SEG was reevaluated in 2010 (using data through 2009), and the goal was left unchanged. No new information is available to indicate a substantial change in stock productivity, and the team agreed that the goal should remain unchanged in 2013 (Table 1).

Pasagshak River

Stock Status

In 2011, the Pasagshak SEG was changed from 3,000 to 12,000 to a lower-bound SEG of 3,000 fish (Table 1; Appendix J1). Escapements in 2011 and 2012 were above the goal (Appendix J2).

Escapement Goal Staff Recommendation to Directors

The SEG was reevaluated in 2010 (using data through 2009), and new goal was implemented in 2011. No new information is available to indicate a substantial change in stock productivity, and the team agreed that the goal should remain unchanged in 2013 (Table 1).

Saltery Lake

Stock Status

The current Saltery Lake sockeye salmon BEG of 15,000 to 35,000 was adopted in 2011 (Table 1; Appendix K1). Since then, escapements have been within the BEG.

Escapement Goal Staff Recommendation to Directors

The BEG was reevaluated in 2010 (using data through 2009) and implemented in 2011. No new information is available to indicate a substantial change in stock productivity, and the team agreed that the goal should remain unchanged in 2013 (Table 1).

Uganik Lake

Stock Status

The current Uganik Lake sockeye salmon lower-bound SEG is 24,000 fish (Table 1; Appendix L1). Escapements have been above the goal since 2008, except in 2012 (Appendices L2 and L3).

Escapement Goal Staff Recommendation to Directors

The SEG was reevaluated in 2010 (using data through 2009) and left unchanged. No new information is available to indicate a substantial change in stock productivity, and the team agreed that the goal should remain unchanged in 2013 (Table 1).

Upper Station

Stock Status – Early Run

The Upper Station early-run sockeye salmon BEG of 43,000 to 93,000 fish was implemented beginning in the 2011 season. Escapements since then have been below the BEG in all years (Appendices M2 and M4). Management of the fishery is guided by the OEG of 25,000 fish, which has been achieved in all but one year since it was implemented in 1999 (Table 1; Appendices M1, M2, and M4). The recent 10-year average return is 104,584 fish (Appendix G6); recent returns (brood years 2003-2005) have been below average.

Stock Status – Late Run

Since the Upper Station late-run sockeye BEG of 120,000 to 265,000 fish was implemented in 2005, escapements have been within the BEG in all but one year (2011; Appendices M3 and M4). The recent 10-year average return is 291,237 fish (Appendix M6); recent returns (brood years 2003-2005) have similar to the average.

Evaluation of Recent Data – Early Run

A Ricker spawner-recruit model was fit to data from fully recruited brood year data from early-run sockeye salmon returning to Upper Station from 1975 through 2006. The contrast of the escapement data was 16.5 (Appendix M1), which was above the recommended minimum contrast of 4 (CTC 1999). The multiplicative error model was significant (P<0.05). The S_{MSY} was estimated at 65,000 sockeye salmon with a 90% MSY range of 43,000 to 97,000, while S_{EQ} was estimated at 161,000 sockeye salmon (Appendices M5 and M7). The model did not have significant autocorrelation (lag-1).

Evaluation of Recent Data – Late Run

A Ricker spawner-recruit model was fit to data from fully-recruited brood year data from late-run sockeye salmon returning to Upper Station from 1975 through 2006 (Appendix M6). The contrast of the escapement data was 10.7 (Appendix M1), above the recommended minimum contrast of 4 (CTC 1999). The multiplicative error model was significant (P<0.05), but the model had significant autocorrelation (lag-1) and serious nonstationary processes affecting the

time series of production. The combined early- and late-run spawner recruit model was not significant (P>0.05).

The euphotic volume model estimated the optimal escapement to Upper Station to be 119,000 adult sockeye salmon. The zooplankton biomass model estimated the optimal escapement to Upper Station River to be 106,000 adult sockeye salmon.

Escapement Goal Staff Recommendation to Directors

The team recommended no change to the early-run Upper Station sockeye salmon BEG of 43,000 to 93,000 fish based on the spawner-recruit model (Table 1). The team recommended no change to the late-run Upper Station sockeye salmon BEG of 120,000–265,000 fish (Table 1). Although the spawner-recruit model was significant, serious nonstationary processes in the time series suggest estimating maximum productivity from this model would be inaccurate.

COHO SALMON

American, Buskin, Olds, and Pasagshak Rivers

Stock Status – All Systems

All 4 of these systems are located on the Kodiak road system and all were reviewed in 2010. Escapement goals for the American, Olds, and Pasagshak rivers were changed from a SEG to a lower-bound SEG (implemented in 2011). The lower-bound SEGs are 400 fish for the American River, 1,000 fish for the Olds River, and 1,200 fish for the Pasagshak River. Escapements have been as follows: American River escapements have been above the SEG the last 2 years (2010 was not surveyed; Appendices N2 and N3); Olds River escapements have been above the SEG 2 out of 3 years (Appendices P2 and P3); and Pasagshak River escapements have been below the SEG in one year and above the SEG in 2 years (Appendix Q3).

The Buskin River escapement goal was changed from a BEG of 3,200–7,200 fish to a BEG of 4,700–9,600 fish (implemented 2011). Escapements were within the BEG the last 3 years (Appendices O2 and O3.

Evaluation of Recent Data

The escapement goal review team reviewed the most recent data available for KMA coho salmon stocks (Table 1); 3 additional years of escapement data were available for coho salmon from all 4 rivers (the Buskin, American, Olds, and Pasagshak rivers), including spawner-recruit data for the Buskin River stock. The team examined stock assessment data from these stocks, concluded that the 3 additional years of data for the American, Olds, and Pasagshak rivers would not affect the results of the previous analyses in 2010, and declined to evaluate them further. A full probability-recruit model was fit to Buskin River coho salmon spawner-recruit data from 1989 to 2008 (Appendix O2). The contrast of the Buskin River escapement data was 3.3 (Appendix O1). Median S_{MSY} was estimated at 7,042 (90% credibility interval of 4,291 to 8,430), and median S_{EQ} was estimated at 16,590 fish (Appendix O2).

Escapement Goal Staff Recommendation to Directors

The escapement goal team recommended no change to the SEGs for the American, Olds, and Pasagshak rivers. A Bayesian spawner-recruit analysis incorporating escapements through 2012 (Schmidt et al. *In prep*) was completed for the Buskin River coho stock. This analysis estimated

the coho salmon escapement for S_{MSY} to be about 7,300 fish and a maximum sustained yield of approximately 8,100 coho salmon.

The team recommended the Buskin River BEG be increased from 3,200–7,200 to 4,700–9,600 coho salmon (Table 1).

PINK SALMON

Kodiak Archipelago and Mainland District Aggregates

Stock Status

In 2011 the Kodiak Archipelago pink salmon SEG was split into an odd-year SEG of 2,000,000 to 5,000,000 and an even-year SEG of 3,000,000 to 7,000,000 pink salmon (Table 1; Appendix R1). The Kodiak Mainland pink salmon SEG also changed from 250,000 to 750,000 fish to an SEG of 250,000 to 1,000,000 fish (Table 1; Appendix S1). Escapements have been within all SEGs since they were adopted.

Escapement Goal Staff Recommendation to Directors

Pink salmon SEGs were reevaluated in 2010 (using data through 2009) and new goals implemented in 2011. The additional data since 2011 does not indicate a substantial change in stock productivity, and the team recommended no change to the existing SEGs for the Kodiak Archipelago and Mainland District pink salmon stocks (Table 1).

CHUM SALMON

Kodiak Archipelago and Mainland District Aggregates

Stock Status

The current lower-bound SEGs for chum salmon in the KMA (Kodiak Archipelago and Mainland District) were set in 2007, for returns beginning in 2008 (Honnold et al. 2007). The lower-bound SEG of 151,000 Kodiak Archipelago chum salmon was exceeded 2009–2012, but not in 2008; the lower-bound SEG of 104,000 Mainland District chum salmon was exceeded in 2008 and 2010–2012, but not in 2009 (Table 1).

Escapement Goal Staff Recommendation to Directors

Chum salmon SEGs were reevaluated in 2010 (using data through 2009) and goals were left unchanged. The additional data since 2011 does not indicate a substantial change in stock productivity. The team recommended no change to the existing lower-bound SEGs for the Kodiak Archipelago and Mainland District chum salmon stocks (Table 1).

SUMMARY OF STAFF RECOMMENDATIONS TO DIRECTORS

The 2013 review team reviewed data for all 25 salmon escapement goals in the KMA, and then analyzed 5 of these goals further. Overall, the team recommended changing one goal and eliminating one goal. The new recommendations result in a total of 24 escapement goals in the KMA, as follows: 2 goals for Chinook salmon (both BEGs); 13 goals for sockeye salmon (8 BEGs, 3 SEGs, and 2 lower-bound SEGs); 4 goals for coho salmon (one BEG and 3 lower-bound SEGs); 3 aggregate SEGs for pink salmon; and 2 aggregate SEGs for chum salmon.

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TABLES AND FIGURES

Table 1.–Existing and recommended salmon escapement goals for the Kodiak Management Area.

Species	System	Escapement data[a]	Current escapement goal Type	Lower	Point	Upper	Escapements 2010	2011	2012	Recommendation
Chinook										
	Ayakulik	WC	BEG	4,000	5,165	7,000	5,197	4,251	4,744	No change
	Karluk	WC	BEG	3,000	3,975	6,000	2,917	3,420	3,197	No change
Sockeye										
	Afognak	WC	BEG	20,000	39,170	50,000	52,255	49,193	41,553	No change
	Ayakulik[b]									
	Early run	WC	SEG	140,000		280,000	201,933	177,480	213,501	No change
	Late run	WC	SEG	60,000		120,000	60,394	83,661	114,753	No change
	Buskin	WC	BEG	5,000	6,544	8,000	9,800	11,982	8,565	No change
	Frazer	WC	BEG	75,000	117,000	170,000	94,680	134,642	148,884	No change
	Karluk									
	Early run	WC	BEG	110,000	150,000	250,000	71,453	87,049	188,085	No change
	Late run	WC	BEG	170,000	267,000	380,000	276,649	230,273	314,605	No change
	Little River	PAS	LB SEG	3,000			3,200	3,900	6,300	Eliminate goal
	Malina	PAS	SEG	1,000		10,000	4,000	3,800	4,100	No change
	Pasagshak	WC or PAS	LB SEG	3,000			4,800	13,402[c]	4,585[c]	No change
	Saltery	WC or PAS	BEG	15,000	24,000	35,000	24,102	27,803	25,155	No change
	Uganik Lake	PAS	LB SEG	24,000			30,700	37,900	22,200	No change
	Upper Station									
	Early run[d]	WC	BEG	43,000	66,000	93,000	42,060	28,759	25,487	No change
	Late run	WC	BEG	120,000	186,000	265,000	141,139	101,893	149,325	No change
Coho										
	American	FS	LB SEG	400			ND	1,061	427	No change
	Buskin	WC	BEG	3,200	5,000	7,200	6,096	5,116	5,291	Increase BEG to 4,700-9,600
	Olds	FS	LB SEG	1,000			ND	1,003	624	No change
	Pasagshak	WC	LB SEG	1,200			1,971	1,083	3,132	No change
Pink										
	Kodiak Archipelago									
	Odd year	PAS	SEG	2,000,000		5,000,000		2,506,714		No change
	Even year	PAS	SEG	3,000,000		7,000,000	3,378,483		5,111,049	No change
	Mainland District	PAS	SEG	250,000		1,000,000	265,650	273,500	413,325	No change
Chum										
	Kodiak Archipelago	PAS	LB SEG	151,000			160,290	192,400	159,825	No change
	Mainland District	PAS	LB SEG	104,000			124,500	128,700	127,850	No change

Note: ND = no data.

Chum salmon escapement estimates are different than those that appear in previous reports (e.g., Munro and Volk 2012).

[a] PAS = Peak Aerial Survey, WC= Weir Count, FS=Foot Survey.

[b] Harvest contributions for Ayakulik early and late run cannot be estimated so the brood table (Appendix D4) is for both runs combined.

[c] Escapement goal based on PAS; however, 2011 and 2012 data are WC.

[d] Upper Station early run has the only optimal escapement goal (OEG; 25,000) in the KMA, established by the board in 1999.

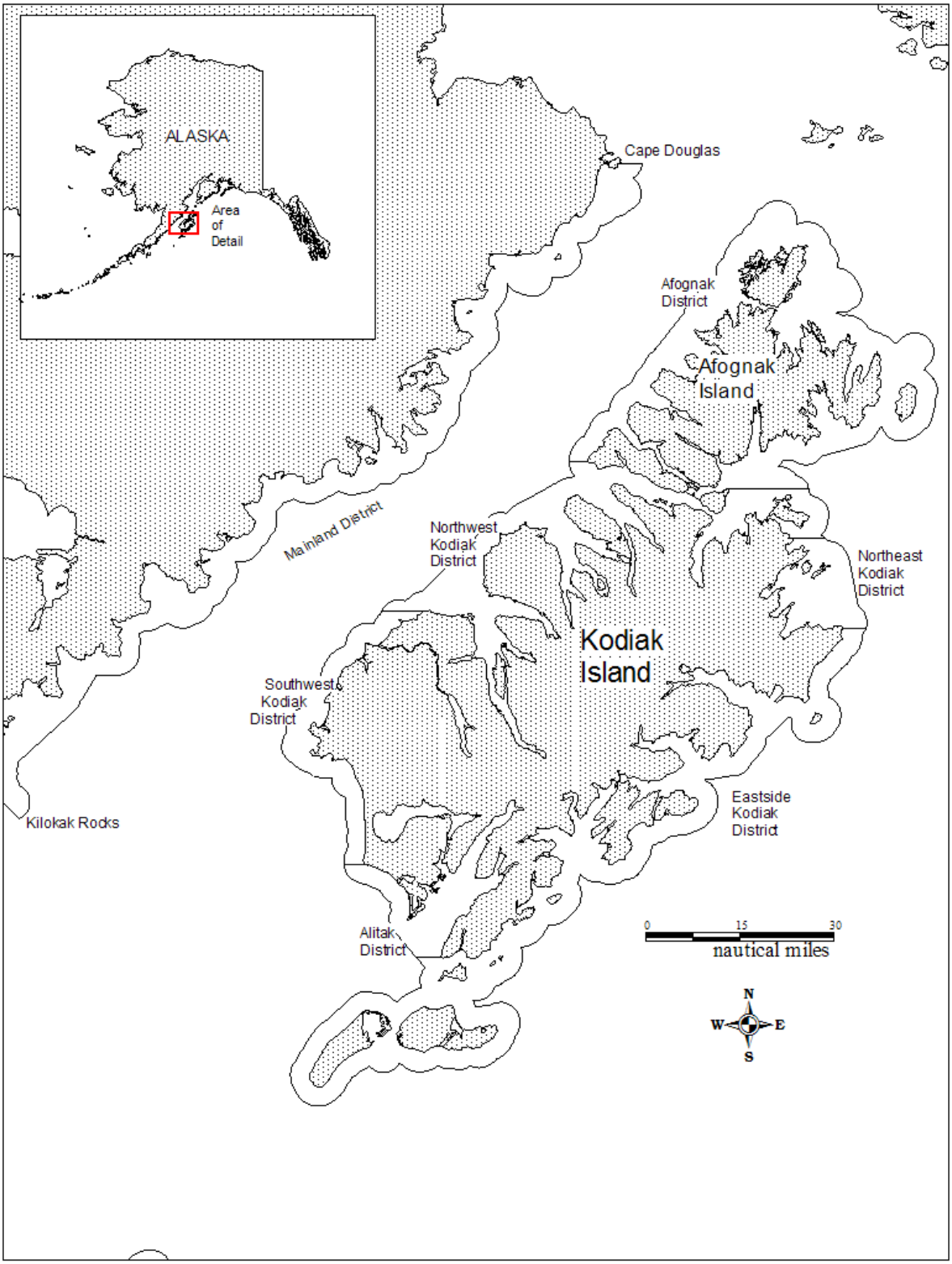


Figure 1.–The Kodiak Management Area, showing the commercial salmon fishing districts.

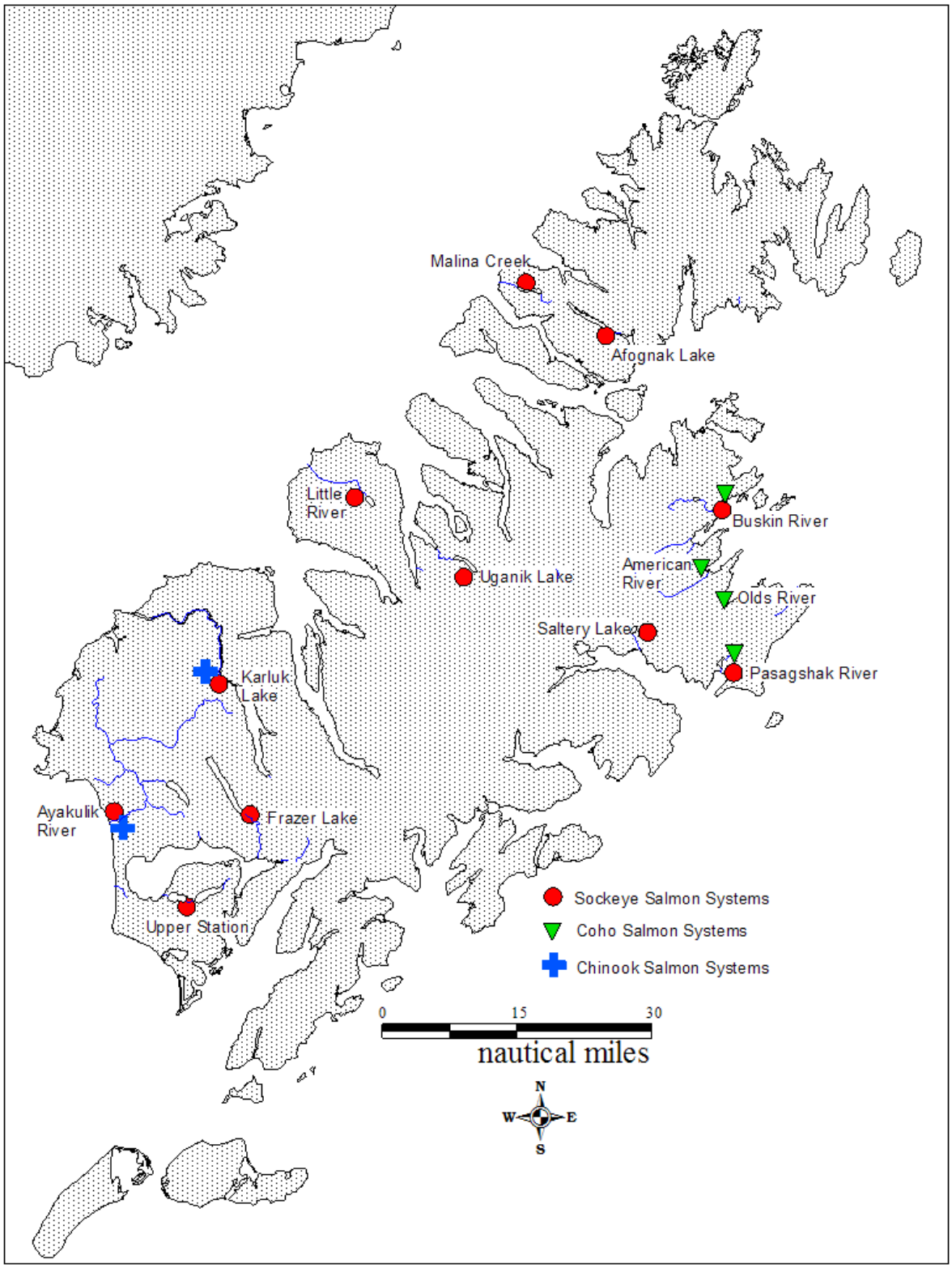


Figure 2.–Locations of Chinook, sockeye, and coho salmon systems with escapement goals in the Kodiak Management Area in 2012.

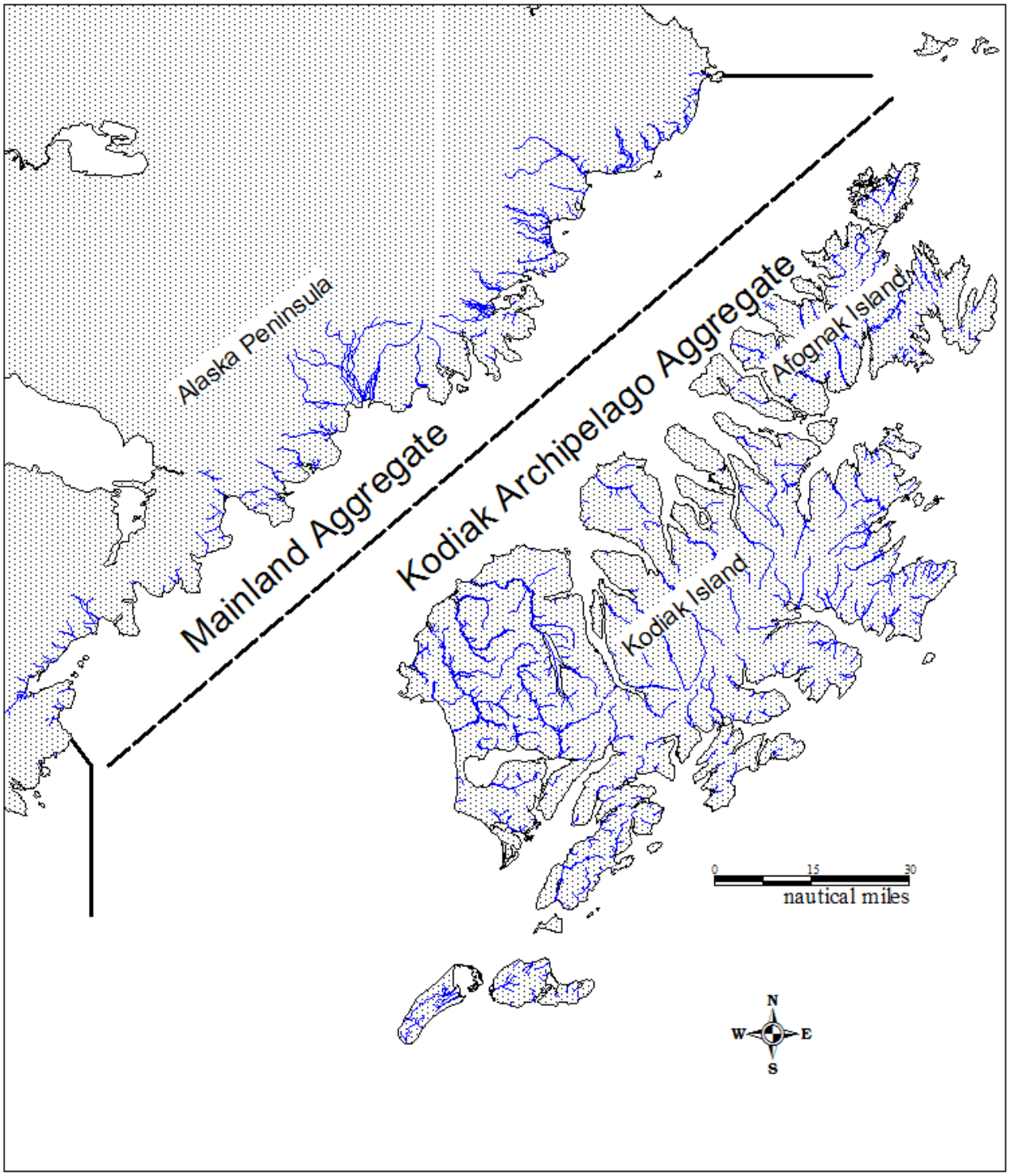


Figure 3.–Geographic boundaries of aggregate escapement goals for chum and pink salmon in the Kodiak Management Area in 2012.

APPENDIX A. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR KARLUK RIVER CHINOOK SALMON

Appendix A1.–Description of stock and escapement goal for Karluk River Chinook salmon.

System: Karluk River

Species: Chinook salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Sport and Commercial
Primary fishery:	Sport, commercial, and subsistence
Current escapement goal:	BEG: 3,000–6,000 (2011)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Weir counts, 1976 to 2012
Data summary:	
Data quality:	Good escapement and harvest data.
Data type:	Weir estimates, harvest estimates, age composition.
Data contrast:	All survey data 1976 to 2012: 18.27
Methodology:	Bayesian spawner-recruit analysis with an AR(1) productivity term.
Autocorrelation:	Present
Comments:	Currently listed as a stock of management concern.

Appendix A2.–Annual harvest, weir count, total return, and escapement estimates for Karluk River Chinook salmon, 1976–2012.

