2A94-34

SALMON SPAWNING GROUND SURVEYS IN THE BRISTOL BAY AREA, ALASKA, 1994

By

Keith A. Weiland

Richard B. Russell

Jeffrey R. Regnart

Thomas E. Brookover

Regional Information Report[1] No. 2A94-34

Alaska Department of Fish and Game
Division of Commercial Fisheries Management and Development, Central Region
333 Raspberry Road
Anchorage, Alaska 99518

November 1994

---

[1]Contribution 2A94-34 from the Anchorage Regional office. The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate needs for up-to-date information, reports in this series may contain preliminary data.

AUTHORS

Keith Weiland is the Ugashik Area Management Biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, 333 Raspberry Road, Anchorage, AK 99518.

Richard B. Russell is the Region II Area Management Biologist (East Side, Bristol Bay) for the Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, P.O. Box 37, King Salmon, AK 99613-0037.

Jeffrey R. Regnart is the Naknek/Kvichak Area Management Biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, 333 Raspberry Rd, Anchorage, AK 99518.

Thomas E. Brookover is the Region II Area Management Biologist (West Side, Bristol Bay) for the Alaska Department of Fish and Game, Division of Commercial Fisheries, P.O. Box 230, Dillingham, AK 99576-0230.

ACKNOWLEDGMENTS

We would like to thank the U.S. Fish and Wildlife Service for equipment, personnel support and funding they provided to help gather escapement data in 1994. Critical review of this manuscript by Stephen M. Fried is gratefully acknowledged.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIX TABLES

LIST OF APPENDIX TABLES (Continued)

LIST OF APPENDIX TABLES (Continued)

ABSTRACT

Aerial surveys were conducted during 1994 in the Naknek-Kvichak, Egegik, Ugashik, Nushagak, and Togiak Districts of Bristol Bay, Alaska, to assess salmon escapement abundance and distribution. Alagnak River aerial counts totaled 245,595 sockeye, 8,480 chinook, and 62,900 chum salmon. Total sockeye salmon escapements estimated from tower counts for the Kvichak and Naknek Rivers were 8,337,840 and 990,810, respectively. Naknek River drainage aerial counts for chinook salmon spawners yielded a total of 9,678. Egegik District aerial counts totaled 2,304 chinook, and 2,937 chum salmon. The total sockeye salmon escapement estimated from tower counts for the Egegik River was 1,967,730 fish, which was the third largest tower count recorded for this system. Ugashik District aerial counts totaled 14,210 sockeye (Dog Salmon and King Salmon Rivers), 9,158 chinook, and 31,531 chum salmon. Ugashik River tower counts totaled 1,080,858 sockeye salmon. Spawning escapements of salmon in the Nushagak-Mulchatna River system were estimated using sonar at Portage Creek and totaled 509,326 sockeye, 95,954 chinook, 378,928 chum, 191,772 pink, and 82,019 coho salmon. Sockeye escapements were estimated from tower counts in the Wood and Igushik Rivers, and totaled 1,471,890 and 445,920 fish, respectively. The sockeye escapement in the Togiak Lake system was estimated from tower counts at 154,752, while aerial surveys of Togiak River and its tributaries downstream of the tower yielded an additional inriver escapement estimate of 19,420. The escapement estimate for sockeye salmon in Togiak River and Togiak Lake combined was 174,172. The sockeye salmon escapement estimate for the Kulukak Bay drainage was estimated at 29,740. Chinook and chum salmon escapements for the Togiak and Kulukak Rivers combined were estimated at 17,203 chinook and 203,750 chum salmon. Weather prevented aerial surveys for most of the Togiak District river systems during the peak of coho salmon spawning.

KEY WORDS: Sockeye salmon, chinook salmon, chum salmon, pink salmon, coho salmon, Bristol Bay, spawning escapement enumeration, population estimation, aerial surveys.

INTRODUCTION

Aerial surveys of salmon spawning streams have been conducted in the Bristol Bay area of Alaska (Figure 1) for many years to provide biologists with information regarding the abundance and distribution of sockeye salmon (*Oncorhynchus nerka*), chinook salmon (*O. tshawytscha*), chum salmon (*O. keta*), pink salmon (*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. The data collected is used to: (1) evaluate escapement goals and escapement/return relationships, (2) forecast future returns, (3) identify possible management problems relating to escapements, and (4) contribute to strategies designed to alleviate escapement problems. This report summarizes the 1994 salmon spawning ground surveys conducted in the Bristol Bay area.

Naknek/Kvichak District

The Naknek-Kvichak District is comprised of three 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 escapements have been estimated using counting towers located on the mainstem river approximately one quarter mile downstream of Lake Iliamna's outlet. From 1957 to 1976, Alagnak River sockeye escapements were estimated using a counting tower located near the upper extent of tidal influence. Since 1977, all Alagnak sockeye escapements have been estimated using aerial surveys. From 1950 to 1957, sockeye escapements to the Naknek River system were counted using a weir on the mainstem river just upstream of the tidal influence. From 1958 to the present, escapements have been estimated using counting towers near the Naknek River 'Rapids' downstream of the outlet of Naknek Lake. All escapement estimates of other salmon species into Naknek-Kvichak District drainage have been approximated using aerial surveys.

Egegik District

The Egegik River system contains two major watersheds: (1) the Egegik River, emanating 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 Egegik village.

From 1952 through 1956, a weir was used in the Egegik River to count sockeye salmon escapements. The weir was located near the base 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 escapements. Escapements for other salmon species have been estimated using aerial surveys.

Ugashik District

The Ugashik River system is comprised of four 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 three major runoff tributaries, and (4) Dago Creek, emitting from a large lowland coastal area (Figure 4). All of these watersheds 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 escapements. From 1957 to the present, sockeye escapements have been estimated using counting towers situated between the outlet of Lower Ugashik Lake and Ugashik Lagoon. Escapements for other salmon species have been estimated using aerial surveys.

Nushagak District

The Nushagak watershed is comprised of four major rivers: (1) the Wood River, draining Grant, Kulik, Beverley, Nerka, and Aleknagik Lakes, (2) the Nushagak River, draining the 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 through 8). All these systems empty into Nushagak Bay.

Sockeye escapement in the Wood River Lake system is estimated from counting towers at the outlet of Lake Aleknagik. Sockeye spawner distribution within the Wood River Lake system is assessed each year by aerial surveys, conducted by the department, and by ground surveys, conducted on major creeks and some rivers of the system by the University of Washington, Fisheries Research Institute.

Sockeye salmon distribution in the Wood River Lake system is an important element in establishing escapement goals and measuring management success for this system. The few interconnecting rivers between the large lakes in the system are primarily used by three-ocean sockeye for spawning, while the lake beaches and tributary streams are used more by two-ocean sockeye. Knowledge of the age composition of returning sockeye gives managers the ability to use a variable escapement goal policy to attempt to minimize overcrowding of spawners in the interconnecting rivers while taking

advantage of the extensive beach spawning areas and numerous tributary streams. Surveys of the actual spawning distribution within the creeks, rivers, and beaches of the system provide a measure of management success in obtaining the desired spawning distribution.

A sonar project, located on the Nushagak River below Portage Creek and approximately 32 km (20 miles) upstream from the river mouth, is used to estimate escapement of all salmon species that spawn in the Nushagak drainage. Although reliable estimates of spawning escapements for all species of salmon have been produced by the sonar project for several years, aerial surveys of the Nushagak-Mulchatna system were conducted until recently to provide comparisons with the sonar estimates and to document spawner distribution for all species except coho salmon. Chum salmon surveys were discontinued in the Nushagak District in 1980, and all Nushagak-Mulchatna surveys were discontinued in 1991 due to lack of funding.

Distribution of spawning sockeye in the Tikchik Lake system based on aerial surveys has not been documented since 1991. The Tikchik Lakes system usually gets the majority of sockeye salmon that enter the Nushagak River. However, 1990 and 1991 sockeye salmon spawners were most abundant in the Nushagak-Mulchatna system, with below averages numbers in the Tikchik Lakes system. The most recent spawner distribution information obtained for salmon in the Nushagak-Mulchatna and Tikchik Lake drainage was presented in Russell, et al.(1992)

Sockeye escapement is measured in the Igushik Lakes system at a counting tower located at the outlet of Amanka Lake. Spawner distribution has not been documented annually, and surveys have not been conducted on the Igushik system for sockeye salmon and other species since 1991 (Russell, Regnart, and Brookover 1992). Spawning escapement and distribution of sockeye salmon in the Snake Lake system used to be estimated annually by aerial surveys, but funding was not available for these surveys from 1991 through 1993.

In 1994, the operating budget did not contain enough money to conduct aerial surveys within the Nushagak District. However, funding was obtained from the University of Washington, Fisheries Research Institute (FRI), to conduct aerial surveys of the Wood River Lakes system sockeye spawning population. Private funding enabled aerial surveys of the Tikchik Lake system as well. Interest in the Tikchik Lake system was generated by reports of very low numbers of spawning sockeye in 1994. Surveys were partly funded for Nushagak-Mulchatna chinook escapements.

Togiak District

The Togiak District includes two major river drainages: (1) the Togiak River, draining Togiak, Gechiak, Pungokepuk, and Ongivinuck

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 Tithe Creek Ponds and the Quigmy, Matogak, Osviak, Slug, Negukthlik, and Ungalikthluk Rivers. The Kulukak River and the Tithe Creek Ponds 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.

For the fourth consecutive year, the operating budget did not contain sufficient funds to conduct aerial surveys in the Togiak District. However, the U.S. Fish and Wildlife Service and Togiak National Wildlife Refuge (TNWR), again donated an aircraft and pilot, or funding for a charter aircraft for surveys in the District.

METHODS

All survey flights were conducted from small fixed-wing, high-wing, wheeled aircraft (Super Cub, Cessna 180, Cessna 185, or Cessna 206) or helicopter (Robinson R-22) chartered from local air charter companies and flown by experienced survey pilots. Several surveys in the Togiak National Wildlife Refuge (TNWR) were flown by refuge staff pilots in U.S. Fish and Wildlife Service (USFWS) aircraft. Fish were counted by Department of Fish and Game or USFWS biologists familiar with the streams and target species. Counts were made from low altitudes (200 to 400 feet) at air speeds of 50 to 80 mph. Polaroid sunglasses and aircraft positioning were used to minimize effects of glare off the water. Surveys were scheduled to coincide as closely as possible to the historic peak of spawning for the target species, taking into account weather, water conditions, and aircraft availability. Peak of spawning was defined as that point when the greatest number of spawning fish are occupying redds. Counts were registered on a hand tally counter or on a tape player. This information was transferred to survey data forms either sometime during the survey or upon returning to the office.

Aerial spawning ground surveys account for only a portion of the known spawning populations (Evzerof, 1975; Nielson and Green, 1981;

Rogers, 1984). At the time of each survey, some of the salmon have yet to reach the spawning grounds, some have already spawned and died, some are still schooled, and some are either mis-identified or not seen. Methods used to interpret aerial survey counts are described below for each commercial fishing district.

Naknek/Kvichak District

Aerial surveys were flown during late summer and fall to assess escapements of sockeye, chinook, and chum salmon in portions of the Naknek-Kvichak District. Salmon counts for these drainage are indices of the total number of each species present in the spawning area at the time of the survey. Two surveys were flown, August 8 and 17, to provide estimates of Alagnak River drainage sockeye, chinook, and chum escapements. Additionally, all major chinook spawning areas in the Naknek River drainage were surveyed between July 29 and August 24, and the Kvichak River chinook escapement survey was flown August 12. These survey counts were not expanded to provide instantaneous population estimates, although expansions have been made in some earlier years based on subjective criteria. Counting towers were used to estimate total sockeye salmon escapements to the Kvichak and Naknek Rivers. A late summer survey of sockeye salmon spawning distribution in the Kvichak River system was completed August 12, 15, and September 7, and the results were documented in Regnart (1994). All aerial survey counts in the district were made by ADF&G, Commercial Fisheries Management and Development Division staff.

Egegik District

No system-wide aerial surveys were flown for sockeye salmon in 1994. Aerial surveys of all known chinook and chum salmon spawning areas in both the Egegik and King Salmon Rivers were flown on July 27 and August 6. With funding provided by U.S Fish and Wildlife Service, aerial surveys were flown on September 26 and 27 to estimate coho salmon escapements. All survey counts in the Egegik District reflect only the actual numbers of salmon sighted and should be considered an index of abundance only.

Ugashik District

Salmon counts in the Ugashik District reflect the actual numbers of salmon sighted on the spawning grounds. The August 11 aerial survey counts should be considered only an index of total abundance.

Nushagak District

Survey and data analysis for the Nushagak District were similar to those described by Nelson (1979), Bucher (1981), and Russell, Bill and Bucher (1990).

Peak aerial counts for sockeye salmon in the Wood, Igushik, Snake, and Tikchik Lakes systems have generally accounted for 50% (range 29%-65%) of the total escapements estimated at towers or weirs on those systems (Nelson, 1967 and 1979). In the Igushik, Snake, and Tikchik systems, peak aerial counts of sockeye salmon are typically doubled to estimate total escapement. However, other adjustments may be applied at the discretion of the surveyor depending on weather, visibility, and survey timing. In the Wood River system, sockeye salmon escapements for each spawning stream, beach, or river have been estimated using the proportion of sockeye salmon observed at a given location in relation to the total tower count. Different expansion factors have been assigned to each type of spawning habitat. For a more detailed description of the analysis of Wood River survey counts, see Nelson (1973).

Togiak District

Survey and data analysis methods used in the Togiak District are also similar to methods described by Nelson (1979), Bucher (1981), and Russell, Bill, and Bucher (1990). Aerial surveys of spawning sockeye, chinook, chum, and coho salmon were conducted at the peak of spawning for each species, using criteria similar to Nelson (1979) and Bucher (1981). Survey coverage was divided between a U.S. Fish and Wildlife Service observer and an ADF&G observer. Comparative counts between the two observers can be found in Russell, Regnart, and Brookover (1992 and 1993).

Aerial survey counts for sockeye salmon in the Togiak Lake system above the counting tower have generally accounted for 47% (range: 40%-50%) of the escapements estimated at the tower (Nelson 1967). Therefore, aerial counts of sockeye salmon in systems without counting towers (i.e. Kulukak River and the mainstem and tributaries of the Togiak River below the towers) were multiplied by 2.0 to estimate total escapement. Since 1980, aerial counts of chinook salmon in the Togiak District have typically been multiplied by 2.5 to estimate total escapement. Since 1968, aerial counts of chum salmon have generally been multiplied by 2.0 (Nelson 1968). Since 1978, pink salmon escapements have also been estimated by multiplying aerial counts by 2.0. 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 adjusted 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 conducted on August 8 and 17. The sockeye salmon escapement index count totaled 242,595 for this system

(Table 1). This count was approximately 19% above the mean (1977-1993) aerial count of 204,000, and was approximately 31% greater than the escapement point goal of 185,000. Total sockeye salmon escapement into this system was probably greater than the index count, which was not expanded to represent an estimate of total escapement. Historic sockeye salmon escapement data for the Alagnak River drainage is listed in Appendix Table 1. Total sockeye salmon escapements estimated from 1994 tower counts for the Kvichak and Naknek Rivers were 8,337,840 and 990,810 respectively (Appendix Table 1).

