Fishery Management Report No. 09-06

Salmon Spawning Ground Surveys in the Bristol Bay Area, Alaska, 2007

by

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and

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February 2009

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)

Measures (fisheries)

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

Mathematics, statistics

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

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ABSTRACT

The salmon spawning ground report is compiled annually to report the results of spawning ground surveys conducted by the Division of Commercial Fisheries staff in Bristol Bay. The report describes the conditions under which salmon were observed and other factors affecting escapement data. Although data have been collected for more than 20 years in most cases, appendix tables contain only information from the last 20 years to give the data context.

Key Words: Bristol Bay Management, commercial fisheries, escapement, spawning, sockeye *Oncorhynchus nerka*, Chinook *O. tshawytscha*, chum *O. keta*, coho *O. kisutch*, and pink salmon *O. gorbuscha*, Naknek, Kvichak, Egegik, Ugashik, Wood, Nushagak, Igushik, Togiak.

INTRODUCTION

Aerial surveys of salmon spawning streams have been conducted in the Bristol Bay area of Alaska (Figure 1) for many years. Surveys provide biologists with subjective information regarding the abundance and distribution of sockeye *Oncorhynchus nerka*, Chinook *O. tshawytscha*, chum *O. keta*, pink *O. gorbuscha*, and coho salmon *O. kisutch* escapements. This information is important to fishery managers for several reasons. It supplements data gathered at counting towers on the mainstem rivers, provides data from rivers where counting towers are not utilized, and provides data for time periods and species not covered by counting tower operations. Collected information can contribute to the: (1) evaluation of escapement goals and of escapement/return relationships, (2) forecast of future returns, (3) identification of possible management problems relating to escapements, (4) development of strategies designed to alleviate escapement problems and (5) evaluation of changes in spawning distribution. Readers must use caution when interpreting these data. Aerial surveys can be good indicators of general trends in fish distribution and abundance but are not good for developing concrete estimates. Generally, aerial survey information is used to supplement more concrete data for developing these finite estimates. In this report, we summarize the 2007 salmon spawning ground surveys conducted in the Bristol Bay area.

BACKGROUND INFORMATION BY DISTRICT

Naknek/Kvichak District

The Naknek-Kvichak District is comprised of 3 major rivers: (1) the Kvichak River, issuing from Iliamna Lake and its tributaries, (2) the Alagnak or Branch River flowing from Kukaklek and Nonvianuk Lakes, and (3) the Naknek River emanating from Naknek Lake and its tributaries (Figure 2). All of these systems flow into Kvichak Bay.

Since 1955, Kvichak River sockeye salmon annual escapement has been estimated using counting towers located on the Kvichak's mainstem, approximately one-quarter mile downstream of Lake Iliamna's outlet (West and Fair 2006). The historical perspective of Kvichak River spawning ground survey information is provided in Morstad (2002). From 1957 to 1976, Alagnak River sockeye salmon annual escapement was estimated using a counting tower located near the upper extent of tidal influence. Since 1977, Alagnak sockeye salmon annual escapement has been estimated using aerial surveys. In 2002, a counting tower was established upriver from the old site. In 2007 it will begin providing the measure of spawners used to assess the escapement goal. Clark (2005) established a relationship between historical tower counts and aerial surveys to standardize the time series of escapement in terms of tower

counts. From 1950 to 1957, annual sockeye salmon escapement to the Naknek River system was counted using a weir on the mainstem of the river upstream of the area under tidal influence. From 1958 to the present, escapement has been estimated using counting towers near the Naknek River 'Rapids' downstream of the outlet of Naknek Lake (West and Fair 2006).

Egegik District

The Egegik District system contains 2 major watersheds: (1) the Egegik River, flowing from Becharof Lake and nearby coastal lowlands, and (2) the King Salmon River, issuing from runoff from the Kejulik Mountains and southern portions of Katmai National Park (Figure 3). Both rivers flow into Egegik Bay near the village of Egegik.

From 1952 through 1956, a weir was used in the Egegik River to count sockeye salmon escapement. The weir was located near the lower end of the Egegik River rapids. From 1957 to the present, counting towers, situated between the outlet of Becharof Lake and Egegik Lagoon, have been used to estimate sockeye salmon escapement. Aerial surveys are used to estimate escapements for salmon species other than sockeye (West and Fair 2006).

Ugashik District

The Ugashik River system is comprised of 4 major watersheds: (1) the Ugashik River, flowing from Lower Ugashik Lake and nearby coastal lowlands, (2) the Dog Salmon River, emanating from glacial melt and runoff from peaks in the Aleutian Range, (3) the King Salmon River, issuing from Mother Goose Lake and 3 major runoff tributaries, and (4) Dago Creek, issuing from a large lowland coastal area (Figure 4). All of these systems flow into the intertidal reaches of Ugashik River and Ugashik Bay.

From 1949 to 1956, a weir located downstream from the outlet of Lower Ugashik Lake was used to count sockeye salmon escapement. From 1957 to the present, sockeye salmon escapement has been estimated using counting towers located between the outlet of Lower Ugashik Lake and Ugashik Lagoon (West and Fair 2006). Escapements for other salmon species have been estimated using aerial surveys.

Nushagak District

The Nushagak District is comprised of 4 major rivers: (1) the Wood River, draining Grant, Kulik, Beverley, Nerka, and Aleknagik lakes, (2) the Nushagak River, draining Tikchik Lakes and the Nuyakuk, upper Nushagak, and Mulchatna rivers, (3) the Igushik River, draining Ualik and Amanka lakes, and (4) the Snake River, draining Lake Nunavaugaluk (Figures 5–8). All of these systems empty into Nushagak Bay.

Abundance and age composition of annual sockeye salmon escapement into the Wood River Lake system has been estimated annually from counting towers at the outlet of Lake Aleknagik since 1953 (West and Fair 2006).

Periodically, Alaska Department of Fish and Game (ADF&G) personnel conduct aerial surveys to assess sockeye salmon spawner distribution within the Wood River Lake system (Table 1). Personnel from the University of Washington, Fisheries Research Institute, also conduct annual ground surveys on major creeks and some rivers of the system to better understand spawning distribution within the drainage.

Salmon escapement in the Nushagak River is estimated by a sonar project, located on the mainstem below the village of Portage Creek, approximately 32 km (20 miles) upstream from the river mouth. The Nushagak River sonar project has been used since 1980 to estimate annual escapements for all salmon species in the entire Nushagak drainage (Brazil 2007). In 2006, budget cuts reduced the operation of the sonar camp by a month, eliminating the coho and pink salmon enumeration portion of the sonar project. Prior to the advent of the sonar project, annual Nushagak River sockeye salmon escapement was estimated by a counting tower project on the Nuyakuk River (1959–1988) and aerial surveys of the Nushagak-Mulchatna system (beginning in 1966). Initial aerial surveys provided escapement estimates for Chinook and chum salmon, while surveys, since 1977, were used to estimate sockeye salmon abundance.

ADF&G staff continued to survey the upper Nushagak and Mulchatna areas after the development of the sonar project to provide a comparison with sonar estimates and document spawner distribution for all species except coho salmon. Chum salmon surveys were discontinued in the Nushagak District in 1980, and surveys of the Nushagak-Mulchatna Rivers for all other species were discontinued in 1991 due to the success of the sonar project and limited funding. The Nuyakuk tower project was halted after the 1988 season due to budget cuts, but was reinitiated for the period 1995 to 2006. Operations ceased again in 2007. Aerial surveys of the Nushagak and Mulchatna systems have been conducted sporadically since 1991 providing infrequent information on spawning sockeye salmon distribution in the Nushagak River.

Aerial surveys were conducted sporadically in the Nuyakuk-Tikchik Lakes system from 1954 to 1987 to assess spawner distribution of sockeye salmon. Surveys of the Nuyakuk-Tikchik Lakes have been conducted, although infrequently, since 1990 to document an apparent change in Nushagak River spawner distribution, evidenced by changes observed in the age composition of Nushagak River sockeye salmon escapement at the sonar site, and supported by reduced numbers of spawners passing the Nuyakuk River counting tower. These changes were first noticed in 1990 when surveys documented lower than expected numbers of spawners in the Nuyakuk-Tikchik Lakes system, based on sonar estimates in the lower Nushagak River and historical distribution patterns (Russell et al. 1991). However, few corresponding surveys were conducted in the Nushagak and Mulchatna drainages to completely assess distribution. In fact, due to funding cuts, no aerial surveys of the Upper Nushagak and Mulchatna drainages have been performed since 1991. Average Nuyakuk River escapement for the 20 years before tower operations ceased was about 375,000 sockeye salmon (excluding 1980, the “strike year”). When tower counts resumed in 1995, escapement was low and remained low through 2006 with an average per year around 152,000 sockeye salmon despite overall strong escapements in the Nushagak River.

Sockeye salmon escapement is measured in the Igushik Lakes system at a counting tower located at the outlet of Amanka Lake (West and Fair 2006). Spawner distribution surveys have not been conducted on the Igushik system for sockeye salmon and other species since 1991 (Russell et al. 1992). Spawning escapement and distribution of sockeye salmon in the Snake Lake system was estimated annually prior to 1998 by aerial surveys, but with the closure of the Snake River section and funding shortages in recent years, these surveys were discontinued.

Togiak District

Two major river drainages flow into the Togiak District: (1) the Togiak River, draining Togiak, Gechiak, Pungokepuk, and Ongivinuk lakes and Nayorurun and Kemuk rivers (Figure 9), and (2)

the Kulukak River, draining Kulukak Lake (Figure 10). Various smaller systems within the district include the Kanik River draining Tithe Creek Ponds and the Quigmy, Matogak, Osviak, Slug, Negukthlik, and Ungalikthluk rivers. Kulukak River and the Kanik River flow into Kulukak Bay, located in the eastern portion of the district. The Togiak and Quigmy rivers flow into Togiak Bay, located in the middle of the district, and the Matogak, Osviak, and Slug rivers flow into Hagemeister Straits and coastal waters in the western portion of the district (Figure 1).

Sockeye salmon escapement is estimated for the Togiak Lake system from counting towers operated at the outlet of Togiak Lake. Abundance and distribution of spawning populations of sockeye salmon in the Togiak River and tributaries below the counting towers, as well as other systems within the Togiak District, are estimated by aerial surveys. Abundance and distribution of Chinook, chum, pink, and coho salmon spawning in Togiak District watersheds are also estimated entirely from aerial surveys.

Since 1991, the operational budget has had insufficient funds to conduct spawning ground aerial surveys in the Togiak District. The U.S. Fish and Wildlife Service Togiak National Wildlife Refuge (USFWS/TNWR) has provided funding for aircraft charters for aerial surveys, and has assisted with aerial surveys in the Togiak District to monitor salmon populations within drainages on the refuge.

METHODS

Survey flights are conducted from either small fixed-wing, high-wing, wheeled aircraft (Super Cub, Cessna 180, Cessna 185, or Cessna 206) or by helicopter (Robinson R-22) chartered from local air charter companies and flown by experienced survey pilots. ADF&G or USFWS biologists familiar with the streams and target species did the counting. USFWS pilots typically fly several of the surveys in the Togiak National Wildlife Refuge.

Counts were made from low altitudes (200 to 400 feet) at air speeds of 50 to 90 mph. Polarized sunglasses were used to minimize surface glare off the water. Surveys were scheduled near the historical peak of spawning for the target species, taking into account weather, water conditions, and aircraft availability. Peak of spawning is the date when the greatest number of spawning salmon are occupying redds. During the survey, counts were registered on a hand tally counter or on a tape player and later transferred to data forms.

Aerial surveys account for only a portion of the known spawning populations (Evzerof 1975; Nielson and Green 1981; Rogers 1984; ADF&G 2005). At the time of each survey, some of the salmon have not reached the spawning grounds, some have already spawned and died, some are still in large schools, and some are either misidentified or not seen. **For all aerial surveys, salmon counts are indices of the total number of each species present in the spawning area at the time of the survey. The aerial survey estimates are actual numbers of salmon observed and should be considered a minimum count.**

Naknek/Kvichak District

Aerial surveys were flown during late summer and fall to assess escapements of sockeye and Chinook salmon in portions of the Naknek/Kvichak District. In the Alagnak drainage, only 2 surveys were flown in 2007. On August 8, the lower Alagnak was flown for Chinook and chum salmon and on August 13 for sockeye salmon in the upper drainages. For the Naknek drainage, all major Chinook salmon spawning areas were surveyed under fair to poor conditions. In 2007, no surveys were flown in the Kvichak River drainage. Similar to previous years, counting

towers were used to estimate total sockeye salmon escapement to the Kvichak, Alagnak, and Naknek rivers. ADF&G Division of Commercial Fisheries staff made all aerial survey counts in the district.

Egegik District

No system-wide aerial surveys were flown for sockeye salmon in 2007. An aerial survey of known Chinook and chum salmon spawning areas in both the Egegik and King Salmon rivers was flown on August 9. An aerial survey was flown on selected index streams within the Egegik system on September 27 to estimate coho salmon escapement. As in previous years, a counting tower was used to estimate total sockeye salmon escapement to the Egegik River. ADF&G Division of Commercial Fisheries staff made all aerial survey counts in the district.

Ugashik District

Aerial surveys of known Chinook and chum salmon spawning areas in the Ugashik drainage were flown on August 12. With funding provided by the USFWS, Becherof National Wildlife Refuge, an aerial survey was flown on September 12 to estimate coho salmon escapement. As in previous years, a counting tower was used to estimate total sockeye salmon escapement to the Ugashik River. ADF&G, Division of Commercial Fisheries staff made all aerial survey counts in the district.

Nushagak District

In conjunction with the University of Washington Fisheries Research Institute (FRI), ADF&G staff flew aerial surveys of the Wood River Lake system in 2007. Surveys were flown August 15 and 17 in a fixed-wing aircraft with 2 observers on the same side of the aircraft. Observers recorded individual estimates of sockeye salmon on the lakeshore either spawning or holding near stream mouths. We also surveyed the streams between lakes. The individual observations were reconciled later and 1 estimate was generated. In addition, FRI estimated spawning abundance for most of the small streams in the Wood River lake system with foot surveys.

Togiak District

Survey and data analysis methods used in the Togiak District were similar to those described by Nelson (1979), Bucher (1981), and Russell et al. (1990). This year, surveys were flown on August 8 and September 12 (Tables 2–5) in a cooperative effort between USFWS/TNWR staff and ADFG staff. Poor weather and pilot availability posed severe limitations to survey completion in 2007.

