Special Publication No. 15-19

Norton Sound Subdistrict 5 (Shaktoolik) and Subdistrict 6 (Unalakleet) King Salmon Stock Status and Action Plan, 2016; a Report to the Alaska Board of Fisheries

by

Scott M. Kent

and

Daniel J. Bergstrom

December 2015

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

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

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

SPECIAL PUBLICATION NO. 15-19

NORTON SOUND SUBDISTRICT 5 (SHAKTOOLIK) AND SUBDISTRICT 6 (UNALAKLEET) KING SALMON STOCK STATUS AND ACTION PLAN, 2016; A REPORT TO THE ALASKA BOARD OF FISHERIES

by

Scott M. Kent

and

Daniel J. Bergstrom

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1599

December 2015

The Special Publication series was established by the Division of Sport Fish in 1991 for the publication of techniques and procedures manuals, informational pamphlets, special subject reports to decision-making bodies, symposia and workshop proceedings, application software documentation, in-house lectures, and became a joint divisional series in 2004 with the Division of Commercial Fisheries. Special Publications are intended for fishery and other technical professionals. Special Publications are available through the Alaska State Library, Alaska Resources Library and Information Services (ARLIS) and on the Internet: http://www.adfg.alaska.gov/sf/publications/. This publication has undergone editorial and peer review.

Scott M. Kent,
Alaska Department of Fish and Game, Division of Commercial Fisheries,
P.O. Box 1148 Nome, AK 99762, USA

and

Daniel J. Bergstrom
Alaska Department of Fish and Game, Division of Commercial Fisheries,
333 Raspberry Road, Anchorage, AK 99518, USA

This document should be cited as follows:
Kent, S. M., and D. J. Bergstrom. 2015. Norton Sound Subdistrict 5 (Shaktoolik) and Subdistrict 6 (Unalakleet) king salmon stock status and action plan, 2016; a report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Special Publication No. 15-19, Anchorage.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

In response to the guidelines established in the *Policy for Management of Sustainable Salmon Fisheries* (SSFP; 5 AAC 39.222), the Alaska Board of Fisheries (board) classified Norton Sound Subdistrict 5 (Shaktoolik) and Subdistrict 6 (Unalakleet) king salmon *Oncorhynchus tshawytscha* as a stock of yield concern at its January 2004 meeting. An action plan was developed by the Alaska Department of Fish and Game (department) and acted upon by the board. The board continued the Subdistrict 5 and Subdistrict 6 king salmon classification as a stock of yield concern in 2007, and adopted a king salmon management plan (5 AAC 04.395) in order to increase escapements and restore the stock to historical levels of abundance. In 2010 and 2013, the board continued the stock of concern designation and modified the management plan to provide direction for targeting commercial chum (*O. keta*) and pink (*O. gorbuscha*) salmon fisheries in times of low king salmon abundance. The North River escapement goal was achieved in 2007, 2009, 2010, 2014, and 2015, but only as a result of inriver and marine gillnet mesh size restrictions, and closures to subsistence and sport fisheries. Escapement goals were not achieved in 2008, 2012, and 2013 despite similar conservation measures; escapement estimates are considered incomplete for 2011. During the recent regulatory cycle, the subdistricts 5 and 6 king salmon stock yields have remained well below average yields, despite the use of specific management measures. Therefore, subdistricts 5 and 6 king salmon continue to meet the definition for a stock of yield concern as defined in the SSFP and the department recommends continuing the stock of yield concern classification.

Key words: Norton Sound, king salmon, *Oncorhynchus tshawytscha*, stock of concern, yield concern, commercial, fishing, department, sustainable salmon fisheries policy, Alaska Board of Fisheries

INTRODUCTION

The *Policy for Management of Sustainable Salmon Fisheries* (SSFP) directs the Alaska Department of Fish and Game (department) to provide the Alaska Board of Fisheries (board) with reports on the status of salmon stocks and identify any salmon stocks that present a concern related to yield, management, or conservation during regular board meetings. This report provides the department's reassessment of the Norton Sound subdistricts 5 (Shaktoolik) and 6 (Unalakleet) king salmon (*Oncorhynchus tshawytscha*) stock, which has been classified as a yield concern.

A stock of yield concern is defined as "a concern arising from a chronic inability, despite the use of specific management measures, to maintain expected yields, or harvestable surpluses, above a stock's escapement needs; a yield concern is less severe than a management concern" (5 AAC 39.222(f)(42)). The SSFP defines a chronic inability as "the continuing or anticipated inability to meet expected yields over a 4 to 5 year period," and expected yields are defined as "mean levels at or near the lower range of recent historical harvests if they are deemed sustainable."

In response to the guidelines established in the SSFP, the board classified the Norton Sound subdistricts 5 and 6 king salmon stock as a yield concern at the January 2004 board meeting. An action plan developed by the department (Jones 2003) was acted upon by the board in January 2004. Following 3 consecutive years (2004–2006) of failing to meet escapement goals despite reductions in harvests, and the continuing inability to meet expected yields over a 5-year period, the department recommended continuing the stock of yield concern classification (Kent and Bergstrom 2006). The board agreed with this determination at its February 2007 meeting and, in an effort to further conserve king salmon and restore the stock to historical yield levels, adopted the *Subdistricts 5 and 6 of the Norton Sound District and the Unalakleet River King Salmon Management Plan* (5 AAC 04.395). The management plan incorporates a restrictive subsistence fishing schedule and 50% reductions in the bag, possession, and annual sport fish bag limits. As specified in 5 AAC 04.395, subsistence fishing from June 15 to July 15 in Subdistrict 6 is limited

to two 48-hour periods per week in the marine waters, and two 36-hour periods per week in Unalakleet River. Likewise, the Unalakleet River sport fish bag and possession limit for king salmon, 20 inches or greater, was reduced to 1 fish per day, and the annual harvest limit was reduced from 4 to 2 fish. The plan provides authority to the department to liberalize subsistence fishing time and sport fish annual limit if the midpoint of the king salmon escapement goal range is projected to be exceeded. The intent of 5 AAC 04.395 was to increase king salmon escapements by providing escapement windows between subsistence fishing periods and by reducing sport fish harvests. At the 2010 board meeting, subdistricts 5 and 6 king salmon retained its stock of yield concern designation based on escapement goals being reached in only 2 of the 3 previous years and harvestable surpluses remaining well below historical (1989-1998 average) yield levels. Similarly, poor king salmon run performance resulted in the board continuing the stock of yield concern designation at the January 2013 meeting.

In accordance with the SSFP, the department recommended continuing the designation of Norton Sound subdistricts 5 and 6 king salmon as a stock of yield concern at the October 2015 Alaska Board of Fisheries work session. This recommendation, as a yield concern, was based on record low harvests during the most recent 5-year period (2011–2015) compared to the historical average yield, as indicated by the historical 6-year (1994–1999) average for commercial and subsistence harvests. This is a change from the previous base years of 1989–1998 historical average yield because subsistence harvest data were not collected in some years and varying data collection methods were used prior to 1994. Since subsistence harvest makes up a considerable component of the overall harvest, the historical baseline for comparison was established as those years since standardized subsistence harvest data collection (post-1994) but prior to the decline in harvests initially prompting stock of concern designation (pre-1999). Unalakleet River and marine (2012) king salmon test fishery catches were distributed to subsistence users and were added to subsistence survey harvest estimates for all years prior to 2012 to fully capture harvests for subsistence uses. Test fisheries are no longer operated by the department in Unalakleet Subdistrict.

Sport fishing harvest and effort information has been collected from anglers on the Unalakleet River by the department since 1983, and total catch information (including fish that were released) is available starting in 1990. Sport fish harvest and catch statistics are not yet available for 2015. However, there have not been any sport fishery harvests since 2011 due to the fishery either being restricted to catch-and-release only (2012–2013), or closed at the beginning of the season (2014–2015).

Customary and Traditional Use Finding and Amount Necessary for Subsistence Uses

The board has made a positive finding for customary and traditional (C&T) uses of salmon in the Norton Sound–Port Clarence Area. The amount necessary for subsistence (ANS) uses has been determined to be 96,000–160,000 salmon of all species for the Norton Sound–Port Clarence Area (5 AAC 01.186).

STOCK ASSESSMENT BACKGROUND

The Norton Sound District is composed of 6 commercial fishing subdistricts (Figure 1). In Subdistrict 5, most freshwater subsistence fishing occurs in the Shaktoolik River and in Subdistrict 6, in the Unalakleet River. Subdistricts 5 and 6 salmon fisheries are managed as one

unit because previously conducted tagging studies (Gaudet and Schaeffer 1982) have shown salmon bound for these subdistricts intermingle in marine waters; thus, marine harvests likely contain fish bound for both river drainages.

Historically, king salmon abundance in subdistricts 5 and 6 has been evaluated using a combination of inseason subsistence fishery surveys and passage estimates obtained at a counting tower project located on the North River (1984–1986, 1996–2015), an important spawning tributary of Unalakleet River. More recently, additional assessments have been obtained from mainstem weir counts on the Unalakleet River using a resistance-board weir since 2010 (Kent et al. 2014). King salmon test fishery catches in the lower Unalakleet River had historically been used only to gauge run timing from 1985–2012 (Kent 2010). In 2012, a nearshore variable mesh gillnet marine test fishery was also conducted near the village of Unalakleet to describe run timing and age, sex, and size structure of the subdistricts 5 and 6 king salmon run. Unalakleet River and Unalakleet Subdistrict marine test fishery projects were discontinued in 2012. Aerial surveys are also flown on the Shaktoolik and Unalakleet river drainages in order to ground truth North River tower counts, calibrate survey estimates, and correlate surveys with historical data.