System: Karluk River

Species: Chinook salmon

Return Year	Commercial Harvest[a]	Subsistence Harvest[b]	Weir Count[c]	Total Return	Recreational Harvest[d]	Escapement[e]
1976	2	0	6,897	6,899	461	6,436
1977	0	0	8,434	8,434	461	7,973
1978	35	0	9,795	9,830	461	9,334
1979	0	0	9,555	9,555	461	9,094
1980	0	0	4,810	4,810	461	4,349
1981	0	0	7,575	7,575	461	7,114
1982	0	0	7,489	7,489	796	6,693
1983	0	0	11,746	11,746	304	11,442
1984	2	0	7,747	7,749	175	7,572
1985	5	0	5,362	5,367	472	4,890
1986	542	0	4,429	4,971	122	4,307
1987	313	0	7,930	8,243	199	7,731
1988	3	0	13,337	13,340	819	12,518
1989	0	0	10,484	10,484	559	9,925
1990	0	0	14,442	14,442	700	13,742
1991	0	0	14,022	14,022	1,599	12,423
1992	264	0	9,601	9,865	856	8,745
1993	3,082	5	13,944	17,031	1,634	12,310
1994	5,114	13	12,049	17,176	1,483	10,566
1995	1,794	31	12,657	14,482	1,284	11,373
1996	1,662	4	10,051	11,717	1,695	8,356
1997	1,445	17	13,443	14,905	1,574	11,869
1998	252	4	10,239	10,495	1,173	9,066
1999	1,067	7	13,063	14,137	1,766	11,297
2000	693	22	10,460	11,175	2,581	7,879
2001	2,588	24	4,453	7,065	1,304	3,149
2002	1,262	165	7,175	9,087	231 [f]	6,944
2003	1,336	6	7,256	8,891	270 [g]	6,986
2004	2,249	16	7,525	10,183	297 [h]	7,228
2005	349	5	4,798	5,406	114 [i]	4,684
2006	900	17	4,112	5,270	439 [j]	3,673
2007	313	1	1,765	2,217	68 [k]	1,697
2008	13	5	752	770	0	752
2009	0	0	1,306	1,306	0	1,306
2010	0	0	2,917	2,917	0	2,917
2011	0	2	3,420	3,422	0	3,420
2012	0	0	3,197	3,197	0	3,197

-continued-

[a] Source: ADF&G, Division of Commercial Fisheries Statewide Harvest Receipt (fish ticket) database. Commercial harvest is the harvest of Chinook salmon from Inner and Outer Karluk statistical areas (255-10 and 255-20) through July 15.

[b] Based on subsistence harvest records maintained by the Westward Region of ADF&G Division of Commercial Fisheries; includes all reported harvest in Karluk Section.

[c] Total return is weir count, plus commercial and subsistence harvest.

[d] Recreational harvest is from the Statewide Harvest Survey.

[e] Escapement is weir count, minus recreational harvest.

[f] Recreational harvest does not include harvest below weir of 485 Chinook salmon.

[g] Recreational harvest does not include harvest below weir of 293 Chinook salmon.

[h] Recreational harvest does not include harvest below weir of 393 Chinook salmon.

[I] Recreational harvest does not include harvest below weir of 254 Chinook salmon.

[j] Recreational harvest does not include harvest below weir of 231 Chinook salmon.

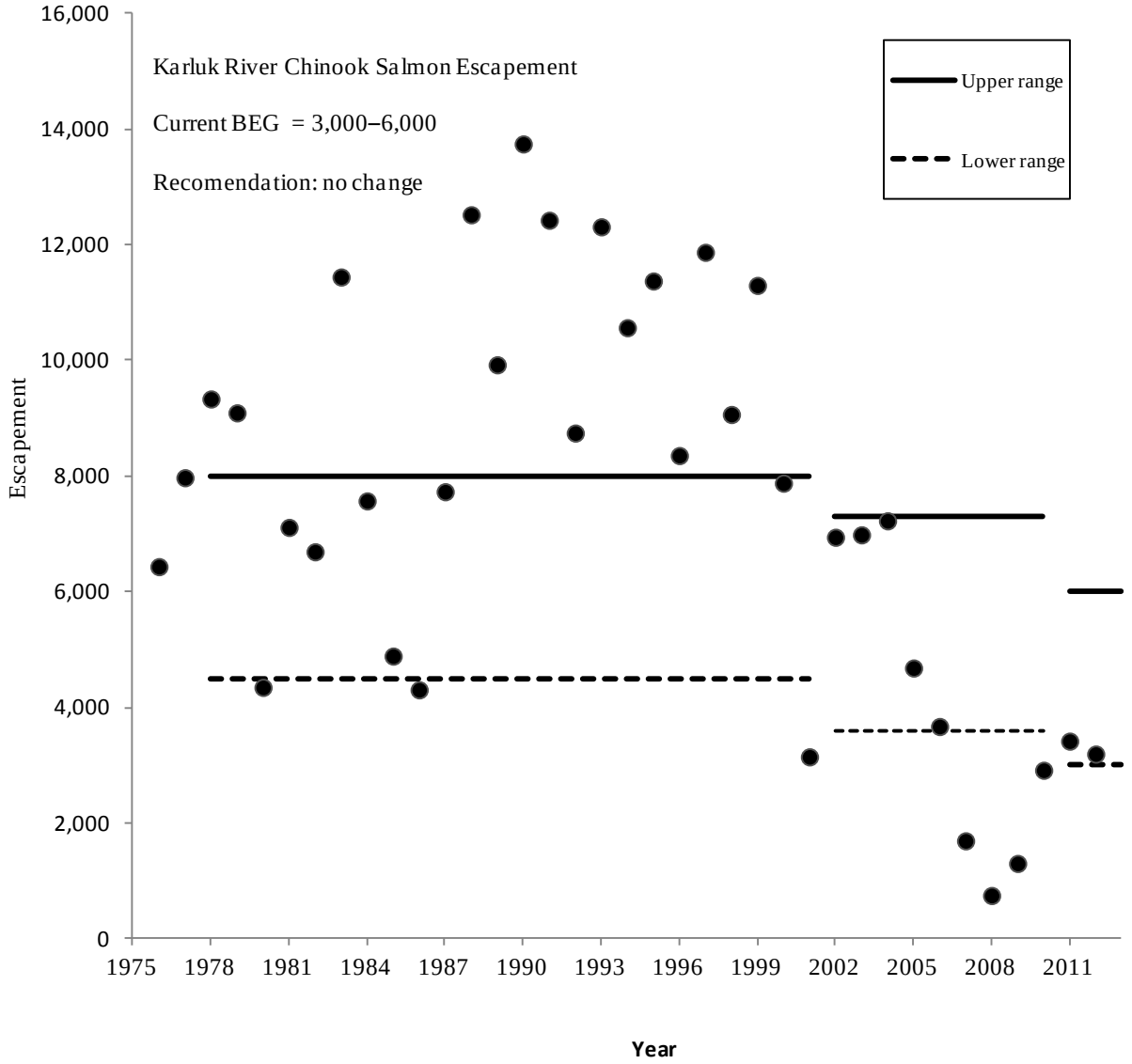
[k] Recreational harvest does not include harvest below weir of 137 Chinook salmon.

Appendix A3.–Karluk River Chinook salmon escapement and escapement goal ranges, 1976–2012.

System: **Karluk River**

Species: **Chinook salmon**

Observed escapement by year (weir counts)



Appendix A4.–Brood table for Karluk River Chinook salmon.

Brood Year	Escapement	Return by age					Total Return	Return/ Spawner
		3	4	5	6	7		
1976	6,436	159	489	2,129	3,879	919	7,575	1.18
1977	7,973	80	771	2,105	6,085	606	9,646	1.21
1978	9,334	126	762	3,301	4,014	420	8,623	0.92
1979	9,094	125	1,195	2,178	2,780	389	6,667	0.73
1980	4,349	196	788	1,508	2,575	645	5,712	1.31
1981	7,114	129	546	1,397	4,270	1,043	7,385	1.04
1982	6,693	89	506	2,317	6,910	820	10,642	1.59
1983	11,442	83	839	3,749	5,431	1,129	11,231	0.98
1984	7,572	137	1,357	2,946	7,481	1,097	13,019	1.72
1985	4,890	222	1,067	4,059	7,264	771	13,383	2.74
1986	4,307	175	1,469	3,941	5,110	77	10,772	2.50
1987	7,731	241	1,427	2,772	10,360	1,098	15,897	2.06
1988	12,518	234	1,004	5,165	10,317	1,484	18,204	1.45
1989	9,925	164	1,352	3,417	8,642	913	14,488	1.46
1990	13,742	77	1,692	2,021	5,950	882	10,621	0.77
1991	12,423	653	1,891	2,751	6,922	0	12,218	0.98
1992	8,745	444	1,921	5,271	7,866	848	16,351	1.87
1993	12,310	115	1,237	1,210	5,938	112	8,612	0.70
1994	10,566	592	1,343	5,938	6,817	707	15,396	1.46
1995	11,373	77	1,272	3,576	4,804	363	10,093	0.89
1996	8,356	141	447	1,554	3,271	89	5,503	0.66
1997	11,869	224	0	2,908	1,778	575	5,485	0.46
1998	9,066	0	2,272	5,246	5,577	178	13,273	1.46
1999	11,297	273	1,689	3,443	2,096	1,203	8,704	0.77
2000	7,879	89	435	2,246	2,840	554	6,264	0.80
2001	3,149	154	680	964	1,109	121	3,028	0.96
2002	6,944	205	263	302	647	119	1,536	0.23
2003	6,986	0	101	81	356	355	893	0.13
2004	7,228	0	0	514	1,026	299	1,839	0.25
2005	4,684	0	277	592	749	100	1,718	0.37
2006	3,673	40	197	937	1,699			
2007	1,697	0	150	1,199				
2008	752	37	200					
2009	1,306	0						
2010	2,917							
2011	3,420							
2012	3,197							

APPENDIX B. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR AYAKULIK RIVER CHINOOK SALMON.

Appendix B1.–Description of stock and escapement goal for Ayakulik River Chinook salmon.

System: Ayakulik River

Species: Chinook salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Sport and Commercial
Primary fishery:	Commercial, sport, and subsistence
Current escapement goal:	BEG: 4,000–7,000 (2011)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Weir counts, 1977 to present
Data summary:	
Data quality:	Good escapement and harvest data.
Data type:	Weir estimates, harvest estimates, age composition.
Data contrast:	All survey data 1977 to 2012: 26.12.
Methodology:	Bayesian spawner-recruit analysis with an AR(1) productivity term.
Autocorrelation:	Present.

Appendix B2.–Annual harvest, weir count, total return, and escapement estimates for Ayakulik River Chinook salmon, 1977–2012.

System: **Ayakulik River**

Species: **Chinook salmon**

Return Year	Commercial Harvest[a]	Subsistence Harvest[b]	Weir Count[c]	Total Return	Recreational Harvest[d]	Escapement[e]
1977	361	0	5,163	5,524	0	4,958
1978	615	0	4,739	5,354	0	4,551
1979	70	0	4,833	4,903	0	4,641
1980	0	0	974	974	0	935
1981	473	0	8,018	8,491	0	7,699
1982	83	0	3,230	3,313	0	3,230
1983	662	0	15,511	16,173	145	15,366
1984	1,409	0	6,502	7,911	437	6,065
1985	3,043	0	8,151	11,194	76	8,075
1986	1,785	0	6,371	8,156	76	6,295
1987	729	0	15,636	16,365	126	15,510
1988	2,257	0	21,370	23,627	600	20,770
1989	0	0	15,432	15,432	390	15,042
1990	5,332	0	11,251	16,583	252	10,999
1991	4,685	0	12,988	17,673	563	12,425
1992	4,909	0	9,135	14,044	776	8,359
1993	2,708	0	7,819	10,527	1,004	6,815
1994	0	3	9,138	9,141	948	8,190
1995	2,412	4	17,701	20,117	200	17,501
1996	3,723	0	10,344	14,067	419	9,925
1997	812	0	14,357	15,169	1,190	13,167
1998	3,795	0	14,038	17,833	259	13,779
1999	3,564	26	13,503	17,093	609	12,894
2000	3,416	38	20,527	23,981	803	19,724
2001	6,727	16	13,929	20,672	568	13,361
2002	85	37	12,552	12,674	362	12,190
2003	0	14	17,557	17,571	451	17,106
2004	158	16	24,830	25,004	405	24,425
2005	2	8	8,340	8,350	165	8,175
2006	4	37	3,106	3,147	169	2,937
2007	0	0	6,535	6,535	303	6,232
2008	0	0	3,071	3,071	0	3,071
2009	0	0	2,615	2,615	0	2,615
2010	65	0	5,301	5,366	104	5,197
2011[f]	62	0	4,316	4,378	65	4,251
2012[g]	115	0	4,760	4,875	16	4,744

-continued-

[a] Source: ADF&G, Division of Commercial Fisheries Statewide Harvest Receipt (fish ticket) database. Commercial harvest is the harvest of Chinook salmon from Inner and Outer Ayakulik statistical areas (256-15 and 256-20) through July 15.

[b] Based on subsistence harvest records maintained by the Westward Region of ADF&G Division of Commercial Fisheries; includes all reported harvest in Red River Section.

[c] Source ADF&G, Division of Commercial Fisheries Kodiak escapement (weir count) database.

[d] Recreational harvest is from the Statewide Harvest Survey.

[e] Escapement is weir count, minus recreational harvest.

[f] Recreational harvest from sportfish logbook program, guided only.

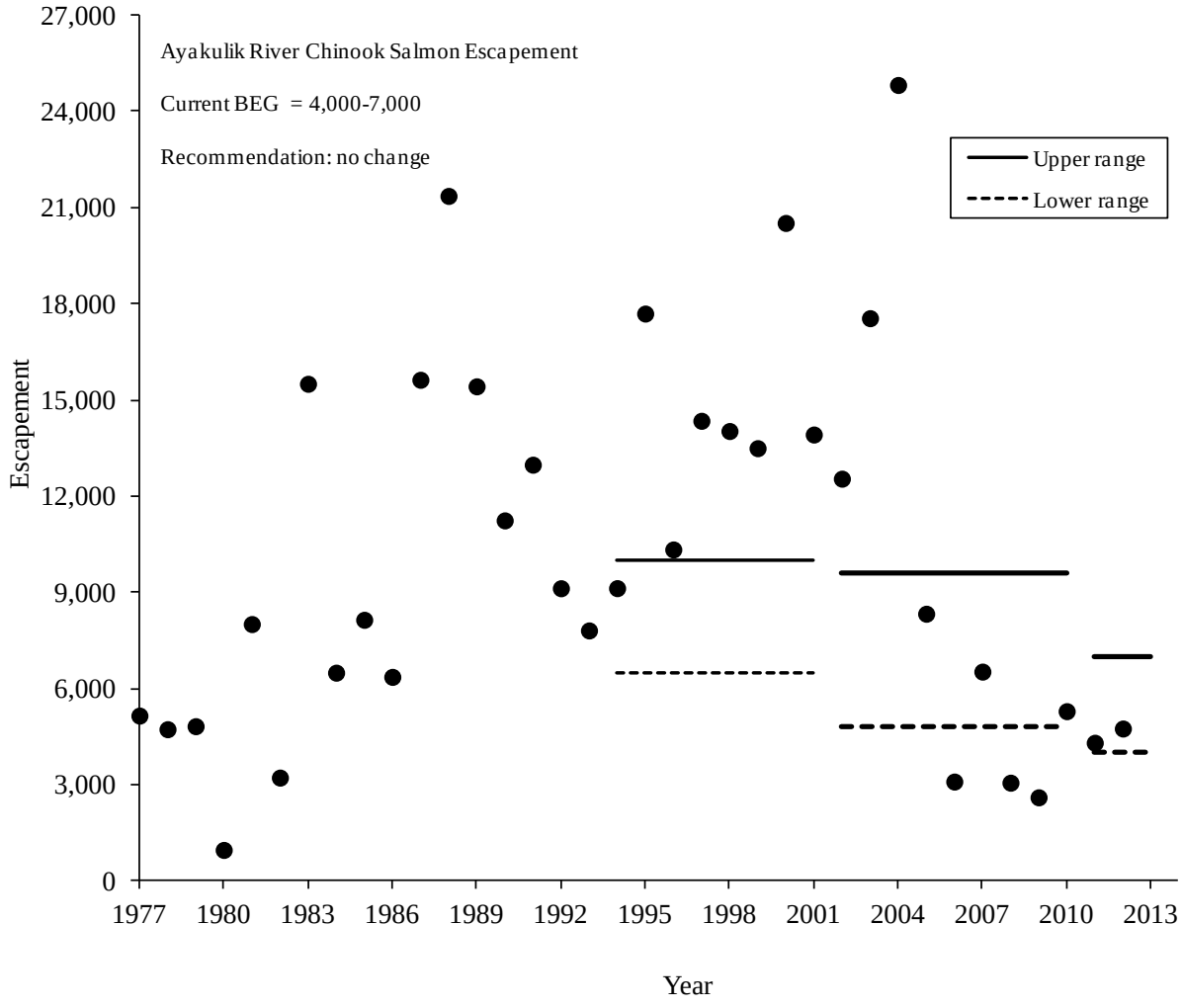
[g] Recreational harvest from sportfish logbook program, guided only.

Appendix B3.–Ayakulik River Chinook salmon escapement and escapement goal ranges, 1977–2012.

System: **Ayakulik River**

Species: **Chinook salmon**

Observed escapement by year (weir counts)



Appendix B4.–Data available for analysis of escapement goal by brood year, Ayakulik River Chinook salmon.

Brood Year	Escapement	Return by age					Total Return	Returns/ Spawner
		3	4	5	6	7		
1977	4,958	44	1,269	963	7,624	333	10,233	2.1
1978	4,551	385	495	4,702	3,729	471	9,783	2.1
1979	4,641	150	2,418	2,300	5,277	343	10,488	2.3
1980	935	733	1,183	3,255	3,845	688	9,703	10.4
1981	7,699	359	1,673	2,371	7,714	993	13,111	1.7
1982	3,230	508	1,219	4,758	11,138	649	18,272	5.7
1983	15,366	370	2,446	6,870	7,275	697	17,658	1.1
1984	6,065	742	3,532	4,487	7,817	743	17,321	2.9
1985	8,075	1,071	2,307	4,822	8,331	590	17,121	2.1
1986	6,295	700	2,479	5,139	6,620	1,695	16,633	2.6
1987	15,510	752	2,642	4,083	4,092	170	11,739	0.8
1988	20,770	801	2,099	1,815	4,769	1,538	11,022	0.5
1989	15,042	637	2,857	2,240	12,084	559	18,376	1.2
1990	10,999	69	974	2,637	6,095	834	10,608	1.0
1991	12,425	988	2,819	3,351	8,732	428	16,318	1.3
1992	8,359	1,040	3,503	2,934	11,288	210	18,975	2.3
1993	6,815	559	1,537	2,140	4,765	58	9,059	1.3
1994	8,190	1,133	2,479	8,439	10,845	567	23,463	2.9
1995	17,501	1,498	3,253	12,315	12,997	702	30,765	1.8
1996	9,925	426	732	3,849	3,519	72	8,599	0.9
1997	13,167	29	1,564	4,244	3,629	705	10,170	0.8
1998	13,779	1,695	3,375	10,300	16,502	192	32,064	2.3
1999	12,894	686	3,504	6,861	3,106	132	14,290	1.1
2000	19,724	67	606	3,666	881	1,506	6,726	0.3
2001	13,361	330	1,035	1,655	3,372	584	6,978	0.5
2002	12,190	359	406	1,382	1,172	146	3,464	0.3
2003	17,106	79	295	880	728	428	2,409	0.1
2004	24,425	0	366	801	1,625		2,792	0.1
2005	8,175	74	728	1,454		122	2,378	0.3
2006	2,937	218	1,711		2,807			
2007	6,232	86		976				
2008	3,071		854					
2009	2,615	0						
2010	5,197							
2011	4,251							
2012	4,744							

Note: No age data were collected in 2009, and age data currently unavailable for 2011 and 2012 brood years.

APPENDIX C. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR AFOGNAK LAKE SOCKEYE SALMON

Appendix C1.–Description of stock and escapement goal for Afognak Lake sockeye salmon.

System: Afognak Lake

Species: Sockeye salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine, subsistence, and sport
Current escapement goal:	BEG: 20,000–50,000 (2005)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Weir counts, 1921–1933; 1978–2012
	Aerial survey, 1966–1977
Data summary:	
Data quality:	Fair for weir counts 1921–1933; fair for aerial surveys 1966–1977; excellent for weir enumeration 1978–2009; good for harvest and age data.
Data type:	Weir counts from 1978 to 2012 with escapement age data during weir counts, 1985–2012. Fixed-wing aerial surveys from 1966 to 1977. Commercial, subsistence, and sport fish harvest data from Afognak Bay (252–34) from 1978 to 2012.
Data contrast:	Weir and aerial data, all years: 440
	Weir data, all years: 21
	Recent weir data, 1982–2012: 9
	Weir data from prefertilization years, 1978–1993: 3
Methodology:	Ricker spawner-recruit models, smolt biomass as a function of zooplankton biomass, and euphotic volume models.
Autocorrelation:	None
Criteria for BEG:	Ricker spawner-recruit model
Comments	None

-continued-

Appendix C2.–Afognak Lake sockeye salmon escapement, 1921–2012.

System: **Afognak Lake**

Species: **Sockeye salmon**

Data available for analysis of escapement goals

Year	Weir Counts	Peak Aerial Survey	Year	Weir Counts
1921	37,653		1982	123,055
1922	-		1983	40,049
1923	8,025		1984	94,463
1924	10,317		1985	53,872
1925	11,000		1986	48,333
1926	22,250		1987	26,474
1927	7,491		1988	39,012
1928	20,812		1989	88,825
1929	25,400		1990	90,666
1930	2,467		1991	88,557
1931	30,515		1992	77,260
1932	25,202		1993	71,460
1933	36,154		1994	80,570
			1995	100,131
1966		950	1996	101,718
1967		550	1997	132,050
1968		-	1998	66,869
1969		2,600	1999	95,361
1970		7,500	2000	54,064
1971		22,000	2001	24,271
1972		100	2002	19,520
1973		100	2003	27,766
1974		4,300	2004	15,181
1975		10,000	2005	21,577
1976		29,000	2006	22,933
1977		51,300	2007	21,070
1978	52,699		2008	26,874
1979	82,740		2009	31,358
1980	93,806		2010	52,255
1981	57,267		2011	49,193
			2012	41,553

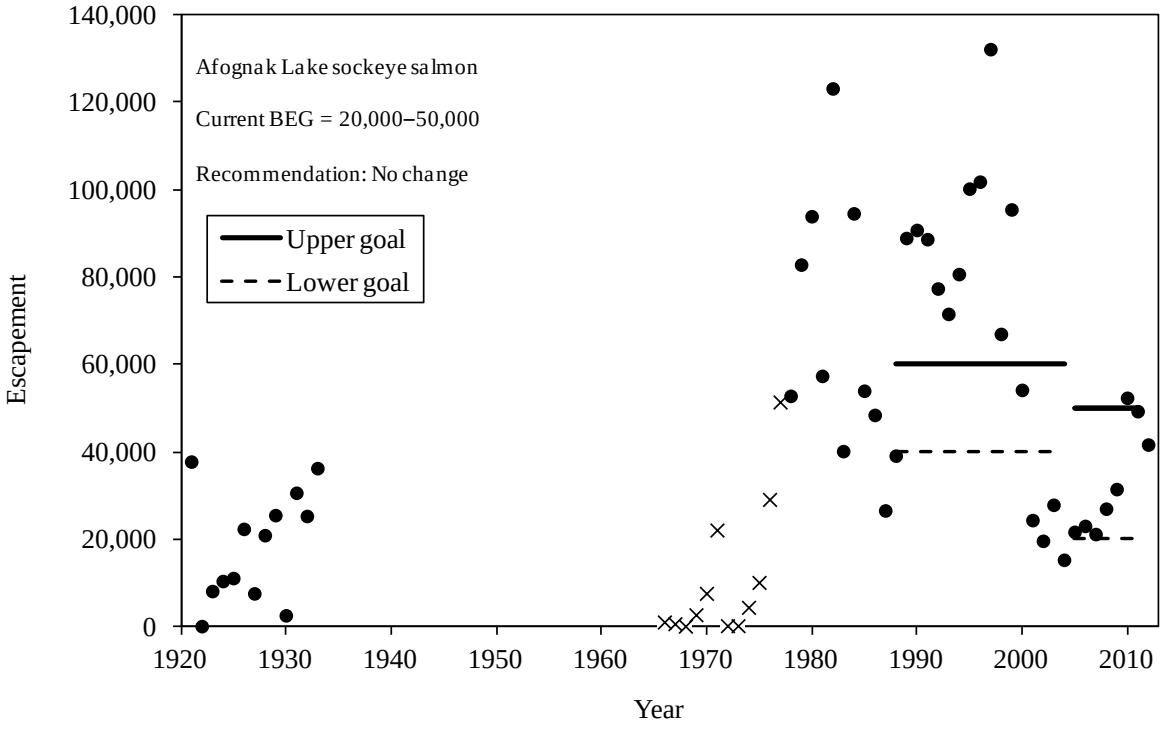
Note: Weir count numbers do not account for spawners removed for broodstock.

Appendix C3.–Afognak Lake sockeye salmon escapement and escapement goal ranges, 1921–2012.

System: **Afognak Lake**

Species: **Sockeye salmon**

Observed escapement by year (solid circles for weir counts, Xs for aerial surveys) and current BEG (dashed lines)



APPENDIX D. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR AYAKULIK RIVER SOCKEYE SALMON

Appendix D1.–Description of stock and escapement goal for Ayakulik River sockeye salmon.

System: Ayakulik River

Species: Sockeye salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine, sport, and subsistence
Current escapement goal:	Early-run SEG: 140,000–280,000 (2011)
	Late-run SEG: 60,000–120,000 (2011)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Weir counts, 1929–1961 (variable); 1962–2012
Data summary:	
Data quality:	Fair for weir counts 1929–1961; excellent for weir enumeration 1962–2012; good for harvest and age data.
Data type:	Weir counts from 1962 to 2009 with escapement age data during weir counts. Harvest estimates with age data 1970–2012. Limnology information 1990–1996 and 2009–2012.
Data contrast:	Weir data, all years: 40.1
	Weir data, 1970–2012: 22.9
Methodology:	Ricker spawner-recruit models, smolt biomass as a function of zooplankton biomass, and euphotic volume models.
Autocorrelation:	None
Criteria for SEG:	Limnology models and historical escapement.
Comments:	None

Appendix D2.–Ayakulik River sockeye salmon escapement and harvest estimates, 1929–2012.