Aerial surveys of chinook salmon escapements into the Naknek River drainage were flown from July 29 through August 24. Chinook salmon escapement counts were made in each of the four main spawning areas: mainstem Naknek River, Big Creek, King Salmon Creek, and Paul's Creek. A total of 9,678 chinook salmon were counted. The largest components of this total were counts of 2,531 chinook in Big Creek on August 16, and 5,970 chinook in the mainstem Naknek River on August 24 (Table 2). Over the period from 1970-1993 there have been 14 years in which chinook salmon escapement indices have been obtained from all four main spawning areas (Appendix Tables 2-6). The chinook escapement index for these 14 years has ranged from a low of 2,691 in 1992 to a high of 11,730 in 1988. The 1994 count was the second largest on record, and well above the 1970-1993 average count of 5,009.

The Alagnak River drainage chinook salmon escapement was surveyed on August 8, yielding a count of 10,170 fish (Table 2). From 1970-1993, Alagnak chinook salmon counts have ranged from a low of 824 in 1973 to a high of 11,650 in 1978 with an average of 4,079 fish (Appendix Table 9). The 1994 count was about twice the average . An aerial survey of chinook salmon escapement into the Kvichak River was conducted on August 12 and yielded a count of 306 fish (Table 2). Counts from 1970-1994 are listed in Appendix Table 9, and the 1994 Kvichak River count was 18% above average.

The Naknek-Kvichak District chinook escapement index, the sum of counts for the Alagnak, Kvichak and Naknek river drainage, was 18,464 fish (Table 2). This total is the largest count on record and about twice the average count of 8,991 (Appendix Table 9). The District's commercial harvest of 6,100 chinook salmon was about average.

Chum salmon were counted only during the August 8 Alagnak River aerial surveys (Table 2). The Alagnak River has been the principal chum salmon producing system in the Naknek-Kvichak District. A total of 62,900 spawning chum salmon were observed during the 1994 survey. The 1994 chum count was approximately twice the 1963-1993 average count of 31,600 (Appendix Table 10).

No surveys were flown to count pink salmon escapements into the Naknek-Kvichak District drainage during 1994. Historic pink salmon

escapement index counts for the Alagnak River, Kvichak River, and Naknek River from 1966-1994 are recorded in Appendix Tables 11-13.

Escapement surveys for coho salmon were not flown in Naknek-Kvichak District drainage during 1994 since funding was not available. A conservative approach to the commercial fishing season was initiated this season, and a three-day weekly period was announced at the beginning of the coho season. Average to slightly below average daily and cumulative commercial catch statistics resulted in the weekly fishing period staying at three days per week for the entire coho season.

Egegik District

The 1994 Egegik River sockeye escapement past the counting towers was 1,966,000 fish, the third largest count on record for this system. Although no system-wide aerial surveys were flown, small numbers of sockeye salmon were observed in in Shosky Creek, and Lake 592, a tributary of Contact Creek. No surveys to determine the distribution of sockeye salmon within the Egegik River system were flown since funding was not available.

Aerial surveys of all known chinook spawning areas were conducted August 6, yielding a total count of 2,304 chinook salmon (Table 3). This total was 88% above the 1981-1993 average count of 1,234 (Appendix Table 14). Contact Creek showed the most improved escapement count with a total of 705 fish, over three times its average count of 167.

The commercial harvest of 1,231 chinook salmon in the Egegik District was 57% below the 1974-1993 average harvest of 2,893. The closure of the commercial fishery from June 16 to June 23 facilitated passing chinook salmon through the commercial fishing district. Overall it was estimated that the 1994 Egegik District chinook salmon run was slightly below average.

A total of 2,937 chum salmon were counted during aerial surveys of all known spawning areas within the Egegik District on July 27 and August 6 (Table 4). Compared to the 1982-1993 average escapement count of 13,325, the 1994 count was well below average (Appendix Table 15). The 1994 commercial chum harvest from the Egegik District was approximately 57,222 fish, 39% below the 1974-1993 average of 94,000. Escapement counts of less than 10,000 chum salmon have been recorded in the district in each of the last six years, which greatly concerns district managers. However, due to the murky water, daily monitoring of chum and chinook salmon can not be accomplished without either a weir or hydroacoustic equipment. Since the peak of the chum salmon run closely overlaps the peak of the sockeye salmon run, the much less abundant chum salmon resource suffers when extended commercial fishing is needed to harvest surplus sockeye salmon.

An aerial pink salmon count was made incidentally to counting chinook and chum salmon on the August 6 survey. The 1994 District count of 605 was well below the even-numbered year counts of several thousand fish. However, the August 6 survey was about three weeks earlier than past surveys. Because of a lack of funding, no other surveys could be made to document pink salmon abundance. The commercial catch was minimal, with less than 100 fish reported, and well below the 1974-1993 even-year average of 5,000 (Appendix Table 16).

The coho salmon escapement was documented with aerial surveys conducted on September 26 and 27. Funding for these surveys was provided by the U.S. Fish and Wildlife Service. A total of 7,412 coho salmon were counted in the King Salmon and Egegik Rivers and in numerous tributaries of Becharof Lake. Of this total, approximately 6,200 fish were counted upstream of the Egegik River counting towers. This year, for the first ever, the Egegik River counting towers were maintained beyond the sockeye season. From July 22 through September 11 the towers were operated by U.S. Fish and Wildlife Service personnel, and a total of 10,140 coho salmon were counted. The commercial harvest of approximately 48,500 fish was significant, and well above the 1974-1993 average of 31,100 (Appendix Table 17).

Ugashik District

The 1994 sockeye salmon escapement past Ugashik River counting tower totaled 1,080,858 fish, the eleventh largest escapement on record and 54% above the point goal of 700,000. No system-wide aerial surveys documenting escapement distribution were flown because of a lack of funding. However, an additional 5,325 and 8,885 sockeye salmon were counted in the Dog Salmon and King Salmon River drainage, respectively, during chinook and chum salmon surveys (Table 5).

Chinook salmon escapement surveys of Dog Salmon, King Salmon, and Ugashik River drainage were flown on August 11, yielding a count of 9,158 for the entire system. The King Salmon River chinook count of 7,250 was the largest escapement component for the system (Table 6). The 1994 total escapement count was 79% above the 1980-1993 average escapement count of 5,101 chinook salmon (Appendix Table 18). The Ugashik District's commercial chinook salmon harvest of 3,757 was average. Overall, the Ugashik chinook salmon return was probably average to above average.

Chum salmon were also counted during aerial surveys of Dog Salmon, King Salmon, and Ugashik River drainage on August 11, yielding a total count of 31,531 chum salmon (Table 7). Surveys were judged to be near the peak of spawning abundance. The 1994 escapement was about 17% below the 1980 to 1993 average of 38,253 (Appendix Table 19). The District's commercial chum salmon harvest was

approximately 48,951 fish. The catch was 19% below the 1974-1993 average of 60,670.

The Ugashik District pink salmon run has historically been very small, and almost nonexistent during odd-numbered years. This year's reported commercial catch of 117 was well below the 1974-1993 even-numbered year average of 443 fish. A total of 425 pink salmon were seen during an aerial escapement survey flown on August 11 (Appendix Table 20).

No aerial surveys for coho salmon were made in Ugashik District drainage in 1994 because funds were not available. Daily and cumulative commercial coho catch statistics were about average and the District remained on normal fishing time for the entire coho season. Historic coho salmon escapement data is recorded in Appendix Table 21.

Nushagak District

Peak aerial estimates and total population estimates of sockeye salmon were made for the Wood River lakes system in 1994 (Table 8). Survey timing and visibility was good for all creeks and rivers surveyed.

The 1994 Wood River tower count of 1,471,890 sockeye salmon was greater than the escapement goal of 1,000,000, and 23% above the upper end of the escapement goal range of 800,000 - 1,200,000. Sockeye spawning in the Wood River system appeared to be distributed evenly across creek, beach and river habitat types (Appendix Table 22). However, all habitat types were more heavily utilized than normal due to the abundance of fish in the system. Spawning was particularly heavy in the Agulukpak River. Large schools were also observed in the Silver Horn arm of Lake Beverley, the D slough Beach area of Little Togiak Lake and along the north shore of Lake Kulik.

Sockeye salmon escapement in the Nushagak River drainage was estimated to be 509,326 fish in 1994, 93% of the escapement goal of 550,000 (Miller, *in press*). Compared to average aerial counts and other recent surveys, the number of sockeye spawners utilizing the Tikchik Lakes system was very low (Table 9). Timing of the Tikchik surveys was generally good, but beach surveys were past the peak of spawning. Although sockeye salmon escapement in the upper Nushagak and Mulchatna Rivers was not assessed in 1994, the results of the Tikchik surveys further support the apparent recent shift in the distributions from the Tikchik Lake system to the Nushagak-Mulchatna river system.

Sockeye salmon escapement into the Snake Lake system was estimated to be 22,480 fish (Table 10). Spawner distribution appeared normal with the majority of the activity observed along the west shore beaches (Appendix Table 23).

Chinook salmon escapement into the Nushagak River drainage was estimated to be 95,954 fish at the Portage Creek sonar counter, or 28% above the inriver goal of 75,000 (Appendix Table 24). The 1994 inriver escapement was similar to the 1974-93 average, but 19% above the 1984-1993 average. Unfortunately, turbid water conditions prevented aerial surveys of the Nushagak chinook salmon escapement.

This year's chum salmon escapement into the Nushagak River was estimated to be 378,928 fish. This was 27% greater than the 1974-93 average escapement of 299,031 (Appendix Table 25).

Coho salmon escapement again fell short of the escapement goal of 100,000 fish due to a poor run. The 1994 escapement of 82,019 coho salmon was 18% below the escapement goal. No aerial surveys were conducted for coho salmon.

In 1994, no aerial counts for pink salmon were made in the Nushagak District. However, an estimated 192,780 pink salmon passed the Portage creek sonar (Appendix Table 26).

Togiak District

Peak aerial escapements and total population estimates were made for sockeye salmon in the major spawning systems of the Togiak District in 1994 (Table 11). The aerial survey count of 19,420 sockeye salmon for the Togiak River and its tributaries below the counting tower was well below the 1983-1993 average of 25,870 (Appendix Table 27). Escapement past the counting tower; however, was estimated at 154,752 sockeye salmon, which was slightly over the goal of 150,000. The spawning population in the Kulukak River Section, including Tithe Creek Ponds, was estimated to be 29,740 sockeye salmon, 87% of the 1984-1993 average of 34,120. Peak aerial sockeye counts into the mainstem portion of the Togiak River, the Gechiak Lake system, and Tithe Creek Ponds were all considerably less than the 1974-1993 averages, while counts for the Slug, Matogak, and Ongivinuck Rivers were all above average (Appendix Tables 28 and 29). The total sockeye salmon escapement for the entire district was 233,632 fish.

Surveys were made close to the peak of spawning for all areas of the Togiak and Kulukak River drainage, with the exception of pre-peak timing in the Gechiak River. Spawning activity appeared to peak for sockeye in Kulukak Lake on approximately July 26, based on the ratio of schooled to dead sockeye salmon observed on earlier surveys. Aerial counts of sockeye salmon in the Slug, Matogak, Osviak, Negukthlik, and Ungalikthluk Rivers were obtained incidentally during chum and chinook salmon escapement surveys, following the methods used by Nelson (1979). In all areas, the aerial counts were doubled to estimate sockeye spawning escapements.

Aerial counts of live chinook salmon and expanded escapement estimates were conducted of all major drainage in 1994 (Table 12). The total district escapement of 19,353 chinook salmon was the highest documented since 1984 and 51% above the 1984-93 average of 12,796 (Appendix Table 24). The chinook salmon escapement of 15,115 into the Togiak River represented the second time, for the second consecutive year, that the escapement goal of 10,000 had been reached. Counts in the upper Togiak River and its upper tributary streams were above average levels, while counts in most other streams, including the Kulukak River were average to below average levels (Appendix Tables 30 and 31). An extended closure during the traditional peak of the commercial chinook fishery probably played a substantial role in increasing chinook escapements.

Conditions and timing were good for all chinook salmon areas surveyed. The standard multiplier of 2.5 was applied to most aerial chinook salmon counts. Due to high and turbid water conditions, a multiplier of 3.0 was applied to some sections of the Togiak River. The lower Togiak River was not surveyed due to poor visibility. Counts for the lower river sections were estimated based on 1974-1993 average proportions of total Togiak River chinook salmon counts. Surveys of the Togiak River system were flown during the preferred time described in Nelson (1979), between the peak of spawning for both chum and chinook salmon. Progression of the chinook spawning activity appeared to be normal in most areas, and peaked during the week of August 1.

The chum salmon escapement for the entire district was estimated to be 229,470, the largest escapement documented for the Togiak District since 1988 (Table 13 and Appendix Table 25). The district escapement was 9% greater than the 1984-93 average, and comprised 93% of the 1974-1993 average. Peak counts of chum salmon were below the 1973-1993 average in the Gechiak, Quigmy, Kulukak, Matogak, Osviak and Ungalikthluk Rivers (Appendix Tables 32 and 33).

Chum salmon counts were made during the same surveys used to count chinook salmon. Survey timing for chum salmon was generally late with respect to the peak of spawning. Significant carcass numbers indicated that spawning activity had peaked in all rivers surveyed. To compensate for late survey timing, aerial counts for most systems were multiplied by 3.0, except where carcass counts were included. The lower Togiak River was not surveyed due to poor visibility. Counts for the lower river sections were estimated based on 1974-1993 average proportions of total Togiak River chum salmon counts.

Extensive fall rains resulted in extremely high and turbid water conditions during the peak of coho spawning activity. Aerial counts of spawning coho salmon were obtained in the Togiak River tributary streams, but could not be achieved in the mainstem Togiak River or other streams because of the water conditions (Table 14).

Counts obtained on October 11 are considered to be very conservative. Spawning activity appeared to be past the peak by that date (Appendix Tables 34 and 35). Due to missing counts on the Togiak mainstem and other rivers within the district, coho salmon escapement can not be accurately assessed for 1994. Using subjective indicators of inriver abundance such as commercial catch rates, inseason survey estimates, and reports from sport and subsistence users, coho escapement in the Togiak River appears to have been fair to good.