Escapement

The *Subdistricts 5 and 6 of the Norton Sound District and the Unalakleet River King Salmon Management Plan* is largely focused on reaching the North River tower-based sustainable escapement goal (SEG) range of 1,200–2,600 fish. The North River counting tower has been operated continually since 1996 by various agencies and entities, including Kawerak Inc. (1996-2001), Native Village of Unalakleet (NVU) (2002–2006), NVU and the department (2007–2008), and most recently, Norton Sound Economic Development Corporation (NSEDC) (2009–2015) (Table 1). The efficacy of the North River tower to index drainagewide king salmon escapement has also been evaluated using radiotelemetry. Wuttig (1999) and Joy and Reed (2014) showed that North River accounted for 37% (1997), 40% (1998), 34% (2009), and 53% (2010) of the Unalakleet River king salmon drainagewide escapement. Magnitude of the proportional abundance estimates suggest that the North River serves as an important index of drainagewide king salmon escapement.

Since 2010, Unalakleet River mainstem king salmon escapements have been monitored using a resistance-board weir, and have included age, sex, and length information (Kent et al. 2014). Weir counts of king salmon during the 2013–2015 seasons were 767, 1,126, and 2,771 fish, respectively (Table 1). A prolonged installation phase, multiple high water events, and damage to weir components led to a significant amount of unmonitored salmon passage at Unalakleet River weir in 2014. As such, the 2014 escapement estimate should be considered a minimum count. As with North River tower, late king salmon run timing characterized the 2013 season at Unalakleet River weir, followed by an early run in 2014, and a run exhibiting normal timing in 2015.

In 1999, an escapement goal range of 1,200–2,400 was first established for the North River (Fair et al. 1999), and later revised to an SEG with the current upper bound of 2,600 salmon (ADF&G 2004). King salmon escapements to North River met or exceeded established escapement goal ranges in 1999, 2001, 2002, 2003, 2007, 2009, 2010, 2014, and 2015 (Table 1; Figure 2). Thus, the North River SEG has only been met in 2 of last 5 years, and 9 of the 16 years since goals were first established. In 2013, North River tower established a new record low escapement count of 564 king salmon despite implementing a marine subsistence gillnet schedule and mesh

size restrictions in the Unalakleet River. However, the 2014–2015 seasons marked a significant improvement in king salmon escapements. Despite being a partial estimate due to high water events, the 2014 king salmon tower count was the third highest on record. The 2015 tower count also exceeded the midpoint of the escapement goal range for only the fourth time since 1999. It should be noted, however, that 2014 and 2015 escapements only met the SEG range as a result of severe early season restrictions and closures to subsistence and sport fisheries.

Aerial surveys of king salmon spawning areas in the Shaktoolik and Unalakleet River drainages have also been periodically flown to help evaluate tower and weir counts, make comparisons with historical data, and evaluate existing aerial survey SEGs. In 1999, aerial survey SEG ranges were established for Shaktoolik (400–800 king salmon) and the upper Unalakleet (550–1,100 king salmon) rivers. The Unalakleet River aerial survey index area encompasses the upper 80 km of the mainstem of Unalakleet River, as well as Old Woman River tributary (Fair et al. 1999; ADF&G 2004). However, evaluating these goals has been problematic and challenging. The Unalakleet River aerial survey index area is difficult to survey even when water levels are low because the upper river is heavily braided with forested riparian zones. Aircraft speed of fixed-wing aircraft coupled with the shadow and sunken timber create suboptimal viewing conditions even when water levels are low. Although the use of helicopters could mitigate some of these effects, helicopters are too cost prohibitive in these areas because of ferry time costs. Consequently, since 1999, there have only been 2 complete surveys of the Unalakleet River index area (2007 and 2009) conducted during the peak king salmon spawning phase, and only 5 acceptable surveys of Shaktoolik River (2001, 2004, 2007, and 2011) conducted since these SEGs were established. For this reason, aerial survey data are only marginally used in analyses. In recent years, a partial aerial survey on the Unalakleet River was flown during the 2013 season when 339 king salmon were counted. Poor counting conditions precluded aerial surveys being conducted on the spawning grounds in 2014 and 2015.

YIELD

Significant declines in total run size of Unalakleet River king salmon have resulted in comparably large declines in total harvest or yield in subdistricts 5 and 6. Total run sizes for Unalakleet River king salmon were estimated by adding drainagewide escapement estimates to combined harvests (sport, commercial, and subsistence), assuming 100% of the marine subsistence and commercial king salmon harvest in Subdistrict 6 was of Unalakleet River origin. Although historical total run data are limited, an 82% decline in total run is evident from 1997-1998 compared to recent years (Table 2).

Because of declining run sizes, the commercial harvest of king salmon in subdistricts 5 and 6 has been incidental to directed chum (*O. keta*), pink (*O. gorbuscha*), and coho (*O. kisutch*) salmon fisheries since 2001, except for a small directed commercial harvest of king salmon in 2005. Combined commercial harvests for subdistricts 5 and 6 averaged 6,745 king salmon per year for the historical period 1994–1999 (Table 2). Commercial harvests over the recent 5-year (2011-2015) period averaged 157 king salmon, which represents a 98% decline from the historical commercial harvest average.

Although subsistence harvests have decreased in subdistricts 5 and 6 over the last 18 years, the decrease was not as dramatic as that of the commercial harvest. Subsistence fishing closures in subdistricts 5 and 6 were implemented in 2003, 2004, and annually since the 2006 season because of difficulty achieving the North River tower SEG (Figure 2) and comparably low

Unalakleet River weir escapement counts of king salmon. Subdistricts 5 and 6 subsistence harvests averaged 754 king salmon from 2011–2015, an 83% decline from the 1994–1999 average subsistence harvest of 4,438 king salmon (Table 2). Large decreases in combined king salmon commercial and subsistence harvest patterns have been apparent within each subdistrict since 2011 (Figures 3–4). The average combined harvest (commercial and subsistence) of both subdistricts 5 and 6 from 2011–2015 (910 king salmon) decreased 92% from the historical 1994-1999 average combined harvest of 11,184 king salmon (Table 2; Figure 5).

As with subsistence, sport fishing closures have been implemented in 2003, 2004, and annually since 2006 to assist in meeting escapement objectives. Sport fisheries have been active on Unalakleet River for many years, both by local residents and nonlocals. Pre-emptive catch and release only restrictions and complete closures to the king salmon sport fishery since 2012 have resulted in no sport fish harvests of king salmon reported in the Unalakleet Subdistrict since 2012. The recent 5-year (2011–2015) average harvest of 13 king salmon represents a 97% decline from the (1994–1999) average harvest of 465 king salmon (Table 3). Sport fishing effort in Shaktoolik River is very low, and the small amount of sport fishing that does occur is generally focused on coho salmon.

STOCK OF CONCERN RECOMMENDATION

Management direction provided in the subdistricts 5 and 6 king salmon management plan has enabled the department to implement actions and successfully control harvests for the purpose of reaching escapement goals in 2 of the previous 5 years. It is possible that escapement goals were achieved in 2011, but high water levels precluded obtaining reliable assessments of North River king salmon escapement. However, given the continued inability to maintain near-average yields despite management measures, the Norton Sound subdistricts 5 and 6 king salmon stock continues to meet the criteria of a stock of yield concern. Therefore, based on the definitions provided in the SSFP in 5 AAC 39.222(f)(42), the board continued the yield concern classification for the Norton Sound subdistricts 5 and 6 king salmon stock at the October 2015 work session.

OUTLOOK

The 2016 king salmon run in Norton Sound subdistricts 5 and 6 is expected to be similar to king salmon runs observed in 2014 and 2015 with a strong possibility for continued improvement in run performance. An increase in run size is possible based on the upward trend in runs observed since 2014 and pelagic trawl studies in Norton Sound that indicate good early life survival of king salmon originating from the 2011 and 2012 brood years (K. G. Howard, Fisheries Scientist, Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage; personal communication).

The anticipated slight increase in run sizes should allow the department to provide a limited amount of marine subsistence fishing opportunity targeting king salmon for the first time since 2013. However, any large mesh periods focusing on king salmon will probably be of short duration and gillnets will probably be restricted to a mesh size of 7 inches or smaller. The goal of the 7-inch mesh restriction is to more evenly distribute harvest pressure on all age and size classes of king salmon, rather than targeting the largest, most fecund female king salmon in the population. As has been the case since 2006, it is not anticipated that directed commercial king fishing will be allowed and it may be necessary to implement preseason restrictions to sport and inriver subsistence fisheries in order to maintain low rates of exploitation and reach king salmon

escapement goals. Specific management measures expected in 2016 include inriver and marine gillnet mesh-size restrictions, reductions in marine subsistence fishing time, and catch-and-release restrictions and/or annual possession limit reductions to the sport fishery for king salmon. Additional conservation measures may be necessary in 2016 if the observed run abundance inseason is tracking below forecasted abundance. Despite the positive signs observed over the past couple of seasons, strength of future returns may be poor because of the record low parent year escapements observed in 2012 and 2013.