Total escapement was estimated for sockeye salmon in systems without counting towers (i.e. Kulukak River, mainstem and tributaries of the Togiak River below the towers) by multiplying peak aerial counts by an expansion factor between 1.5 and 3.0 depending on survey and water conditions (Tables 2–5 list expansion factors by stream for each species). Expansion factors are used only in the Togiak system because escapement goals have been set that can only be assessed with aerial surveys. Because budget constrains generally result in 1 survey a year, expansion factors are used to account for less than ideal survey conditions or timing in relation to the peak spawning. Since 1980, total escapement for Chinook salmon in the Togiak District has been calculated by aerial counts using a multiplier of 2.5 if the survey was timed properly relative to the historical spawning peak and visibility conditions were average. In 2007, an expansion factor of 2.0 was used for Chinook salmon surveys in all systems except the

Neguthluk (expansion factor of 3.0). An expansion factor of 3.0 has been used for coho salmon in all areas of the Togiak District since the initiation of coho surveys in 1980. Expansion factors have been subjectively set based on weather conditions, visibility, and survey timing with respect to the peak spawning activity.

RESULTS AND DISCUSSION

Naknek/Kvichak District

Aerial surveys of sockeye salmon escapement into the Alagnak River and its tributaries were flown only once due to the rainy fall conditions in 2007. The peak count for each of the systems are represented in Table 6 and come from the single survey on August 13 (Table 6). The tower on the lower Alagnak operated from June 26 until July 21 and estimated 2,466,414 sockeye salmon. On the Naknek River, the tower operated from June 19 until July 18 counted 2,945,304 sockeye salmon. The Kvichak River tower near Igiugig village began counting on June 21 and ceased July 21, counting 2,810,208 sockeye salmon.

Aerial surveys of Chinook salmon escapements into the Naknek and Alagnak River drainages were flown in 2007 (Table 7; Appendix A2). For the Naknek River drainage, Chinook salmon surveys were flown on 3 different days between August 3 and August 22 for a total estimate of approximately 5,500 (Table 7). For the Alagnak River drainage, Chinook salmon escapement was surveyed on August 8, four days before the typical peak, for a total of 3,455 (Table 7).

Egegik District

The 2007 Egegik River sockeye salmon escapement past the counting towers totaled 1,432,500 fish. Aerial surveys are unnecessary in the Egegik River for sockeye salmon since the tower estimates account for all spawning fish.

Aerial survey counts of known Chinook salmon spawning areas in the Egegik drainage was 555 (Table 8). No additional Chinook salmon were counted at the Egegik River counting towers. This total was 46% below the average count of 1,038 (Appendix A5). The commercial Chinook salmon harvest in the Egegik District totaled 555 fish, 54% below the 1987 to 2006 average harvest of 1,195. Since 1998, the department has reduced commercial fishing time to 3 days per week between June 1 and June 16. Using gillnets larger than five and one half-inch mesh in the commercial fishery from June 1 to July 1 has also been prohibited. All of these factors probably contributed to the reduced commercial harvest of Chinook salmon, but in general, recent Chinook salmon runs to Egegik have been small.

The chum salmon escapement aerial survey index was 3,783 fish (Table 9), 20% below the 20 year average of 4,755 (Appendix A6). The 2007 commercial chum salmon harvest from the Egegik District totaled approximately 161,000 fish, nearly double the 1987 to 2006 average catch of 86,000. Escapement indices less than 2,000 chum salmon have been recorded in 8 of the last 10 years, but aerial surveys for chum salmon are unreliable; we believe that chum escapement indices greatly underestimate chum salmon escapements. In a 1999 comparison study at Gertrude Creek, the aerial count was roughly 2% of the weir count.

In 2007, the coho salmon escapement was estimated with a September 11 aerial survey (Table 10 and Appendix A7). This date is slightly earlier than typical coho salmon surveys, but in 2007 the run appeared early and weak. A total of 2,000 coho salmon were counted in Becharof Lake, but were not associated with a particular tributary. The aerial counts were only focused on major

coho salmon producing areas (Table 10). The commercial harvest of coho salmon was about 18,000 fish, 42% below the 20 year (1987–2006) average of 31,000 (Sands et al. 2008).

Ugashik District

The 2007 Ugashik River sockeye salmon run was the largest ever recorded in the District. The escapement past the tower was 2,473,746 fish, nearly 3 times the midrange goal of 850,000 and the second largest on record. System-wide aerial surveys were conducted in early August and approximately 70,000 sockeye salmon additional to tower counts were observed in the Dog Salmon River (Table 11). Environmental conditions impacted all surveys conducted in the King Salmon River system in 2007.

Chinook salmon escapement surveys of Dog Salmon, King Salmon, and Ugashik rivers were flown on August 12 and approximately 6,000 Chinook salmon were observed (Table 12). The 20 year average is approximately 4,400 Chinook salmon (Appendix A9). The Ugashik District's commercial catch of approximately 1,445 Chinook salmon was 15% below the 20 year average harvest of 1,705 (Sands et al. 2008).

Aerial surveys of Dog Salmon, King Salmon, and Ugashik rivers for chum salmon were also flown on August 12 (Table 13; Appendix A10). The District's commercial chum salmon harvest of approximately 215,000 fish is 4 times higher than the 20 year average of 62,000 (Sands et al. 2008).

Once again, we made an aerial survey for coho salmon in the Ugashik drainage thanks to funding provided by US Fish and Wildlife Service, Becherof National Wildlife Refuge. A total of 1,000 coho salmon were observed on the September 11 flight (Table 14), however, many of the tributaries were turbid due to high water. Most of the count came from the Lower Ugashik Lake. Historical coho salmon escapement data are recorded in Appendix A11.

Environmental Conditions

An unusual event occurred in the Mother Goose Lake drainage during the spring or early summer of 2005. An event known as a lahar took place on Mt. Chiginigak, a semi-active volcano from which the headwaters of Volcano and Indecision creeks flow. These creeks provide water to Mother Goose Lake which in turn is the source for the King Salmon River, a tributary that empties into Ugashik Bay.

A lahar is basically a runoff event, and while the mechanics or timing in this case is not clear, the effects were fairly dramatic. Sometime in the spring or early summer of 2005, an event took place on or within Mt. Chiginigak that caused the snow on and within the summit crater to melt and runoff into the Mother Goose drainage and an unnamed tributary on the Pacific side of the Alaska Range. This runoff was extremely acidic in nature and large enough in volume to lower the pH of Mother Goose Lake and the King Salmon River to between 3.0 and 3.5. This condition persisted through most of the summer and into the fall and prevented salmon and other anadromous fish from migrating into the upper reaches of the system. Chinook and chum salmon were observed during aerial survey flights in 2 tributaries in the lower reaches of the King Salmon River, Pumice and Old creeks, but no fish were observed in the King Salmon River mainstem or Painter Creek, a tributary with a confluence just below Mother Goose Lake, or in Volcano or Indecision creeks. Painter Creek is a major spawning area for Chinook salmon in the Ugashik system.

Long-term ramifications from this event could be significant. At least 2 and possibly 3 major age classes of salmon were impacted, depending on the timing of the event. The juvenile classes of 2004, which hatched in the spring of 2005, and the 2005 return were definitely affected, but depending on the timing of the lahar, the outgoing age class of the 2003 spawning event (smolts) could have outmigrated before the river was impacted by the acidic runoff.

In terms of impacts to the fisheries, estimation of escapement in the King Salmon/Mother Goose system is done via aerial surveys and the historical range of estimates is approximately 4,000 to 30,000 sockeye salmon, with the latest 20 year average at about 15,000. This is a small number when compared to the overall Ugashik District. For Chinook salmon the system can contribute a significant percentage to the Ugashik District, although the latest 20 year average is only about 2,100 fish in the commercial fishery. A more significant impact would be felt by the sport fishing community since Painter Creek is one of the larger contributors to that fishery within the Ugashik District.

Aerial surveys conducted in early August and again in early September, 2007 revealed one pair of Chinook and a single chum salmon in Painter Creek. The area between the confluence of Painter Creek and the King Salmon River had no live fish, but near the confluence of Old Creek and the King Salmon River we observed a gradient of carcasses with more near Old Creek, and diminishing as distance upriver increased. The lowest 2 tributaries of the King Salmon River, Old and Pumice Creeks were again well populated with Chinook, chum and some sockeye salmon. The area of the mainstem King Salmon River immediately below the confluence of Pumice Creek had several thousand fish of mixed species staged and presumably waiting for a chance to move up the mainstem.

Unlike 2006, August of 2007 was comparatively dry. While conditions in 2006 may have allowed fish into the upper tributary, Painter Creek, low water likely prevented significant numbers of fish from making progress to the upper drainage in 2007.

It is unknown at this time how long the acidic water will be present in the King Salmon River/ Mother Goose Lake complex. Staff from the Volcano Observatory Group, the USFWS Alaska Peninsula National Wildlife Refuge, and ADF&G will continue to monitor the river and document impacts to the watershed through time.

Nushagak District

The sonar project at Portage Creek produced apportioned estimates of 60,459 Chinook salmon, 518,041 sockeye salmon, and 161,483 chum salmon in the Nushagak River for 2007. A counting tower was not operated on the Nuyakuk River in 2007.

Spawning escapement of sockeye salmon in the Wood River system was estimated by tower to be 1,528,086 fish, while the Igushik River tower count was 415,452. The distribution of sockeye salmon in the Wood river system is documented in Table 1 and Appendix A11. The total count of sockeye salmon by aerial and foot survey was 406,964, slightly more than one fourth of the escapement documented by the tower count. No surveys occurred in the Nushagak or Igushik systems.

Togiak District

This year's survey season was characterized by poor weather conditions throughout the season. On the few days when the weather would clear, no pilots were available. The Togiak River was

surveyed for chum and Chinook salmon, however, the survey was deemed invalid due to the large number of dead salmon observed, suggesting that the peak spawning had long since passed.

Through the course of the Togiak River escapement project, 269,646 sockeye salmon were counted past the towers below Togiak Lake (Table 2). The spawning escapement of sockeye salmon in the Kulukak Section, including the Kulukak River, Kulukak Lake, and Tithe Creek Ponds, was not assessed this year (Appendices A12–A14).

With no escapement information on the Togiak drainage (Table 3), it is impossible to determine if the escapement goal for Chinook salmon in the Togiak Drainage of 10,000 fish was met. However, with strong commercial catch rates and low effort, it is likely that escapement in the Togiak District was also strong. Peak aerial counts for Chinook salmon and historical counts are available in Appendices A19 and A20.

Chum salmon counts are conducted coincidentally with the Chinook salmon surveys. As mentioned above, only 1 survey was performed this year. This survey was hampered due to weather and pilot availability, and was invalidated due to its late timing (Table 4; Appendices A21 and A22).

No aerial surveys were performed for coho salmon in 2007, and therefore we could not estimate coho escapement for Togiak River or its tributaries (Table 5; Appendix A23 and A24). Similar to other years, there was little commercial harvest of coho salmon reported in 2007 from a weak market.

ACKNOWLEDGEMENTS

We would like to thank the U.S. Fish and Wildlife Service, National Park Service, and the University of Washington, Fisheries Research Institute for the equipment, personnel, and funding they provided to help gather escapement data in 2007.

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TABLES AND FIGURES

Table 1.–Peak aerial counts of live sockeye salmon and total escapement estimates, Wood River system, 2007.

Location	Date	Aerial Count
Wood River[a]	15-Aug	8,200
Lake Aleknagik		41,604
Eagle Creek[b]	17-Aug	905
Hansen Creek[b]	7-Aug	6,466
Happy Creek[b]	7-Aug	11,778
Bear Creek[b]	12-Aug	1,890
Yako Creek[b]	14-Aug	4,012
Whitefish Creek[b]	26-Aug	844
Ice Creek[b]	1-Aug	8,888
Mission Creek[b]	13-Aug	645
Sunshine Creek	15-Aug	826
Youth Creek		N/A
Northshore Beaches	15-Aug	N/A
Southshore Beaches	15-Aug	3,200
Yako Beaches	15-Aug	2,150
Agulowok River & lower River Bay	15-Aug	55,000
Lake Nerka		108,454
Fenno Creek[b]	11-Aug	5,648
Pike Creek[b]	20-Aug	4,298
Stovall Creek[b]	28-Aug	6,847
Bear Creek		N/A
Teal Creek[b]	20-Aug	5,120
Pick Creek[b]	17-Aug	6,224
Elva Creek[b]	27-Aug	35
Kema Creek[b]	29-Aug	6,410
Hidden Lake Creek[b]	18-Aug	5,652
Lynx Creek[b]	26-Aug	1,539
Sam Creek[b]	5-Aug	2,578
Joe Creek[b]	7-Aug	1,453
Upper River Bay Beaches, NW	15-Aug	1,100
Upper River Bay Beaches, SE	15-Aug	400
Allan Cr. - Ross Cr. Beaches	15-Aug	3,300
N6 - River Bay Beach	15-Aug	11,000
Pick Creek Beach[b]	15-Aug	1,100
Elva Creek Beach	15-Aug	6,000
Amakuk Arm Beaches	15-Aug	2,300
Amakuk Arm - Ott's Bay Beach	15-Aug	N/A
Ott's Bay Beach	15-Aug	12,500

-continued-

Table 1.–Page 2 of 2.

Location	Date	Aerial Count
Anvil Bay Beaches	15-Aug	5,100
Anvil Bay - Elbow Pt. Beach	15-Aug	4,200
Elbow Pt. - Lynx Cr. Beach	15-Aug	1,000
Lynx Cr. - Teal Cr. Beach	15-Aug	2,650
Kema Lake Beaches	15-Aug	2,000
Hidden Lake Beaches	15-Aug	N/A
Lynx Lake Beaches	15-Aug	10,000
Little Togiak River[b]	15-Aug	26,000
Little Togiak Lake	15-Aug	12,000
Northshore Beaches	15-Aug	4,000
Southshore Beaches	15-Aug	4,000
D Slough Beaches	15-Aug	4,000
Agulukpak River	15-Aug	70,000
Lake Beverley		36,926
Tsun Creek		N/A
Moose Creek[b]	16-Aug	5,226
Hope Creek		N/A
Hardluck Bay Beaches	17-Aug	5,800
Sam's Beach	17-Aug	1,000
Golden Horn Beaches	17-Aug	5,600
Silver Horn Beaches	17-Aug	8,400
B12 & B9 Beaches	17-Aug	4,600
B9-B1	17-Aug	2,300
Other	17-Aug	4,000
Hope Lake Beach	17-Aug	N/A
Peace River	17-Aug	4,000
Lake Mikchalk	17-Aug	4,200
Narrows	17-Aug	200
Northshore Beaches	17-Aug	1,500
Southshore Beaches	17-Aug	2,500
Wind River	17-Aug	3,300
Lake Kulik	17-Aug	26,100
K1 & K2 Creeks	17-Aug	N/A
K5 Creek - Grant River Beaches	17-Aug	1,000
Grant River - K2 Creek Beaches	17-Aug	22,500
Southshore Beaches	17-Aug	2,600
Grant River[b]	22-Aug	11,180
Total		406,964

[a] Total does not include tower count of 1,528,086 sockeye salmon.