System: Ayakulik River

Species: Sockeye salmon

Data available for analysis of escapement goals

	Weir Counts		Commercial		Weir Counts		Commercial
Year	Early	Late	Harvest	Year	Early	Late	Harvest
1929	18,481	10,386		1975	59,021	35,496	0
1930	54,390	79,396		1976	182,784	36,263	132,805
1931	257,444	363,549		1977	236,127	70,855	165,424
1932	295,953	202,570		1978	107,847	25,017	178,080
1934	659,472	500,824		1979	157,408	64,862	31,901
1935	314,341	200,626		1980	481,165	293,163	208,281
1936	324,240	167,132		1981	125,272	153,928	177,795
1937	202,848	51,146		1982	125,852	43,826	102,075
1938	133,743	52,760		1983	93,540	77,875	25,003
1939	145,559	38,948		1984	232,466	50,749	392,218
1940	221,759	62,874		1985	300,568	88,191	517,250
1941	149,100	131,736		1986	238,557	79,578	415,848
1942	223,121	61,924		1987	180,515	81,398	119,459
1945	293,306	136,577		1988	191,386	100,388	312,132
1946	133,474	36,881		1989	533,066	235,035	0
1948	105,272	112,957		1990	196,695	174,587	1,467,737
1949	43,945	57,680		1991	321,985	52,874	926,419
1950	110,215	66,404		1992	219,723	124,461	404,246
1953	68,465	53,189		1993	195,701	90,469	338,727
1954	62,689	44,680		1994	241,811	138,370	41,331
1955	64,819	21,013		1995	198,864	118,968	565,040
1956	62,486	9,087		1996	213,229	123,926	906,897
1957	105,193	49,702		1997	206,346	101,868	135,595
1958	57,631	37,224		1998	313,739	113,469	1,018,898
1959	65,946	9,154		1999	204,552	91,165	693,912
1960	16,398	18,216		2000	174,297	34,354	236,190
1962	229,603	49,351		2001	177,822	41,070	367,522
1963	27,085	36,478		2002	194,187	35,105	6,505
1964	8,363	27,979		2003	162,708	35,184	90
1965	35,681	39,675		2004	245,123	30,115	170,749
1966	11,591	59,568		2005	139,246	112,660	53,835
1967	102,890	121,310		2006	59,315	28,465	32,325
1968	166,309	54,541		2007	169,596	113,446	99,937
1970	12,620	21,248	28,306	2008	96,912	65,976	81,540
1971	51,011	58,188	0	2009	200,648	114,536	70,588
1972	82,804	30,929	46,733	2010	201,933	60,394	255,942
1973[a]	99,783	20,210	36,455	2011	177,480	83,661	170,490
1974	147,590	34,041	43,251	2012	213,501	114,753	229,906

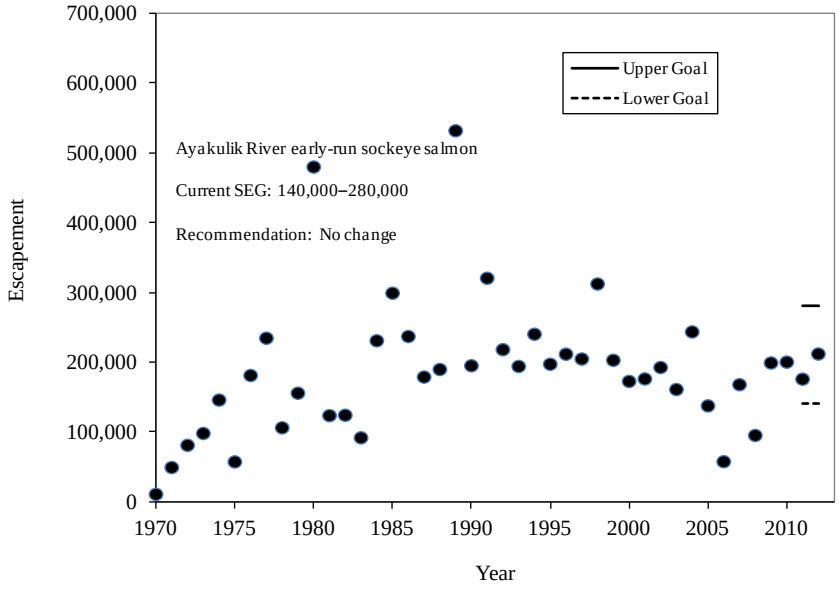
[a] 1973 escapement is not in database; value is from the 1973 Annual Management Report.

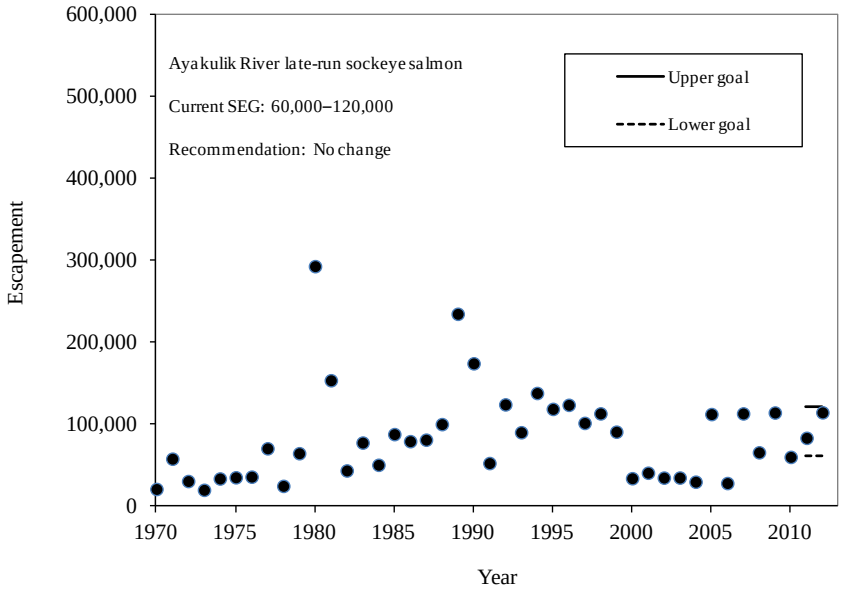
Appendix D3.–Ayakulik River sockeye salmon escapement and escapement goals, 1970–2012.

System: **Ayakulik River**

Species: **Sockeye salmon**

Observed escapement by year (circles)





Appendix D4.–Ayakulik River sockeye salmon brood table.

Brood Year	Escap.	Age 0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	3.1	1.4	2.3	3.2	2.4	3.3	3.4	Total Return
1976	219,047	0	0	5,835	3,855	405,330	8,408	0	164,495	187,009	0	0	61,395	0	0	0	0	836,328
1977	306,982	0	0	0	0	5,060	3,431	0	18,656	170,721	0	0	85,541	3,940	0	0	0	287,349
1978	132,864	0	0	0	0	1,556	15,799	0	14,937	45,081	0	0	42,151	2,747	0	0	0	122,273
1979	222,270	0	0	3,625	441	16,345	18,352	0	40,958	131,539	0	0	41,815	1,438	0	0	0	254,511
1980	774,328	0	0	11,780	13,347	402,761	24,781	0	232,583	305,083	0	0	159,440	2,762	0	0	0	1,152,537
1981	279,200	0	0	17,149	0	310,784	7,450	0	230,889	328,622	0	0	168,527	28,564	0	0	0	1,091,984
1982	169,678	0	0	6,857	7,500	1,626	2,596	0	16,351	123,667	0	0	77,129	4,751	0	0	0	240,476
1983	171,415	0	0	548	1,171	20,198	15,116	0	72,231	168,055	0	0	104,765	0	0	0	0	382,085
1984	283,215	0	0	7,779	3,311	138,185	78,899	0	72,319	197,026	0	0	103,450	3,347	0	0	0	604,316
1985	388,759	0	0	61,345	3,903	365,489	18,971	0	589,731	513,314	0	0	229,750	4,276	0	0	0	1,786,779
1986	318,135	0	0	4,480	38,326	571,371	6,489	0	506,463	365,644	0	0	231,471	5,967	0	0	0	1,730,211
1987	261,913	0	0	12,991	15,380	173,341	13,602	0	103,512	317,142	0	0	341,728	32,807	0	5,063	0	1,015,566
1988	291,774	0	0	2,822	3,351	81,584	2,832	0	62,159	126,124	0	0	27,783	10,655	0	8,225	0	325,535
1989	768,101	0	0	2,571	5,565	26,297	29,189	0	18,318	310,379	0	0	254,557	59,553	0	46,238	0	752,667
1990	371,282	0	0	1,028	8,047	3,618	14,638	0	59,035	295,167	0	0	202,600	16,202	0	102	38	600,475
1991	384,859	0	640	22,371	17,118	145,925	36,123	0	393,249	482,187	0	19	158,923	5,779	64	2,796	112	1,265,306
1992	344,184	0	4,591	2,578	9,900	65,889	24,694	205	10,135	200,817	2,188	2,685	230,460	19,788	1,983	6,010	112	582,035
1993	286,170	0	0	3,093	3,678	2,504	16,283	400	176,539	409,718	516	8,075	138,504	7,591	344	5,426	0	772,671
1994	380,181	0	465	42,711	7,275	555,246	35,908	17,036	338,728	344,937	546	79	102,628	7,224	401	1,737	0	1,454,921
1995	317,832	0	0	4,711	4,707	101,292	18,181	516	53,759	227,822	3,186	0	240,294	22,068	1,125	6,135	0	683,795
1996	337,155	0	269	1,770	17,050	16,902	8,589	332	93,851	198,161	364	0	143,934	802	291	244	0	482,559
1997	308,214	0	5	1,250	4,810	14,447	5,395	597	11,767	34,814	330	0	16,169	727	0	1,490	0	91,802
1998	427,208	62	0	4,554	597	29,683	2,929	0	12,657	97,574	1,470	602	46,305	10,818	234	4,760	40	212,288
1999	295,717	0	0	2,953	4,818	53,015	8,754	353	124,906	192,030	0	240	80,066	4,301	658	1,930	0	474,025
2000	208,651	130	0	2,261	7,074	56,453	5,858	0	40,660	148,872	148	0	26,019	893	539	2,481	0	291,390
2001	218,892	0	0	97	0	21,217	4,756	0	12,812	57,133	0	315	95,615	2,218	299	142	0	194,605
2002	229,292	0	0	499	121	13,352	4,881	141	61,713	162,634	214	1,386	67,474	189	477	311	0	313,392
2003	197,892	0	40	2,224	1,086	47,900	5,678	0	47,986	88,088	0	152	36,068	2,986	296	1,015	0	233,520
2004	275,238	0	0	2,445	3,358	24,944	5,073	152	59,544	163,974	0	625	34,630	3,192	195	0	0	298,131
2005	251,906	0	67	5,423	694	99,530	13,239	0	73,594	260,808	1,059	307	33,847	2,480	0	682		491,729
2006	87,780	0	0	8,645	839	110,179	16,074	0	77,324	161,777	163	317	40,897	4,379				
2007	283,042	0	0	15,958	1,454	101,723	35,354	0	103,711	318,854	224							
2008	162,888	0	0	16,912	866	66,934	11,628											
2009	315,184	95	0	9,668														
2010	262,327	0																
2011	261,141																	
2012	328,254																	
														10-year average (1996–2005):				308,344

Note: For brood years 1968–1975, refer to Nemeth et al. (2010).

APPENDIX E. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR BUSKIN RIVER SOCKEYE SALMON

Appendix E1.–Description of stock and escapement goal for Buskin River sockeye salmon.

System: Buskin River

Species: Sockeye salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Sport and Commercial
Primary fishery:	Sport and subsistence
Current escapement goal:	BEG: 5,000–8,000 (2011)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Weir counts, 1990 to present
Data summary:	
Data quality:	Good escapement and harvest data.
Data type:	Weir estimates, harvest estimates, age composition.
Data contrast:	Weir count escapement data 1997 to 2012: 4.05
Methodologies:	Bayesian spawner-recruit analysis yielding 90% credibility interval for S_{MSY} of 4,950–8,700 and probability of sustained yield being greater than 90% of S_{MSY} occurring for a BEG of 5,000–8,000.
Autocorrelation:	Present
Comments:	None

Appendix E2.–Buskin River sockeye salmon estimated escapement and total run, 1997–2012.

System: Buskin River

Species: Sockeye salmon

Data available for analysis of escapement goals

Return Year	Commercial Harvest[a]	Subsistence Harvest	Inriver Return[b]	Recreational Harvest[c]	Total Return	Escapement[d]
1997	0	5,890	9,798	1,843	17,531	9,798
1998	0	6,011	14,746	1,983	22,740	14,746
1999	0	7,985	10,809	1,467	20,261	10,809
2000	0	7,315	11,223	2,041	20,579	11,223
2001	0	10,260	20,556	827	31,643	20,556
2002	0	13,366	17,174	2,204	32,744	17,174
2003	6	10,651	23,870	3,017	37,544	23,870
2004	1,098	9,421	22,023	1,379	33,921	22,023
2005	0	8,239	15,468	1,540	25,247	15,468
2006	6	7,577	17,734	1,577	26,894	17,734
2007	30	11,151	16,502	1,509	29,192	16,502
2008	0	2,664	5,900	1,160	9,724	5,900
2009	0	1,853	7,757	695	10,305	7,757
2010	0	2,631	9,800	332	10,132	9,800
2011	38	4,639	11,982	1277	13,259	11,982
2012	1	2,631	8,565	1484	10,049	8,565

[a] Commercial harvest is the harvest of sockeye salmon from the Buskin River and Womans Bay statistical areas (259-22, 259-26).

[b] Inriver return is the estimated return to the weir at Buskin Lake.

[c] Recreational harvest from SWHS.

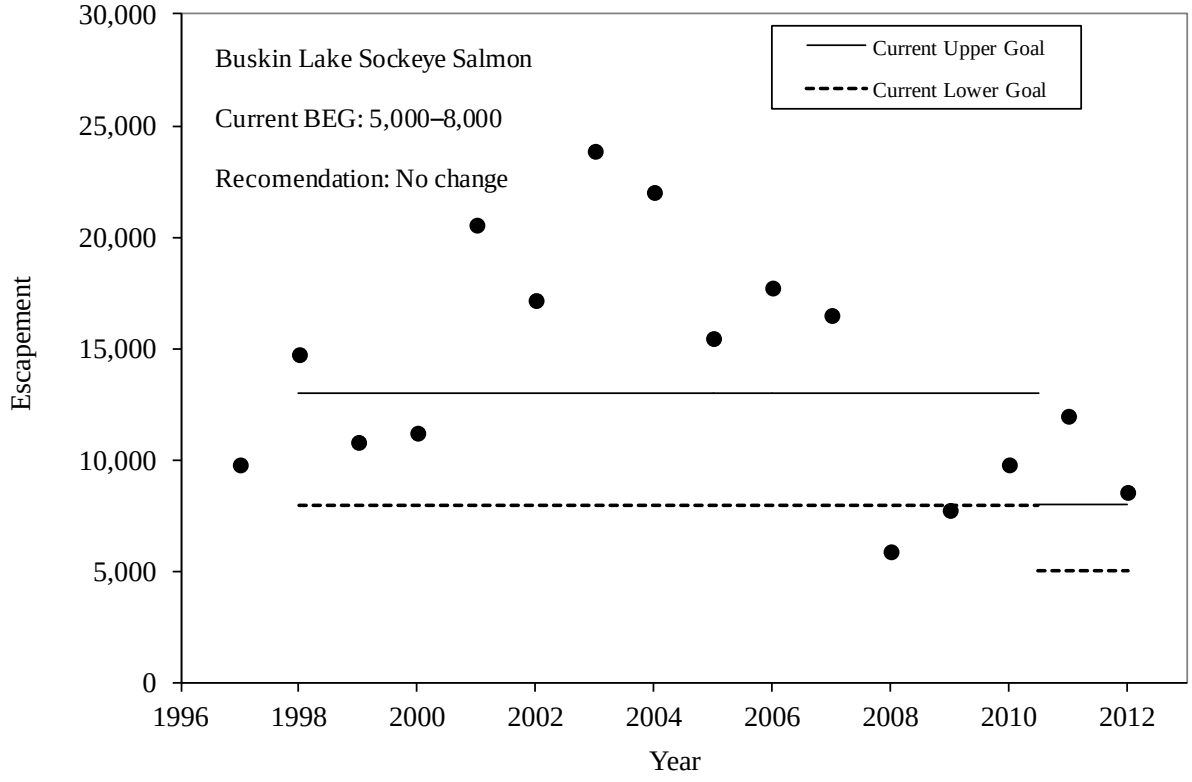
[d] Escapement= inriver return.

Appendix E3.–Buskin River sockeye salmon escapement and escapement goals, 1997–2012.

System: **Buskin River**

Species: **Sockeye salmon**

Observed escapement by year (weir counts)



APPENDIX F. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR FRAZER LAKE SOCKEYE SALMON

Appendix F1.–Description of stock and escapement goal for Frazer Lake sockeye salmon.

System: Frazer Lake

Species: Sockeye salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and gillnet
Current escapement goal:	BEG: 75,000–170,000 (2008)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Weir counts, 1956–2012
Data summary:	
Data quality:	Excellent for weir counts; good for harvest and age data.
Data type:	Weir counts from 1956 to 2012 with escapement age data during weir counts. Weir counts through Dog Salmon Creek (1985–2012). Total run estimates with age data 1974–2012. Limnology information 1985–1997 and 2001–2012.
Data contrast:	30.7 (weir data from 1966 through 2012)
Methodology:	Ricker spawner-recruit models, smolt biomass as a function of zooplankton biomass, and euphotic volume models.
Autocorrelation:	None
Criteria for SEG:	None
Comments:	None

Appendix F2.–Frazer Lake sockeye salmon escapement and total run estimates, 1968–2012.

System: Frazer Lake
Species: Sockeye salmon
Data available for analysis of escapement goals

Year	Weir Counts	Total Run
1968	16,738	
1969	14,041	
1970	24,039	
1971	55,366	
1972	66,419	
1973	56,255	
1974	82,609	85,374
1975	64,199	67,499
1976	119,321	128,091
1977	139,548	140,914
1978	141,981	172,317
1979	126,742	153,547
1980	405,535	460,708
1981	377,716	487,926
1982	430,423	506,655
1983	158,340	196,323
1984	53,524	67,377
1985	485,835	637,871
1986	126,529	178,205
1987	40,544	57,582
1988	246,704	458,461
1989	360,373	1,070,871
1990	226,707	979,833

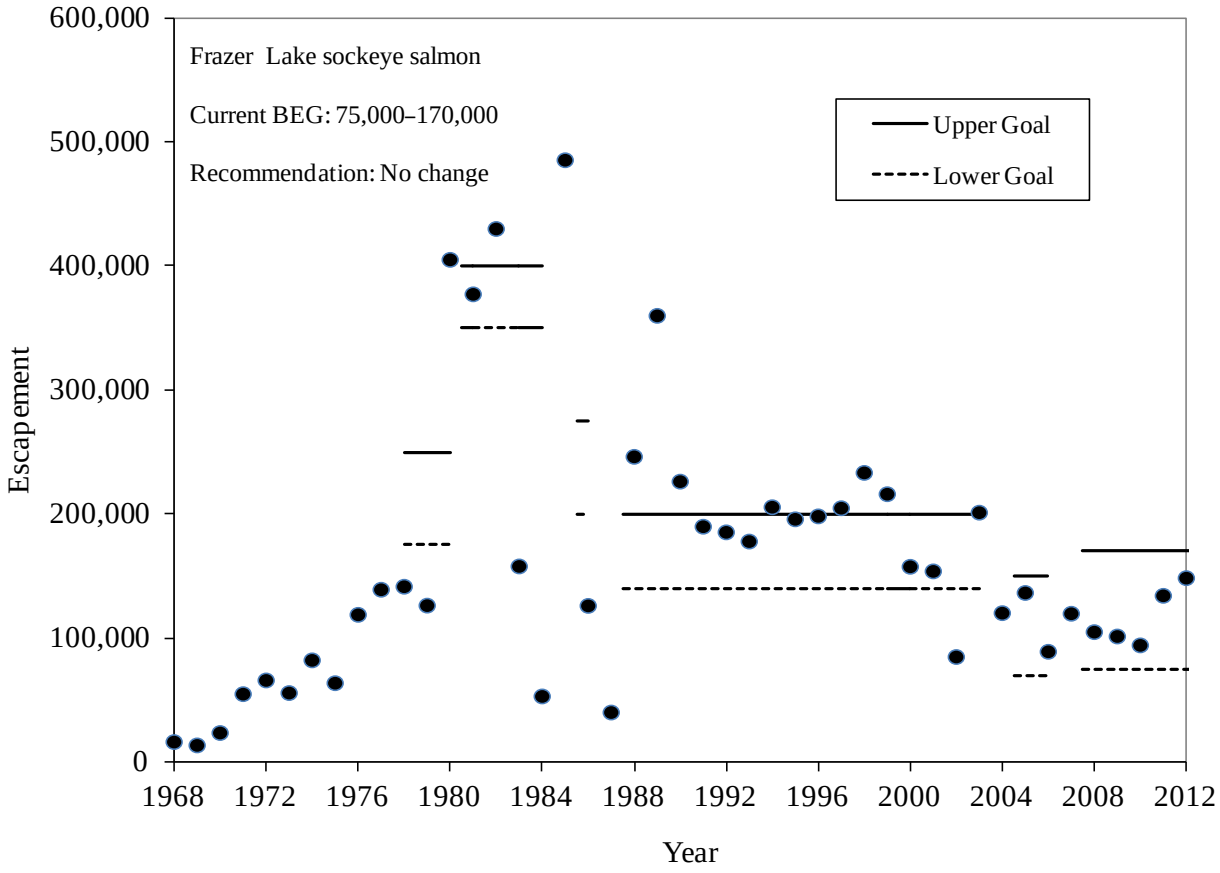
Year	Weir Counts	Total Run
1990	226,707	979,833
1991	190,358	1,268,145
1992	185,825	418,773
1993	178,391	751,405
1994	206,071	650,045
1995	196,323	952,377
1996	198,695	700,913
1997	205,264	416,419
1998	233,755	606,343
1999	216,565	357,079
2000	158,044	394,705
2001	154,349	403,372
2002	85,317	110,225
2003	201,679	313,914
2004	120,664	712,251
2005	136,948	625,937
2006	89,516	117,900
2007	120,186	168,571
2008	105,363	520,603
2009	101,845	474,976
2010	94,680	165,112
2011	134,642	372,423
2012	148,884	372,047

Appendix F3.–Frazer Lake sockeye salmon escapement and escapement goal ranges, 1968–2012.

System: **Frazer Lake**

Species: **Sockeye salmon**

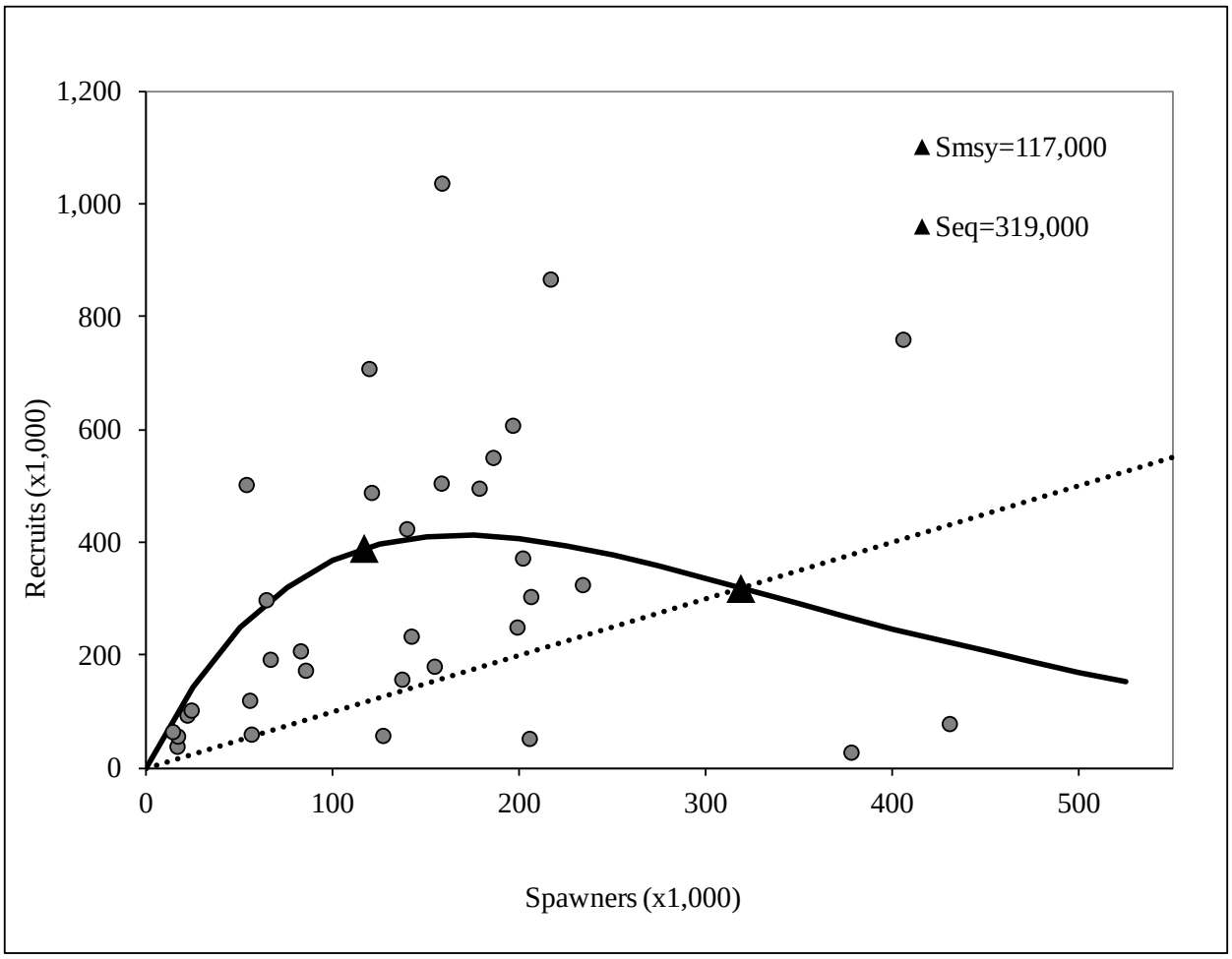
Observed escapement by year (circles)



Appendix F4.–Fitted Ricker stock-recruitment curves, line of replacement, and actual data for Frazer Lake sockeye salmon.