ESCAPEMENT GOAL EVALUATION

The department has undertaken triennial reviews of escapement goals since 1999 for several Norton Sound salmon stocks where long-term escapement, catch, and age composition data exist that enable development of biological escapement goals (BEGs) or SEGs based on analysis of production consistent with the escapement goal policy. In 1999, the department established a king salmon aerial survey escapement goal for the Unalakleet/Old Woman rivers. Additionally, a tower-based escapement goal for the North River was also established in 1999 (Fair et al. 1999). In 2004, utilizing additional data since the escapement goal for the North River tower was established resulted in the department establishing a SEG range of 1,200 to 2,600 king salmon (ADF&G 2004). At the most recent escapement goal review undertaken in 2015, the review panel recommended that the Unalakleet/Old Woman rivers aerial survey SEG range of 550–1,100 be discontinued because it is difficult to obtain aerial survey counts in this index area as a result of adverse upper river viewing conditions. Due to poor weather conditions, uncertainty of the relationship of the survey to peak spawning time, and availability of aircraft, these index counts are unreliable for evaluating a goal. Within the Unalakleet River drainage there is an existing tower-based goal for the North River tributary, which provides more robust data than aerial surveys can provide from the Old Woman River. Additionally, a weir project has been operational on the mainstem Unalakleet River since 2010 and has shown to provide accurate escapement information. It is the review team's long-term plan that when this weir project has sufficient years and range of escapement data, steps will be taken to establish an escapement goal for the mainstem Unalakleet River weir.

The following is a list of current and proposed escapement goals for subdistricts 5 and 6 king salmon stocks:

Stream (Project Type)	Current Goal		Proposed Goal
Unalakleet/Old Woman River (aerial)	550–1,100	SEG	Discontinue
North River (tower)	1,200–2,600	SEG	No Change

MANAGEMENT ACTION PLAN OPTIONS FOR ADDRESSING STOCKS OF CONCERN AS OUTLINED IN THE *POLICY FOR MANAGEMENT OF SUSTAINABLE SALMON FISHERIES*

NORTON SOUND SUBDISTRICTS 5 AND 6 KING SALMON MANAGEMENT PLAN REVIEW/DEVELOPMENT

Current Stock Status

In response to guidelines established in the SSFP, the department recommended continuing the designation of the subdistricts 5 and 6 king salmon stock as a yield concern at the October 2015 board work session. The board, after reviewing stock status information and public input during the October 2015 works session, continued the classification of subdistricts 5 and 6 king salmon stock as a yield concern. This determination is based on the inability, despite the use of specific management measures, to maintain expected yields, or harvestable surpluses, above a stock's escapement needs during the last 5 years (2011–2015).

Customary and Traditional Use Finding and Amount Necessary for Subsistence Uses

As previously mentioned, there is a positive C&T finding for salmon (all species) and an ANS of 96,000–160,000. Subsistence fishing restrictions targeting the king salmon stocks have occurred over the last 10 years (2006–2015) in subdistricts 5 and 6.

HABITAT FACTORS ADVERSELY AFFECTING THE STOCK

There has been minimal fish habitat alteration in the Unalakleet River drainage due to road construction. An access road has altered natural rates of estuarine exchange within the lower Unalakleet River estuary, although fish passage is maintained through other channels. Historically, this area and the Shaktoolik River drainage have not been mined, unlike northern Norton Sound drainages. The upper Unalakleet River is designated as "wild" under the Wild and Scenic River Act and there are only a few seasonal fish camps located on the lower Shaktoolik River. Spawning and rearing habitats within both drainages remain pristine.

DO NEW OR EXPANDING FISHERIES ON THIS STOCK EXIST?

There are no new or expanding fisheries on this stock. King salmon of Norton Sound origin are likely taken as bycatch in the Bering Sea–Aleutian Islands (BSAI) groundfish fisheries along with other stocks from the coastal western Alaska stock grouping, but impacts to subdistricts 5 and 6 origin fish are likely small. Studies of bycatch samples show that over half of the king salmon caught as bycatch in the pollock fishery are of Western Alaskan origin (which includes the Unalakleet and Shaktoolik rivers) (Guthrie et al. 2014). It is unknown what proportion of Western Alaska stocks in the bycatch would have originated in Unalakleet and Shaktoolik rivers, but it is probably small because these rivers produce far fewer fish than Yukon, Kuskokwim, and Nushagak rivers, which are more significant contributors to this stock group. After record bycatch in 2007 of approximately 130,000 king salmon of all stock groups, the North Pacific Fishery Management Council implemented several actions to reduce king salmon bycatch in this

fishery, with actions first initiated in 2011. Since 2011, total bycatch in this fishery has remained below 30,000 king salmon of all stock groups.

EXISTING MANAGEMENT PLAN

5 AAC 04.395 *Subdistricts 5 and 6 of the Norton Sound District and the Unalakleet River king salmon management plan.*

ACTION PLAN DEVELOPMENT

NORTON SOUND SUBDISTRICTS 5 AND 6 KING SALMON ACTION PLAN GOALS

The action plan goals are as follows:

1. Reduce fishing mortality in order to meet spawning escapement goals,
2. Provide reasonable opportunity for subsistence fishing,
3. Rebuild run size in order to
    a. re-establish historical levels of subsistence harvest, and
    b. increase directed king salmon harvest by commercial and sport fisheries to sustainable levels.

REVIEW OF MANAGEMENT ACTION PLAN

Regulation Changes Adopted in February 2004

In January 2004, after review of the management action plan options addressing this stock of concern (Jones 2003), the board adopted subsistence fishing regulations 5 AAC 01.170(j)(1) and sport fishing regulations 5 ACC 70.011(c)(9). Under regulation 5 AAC 01.170(j)(1), during times in which the commissioner determines it is necessary for the conservation of king salmon, the commissioner may, by emergency order, close the subsistence fishing season in subdistricts 5 and 6 and immediately reopen the season in those subdistricts during which gillnets must have a mesh size not exceeding 6 inches. The sport fish bag and possession limit in regulation 5 ACC 70.011(c)(9) for king salmon less than 20 inches was reduced from 10 to 1 fish, effectively reducing the overall bag limit from 11 to 2 fish. However, the bag limit can only be composed of 1 fish exceeding 20 inches in length. In addition, this regulation placed an annual sport limit of 4 king salmon 20 inches or greater in the Unalakleet River drainage, of which only 2 can be taken from the North River. Regulation 5 ACC 70.011(c)(9) also stipulated that anglers targeting king salmon in the Unalakleet River drainage must possess and complete a current harvest record as described in 5 AAC 70.024.

Regulation Changes Adopted in February 2007

In February 2007, after review of the management action plan options addressing this stock of concern (Kent and Bergstrom 2006), the board adopted regulation 5 AAC 04.395 *Subdistricts 5 and 6 of the Norton Sound District and Unalakleet River King Salmon Management Plan*. Regulation 5 AAC 04.395(b)(1) directs the commissioner to close the subsistence fishery and reopen it no earlier than June 15 to a subsistence fishing schedule of two 48-hour periods per week in the ocean and two 36-hour periods per week in Unalakleet River. Regulation 5 AAC 04.395(b)(2) directs the commissioner to reduce the bag and possession limit to 2 king salmon drainagewide, of which only 1 can be 20 inches and greater, and the annual possession limit for

fish 20 inches or greater in length is 2 fish. Additionally, 5 AAC 04.395(c) states that if the projected escapement is below the lower end of the escapement goal range, all fishing for king salmon will be closed; and in 5 AAC 04.395(d)(3), the commissioner may open a commercial king salmon fishery of no more than two 24-hour periods per week only if the midpoint of the escapement goal is projected to be reached. In the subsistence fishery, gillnet mesh size could be reduced to 4.5 inches or less by emergency order (5 AAC 01.170(k)) enabling the department to allow for subsistence fishing targeting pink salmon while conserving king salmon.

Regulation Changes Adopted in January 2010

In January 2010, the board further modified 5 AAC 04.395 based on an action plan alternative proposed by the department in the management action plan (Kent and Bergstrom 2009). Regulation 5 AAC 04.395(h) provides the department discretion to allow commercial pink or chum salmon fisheries provided there is a harvestable surplus of pink or chum salmon available and that commercial fishing for these species will not have a significant impact on king salmon escapement needs and subsistence uses of king salmon. However, this regulation also explicitly directs the department to not allow directed pink or chum salmon commercial fisheries to occur prior to July 1 if gillnet mesh size or fishing periods are restricted in the king salmon subsistence fishery. In the subsistence fishery, gillnet mesh size could be reduced to 7 inches or less by emergency order (5 AAC 01.170(j)(1)(B) and 5 AAC 01.170(k)(3)), enabling the department to target smaller king salmon and still protect larger king salmon, particularly female salmon.

Regulation Changes Adopted in January 2013

In January 2013, the board further modified 5 AAC 04.395 based on an action plan alternative submitted by the department (Kent and Bergstrom 2012). The plan now gives the department the flexibility to allow directed pink and chum salmon commercial harvest opportunities prior to July 1 as long as there are no reductions to allowable mesh size or fishing period length in the marine king salmon subsistence fishery. The management plan was further modified to prohibit the commercial sale of king salmon incidentally harvested in chum and pink salmon commercial fisheries unless the midpoint of the North River tower-based king salmon escapement goal is projected to be reached. When commercial sale is prohibited, incidentally caught king salmon may be retained for personal use but not sold.

MANAGEMENT REVIEW

Commercial Fisheries

Historical management actions related to subdistricts 5 and 6 salmon fisheries are summarized in Table 4. Prior to the mid-2000s, the department would wait until increasing test fishery and subsistence catches were observed for at least 7 days in the Unalakleet River before allowing directed commercial king salmon fishing in subdistricts 5 and 6. In most years, king salmon commercial fishing consisted of twice-weekly 24-hour periods to prevent fishing on milling king salmon and co-migrating Yukon River stocks, and to allow for adequate escapement. However, diminishing abundance since 2007 necessitated a much more conservative management regime. The management plan was modified in 2007 so that a commercial king salmon fishery may only occur if the midpoint of the North River tower king salmon escapement goal range is projected to be reached. King salmon directed commercial fisheries have not occurred during the recent 5-year period because managers either projected that escapement goals would not be reached or that severe restrictions to subsistence fisheries would be necessary to achieve goals.