[b] Ground survey counts conducted by University of Washington Fisheries Research Institute (FRI).

Table 2.–Peak aerial counts of live sockeye salmon and total escapement estimates, Togiak District, 2007.

	Aerial Counts		Total Escapement Estimate	
Location	Date	Number	Factor [a]	Number
Togiak Section				
Togiak Tower				269,646
Togiak River mainstem		No Surveys Done	2.0	
Gechiak Lake System		No Surveys Done	1.5	
Pungokepuk Lake		No Surveys Done	1.5	
Nayorurun River		No Surveys Done	1.5	
Kemuk River		No Surveys Done	1.5	
Ongivinuk Lake System		No Surveys Done	1.5	
Subtotal				
Kulukak Section				
Kulukak River		No Surveys Done	2.0	
Kulukak Lake		No Surveys Done	2.0	
Tithe Creek Ponds		No Surveys Done	1.5	
Subtotal				
Matogak, Osviak, and Cape Peirce Sections				
Matogak River		No Surveys Done	3.0	
Osviak River		No Surveys Done	2.5	
Slug River		No Surveys Done	2.0	
Subtotal				
Other				
Quigmy River		No Surveys Done	2.5	
Negukthlik River		No Surveys Done	3.0	
Ungalikthluk River		No Surveys Done	2.0	
Subtotal				
Total				269,646

[a] Derived by expanding peak live count to reflect fish not counted due to variables such as schooled and dead fish, late or poor survey conditions, bad weather, etc.

Table 3.–Peak aerial counts of live Chinook salmon and total escapement estimates, Togiak District, 2007.

	Aerial Counts		Total Escapement Estimate	
Location	Date	Number	Factor [a]	Number
Togiak Section				
Togiak River mainstem [b]				
A	17 August		2.0	
B	17 August		2.0	
C	17 August		2.0	
D	17 August		2.0	
E	17 August		2.0	
F	17 August		2.0	
Subtotal				
Gechiak River	17 August		2.0	
Pungokepuk River	17 August		2.0	
Nayorurun River	17 August		2.0	
Kemuk River	17 August		2.0	
Ongivinuk River	17 August		2.0	
Subtotal				
Togiak River Drainage Total				
Kulukak Section				
Kulukak River		No Surveys Done	2.0	
Matogak, Osviak, and Cape Peirce Sections				
Matogak River		No Surveys Done	2.0	
Osviak River		No Surveys Done	2.0	
Slug River		No Surveys Done	2.0	
Subtotal				
Other				
Quigmy River		No Surveys Done	2.0	
Negukthlik River		No Surveys Done	3.0	
Ungalikthluk River		No Surveys Done	2.0	
Subtotal				
Total		0		0

[a] Derived by expanding peak live count to reflect fish not counted due to variables such as schooled and dead fish, late or poor survey conditions, bad weather, etc.

[b] Survey was performed late and was affected by high water, all data considered invalid.

Table 4.–Peak aerial counts of live chum salmon and total escapement estimates, Togiak District, 2007.

	Aerial Counts		Total Escapement Estimate	
Location	Date	Number	Factor [a]	Number
Togiak Section				
Togiak River mainstem[b]				
A	17 August		2.0	
B	17 August		2.0	
C	17 August		2.0	
D	17 August		2.0	
E	17 August		2.0	
F	17 August		2.0	
Subtotal				
Gechiak River	17 August		2.0	
Pungokepuk River	17 August		2.0	
Nayorurun River	17 August		2.0	
Kemuk River	17 August		2.0	
Ongivinuk River	17 August		2.0	
Subtotal				
Togiak River Drainage Total				
Kulukak Section				
Kulukak River		No Surveys Done	2.0	
Matogak, Osviak, and Cape Peirce Sections				
Matogak River		No Surveys Done	2.0	
Osviak River		No Surveys Done	2.0	
Slug River		No Surveys Done	2.0	
Subtotal				
Other				
Quigmy River		No Surveys Done	2.0	
Negukthlik River		No Surveys Done	2.0	
Ungalikthluk River		No Surveys Done	2.0	
Subtotal				
Total		0		0

[a] Derived by expanding peak live count to reflect fish not counted due to variables such as schooled and dead fish, late or poor survey conditions, bad weather, etc.

[b] Survey was performed late and was affected by high water; all data considered invalid.

Table 5.–Peak aerial counts of live coho salmon and total escapement estimates, Togiak District, 2007.

	Aerial Counts		Total Escapement Estimate	
Location	Date	Number	Factor [a]	Number
Togiak Section				
Togiak River mainstem				
A		No Surveys Done		
B		No Surveys Done		
C		No Surveys Done		
D		No Surveys Done		
E		No Surveys Done		
F		No Surveys Done		
Subtotal				
Gechiak River		No Surveys Done		
Pungokepuk River		No Surveys Done		
Nayorurun River		No Surveys Done		
Kemuk River		No Surveys Done		
Ongivinuk River		No Surveys Done		
Subtotal				
Togiak River Drainage				
Kulukak Section				
Kulukak River		No Surveys Done	2.0	
Matogak, Osviak, and Cape Peirce Sections				
Matogak River		No Surveys Done	2.0	
Osviak River		No Surveys Done	3.0	
Slug River		No Surveys Done	3.0	
Subtotal				
Other				
Quigmy River		No Surveys Done	3.0	
Negukthlik River		No Surveys Done	3.0	
Ungalikthluk River		No Surveys Done	3.0	
Subtotal				
Total		0		0

[a] Derived by expanding peak live count to reflect fish not counted due to variables such as schooled and dead fish, late or poor survey conditions, bad weather, etc.

Table 6.–Aerial survey counts of sockeye salmon, Alagnak River system, 2007.

Location	Number of Fish	Percent of Total
Nonvianuk River	30,000	2.6
Nonvianuk Lake	150,000	13.0
Kulik River	20,000	1.7
Kulik Lake	5,000	0.4
Alagnak River	5,000	0.4
Kukaklek Lake	30,000	2.6
Nanuktuk Creek	235,000	20.3
Battle River	95,000	8.2
Battle Lake	20,000	1.7
Moraine/Spectacle Creek	350,000	30.3
Funnel Creek	215,000	18.6
Total	1,155,000	100.0

Note: Aerial surveys were conducted with fixed-wing aircraft.

Table 7.–Aerial survey counts of Chinook, chum, pink, and coho salmon, Naknek-Kvichak District, 2007.

	Survey	Number of Salmon			
Location	Date	Chinook	Chum	Pink	Coho
Kvichak River					
Alagnak River	8-Aug	3,455	100,000	No count	
Naknek River [a]					
Paul's Creek	3-Aug	No count	No count	No count	
King Salmon Creek	3-Aug	473	800	No count	
Big Creek	8-Aug	1,975	40,000		
Mainstem Naknek River	22-Aug	3,050	No count	No count	No count
Total		7,953	148,000		

Note: Blank cells represent no data.

[a] Naknek River drainage flown under poor conditions so no estimate was possible.

Table 8.–Aerial survey peak counts of Chinook salmon escapement, Egegik District, 2007.

Location	Survey Date	Chinook Salmon Counted
Egegik River	August 09	
Shosky Creek	August 09	15
Whale Mountain Creek	August 09	0
Mossy Creek	August 09	7
Mink Creek	August 09	3
Gertrude Creek	August 09	131
Kaye's Creek	August 09	113
Takayoto Creek	August 09	214
Angle Creek	August 09	0
Contact Creek	August 09	72
Mainstem King Salmon River	August 09	
Total		555

Note: Blank cells represent no data.

Table 9.–Aerial survey peak counts of chum salmon escapement, Egegik District, 2007.

Location	Survey Date	Chum Salmon Counted
Egegik River	August 09	
Shosky Creek	August 09	3
Whale Mountain Creek	August 09	2,450
Mossy Creek	August 09	60
Mink Creek	August 09	30
Gertrude Creek	August 09	860
Kaye's Creek	August 09	60
Takayoto Creek	August 09	0
Angle Creek	August 09	
Contact Creek	August 09	320
Mainstem King Salmon River	August 09	
Total		3,783

Note: Blank cells represent no data.

Table 10.–Aerial survey counts of coho salmon escapement, Egegik District, 2007.

Location [a]	Survey Date	Coho Salmon Counted	Comments
Egegik River Rapids	September 11		
Stream 115.8 (Featherly Creek)	September 11		
Stream 107.6 (Burl's Creek)	September 11		
Stream 90.3 (Salmon Creek)	September 11		
Stream 89.8 (Ruth Creek)	September 11		
Stream 87.0 (Bear Creek)	September 11		
Stream 73.5 (Becharof Creek)	September 11		
Stream 48.1 (Kejulik River)	September 11		
Total		2,000 [b]	

[a] Streams tributary to Becharof Lake are designated by the number of miles between their mouth and the outlet of Becharof Lake (Egegik River) as one travels around the lake in a clockwise fashion from the Becharof lake outlet. This is the same system of designation used for years by previous investigators.

[b] All fish still in Becharof Lake and not associated with tributary systems.

Table 11.–Aerial survey peak counts of sockeye salmon escapement, King Salmon and Dog Salmon River, Ugashik District, 2007.

Location	Survey Date	Sockeye Salmon Counted
King Salmon River System:		
Goose Lake and outlet	Aug. 12	[a]
Needle Lake	Aug. 12	[a]
Volcano Creek	Aug. 12	[a]
Painter Creek	Aug. 12	[a]
Indecision Creek	Aug. 12	[a]
Sub-total		
Dog Salmon River System:		
Figure-Eight Creek	Aug. 12	50,000
Goblet Creek	Aug. 12	0
Oldham Creek	Aug. 12	20,000
Wandering Creek	Aug. 12	20
Mainstem Dog Salmon River	Aug. 12	no count
Subtotal		70,020
Total		70,020

[a] See Ugashik District text for results explanation.

Table 12.–Peak survey counts of Chinook salmon escapement, Ugashik District, 2007.

Location	Survey Date	Chinook Salmon Counted
King Salmon River System		
Old Creek	Aug. 12	785
Pumice Creek	Aug. 12	4,700
Painter Creek	Aug. 12	[a]
Mainstem King Salmon River	Aug. 12	220
Indecision Creek	Aug. 12	[a]
Volcano Creek	Aug. 12	[a]
Subtotal		5,707
Dog Salmon River System		
Figure-Eight Creek	Aug. 12	240
Goblet Creek	Aug. 12	68
Oldham Creek	Aug. 12	0
Wandering Creek	Aug. 12	0
Mainstem Dog Salmon River	Aug. 12	0
Subtotal		308
Ugashik River System		
Mainstem Ugashik River	Aug. 12	0
Grassy Creek	Aug. 12	38
Subtotal		38
Total		6,053

[a] See Ugashik District text for results explanation.

Table 13.–Peak survey counts of chum salmon escapement, Ugashik District 2007.

Location	Survey Date	Chum Salmon Counted
King Salmon River System		
Old Creek	Aug. 12	15,500
Pumice Creek	Aug. 12	20,300
Painter Creek	Aug. 12	[a]
Mainstem King Salmon River	Aug. 12	10,000
Needle Lake	Aug. 12	[a]
Indecision Creek	Aug. 12	[a]
Volcano Creek	Aug. 12	[a]
Subtotal		45,800
Dog Salmon River System		
Figure-Eight Creek	Aug. 12	360
Goblet Creek	Aug. 12	80
Oldham Creek	Aug. 12	0
Wandering Creek	Aug. 12	10
Mainstem Dog Salmon River	Aug. 12	0
Subtotal		450
Ugashik River System		
Mainstem Ugashik River	Aug. 12	0
Grassy Creek	Aug. 12	290
Subtotal		290
Total		46,540

[a] See Ugashik District text for results explanation.

Table 14.–Aerial survey counts of coho salmon escapement, Ugashik District, 2007.

Location	Survey Date	Coho Salmon Counted	Comments
Upper Ugashik Lake			
Crooked Creek	September 11		Turbid water.
Deer Creek	September 11		
Lower Ugashik Lake			
"E" Creek	September 11	2,500	at mouth of stream.
South Creek	September 11	No Survey	
Ugashik Outlet	September 11	1,000	
King Salmon River Tributaries			
Pumice Creek	September 11		Turbid water.
Old Creek	September 11		Turbid water.
Painter Creek	September 11		Turbid water.
Dog Salmon River Tributaries			
Figure Eight Creek	September 11		Turbid water.
District Total		3,500	

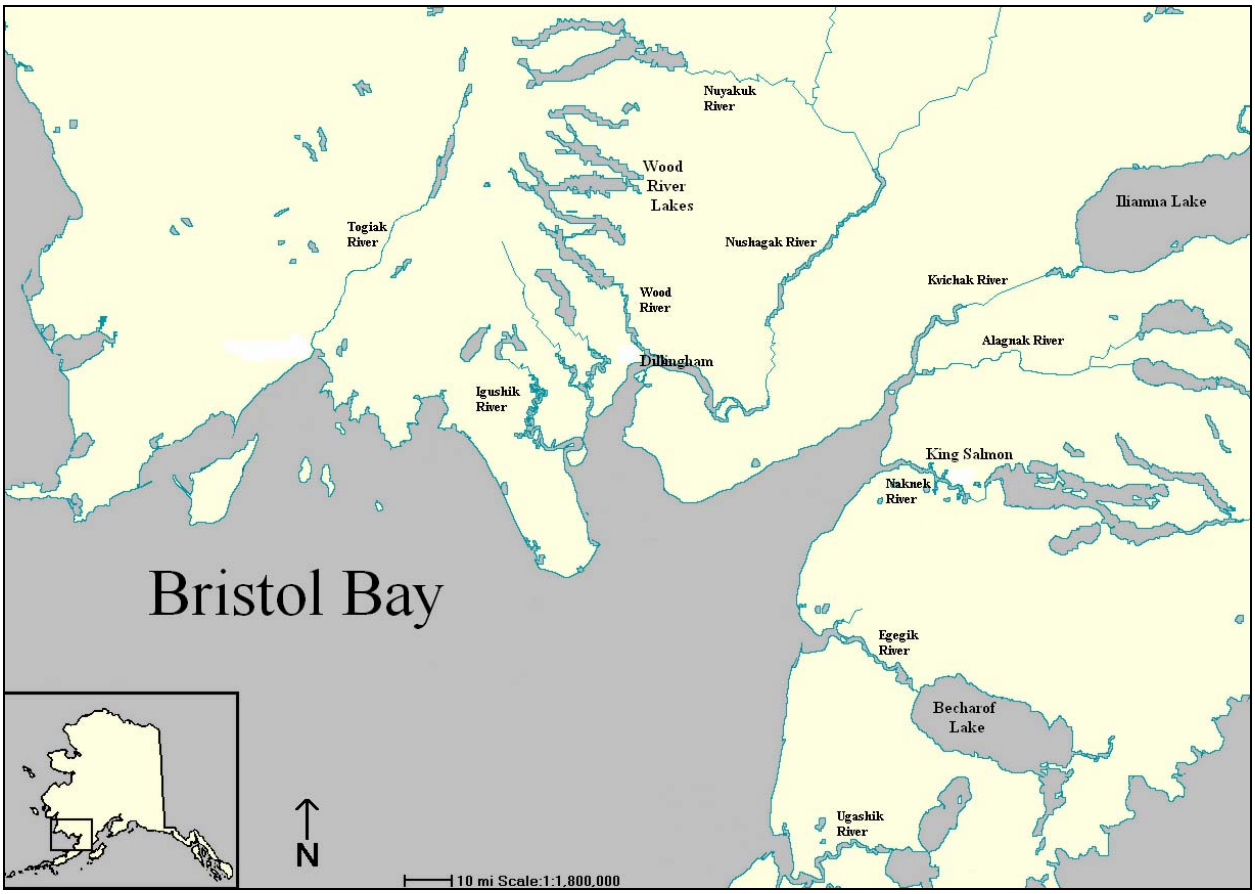

Figure 1.–Bristol Bay management area, Alaska.