System: **Frazer Lake**

Species: **Sockeye salmon**



Note: The solid line represents the Ricker curve and the dotted line represents replacement. Data for brood years 1966 through 2005, excluding brood years 1985 through 1991 because they were affected by fertilization.

Appendix F5.–Frazer Lake sockeye salmon brood table. Escapements taken from Dog Salmon weir to include all fish returning to watershed.

Brood		Age																Total	Return/
Year	Escap.	0.2	1.1	0.3	1.2	2.1	1.3	2.2	3.1	1.4	2.3	3.2	4.1	2.4	4.2	3.3	8 yo	Return	Spawner
1966	16,456	0	0	0	11,820	1,732	7,580	16,149	0	0	2,629	0	0	0	0	0	0	39,910	2.4
1967	21,834	0	1,118	0	38,626	395	38,395	11,553	0	0	5,114	0	0	0	0	0	0	95,202	4.4
1968	16,738	0	461	0	15,565	899	15,228	14,998	0	0	10,757	0	0	0	0	0	0	57,910	3.5
1969	14,041	0	138	0	14,654	5,229	9,306	30,137	0	0	6,007	0	0	0	0	512	0	65,984	4.7
1970	24,039	0	2,241	0	17,672	16,989	1,687	51,299	0	0	9,351	3,074	0	0	0	1,691	0	104,005	4.3
1971	55,366	0	512	0	1,417	6,345	769	92,226	0	0	20,151	0	0	0	0	0	0	121,419	2.2
1972	66,419	0	742	0	10,888	11,016	8,032	91,876	0	0	71,167	345	0	0	0	0	0	194,066	2.9
1973	56,255	0	256	0	2,677	5,637	4,825	31,706	345	0	15,969	0	0	0	0	0	0	61,415	1.1
1974	82,609	0	10,850	0	53,591	9,305	28,713	75,084	154	461	30,407	461	0	0	0	0	0	209,026	2.5
1975	64,199	0	1,034	0	22,571	8,906	20,732	173,687	0	0	72,701	0	0	0	0	0	0	299,631	4.7
1976	119,321	0	2,150	0	223,444	8,753	73,677	257,625	0	0	143,383	0	0	0	0	393	0	709,424	5.9
1977	139,548	0	2,764	0	73,189	2,928	92,211	107,917	0	0	146,064	393	0	0	0	0	0	425,466	3.0
1978	141,981	0	7,807	0	162,130	507	24,148	22,970	0	0	16,844	0	0	0	0	638	0	235,043	1.7
1979	126,742	0	507	0	1,374	982	2,965	24,323	0	0	26,791	0	0	0	0	2,165	0	59,106	0.5
1980	405,535	0	0	0	6,064	16,305	7,654	589,393	0	0	141,065	684	0	46	0	52	0	761,264	1.9
1981	377,716	0	876	0	12,120	0	2,455	7,748	0	172	5,239	0	0	0	0	862	0	29,471	0.1
1982	430,423	0	1,276	0	23,647	431	28,624	3,735	24	754	10,870	10,812	0	0	0	0	0	80,172	0.2
1983	158,340	0	10	26	8,935	9,729	13,438	380,531	1,604	0	586,833	0	0	0	0	36,986	0	1,038,092	6.6
1984	53,524	0	1,001	0	5,771	33,628	7,437	386,832	0	0	67,142	2,046	0	0	0	0	0	503,856	9.4
1985	485,835	0	192	0	16,502	4,399	49,290	53,978	151	0	22,578	9,032	0	1,595	0	2,694	0	160,412	0.3
1986	126,529	1,393	67,475	0	727,658	40,794	230,893	972,290	0	0	168,815	9,129	0	0	0	8,584	0	2,227,031	17.6
1987	40,544	0	1,787	1,851	3,019	26,596	3,902	187,581	0	0	159,822	104	0	156	0	882	0	385,701	9.5
1988	246,704	0	1,886	0	21,073	7,793	30,096	210,586	133	0	64,565	20,510	0	16	0	7,994	0	364,652	1.5
1989	360,373	0	16,191	208	327,929	12,847	153,078	373,277	5,752	0	300,182	145,325	0	0	0	40,754	0	1,375,543	3.8
1990	226,707	0	1,096	0	18,217	12,986	33,393	400,750	1,678	0	210,744	15,341	0	455	0	9,340	0	704,000	3.1
1991	190,358	0	621	0	2,031	57,463	1,728	330,834	302	0	105,361	630	0	0	0	0	0	498,970	2.6
1992	185,825	0	3,545	0	20,513	78,168	27,471	211,959	4,666	0	185,148	18,141	0	0	0	2,209	0	551,819	3.0
1993	178,391	0	2,529	45	12,677	41,759	56,178	291,218	4,831	0	64,155	17,867	0	256	0	5,830	0	497,344	2.8
1994	206,071	0	2,056	0	23,034	17,688	39,741	112,849	1,048	0	77,546	15,427	0	187	0	15,733	0	305,309	1.5
1995	196,323	0	10,106	0	59,574	39,574	77,223	152,287	1,251	0	251,356	11,284	0	815	0	5,387	0	608,857	3.1
1996	198,695	0	20,062	0	41,983	22,276	81,667	32,786	26	1,641	50,325	101	0	191	0	201	0	251,259	1.3
1997	205,264	0	626	0	8,327	1,639	9,831	14,560	231	630	15,665	2,251	0	0	0	0	77	53,837	0.3
1998	233,755	0	367	0	1,374	24,808	14,710	87,861	16,454	0	57,957	88,617	0	366	0	33,880	0	326,394	1.4
1999	216,565	0	1,152	0	3,507	136,968	77	481,220	0	0	241,075	1,299	0	496	0	2,090	97	867,981	4.0
2000	158,044	0	35,476	0	68,494	15,072	219,630	107,018	0	521	58,178	330	0	547	233	289	521	506,309	3.2
2001	154,349	0	814	0	21,700	557	5,639	3,657	23,842	131	11,476	29,633	293	776	718	81,003	1,501	181,739	1.2
2002	85,317	0	335	0	5,659	14,124	5,844	27,492	11,173	0	44,559	35,868	0	415	0	29,071	153	174,694	2.0
2003	201,679	0	3,365	0	8,565	58,042	16,372	170,743	2,948	0	81,058	31,271	0	162	0	1,004	0	373,528	1.9
2004	120,664	0	14,757	0	148,241	16,861	90,953	197,458	0	250	20,896	233	0	175	0	0	0	489,822	4.1
2005	136,948	0	1,993	0	34,005	9,131	34,164	29,710	8,606	434	36,619	3,204	90	344	0	506		158,805	1.2
2006	89,516	0	113	224	5,281	58,888	21,506	216,074	7,610	0	118,641	5,882	0						
2007	120,186	0	5,543	660	13,247	68,111	21,217	174,630	0										
2008	105,363	0	4,692	0	46,539	3,757													
2009	101,845	499	34																
2010	94,680																		
2011	134,642																		
2012	148,884																		
																	10-Year Average (1996-2005):	338,437	2.0

APPENDIX G. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR KARLUK LAKE SOCKEYE SALMON

Appendix G1.–Description of stock and escapement goals for Karluk Lake sockeye salmon.

System: Karluk Lake

Species: Sockeye salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and set gillnet
Current escapement goal:	Early-run BEG: 110,000–250,000 (2008)
	Late-run BEG: 170,000–380,000 (2005)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Weir counts: 1922–2012
Data summary:	
Data quality:	Good
Data type:	Weir counts from 1922 to 2012. Age compositions and stock-specific harvest 1985–2012. Rough estimates of harvest attributed to both runs combined, 1922–2012. Smolt outmigration estimates 1961–68, 1980–84, 1991–92, 1999–2006, and 2011 and 2012. Limnology information 1981–2009.
Data contrast:	Weir data 1981–2012: early (8.7), late (19.9).
Methodology:	Ricker spawner-recruit
Comments:	None

Appendix G2.–Karluk Lake early-run sockeye salmon escapement, 1981–2012.

System: **Karluk Lake early run**

Species: **Sockeye salmon**

Data available for analysis of escapement goals

Year	Weir Counts	Commercial Harvest
1981	97,937	
1982	122,705	
1983	215,620	
1984	288,422	
1985	316,688	28,326
1986	358,756	116,191
1987	354,094	77,156
1988	296,510	35,236
1989	349,753	2
1990	196,197	32,021
1991	243,069	28,135
1992	217,152	245,012
1993	261,169	308,579
1994	260,771	188,452
1995	238,079	283,333
1996	250,357	509,874
1997	252,859	134,480
1998	252,298	116,473
1999	392,419	182,577
2000	291,351	266,485
2001	338,799	303,664
2002	456,842	167,038
2003	451,856	372,761
2004	393,468	396,088
2005	283,860	245,800
2006	202,366	272,537
2007	294,740	198,354
2008	82,191	70,751
2009	52,798	16,054
2010	71,453	9,908
2011	87,049	6,805
2012	188,085	47,801

Appendix G3.–Karluk Lake late-run sockeye salmon escapement, 1981–2012.

System: Karluk Lake late run

Species: Sockeye salmon

Data available for analysis of escapement goals

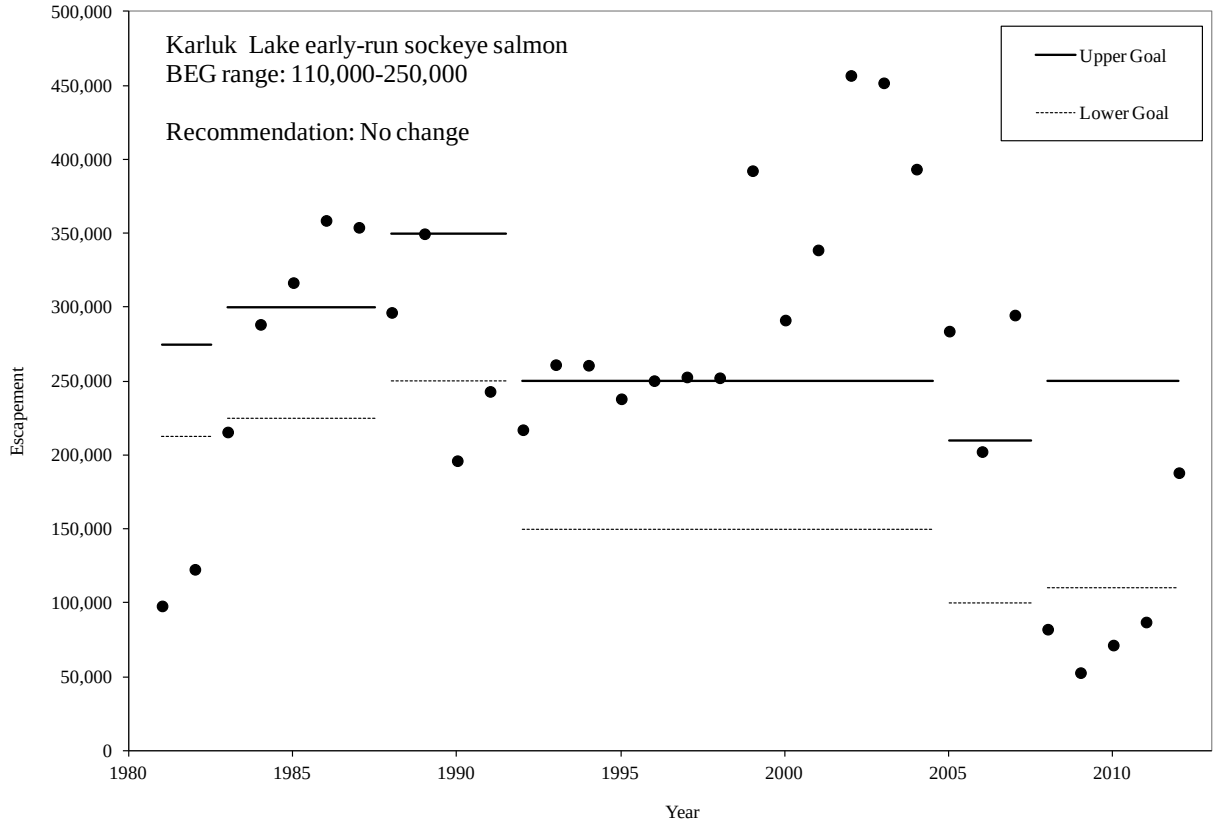
Year	Weir Counts	Commercial Harvest
1981	124,769	
1982	41,702	
1983	220,795	
1984	131,846	
1985	679,260	168,328
1986	528,415	297,042
1987	412,157	170,019
1988	282,306	127,721
1989	758,893	3,476
1990	541,891	990,660
1991	831,970	1,097,830
1992	614,262	442,692
1993	396,288	235,361
1994	587,258	106,325
1995	504,977	361,535
1996	323,969	187,717
1997	311,902	127,114
1998	384,848	302,166
1999	589,119	414,885
2000	445,393	211,546
2001	524,739	347,790
2002	408,734	457,285
2003	626,854	965,484
2004	326,466	332,464
2005	498,102	423,573
2006	288,007	282,441
2007	251,835	469,775
2008	164,299	130,587
2009	277,280	52,503
2010	276,649	39,348
2011	230,273	34,995
2012	314,605	275,192

Appendix G4.–Karluk Lake early-run sockeye salmon escapement and escapement goal ranges, 1981–2012.

System: **Karluk Lake early run**

Species: **Sockeye salmon**

Observed escapement by year (circles)

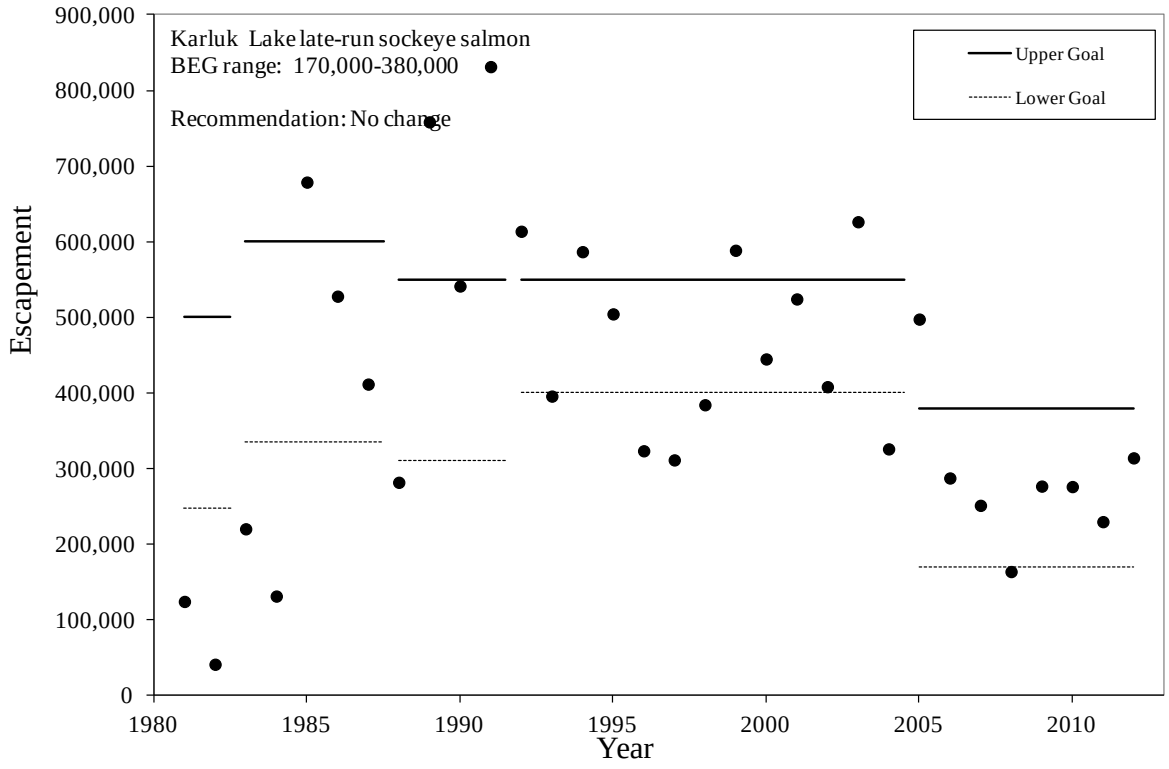


Appendix G5.–Karluk Lake late-run sockeye salmon escapement and escapement goals, 1981–2012.

System: **Karluk Lake late run**

Species: **Sockeye salmon**

Observed escapement by year (circles)



Appendix G6.–Karluk Lake early-run sockeye salmon brood table.

Brood		Age																	Total	Return/
Year	Escap.	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	3.1	1.4	2.3	3.2	4.1	2.4	3.3	4.2	8yo	9yo	Return	Spawner
1976	204,037																		0		
1977	185,312																	0	0		
1978	248,741														0	10,989	0	0	0		
1979	212,872										0	50,484	45,654	0	641	14,673	0	0	0		
1980	132,396						0	11,635	193,760	4,085	0	103,899	60,395	0	0	37,689	0	0	0		
1981	97,937			0	8,558	18,604	0	3,735	278,831	1,672	0	117,158	38,129	0	272	22,433	0	0	0		
1982	122,705	0	1,244	841	4,650	5,466	0	21,058	197,293	4,169	0	93,560	37,079	0	0	20,728	0	0	320	386,408	3.1
1983	215,620	0	143	564	8,159	7,032	0	14,244	149,947	1,728	0	183,829	33,945	0	337	14,082	0	0	0	414,009	1.9
1984	288,422	0	0	0	4,090	8,393	0	5,830	97,537	738	0	94,258	30,589	0	908	19,634	0	0	0	261,977	0.9
1985	316,688	0	0	24	4,258	2,842	0	3,969	72,857	3,010	0	88,599	57,934	0	1,955	40,331	0	68	0	275,847	0.9
1986	358,756	24	0	337	6,152	2,201	346	6,443	87,691	4,031	94	129,381	131,218	0	479	61,223	1,508	348	0	431,475	1.2
1987	354,094	427	0	1,456	958	2,884	0	8,503	114,504	19,876	416	44,051	337,905	0	285	60,244	2,309	2,659	0	596,477	1.7
1988	296,510	0	0	0	8,383	6,297	0	9,708	84,322	13,770	0	37,096	202,729	0	320	70,357	231	2,945	0	436,159	1.5
1989	349,753	0	1,621	0	8,492	7,624	0	13,979	104,564	5,517	0	167,751	101,296	0	1	69,709	5,362	1,713	0	487,630	1.4
1990	196,197	0	181	0	18,149	2,780	0	50,649	79,156	6,586	652	146,751	97,063	0	269	70,863	760	0	0	473,858	2.4
1991	243,069	0	1,224	1,062	26,661	12,015	0	83,430	326,422	7,087	0	127,809	81,364	809	107	12,113	2,476	247	0	682,826	2.8
1992	217,152	0	2,669	4	9,627	9,642	0	13,159	52,730	14,935	0	42,891	58,375	0	769	36,603	0	79	0	241,483	1.1
1993	261,169	2	1,534	350	3,309	18,252	0	7,718	226,377	2,275	0	128,158	35,029	0	1,752	42,563	437	288	0	468,044	1.8
1994	260,771	0	1,017	0	8,956	7,266	0	41,179	294,780	1,857	427	182,133	54,148	0	587	33,887	1,781	1,042	0	629,059	2.4
1995	238,079	0	218	0	23,268	13,106	0	33,004	231,809	3,463	0	245,934	83,559	0	1,405	52,470	835	492	0	689,562	2.9
1996	250,357	0	0	0	2,063	5,959	0	2,217	253,847	2,326	0	215,129	84,029	0	61	42,035	0	1,575	0	609,241	2.4
1997	252,859	0	0	1,838	3,930	11,696	0	6,691	233,964	3,274	0	131,879	63,748	0	0	24,066	0	0	0	481,086	1.9
1998	252,298	0	574	0	4,258	19,885	0	5,410	531,206	4,517	532	168,024	104,530	715	0	14,578	0	0	0	854,229	3.4
1999	392,419	0	898	0	15,382	28,948	0	33,620	432,204	10,393	76	192,314	80,270	0	0	48,461	0	116	0	842,682	2.1
2000	291,351	0	939	0	9,611	4,286	0	3,393	223,141	6,013	129	109,252	78,082	0	483	74,506	523	1,561	0	511,919	1.8
2001	338,799	0	0	0	3,223	6,573	0	1,102	216,151	5,644	0	274,770	51,394	0	3,144	42,585	425	895	0	605,906	1.8
2002	456,842	0	78	0	4,894	11,188	0	7,592	69,773	1,251	99	59,363	12,086	0	698	4,882	0	0	0	171,904	0.4
2003	451,856	0	0	286	2,237	9,403	0	1,150	30,926	638	49	15,852	15,878	621	1	1,494	686	128	0	79,349	0.2
2004	393,468	760	0	99	196	390	0	946	17,044	4,700	0	5,120	32,065	0	0	10,449	101	21		71,891	0.2
2005	283,860	0	279	0	6,029	1,257	0	2,506	14,088	4,245	0	7,754	16,806	176	0	871	0			54,010	0.2
2006	202,366	0	0	23	15,167	5,207	0	4,056	27,614	6,532	0	13,395	8,786	0							
2007	294,740	0	759	20	3,832	16,049	0	10,030	175,426	1,589											
2008	82,191	0	338	0	15,219	10,309															
2009	52,798	0	240																		
2010	71,453																				
2011	87,049																				
2012	188,085																				
																			10-year average (1996–2005):	428,222	1.4

Appendix G7.–Karluk Lake late-run sockeye salmon brood table.

Brood Year	Escap.	Age 0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	3.1	1.4	2.3	3.2	2.4	3.3	4.2	8yo	9yo	Total Return
1976	319,459																		0	
1977	366,936																	0	0	
1978	112,194														0	6,728	0	0	0	
1979	248,908											0	54,171	167,426	0	85,143	0	0	0	
1980	14,227							0	446	596,053	4,476	0	156,074	177,587	1,190	25,537	0	0	0	
1981	124,769				0	5,158	13,129	0	0	402,872	2,521	0	187,293	49,557	0	14,077	0	0	0	
1982	41,702		0	0	0	0	1,261	0	5,239	290,631	606	0	110,997	34,711	0	19,631	0	0	0	
1983	220,795	0	0	0	4,079	4,160	12,830	0	480	241,803	1,268	31	213,452	42,156	2,070	47,370	0	0	0	569,699
1984	131,846	0	885	0	0	445	6,246	0	30,516	424,123	0	937	303,542	271,018	471	71,764	651	0	0	1,110,598
1985	679,260	169	0	0	1,084	30,165	212	189	60,235	784,914	494	595	493,743	421,972	462	43,998	0	42	0	1,838,274
1986	528,415	0	893	0	15,519	39,109	978	105	57,974	835,214	1,162	0	114,862	655,219	563	60,240	325	1,770	0	1,783,933
1987	412,157	106	5,976	201	17,067	24,703	1,737	0	550	226,552	2,373	0	23,389	320,723	79	54,451	1,600	0	0	679,507
1988	282,306	0	2,531	111	2,424	4,649	1,512	0	3,127	189,196	7,249	0	71,078	212,649	0	16,740	0	9	0	511,274
1989	758,893	0	3,555	799	3,717	5,909	12,607	0	3,302	308,439	6,233	0	151,212	214,110	0	12,030	950	0	0	722,863
1990	541,891	0	3,591	971	6,292	16,995	3,241	0	10,310	447,371	1,085	18	52,479	80,226	591	62,392	1,095	64	0	686,721
1991	831,970	0	7,113	340	2,879	16,292	3,023	0	8,568	340,535	4,731	52	191,311	85,334	952	13,107	659	111	0	675,007
1992	614,262	0	1,567	1,923	0	3,880	6,759	0	12,234	57,188	5,043	0	76,196	138,987	513	28,379	0	0	0	332,669
1993	396,288	0	0	1,501	2,860	3,550	17,168	0	11,541	412,758	1,362	36	202,913	75,591	0	23,523	0	0	0	752,802
1994	587,258	0	0	198	1,192	24,718	4,323	0	17,261	616,350	1,008	0	159,094	109,890	551	41,274	821	128	0	976,808
1995	504,977	0	1,156	0	3,219	48,766	8,685	0	1,839	353,857	5,252	0	390,880	129,216	424	28,253	405	1,668	0	973,619
1996	323,969	0	540	633	0	2,970	108	0	469	283,071	2,817	0	149,445	139,820	0	83,431	0	934	0	664,238
1997	311,902	0	0	407	0	1,473	21,821	0	291	494,043	18,682	0	268,631	235,707	0	12,330	0	421	0	1,053,807
1998	384,848	0	0	136	0	586	33,787	1,399	2,716	923,141	8,407	0	78,063	143,454	0	12,558	0	284	0	1,204,530
1999	589,119	0	0	0	0	25,117	41,401	0	7,645	403,399	3,410	85	154,603	210,642	0	65,446	0	302	0	912,219
2000	445,393	155	669	51	3,376	6,049	270	0	1,126	531,303	2,955	0	292,380	55,025	2,875	100,967	1,046	4,014	10	1,002,271
2001	524,739	0	0	0	0	2,543	5,375	0	2,611	132,216	3,786	0	305,575	113,907	13,374	38,224	0	262	0	617,979
2002	408,734	0	0	62	2,790	3,319	12,383	0	6,844	183,353	672	361	161,086	25,895	9	14,881	99	528	0	412,282
2003	626,854	0	0	208	1,750	2,494	1,544	0	1,887	41,395	2,247	0	15,635	269,401	0	5,707	10,460	1,746	0	354,474
2004	326,466	0	277	5	301	1,998	510	0	543	15,162	10,973	0	7,084	223,546	0	8,868	2,084	0		271,352
2005	498,102	0	3,532	63	0	423	2,022	0	544	63,514	768	0	20,543	72,929	0	3,929	0			168,266
2006	288,007	0	0	15	0	1,734	2,029	0	1,553	123,394	11,965	34	38,311	73,030	0					
2007	251,835	0	0	81	2,235	3,207	18,490	0	6,173	452,112	217									
2008	164,299	0	0	0	34	8,620	6,489													
2009	277,280	0	501	349																
2010	276,649	0																		
2011	230,273																			
2012	314,605																			
																			10-year average (1996–2005):	666,142

APPENDIX H. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR LITTLE RIVER SOCKEYE SALMON

Appendix H1.–Description of stock and escapement goal for Little River sockeye salmon.