There has been a resurgence of market interest in Norton Sound chum and pink salmon since 2010. There is also increased interest in commencing commercial salmon fishing for these species prior to July 1 in order to target these species earlier in their migration to increase harvests and improve the quality of the harvest. This has been especially the case since 2014 with salmon runs showing early to normal run timing compared to the late runs of salmon observed from 2007–2013. Chum and pink salmon stocks in subdistricts 5 and 6 could sustain considerably higher commercial harvest rates in most years, but the fishery has been managed conservatively for the first 2 weeks of July in order to minimize incidental harvest of king salmon. Generally, this has involved limiting chum salmon fishing periods to 24–36 hours in duration. In some years, only the southern half of the Unalakleet Subdistrict was opened to protect king salmon as they move through the northern half of the subdistrict and enter the Unalakleet River.

Incidental harvests of king salmon in recent chum and pink salmon commercial harvests have been small and are not expected to increase significantly if these fisheries are prosecuted earlier. Harvests of king salmon in the subdistricts 5 and 6 directed commercial chum salmon fishery have been very low since 2007. Average chum salmon commercial harvest in subdistricts 5 and 6 during the recent period (2011–2015) was approximately 55,000 fish, whereas average annual king salmon incidental harvest was approximately 150 fish (Table 5). There was a directed pink salmon fishery in 2012 and 2014, and incidental harvest of king salmon in directed pink salmon openings was even lower than in chum salmon openings. In accordance with the management plan, the commercial sale of king salmon has been prohibited in subdistricts 5 and 6 by emergency order since 2013. When commercial sale is prohibited, incidentally caught king salmon may be retained for personal use and by regulation, all fish caught but not sold must be recorded on fish tickets. Regardless of low incidental harvest rates in chum and pink salmon fisheries, however, the North River king salmon SEG was not achieved in 2012.

Subsistence Fisheries

In 2011 and 2012, per the management plan, subsistence fishing schedules were implemented for the subdistricts 5 and 6 marine and Unalakleet River subsistence fisheries from mid-June to mid-July. In marine waters, the subsistence fishing schedule consisted of two 48-hour periods per week. In Unalakleet River, subsistence fishing is restricted to two 36-hour periods per week. Subsistence fishing in Unalakleet River was also restricted to set gillnets with a stretched mesh size of 6 inches or less in late June through mid-July in 2011; mesh-size restrictions were not implemented in 2012 because of the very late run and an early closure to the king salmon subsistence fishery. Mesh-size restrictions were planned in order to protect milling king salmon, particularly large females, in the lower Unalakleet River during the peak migration period. Allowing more of these larger and more fecund females to reach spawning areas was considered imperative in light of continued diminished productivity of subdistricts 5 and 6 king salmon and concerns with quality of the spawning escapement.

Since 2013, exceptionally weak runs of king salmon have necessitated major reductions in marine subsistence fishing time in conjunction with mesh size restrictions in the marine subsistence fishery in subdistricts 5 and 6. Additionally, subsistence fisheries in the Unalakleet and Shaktoolik rivers have been restricted to set gillnets with mesh sizes of 4.5 or 4 inches or less, and king salmon captured in beach seine gear while targeting other species have been required to be released immediately alive and unharmed. Other outlying areas, such as from Black Point south to Wood Point, east of St. Michael as well as the marine waters from Cape

Denbigh east to Point Dexter north of Shaktoolik, were closed entirely during the month of June in 2014 and 2015. These measures were enacted at the start of the season to prevent southern Norton Sound subsistence users from targeting king salmon migrating through these coastal waters to subdistricts 5 and 6.

As a result of recent management measures, particularly over the past 5–6 years, subsistence users in subdistricts 5 and 6 are shifting some harvest pressure toward abundant chum salmon runs in these areas. Additionally, recent management strategies have resulted in the vast majority of king salmon harvests and fishing effort occurring in the marine waters where fish are less vulnerable to capture in gillnets due to less milling behavior. Hazardous surf conditions in the marine waters during storm events also offer escapement windows for migrating king salmon even when the subsistence fishery is open because it is not safe to fish or the conditions limit the effectiveness of set gillnet gear.

Sport Fisheries

Sport fishery management actions are taken inseason, when necessary, in accordance with guidelines in the king salmon management plan. The sport fishery for king salmon has been closed by emergency order 12 out of the last 13 years due to low projected escapements, and was not reopened in the 4 years in which the lower end of the escapement goal had been met later in the season (2003, 2007, 2009, and 2010). These closures apply not only to the Unalakleet River drainage but also to Shaktoolik River, as well as marine waters in subdistricts 5 and 6. In addition to estimating sport harvest and catch of king salmon through a mail-out Statewide Harvest Survey sent to licensed anglers, beginning in 2005, all sport fishing guides must maintain department guide logbooks, and record all catch and harvest from clients. For 2006-2011, the harvest of king salmon by guided anglers ranged from 29 to 64 fish annually, and no king salmon have been harvested by guided anglers since 2011.

2016 ALASKA BOARD OF FISHERIES REGULATORY PROPOSALS AFFECTING NORTON SOUND SUBDISTRICTS 5 AND 6 KING SALMON

SUBSISTENCE

Proposal 129 – During times of conservation, require the return of a specified salmon species immediately to the water unharmed when beach seining.

Proposal 130 – Allow the restriction of gillnet mesh size during times of conservation for chum and king salmon.

COMMERCIAL

Proposal 133 – Allow the use of beach seines for commercial harvest of chum and pink salmon in Subdistricts 5 and 6 of the Norton Sound District during times of king salmon conservation.

RESEARCH PLAN

RESEARCH AND STOCK ASSESSMENT PROJECTS

Since 2007, department personnel have documented the age, sex, and size composition of king salmon escapement to Unalakleet River by capturing king salmon upstream from subsistence

fishing areas using beach seines and, more recently, the Unalakleet River weir. Similarly, the age, sex, and size composition of the subsistence harvest has been documented during this time. Additionally, 140 genetic tissue samples were collected annually from 2007–2009 marine subsistence harvests of subdistricts 5 and 6 king salmon. If proper genetic markers become available, the department intends to sequence these samples in efforts to more accurately apportion marine harvests from this regional mixed-stock fishery. Genetic baseline collections from king salmon spawning populations in Norton Sound–Port Clarence Area are ongoing and there has been significant progress developing baselines for the Golsovia, Inglutalik, Pilgrim, Shaktoolik, Tubutulik, Unalakleet, and Ungalik rivers.

Stock-specific length-fecundity and age-fecundity relationships for Unalakleet River king salmon were also recently examined from 2008–2010 (Bell and Kent 2012). A total of 110 king salmon were harvested and sampled. A total of 84 salmon were aged. Average fecundity was 9,223 eggs per fish. As expected, fecundity was positively correlated with length and there were distinct length-fecundity relationships for age-1.3 and age-1.4 king salmon. Interestingly, fecundity-at-length was larger for age-1.3 salmon than age-1.4 fish. Relationships between length and fecundity by age are unclear and may vary by region and system. Future work should explore other aspects of the reproductive potential of Unalakleet River king salmon, such as competitive interactions, egg deposition, and survival on the spawning grounds.

NSEDC has operated a Dual Frequency Identification sonar (DIDSON) unit on Shaktoolik River for 9 seasons. The first 5 years were used to pinpoint a favorable site, develop local hires, and develop sonar expertise. The 2012 season was the first season that NSEDC evaluated varying methods to apportion sonar counts by species. Beginning in 2014, the project was modified to an enumeration tower project supplemented by DIDSON sonar counts apportioned from diurnal migration patterns for each species based on tower counts. Sonar counts are used when conditions preclude using the enumeration tower platform. Additionally, under a cooperative agreement, the department provided funding and technical support to NSEDC on this project.

There is also considerable interest in securing funding to develop a marine acoustic tagging program in subdistricts 5 and 6 for king salmon to better understand stock of origin in marine harvests when genetic differentiation between adjacent stocks are not possible, such as for Unalakleet and Shaktoolik river king salmon. A feasibility study using this technology is being used to describe chum salmon marine movement and river of origin in Subdistrict 1 in northern Norton Sound. Successful implementation of this research could provide estimates of the proportion of Shaktoolik, Unalakleet, and possibly Yukon River king salmon contributing to marine harvests in southern Norton Sound.

Additional salmon research and assessment in this area continues to be conducted in cooperation and coordination with multiple local entities, including NSEDC, U.S. Fish and Wildlife Service, Bureau of Land Management, Native Village of Unalakleet, and Unalakleet Native Corporation. The efforts of these organizations contributes to strengthening knowledge of these stocks and improving the management capabilities of the department.

REFERENCES CITED

ADF&G (Alaska Department of Fish and Game). 2004. Escapement goal review of select AYK Region salmon stocks. Alaska Department of Fish and Game, Division of Commercial Fisheries Regional Information Report 3A04-01, Anchorage.

Bell, J., and S. Kent. 2012. Chinook salmon fecundity in the Unalakleet River, 2008–2010. Alaska Department of Fish and Game, Fishery Data Series No. 12-86, Anchorage.

Fair, L., C. Lean, F. DeCicco, J. Magdanz, and R. McLean. 1999. Proposed salmon BEGs for Norton Sound and Kotzebue Sound. Alaska Department of Fish and Game, Division of Commercial Fisheries, Memorandum, Anchorage.

Gaudet, D. M., and G. Schaefer. 1982. Migrations of salmon in Norton Sound determined by tagging in 1978–1979. Alaska Department of Fish and Game, Informational Leaflet No. 198, Juneau.