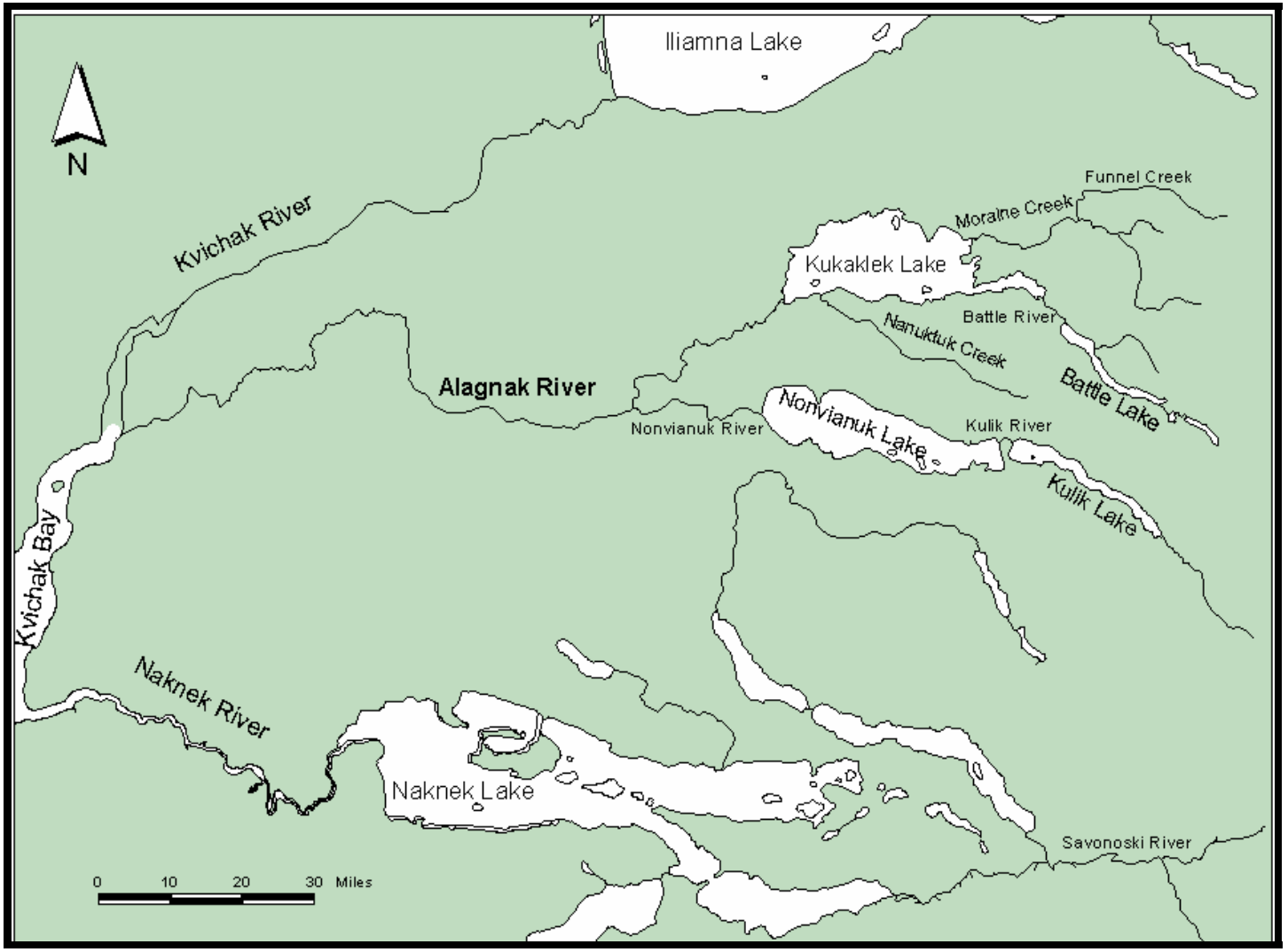

Figure 2.–Alagnak River drainage, Bristol Bay, Alaska.

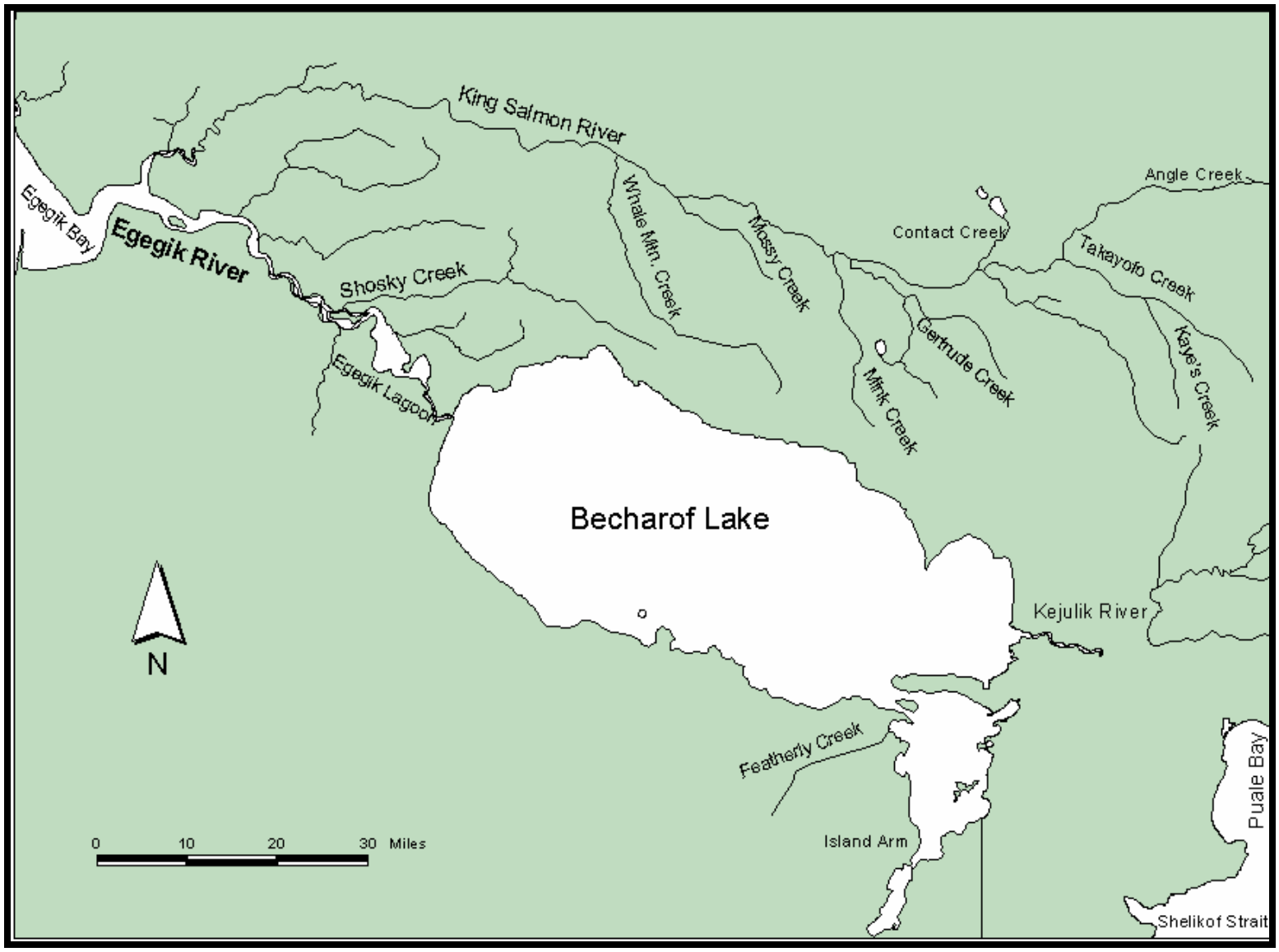

Figure 3.–Egegik River drainage, Bristol Bay, Alaska.

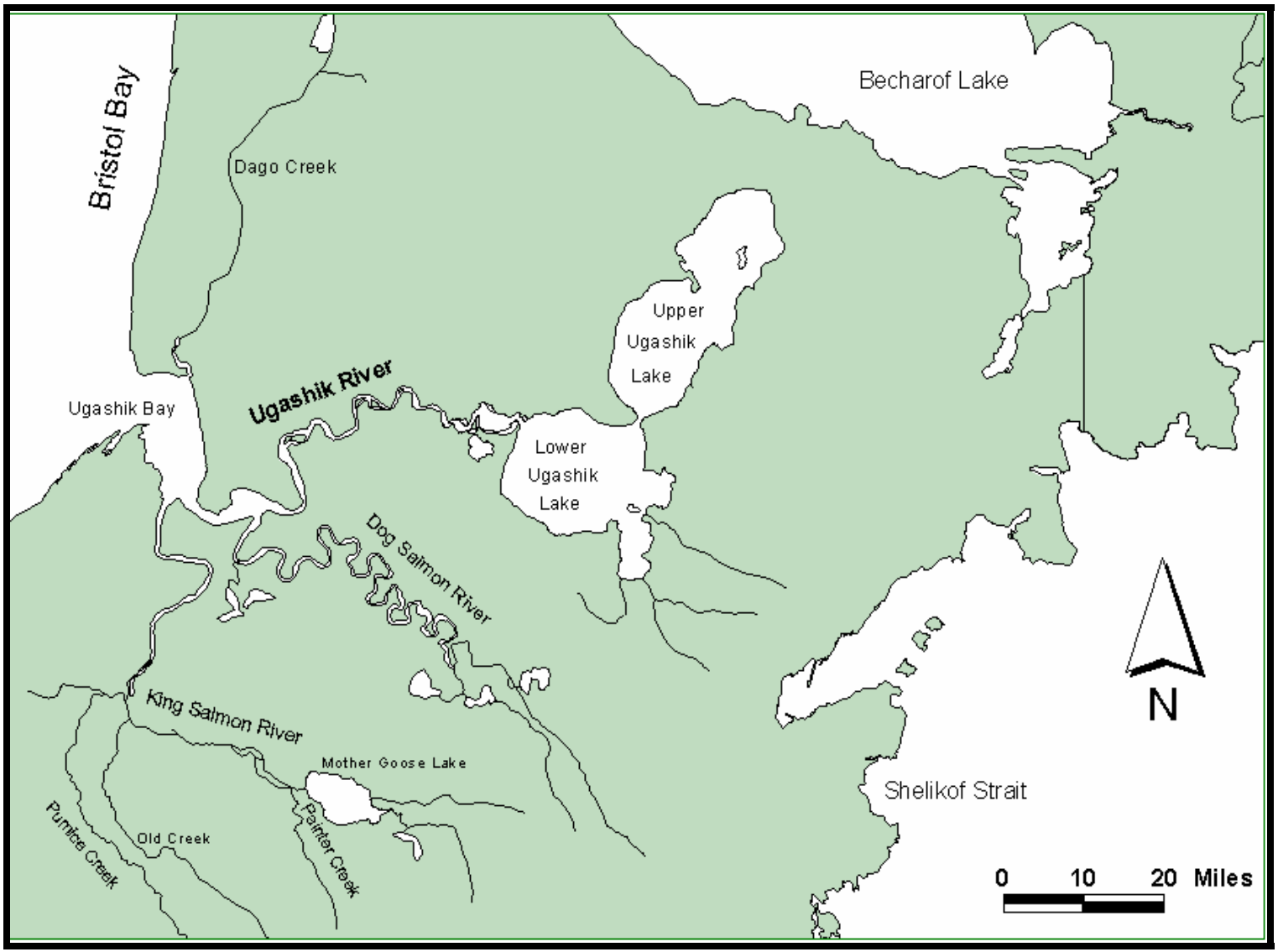

Figure 4.–Ugashik River drainage, Bristol Bay, Alaska.