LITERATURE CITED

Bucher, W.A. 1981. Spawning ground surveys in the Nushagak and Togiak Districts of Bristol Bay, 1980. Alaska Department of Fish and Game, Division of Commercial Fisheries, Bristol Bay Data Report 81, Anchorage.

Evzerov, A.V. 1975. An evaluation of the errors occurring in salmon census by aerial survey. In Canadian Translation Fisheries and Aquatic Sciences. No. 4714, 1981. [Transl. from Russian] (Otsenka pogreshnogtei aerovizual'nogo metoda ucheta Lososei), p. 82-84. From Lososevye Dal'Nego Vostoka (CVI:1975).

Miller, J.X. 1994. Sonar enumeration of pacific salmon escapement into the Nushagak River, 1993. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Regional Information Report No. 2A94-20 Anchorage.

Nielson, J.D. and G.H. Green, 1981. Enumeration of spawning salmon from spawner residence time and aerial counts. Transactions of the American Fisheries Society 110:554-556.

Nelson, M.L. 1967. Red salmon spawning ground surveys in the Nushagak and Togiak Districts, Bristol Bay, 1966. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 96.

Nelson, M.L. 1968. Spawning ground surveys in the Nushagak and Togiak Districts, Bristol Bay, 1968. Alaska Department of Fish and Game, Division of Commercial Fisheries, Bristol Bay Data Report 5.

Nelson, M.L. 1973. Spawning ground surveys in the Nushagak and Togiak Districts of Bristol Bay, 1973. Alaska Department of Fish and Game, Division of Commercial Fisheries, Bristol Bay Data Report 46.

Nelson, M.L. 1979. Spawning ground surveys in the Nushagak and Togiak Districts of Bristol Bay, 1977-1979. Alaska Department of Fish and Game, Division of Commercial Fisheries, Bristol Bay Data Report 73, Anchorage.

Regnart, J.R. 1993. Kvichak River sockeye salmon spawning ground surveys, 1955-1993. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report No. 2A93-40, Anchorage.

LITERATURE CITED (Continued)

Rogers, D.E. 1984. Aerial survey estimates of Bristol Bay sockeye salmon escapements. Proceedings of the Workshop on Stream Indexing for Salmon Escapement Estimation. Canadian Technical Report of Fisheries and Aquatic Sciences. 1326:197-208.

Russell, R.B., D.L. Bill, and W.A. Bucher, 1990. Salmon spawning ground surveys in the Bristol Bay area, 1989. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 2K89-15, Anchorage.

Russell, R.B., J.R. Regnart, and T.E. Brookover, 1992. Salmon spawning ground surveys in the Bristol Bay area, 1991. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 2A92-01, Anchorage.

Russell, R.B., J.R. Regnart, and T.E. Brookover, 1993. Salmon spawning ground surveys in the Bristol Bay area, 1992. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 2A93-08, Anchorage.

Table 1. Aerial survey counts of sockeye salmon, Alagnak River system, 1994.[1]

System Location	Number of Fish				Percent of Total
	Spawning	Dead	Schooled	Total	
Nonvianuk River	0	0	0	0	0
Nonvianuk Lake	0	0	160	160	0
Kulik River	12,500	1,300	12,700	26,500	11
Kulik Lake	0	0	50	50	0
Alagnak River	0	0	0	0	0
Kukaklek Lake	0	0	125	125	0
Nanuktuk Creek	36,200	7,515	13,900	57,615	24
Battle River	7,000	1,900	11,400	20,240	8
Battle Lake	0	0	70	70	0
Spectacle Creek	29,500	6,480	51,500	87,480	36
Funnel Creek	36,400	2,395	11,500	50,295	21
Total	121,600	19,590	101,405	242,595	100

[1] Aerial surveys were conducted with fixed-wing aircraft.

Table 2. Aerial survey counts of chinook, chum, pink, and coho salmon, Naknek-Kvichak District, 1994.[1]

Location	Survey Date	Number of Salmon			
		Chinook	Chum	Pink	Coho
Kvichak River	Aug. 12	306			
Alagnak River	Aug. 08	8,480	62,900		
Naknek River:					
Paul's Creek	July 29	203	0[a]		
King Salmon Creek	July 29	974	53[a]		
Big Creek	Aug. 16	2,531			
Mainstem Naknek R.	Aug. 24	5,970			
Total		18,464	62,953		

[1] Aerial surveys were conducted with fixed-wing aircraft.
[a] Incidental observation.

Table 3. Aerial survey peak counts of chinook salmon escapement, Egegik District, 1994.[1]

Location	Survey Date	Number of Chinook Salmon
Egegik River	Jul. 27	40
Shosky Creek	Aug. 06	48
Whale Mountain Creek	Aug. 06	32
Mossy Creek	Aug. 06	118
Mink Creek	Aug. 06	77
Gertrude Creek	Aug. 06	840
Kaye's Creek	Aug. 06	214
Takayoto Creek	Jul. 27	230
Angle Creek	Aug. 06	[a]
Contact Creek	Aug. 06	705
Mainstem King Salmon River	Aug. 06	[a]
Total		2,304

[1] Aerial surveys were conducted with a helicopter.
[a] No counts made due to turbid water conditions.

Table 4. Aerial survey peak counts of chum salmon escapement, Egegik District, 1994.[1]

Location	Survey Dates	Number of Chum Salmon
Egegik River	Aug. 06	0
Shosky Creek	Aug. 06	0
Whale Mountain Creek	Aug. 06	1,700[a]
Mossy Creek	Aug. 06	5
Mink Creek	Aug. 06	7
Gertrude Creek	Jul. 27	760
Kaye's Creek	Aug. 06	175
Takayoto Creek	Jul. 27	30
Angle Creek	Aug. 06	[b]
Contact Creek	Aug. 06	260
Mainstem King Salmon River	Aug. 06	[b]
Total		2,937

[1] Aerial surveys were conducted with a helicopter.
[a] Includes estimate of carcasses.
[b] No counts made due to turbid water conditions.

Table 5. Aerial survey peak counts of sockeye salmon escapement, King Salmon and Dog Salmon Rivers, Ugashik District, 1994.[1]

Location	Survey Date	Number of Sockeye Salmon
Ugashik River:		
Grassy Creek	Aug. 11	0
Subtotal		0
King Salmon River:		
Needle Lake	Aug. 11	1,550
Mother Goose Lake	Aug. 11	60
Painter Creek	Aug. 11	3,075
Mainstem King Salmon River	Aug. 11	4,200
Subtotal		8,885
Dog Salmon River:		
Figure-Eight Creek	Aug. 11	2,825
Goblet Creek	Aug. 11	0
Oldham Creek	Aug. 11	2,150
Wandering Creek	Aug. 11	350
Mainstem Dog Salmon River	Aug. 11	[a]
Subtotal		5,325
Grand Total		14,210

[1] Aerial surveys were conducted with a helicopter.
[a] No counts made due to turbid water conditions.

Table 6. Peak survey counts of chinook salmon escapement, Ugashik District, 1994.[1]

Location	Survey Date	Number of Chinook Salmon
King Salmon River System:		
Old Creek	Aug. 11	1,490
Pumice Creek	Aug. 11	2,530
Painter Creek	Aug. 11	1,005
Mainstem King Salmon River	Aug. 11	2,225
Mother Goose Lake	Aug. 11	0
Indecision Creek	Aug. 11	0
Volcano Creek	Aug. 11	[a]
Subtotal		7,250
Dog Salmon River System:		
Figure-Eight Creek	Aug. 11	1,497
Goblet Creek	Aug. 11	238
Oldham Creek	Aug. 11	5
Wandering Creek	Aug. 11	1
Mainstem Dog Salmon River	Aug. 11	[a]
Subtotal	Aug. 11	1,741
Ugashik River System:		
Mainstem Ugashik River	Aug. 11	25
Grassy Creek	Aug. 11	142
Subtotal		167
Grand Total		9,158

[1] Aerial surveys were conducted with a helicopter.
[a] No counts made due to turbid water conditions.

Table 7. Peak survey counts of chum salmon escapement, Ugashik District, 1994.[1]

Location	Survey Date	Number of Chum Salmon
King Salmon River System:		
Old Creek	Aug. 11	6,975
Pumice Creek	Aug. 11	12,750
Painter Creek	Aug. 11	1,625
Mainstem King Salmon River	Aug. 11	9,150
Mother Goose Lake	Aug. 11	115
Indecision Creek	Aug. 11	5
Needle Lake	Aug. 11	30
Subtotal		30,650
Dog Salmon River System:		
Figure-Eight Creek	Aug. 11	425
Goblet Creek	Aug. 11	16
Oldham Creek	Aug. 11	310
Wandering Creek	Aug. 11	100
Mainstem Dog Salmon River	Aug. 11	[a]
Subtotal		851
Ugashik River System:		
Mainstem Ugashik River	Aug. 11	0
Grassy Creek	Aug. 11	30
Subtotal		30
Grand Total		31,531

[1] Aerial surveys were conducted with a helicopter.
[a] No counts made due to turbid water conditions.

Table 8. Peak aerial counts of live sockeye salmon and total escapement estimates, Wood River system, 1994.

Area	Aerial Counts[1] Date	Aerial Counts[1] Number	Total Escapement Estimate Number	Total Escapement Estimate Distribution (%)
Wood River	8/18	9,100	13,600	0.9%
Lake Aleknagik				
Eagle Creek	8/12	781[a]		
Hansen Creek	8/06	3,205[a]		
Happy Creek	8/07	4,676[a]		
Bear Creek	8/08	2,400		
Yako Creek	8/05	1,725[a]		
Whitefish Creeks	8/14	384[a]		
Ice Creek	8/08	7,400		
Mission Creek	8/14	1,717[a]		
Sunshine Creek	8/08	2,360		
Northshore Beaches	9/06	1,930[b]		
Southshore Beaches	9/06	150[b]		
Yako Beach	9/06	340[b]		
Youth Creek				
Total		26,522	216,400	14.7%
Agulowak River & Lower River Bay	8/29	150,000	224,000	15.2%
Lake Nerka				
Fenno Creek	8/08	2,800		
Upper River Bay Beaches, NW	8/29	600		
Upper River Bay Beaches, SE	8/29	1,640		
Allan Cr. to Ross Cr. Beaches	8/29	2,600		
Pike Creek	8/13	720		
Stovall Creek [2]	8/13	840		
Bear Creek	8/13	35		
Teal Creek	8/18	520[b]		
N6 to River Bay Beach	8/29	4,760		
Pick Creek Beach	8/29	1,440		
Pick Creek	8/11	4,700		
Elva Creek Beach	8/29	820		
Elva Creek	8/13	220		
Amakuk Arm Beaches	8/29	640		
Amakuk Arm Beach - Ott's Bay Beach	8/29	1,060		
Ott's Bay Beaches	8/29	1,100		
Kema Creek	8/13	2,070		
Kema Creek Lake Beaches [2]	8/13	0		

(continued)

Table 8. (page 2 of 3)

Area	Aerial Counts[1] Date	Aerial Counts[1] Number	Total Escapement Estimate Number	Total Escapement Estimate Distribution (%)
Lake Nerka (continued)				
Hidden Lake Creek	8/13	750		
Hidden Lake Beaches	8/13	170		
Anvil Bay Beaches	9/06	5,400		
Anvil Bay Beach - Elbow Pt. Beach	9/06	1,400		
Elbow Pt. Beach - Lynx Cr. Beach	9/06	1,080		
Lynx Cr.- Teal Cr. Beaches	9/06	240		
Lynx Creek	8/18	1,350		
Lynx Lake Beaches	9/06	980		
Total		37,935	309,500	21.0%
Little Togiak River	8/18	4,100	6,100	0.4%
Little Togiak Lake				
Northshore Beaches	9/06	1,090		
Southshore Beaches	9/06	940		
D Slough Beach	9/06	1,000		
Total		3,030	24,700	1.7%
Agulukpak River	8/28	205,000	306,000	20.8%
Lake Beverley				
Hardluck Bay Beaches	8/29	6,280		
Sam's Beach	8/29	1,250		
Golden Horn Beaches	9/06	1,115		
Silver Horn Beaches	9/06	4,550		
B12 & B9 Beaches	8/29	4,100		
Tsun Creek	8/18	65		
Moose Creek	8/18	1,890[b]		
Hope Creek	8/18	3,450[b]		
Hope Creek Lake Beach	8/18	350		
Total		23,050	188,000	12.8%
Peace River	8/18	1,600	3,200	0.2%

(continued)

Table 8. (page 3 of 3)

Area	Aerial Counts[1] Date	Aerial Counts[1] Number	Total Escapement Estimate Number	Total Escapement Estimate Distribution (%)
Lake Mikchalk				
Narrows	8/28	1,300		
Northshore Beaches	8/28	400		
Southshore Beaches	8/28	700		
Total		2,400	19,600	1.3%
Wind River	8/18	680	1,300	0.1%
Lake Kulik				
K5 Creek - Grant River Beaches	8/28	1,260		
Grant River to K2 Creek Beaches	8/28	11,600		
Southshore Beaches	8/28	3,340		
K1 and K2 Creeks	8/18	2,500		
Total		18,700	152,500	10.4%
Grant River	8/18	3,500	7,000	0.5%
Total		485,617	1,471,900	100.0

[1] All counts rounded to nearest 10 fish.
[2] Lake access blocked by beaver dams.
[a] Ground survey counts conducted by F.R.I., University of Washington.
[b] Minimal estimate due to late survey or poor conditions.

Table 9. Peak aerial counts and total escapement estimates of sockeye salmon, Tikchik Lakes system, 1994.

Area	Date	Aerial Counts Live	Dead	Total	Mean Live Count[1]	Factor[2]	Escapement Estimate
Tikchik Lake							
Creek A	08-Aug	1,250		1,250	2,281		
Creek B	08-Aug	180		180	3,620		
Creek C	08-Aug	950		950	256		
Subtotal		2,380	0	2,380	6,157	3	7,140
Tikchik River							
Tikchik River (Mainstem)	08-Aug	10,400		10,400	20,705		
Cow Creek	08-Aug	250		250	4,250		
Koneruk Creek					0		
Subtotal		10,650	0	10,650	24,955	3	31,950
Nuyakuk Lake							
Northshore Beaches	28-Aug	395	20	415	1,635		
Southshore Beaches	28-Aug	460		460	2,850		
Portage Arm	28-Aug	40		40	478		
Mirror Bay	28-Aug	180	10	190	3,009		
Rapids	08-Aug	550		550	1,973		
Subtotal		1,625	30	1,655	9,999	3	4,875
Lake Chauekuktuli							
Creek #1				0	80		
Allen River Beach	08-Aug	5,300		5,300	15,586		
Allen River	08-Aug	800		800	415		
Northshore Beaches	28-Aug	1,320	175	1,495	2,661		
Southshore Beaches	28-Aug	135	65	200	383		
Shadow Bay	28-Aug	10		10	0		
Subtotal		7,565	240	7,805	19,126	3	22,695
Total		22,220	270	22,490	60,237		66,660[a]

[a] Total escapement estimate does not include an estimate for Koneruk Creek, which accounts for an average of 6% of the Tikchik Lake system escapement.