Guthrie, C. M., III, H. T. Nguyen, and J. R. Guyon. 2014. Genetic stock composition analysis of Chinook salmon bycatch samples from the 2012 Bering Sea and Gulf of Alaska trawl fisheries. U.S. Department of Commerce, NOAA Technical Memo. NMFS-AFSC-270, 33 p.

Jones, W. W. 2003. Norton Sound Shaktoolik and Unalakleet subdistricts Chinook salmon stock status and action plan. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A03-38, Anchorage.

Joy, P., and D. J. Reed. 2014. Estimation of Chinook salmon abundance and spawning distribution in the Unalakleet River, 2010. Alaska Department of Fish and Game, Fishery Data Series No. 14-38, Anchorage.

Kent, S. 2010. Unalakleet River salmon studies, 2002–2008. Alaska Department of Fish and Game, Fishery Data Series, No. 10-83, Anchorage.

Kent, S. M., J. Bell, and L. Neff. 2014. Unalakleet River Chinook salmon escapement monitoring and assessment, 2011–2012. Alaska Department of Fish and Game, Fishery Data Series No. 14-15, Anchorage.

Kent, S. M., and D. J. Bergstrom. 2006. Norton Sound Shaktoolik and Unalakleet Subdistricts Chinook salmon stock status and action plan, 2007; a report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Special Publication No. 06-37, Anchorage.

Kent, S. M., and D. J. Bergstrom. 2009. Norton Sound Subdistrict 5 (Shaktoolik) and Subdistrict 6 (Unalakleet) Chinook salmon stock status and action plan, 2010; a report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Special Publication No. 09-25, Anchorage.

Kent, S. M., and D. J. Bergstrom. 2012. Norton Sound Subdistrict 5 (Shaktoolik) and Subdistrict 6 (Unalakleet) king salmon stock status and action plan, 2013: a report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Special Publication No. 12-28, Anchorage.

Wuttig, K. G. 1999. Escapement of Chinook salmon in the Unalakleet River in 1998. Alaska Department of Fish and Game, Fishery Data Series No. 99-10, Anchorage.

TABLES AND FIGURES

Table 1.–Estimated escapement, total harvest, and total run, Unalakleet River king salmon, 1996–2015.

Year	Escapement: North River	Escapement: Unalakleet Mainstem	Drainagewide Escapement [a]	Combined Harvest [b]	Total Estimated Run Size	Exploitation Rate (Percent) [c]
1996	1,197			7,051	[f]	[f]
1997	4,185		11,204	14,100	25,304	55.7
1998	2,100		5,220	10,992	16,212	67.8
1999	1,639 [e]			9,279	[f]	[f]
2000	1,046			3,356	[f]	[f]
2001	1,337 [e]			3,176	[f]	[f]
2002	1,484			2,915	[f]	[f]
2003	1,452			2,692	[f]	[f]
2004	1,125			3,185	[f]	[f]
2005	1,015			2,510	[f]	[f]
2006	906			2,842	[f]	[f]
2007	1,948			1,826	[f]	[f]
2008	903			2,047	[f]	[f]
2009	2,352		6,918	2,207	9,125	24.2
2010	1,256	1,021	2,277	1,234	3,511	35.1
2011	864 [g]	1,122 [g]	1,986 [g]	1,149	[f]	[f]
2012	996	804	1,800	965 [h]	2,765	34.9
2013	564	767	1,331	599 [h]	1,930	31.0
2014	2,681 [g]	1,126 [g]	3,807 [g]	512 [h]	[f]	
2015	1,938	2,771	4,709	675 [h]	5,384	12.5
Historical Average [i]	2,494		8,212	10,356	20,758	61.8
2011-2015 Average [j]	1,166	1,447	2,613	780	3,360	19.6

Note: Blank cells denote no data available.

[a] Drainagewide escapement estimates prior to 2010 are calculated by expanding tower counts by the proportion of king salmon migrating into the North River, 1997 (34%), 1998 (40%; Wuttig 1999), and 2009 (34%; Joy and Reed 2014).

[b] Harvest includes sport, commercial, and subsistence, assuming 100% of the marine subsistence and commercial king salmon harvest was of Unalakleet River origin.

[c] Because marine harvests in the Unalakleet Subdistrict represent mixed stocks, rates presented here may overestimate actual exploitation rate in years when marine harvest is a larger component of the overall harvest.

[d] The 1994–2001 average subsistence harvest of 3,041 king salmon was used for 1984–1986 subsistence harvest estimates.

[e] Project started late. King salmon escapement underestimated.

[f] Lack of or incomplete escapement data preclude calculation of total run and exploitation rates for those years.

[g] King salmon escapement underestimated in 2011 and 2014 due to poor counting conditions.

[h] No sport harvests reported from 2012–2015 due to preseason restrictions and closures. Combined harvest is subsistence and commercial only.

[i] Historical average is from 1996–1999, excluding those years footnoted to be incomplete estimates.

[j] Recent 5-year average 2011–2015, excluding those years footnoted to be incomplete estimates.

Table 2.–Subdistricts 5 (Shaktoolik) and 6 (Unalakleet) commercial and subsistence king salmon harvest, Norton Sound District, 1994–2015.

	Shaktoolik (5)			Unalakleet (6)			Subdistricts 5 & 6		
Year	Commercial	Subsistence	Total	Commercial	Subsistence	Total	Commercial	Subsistence	Total
1994	885	1,175	2,060	4,400	3,035	7,435	5,285	4,210	9,495
1995	1,239	1,275	2,514	7,617	3,114	10,731	8,856	4,389	13,245
1996	1,340	1,114	2,454	3,644	3,023	6,667	4,984	4,137	9,121
1997	2,449	1,146	3,595	9,067	4,191	13,258	11,516	5,337	16,853
1998	910	982	1,892	6,413	4,066	10,479	7,323	5,048	12,371
1999	581	818	1,399	1,927	2,691	4,618	2,508	3,509	6,017
2000	160	440	600	582	2,429	3,011	742	2,869	3,611
2001	90	936	1,026	116	2,810	2,926	206	3,746	3,952
2002	1	1,230	1,231	4	2,367	2,371	5	3,597	3,602
2003	2	806	808	10	2,585	2,595	12	3,391	3,403
2004	0	943	943	0	2,829	2,829	0	3,772	3,772
2005	50	807	857	101	2,193	2,294	151	3,000	3,151
2006	0	382	382	12	2,537	2,549	12	2,919	2,931
2007	5	515	520	13	1,666	1,679	18	2,181	2,199
2008	6	422	428	65	1,402	1,467	71	1,824	1,895
2009	4	417	421	80	1,892	1,972	84	2,309	2,393
2010	4	327	331	124	1,257	1,381	128	1,584	1,712
2011	45	235	280	124	607	731	169	842	1,011
2012	25	214	239	157	808	965	182	1,022	1,204
2013	6	136	142	131	468	599	137	604	741
2014	16	158	174	70	442	512	86	600	686
2015	34	154	188	175	923	1,098	209	1,077	1,286
Historical Average (1994-1999)	1,234	1,085	2,319	5,511	3,353	8,865	6,745	4,438	11,184
2011-2015 Average	25	179	205	131	650	781	157	829	986

Table 3.–Unalakleet River king salmon sport fish harvest and catch estimates for 1994–2015.

Year	Total King Salmon Catch	Total King Salmon Harvest	Guided King Salmon Catch	Guided King Salmon Harvest
1994	517	379		
1995	588	259		
1996	2,059	384		
1997	5,144	842		
1998	1,539	513		
1999	669	415		
2000	1,045	345		
2001	542	250		
2002	835	544		
2003	505	97		
2004	1,930	356		
2005	431	216		
2006	2,511	394	445	64
2007	776	147	696	43
2008	796	580	373	49
2009	515	248	362	41
2010	99	61	185	36
2011	534	53	589	29
2012	17	0	184	47
2013	184	0	65	0
2014	0	0	9	0
2015	[a]	[a]	[a]	[a]
Historical Average (1994-1999)	1,753	465	NA	NA
2011-2015 Average	184	13	212	19

Note: Catch and harvest from guided anglers is INCLUDED in total catch and harvest table, not in addition to. Sport harvest and catch is estimated using responses from a Statewide Harvest Survey and has an upper and lower range around the estimate, whereas guide harvests and catches are census data.

[a] Sport fish catch data unavailable. Sportfish harvest in 2015 are probably zero due to closures.

Table 4.–Subdistricts 5 (Shaktoolik) and 6 (Unalakleet) historical management actions.