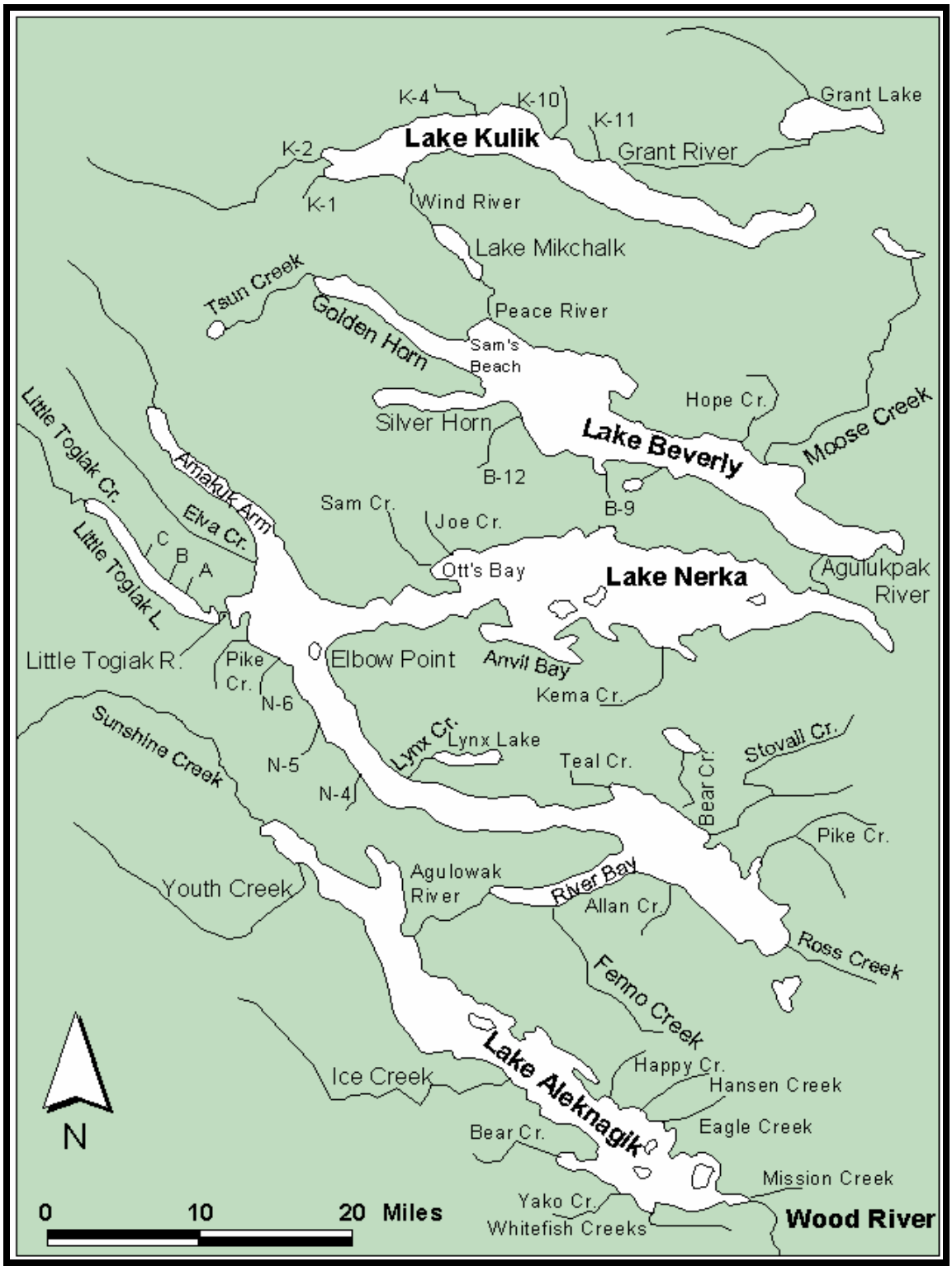

Figure 5.–Wood River Lakes system, Bristol Bay, Alaska.

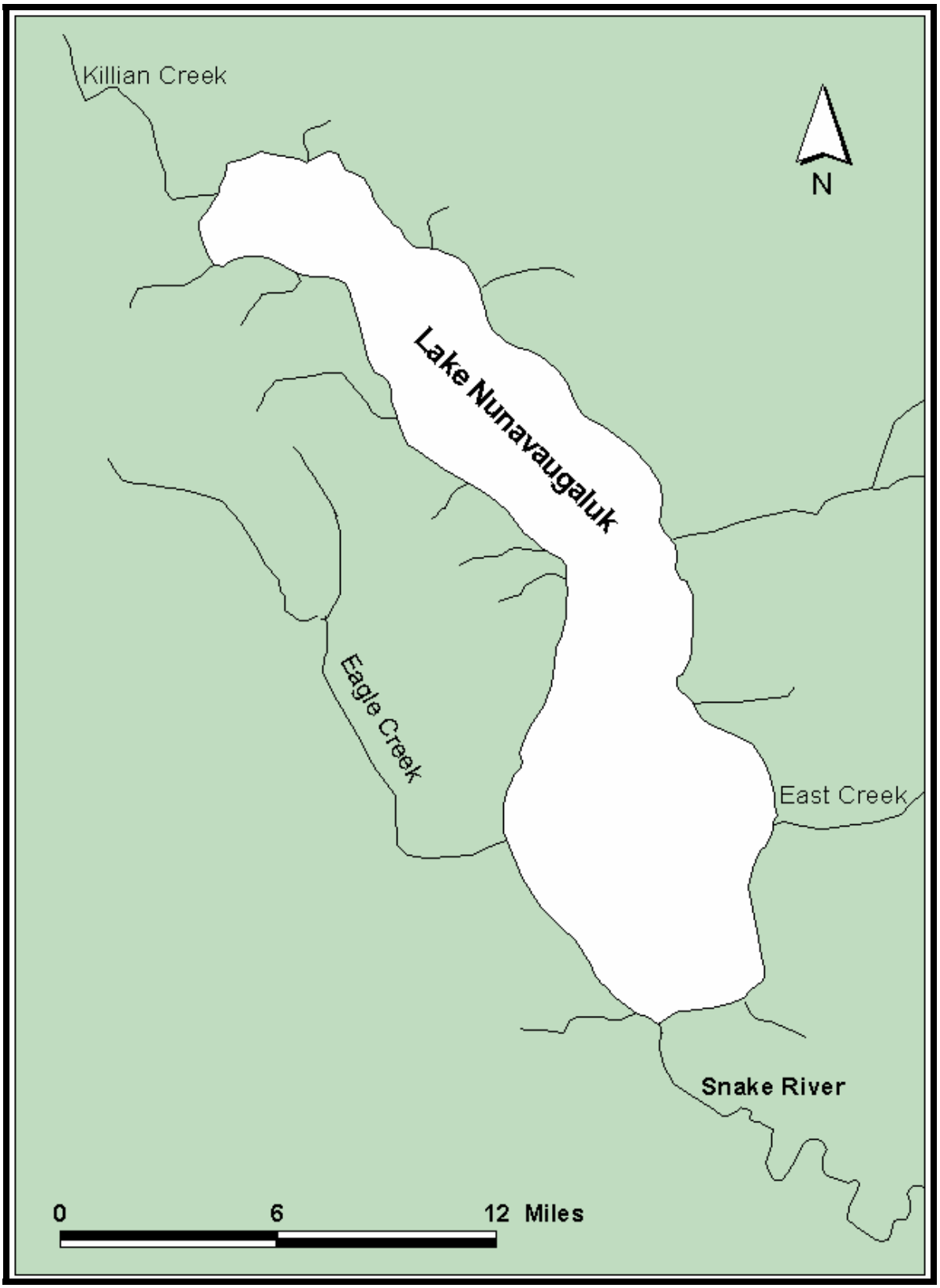

Figure 6.–Lake Nunavaugaluk system, Bristol Bay, Alaska.

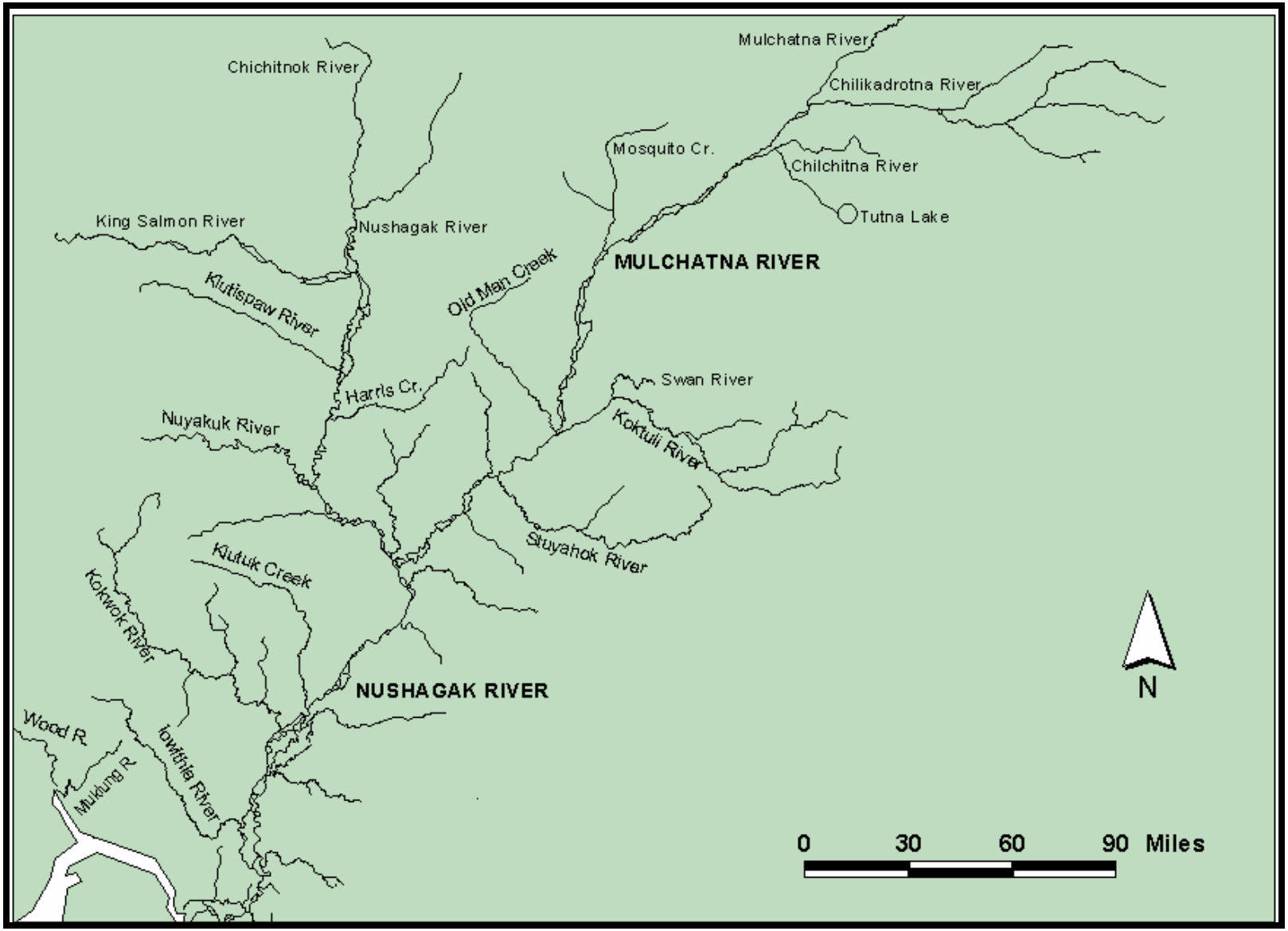

Figure 7.–Nushagak-Mulchatna River system, Bristol Bay, Alaska.

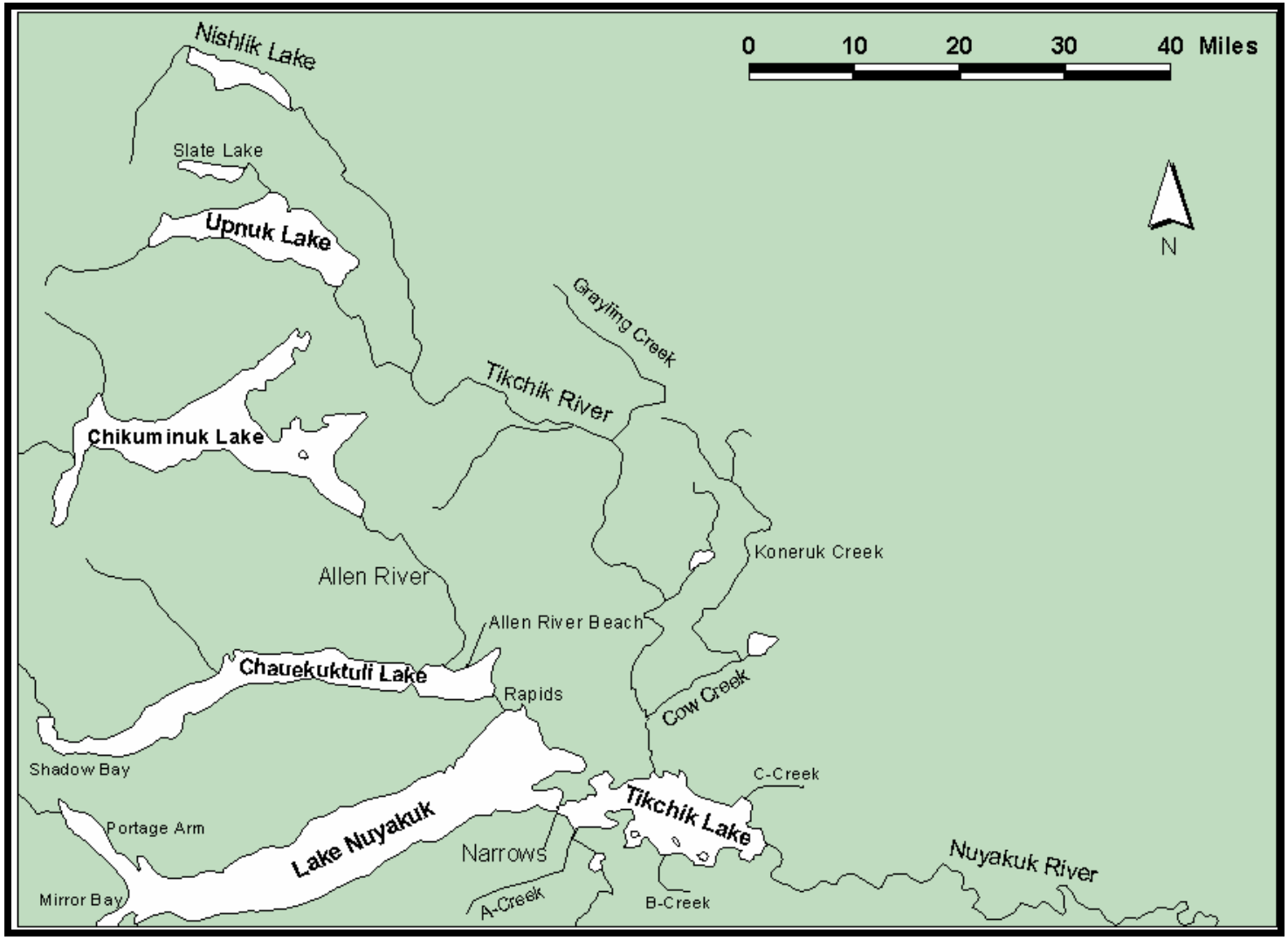

Figure 8.–Tikchik Lakes system, Bristol Bay, Alaska.