[1] Includes live counts from spawning ground surveys conducted from 1958-1966, 1974 and 1991. Surveys conducted in other years due to unusually large escapements were not included.

[2] 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 10. Peak aerial live counts and total escapement estimates of sockeye salmon, Lake Nunavauguluk drainage, 1994.

Location	Aerial Counts[a]		Total Escapement Estimate	
	Date	Number	Factor[1]	Number
Snake River	11-Aug	560	2	1,120
Snake R. - Eagle Cr. Beach	18-Aug	2,450	2	4,900
Westshore Beach	06-Sep	3,880	2	7,760
Eastshore Beach	06-Sep	2,100	2	4,200
Southshore Beach	06-Sep	800	2	1,600
Eagle Lake	11-Aug	480	2	960
Eagle Cr.	11-Aug	70	2	140
Killian Cr.	11-Aug	880	2	1,760
East Cr.	11-Aug	20	2	40
Total		11,240		22,480

[1] 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..
[a] All counts rounded to the nearest 10 fish.

Table 11. Peak aerial counts of live sockeye salmon and total escapement estimates, Togiak District, 1994.

Stream	Aerial Counts Date	Aerial Counts Number	Total Escapement Estimate Factor[1]	Total Escapement Estimate Number
TOGIAK SECTION				
Togiak Tower				154,752
Togiak River (Mainstem)	8/22	3,100	2.0	6,200
Gechiak Lake System	8/12	560	3.0	1,680
Pungokepuk Lake System	8/12	1,870	2.0	3,740
Nayorurun River[2]				
Kemuk River[2]				
Ongivinuck Lake System	8/18	3,900	2.0	7,800
Subtotal		9,430		19,420
KULUKAK SECTION				
Kulukak River[3]	8/11	2,710	2.0	5,420
Kulukak Lake	7/26	7,560	2.0	15,120
Tithe Creek Ponds	8/12	4,600	2.0	9,200
Subtotal		14,870		29,740
MATOGAK, OSVIAK, and CAPE PIERCE SECTIONS				
Matogak River[3]	8/05	990	2.0	1,980
Osviak River[3]	8/05	1,750	2.0	3,500
Slug River[3]	8/05	6,070	2.0	12,140
Subtotal		8,810		17,620
OTHER RIVERS				
Quigmy River[3]	8/05	580	2.0	1,160
Negukthlik River[3]	8/08	2,230[a]	2.0	4,460
Ungalikthluk River[3]	8/08	3,240	2.0	6,480
Subtotal		6,050		12,100
Total		39,160		233,632

[1] 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.

[2] No aerial surveys conducted, or conducted too far past peak of spawning.

[3] USFWS estimate. Sockeye salmon count obtained during chinook and chum surveys.

[a] Includes schooled fish.

Table 12. Peak aerial live counts of live chinook salmon and total escapement estimates, Togiak District, 1994.

Stream	Aerial Counts Date	Aerial Counts Number	Total Escapement Estimate Factor[1]	Total Escapement Estimate Number
TOGIAK SECTION				
Togiak River Mainstem				
A		375[a]	2.5	938
B		390[a]	2.5	975
C		655[a]	2.5	1,638
D	8/05	215	3.0	645
E	8/05	815	3.0	2,445
F	8/05	1,580	2.5	3,950
Subtotal		4,030		10,590
Gechiak River	8/05	420	2.5	1,050
Pungokepuk River	8/05	215	2.5	538
Nayorurun River	8/05	225	2.5	563
Kemuk River	8/05	570	2.5	1,425
Ongivinuck River	8/05	380	2.5	950
Subtotal		5,840		15,115
KULUKAK SECTION				
Kulukak River	8/05	835	2.5	2,088
MATOGAK, OSVIAK, and CAPE PIERCE SECTIONS				
Matogak River[2]	8/05	40	2.5	100
Osviak River[2]	8/26	60	2.5	150
Slug River[2]	8/26	10	2.5	25
Subtotal		110		275
OTHER RIVERS				
Quigmy River[2]	8/05	20	2.5	50
Negukthlik River[2]	8/05	540	2.5	1,350
Ungalikthluk River[2]	8/05	190	2.5	475
Subtotal		750		1,875
Total		7,535		19,353

[1] 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.
[2] USFWS estimate.
[3] Counts interpolated from 1974-1993 average percentages for each area. Not surveyed due to poor survey conditions.

Table 13. Peak aerial counts of live chum salmon and total escapement estimates, Togiak District, 1994.

Stream	Aerial Counts Date	Aerial Counts Number	Total Escapement Estimate Factor[1]	Total Escapement Estimate Number
		TOGIAK SECTION		
Togiak River Mainstem				
A	8/05	14,000[a]	3.0	42,000
B	8/05	6,200[a]	3.0	18,600
C	8/05	4,500[a]	3.0	13,350
D	8/05	1,300	3.0	3,900
E	8/05	5,200	3.0	15,600
F	8/05	10,400	3.0	31,200
Subtotal		41,550		124,650
Gechiak River	8/05	900	3.0	3,900
Pungokepuk River	8/05	2,400	3.0	900
Nayorurun River	8/05	7,100	3.0	8,760
Kemuk River	8/05	900	3.0	1,240
Ongivinuck River	8/05	5,700	3.0	7,000
Subtotal		27,660		61,500
		KULUKAK SECTION		
Kulukak River	8/05	10,700	3.0	32,100
		MATOGAK, OSVIAK, and CAPE PIERCE SECTIONS		
Matogak River[2]	8/05	1,630	2.0	3,260
Osviak River[2,3]	8/05	2,000	2.0	4,000
Slug River[2,3]	8/05	4,360	2.0	8,720
Subtotal		7,990		15,980
		OTHER RIVERS		
Quigmy River[2,3]	8/05	890	2.0	1,780
Negukthlik River[2]	8/08	230	2.0	690
Ungalikthluk River[2]	8/08	1,090	2.0	3,270
Subtotal		2,210		5,740
Total		79,450		229,470

[1] Derived by expanding peak live count to reflect fish not counted due to variables such as schooled and dead fish, late or poor surveys conditions, bad weather, etc.
[2] USFWS estimate. Surveys were past peak of spawning.
[3] Includes carcass count.
[a] Counts interpolated from 1974-93 average percentages for each area. Not surveyed due to poor survey conditions.

Table 14. Peak aerial counts of live coho salmon and total escapement estimates, Togiak District, 1994.

Stream	Aerial Counts Date	Aerial Counts Number	Total Escapement Estimate Factor[1]	Total Escapement Estimate Number
Togiak Section				
Togiak River mainstem[2]				
Gechiak River[3]	11-Oct	1,290	4.5	5,805
Pungokepuk River[3]	11-Oct	220	4.5	990
Nayorurun River[3]	11-Oct	120	4.5	540
Kemuk River[3]	11-Oct	95	4.5	428
Ongivinuk River	29-Sep	1,930	3.0	5,790
Subtotal		3,655		13,553
Kulukak Section				
Kulukak River[2]				
Matogak, Osviak, and Cape Pierce Sections				
Matogak River[2]				
Osviak River[2]				
Slug River[2]				
Other				
Quigmy River[2]				
Negukthlik River[2]				
Ungalikthluk River[2]				
Total		3,655		13,553

[1] 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..
[2] No aerial surveys conducted due to high turbid water conditions.
[3] Post-peak survey.

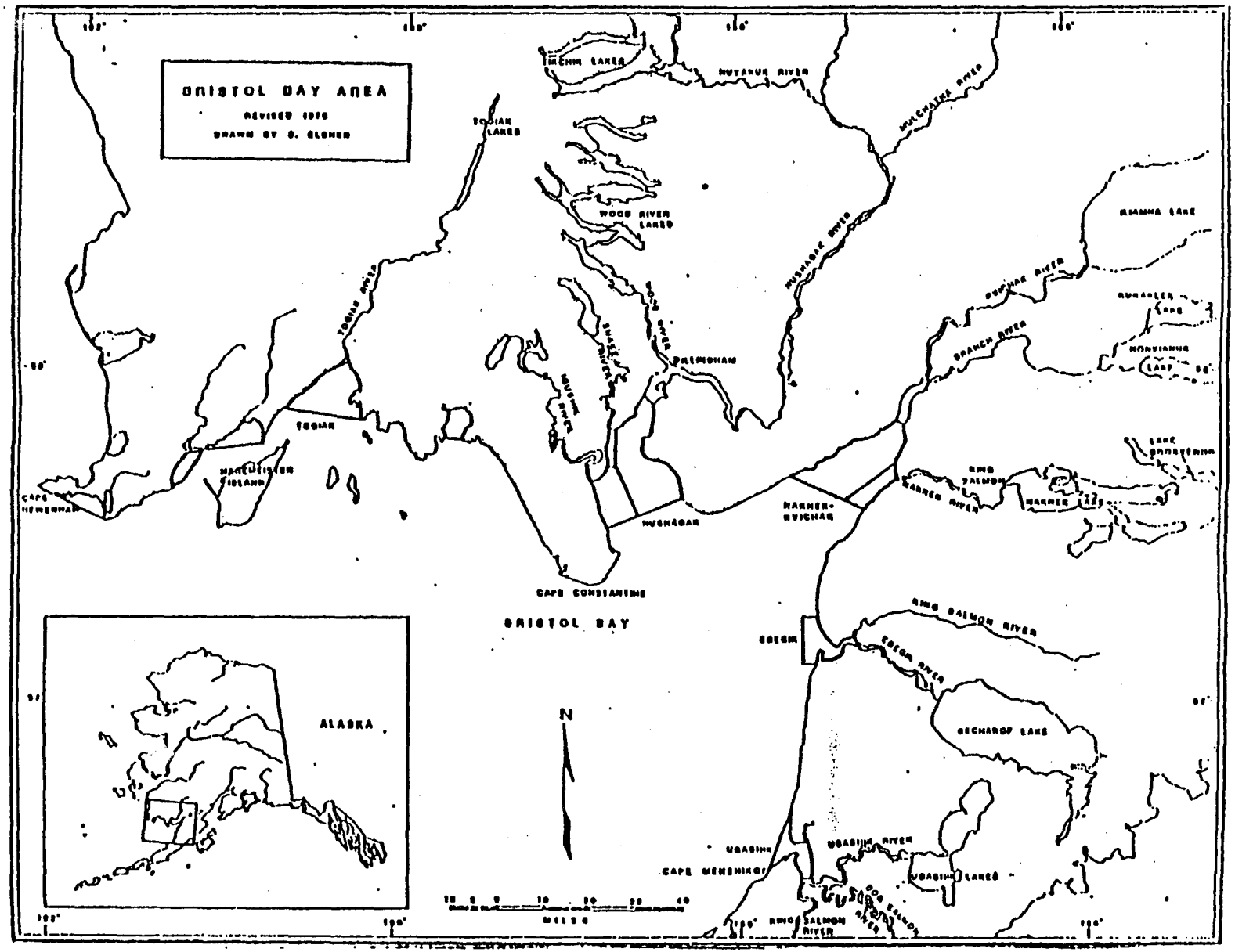

Figure 1. Bristol Bay management area, Alaska.

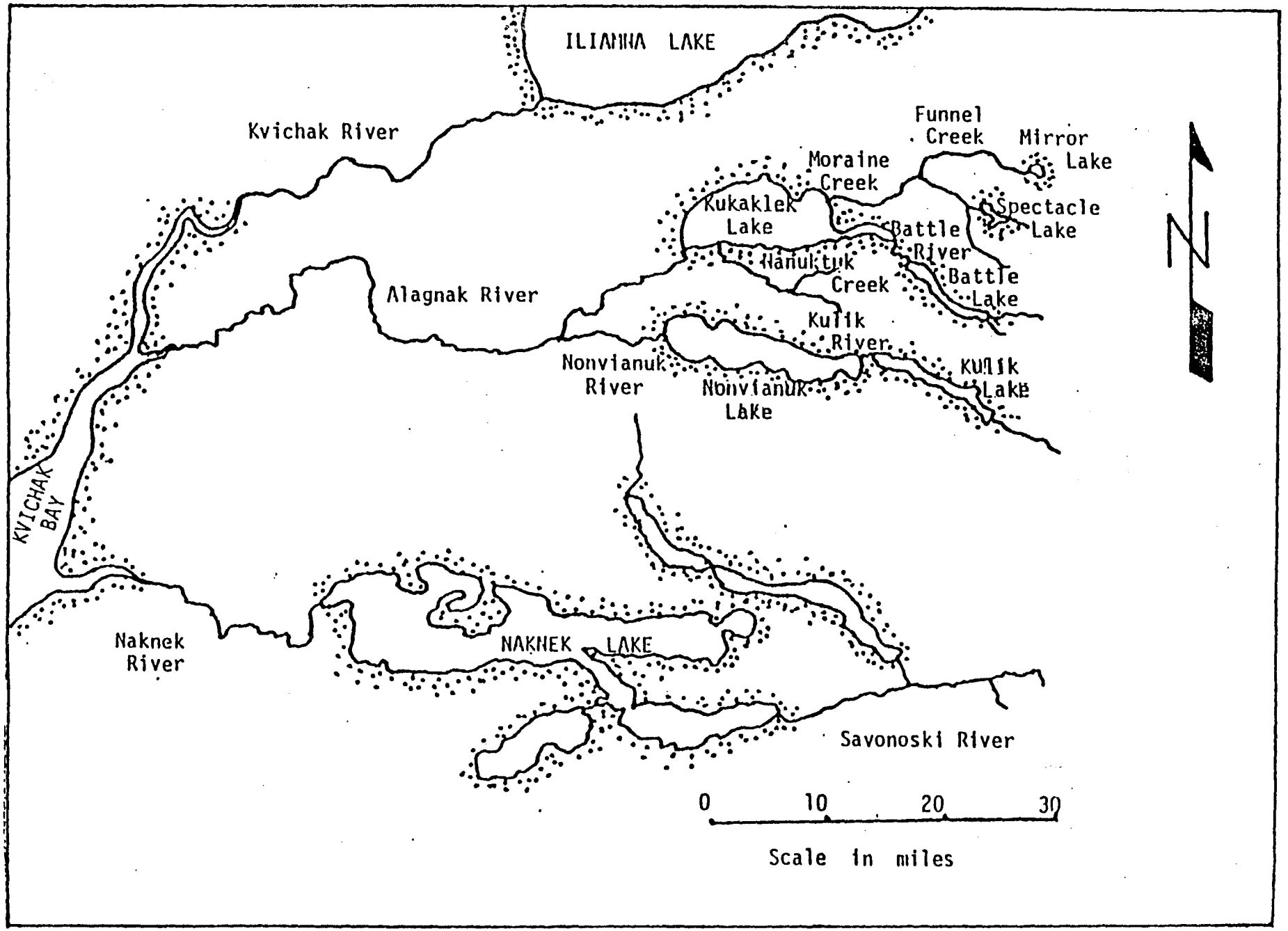

Figure 2. Alagnak River drainage, Bristol Bay, Alaska.