1994	King salmon commercial periods (unrestricted mesh size) limited to two 24-hour periods per week. Pink salmon commercial fishing opened continuously. There was no commercial fishermen interest in chum salmon.
1995	Strong king salmon run. Five king salmon directed commercial fishing periods were opened in both subdistricts. Buyer expressed limited interest in pink and chum salmon with only 3 chum salmon directed (6 inch or smaller mesh size) and 3 pink salmon directed (4 ½ inch or less mesh size) fishing periods.
1996	Early run of king salmon. Six king salmon directed commercial fishing periods in both subdistricts. No chum salmon directed periods. Pink salmon commercial fishing opened continuously.
1997	The last year the majority of the king salmon commercial periods were two 48-hour periods per week. Two 24-hour directed king salmon commercial fishing periods in both subdistricts at the start of season, then 48-hour fishing periods for remainder of king salmon season with no mesh restrictions. Very large king salmon commercial harvest. Limited market for chum salmon with buyer suspending operations in Subdistrict 5 after July 2 until early August.
1998	The majority of directed king salmon commercial periods reduced to 24 hours in length. There were 3 king salmon fishing periods in Sudistrict 5 and 5 king salmon fishing periods in Subdistrict 6. Limited market for chum salmon. Pink salmon commercial fishing opened continuously because of large surplus of pink salmon.
1999	Weak runs of king, chum, and coho salmon. Four 24-hour directed king salmon commercial fishing periods in both subdistricts.
2000	Only two 24-hour directed king salmon commercial fishing periods. Low commercial king and chum salmon harvest. Pink salmon commercial fishing opened continuously to allow buyer to more effectively direct fleet. Pink salmon commercial catches were below average which was attributed to low volumes of fish and lack of fishing interest.
2001	Only two 24-hour directed king salmon commercial fishing periods. Low commercial king and chum salmon harvests.
2002	No commercial king or chum salmon fishing because of weak runs. No market interest in pink salmon unless there was a 500,000 pink salmon harvest projection.
2003	No commercial king or chum salmon fishing because of weak runs. Three-week (July 3-25) subsistence salmon fishing closure to protect king and chum salmon in Shaktoolik and Unalakleet river drainages. Subsistence beach seining for pink salmon was allowed. Unalakleet and Shaktoolik rivers sport fishing closed to the retention of king salmon from July 3 through August 15 and use of bait was prohibited during this period.
2004	No commercial king salmon fishing periods. Unalakleet River drainage closed to salmon gillnet fishing effective July 10. Beach seining was permitted to target large numbers of pink salmon, but closed to the retention of king salmon. Sport fishing was allowed in the Unalakleet River, but all king salmon had to be immediately released, effective July 1 through August 3, and the use of bait was prohibited during this period.
2005	Two 24-hour directed king salmon commercial fishing periods were allowed beginning June 27 and ending June 30. King salmon commercial catches were poor, and test fish catches and tower counts also dropped off abruptly in early July. As a result, commercial fishing was not permitted until coho salmon season.
2006	No commercial king salmon fishing periods. Unalakleet River test fish catches and North River tower counts of king salmon were well below average. As a result, the fresh and marine waters of subdistricts 5 and 6 were closed to salmon gillnet fishing effective July 10. Beach seining was allowed, but king salmon had to be immediately released. Marine and fresh waters of subdistricts 5 and 6 were closed to sport fishing for king salmon from July 8 through August 15, and the use of bait was prohibited during this period.

-continued-

2007	No commercial king salmon fishing periods. On June 16, subdistricts 5 and 6 marine waters placed on subsistence fishing schedule of two 48-hour periods per week and Unalakleet River placed on subsistence fishing schedule of two 36-hour periods per week. Subsistence fishing closed to set gillnets in subdistricts 5 and 6 effective July 4. Sport fishery closed July 5. Beach seining allowed for other salmon species during the regularly scheduled periods. Beach seining for other salmon allowed 7 days a week effective July 16. Also effective July 16, gillnetting reopens 7 days a week in the marine waters and in the Unalakleet River below the confluence of the North River to set gillnets with a mesh size of 6 inches or less. Two 24-hour commercial openings directed at chum salmon on July 18 and July 20.
2008	No commercial king salmon fishing periods. Lower river subsistence mesh-size restrictions (6 inches or less) imposed on the Unalakleet River, effective June 30, due to anticipated difficulty in reaching escapement goals. Restrictions were timed to coincide with peak migration period of king salmon entering the lower Unalakleet River. Subsistence fishery closed to set gillnets and sport fishery closed to retention of king salmon on July 5. Subsistence salmon fishing with set gillnets reopens in the marine waters of subdistricts 5 and 6 on July 7. From July 8–15, daily pink salmon commercial openings occur, each ranging from 6–8 hours. Effective July 16, all marine and fresh waters of subdistricts 5 and 6 reopens to subsistence salmon fishing with set gillnets 7 days a week, but gillnets are restricted to a mesh size of 6 inches or less. Commercial chum salmon fishing occurs from July 17–25, consisting of one 24-hour and two 48-hour periods.
2009	No commercial king salmon fishing periods. Subsistence fishing schedule goes into effect June 15 for subdistricts 5 and 6. Lower river mesh-size restrictions (6 inches or less) implemented for the Unalakleet River effective June 29 in order to protect king salmon during their peak migration period in the lower Unalakleet River. On July 4, king salmon set gillnet subsistence and sport fisheries closed due to below-average tower counts. Beach seining allowed 7 days per week for other salmon. On July 8, one 24-hour commercial pink salmon opening allowed in subdistricts 5 and 6. Subsistence salmon fishing with set gillnets reopens in the marine waters of subdistricts 5 and 6 with mesh size restricted to 6 inches or less on July 10. On July 10–16, commercial chum salmon openings occur consisting of four 24-hour periods in subdistricts 5 and 6 with set gillnets restricted to 6 inches or less. On July 16, subsistence king salmon fishery reopens to 7 days per week in the marine waters and all fresh waters, except for the Unalakleet River drainage above the confluence of the North River. Schedule of 48-hour commercial chum salmon openings occur from July 17–31.
2010	No commercial king salmon fishing periods. Subsistence fishing schedule goes into effect June 15 for subdistricts 5 and 6. Lower river mesh-size restrictions (6 inches or less) implemented for the Unalakleet River, effective July 5, in order to protect king salmon during their peak migration period in the lower Unalakleet River. July 9, beach seining allowed until July 31 in all fresh and marine waters of subdistricts 5 and 6 to target salmon other than king salmon for subsistence purposes. On July 10, king salmon set gillnet subsistence and sport fisheries closed due to below-average tower counts. Subsistence fishing with set gillnets with a mesh size of 6 inches or less allowed 7 days per week in marine waters to target other salmon. Commercial salmon fishing opens July 2 for one 24-hour period directed at chum salmon (mesh size 6 inches or less) in Subdistrict 5 and southern half of Subdistrict 6. Subdistricts 5 and 6 reopened to commercial chum salmon fishing for 48 and 36 hours, respectively. However, northern half of Subdistrict 6 closed to commercial fishing. Entire Subdistrict 6 and Subdistrict 5 reopen to commercial chum salmon fishing for 36 hours on July 10. On July 12, commercial chum salmon fishing schedule set for subdistricts 5 and 6 for the remainder of the July.

-continued-

2011	No commercial king salmon fishing periods. Subsistence fishing schedule goes into effect June 16 for subdistricts 5 and 6. Lower river mesh-size restrictions (6 inches or less) implemented for the Unalakleet River effective July 1 in order to protect king salmon in the lower Unalakleet River. On July 9, beach seining allowed until August 15 in all fresh and marine waters of subdistricts 5 and 6 to target salmon other than king salmon for subsistence purposes. King salmon set gillnet subsistence and sport fisheries closed due to below-average tower counts. Subsistence fisheries in fresh and marine waters reopened to subsistence fishing 7 days per week with 4.5-inch and 6-inch mesh, respectively. From July 3–5, subdistricts 5 and 6 opened to commercial fishing for chum salmon for two 24-hour periods. Northern half of Subdistrict 6 remains closed. From July 8–12, subdistricts 5 and 6 reopened to commercial fishing for chum salmon for two 36-hour periods. On July 9, northern half of Subdistrict 6 reopened to commercial fishing. On July 12, subdistricts 5 and 6 placed on a commercial chum salmon schedule for the remainder of July. Periods range from 48 to 72 hours in duration.
2012	No commercial king salmon fishing periods. Subsistence fishing schedule goes into effect June 24 for subdistricts 5 and 6 due to a very late run. On June 27, beach seining allowed 7 days per week until August 15 in all fresh and marine waters of subdistricts 5 and 6 to target salmon other than king salmon for subsistence purposes. Beach seining was opened earlier to take advantage of good drying weather.
2013	No commercial king salmon fishing periods. Commercial sale of king salmon caught in Subdistricts 5 and 6 commercial fishery prohibited by regulation because of weak runs. Sport fishery for king salmon restricted to catch and release at the onset of the season in all freshwaters of Subdistricts 5 and 6. Beginning June 16, Subdistrict 6 marine subsistence fishery placed on reduced schedule of two 24-hour periods per week with no mesh size restrictions. Subdistrict 5 marine subsistence fishery placed on normal fishing schedule of two 48-hour periods per week with mesh size restricted to 6 inches or less. Unalakleet River placed on schedule of two 36-hour periods per week with gillnets restricted to a mesh size of 4½ inches or less. Shaktoolik River open 24 hours a day, 7 days per week but restricted to gillnets with a mesh size of 4½ inches or smaller. On July 1, all freshwaters of Subdistricts 5 and 6 open to subsistence beach seining 7 days per week for all salmon but king salmon must be released.
2014	No commercial king salmon fishing periods. Commercial sale of king salmon caught in subdistricts 5 and 6 commercial fishery prohibited by regulation because of weak runs. Sport fishery for king salmon closed at the start of the season in subdistricts 5 and 6. Beginning June 9, subsistence fishing closed in all subdistricts 5 and 6 freshwater areas and all marine waters from Point Dexter to Wood Point until June 30. From June 16–30, only one 24-hour marine subsistence fishing period per week scheduled for the subdistricts 5 and 6 marine waters from Cape Denbigh to Black Point; gillnets during these periods restricted to a mesh size of 6 inches or smaller. Multiple marine subsistence openings restricted to either 4½ inch or 6 inch stretched measure beginning July 1 concurrent with directed chum and pink salmon commercial fisheries. Beginning June 25, two 24–30 hour freshwater subsistence beach seine openings per week for all salmon but king salmon in subdistricts 5 and 6.
2015	No commercial king salmon fishing periods. Commercial sale of king salmon caught in subdistricts 5 and 6 commercial fishery prohibited by regulation because of weak runs. Sport fishery for king salmon closed at start of the season in subdistricts 5 and 6. Beginning June 8, subsistence fishing closed in all subdistricts 5 and 6 freshwater areas and all marine waters from Point Dexter to Wood Point until June 30. Week of June 15, one 24-hour marine subsistence fishing period scheduled in subdistricts 5 and 6 with gillnets restricted to 6 inch mesh or smaller. For the week beginning Monday, June 22: two 24-hour subsistence fishing periods scheduled with 6 inch mesh or smaller and for the week beginning June 29, two 48-hour subsistence fishing periods with 6 inch mesh or smaller scheduled. From June 8–28, subdistricts 5 and 6 freshwaters open only to set gillnets with a mesh size of 4 inches or less, 7 days per week. For the week beginning June 29, two 36-hour fishing periods allowing beach seines and set gillnets with a mesh size of 4½ inches or less. King salmon captured in beach seines required to be immediately released alive and unharmed. For the week beginning Monday, July 6, two 36-hour fishing periods allowing beach seines and with set gillnets with a mesh size of 6 inches or less.