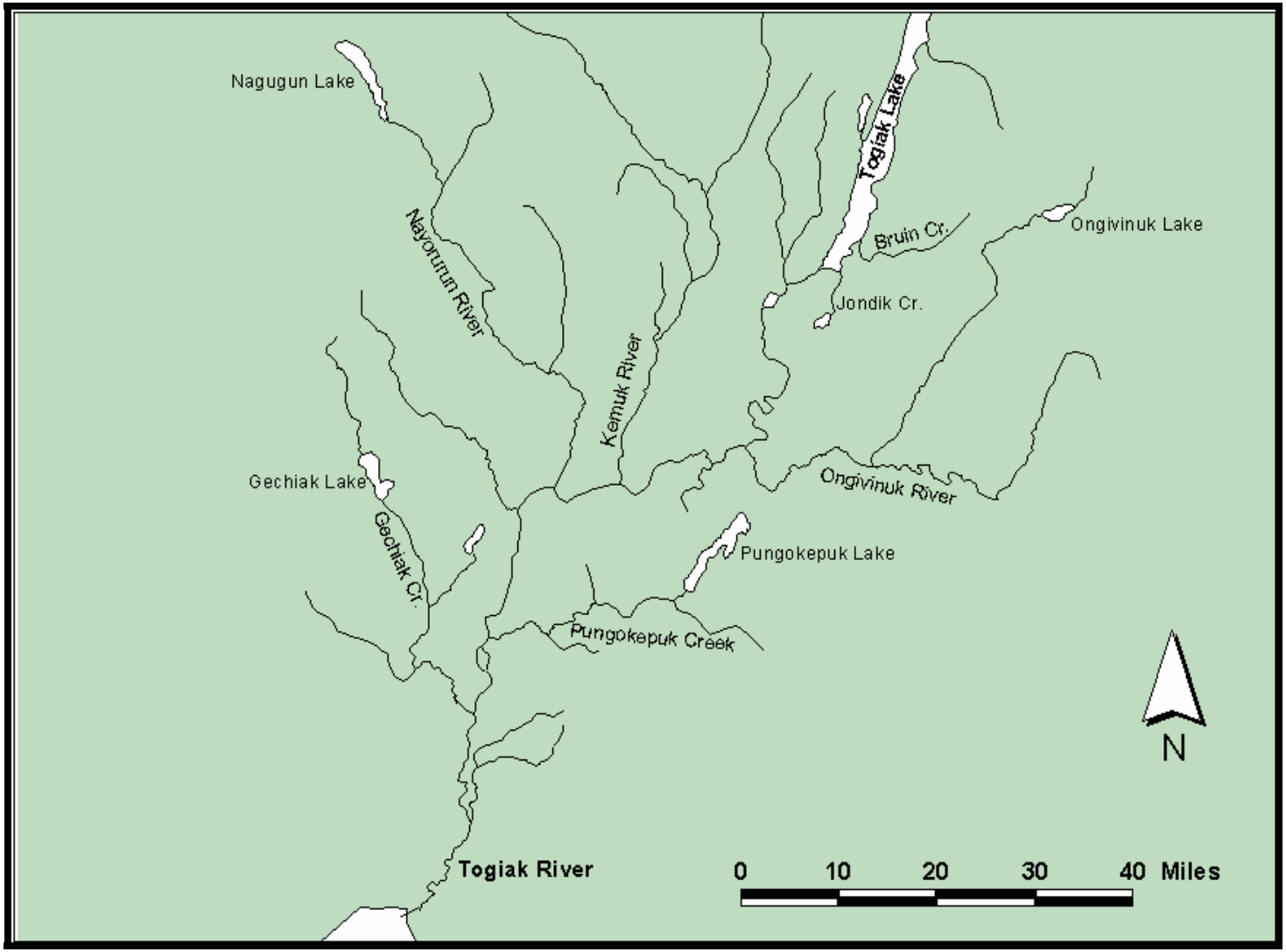

Figure 9.–Togiak River system, Bristol Bay, Alaska.

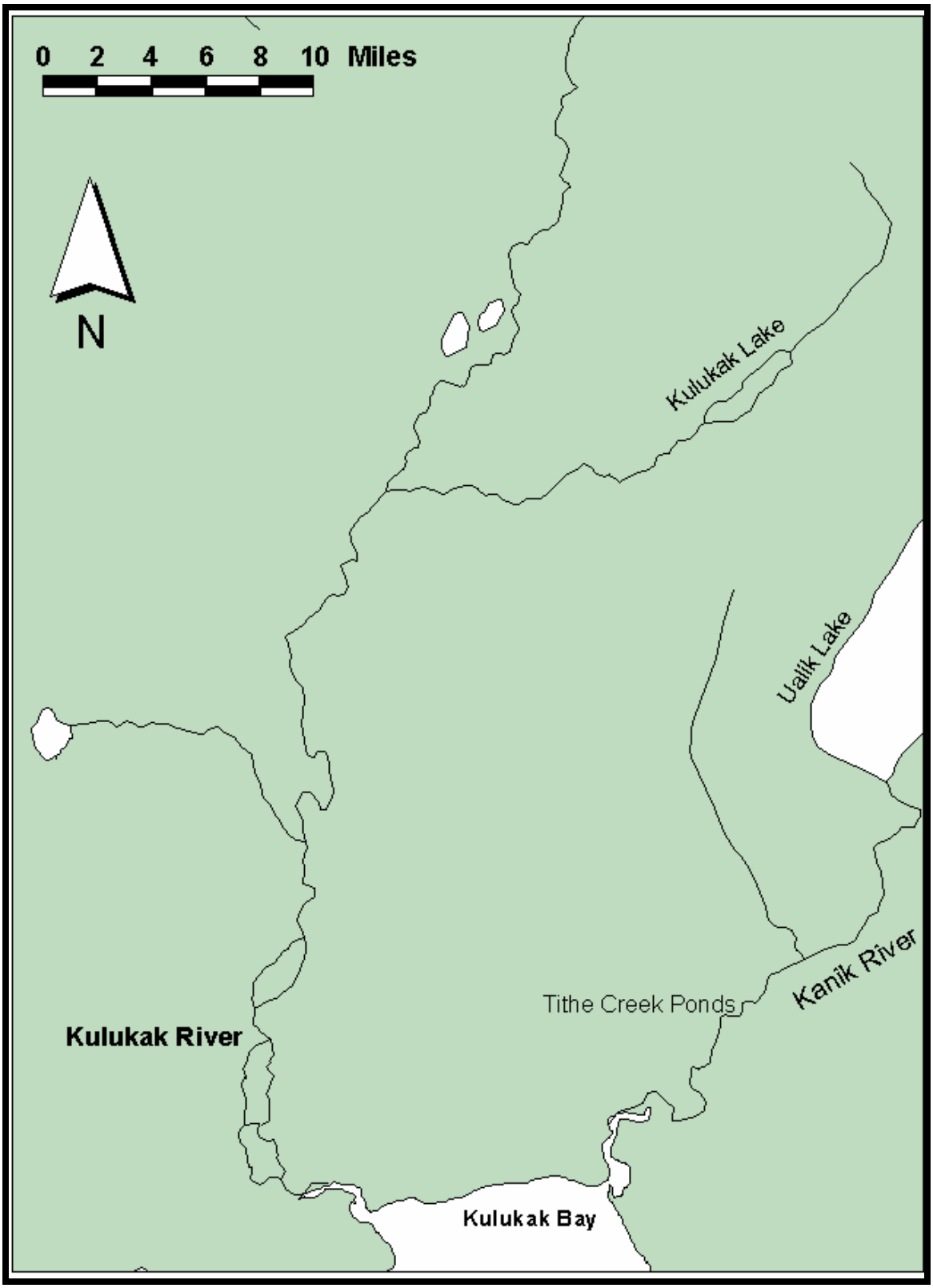

Figure 10.–Kulukak River system, Bristol Bay, Alaska.

APPENDIX A

Appendix A1.–Sockeye salmon total escapement estimates, Naknek-Kvichak District, 1987–2007.

Year	Kvichak	Naknek	Alagnak	Total	Alagnak Percent of Total
1987	6,065,880	1,061,806	154,210[a]	7,281,896	2
1988	4,065,216	1,037,862	194,630[a]	5,297,708	4
1989	8,317,500	1,161,984	196,760[a]	9,676,244	2
1990	6,970,020	2,092,578	168,760[a]	9,231,358	2
1991	4,222,788	3,578,508	277,589[a]	8,078,885	3
1992	4,725,864	1,606,650	226,643[a]	6,559,157	3
1993	4,025,166	1,535,658	347,975[a]	5,908,799	6
1994	8,337,840	990,810	242,595[a]	9,571,245	3
1995	10,038,720	1,111,140	215,713[a]	11,365,573	2
1996	1,450,578	1,078,098	306,750[a]	2,835,426	11
1997	1,503,732	1,025,664	218,115[a]	2,747,511	8
1998	2,296,074	1,202,172	252,200[a]	3,750,446	7
1999	6,196,914	1,625,364	463,600[a]	8,285,878	6
2000	1,827,780	1,375,488	451,300[a]	3,654,568	12
2001	1,095,348	1,830,360	267,000[a]	3,192,708	8
2002	703,884	1,263,918	282,100[a]	2,249,902	13
2003	1,686,804	1,831,170	2,110,000[a]	5,627,974	37
2004	5,500,134	1,939,374	5,396,592	12,836,100	42
2005	2,320,422	2,744,622	4,219,026	9,284,070	45
2006	3,055,128	1,953,228	1,773,966	6,782,322	26
2007	2,810,208	2,945,304	2,466,414	8,221,926	30
Mean[b]	4,220,290	1,602,323	888,276	6,710,889	12

[a] Aerial survey counts.

[b] Mean of counts from 1987 to 2006.

Appendix A2.–Aerial survey counts of Chinook salmon escapements, Naknek River drainage, 1987–2007.

Year	Mainstem Naknek River	Paul's Creek	King Salmon Creek	Big Creek	Total
1987	2,800	7	290	1,353	4,450
1988	7,380	150	600	3,600	11,730
1989	1,700	50	100	860	2,710
1990	4,500	150	350	2,000	7,000
1991	1,655	121	275	2,340	4,391
1992	1,550	88	158	895	2,691
1993	5,520	86	700	1,710	8,016
1994	5,970	203	974	2,531	9,678
1995	2,790	26	239	1,905	4,960
1996	2,965	157	312	1,576	5,010
1997	7,520	248	902	1,783	10,453
1998	2,150	210	1,060	2,085	5,505
1999	[a]	223	847	2,250	3,320
2000	1,900	43	178	1,112	3,233
2001	3,800	118	413	2,009	6,340
2002	4,240	314	934	2,015	7,503
2003	4,150	583	1,348	[a]	6,081
2004	6,900	315	1,582	4,081	12,878
2005 [a]					
2006 [a]					
2007 [a]					
Mean	3,970	172	626	2,006	6,442

[a] Counts unavailable due to poor conditions.

Appendix A3.–Chinook salmon escapement data, Naknek-Kvichak District, 1987–2007.

	Non-expanded Escapement Indices by Drainage [a]			
Year	Naknek	Alagnak	Kvichak	Total
1987	4,450	2,420		6,870
1988	11,730	4,600	190	16,520
1989	2,710	3,650	100	6,460
1990	7,000	1,720	170	8,890
1991	4,391	2,531		6,922
1992	2,691	3,042	264	5,997
1993	8,016	10,170	115	18,301
1994	9,678	8,480	306	18,464
1995	4,960	6,860	96	11,916
1996	5,010	9,885	132	15,027
1997	10,453	15,210	103	25,766
1998	5,505	4,148	187	9,840
1999	3,320 [b]	2,178	1,200	6,698
2000	3,233	2,220	6	5,459
2001	6,340	5,458	36	11,834
2002	7,503	3,765		11,268
2003	6,081 [c]	8,209		14,290
2004	12,878	6,755		19,633
2005		5,084		
2006		4,278		
2007	5,498	3,455		
Mean	6,442	5,533	223	12,231

Note: Blank cells represent no data.

[a] Includes aerial indices from all streams surveyed in drainage.

[b] No index count for Naknek River.

[c] No index count for Big Creek.

Appendix A4.–Chum salmon escapement survey history, Alagnak River, 1990–2007.

Year	Count Dates	Aerial Index Estimate
1990	8/08	8,500
	8/18	48,800
1991	8/09	43,000
	8/19	64,300
1992	8/10	114,000
1993	8/09	4,600
1994	8/08	62,900
1995	8/10	132,000
1996	8/12	145,000
1997	8/07	37,800
1998	8/12	3,150
1999	8/10	11,800
2000	8/07	10,120
2001	8/08	70,800
2002	8/02	157,800
2003	8/13	78,000
2004		
2005	7/30	20,300
2006		
2007	8/08	100,000

Note: Blank cells represent no data.

Appendix A5.–Aerial survey counts of Chinook salmon escapement, Egegik District, 1987–2007.

Year	Egegik River	Shosky Creek	Whale Mountain Creek	Mossy Creek	Mink Creek	Gertrude Creek	Kaye's Creek	Takayoto Creek	Angle Creek[a]	Contact Creek	Total
1987	15	174	2	74	0	408	284	232	2	88	1,279
1988	50	151	0	12		248	120	177		110	868
1989	14	90	13	43	7	310	120	300		100	997
1990	24 [b]	85	7	35	2	260	175	175		205	968
1991	0 [b]	62	60	30	33	83	117	95		73	553
1992[c]	15	143	52	54	22	416	320	190		296	1,508
1993	80	58	6	38	6	350	170	200		235	1,143
1994[c]	66 [b]	48	32	118	77	840	214	230		705	2,330
1995[c]	60 [b]	32	10	53	103	456	248	130		275	1,367
1996	42 [b]	102	8	38	20	230	74	123	6	203	846
1997	30 [b]	39	2	18	10	260	173	374		740	1,646
1998	0 [b]	29	45	55		320	165	120		329	1,063
1999	6 [b]	75	10	51		165	6	115		145	573
2000	0 [b]	4	0	16		85	41	73		341	560
2001	0 [b]	32	0	35		116	120	153		299	755
2002	0 [b]	24	4	0		277	220	149		238	912
2003	0 [b]	35	0	20	10	297	180	313		197	1,052
2004	0	20	0	40	4	226	134	219		870	1,513
2005	0 [b]	21	8	36	0	165	71	99		150	550
2006	0 [b]	1	0	1	1	66	80	50	27	50	276
Average	20	61	13	38	21	279	152	176	12	282	1,038
2007		15	0	7	3	131	113	214		72	555
Deviation		-76%	-100%	-82%	-86%	-53%	-25%	22%		-75%	-47%

Note: Peak aerial counts unless otherwise noted. Data not expanded. Blank cells represent no data.

[a] Angle Creek is usually too turbid to survey.

[b] Tower count.

[c] Helicopter surveys.

Appendix A6.–Aerial survey counts of chum salmon escapement, Egegik District, 1987–2007.