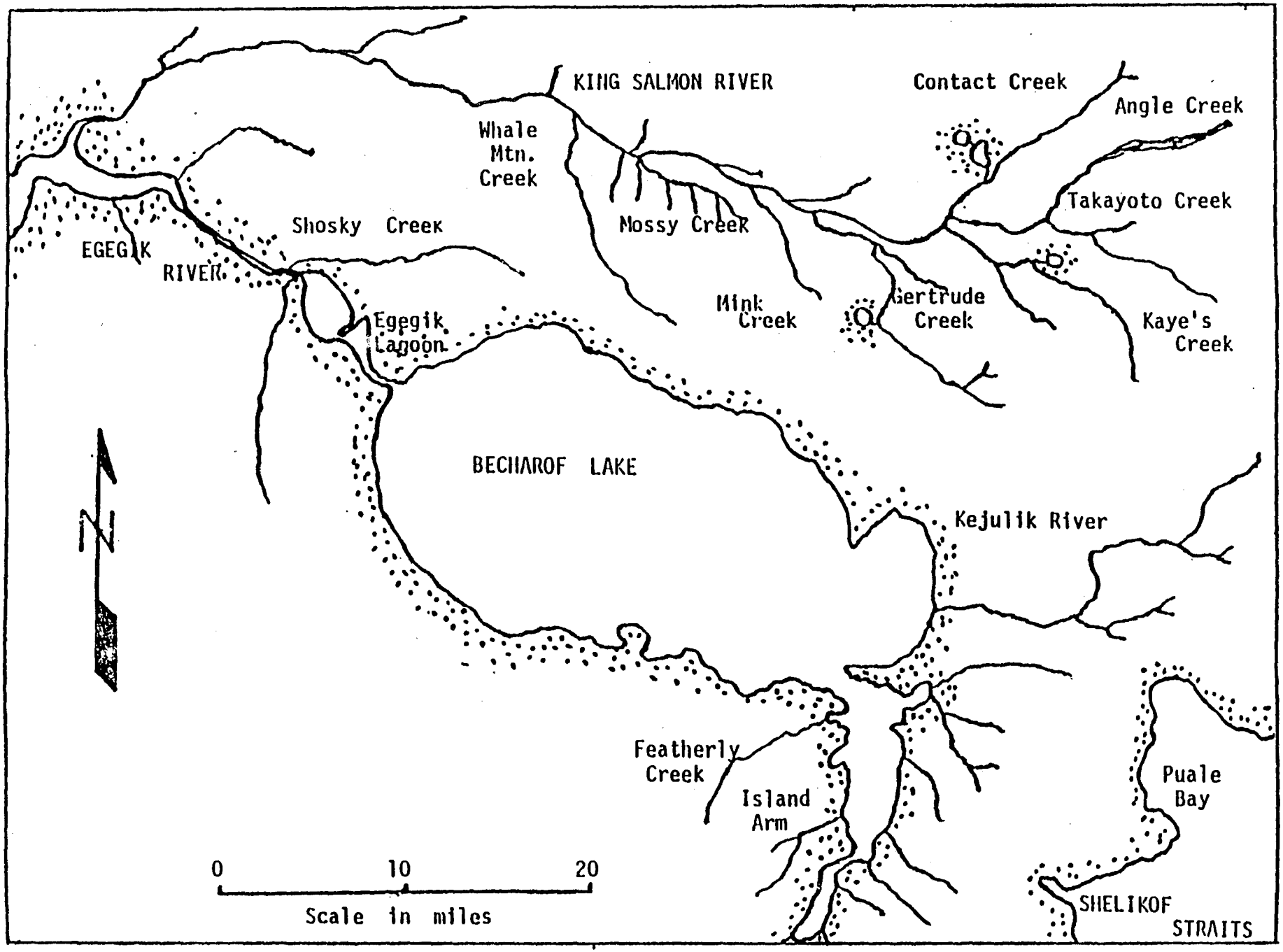

Figure 3. Egegik River drainage, Bristol Bay, Alaska.

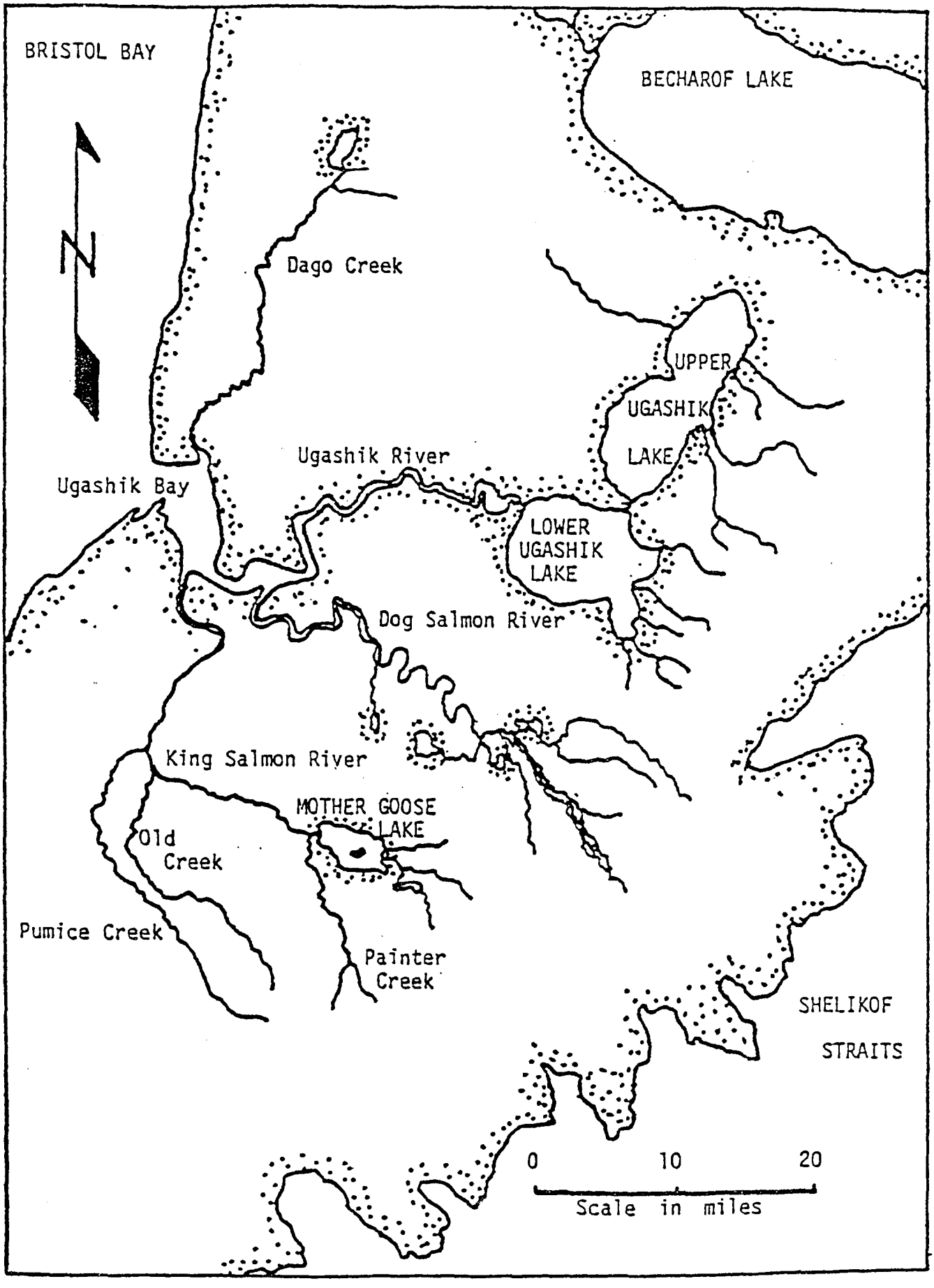

Figure 4. Ugashik River System, Bristol Bay, Alaska.

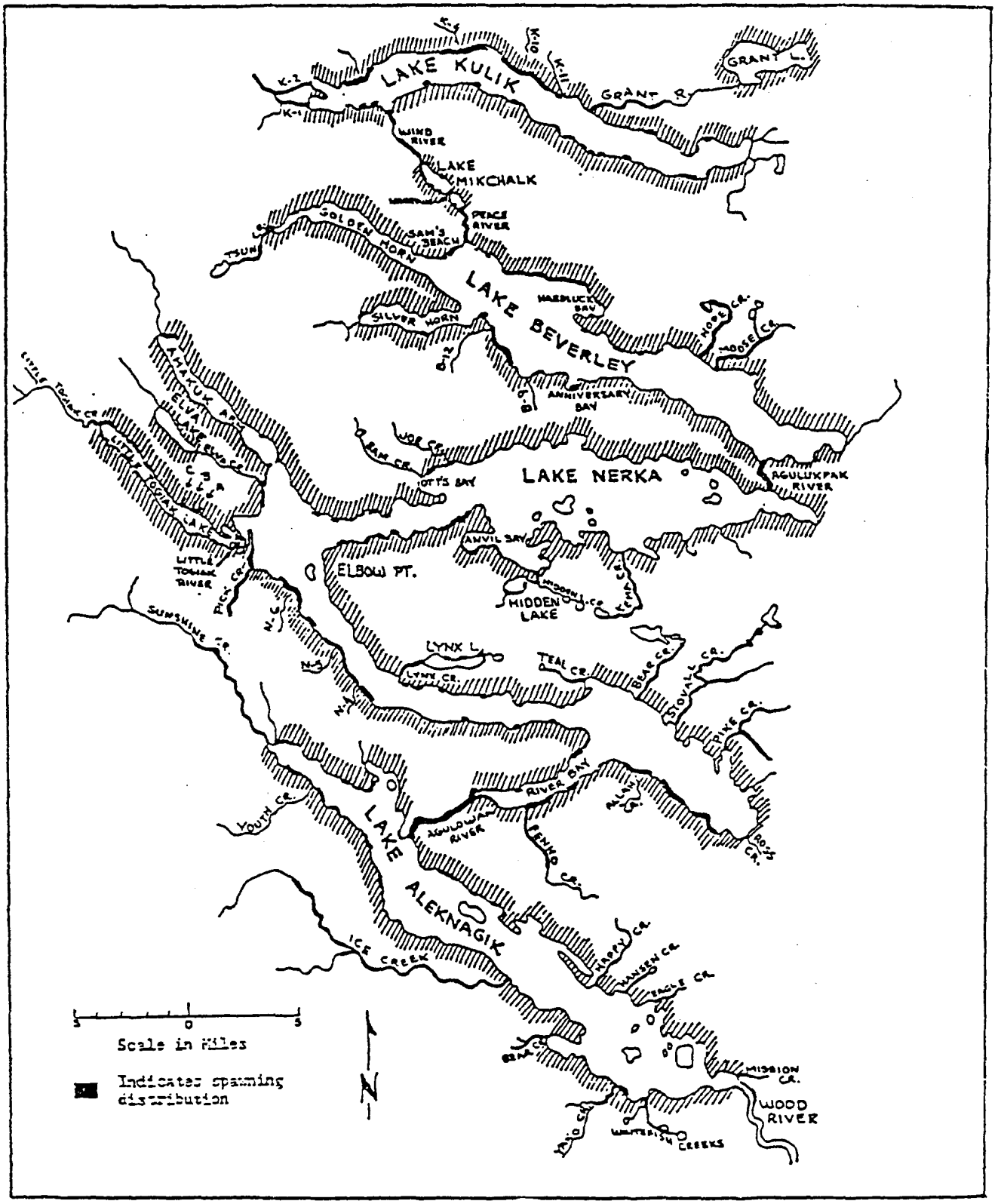

Figure 5. Wood River Lakes system, Bristol Bay, Alaska.

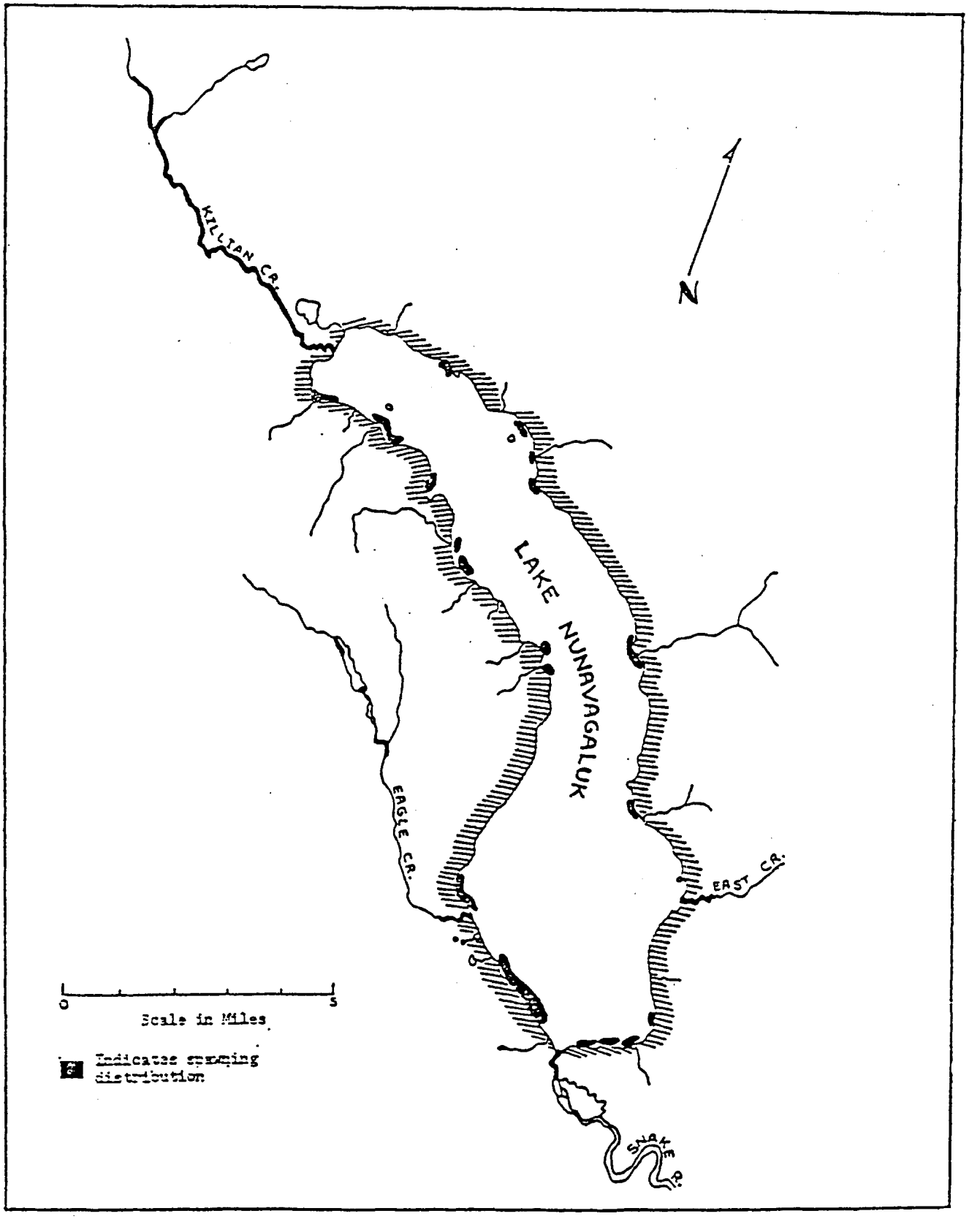

Figure 6. Lake Nunavaugaluk system, Bristol Bay, Alaska.