Table 5.–Combined Subdistricts 5 and 6 incidental king and chum salmon commercial harvests during directed chum salmon openings, 2007–2015.

			Subdistricts 5 and 6 Combined			
			Incidental King Salmon Harvest Data [a]			
Year	Date of First Commercial Opening	Number of Periods	Caught and Sold	Caught but not Sold	Total King Salmon Harvest	Chum Salmon Harvest
2007	18-Jul	5	12	2	14	11,820
2008	17-Jul	4	43	17	60	12,432
2009 [b]	10-Jul	8	0	61	61	22,598
2010	2-Jul	9	92	106	198	59,884
2011	2-Jul	9	114	33	147	51,301
2012 [b]	5-Jul	7	0	182	182	39,115
2013 [c]	1-Jul	9	0	130	130	68,720
2014 [c]	1-Jul	8	0	69	69	53,402
2015 [c]	1-Jul	9	0	205	205	62,400
Totals		68	261	805	1,066	381,672
2011-2015 Average		-	-	124	147	54,988

[a] Does not include king salmon caught during the coho salmon and pink salmon directed fisheries.

[b] Incidentally caught king salmon were not purchased by the buyer.

[c] Commercial sale of king salmon prohibited by regulation due to king salmon conservation concerns.

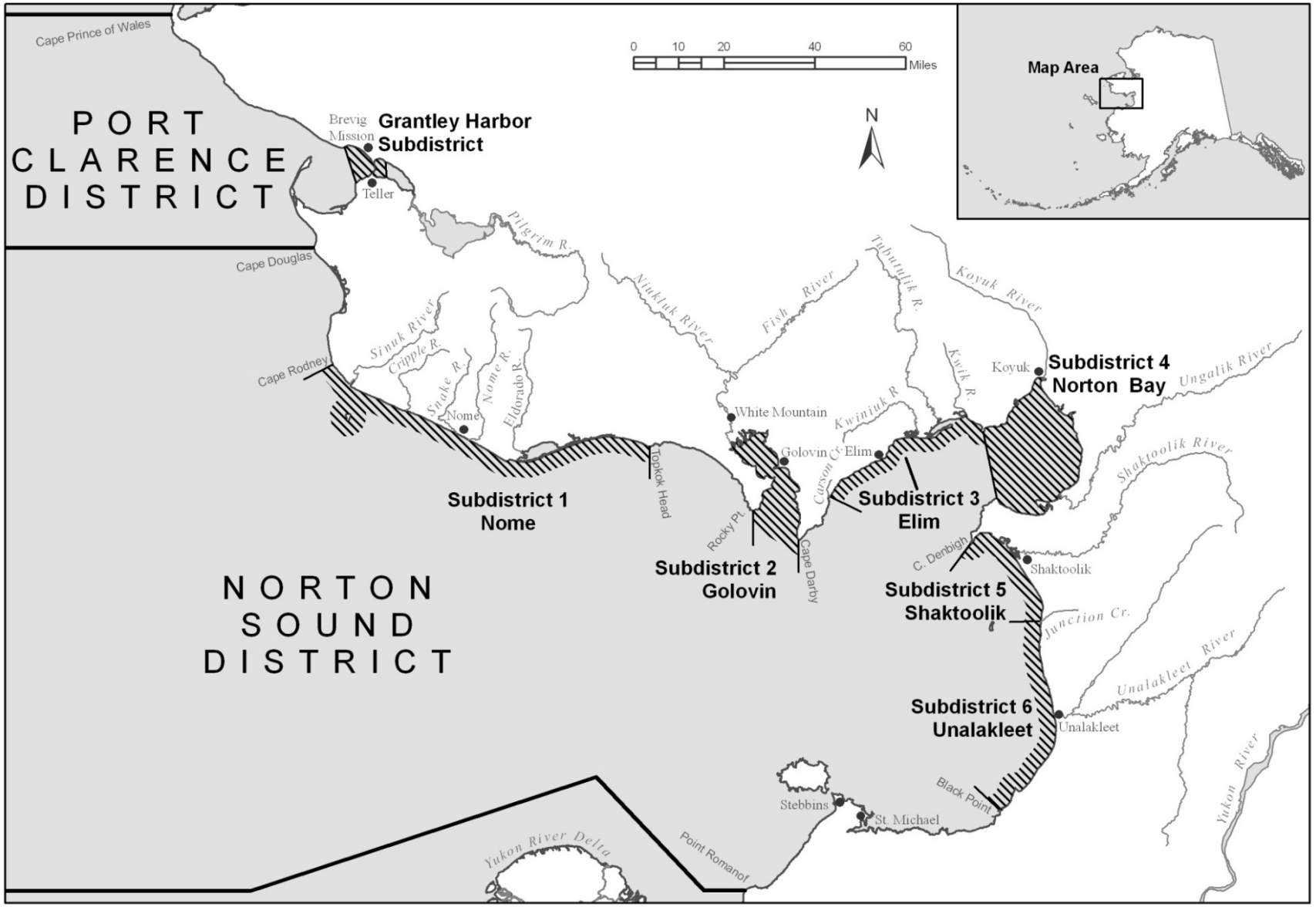

Figure 1.–Salmon commercial fishing subdistricts and rivers in Norton Sound.

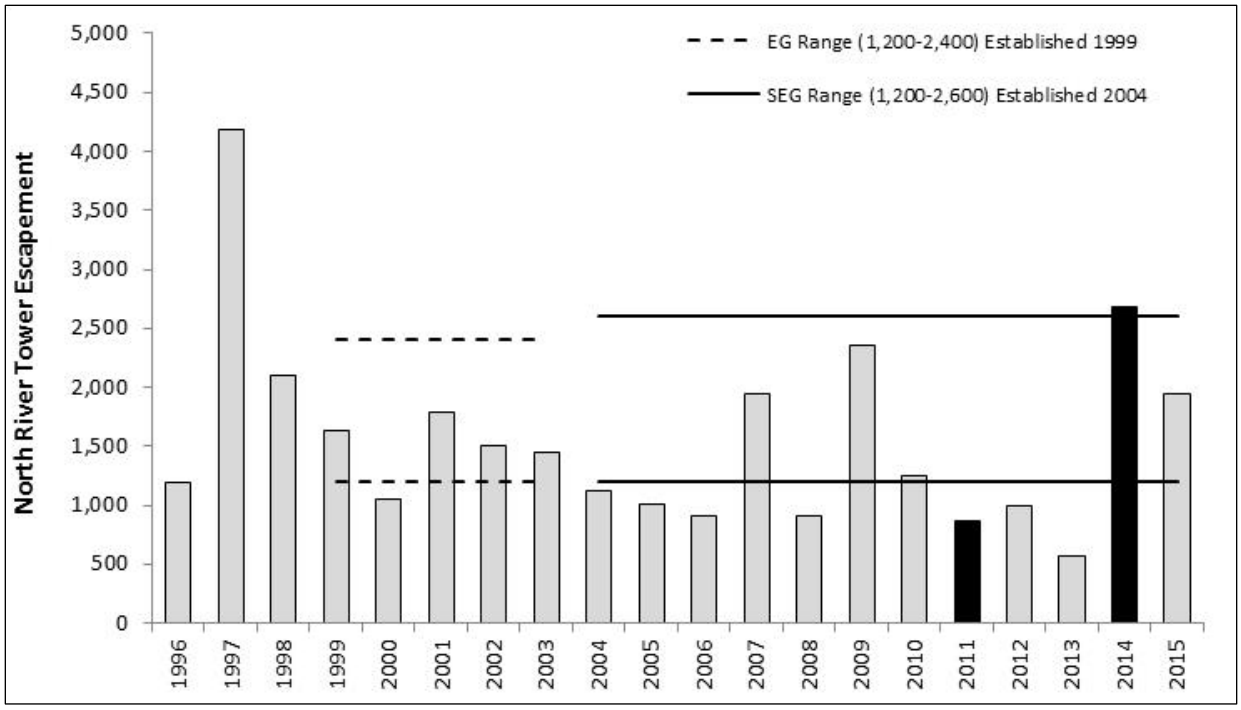

Figure 2.–Annual king salmon escapement compared with established escapement goal ranges, 1996-2015, North River counting tower, Unalakleet River drainage, Norton Sound District.

Note: The 2011 and 2014 North River tower count is considered an incomplete estimate of escapement because of poor counting conditions.