Year	Egegik River	Shosky Creek	Whale Mountain Creek	Mossy Creek	Mink Creek	Gertrude Creek	Kaye's Creek	Takayoto Creek	Contact Creek	King Salmon River	Total
1987	150	0	19,000	16	1,000	3,770	2,780	0	2,850		29,566
1988	500	50	4,400	100	50	5,200	1,600	0	3,200		15,100
1989	0	10	3,200	25	100	1,100	0	0	200	14	4,649
1990	72 [a]	0	2,000	0	150	1,675	80	0	750		4,727
1991	0 [a]	0	1,500	70	100	990	280	0	480		3,420
1992[b]	50	0	680	15	25	4,500	400	0	3,630	200	9,500
1993	100	0	1,020	8	1	1,075	0	0	100		2,304
1994[b]	42 [a]	0	1,700	5	7	760	175	30	260		2,979
1995[b]	144 [a]	2	395	15	30	560	162	5	600		1,913
1996	12		438	4	20	530		24	633		1,661
1997	0 [a]		220	8	10	495	290	60	640		1,723
1998	17 [a]	8	1,480	4		920	4	4	140		2,577
1999	6 [a]		1,040	4		243		4	140		1,437
2000	0 [a]		492	4		475	32	6	180		1,189
2001	0 [a]		424	6		494	40	30	1,240		2,234
2002	0 [a]		284	5		302	16		150		757
2003	0 [a]	0	540	70	50	690	0	0	3,800		5,150
2004	0 [a]	0	260	50	20	610	50	0	750		1,740
2005	0 [a]	0	300	10	14	770	30	0	390		1,514
2006	0 [a]	20	340	9	4	450	4	0	130		957
Average	55	6	1,986	21	105	1,280	330	9	1,013	107	4,755
2007		3	2,450	60	30	860	60	0	320	0	3,783

Note: Peak aerial counts unless otherwise noted. Data not expanded. Blank cells represent no data.

[a] Tower count.

[b] Helicopter surveys.

Appendix A7.–Aerial survey counts of coho salmon escapement, Egegik District, 1987–2007.

Year	Number of Surveys	Coho Salmon Count	Comments
1987	6	6,930	Included King Salmon River & tributaries.
1988	6	13,715	Included King Salmon River & tributaries.
1989	9	4,485	Included Gertrude & Whale Mountain Creeks.
1990	7	13,400	Peak survey on August 17.
1991	0	220	Incidental observation made August 6.
1992 [a]	0	200	Incidental observation in Egegik River August 6.
1993	0	1,130	Incidental observation from Egegik River August 16.
1994 [a,b]	2	7,412	Included King Salmon River & tributaries.
1995 [c]	2	5,258	Included King Salmon River & tributaries.
1996 [d]	2	9,043	Included King Salmon River & tributaries.
1997	3	4,106	Gertrude Weir Count & selected Becharof Lake tributaries.
1998	1	6,075	Gertrude Weir Count & selected Becharof Lake tributaries.
1999	1	4,353	Gertrude Weir Count & selected Becharof Lake tributaries.
2000	1	4,870	Selected Becharof Lake tributaries
2001	1	5,100	Selected Becharof Lake tributaries
2002	1	7,050	Selected Becharof Lake tributaries
2003	1	5,280	Selected Becharof Lake tributaries
2004	1	41,400	Selected Becharof Lake tributaries
2005	1	22,450	Selected Becharof Lake tributaries
2006	1	21,000	Selected Becharof Lake tributaries
2007	1	2,000	Selected Becharof Lake tributaries (Sept 7)

[a] Helicopter surveys.

[b] The Egegik River Tower was maintained through September 11 and approximately 10,140 coho salmon were counted.

[c] The Egegik River Tower was maintained through August 30 and approximately 7,470 coho salmon were counted.

[d] The Egegik River Tower was maintained August 7 to September 11 and approximately 24,918 coho salmon were counted.

Appendix A8.–Aerial survey counts of Chinook salmon escapement, Ugashik District, 1987–2007.

Year	Ugashik River	Dog Salmon River [a]	King Salmon	Painter Creek	Pumice Creek	Old Creek	Total
1987	54 [b]	751	981	1,051	1,602	1,155	5,594
1988	249 [d]	900	5,820	1,170	1,025	660	9,824
1989	226 [c,d]	848	1,670	1,030	510	520	4,804
1990	67 [b,d]	540	1,500	590	450	610	3,757
1991	131 [b,d]	449	700	365	375	420	2,440
1992[e]	260 [b,d]	821	1,260	855	750	815	4,761
1993	188 [b,d]	579	1,970	865	450	635	4,687
1994[e]	233 [b,d]	1,741	2,225	1,005	2,530	1,490	9,224
1995	149 [b,d]	882	440	366	501	505	2,843
1996	76 [b,d]	1,079	1,200	403			2,758
1997	839 [b,d]	906	802	525	536	558	4,166
1998	458 [b,d]	1,411	883	1,230	352	438	4,772
1999	237 [b,d]	535		166	340	213	1,491
2000	26 [b]	425		314	339	246	1,350
2001	346 [b,c,d]	929	828	563	646	530	3,842
2002	618 [b,c,d]	1,121	430	472	586	408	3,635
2003	469 [b,c,d]	1,053	334	490	596	351	3,293
2004	309 [b,c,d]	1,640	1176	1069	470	374	5,038
2005	[f]	[f]	[f]	[f]	124 [g]	54 [g]	178
2006	53	195	- [f]	- [f]	2,100	201	2,549
Average	263	884	1,389	696	752	536	4,050
2007	38	308	220	2	4,700	785	6,053

[a] Includes Figure-Eight, Goblet, Oldham, and Wandering creeks.

[b] Tower count plus later aerial survey counts of main river.

[c] Tower counts.

[d] Survey included Grassy Creek (tributary downstream of Ugashik Lagoon).

[e] Helicopter surveys.

[f] Flown but no estimate.

[g] New observer counts not reliable.

Appendix A9.–Aerial survey counts of chum salmon escapement, Ugashik District, 1987–2007.

Year	Ugashik River	Dog[a] Salmon River	King Salmon River	Painter Creek	Pumice Creek	Old Creek	Other	Total
1987	130 [b]	340	9,750	2,290	10,340	2,090	40	24,980
1988	752 [b,c]	2,290	25,000	10,500	11,650	5,800	950	56,942
1989	600 [b,c]	1,005	7,500	3,700	2,200	2,010	625	17,640
1990	312 [b,c]	170	6,200	1,150	1,630	410	10	9,882
1991	315 [b,c]	240	7,400	750	2,550	2,525	130	13,910
1992[d]	510 [a,b,c]	1,210	8,525	4,000	14,000	15,000	0	43,245
1993	93 [c,e]	105	7,000	720	2,040	1,025	8	10,991
1994[d]	66 [c,e]	851	9,150	1,625	12,750	6,975	150	31,567
1995	6 [c,e]	160	3,900	1,370	2,600	1,800	0	9,836
1996	138 [c]	85	16,500	700	7,400	2,500	0	27,323
1997	100 [c,e]	450	10,500	4,200	5,300	9,480	115	30,145
1998	607 [c,e]	840	10,600	3,800	2,000	4,350	224	22,421
1999	278 [c,e]	400	[f]	650	1,660	2,020	50	5,058
2000	7 [c]	510	[f]	2,150	7,300	5,850		15,817
2001	78 [c,e]	1,140	8,100	6,000	13,500	7,800	200	36,818
2002	0 [c,e]	1,000	8,200	3,100	5,100	4,200	100	21,700
2003	142 [c,e]	1,130	5,500	8,000	4,000	3,000	50	21,822
2004	24 [c,e]	950	1,800	20,000	5,700	5,000	50	33,524
2005	NA [f]	NA [f]	NA [f]	NA [f]	1310 [g]	2030 [g]	NA [g]	3,340
2006	140	940	NA [f]	NA [f]	15,150 [g]	830 [g]	NA	17,060
Average	226	727	9,102	4,150	6,409	4,235	159	22,701 [h]
2007	290	450	10,000	1	20,300	15500	NA	46,541

Note: Blank cells represent no data.

[a] Includes Figure-Eight, Goblet, Oldham, and Wandering creeks.

[b] Included tower count plus later aerial survey count.

[c] Helicopter surveys.

[d] State tower counts, Federal tower count was 5,700 in 2001, 870 in 2002, and 630 in 2003.

[e] Survey included Grassy Creek (tributary downstream of Ugashik Lagoon).

[f] Average of the sums of indices for all locations.

[g] New observer counts not reliable.

[h] Flown but no estimate.

Appendix A10.–Aerial survey counts of coho salmon escapement, Ugashik District, 1987–2007.

Year	Number of Surveys	Salmon Counts	Comments
1987	2	17,000	16,700 in King Salmon River on August 23.
1988	7	28,280	12,900 in King Salmon River on September 7.
1989	4	11,515	7,615 observed on August 14.
1990	5	12,610	
1991	0	400	Incidental observation made August 12.
1992[a]	0	790	Incidental observation made August 11.
1993	0	705	Incidental observation made August 16.
1994[a]	0	760	Incidental observation made August 11.
1995	0		
1996 [b]	1	8,275	Surveyed on September 27 and 28.
1997 [b]	2	9,400	Surveyed on September 30 and October 17.
1998 [b]	1	1,459	Surveyed on November 19.
1999[b]	1	10,210	Surveyed on October 14.
2000[b]	1	12,070	Surveyed on October 12.
2001[b]	1	4,540	Surveyed on September 27.
2002[b]	1	3,805	Surveyed on September 22.
2003[b]	1	19,670	Surveyed on September 21.
2004[bc]	1	5,440	Surveyed on September 26.
2005	1	9,850	Surveyed on September 20.
2006	1	20,100	Surveyed on September 28.
2007	1	1,102	Surveyed on September 11.

Note: Blank cells represent no data.

[a] Helicopter survey.

[b] Surveys are of selected areas in the Ugashik Lakes, King Salmon, and Dog Salmon River drainages.

[c] In 2004, surveys of Painter, Old, and Pumice creeks could not be completed; 5,360 coho salmon were counted from the Ugashik Lakes area and it was the second highest count for this area in 9 years.

Appendix A11.–Spawner distribution and total escapement estimates of sockeye salmon, Wood River system, 1987–2007.

	Spawner Distribution (%)			
Year	Creeks	Beaches	Rivers	Total Escapement[a]
1987	27.6	56.1	16.3	1,337,000
1988	31.0	44.4	24.6	866,800
1989	19.6	28.9	51.5	1,186,400
1990				1,069,400
1991			19.0	1,159,900
1992	24.9	56.7	18.4	1,286,300
1993	40.9	34.1	25.0	1,176,100
1994	25.5	36.4	38.1	1,471,900
1995	33.5	52.9	13.6	1,482,200
1996	25.8	39.3	34.9	1,649,600
1997	15.6	60.8	23.6	1,512,400
1998	20.0	66.2	13.8	1,755,800
1999				1,512,400
2000				1,300,000
2001				1,458,700
2002				1,283,700
2003				1,459,800
2004				1,543,400
2005	39.8	46.6	13.6	1,496,600
2006	12.5	55.0	32.5	4,008,100
Mean	27.0	48.0	25.0	1,500,825
2007	21.0	35.0	44.0	1,528,086

Note: Blank cells represent no data.

[a] Estimated from Wood River tower counts. Rounded to the nearest hundred.

Appendix A12.–Aerial estimates of sockeye salmon escapements, Togiak District, 1987–2007.

Year	Togiak River & Tributaries[a]	Kulukak Systems[b]
1987	28,600	37,800
1988	32,400	31,700
1989	19,800	10,800
1990	47,100	49,600
1991	23,700	23,900
1992	16,500	26,400
1993	15,900	31,800
1994	19,400	29,700
1995	25,500	14,600
1996	30,200	19,000
1997	20,600	8,000
1998	21,900	13,000
1999	40,200	12,300
2000	40,300	22,400
2001[c]	6,700	17,000
2002	16,200	8,500
2003		8,000
2004	3,100	
2005	3,470	
2006		
1987–2006 Mean (20-Year)	22,865	21,441
1987–1996 Mean (10-Year)	25,910	27,530
1997–2006 Mean (10-Year)	19,059	12,743
2007		

Note: All counts are rounded to the nearest hundred.

[a] Estimates do not include fish spawning above the counting tower (Togiak Lake outlet); estimates for Ungalikthluk, Osviak, Matogak, and Slug rivers are not included in the 1977–1994 data as reported in Bristol Bay Data Reports 73 and 81.

[b] Includes Kulukak River, Kulukak Lake, and Tithe Creek Ponds.

[c] Togiak count includes only the Togiak mainstem and Ongivinuk Rivers.

Appendix A13.–Peak aerial counts of live sockeye salmon, Togiak River drainage, 1987–2007.

Year	Togiak Mainstem	Gechiak River	Pungokepuk River	Narogurum River	Kashaiak River	Ongivinuk River	Total
1987	5,200	3,600	600	0	0	4,900	14,300
1988	9,400	2,000	1,100	0	0	3,700	16,200
1989	7,600	1,500	630			150	9,880
1990	8,770	5,720	5,980	0	2,550	1,190	24,210
1991	7,990	1,640	1,220			1,010	11,860
1992	3,030	1,280	1,400			2,200	7,910
1993	2,300	1,270	540			2,950	7,060
1994	3,100	560	1,870			3,900	9,430
1995	3,260	1,745	1,000		4,200	2,330	12,535
1996	9,160	2,270	150	100	240	3,190	15,110
1997	8,200	1,600	450	50	650	2,800	13,750
1998	4,890	3,100	150	10	0	2,800	10,950
1999	5,400	11,275	1,475	100	75	6,700	25,025
2000	12,600	8,100	925	150	100	775	22,650
2001	3,260					100	3,360
2002	2,050	5,000	75	1,525	0	1,450	10,100
2003							
2004	3,050					50	3,100
2005	2,790	320	120	10	120	110	3,470
2006							
Mean	5,669	3,186	1,105	195	721	2,239	12,272 [a]
Percent	46.2	26.0	9.0	1.6	5.9	18.2	100.0
2007							

Note: Blank cells represent no data.

[a] Sum of means for all streams.

Appendix A14.–Peak aerial counts of live sockeye salmon, Togiak District, 1987–2007.