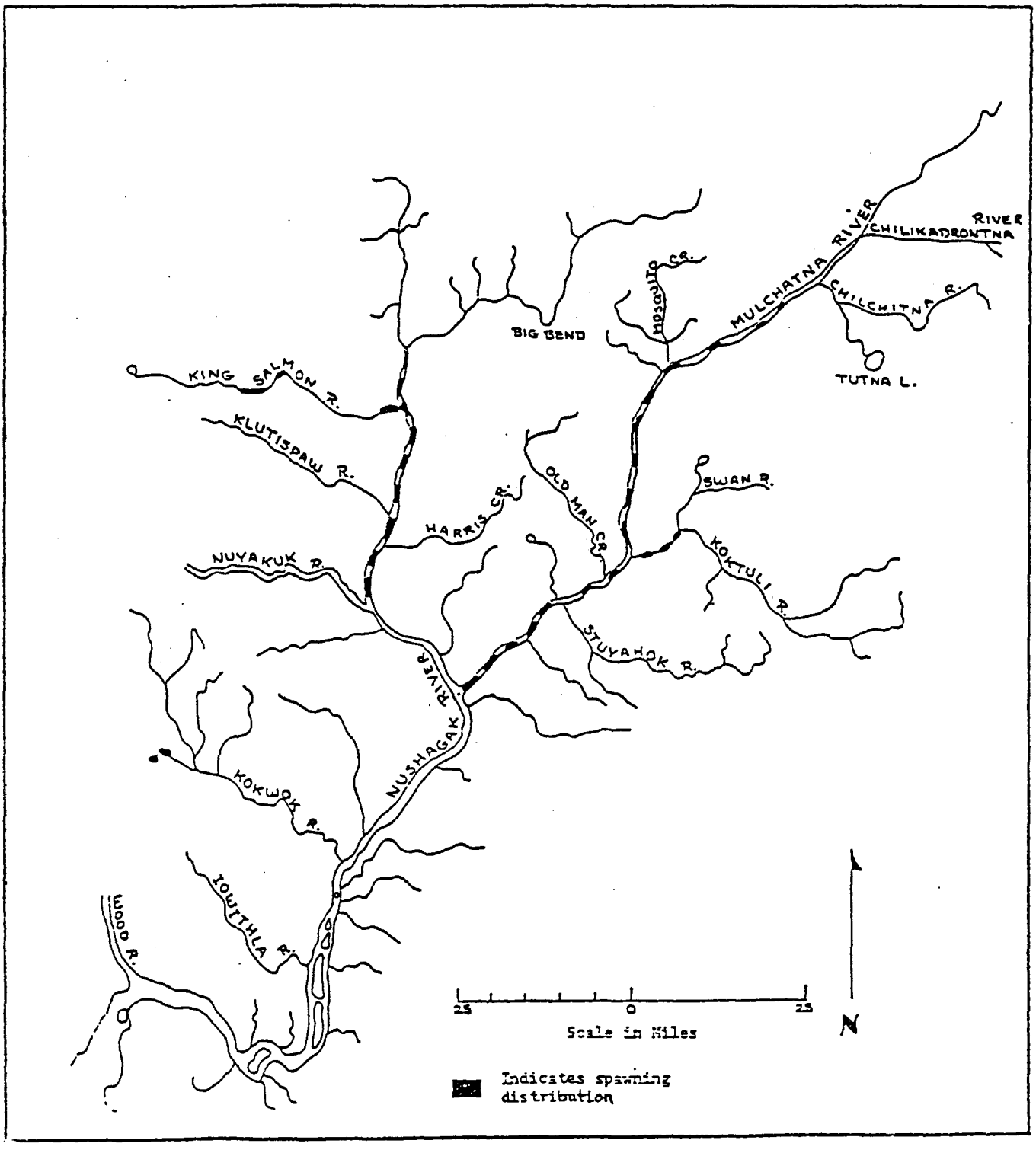

Figure 7. Nushagak-Mulchatna River system, Bristol Bay, Alaska.

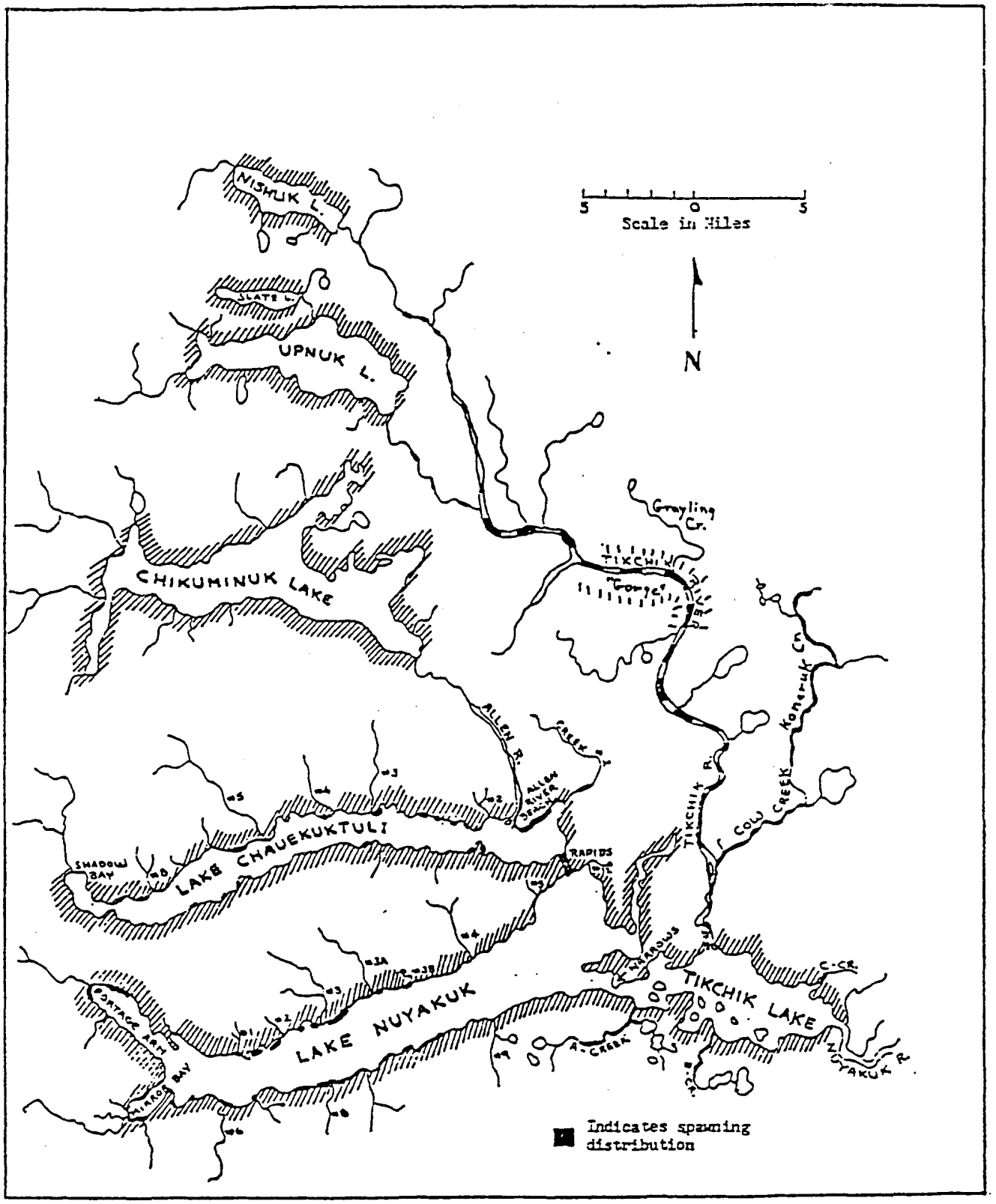

Figure 8. Tikchik Lakes system, Bristol Bay, Alaska.

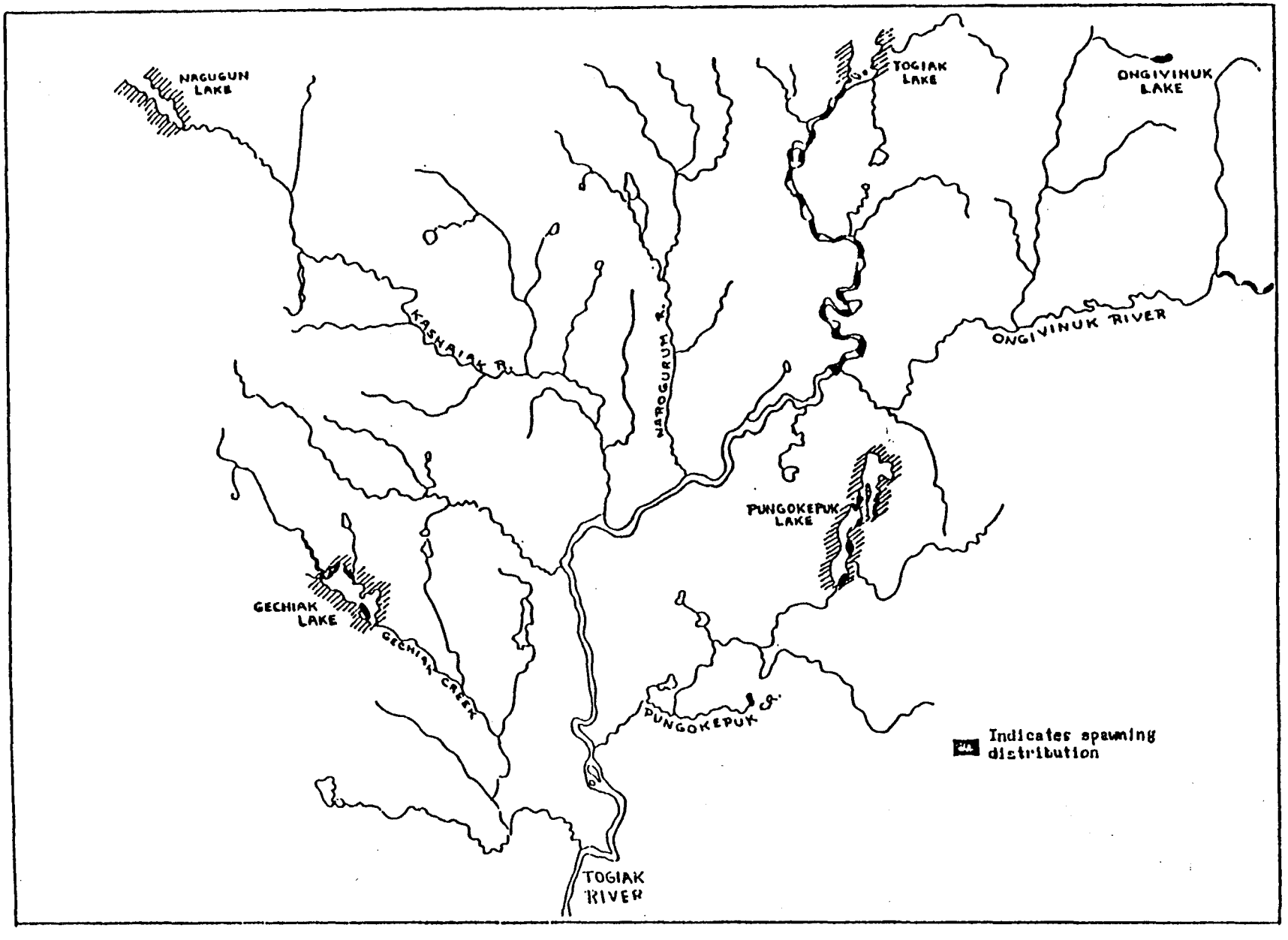

Figure 9. Togiak River system, Bristol Bay, Alaska.