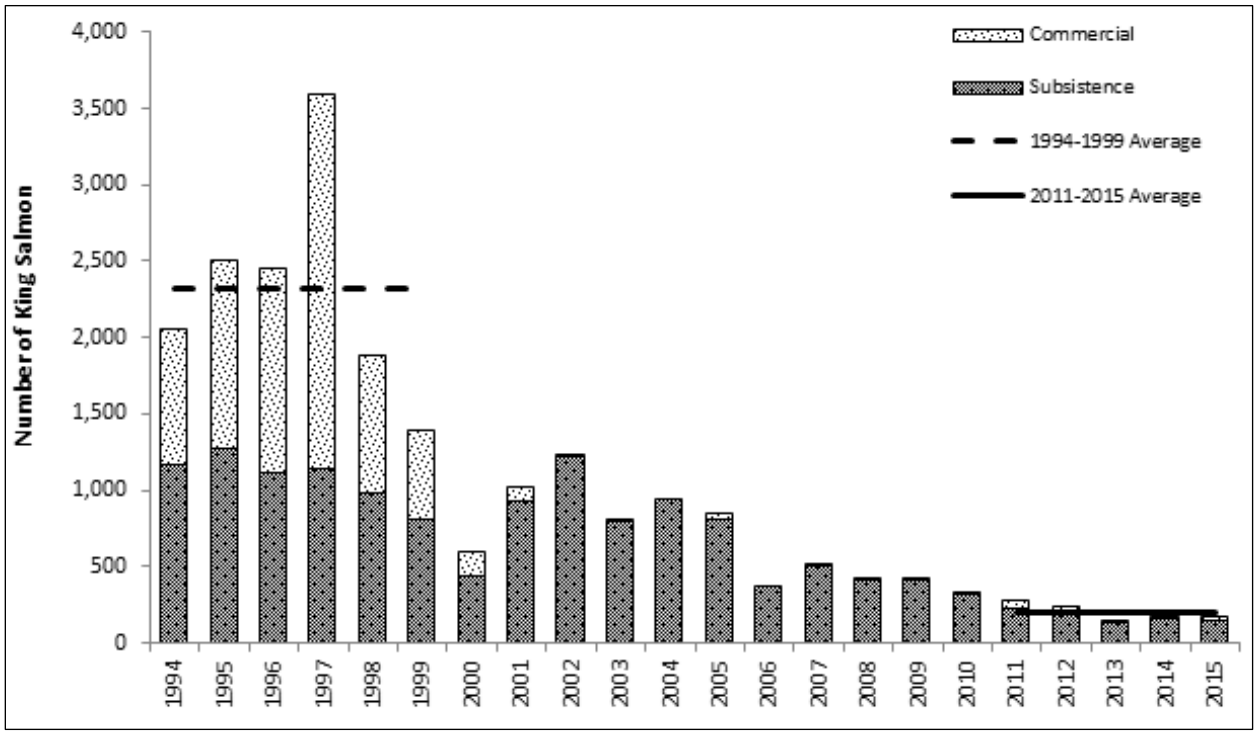

Figure 3.–Subdistrict 5 combined (subsistence + commercial) king salmon harvests, compared to the recent 5-year (2011–2015) and historical (1994–1999) averages.

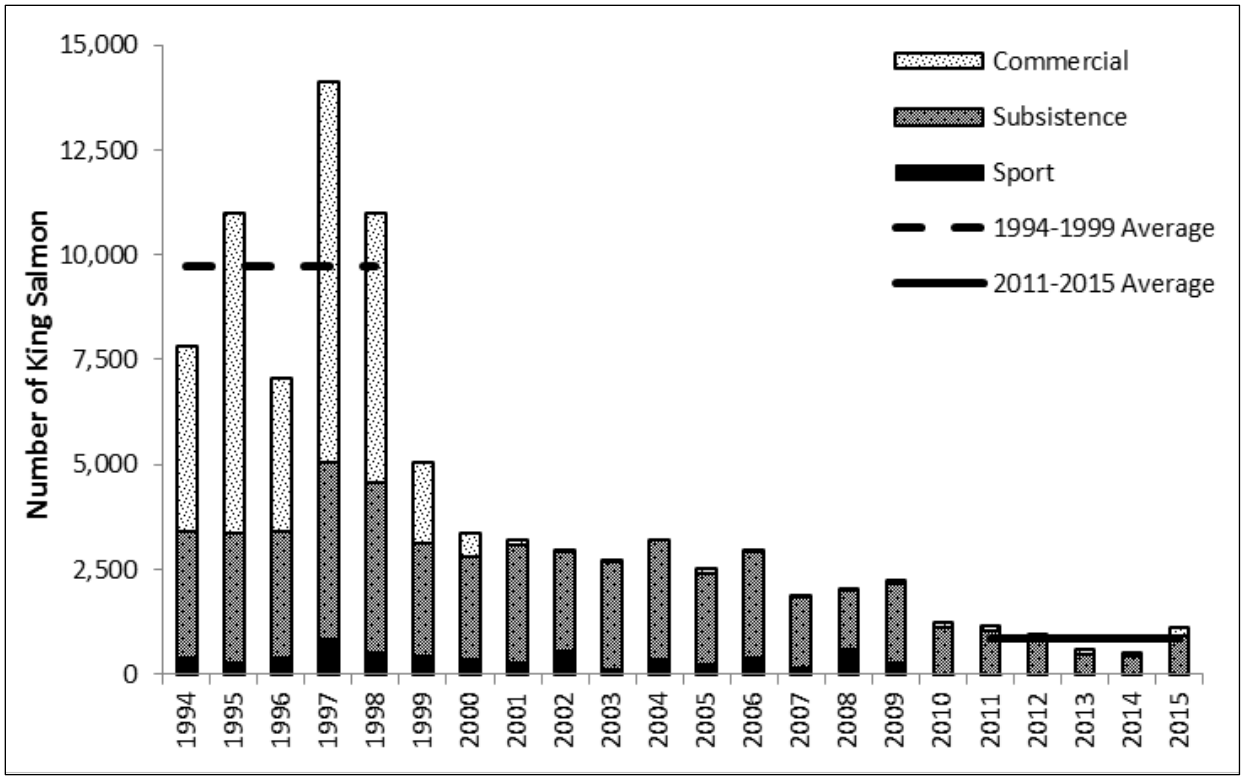

Figure 4.–Subdistrict 6 combined (subsistence + commercial) king salmon harvests compared to the recent 5-year (2011–2015) and historical (1994–1999) averages.

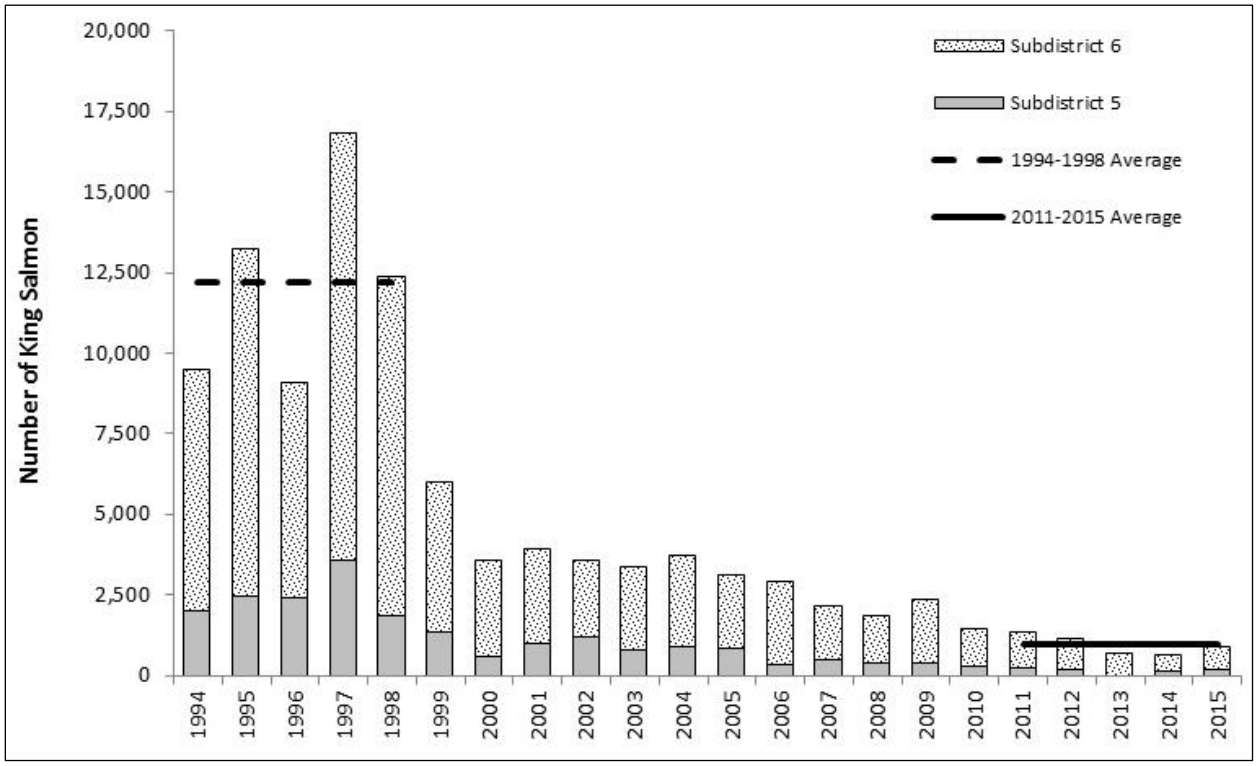

Figure 5.–Subdistricts 5 and 6 combined king salmon harvests, compared to the recent 5-year (2011-2015) and historical (1994–1999) averages.