System: Little River

Species: Sockeye salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and gillnet
Current escapement goal:	Lower-bound SEG: 3,000 (2008)
Recommended escapement goal:	Eliminate goal
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial surveys: 1968–1972, 1974–2012, weir counts 2001–2003
Data summary:	
Data quality:	Fair for aerial surveys, good for weir counts.
Data type:	Fixed-wing aerial surveys with peak surveys from 1968 to 2012, and weir counts 2001 to 2003. No stock-specific harvest information is available.
Data contrast:	All survey data 1968 to 2012: 41.0
Methodology:	Percentile method
Autocorrelation:	None
Comments:	This system is a low priority to survey and the assessment may no longer adequately index or monitor trends in escapement.

Appendix H2.–Little River sockeye salmon aerial survey and weir count estimates, 1968–2012.

System: **Little River**

Species: **Sockeye salmon**

Data available for analysis of escapement goals

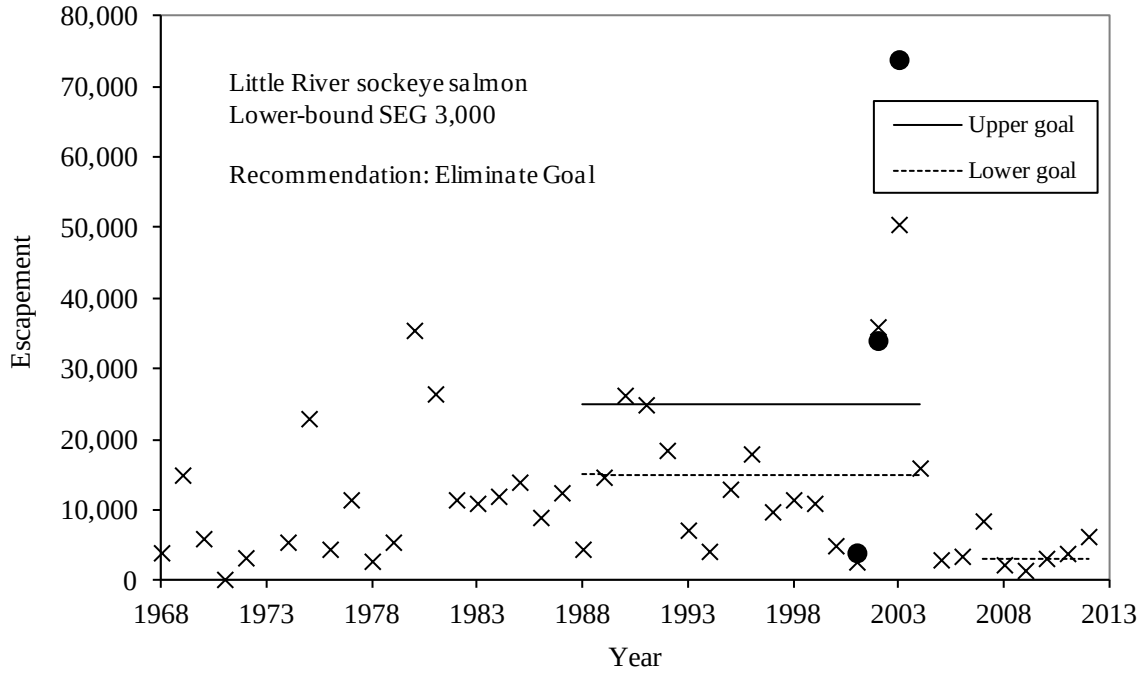
Year	Peak Survey	Weir Counts	Year	Peak Survey	Weir Counts
1968	4,000		1990	26,300	
1969	15,000		1991	24,960	
1970	6,000		1992	18,500	
1971	230		1993	7,200	
1972	3,289		1994	4,200	
1973			1995	13,000	
1974	5,500		1996	18,000	
1975	23,000		1997	9,800	
1976	4,500		1998	11,500	
1977	11,500		1999	11,000	
1978	2,800		2000	5,000	
1979	5,500		2001	2,700	3,994
1980	35,500		2002	36,000	34,064
1981	26,500		2003	50,500	73,856
1982	11,500		2004	16,000	
1983	11,000		2005	3,000	
1984	12,000		2006	3,500	
1985	14,000		2007	8,500	
1986	9,000		2008	2,300	
1987	12,500		2009	1,500	
1988	4,500		2010	3,200	
1989	14,700		2011	3,900	
			2012	6,300	

Appendix H3.–Little River sockeye salmon escapement and escapement goal ranges, 1968–2012.

System: **Little River**

Species: **Sockeye salmon**

Observed escapement by year (circles are weir counts, Xs are aerial surveys)



APPENDIX I. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR MALINA CREEK SOCKEYE SALMON

Appendix I1.–Description of stock and escapement goal for Malina Creek sockeye salmon.

System: Malina Creek

Species: Sockeye salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine
Current escapement goal:	SEG: 1,000 to 10,000 (2005)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial counts, 1968–1991, 2003–2012 Weir counts, 1992–2002, 2004–2005
Data summary:	
Data quality:	Fair to poor for aerial counts, excellent for weir counts.
Data type:	Aerial counts from 1968 through 1991 and 2003 through 2012, weir counts from 1992 through 2002 and 2004 through 2005 include escapement age data. Limnology data from 1989 to 2009. No stock-specific harvest information is available.
Data contrast:	Peak aerial surveys 1968–1991, 2003–2012: 42.4 Weir data 1992–2002, 2004, 2005: 10.1 All available weir and survey data 1968–2012: 64.4
Methodology:	Percentile, euphotic volume analysis, spawning habitat, smolt biomass as a function of zooplankton biomass.
Percentiles:	15^{th} to 75^{th} (all available data and aerial survey data) 15^{th} to 85^{th} (weir data only)
Comments:	Lake was stocked with indigenous juvenile sockeye salmon from 1992 to 1999 and fertilized from 1991 to 2001.

Appendix I2.–Malina Creek sockeye salmon escapement, 1968–2012.

System: Malina Creek

Species: Sockeye salmon

Data available for analysis of escapement goals

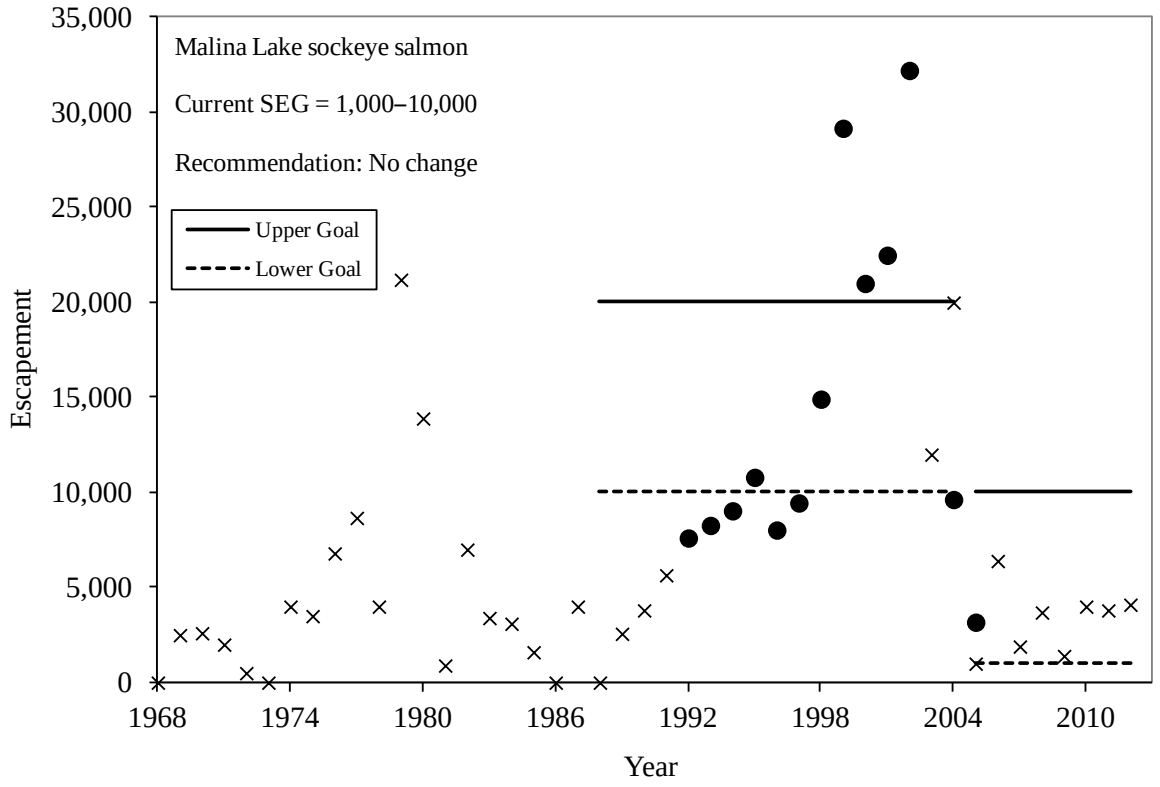
Year	Peak Aerial Survey	Weir Counts
1968	0	
1969	2,500	
1970	2,600	
1971	2,000	
1972	500	
1973	0	
1974	4,000	
1975	3,500	
1976	6,800	
1977	8,667	
1978	4,000	
1979	21,200	
1980	13,900	
1981	900	
1982	7,000	
1983	3,400	
1984	3,100	
1985	1,600	
1986	0	
1987	4,000	
1988	0	
1989	2,570	
1990	3,800	
1991	5,650	
1992		7,610
1993		8,273
1994		9,042
1995		10,803
1996		8,030
1997		9,455
1998		14,917
1999		29,171
2000		21,006
2001		22,490
2002		32,214
2003	12,000	
2004	20,000	9,636
2005	1,000	3,180
2006	6,400	
2007	1,900	
2008	3,690	
2009	1,400	
2010	4,000	
2011	3,800	
2012	4,100	

Appendix I3.–Malina Creek sockeye salmon escapement and escapement goals, 1968–2012.

System: **Malina Creek**

Species: **Sockeye salmon**

Observed escapement by year (Xs for aerial surveys, solid circles for weir counts) and SEG.



APPENDIX J. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR PASAGSHAK RIVER SOCKEYE SALMON

Appendix J1.–Description of stock and escapement goal for Pasagshak River sockeye salmon.

System: Pasagshak River

Species: Sockeye salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Subsistence gillnet, commercial purse seine, and sport
Current escapement goal:	Lower-bound SEG: 3,000 (2011)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Survey counts, 1968–1969, 1971–1976, 1978–2012. Weir counts, 2011 and 2012
Data summary:	
Data quality:	Good. Small lake and limited tributaries represent a small area to survey.
Data type:	Fixed-wing peak aerial survey escapement index counts for 1968–2012; weir installed in 2011 and 2012. Subsistence harvest estimated annually since 1993 from permit returns. Inriver sport harvests estimated annually since 1977 through the Statewide Harvest Survey. No stock-specific harvest information for commercial fisheries, though total annual catch data are available from Pasagshak Bay (statistical area 259-43). Commercial harvests include sockeye salmon from the Pasagshak River and other nearby systems. No age data collected from the escapements or harvests. Limnology data collected in 2000.
Data contrast:	All survey data 1968 to 2012: 128.0
Methodology:	Percentile
Autocorrelation:	None
Comments:	None

Appendix J2.–Pasagshak River sockeye salmon aerial survey and harvest estimates, 1968–2012.

System: Pasagshak River

Species: Sockeye salmon

	Peak		Harvest		
Year	Survey	Weir	Recreational[a]	Subsistence[b]	Commercial[c]
1968	3,000				
1969	4,500				
1970					
1971	700				
1972	2,000				
1973	200				
1974	4,000				
1975	1,000				
1976	4,500				
1977			176		
1978	5,470		85		
1979	12,000		236		
1980	3,484		284		
1981	2,759		205		
1982	5,400		199		
1983	3,458		192		
1984	3,700		374		
1985	1,500		182		
1986	3,200		428	64	
1987	14,000		417	82	
1988	20,000		819	84	
1989	14,300		1,244	166	
1990	4,680		1,018	598	
1991	25,000		815	1,664	
1992	3,590		427	1,752	
1993	16,000		543	2,253	
1994	2,400		861	1,554	
1995	12,500		571	2,099	
1996	21,500		723	2,854	
1997	13,200		1,009	2,759	
1998	1,850		614	1,089	
1999	9,800		1,241	2,996	
2000	6,000		2,721	4,520	
2001	3,800		701	6,650	
2002	4,750		1,062	4,577	
2003	8,000		492	5,910	
2004	46,400		3,192	10,023	8,612
2005	22,000		3,751	7,416	1,861
2006	6,300		2,074	7,616	612
2007	14,300		1,721	7,550	0
2008	14,900		4,527	8,826	0
2009	1,400		1,021	7,185	0
2010	4,800		1,027	4,627	0
2011	8,100	13,402	1,693	5,631	11
2012	2,600	4,585	2,080	4,981	0

[a] Recreational harvests from the Statewide Harvest Survey.

[b] Subsistence harvests from the ADF&G Division of Commercial Fisheries database, Westward Region.

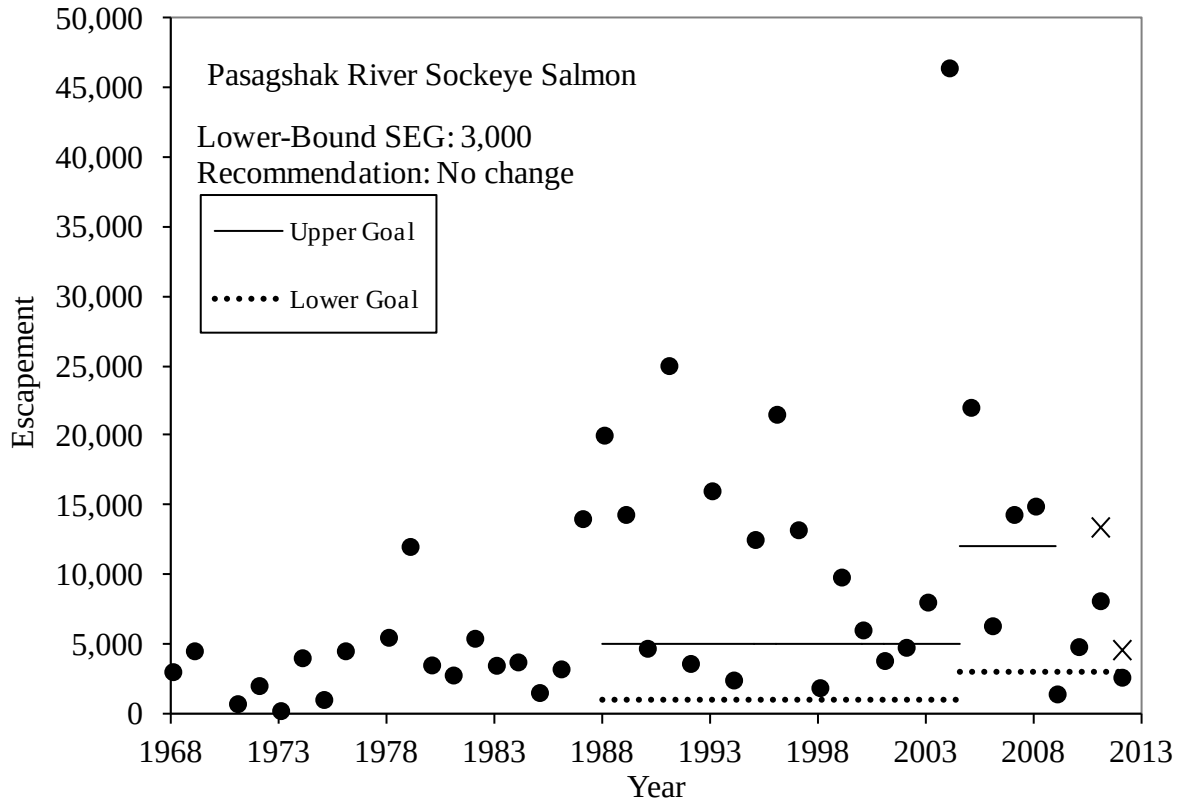
[c] Commercial harvests from the ADF&G Division of Commercial Fisheries database statistical area 259-43. Prior to 2004, statistical areas were not split out, and it is impossible to separate harvest among systems.

Appendix J3.–Pasagshak River sockeye salmon escapement and escapement goals, 1968–2012.

System: **Pasagshak River**

Species: **Sockeye salmon**

Observed escapement by year (Xs for aerial surveys, solid circles for weir counts) and SEG.



APPENDIX K. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR SALTERY LAKE SOCKEYE SALMON

Appendix K1.–Description of stock and escapement goal for Saltery Lake sockeye salmon.

System: Saltery Lake

Species: Sockeye salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine, sport, and subsistence
Current escapement goal:	BEG: 15,000–35,000 (2011)
Recommended escapement goal:	No change
Optimal escapement goal:	None
In Lake goal:	None
Action points:	None
Escapement enumeration:	Aerial surveys: 1976–1986, 1992, 2004–2007 Weir counts: 1986–1991, 1993–2003, 2008–2012
Data summary:	
Data quality:	Fair for aerial surveys, good for weir counts
Data type:	Aerial surveys from 1976–1986, 1992, 2004–2007, weir counts from 1986–1991, 1993–2003, and 2008–2012. Harvest data are available from 1976–2009. Limnology data from 1994 to 2009.
Data contrast:	All data 1976 to 2012: 7.0
Methodology:	S-R model, zooplankton model
Autocorrelation:	None
Criteria for BEG:	S-R model, zooplankton model
Comments:	Saltery Lake sockeye salmon escapement has been estimated via weir since 2008 and current plans by KRAA are to continue the project on an annual basis.

Appendix K2.–Saltery Lake sockeye salmon aerial survey and weir count estimates, 1976–2012.

System: **Saltery Lake**

Species: **Sockeye salmon**

Data available for analysis of escapement goals

Year	Peak Survey	Weir Counts	Year	Peak Survey	Weir Counts
1975			1994		58,975
1976	18,000		1995		43,859
1977	30,800		1996		35,488
1978	22,000		1997		31,016
1979	43,000		1998		26,263
1980	31,600		1999		62,821
1981	43,000		2000		45,604
1982	28,000		2001		45,608
1983	46,400		2002		36,336
1984	120,000		2003		57,993
1985	26,000		2004	50,721	
1986	24,000	38,314	2005	23,078	
1987		22,705	2006	24,631	
1988		25,654	2007	15,382	
1989		30,237	2008		47,467
1990		29,767	2009		43,468
1991		52,592	2010		24,102
1992	44,450		2011		27,803
1993		77,186	2012		25,155

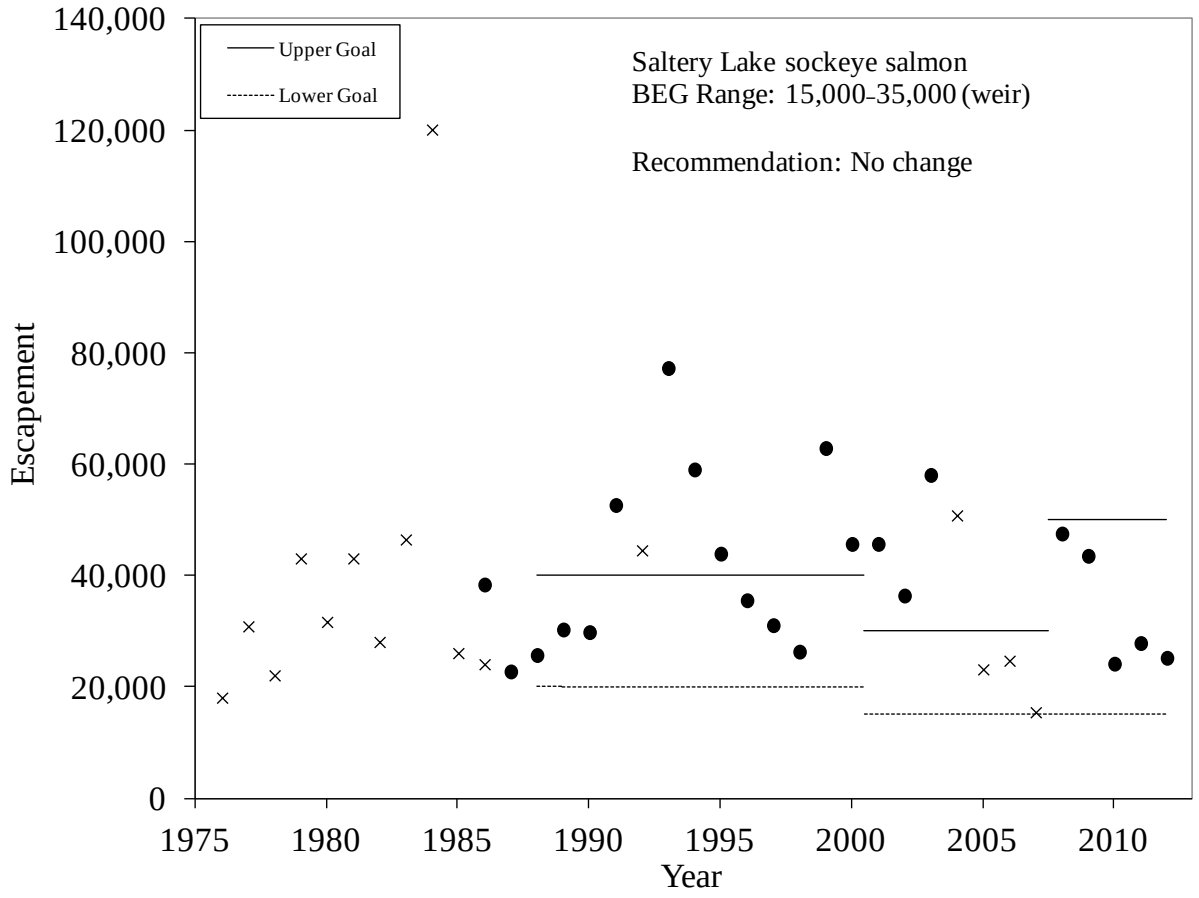
Note: Escapement numbers since 2004 have egg-take removals subtracted from total escapement.

Appendix K3.–Saltery Lake sockeye salmon escapement and escapement goals, 1976–2012.

System: **Saltery Lake**

Species: **Sockeye salmon**

Observed escapement by year (circles are weir counts, Xs are aerial surveys)



APPENDIX L. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR UGANIK LAKE SOCKEYE SALMON

Appendix L1.–Description of stock and escapement goal for Uganik Lake sockeye salmon.

System: Uganik Lake

Species: Sockeye salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and gillnet
Current escapement goal:	Lower-bound SEG: 24,000 (2007)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Weir counts, 1928–1932, 1990–1992.
	Aerial surveys, 1974, 1976–1977, 1979–2012.
Data summary:	
Data quality:	Fair for aerial surveys (glacially-fed lake has variable water visibility); good for weir enumeration.
Data type:	Fixed-wing aerial surveys, weir escapement estimates from 1990 to 1992 include some escapement age data. No stock-specific harvest information is available. Limnology data from 1990, 1991, 1996, and 2009.
Data contrast:	All survey data 1974 to 2012: 31.4
Methodology:	Percentile Method
Autocorrelation:	None
Comments:	None

Appendix L2.–Uganik Lake sockeye salmon aerial survey and weir count estimates, 1928–2012.