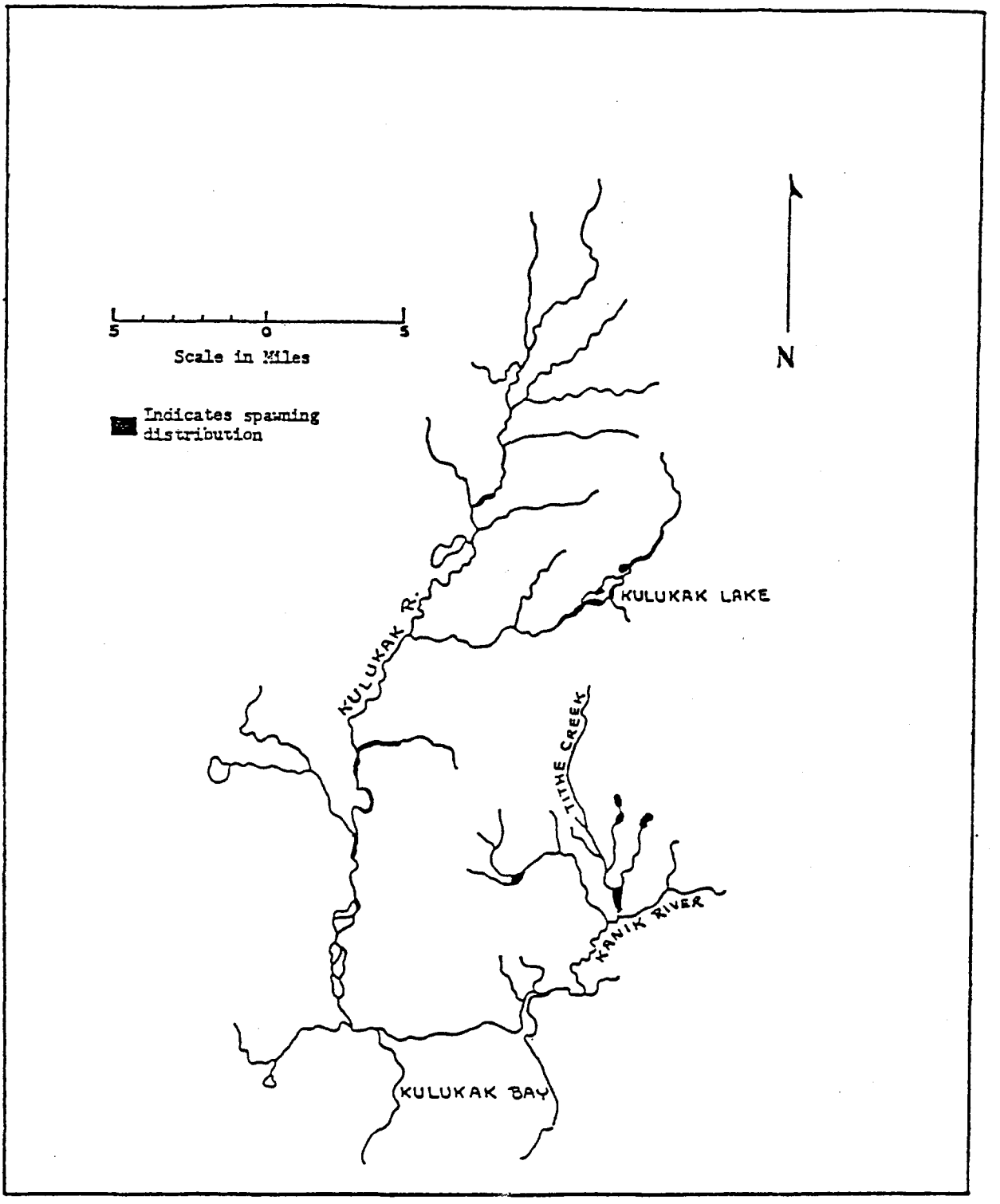

Figure 10. Kulukak River system, Bristol Bay, Alaska.

Appendix Table 1. Sockeye salmon total escapement estimates, Naknek-Kvichak District, 1955-1994. Estimates based on visual counts from towers unless otherwise noted.

	Escapement				Alagnak Percent of
Year	Kvichak	Naknek	Alagnak	Total	Total
1955	250,546	278,500[b]	171,500[a]	700,546	24
1956	9,443,318	1,772,595[b]	784,000[a]	11,999,913	7
1957	2,842,810	634,655[b]	126,595	3,604,060	4
1958	534,785	278,118	94,650	907,553	10
1959	680,000	2,231,807	825,431	3,737,238	22
1960	14,630,000	828,381	1,240,530	16,698,911	7
1961	3,705,849	351,078	90,036	4,146,963	2
1962	2,580,884	723,066	90,630	3,394,580	3
1963	338,760	905,358	203,304	1,447,422	14
1964	957,120	1,349,604	248,700	2,555,424	10
1965	24,325,926	717,798	175,020	25,218,744	1
1966	3,775,184	1,016,445	174,336	4,965,965	4
1967	3,216,208	755,640	202,626	4,174,474	5
1968	2,557,440	1,023,222	193,872	3,774,534	5
1969	8,394,204	1,331,202	122,490	9,847,896	1
1970	13,935,306	732,502	177,060	14,844,868	1
1971	2,387,392	935,754	187,302	3,510,448	5
1972	1,009,962	586,518	151,188	1,747,668	9
1973	226,554	356,676	35,280	618,510	6
1974	4,433,844	1,241,058	214,848	5,889,750	4
1975	13,140,450	2,026,686	100,480	15,267,616	1
1976	1,965,282	1,320,750	81,822	3,367,854	2
1977	1,341,144	1,085,856	100,000[a]	2,527,000	4
1978	4,149,288	813,378	229,400[a]	5,192,066	4
1979	11,218,434	925,362	294,200[a]	12,437,996	2
1980	22,505,268	2,644,698	297,900[a]	25,447,866	1
1981	1,754,358	1,796,220	82,210[a]	3,632,788	2
1982	1,134,840	1,155,552	239,300[a]	2,529,692	9
1983	3,569,982	888,294	96,220[a]	4,554,496	2
1984	10,490,670	1,242,474	215,370[a]	11,948,514	2
1985	7,211,046	1,849,938	118,030[a]	9,179,014	1
1986	1,179,322	1,977,645	230,180[a]	3,387,147	7
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
Average	5,596,887	1,226,971	234,899	7,058,758	3
1994	8,337,840	990,810	242,595[a]	9,571,245	3
Deviation 1994[c]	+49%	-19%	+3%	+36%	

[a] Aerial survey index counts.
[b] Weir counts.
[c] 1994 deviation from the 1955-1993 average.

Appendix Table 2. Aerial survey counts of chinook salmon escapements, Naknek River drainage, 1970-1994.

Year	Mainstem Naknek River	Paul's Creek	King Salmon Creek	Big Creek	Total
1970	3,060		260	825	4,145
71	1,639	52	704	490	2,885
72	351	156	1,224	1,060	2,791
73	1,315		115	1,106	2,536
74		91	495	860	1,446
1975	2,250	144	279	779	3,452
76	5,950	31	180	970	7,131
77	4,830		1,860		6,690
78					[a]
79					[a]
1980	300	17		30	347
81	2,890		591	790	4,271
82	5,360	340	980	1,930	8,610
83	2,860	290	460	4,220	7,830
84	790	400	385	3,420	4,995
1985	590				590
86	2,200	73	102	1,542	3,917
87	2,800	7	290	1,353	4,450
88	7,380	150	600	3,600	11,730
89	1,700	50	100	860	2,710
1990	4,500	150	350	2,000	7,000
91	1,655	121	275	2,340	4,391
92	1,550	88	158	895	2,691
93	5,520	86	700	1,710	8,016
Total	59,490	2,246	10,108	30,780	102,624
Average	2,833	132	505	1,539	5,009[b]
Percent	57	3	10	31	100
1994	5,970	203	974	2,531	9,678
Deviation 1994[c]	+111%	+54%	+93%	+64%	

[a] Non-expanded index counts unavailable.
[b] Sum of mean indices.
[c] 1994 deviation from 1970-1993 average.

Appendix Table 3. Chinook salmon escapement survey history, Mainstem Naknek River, 1929-1994.

Year	Count Dates	Surveyor	Actual Weir Count[1]	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate[2]	Comments
1929	7/03-7/31		1,498			Peak count 7/27.
1930	6/20-8/09		1,999			Peak count 8/09.
1931	6/17-8/09		896			Peak count 8/07.
1932	6/23-8/10		1,869			
1950	7/08-8/20		3,097			Peak count 8/09.
1951	6/28-8/07		1,876			Peak count 8/04.
1952	6/25-8/10		633			Peak count 8/06.
1953	6/24-8/10		2,074			Peak count 7/26.
1954	6/20-8/11		3,474			Peak count 8/10.
1955	6/13-8/17		4,188			Peak count 8/16.
1956	6/22-8/28		7,378			Peak count 8/18.
1957	6/28-8/04		8,504			Peak count 8/03.
1966	8/26	Redick				300 counted via skiff.
1967	Mid August	Paddock			800	
1968					1,200	Conservative estimate.
1969					1,200	
1970	7/31	Whitehead		845		
	8/03	Siedelman		3,060		Visibility very good.
	8/22	Siedelman		1,540	1,750	Pre-peak. River murky.
	8/22	Whitehead		1,310		
	8/25	Whitehead		2,225		Optimal count conditions.
	8/25	Siedelman		2,536	2,500	Pre-peak. Good vis.
1971	8/26	Cunningham		1,639		Most @ Rapids. Few dead
1972	8/23	Cunningham		351		Post-peak. Poor vis.
1973	8/19	Russell		1,315		Near peak. Good vis.
1974	8/19	Russell			450	Fish deep. Accuracy ??.
1975	8/17	Russell		2,250		Peak near. Good vis.
1976	8/13	Bill		2,615		Near peak. Few dead.
	8/16	Russell		5,950	7,250	Pre-peak. Large schools.
1977	8/22	Russell		4,830	5,750	Pre-peak. Few dead.
1978	8/09	Gwartney			4,000	Near peak.
1979		Gwartney			1,750	
1980	8/08	Bill		300	500	
1981	8/26	Bill		2,890	3,470	At peak. Good vis.
1982	8/07	Bill		570	1,000	Pre-peak. Many schooled.
	8/19	Bill		5,360	5,400	
1983	8/14	Bill		2,860	3,000	Pre-peak. Still schooled.
1984	8/14	Bill		790	2,370	
1985	8/06	Bill			600	Pre-peak.
	8/27	Bill		590	700	
1986	8/18	Russell		1,990		Pre-peak. Many schooled.
	8/19	Meyer		2,200		Peak near.
1987	8/19	Meyer		2,800		Pre-peak. Still schooled.
	8/28	Bill		2,655	2,855	
1988	8/09	Minard		7,380	7,400	Near peak. Most on redds.
1989	8/14	Minard		1,700		Fish spawning. Few dead.
1990	8/06	Minard		4,500		
1991	8/20	Russell		1,655		Pre-peak. Many schooled.
1992	8/21	Regnart		877		Poor visibility in holes.
	8/27	Regnart		1,550		At peak. All on redds.
1993	8/23	Regnart		5,520		Near peak. Some schooled.
Totals			37,486	59,490[a]		
Average			3,124	2,833		
1994	8/24	Regnart		5,970		Visibility good. Near peak.
Deviation 1994 [b]				+111%		

[1] Weir count provides no estimate of 15-20% of population spawning downstream of weir site, or the fish passing before and after weir in operation.
[2] Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.
[a] Includes only largest index count each year.
[b] 1994 deviation from 1970-1993 average.

Appendix Table 4. Chinook salmon escapement survey history, Big Creek, Naknek River drainage, 1963-1994.

Year	Count Dates	Surveyor	Float Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate[1]	Comments
1963	8/01	Paddock		362		Heli. Covered 1/2 stream.
	8/13	Paddock		1,345	2,690	Near peak. Good vis.
1964	7/31	Paddock		448		Too early.
	8/15	Siedelman		636		Helicopter. Near peak.
	8/15-8/18	Siedelman	1,130			Past peak.
1965	8/05-8/08	Andrews	578			Fair survey.
1966	8/13-8/16	Redick	979			At peak. Fair vis.
1967	8/10-8/14	Whitehead	1,129			Some aband. redds.
1968	8/10-8/14	Meyers	3,827			Conditions fair to poor.
1969	8/12-8/14	Parkinson	1,012			High murky waters.
	Mid-August				5,000	
1970	7/19	Whitehead		825		
	8/15-8/17	Parkinson	1,601			2/3 stream high & murky.
1971	8/13	Cunningham		490	1,200	Only upper 1/3 surveyed.
	8/28	Siedelman		277		Past peak. 30+ mph winds.
1972	8/08	Cunningham		695		Pre-peak.
	8/18	Siedelman		1,060		Past peak.
1973	8/17	Russell		1,106		At peak. Lots w/fungus.
1974	8/01	Russell		520	850	Pre-peak. No dead.
	8/11	Russell		860	1,250	Near peak. Didn't include lower 8 mi. of stream where 150 more were seen Aug 10.
1975	8/09	Russell		779		Pre-peak.
1976	8/13	Bill		970	1,400	Partial stream coverage.
1977		Gwartney			2,700	
1978	8/07	Gwartney			4,800	Good vis. Fish all over.
1979		Gwartney			3,650	
1980	8/08	Bill		30	120	High muddy water.
1981	8/26	Bill		790	3,950	Muddy. Lots of carcasses.
1982	8/07	Bill		1,930	6,900	At peak.
1983	8/14	Bill		4,220	9,000	
1984	8/08	Bill		3,420	8,800	At peak of spawning.
1985	8/06	Bill			2,900	Poor survey conditions.
1986	8/08	Meyer		1,542	6,000	At peak. Excellent vis.
1987	8/21	Meyer		1,353	2,500	
1988	8/09	Minard		3,600		
1989	8/14	Minard		860		
1990	8/06	Minard		2,000		
1991	8/12	Regnart		2,340		At peak. All on redds.
1992	8/18	Regnart		895		Past peak. Incl 125 dead.
1993	8/17	Regnart		1,710		Est. past peak 3-4 days.
Totals			10,256	32,761[a]		
Average			1,465	1,489		
1994	8/17	Regnart		2,531		Visibility good. Past peak.
Deviation 1994[b]				+70%		

[1] Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

[a] Includes only largest index count each year.

[b] 1994 deviation from 1963-1993 average.

Appendix Table 5. Chinook salmon escapement survey history, King Salmon Creek, Naknek River drainage, 1964-1994.

Year	Count Dates	Surveyor	Float Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate[1]	Comments
1964	7/31	Paddock		378		Helicopter. Survey fair.
	8/11	Paddock		55		Helicopter. Poor vis.
	8/11-8/14	Paddock	104			Past peak. Turbid.
1966	7/31-8/03	Redick	633			At or near peak.
1967	7/24-7/26	Paddock	289		600	Poor visibility.
1968	7/17	Whitehead		282		Helicopter. Pre-peak.
	7/17	Meyers		242		Helicopter. Pre-peak.
	7/20	Whitehead		868		H-21 heli. Good survey
	7/20	Meyers		575		H-21 heli. Good survey
	7/20-7/23	Whitehead	2,204			Count conditions optimal.
1969	7/23-7/25	Parkinson	2,722			Pre-peak. Survey fair.
1970	7/19	Whitehead		260		Pre-peak. Poor vis.
1971	7/28	Cunningham		704		Good visibility.
1972	7/29	Siedelman		1,224		At spawning peak.
1973	8/01	Siedelman		115		Past peak. Vis fair.
1974	7/15	Russell		164	350	Pre-peak. Fish in pools.
	7/28	Russell		495	625	At/near peak. Good vis.
1975	7/28	Russell		279	375	Pre-peak. Good vis.
	8/10	Russell	67			Lower 12 miles of stream
	8/17			0		Spawning over. Good Vis.
1976	8/03	Bill		180	400	Peak within next 3 days.
1977	7/29	Russell		1,860	2,350	At spawning peak.
1978	8/09	Gwartney			350	Past peak. Good survey.
1979		Gwartney			1,750	
1980	8/08	Bill				Creek too murky to count.
1981	7/30	Russell		591	1,500	At peak. Vis fair/poor.
1982	8/07	Bill		980	3,920	Good visibility.
1983	8/14	Bill		460	1,400	30% dead. Poor vis.
1984	8/08	Bill		385	1,155	
1985	8/06	Bill			500	
1886	8/08	Meyer		70		Poor survey conditions.
	8/11	Meyer		102	284	Past peak. Fair survey.
1987	8/13	Russell		290	800	Past peak. Poor vis. Est. based on jet boat trip, carcass samplers
	8/21	Meyer		13	33	Past peak by 2 weeks.
1988	8/08	Minard		600		At peak.
1989	8/14	Minard		100		Past peak.
1990	8/06	Minard		350		
1991	7/30	Russell		100		Pre-peak. Survey fair.
	8/05	Russell		275		At peak. Fish on redds.
1992	8/09	Russell		158		Past peak. Incl 47 dead.
1993	7/31	Russell		700	900	Slightly pre-peak.
Totals			5,952	11,354[a]		
Average			1,190	516		
1994	7/29	Russell		974	1,200	Slightly pre-peak.
Deviation 1994[b]				+89%		

[1] Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

[a] Includes only largest index count each year.