Year	Togiak River [a]	Kulukak River [b]	Tithe Creek Ponds	Quigmy River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total	
1987	14,300	10,500	8,400							33,200	
1988	16,200	12,600	3,250	250	100	380	5,880	200	2,700	41,560	
1989	9,880	2,920	2,500					5,000		20,300	
1990	24,210	10,600	14,200	100	400	2,200	3,540	9,700	3,800	68,750	
1991	11,860	8,650	3,320	35	860	2,530	560	3,400	2,650	33,865	
1992	7,910	7,530	4,950	40	300	3,340	1,460	3,600	3,760	32,890	
1993	7,060	9,600	6,300					3,100	5,680	31,740	
1994	9,430	10,270	4,600	580	990	1,750	6,070	2,230	3,240	39,160	
1995	12,535	3,000	4,310	200	610	1,470	2,820	390	1,720	27,055	
1996	15,110	2,490	7,000		360	780	1,045	1,000		27,785	[c]
1997	13,750	2,300	3,000		360	780	1,045	1,000		22,235	
1998	10,950	2,175	4,300	20	900	2,600	5,010	2,300	240	28,495	
1999	25,025	3,250	3,200	1,100	2,400	750	1,400	1,625	625	39,375	
2000	22,650	6,100	5,075	125	526	1,512	1,201	2,175	575	39,939	
2001	3,360	5,140	3,500	160	370	210	4,620	740	2,340	20,440	
2002	10,100	2,375	1,875	660	1,450	1,705	371	160	0	18,696	[c]
2003		900	4,136	110	500	2,180	2,330	1,500	2,580	14,236	
2004	3,100			330	1,096	1,381	1,499	1,200	2,440	11,046	[c]
2005	3,470					1,485				4,955	[c]
2006											
Mean	12,272	5,906	4,936	285	748	1,566	2,590	2,313	2,311	29,249	[d]
Percent	42.0	20.2	16.9	1.0	2.6	5.4	8.9	7.9	7.9	100.0	
2007[e]											

Note: Blank cells represent no data.

[a] Includes all surveyed sections of Togiak River proper and all tributaries to the Togiak River.

[b] Includes surveys of Kulukak Lake. Counts prior to 1977 include Kulukak Lake only and are not included in the mean.

[c] Complete count not available.

[d] Sum of means for all streams.

[e] No aerial surveys performed due to inclement weather.

Appendix A15.–Peak aerial counts of live Chinook salmon, Togiak River drainage, 1987–2007.

	Togiak River Section [a]											
Year	A	B	C	D	E	F	Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivinuk River	Total
1987	20	70	170	120	200	480	610	180	100	120	320	2,390
1988	70	70	160	160	170	710	390	180	60	70	90	2,130
1989	10	30	370			940	190	80			40	1,660
1990	230	170	680	365	805	1,085	370	125	75	400	10	4,315
1991	505	165	475	225	520	455	460	105	90	100	150	3,250
1992	150	250	440	225	450	690	250	160	70	175	105	2,965
1993	170	120	220	160		1,810 [b]	595	240	130	65	440	3,950
1994				215	815	1,580	420	215	225	570	380	4,420
1995	120	220	750	255	800	800	715	140	425	520	295	5,040
1996	75	150	160	100	255	625	335	120	120	235	325	2,500
1997	100	350	1,300	600	820	1,000	275	180	150	275	100	5,150
1998	10	20	250	50	400	1,200	400	150	275	140	275	3,170
1999	150	210	540	510	225	480	365	90	240	305	270	3,385
2000	75	50	500	400	850	1,450	350	85	125	100	75	4,060
2001	610	500	500	200	300	950	700	270	550	1,050	160	5,790
2002	140	410	820	250	390	690	400	45	65	210	125	3,545
2003				180	265	495			115	100	135	1,290
2004	198	549	1,044	603	657	1,598	90	320	666	239	198	6,162
2005	117	414	927	576	635	1,139	144	170	360	265	347	5,094
2006[d]												
Mean	162	220	547	289	503	957	392	159	213	274	202	3698 [c]
Percent	4.4	6.0	14.8	7.8	13.6	25.9	10.6	4.3	5.8	7.4	5.5	100.0
2007[d]												

Note: Blank cells represent no data.

[a] Section A: Togiak Bay - Gechiak River
Section B: Gechiak River - Pungokepuk River
Section C: Pungokepuk River - Nayorurun River
Section D: Nayorurun River - Kashaiak River
Section E: Kemuk River - Ongivinuck River
Section F: Ongivinuck River - Togiak Lake

[b] Includes count for Section E.

[c] Sum of means for all streams.

[d] No aerial surveys performed due to inclement weather.

Appendix A16.–Peak aerial counts of live Chinook salmon, Togiak District, 1987–2007.

Year	Togiak River [a]	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
1987	2,390		300	30	40		660	80	3,500
1988	2,130	10	490	0	40	0	650	170	3,490
1989	1,660		740				560		2,960
1990	4,315	30	635	75	60	0	930	25	6,070
1991	3,250	25	285	75	100		1,175	55	4,965
1992	2,965	15	485	40	105	30	490	35	4,165
1993	3,950		1,140	80	110	100	830	70	6,280
1994	4,420	20	835	40	60	10	540	190	6,115
1995	5,040	35	430	65	135	50	740	80	6,575
1996	2,500	35	698	35	71	30	402		3,771
1997	5,150	10	310	50	65	33		10	5,628
1998	3,170	45	375	92	58	39	75	25	3,879
1999	3,385	10	240	105	40	150	345	130	4,405
2000	4,060	26	340	65	42	6	1,100	226	5,865
2001	5,790	24	330	58	84	2	201	74	6,563
2002	3,545	28	860	54	62	7	1,203	161	5,920
2003	1,290	17	360	28	99	66	466	40	2,366 [b]
2004	6,162	4	594	17	63	15	720	60	7,635
2005	5,094	16	447	133	202	90	255	396	6,633
2006		15		140	680				835
Mean	3,698	21	521	62	111	39	630	107	4,881 [c]
Percent	75.8	0.4	10.7	1.3	2.3	0.8	12.9	2.2	100.0
2007									[d]

Note: Blank cells represent no data.

[a] Includes all surveyed sections of Togiak River proper and all tributaries to the Togiak River.

[b] Partial aerial survey for Togiak District.

[c] Sum of means for all streams.

[d] No valid survey data.

Appendix A17.–Peak aerial counts of live chum salmon, Togiak River drainage, 1987–2007.

	Togiak River Section [a]												
Year	A	B	C	D	E	F		Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivinuk River	Total	
1987	12,000	9,400	2,700	500	13,200	33,000		2,600	1,200	4,100	700	13,100	92,500	
1988	10,000				4,900	3,800		3,700	5,000	3,500	200	3,800	34,900	
1989		2,600	2,100		5,000	8,100		290	700			1,200	19,990	
1990	2,200	1,275	1,350	400	650	4,200		3,150	1,150	3,400	250	125	18,150	
1991	10,200	3,900	2,800	600	5,500	6,000		2,300	500	3,500	800	3,480	39,580	
1992 [b]	1,800	1,800	300	100	1,200	1,500		2,000	500	1,800	900	800	22,700	[c]
1993	6,500	3,500	2,300	60		4,400	[d]	1,950	450	4,380	620	3,500	27,660	
1994				1,300	5,200	10,400		900	2,400	7,100	900	5,700	33,900	
1995	15,700	7,100	4,700	1,800	6,800	5,900		4,800	1,900	9,700	2,700	8,200	69,300	
1996	3,700	10,250	5,500	1,300	5,750	8,250		2,600	750	900	550	3,400	42,950	
1997	3,900	3,100	3,800	2,750	7,100	4,550		3,200	800	4,750	1,800	3,900	39,650	
1998	2,300	1,400	2,750	1,300	4,300	8,950		3,600	1,050	3,000	250	1,650	30,550	
1999	3,975	1,950	2,375	1,300	1,725	2,200		1,840	440	4,230	480	2,540	23,055	
2000 [e]														
2001	9,400	6,500	5,250	1,000	3,500	9,850		7,800	2,850	200	21,450	6,000	73,800	
2002	3,350	5,300	4,200	800	4,650	2,100		4,950	650	2,700	1,800	650	31,150	
2003				25	675	1,000				175	1,125	1,125	4,125	
2004	5,175	2,175	1,575	330	1,875	18,975		750	290	6,675	1,688	450	39,958	
2005	720	730	450	105	445	638		765	60	420	120	780	5,233	
2006														[e]
Mean	6,366	4,227	2,989	905	4,454	7,783	0	2,825	1,262	3,671	2,215	3,506	36,850	[f]
Percent	17.3	11.5	8.1	2.5	12.1	21.1		7.7	3.4	10.0	6.0	9.5	100.0	
2007														[g]

Note: Blank cells represent no data.

[a] Section A: Togiak Bay - Gechiak River
Section B: Gechiak River - Pungokepuk River
Section C: Pungokepuk River - Narogurum River
Section D: Narogurun River - Kashaiak River
Section E: Kemuk River - Ongivinuck River
Section F: Ongivinuck River - Togiak Lake

[b] No aerial surveys conducted.

[c] Counts by section are not representative due to post-peak survey, and are not included in the mean.

[d] Preferred total estimate; management survey count conducted 7/15/92.

[e] Includes count for Section E.

[f] Sum of means for all streams.

[g] No valid survey data

Appendix A18.–Peak aerial counts of live chum salmon, Togiak District, 1987–2007.

Year	Togiak River [a]	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
1987	92,500	1,500	22,000	2,300	2,160				120,460
1988	34,900	10,800	35,000	12,000	17,400	7,600	400	11,300	129,400
1989	19,990	2,820	5,580	7,450	4,900		560		41,300
1990	18,150	555	5,550	1,475	2,300	3,650	750	1,300	33,730
1991	39,580	4,420	9,540	4,730	8,700		120	3,020	70,110
1992	22,700 [b]	600	4,800 [b]	4,400	7,100	1,700	100	4,000	45,400
1993	27,660		6,950	1,970	1,360	3,060	20	4,020	45,040
1994	33,900	890	10,700	1,630	2,000	4,360	230	1,090	54,800
1995	138,600	2,200	7,600	5,200	13,920	6,440	1,000	7,200	182,160
1996	42,950	960	7,560	560	810	2,670	40		55,550
1997	39,650	1,700	4,550	3,000	2,500	1,890			53,290
1998	30,550	2,630	2,700	4,980	3,870	1,060	150	1,300	47,240
1999	23,055	1,340	3,430	5,700	3,650	4,750	410	11,360	53,695
2000		2,870	4,950	9,090	10,880	4,150	200	5,520	37,660
2001	75,600	2,590	22,300	2,840	2,220	5,570	220	5,480	116,820
2002	31,150	3,300	15,400	7,600	6,360	800	530	6,940	72,080
2003	4,125 [c]	720	3,425	1,340	3,480	1,030	30	4,970	14,995
2004	39,958	1,080	5,831	2,310	1,970	416	100	250	51,915
2005	5,233	8,100	790	17,200	15,300	1,350	1,760	4,440	54,173
2006		5,200		3,720	4,530				13,450
Mean	39,785	2,726	9,403	5,041	5,836	3,156	389	4,813	67,359 [d]
Percent	59.1	4.0	14.0	7.5	8.7	4.7	0.6	7.1	100.0
2007									[e]

Note: Blank cells represent no data.

[a] Includes all surveyed sections of Togiak River proper and tributaries to the Togiak River.

[b] Preferred estimate from a management survey due to post-peak spawning ground survey.

[c] Partial aerial survey data.

[d] Sum of means for all streams.

[e] No valid survey data.

Appendix A19.–Peak aerial counts of live coho salmon, Togiak River drainage, 1987–2007.

	Togiak River Section [a]						Mainstem	Gechiak	Pungokepuk	Narogurum	Kashaiak	Ongivinuk	
Year	A	B	C	D	E	F	Total	River	River	River	River	River	Total
1987	340	500	250	200	240	530	2,060	1,020	70			1,060	4,210
1988	950	370		140	210	360	2,030	1,530				4,100	7,660
1989													
1990	1,650	390	400	0	540	660	3,640	920	450	260	130	1,730	7,130
1991	4,900	400	700	600	1,680	140	8,020					100	140 [b]
1992	4,420	1,120	1,180	540	2,940	3,080	13,280	5,240	1,440	780	1,500	4,460	26,700
1993													
1994								1,290 [b]	220 [b]	120 [b]	95 [b]	1,930	3,655
1995								1,450			200	1,180	2,830
1996	2,550	1,090	150	250	1,600	5,020	10,910	2,080	1,170	575	725	6,450	21,910
1997	600	200	400	100	400	1,800	3,500	1,000	650	350	475	900	6,875
1998	460	625	100	100	310	1,075	2,670	2,550	575	400	500	1,750	8,445
1999	250	75	50	25	100	75	575	275	35	100	25	175	1,185
2000													
2001													
2002													
2003													
2004													
2005													
2006													
Mean	1,791	530	404	217	891	1,416	5,187	1,736	576	369	456	2,167	8,249 [c]
Percent	21.7	6.4	4.9	2.6	10.8	17.2	62.9	21.0	7.0	4.5	5.5	26.3	100.0
2007													

Note: Blank cells represent no data.

[a] Section A: Togiak Bay - Gechiak River
Section B: Gechiak River - Pungokepuk River
Section C: Pungokepuk River - Narogurum River
Section D: Narogurum River - Kashaiak River
Section E: Kashaiak River - Ongivinuck River

[b] Timing of aerial surveys did not coincide with the period of peak spawning activity, and therefore, counts were not included in the mean or percent.

[c] Sum of means for all streams.

Appendix A20.–Peak aerial counts of live coho salmon, Togiak District, 1987–2007.

Year	Togiak River [a]	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
1987	4,210	30	910	440	120			130	5,840
1988	8,590	460	1,840	310	490	470	370	3,170	15,700
1989									
1990	7,130	1,029	5,195	2,675	1,491	810		4,153	22,483
1991	140		4,200						4,340 [b]
1992	26,700		12,640						39,340
1993									
1994									
1995		855	1,185	1,392	1,080	1,149		5,196 [c]	10,857
1996	21,660	1,211	10,290	3,062	2,805	1,944	851	5,917	47,740
1997	6,875	325	1,675	150	1,046	1,397		1,690	13,158
1998	8,445	390	3,650	1,785	2,001	523		2,770	19,564
1999	1,185	169	500	220	213	117	95	450	2,949
2000									
2001		149		372	370	418			1,309
2002		421		597	539	62		1,027	2,646
2003		680	1,610	1,620					3,910
2004									
2005									
2006			1,539						
Mean	9,437	520	3,770	1,148	1,016	766	439	2,723	14,603 [d]
Percent	64.6	3.6	25.8	7.9	7.0	5.2	3.0	18.6	100.0
2007									

Note: Blank cells represent no data.

[a] Includes all surveyed sections of Togiak River proper and tributaries to the Togiak River.

[b] Timing of aerial surveys did not coincide with the period of peak spawning activity, and therefore, counts were not included in the mean or percent.

[c] Negukthlik and Ungalikthluk rivers combined.

[d] Sum of means for all streams.