System: **Uganik Lake**

Species: **Sockeye salmon**

Data available for analysis of escapement goals

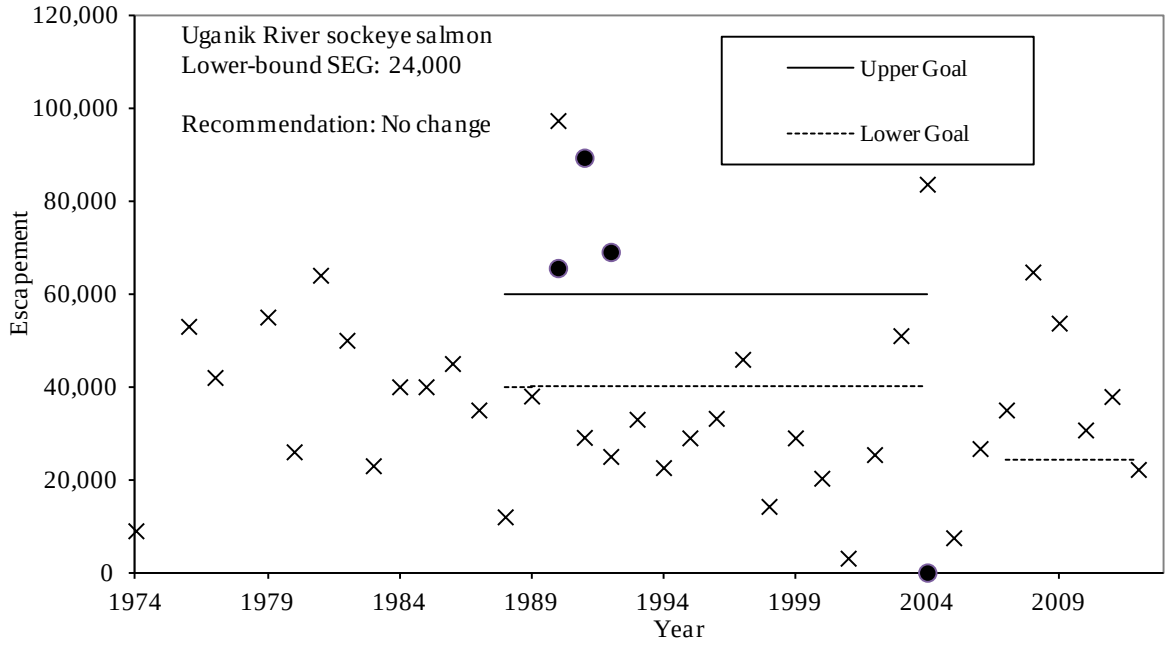
Year	Peak Survey	Weir Counts	Year	Peak Survey	Weir Counts
1928		15,282	1992	25,000	69,015
1929		24,913	1993	33,000	
1930		9,814	1994	22,600	
1931		6,777	1995	29,000	
1932		25,808	1996	33,200	
1974	9,000		1997	45,900	
1976	53,000		1998	14,250	
1977	42,000		1999	29,000	
1979	55,000		2000	20,310	
1980	26,000		2001	3,100	
1981	64,000		2002	25,400	
1982	50,000		2003	51,000	
1983	23,000		2004	83,600	
1984	40,000		2005	7,500	
1985	40,000		2006	26,700	
1986	45,000		2007	35,000	
1987	35,000		2008	64,700	
1988	12,000		2009	57,500	
1989	38,000		2010	30,700	
1990	97,300	65,551	2011	37,900	
1991	29,100	89,304	2012	22,200	

Appendix L3.–Uganik Lake sockeye salmon escapement and escapement goals, 1974–2012.

System: **Uganik Lake**

Species: **Sockeye salmon**

Observed escapement by year (circles are weir counts, Xs are aerial surveys)



APPENDIX M. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR UPPER STATION RIVER SOCKEYE SALMON

Appendix M1.–Description of stock and escapement goal for Upper Station River sockeye salmon.

System: Upper Station

Species: Sockeye salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and gillnet
Current escapement goal:	Early-run SEG: 43,000–93,000 (2010)
	Late-run BEG: 120,000–265,000 (2005)
Recommended escapement goal:	Early-run BEG: No change
	Late-run BEG: No change
Optimal escapement goal:	Early run: 25,000 (1999)
Inriver goal:	None
Action points:	None
Escapement enumeration:	Weir counts, 1969–2012 (early run) and 1966–2012 (late run)
Data summary:	
Data quality:	Excellent for weir counts 1966–2012; fair for harvest and age data.
Data type:	Weir counts from 1966 to 2012 with escapement age data during weir counts. Harvest estimates with age data 1970–2012. Limnology information 1990–1993, 1995, 1999, 2000, and 2009 through 2012.
Data contrast:	Weir data, all years: 16.5 (early run), 10.7 (late run)
Methodology:	Ricker spawner-recruit models, smolt biomass as a function of zooplankton biomass, and euphotic volume models.
Autocorrelation:	Significant in late run (lag-1)
Comments:	While spawner recruit models are significant for both the early and late run, the late-run model has a strong nonstationary process occurring in addition to significant autocorrelation (lag-1).

Appendix M2.–Upper Station River early-run sockeye salmon escapement and harvest estimates, 1969–2012.

System: **Upper Station early**

Species: **Sockeye salmon**

Data available for analysis of escapement goals

Year	Weir Counts	Commercial Harvest	Year	Weir Counts	Commercial Harvest
1969	22,509		1991	50,026	119,764
1970	16,168		1992	19,076	22,622
1971	32,529		1993	34,852	51,996
1972	39,613		1994	37,645	57,727
1973	26,892		1995	41,492	170,502
1974	35,319		1996	58,686	154,617
1975	10,325		1997	47,655	18,735
1976	28,567		1998	30,713	82,582
1977	26,380		1999	36,521	51,457
1978	66,157		2000	55,761	87,265
1979	53,115		2001	66,795	91,895
1980	37,866		2002	36,802	0
1981	77,042		2003	76,175	24,215
1982	170,610	30,217	2004	78,487	190,627
1983	115,890	27,800	2005	60,349	95,717
1984	96,798	19,994	2006	24,997	7,432
1985	27,408	6,364	2007	31,895	5,877
1986	100,812	113,562	2008	38,800	60,392
1987	74,747	70,072	2009	34,585	46,623
1988	56,724	67,896	2010	42,060	13,105
1989	64,582	59,389	2011	28,759	22,874
1990	56,159	106,647	2012	25,487	34,700

Appendix M3.–Upper Station River late-run sockeye salmon escapement and harvest estimates, 1966–2012.

System: **Upper Station late**

Species: **Sockeye salmon**

Data available for analysis of escapement goals

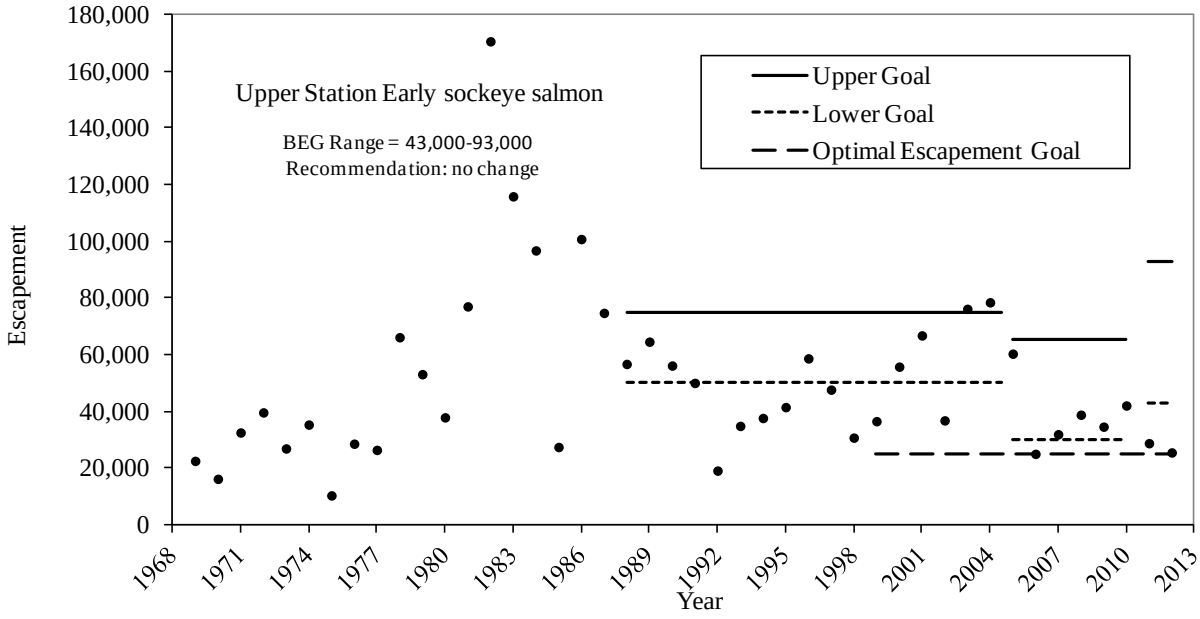
Year	Weir Counts	Commercial Harvest	Year	Weir Counts	Commercial Harvest
1966	36,154		1990	198,287	512,468
1967	66,999		1991	242,860	514,467
1968	15,743		1992	199,067	219,371
1969	74,150		1993	187,229	258,283
1970	36,833		1994	221,675	235,186
1971	95,150		1995	203,659	383,973
1972	68,351		1996	235,727	666,349
1973	67,826		1997	230,793	288,226
1974	251,234		1998	171,214	185,086
1975	74,456		1999	210,016	358,673
1976	48,650		2000	176,783	136,471
1977	49,001		2001	74,408	60,620
1978	38,126		2002	150,349	9,367
1979	134,579		2003	200,894	211,844
1980	77,718		2004	177,108	336,745
1981	118,900		2005	156,401	124,324
1982	306,161	345,943	2006	153,153	62,296
1983	179,741	361,991	2007	149,709	44,032
1984	239,608	328,309	2008	184,856	237,865
1985	408,409	522,561	2009	161,736	187,403
1986	367,922	1,025,016	2010	141,139	63,319
1987	156,274	384,337	2011	101,893	68,875
1988	247,647	754,836	2012	149,325	64,332
1989	221,706	485,347			

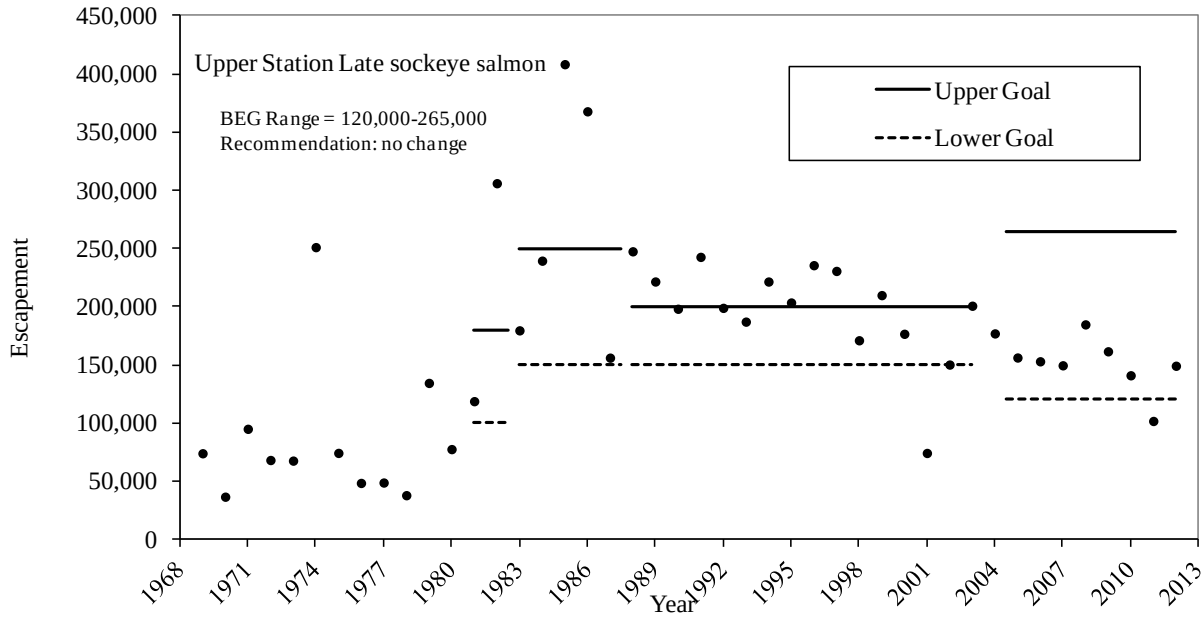
Appendix M4.–Upper Station River early-run sockeye salmon escapement and escapement goals, 1969–2012.

System: **Upper Station River**

Species: **Sockeye salmon**

Observed escapement by year (circles)





Appendix M5.–Upper Station early-run sockeye salmon brood table.

Brood		Age															Total	Return/
Year	Escap.	0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	3.1	1.4	2.3	3.2	3.3	2.4	Return	Spawner
1975	10,325	0	0	0	0	1,458	208	0	6,393	14,783	0	0	8,738	485	0	0	32,065	3.1
1976	28,567	0	0	0	133	9,722	0	0	10,438	47,090	0	0	27,139	0	0	0	94,522	3.3
1977	26,380	0	0	0	0	32,041	243	0	48,850	94,081	0	0	35,526	634	0	0	211,375	8.0
1978	66,157	0	243	243	1,809	28,948	0	0	32,354	70,735	0	0	19,660	0	37	0	154,029	2.3
1979	53,115	0	0	0	0	4,124	0	0	17,554	65,300	0	46	14,870	38	142	0	102,074	1.9
1980	37,866	0	317	0	2,341	11,937	0	0	4,000	7,165	38	0	7,259	0	25	0	33,082	0.9
1981	77,042	0	0	0	542	2,832	1,498	0	4,370	85,872	0	43	23,861	0	0	0	119,018	1.5
1982	170,610	0	2,472	234	1,006	113,439	781	0	75,684	37,220	0	360	18,131	70	0	0	249,398	1.5
1983	115,890	0	285	1,220	1,181	5,491	1,205	0	11,396	87,555	0	0	41,723	217	0	0	150,273	1.3
1984	96,798	0	109	0	3,443	2,118	66	0	1,792	46,879	0	0	14,103	113	60	0	68,683	0.7
1985	27,408	0	1,476	4	2,865	2,314	22,466	0	6,714	86,949	0	0	42,895	633	64	0	166,380	6.1
1986	100,812	0	35	5,680	449	51,361	936	0	36,048	83,179	60	18	8,248	340	408	0	186,763	1.9
1987	74,747	0	2,134	46	1,022	2,027	3,849	0	726	30,417	27	0	25,242	779	57	0	66,326	0.9
1988	56,724	0	17	0	71	82	852	0	1,607	35,640	210	206	7,282	1,072	0	0	47,038	0.8
1989	64,582	0	450	404	5,823	8,751	6,313	0	5,539	67,810	0	0	34,127	0	0	0	129,217	2.0
1990	56,159	0	1,497	578	0	6,275	3,414	0	19,145	82,269	0	0	6,839	361	6	0	120,384	2.1
1991	50,026	0	407	3,258	20,467	46,391	6,815	0	57,478	131,931	0	0	27,274	0	0	0	294,021	5.9
1992	19,076	52	2,338	223	5,878	5,959	3,583	0	3,435	24,099	0	0	7,268	0	0	0	52,835	2.8
1993	34,852	219	669	605	2,423	5,189	2,741	0	11,812	31,749	0	0	5,168	1,229	0	62	61,866	1.8
1994	37,645	0	229	994	4,887	53,607	1,320	0	7,176	33,104	0	0	17,361	570	0	0	119,248	3.2
1995	41,492	0	185	2,467	5,857	33,691	1,497	360	44,415	44,608	0	492	20,938	689	92	0	155,291	3.7
1996	58,686	0	79	177	2,723	30,487	1,973	0	81,164	51,987	4	25	15,238	281	0	0	184,138	3.1
1997	47,655	0	422	45	0	972	2,438	0	558	11,566	34	0	7,233	795	2,006	0	26,069	0.5
1998	30,713	0	0	6	0	145	6,264	0	418	45,950	0	0	16,490	8	0	0	69,281	2.3
1999	36,521	0	0	2,598	328	27,894	6,080	0	34,497	81,382	0	360	38,405	626	28	0	192,198	5.3
2000	55,761	0	780	10,912	7,338	122,434	2,623	69	59,315	40,862	69	121	9,843	139	235	28	254,768	4.6
2001	66,795	0	1,131	1,123	3,856	6,472	5,116	0	4,335	15,475	0	24	13,764	0	0	0	51,298	0.8
2002	36,802	82	532	382	574	1,295	42	36	4,890	2,815	0	0	8,604	0	0	36	19,289	0.5
2003	76,175	0	75	502	88	10,903	3,245	0	9,334	34,250	0	106	13,258	86	0	0	71,846	0.9
2004	78,487	0	191	1,553	6,398	36,836	3,258	0	25,750	32,372	0	0	4,211	0	0	0	110,570	1.4
2005	60,349	0	233	281	0	5,884	3,446	0	3,904	42,706	64	0	9,733	130	0	2	66,385	1.1
2006	24,997	0	0	269	0	1,815	2,367	0	4,513	24,439	5	28	14,943	620				
2007	31,895	0	71	26	136	3,578	4,849	0	3,112	28,723	0							
2008	38,800	0	0	978	52	10,317	2,056											
2009	34,585	0	108	226														
2010	42,060	0																
2011	28,759																	
2012	25,487																	
																10-Year Average (1996–2005):	104,584	2.1

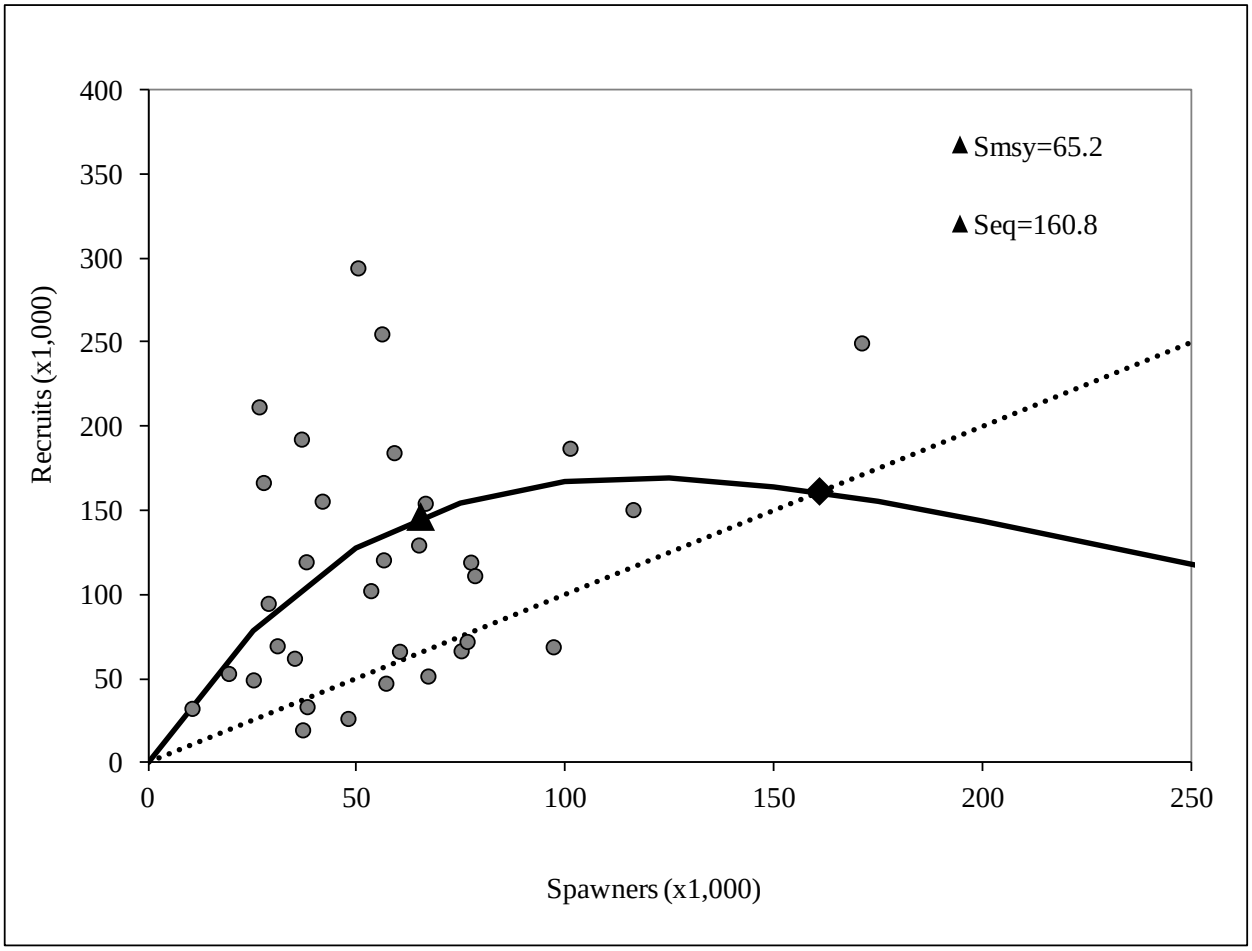
Appendix M6.–Upper Station late-run sockeye salmon brood table.

Brood		Age															Total	Return/
Year	Escap.	0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	3.1	1.4	2.3	3.2	3.3	2.4	Return	Spawner
1975	74,456	901	3,021	0	0	61,142	1,132	0	36,479	76,157	0	0	5,228	0	0	0	184,060	2.5
1976	48,650	0	10,190	0	36,479	38,399	2,560	0	11,501	141,154	0	0	10,336	940	0	0	251,559	5.2
1977	49,001	0	640	0	3,137	52,279	1,046	0	66,714	312,897	0	0	9,732	0	0	0	446,444	9.1
1978	38,126	0	82,601	1,046	90,205	134,367	4,698	0	55,146	217,342	0	0	26,755	2,638	0	0	614,798	16.1
1979	134,579	0	31,947	0	63,256	71,366	0	0	103,020	339,950	0	736	10,850	360	280	0	621,765	4.6
1980	77,718	0	124,890	0	56,178	35,951	2,131	0	21,758	55,472	399	0	16,555	965	223	0	314,522	4.0
1981	118,900	0	1,294	0	17,853	157,249	12,280	1,007	149,158	345,506	0	0	14,809	0	0	879	700,035	5.9
1982	306,161	0	644,017	5,129	324,600	364,312	5,029	117	92,824	231,963	0	0	5,168	2,042	0	0	1,675,201	5.5
1983	179,741	4,867	182,514	0	135,177	23,242	1,682	0	53,195	92,799	0	0	30,036	0	1,488	0	525,000	2.9
1984	239,608	3,012	37,733	528	89,721	187,451	5,064	0	21,543	224,033	0	0	23,712	4,642	0	0	597,438	2.5
1985	408,409	2,313	562,757	1,958	309,775	34,924	12,374	0	40,759	179,839	0	578	45,289	6,140	0	0	1,196,706	2.9
1986	367,922	1,449	72,415	1,953	94,380	291,815	5,610	678	116,039	451,917	0	0	17,721	1,579	1,289	6	1,056,851	2.9
1987	156,274	0	68,016	495	113,821	12,899	127	0	17,053	104,995	0	225	27,470	15,072	39	0	360,212	2.3
1988	247,647	0	9,222	216	27,793	76,583	1,000	0	71,330	80,102	177	133	4,037	1,244	0	0	271,836	1.1
1989	221,706	401	169,158	1,125	85,530	83,807	12,864	142	53,928	184,067	308	0	21,693	0	0	0	613,023	2.8
1990	198,287	1,432	56,992	3,904	115,907	27,747	7,728	444	17,591	237,284	0	0	4,315	0	67	0	473,411	2.4
1991	242,860	6,744	51,810	4,858	163,283	73,541	6,484	160	44,507	712,676	31	0	20,546	0	0	0	1,084,640	4.5
1992	199,067	4,913	61,018	1,108	15,733	58,923	12,611	79	6,302	279,349	0	0	7,189	156	192	26	447,599	2.2
1993	187,229	5,186	46,015	5,688	114,817	35,842	45,256	444	10,769	199,820	191	278	27,883	5,350	0	0	497,539	2.7
1994	221,675	1,417	10,206	6,322	23,167	90,488	17,439	44	25,603	293,322	80	0	6,069	968	0	0	475,125	2.1
1995	203,659	233	3,020	3,340	3,349	179,562	24,492	0	13,017	251,855	0	254	14,264	307	247	20	493,960	2.4
1996	235,727	277	1,972	6,536	1,335	35,606	4,057	0	15,478	88,856	121	1	4,856	2,282	0	1,500	162,877	0.7
1997	230,793	0	347	0	916	2,842	11,901	0	1,932	129,206	1,984	130	8,502	17,554	1,942	0	177,256	0.8
1998	171,214	0	0	89	0	2,511	13,979	0	3,281	219,890	25,325	0	13,190	890	0	0	279,155	1.6
1999	210,016	0	279	2,323	672	80,315	15,939	0	20,091	313,886	19	346	40,906	5,360	465	9	480,610	2.3
2000	176,783	96	34,433	5,197	36,394	122,248	4,045	98	30,388	181,491	0	31	16,677	986	187	165	432,436	2.4
2001	74,408	0	522	215	1,701	5,696	8,310	0	7,078	77,172	0	78	9,900	300	0	0	110,971	1.5
2002	150,349	411	2,421	3,965	7,179	94,543	8,085	0	21,609	95,473	0	0	13,730	0	0	235	247,650	1.6
2003	200,894	43	888	1,667	337	51,307	7,446	0	16,131	256,511	0	357	15,308	548	0	0	350,545	1.7
2004	177,108	669	5,264	1,535	24,845	99,160	7,094	0	29,761	255,957	181	0	5,577	1,457	185	0	431,685	2.4
2005	156,401	139	2,828	2,423	3,067	20,933	20,082	0	6,256	171,458	153	0	8,694	3,150	0	4	239,187	1.5
2006	153,153	0	931	1,561	177	10,327	8,207	0	5,267	126,317	182	74	3,988	6,115				
2007	149,709	218	59	787	287	12,235	11,858	0	10,286	140,872	46							
2008	184,856	0	0	2,217	349	40,340	7,761											
2009	161,736	376	2,236	1,527														
2010	141,139	58																
2011	101,893																	
2012	149,325																	
																	10-Year Average (1996–2005):	291,237	1.7

Appendix M7.–Fitted Ricker stock-recruitment curves, line of replacement, and actual data for Upper Station early-run sockeye salmon from brood years 1975 through 2006.

System: **Upper Station early run**

Species: **Sockeye salmon**



Note: The solid line represents the Ricker curve, and the dotted line represents replacement.

APPENDIX N. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR AMERICAN RIVER COHO SALMON

Appendix N1.–Description of stock and escapement goal for American River coho salmon.

System: American River

Species: Coho salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Sport and Commercial
Primary fishery:	Sport, commercial, and subsistence
Current escapement goal:	Lower-bound SEG: 400 (2011)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Foot surveys, 1980–present with no surveys in 1988, 1989, and 1991.
Data summary:	
Data quality:	Mark-recapture work conducted in 1997 and 1998 (Begich et al. 2000) indicated foot surveys in the Olds River represent 62% to 108% of point estimates of abundance and were within the 95% confidence interval of estimated abundance in 1998.
Data type:	Foot surveys are conducted annually and inriver harvest of the recreational fishery are estimated annually through the Statewide Harvest Survey. Although there is no stock-specific harvest information available for subsistence and commercial fisheries, annual catch data are available for Kalsin Bay (statistical area 259-23).
Data contrast:	All survey data 1980 to 2012: 50.8
Methodology:	Theoretical stock-recruit analysis with average foot surveys and average harvest (recreational, commercial and subsistence) from 1980–2003 was used to specify the SEG that potentially maximizes yield give uncertainty in the productivity of this stock. Alpha-parameter values in the stock-recruit analysis ranged from 4 to 8.
Autocorrelation:	No significant autocorrelation of foot survey counts.
Comments:	None

Appendix N2.–Annual escapement index and harvest of American River coho salmon, 1980–2012.

System: American River

Species: Coho salmon

Data available for analysis of escapement goals

	Foot	Harvest			
Year	Survey	Recreational[a]	Subsistence[b]	Commercial[c]	Total
1980	903		8	433	
1981	627		1	30	
1982	266		95	121	
1983	114	378	43	73	
1984	277	486	0	2	
1985	439	349	15	298	1,101
1986	221	826	2	71	1,120
1987	555	435	33	359	1,382
1988		1,710	0	89	1,799
1989	296	1,500	0	0	1,796
1990	419	849	14	1	1,283
1991		722	60	4	786
1992	167	583	0	0	750
1993	412	2,340	3	73	2,828
1994	194	642	0	0	836
1995	169	794	2	1,303	2,268
1996	69	549	15	0	633
1997	2,204	1,749	6	31	3,990
1998	1,360	700	0	129	2,189
1999	284	1,090	0	29	1,403
2000		480	0	0	480
2001	233	860	18	0	1,111
2002	1,034	1,195	5	0	2,234
2003	511	1,051	42	4	1,608
2004	753	1,283	4	0	2,040
2005	339	1,636	41	0	2,016
2006	2,033	835	0	8	2,876
2007	307	980	0	0	1,287
2008	700	799	1	28	1,528
2009	639	405	0	2,422	3,466
2010		390	13	0	403
2011	1061	710	0	58	1,829
2012	427	409	5	53	894

[a] Recreational harvests from the Statewide Harvest Survey.

[b] Subsistence harvests from the ADF&G Division of Commercial Fisheries database, Westward Region.

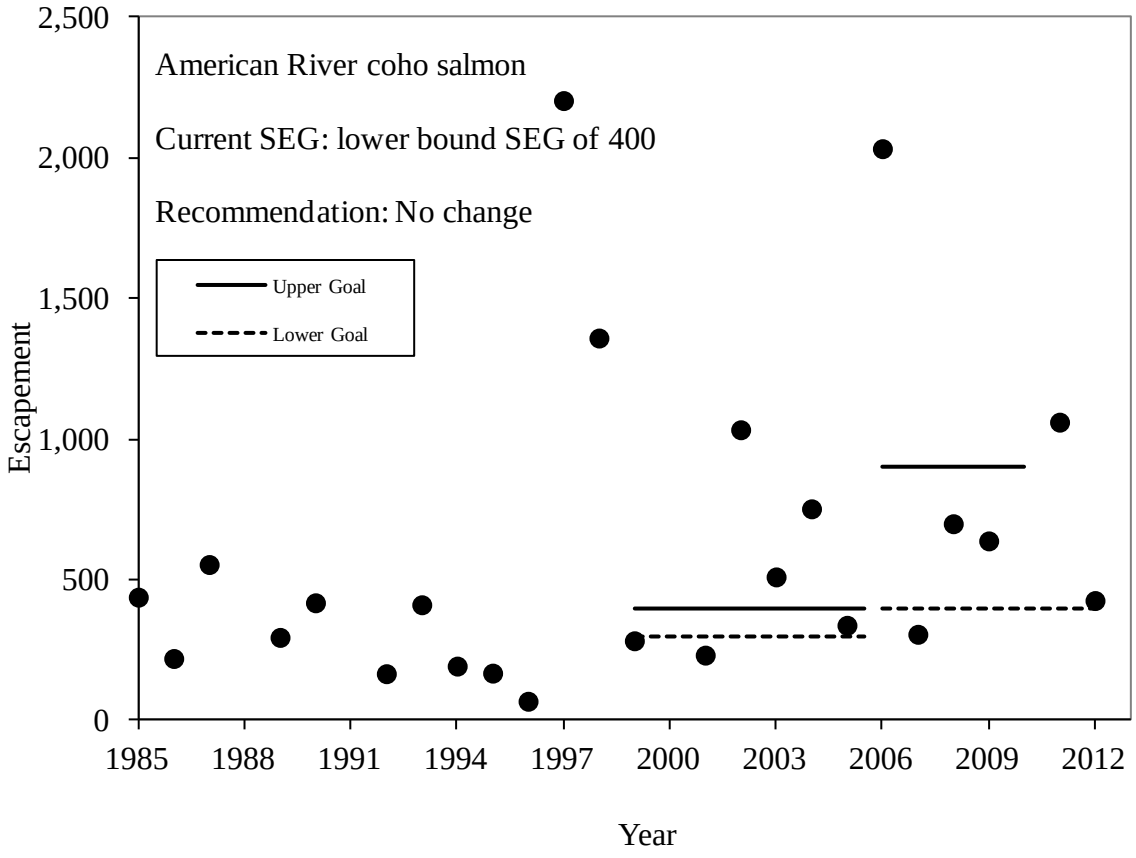
[c] Commercial harvests from the ADF&G Division of Commercial Fisheries database.

Appendix N3.–American River coho salmon escapement and escapement goals, 1985–2012.

System: **American River**

Species: **Coho salmon**

Observed escapement by year (foot surveys)



APPENDIX O. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR BUSKIN RIVER COHO SALMON

Appendix O1.–Description of stock and escapement goal for Buskin River coho salmon.

System: Buskin River

Species: Coho salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Sport and Commercial
Primary fishery:	Sport, commercial, and subsistence
Current escapement goal:	BEG: 3,200–7,200 fish (2005)
Recommended escapement goal:	Change to BEG (4,700–9,600 fish)
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Weir counts, 1985 to present
Data summary:	
Data quality:	Good escapement and harvest data.
Data type:	Weir estimates, harvest estimates, age composition.
Data contrast:	All survey data 1985 to 2012: 3.3
Methodology:	A Bayesian stock-recruit analysis was conducted on brood table information from escapements in 1990–1999 and returns in 1993–2012. Median ln(α)-parameter value for this stock recruit analysis was 1.017 with 95% credibility interval of 0.45–1.29.
Autocorrelation:	There was some positive autocorrelation (median ϕ = 0.4086) although the 95% credibility interval for this parameter extends into the negative.
Recommendation:	Increase BEG to 4,700–9,600.
Comments:	BEG has been achieved each of the past three years (2010–2012).

Appendix O2.–Annual escapement and harvest of Buskin River coho salmon, 1980–2012.

System: **Buskin River**

Species: **Coho salmon**

Data available for analysis of escapement goals

		Weir	Harvest			Total
Year	Escapement	Count	Recreational[a]	Subsistence[b]	Commercial[c]	Run
1980			2,643			
1981			2,269			
1982			2,431			
1983			2,307			
1984			1,871			
1985	9,213	9,474	2,178	2,554	666	14,872
1986	9,447	9,939	4,098	2,541	1,065	17,643
1987	10,727	11,103	3,133	1,742	2,334	18,312
1988	6,365	6,782	3,474	1,586	254	12,096
1989	9,356	9,930	4,782	1,302	0	16,014
1990	6,039	6,222	1,521	1,774	1	9,518
1991	8,434	8,929	4,121	1,481	15	14,546
1992	6,358	6,535	1,474	1,907	0	9,916
1993	6,318	6,813	4,125	1,720	7	12,665
1994	7,855	8,146	2,429	2,167	15	12,757
1995	8,438	8,694	2,132	1,285	224	12,335
1996	8,141	8,439	2,481	1,263	0	12,183
1997	10,582	10,926	2,864	1,383	0	15,173
1998	8,742	9,062	2,669	1,394	9	13,134
1999	9,383	9,794	3,422	1,320	3	14,539
2000	7,737	8,048	2,589	1,717	0	12,354
2001	13,214	13,494	2,332	1,421	0	17,247
2002	10,349	10,649	2,497	1,517	0	14,663
2003	12,754	13,150	3,302	1,242	6	17,700
2004	9,016	9,599	4,860	1,481	95	16,035
2005	16,235	16,596	3,010	2,414	0	22,020
2006	12,560	13,348	6,567	1,567	763	22,245
2007	8,375	9,001	5,215	1,193	757	16,166
2008	8,176	9,028	4,259	1,165	0	14,452
2009	9,583	10,624	5,207	874	138	16,843
2010	6,239	6,808	2,847	679	0	10,334
2011	5,298	6,026	3,640	287	197	10,150
2012	4,906	5,291	1,926	984	10	8,211

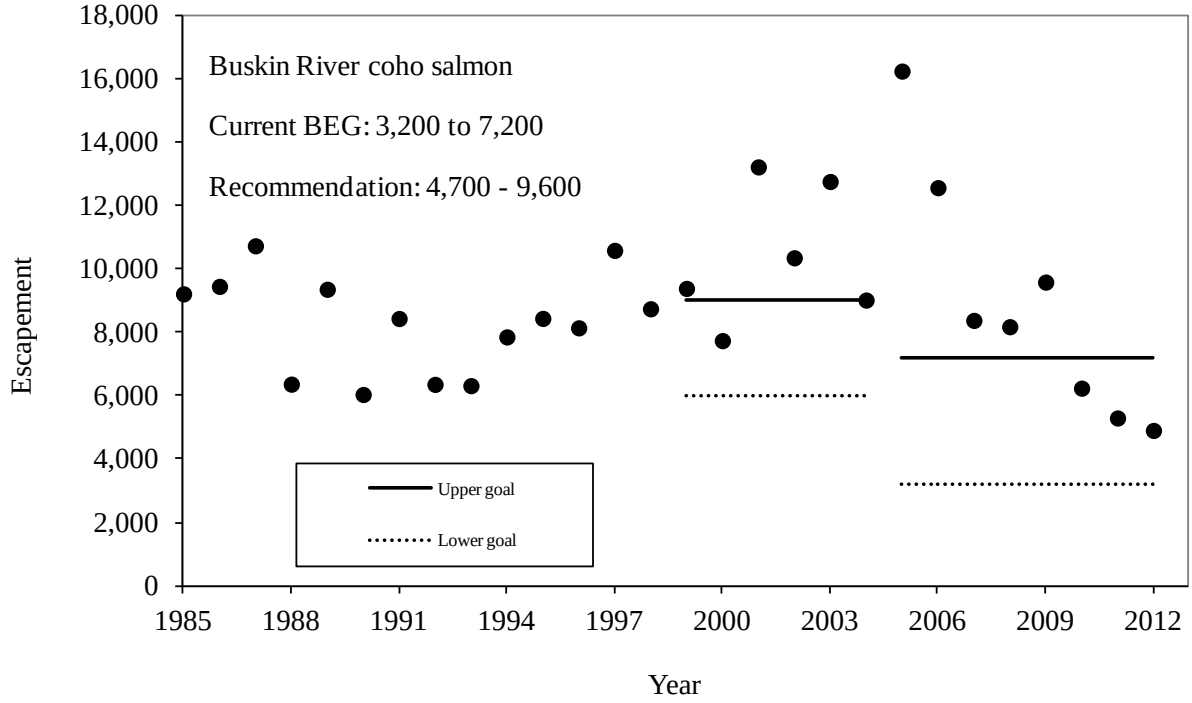
[a] Recreational harvests from the Statewide Harvest Survey.

[b] Subsistence harvests from the ADF&G Division of Commercial Fisheries database, Westward Region.

[c] Commercial harvests from the ADF&G Division of Commercial Fisheries database.

Appendix O3.–Buskin River coho salmon escapement and escapement goals, 1985–2012.

System: **Buskin River**
Species: **Coho salmon**



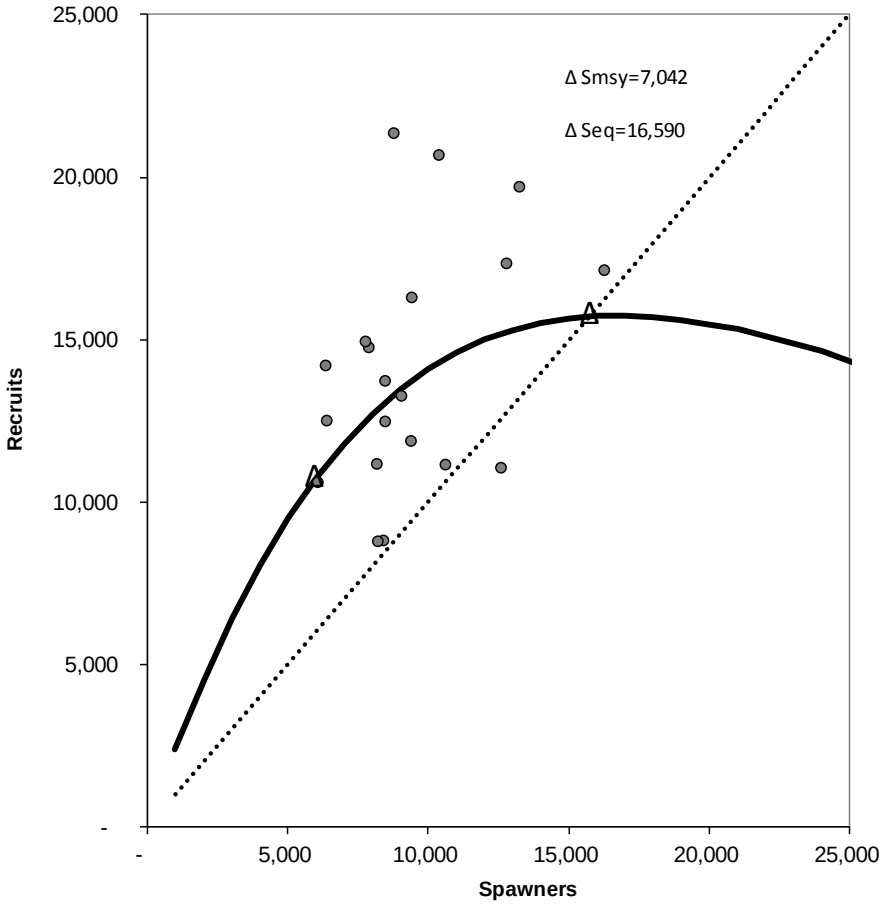
Appendix O4.–Buskin River coho salmon brood table, 1989–2008.

System: Buskin River
Species: Coho salmon

Brood Year	Escapement	Age Class										Return	Return/ Spawner
		1.0	1.1	1.2	2.0	2.1	2.2	3.0	3.1	3.2	4.1		
1989	9,356	-	2,275	-	213	8,774	-	-	648	-	-	11,910	1.3
1990	6,039	-	2,143	38	40	8,082	37	38	262	-	-	10,640	1.8
1991	8,434	-	3,431	-	229	8,938	44	-	1,049	-	69	13,759	1.6
1992	6,358	-	2,767	-	37	8,215	-	-	1,517	-	-	12,537	2.0
1993	6,318	37	2,578	-	-	10,139	55	69	1,265	44	44	14,232	2.3
1994	7,855	-	2,897	-	138	9,074	177	110	2,392	-	-	14,788	1.9
1995	8,438	-	2,310	-	-	9,079	160	44	917	-	-	12,510	1.5
1996	8,141	-	2,303	-	44	8,733	42	40	42	-	-	11,205	1.4
1997	10,582	-	2,153	-	40	8,526	-	42	422	-	-	11,183	1.1
1998	8,742	-	8,106	-	210	11,641	-	47	1,375	-	-	21,379	2.4
1999	9,383	-	2,159	-	94	11,846	-	89	2,137	-	-	16,325	1.7
2000	7,737	-	3,683	-	311	9,653	-	-	1,325	-	-	14,970	1.9
2001	13,214	-	3,624	-	-	14,969	-	-	1,135	-	-	19,729	1.5
2002	10,349	38	5,233	-	66	15,200	-	28	141	-	-	20,705	2.0
2003	12,754	66	5,039	-	55	11,954	-	-	258	-	-	17,372	1.4
2004	9,016	-	2,883	-	492	9,153	-	64	705	-	-	13,297	1.5
2005	16,235	70	4,061	-	64	12,782	-	-	185	-	-	17,163	1.1
2006	12,560	-	2,013	-	302	7,602	-	124	1,047	-	-	11,087	0.9
2007	8,375	-	1,483	-	371	6,805	95	-	95	-	-	8,850	1.1
2008	8,176	-	1,570	-	-	7,158		95	-			8,824	1.1

Appendix O5.–Fitted Ricker stock-recruitment curves, line of replacement for Buskin River coho salmon from brood years 1989 through 2008.

System: Buskin River
Species: Coho salmon



Note: The solid line represents the Ricker curve, and the dotted line represents replacement.

APPENDIX P. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR OLDS RIVER COHO SALMON

Appendix P1.–Description of stock and escapement goal for Olds River coho salmon.

System: Olds River

Species: Coho salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Sport and Commercial
Primary fishery:	Sport, commercial, and subsistence
Current escapement goal:	Lower-bound SEG of 1,000 fish (2010)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Foot surveys, 1980 to present with no surveys in 1981, 1983, 1988, and 1991.
Data summary:	
Data quality:	Mark-recapture work conducted in 1997 and 1998 (Begich et al. 2000) indicated foot surveys in the Olds River represent 69% to 104% of point estimates of abundance and were within the 95% confidence interval of estimated abundance in 1998.
Data type:	Foot surveys are conducted annually and inriver harvest of the recreational fishery are estimated annually through the Statewide Harvest Survey. Although there is no stock-specific harvest information available for subsistence and commercial fisheries, annual catch data are available for Kalsin Bay (statistical area 259-24).
Data contrast:	All survey data 1980 to 2012: 32.0
Methodology:	Theoretical stock-recruit analysis with average foot surveys and average harvest (recreational, commercial, and subsistence) from 1980 to 2003 was used to specify the SEG that potentially maximizes yield give uncertainty in the productivity of this stock. Alpha-parameter values in the stock-recruit analysis ranged from 4 to 8.
Autocorrelation:	No significant autocorrelation of foot survey counts.
Comments:	None

Appendix P2.–Annual escapement index and harvest of Olds River coho salmon, 1980–2012.

System: **Olds River**

Species: **Coho salmon**

	Foot	Harvest			
Year	Survey	Recreational[a]	Subsistence[b]	Commercial[c]	Total
1980	780		0	6,069	
1981			152	1,366	
1982	1,375		279	1,839	
1983		31	64	766	861
1984	325	611	445	4,252	5,633
1985	1,648	304	337	332	2,621
1986	1,849	1,651	312	447	4,259
1987	842	307	379	3,310	4,838
1988		1,273	209	1,773	3,255
1989	743	2,571	143	0	3,457
1990	1,706	948	379	7	3,040
1991		1,778	247	178	2,203
1992	308	1,085	276	0	1,669
1993	525	1,876	82	40	2,523
1994	395	1,083	225	2	1,705
1995	2,642	833	116	3,988	7,579
1996	2,200	864	305	0	3,369
1997	4,064	1,519	363	3,011	8,957
1998	2,296	951	267	10	3,524
1999	1,382	1,349	258	320	3,309
2000	1,097	1,712	337	0	3,146
2001	3,454	1,268	295	4,748	9,765
2002	790	1,346	215	0	2,351
2003	1,534	1,233	595	9	3,371
2004	1,860	2,082	342	446	4,730
2005	2,495	1,993	347	0	4,835
2006	1,912	1,617	366	4,491	8,386
2007	868	1,401	183	1,811	4,263
2008	656	696	173	20	1,545
2009	697	1,889	93	46	2,725
2010	127	1,253	53	0	1,433
2011	1,033	1,351	61	168	2,613
2012	624	734	79	32	1,469

[a] Recreational harvests from the Statewide Harvest Survey.

[b] Subsistence harvests from the ADF&G Division of Commercial Fisheries database, Westward Region.

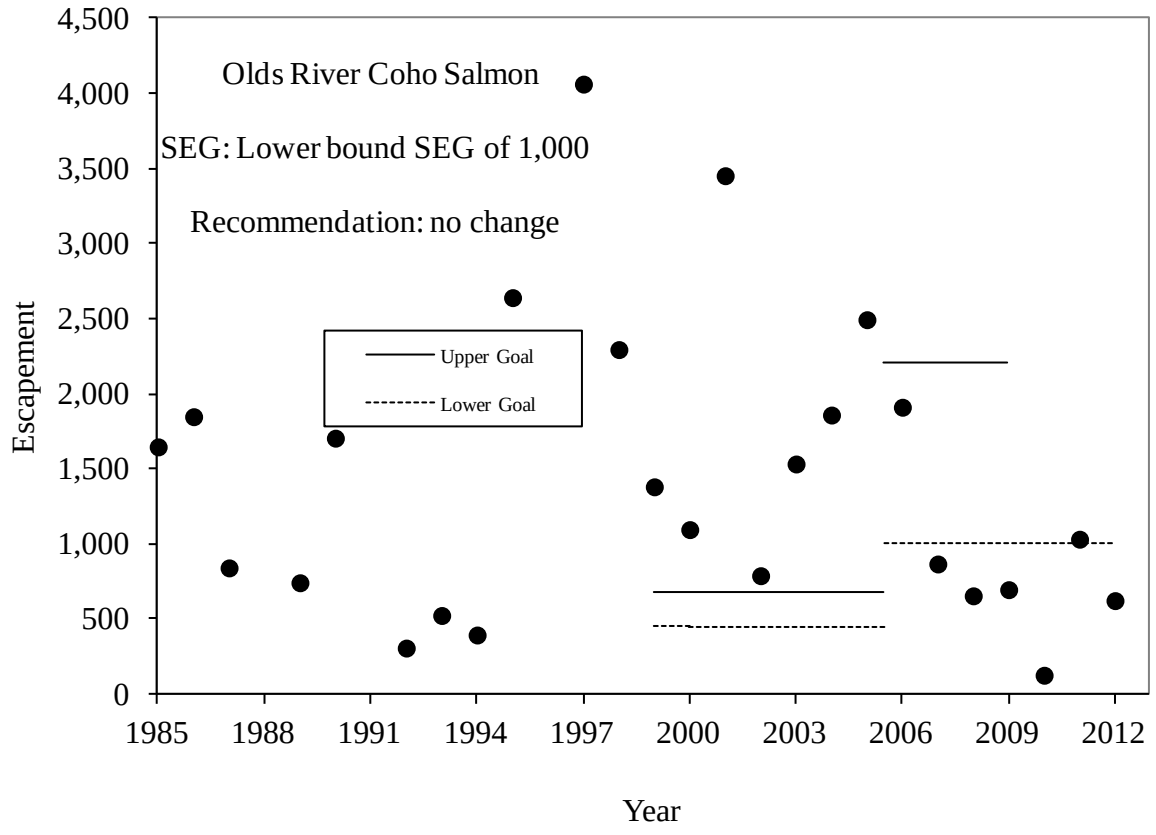
[c] Commercial harvests from the ADF&G Division of Commercial Fisheries database.

Appendix P3.–Olds River coho salmon escapement and escapement goals, 1985–2012.

System: **Olds River**

Species: **Coho salmon**

Observed escapement by year (foot surveys)



APPENDIX Q. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR PASAGSHAK RIVER COHO SALMON

Appendix Q1.–Description of stock and escapement goal for Pasagshak River coho salmon.

System: Pasagshak River

Species: Coho salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Sport and Commercial
Primary fishery:	Sport, commercial, and subsistence
Current escapement goal:	Lower-bound SEG: 1,200 fish (2010)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Foot surveys, 1980–present with no surveys in 1985, 1988, 1989, 1991, 1992, 1994, and 1995.
Data summary:	
Data quality:	Fishery managers have indicated that foot surveys in the Pasagshak River since 1996 likely represent most of the actual escapement to the system.
Data type:	Foot surveys are conducted annually and inriver harvest of the recreational fishery are estimated annually through the Statewide Harvest Survey. Although there is no stock-specific harvest information available for subsistence and commercial fisheries, annual catch data are available for statistical area 259-41.
Data contrast:	All survey data 1980 to 2012: 9.48
Methodology:	Theoretical stock-recruit analysis with average foot surveys and average harvest (recreational, commercial and subsistence) from 1980 to 2003 was used to specify the SEG that potentially maximizes yield give uncertainty in the productivity of this stock. Alpha-parameter values in the stock-recruit analysis ranged from 4 to 8.
Autocorrelation:	Significant autocorrelation of foot survey counts at lag 1 (0.55)
Comments:	None

Appendix Q2.–Annual escapement index and harvest of Pasagshak River coho salmon, 1980–2012.

System: Pasagshak River

Species: Coho salmon

Data available for analysis of escapement goals

	Foot	Harvest			
Year	Survey	Recreational[a]	Subsistence[b]	Commercial[c]	Total
1980	2,664	2,480	18	1,832	6,994
1981	2,621	1,015	16	1,048	4,700
1982	175	1,100	17	2,787	4,079
1983	1,920	1,322	20	2,316	5,578
1984	1,540	1,870	76	1,485	4,971
1985		2,292	117	1,691	4,100
1986	3,571	2,951	35	1,184	7,741
1987	2,519	3,459	0	9,425	15,403
1988		2,601	0	778	3,379
1989		2,065	28	0	2,093
1990	2,173	2,105	60	46	4,384
1991		1,296	216	94	1,606
1992		1,765	118	222	2,105
1993	1,337	2,274	276	714	4,601
1994		994	112	106	1,212
1995		1,215	65	927	2,207
1996	2,248	1,458	196	0	3,902
1997	2,813	1,468	88	41	4,410
1998	1,906	969	140	48	3,063
1999	3,409	1,195	75	226	4,905
2000	4,526	2,691	348	374	7,939
2001	6,209	804	181	44	7,238
2002	5,825	945	112	81	6,963
2003	8,886	2,547	353	143	11,929
2004	3,402	2,441	261	12	6,116
2005	3,773	3,655	334	6,622	14,384
2006	937	1,121	320	8,294	10,672
2007	1,896	2,095	149	0	4,140
2008	3,875	2,836	315	0	7,026
2009	2,385	2,044	232	53	4,714
2010	1,971	2,417	259	0	4,647
2011	1,083	3,509	92	29	4,713
2012	3,132	2,125	159	0	5,416

[a] Recreational harvests from the Statewide Harvest Survey.

[b] Subsistence harvests from the ADF&G Division of Commercial Fisheries database, Westward Region.

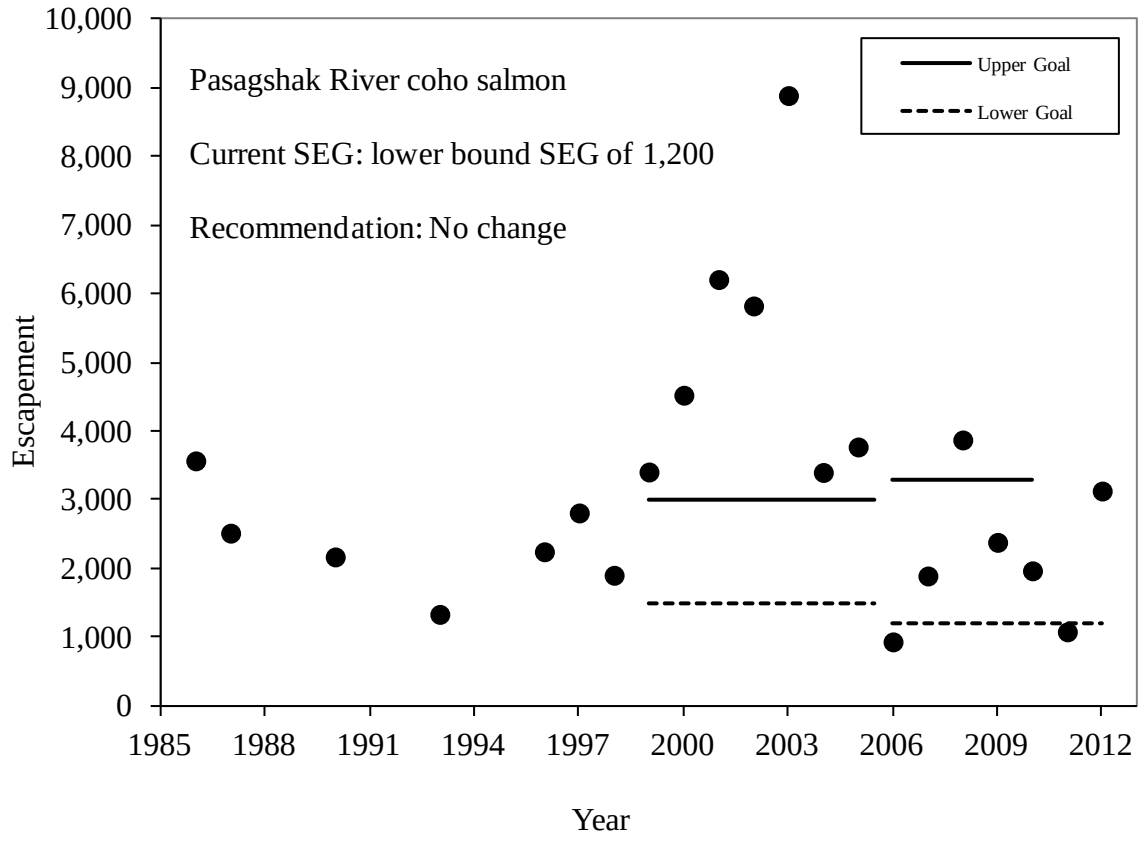
[c] Commercial harvests from the ADF&G Division of Commercial Fisheries database.

Appendix Q3.–Pasagshak River coho salmon escapement and escapement goals, 1985–2012.

System: **Pasagshak River**

Species: **Coho salmon**

Observed escapement by year (foot surveys)



APPENDIX R. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR KODIAK ARCHIPELAGO PINK SALMON

Appendix R1.–Description of stock and escapement goal for Kodiak Archipelago pink salmon.

System: Kodiak Archipelago

Species: Pink salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and gillnet
Current escapement goal:	SEG Odd Years: 2,000,000–5,000,000 (2011)
	SEG Even Years: 3,000,000–7,000,000 (2011)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial Survey, 1968–2012
	Weir counts, 1976–2012
Data summary:	
Data quality:	Fair
Data type:	Fixed-wing aerial surveys from 1968 to 2012 with peak counts used as an index of spawning escapement. Index streams are flown annually with peak counts from streams summed annually to produce a single index for the archipelago after combination with weir counts.
Data contrast:	Peak aerial surveys, all years 1976–2012: 6.3
Methodology:	Ricker Model
Autocorrelation:	None
Comments:	An expansion factor of two (2) was used on pink salmon escapement aerial survey data and combined with Karluk and Ayakulik escapement data. The resultant Ricker model was significant (P=3.9x10-5). The resultant S_{MSY} estimate was corrected for Karluk and Ayakulik weir counts and weighted peak aerial survey data.

Appendix R2.–Kodiak Archipelago pink salmon peak escapement and harvest estimates, 1976–2012.

System: Kodiak Archipelago

Species: Pink salmon

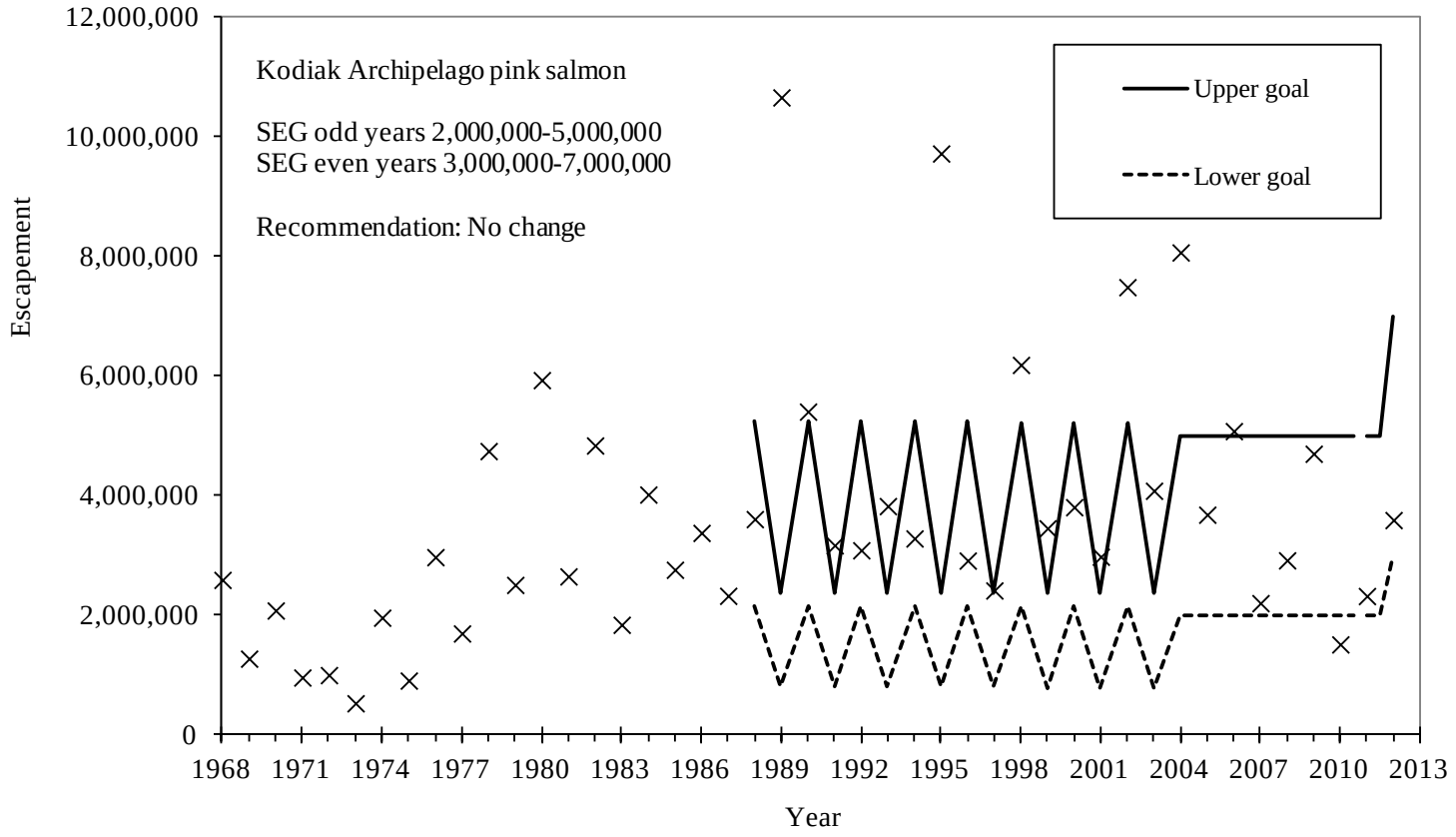
Data available for analysis of escapement goals

Year	Peak Survey	Harvest
1976	2,978,186	
1977	1,701,440	
1978	4,752,564	14,767,000
1979	2,513,297	10,445,000
1980	5,939,637	16,726,000
1981	2,655,869	9,362,000
1982	4,845,754	7,318,000
1983	1,846,583	4,289,000
1984	4,025,164	10,228,000
1985	2,766,941	3,607,000
1986	3,383,518	10,356,000
1987	2,331,221	3,898,000
1988	3,614,253	12,207,000
1989	10,668,567	182,000
1990	5,412,594	4,569,000
1991	3,175,610	14,136,000
1992	3,093,014	2,415,000
1993	3,832,171	20,577,000
1994	3,290,790	5,917,000
1995	9,730,506	37,636,000
1996	2,920,544	2,458,000
1997	2,420,679	9,096,000
1998	6,193,925	15,225,000
1999	3,460,986	7,459,000
2000	3,813,914	6,139,000
2001	2,984,844	6,042,000
2002	7,494,477	11,308,000
2003	4,088,412	8,360,000
2004	8,074,963	17,171,100
2005	3,688,158	16,061,700
2006	5,086,372	26,636,025
2007	2,208,678	16,307,004
2008	2,924,708	6,018,025
2009	4,707,894	18,077,949
2010	3,378,483	5,473,019
2011	2,506,714	14,221,904
2012	5,111,049	13,807,487

Appendix R3.–Kodiak Archipelago pink salmon indexed escapement and escapement goal ranges, 1968–2012.

System: **Kodiak Archipelago**

Species: **Pink salmon**



APPENDIX S. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR KODIAK MAINLAND PINK SALMON

Appendix S1.–Description of stock and escapement goal for Kodiak Mainland pink salmon.

System: Kodiak Mainland

Species: Pink salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine
Current escapement goal:	SEG: 250,000–1,000,000 (2011)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial Survey, 1968–2012
Data summary:	
Data quality:	Fair
Data type:	Fixed-wing aerial surveys from 1968 to 2012 with peak counts used as an index of spawning escapement. 16 streams are flown annually with peak counts from streams summed annually to produce a single index for the district.
Data contrast:	Peak aerial surveys, all years 1976–2012: 31.3
Methodology:	Ricker Model
Autocorrelation:	Present (lag-1), but borderline significant
Comments:	An expansion factor of two (2) was used on pink salmon escapement aerial survey data and coupled with harvest estimates. The resultant Ricker model was significant ($P=6.3x10^{-5}$). The resultant S_{MSY} estimate was corrected for expanded aerial survey information.

Appendix S2.–Kodiak Mainland pink salmon aggregate escapement and harvest estimates, 1978–2012.

System: Kodiak Mainland

Species: Pink salmon

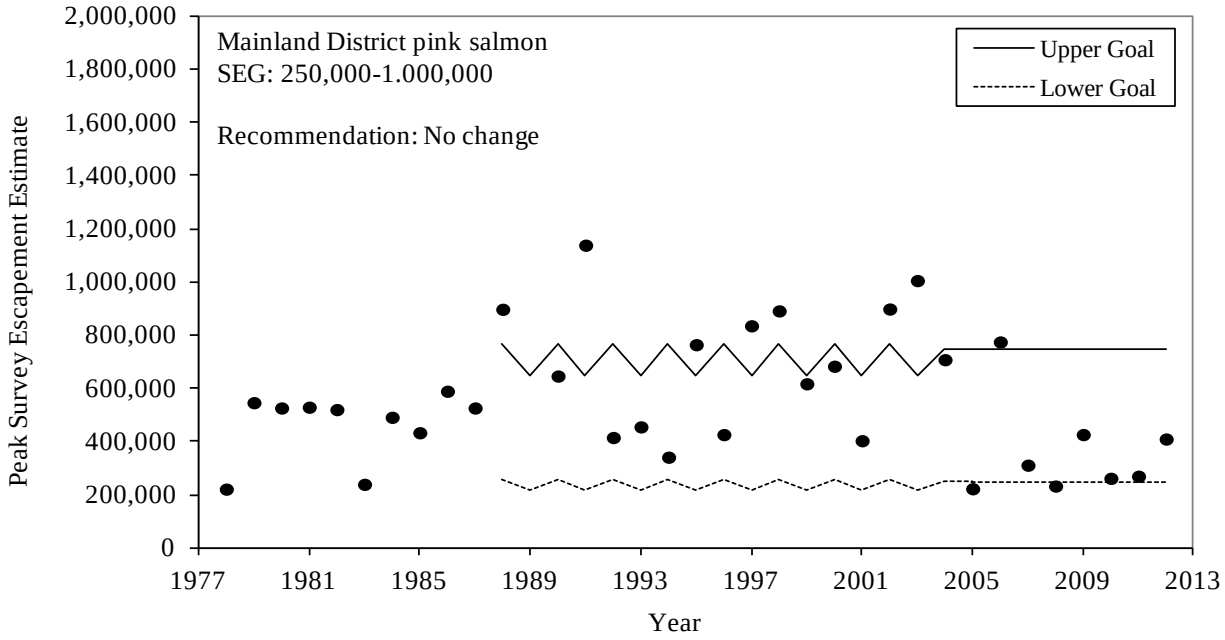
Data available for analysis of escapement goals

Year	Peak Survey	Harvest
1978	225,000	237,000
1979	550,000	623,000
1980	530,000	287,000
1981	533,000	271,000
1982	524,000	582,000
1983	243,000	184,000
1984	495,000	345,000
1985	437,000	261,000
1986	593,000	806,000
1987	530,000	226,000
1988	901,000	1,748,000
1989	3,977,000	0
1990	650,000	876,000
1991	1,142,000	1,166,000
1992	419,000	190,000
1993	459,000	1,366,000
1994	345,000	194,000
1995	768,000	696,000
1996	430,000	50,000
1997	839,000	728,000
1998	895,000	559,000
1999	621,000	384,000
2000	687,000	117,000
2001	407,000	398,000
2002	902,000	323,000
2003	1,009,000	173,000
2004	711,555	283,600
2005	268,050	473,812
2006	778,200	899,213
2007	315,300	617,342
2008	236,500	652,238
2009	430,100	631,800
2010	265,650	141,308
2011	273,500	249,245
2012	413,325	97,687

Appendix S3.–Kodiak Mainland pink salmon indexed escapement and escapement goals ranges, 1968–2012.

System: **Kodiak Mainland**

Species: **Pink salmon**



APPENDIX T. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR KODIAK CHUM SALMON

Appendix T4.–Description of stock and escapement goal for Kodiak chum salmon.

System: Kodiak Archipelago

Species: Chum salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine
Current escapement goal:	Lower-bound SEG: 151,000 (2008)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial Survey, 1967–2012
Data summary:	
Data quality:	Fair
Data type:	Fixed-wing aerial surveys from 1967 to 2012
Data contrast:	Aerial surveys, all years 1976–2012: 108.2
Methodology:	Percentile Approach
Comments:	None

Appendix T5.–Kodiak Archipelago chum salmon aggregate escapement estimates, 1967–2012.

System: Kodiak Archipelago

Species: Chum salmon

Data available for analysis of escapement goals

Year	NW Kod	SW Kod	Alitak	Eastside	NE Kod	Kodiak Aggregate
1967	43,000	45,000	6,735	6,225	5,224	106,184
1968	6,800	71,000	28,000	18,600	0	124,400
1969	6,445	9,500	17,785	22,300	450	56,480
1970	2,500	5,000	3,200	13,150	2,500	26,350
1971	21,000	101,000	31,700	14,050	2,007	169,757
1972	90,340	21,500	21,570	142,315	2,920	278,645
1973	45,848	9,120	22,100	112,380	13,215	202,663
1974	15,600	13,500	6,000	49,860	2,500	87,460
1975	38,350	45,574	27,240	23,725	10,950	145,839
1976	8,000	7,132	41,041	66,250	11,835	134,258
1977	57,602	99,446	46,500	129,775	34,200	367,523
1978	47,700	160,339	36,059	65,139	10,261	319,498
1979	75,200	97,141	10,165	169,495	11,750	363,751
1980	43,050	96,108	86,075	165,510	17,900	408,643
1981	99,100	97,000	52,310	204,070	3,710	456,190
1982	147,700	63,675	121,900	144,720	50,715	528,710
1983	169,225	85,189	117,317	150,657	24,100	546,488
1984	75,600	80,172	68,075	110,360	30,600	364,807
1985	61,600	1,502	42,268	129,500	37,110	271,980
1986	162,890	92,218	25,634	62,973	21,002	364,717
1987	76,950	12,200	38,000	42,600	7,643	177,393
1988	192,550	58,900	11,600	44,080	31,501	338,631
1989	417,100	7,279	41,599	223,645	17,679	707,302
1990	43,920	118,657	8,721	46,870	12,300	230,468
1991	123,503	51,765	99,187	220,951	22,116	517,522
1992	131,710	43,874	28,772	32,085	10,605	247,046
1993	53,825	1,978	18,912	56,650	10,422	141,787
1994	52,950	12,538	48,827	44,170	8,450	166,935
1995	104,800	35,191	58,661	21,353	9,843	229,848
1996	84,900	7,757	21,381	27,365	4,100	145,503
1997	70,900	3,778	17,474	26,525	7,808	126,485
1998	28,250	26,596	38,656	17,925	7,250	118,677
1999	53,300	73,850	40,778	87,705	2,031	257,664
2000	145,800	15,697	53,843	42,100	8,600	266,040
2001	112,550	1,482	29,086	18,750	16,600	178,468
2002	41,200	55,838	27,642	68,400	13,200	206,280
2003	67,700	12,900	60,525	72,100	4,500	217,725
2004	30,700	10,243	25,906	58,750	2,156	127,755
2005	36,150	2,000	47,100	49,300	7,300	141,850
2006	41,800	21,400	10,600	328,700	16,500	419,000
2007	29,510	300	24,500	90,650	21,100	166,060
2008	35,700	4,000	4,500	35,700	3,140	83,040
2009	73,400	750	26,850	62,690	13,800	177,490
2010	37,850	8,400	17,900	79,040	17,100	160,290
2011	80,050	8,400	20,200	75,050	8,700	192,400
2012	41,900	9,100	12,800	78,125	17,900	159,825

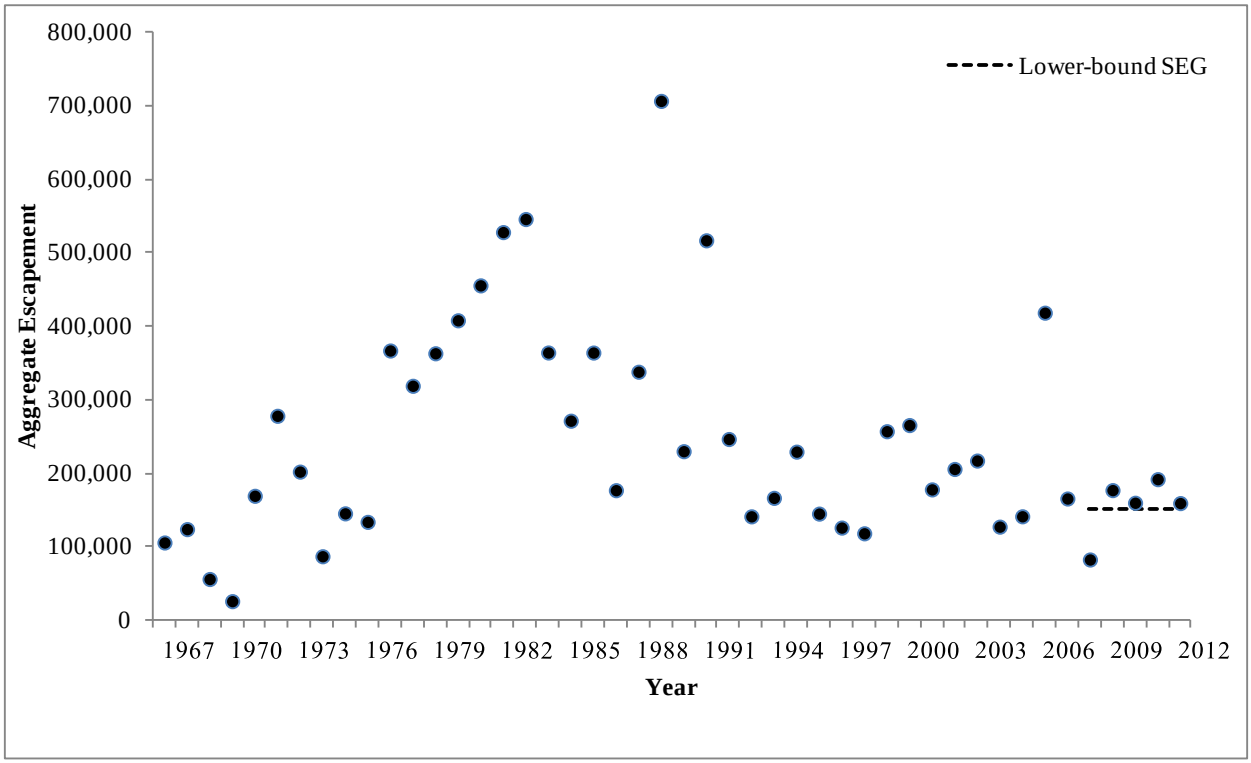
Notes: Kodiak Archipelago aggregate is the sum of observed escapement by district. Afognak District is not part of this aggregate.

Prior to 2008 Chum salmon escapement was managed by district escapement goals.

Appendix T6.–Kodiak Archipelago chum salmon escapement and escapement goals ranges, 1967–2012.

System: **Kodiak Archipelago**

Species: **Chum salmon**



APPENDIX U. SUPPORTING INFORMATION FOR ESCAPEMENT GOALS FOR MAINLAND CHUM SALMON

Appendix U1.–Description of stock and escapement goal for Mainland chum salmon.

System: Kodiak Mainland

Species: Chum salmon

Description of stock and escapement goals

Regulatory area:	Kodiak Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine
Current escapement goal:	Lower-bound SEG: 104,000 (2008)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial Survey, 1967–2012
Data summary:	
Data quality:	Fair
Data type:	Fixed-wing aerial surveys from 1967 to 2012
Data contrast:	Aerial surveys, all years 1976–2012: 64.7
Methodology:	Percentile Approach
Comments:	None

Appendix U2.–Kodiak Mainland chum salmon aggregate escapement estimates, 1967–2012.

System: Kodiak Mainland

Species: Chum salmon

Data available for analysis of escapement goals

Year	Mainland Aggregate
1967	19,250
1968	7,000
1969	22,200
1970	61,500
1971	53,710
1972	38,800
1973	89,450
1974	15,300
1975	31,720
1976	125,910
1977	392,440
1978	119,850
1979	177,310
1980	367,250
1981	238,850
1982	453,148
1983	238,810
1984	246,450
1985	263,100
1986	245,175
1987	225,600
1988	185,800
1989	346,200
1990	207,200
1991	334,100
1992	213,100
1993	51,790
1994	169,100
1995	127,900
1996	158,650
1997	80,300
1998	103,050
1999	166,200
2000	367,650
2001	196,100
2002	120,975
2003	73,800
2004	241,645
2005	22,500
2006	346,140
2007	82,600
2008	72,000
2009	91,106
2010	124,500
2011	128,700
2012	127,850

Appendix U3.–Kodiak Mainland chum salmon escapement and escapement goals ranges, 1967–2012.

System: **Kodiak Mainland**

Species: **Chum salmon**