[b] 1994 deviation from 1964-1993 average.

Appendix Table 6. Chinook salmon escapement survey history, Paul's Creek, Naknek River drainage, 1971-1993.

Year	Count Dates	Surveyor	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate[1]	Comments
1971	7/28	Cunningham	52		
1972	7/28	Siedelman	156		Pre-peak.
1973	8/01	Siedelman			Too murky to survey.
1974	7/15	Russell	2		
	7/26	Russell	91	250	Pre-peak.
1975	7/28	Russell	144	225	Pre-peak. Good vis.
1976	8/03	Bill	31	100	At peak. Poor vis.
1977					No count.
1978	8/09	Gwartney		300	Past peak. 75% dead.
1979					No count.
1980	8/08	Bill	17		All carcasses. Murky.
1981					No count.
1982	8/07	Bill	340	1,020	Near peak. Good vis.
1983	8/14	Bill	290	800	Poor visibility.
1984	8/08	Bill	400	800	Fair vis. 25% dead.
1985	8/06	Bill		170	Pre-peak.
1986	8/08	Meyer	73	236	Approx 30% dead already.
1987	8/13	Russell	7		Past peak. Poor survey vis.
		Meyer		400	Estimate based on jet boat trip by carcass samplers.
1988	8/08	Minard	150		At peak.
1989	8/14	Minard	50		Past peak. Excellent vis.
1990	8/06	Minard	150		Excellent survey conditions.
1991	7/30	Russell	121		Slightly pre-peak.
1992	8/01	Russell	88		Slightly pre-peak.
1993	7/31	Russell	86	140	A little pre-peak.
Totals			2,246[a]		
Average			132		
1994	7/29	Russell	203	300	Visibility good. Pre-peak.
Deviation 1994[b]			+54%		

[1] Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

[a] Includes only largest index count each year.

[b] 1994 deviation from 1971-1993 average.

Appendix Table 7. Chinook salmon escapement survey history, Alagnak River, 1963-1994.

Year	Count Dates	Surveyor	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate[1]	Comments
1963	8/12	Siedelman	551		Good vis. No side-chan. counts.
1966	8/06	Redick	13		Poor vis. Floated Nonv. R. & mainstem 8/06-8/10 & saw 238.
	8/11	Redick	1,465		Pre-peak. Still migrating.
1967	8/16	Van Valin	1,250		
1968	8/18	Siedelman	6,717	8,500	Fairly good survey.
1969	8/19	Siedelman	4,781	6,000	Marginal vis., 20 kn NW winds.
1970	8/22	Siedelman	5,250	5,000	Peak of spawning. Good vis.
	8/22	Whitehead	4,590		Peak of spawning. Good vis.
1971	8/25	Siedelman	1,420	1,500	High water but count okay.
	8/25	Cunningham	1,475		Survey trainee w/Siedelman.
1972	8/23	Cunningham	2,256	2,400	Past peak. Many dead.
1973	8/16	Russell	824	1,250	Near peak. No dead noted.
1974	8/13	Russell	1,411	1,700	Pre-peak.
	8/19	Russell	1,596	1,900	Near peak.
1975	8/17	Russell	6,620	7,250	Pre-peak by about 1 week.
1976	8/16	Bill	7,593	8,750	Pre-peak. Few dead.
1977	8/18	Bill	3,634	12,000	Pre-peak. No count from Pfaff Pond on downstream.
	8/18	Sanders	9,425		Survey trainee w/Bill. Pond downstream.
1978	8/24	Bill	11,650	25,100	
1979					No survey.
1980	8/08	Bill	2,020	5,090	Pre-peak. Fog @ lower river.
	8/21	Bill	2,930	5,860	
1981	8/26	Bill	2,430	8,540	
1982	8/09	Bill	3,400	4,700	At least a week pre-peak.
	8/19	Bill	3,350	5,480	At peak.
1983	8/15	Bill	2,980	3,500	At peak.
1984	8/14	Bill	6,090	9,135	
1985	8/17	Bill	3,920	9,518	Near peak. About 30% dead.
1986	8/11	Bill	3,090	7,200	At peak.
1987	8/22	Bill	2,420	5,363	May be past peak. Lots dead.
1988	8/12	Bill	4,600	7,900	Near peak of spawning.
1989	8/15	Bill	3,650	5,400	About a week pre-peak.
	8/28	Bill	2,560	3,840	
1990	8/08	Bill	1,720	3,255	Pre-peak. Many fish schooled.
1991	8/09	Regnart	2,023		Pre-peak. Most fish schooled.
	8/19	Regnart	2,531		Near peak. Most on redds.
1992	8/10	Regnart	3,042		Pre-peak. Most fish schooled.
	8/21	Regnart	2,275		Near peak. Marginal vis.
1993	8/09	Regnart	10,170		Near peak. Most on redds.
Total			108,530[a]		
Average			3,876		
1994	8/7	Regnart/Weiland	8,480		Pre-peak, half on redds.
Deviation 1994[b]			+119%		

[1] Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.
[a] Includes only largest index count each year.
[b] 1994 deviation from 1963-1993 average.

Appendix Table 8. Chinook salmon escapement survey history, Kvichak River, 1976-1994.

Year	Count Dates	Surveyor	Actual Non-expanded Aerial Index Count	Expanded Aerial Index Estimate[a]	Comments
1976	8/16	Bill	35	45	Survey targeting pinks.
1980	8/08	Bill	900	1,000	Actively spawning.
1984	8/14	Bill	200		
1988	8/13	Bill	190	570	Nearly all on redds.
1989	8/16	Bill	100	260	
1990	8/19	Bill	170	510	
1992	8/13	Regnart	264		All fish on redds.
1993	8/16	Regnart	115		All on Kaskanak Flats.
Totals			1,974[b]		
Average			247		
1994	8/12	Regnart	306		All on Kaskanak Flats.
Deviation 1994[c]			+24%		

[a] Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.
[b] Includes only largest index count each year.
[c] 1994 deviation from 1976-1993 average.

Appendix Table 9. Chinook salmon escapement data, Naknek-Kvichak District, 1970-1994.

	Non-expanded Escapement Indices by Drainage[1]			
Year	Kvichak	Naknek	Alagnak	Total
1970		4,145[a]	5,250	9,395
1971		2,885	1,420	4,305
1972		2,791	2,256	5,047
1973		2,536[a]	824	3,360
1974		1,446[b]	1,596	3,042
1975		3,452	6,620	10,072
1976	35	7,131	7,593	14,759
1977		6,690[a]	3,634	10,324
1978		[c]	11,650	11,650[c]
1979		[c]	[c]	[c]
1980	900	347[d]	2,930	4,177
1981		4,271[a]	2,430	6,701
1982		8,610	3,400	12,010
1983		7,830	2,980	10,810
1984	200	4,995	6,090	11,285
1985		590[e]	3,920	4,510
1986		3,917	3,090	7,007
1987		4,450	2,420	6,870
1988	190	11,730	4,600	16,520
1989	100	2,710	3,650	6,460
1990	170	7,000	1,720	8,890
1991		4,391	2,531	6,922
1992	264	2,691	3,042	5,997
1993	115	8,016	10,170	18,301
Totals	1,974	102,624	93,816	198,414
Average	247	4,665	4,079	8,991[f]
1994	306	9,678	8,480	18,464
Deviation 1994[g]	+24%	+107%	+108%	+105%

[1] Includes aerial indices from all streams surveyed in drainage.
[a] No index count for Paul's Creek.
[b] No index count for Naknek River.
[c] No non-expanded index counts exist for this year.
[d] Includes only index counts for Naknek River & Paul's Creek.
[e] Naknek River mainstem only.
[f] Sum of mean indices.
[g] 1994 deviation from 1970-1993 average.

Appendix Table 10. Chum salmon escapement survey history, Alagnak River, 1961-1994.

Year	Count Dates	Surveyor	Tower Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate[1]	Comments
1961			18,906			
1962			3,846			
1963	8/12	Siedelman	20,124	4,120		
1964			2,562			
1965			132			
1967			9,990			
1968			72			
1969			210			
1970			5,790			
1971			402			
1972			48			
1976	8/16	Bill		2,125	5,250	
1977	8/18	Bill		35,000		Only upper 1/2 river.
1978	8/24	Bill		9,900		
1980	8/21	Bill		7,300	14,600	
1981	8/26	Bill		75,000		
1982	8/09	Bill		14,000	42,000	
	8/19	Bill		12,000	30,000	
1983	8/15	Bill		8,800		Pre-peak.
1984	8/14	Bill		48,000	87,500	
1985	8/17	Bill		18,200	31,200	Includes 11,700 dead.
1986	8/11	Bill		41,400	107,000	Near peak. Lots of dead.
1987	8/22	Bill		7,800	39,000	Past peak. Lots dead.
1988	8/12	Bill		59,000		Pre-peak. Minimum est.
1989	8/15	Bill		3,700	4,000	
	8/28	Bill		6,000		
1990	8/08	Bill		8,500	30,000	Pre-peak.
	8/18	Bill		48,800		Near peak.
1991	8/09	Regnart		43,000		Pre-peak.
	8/19	Regnart		64,300		At peak of spawning.
1992	8/10	Regnart		114,000		Near peak.
1993	8/09	Regnart		4,600		
Totals			39,330	568,345[a]		
Average			3,575	31,575		
1994	8/08	Weiland		62,900		Near peak.
Deviation 1994[b]				+99%		

[1] Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

[a] Includes only largest index count each year.

[b] 1994 deviation from 1961-1993 average.

Appendix Table 11. Pink salmon escapement survey history, Alagnak River, 1968-1994.

Year	Count Dates	Surveyor	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate[1]	Comments
1968	8/27	Siedelman	97,000	125,000	
1970					No survey.
1972					No survey.
1974	8/14	Bill	20,600		Big schools. Pre-peak.
1976	8/16	Bill	6,375	13,000	Pre-peak.
1978	8/24	Bill	330,300	736,000	Just starting to spawn.
1980	8/21	Bill	121,000	242,000	
1982	8/09	Bill	21,300	63,900	Pre-peak.
	8/19	Bill	24,800	43,000	Pre-peak.
1984	8/14	Bill	296,500	567,100	Pre-peak. Most schooled.
1986	8/11	Bill	48,600	145,800	
1988	8/12	Bill	415,000	620,000	Pre-peak.
1990	8/08	Bill	45,100		Pre-peak.
	8/18	Bill	240,500		Est. 1 week pre-peak.
1992	8/10	Regnart	15,000		Pre-peak.
1994					No survey.
Totals			1,615,675[a]		
Average			146,880		

[1] Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

[a] Includes only largest index count each year.

Appendix Table 12. Pink salmon escapement survey history, Kvichak River, 1966-1994.

Year	Count Dates	Surveyor	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate[1]	Comments
1966		Robertson		67,500	
1968	8/26	Siedelman		88,000	
1970					No survey.
1972					No survey.
1974	8/14	Bill		30,560	
1976	8/16	Bill		16,100	Pre-peak.
1978	8/28	Bill	88,000	440,000	Still migrating & schooled.
1980	8/08	Bill	7,000	25,000	Still schooled.
1982					No survey.
1984	8/14	Bill	111,000	165,000	
1986					No survey.
1988	8/13	Bill	94,000		
1990	8/19	Bill	25,300	47,000	
1992					No survey.
1994					No Survey.
Totals			325,300		
Average			65,060		

[1] Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

Appendix Table 13. Pink salmon escapement survey history, Naknek River, 1974-1994.

Year	Count Dates	Surveyor	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate[1]	Comments
1974	8/14	Bill	161,800	362,000	
1976	8/13	Bill	94,600	110,000	Pre-peak. Many schooled.
1978	8/24	Bill	312,000	780,000	
1980	8/08	Bill	80,000	160,000	Pre-peak.
1982	8/19	Bill	33,600	34,000	Pre-peak.
1984	8/14	Bill	27,000	125,000	
1986	8/18	Russell	286,000	375,000	Pre-peak. Most schooled.
1988	8/24	Russell	187,000		
1990	8/18	Bill		65,000	
1992					No survey.
1994					No survey.
Totals			1,182,000		
Average			147,750		

[1] Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

Appendix Table 14. Aerial survey counts of chinook salmon escapement, Egegik District, 1981-1994.

Year	Egegik River	Shosky Creek	Gertrude Creek	Contact Creek	Takayoto Creek	Kaye's Creek	Other	Total
1981			515					515
1982	300		900	300				1,500
1983			860	375	380			1,615
1984	40	300	600	110	350			1,400
1985	75	80	260	95	315	230	25	1,080
1986	65	150	150	18	40	46	63	532[a]
1987	15	174	408	88	232	284	78	1,279
1988	50	151	248	110	177	120	12	868
1989	14	90	310	100	300	120	63	997
1990	24[b]	85	260	205	175	175	44	968
1991	0[b]	62	83	73	95	117	123	553
1992[c]	15	143	416	296	190	320	128	1,508
1993	80	58	350	235	200	170	50	1,143
Total	678	1,293	5,360	2,005	2,454	1,582	586	13,958
Average	62	129	412	167	223	176	65	1,234[d]
1994[c]	40[e]	48	840	705	230	214	227	2,304
Deviation 1994[e]	-35%	-63%	+104%	+322%	+3%	+22%	+249%	+88%

[a] Survey done 10 to 14 days later than normal.
[b] Tower counts.
[c] Helicopter surveys.
[d] Sum of mean indices for all locations.
[e] The Egegik River Tower was maintained through September 11 and a total of 66 chinook salmon were counted.
[e] 1994 deviation from 1981-1993 average.

Appendix Table 15. Aerial survey counts of chum salmon escapement, Egegik District, 1982-1994.

Year	Egegik River	Whale Mountain Creek	Gertrude Creek	Contact Creek	Takayoto Creek	Kaye's Creek	Other	Total
1982			12,000	2,000				14,000
1983			5,000	6,000	3,500			14,500
1984	800		13,000	10,000	2,400		200	26,400
1985	400	600	2,600	500	0	800	285	5,185
1986	0	6,025	140	15	5	3	25	6,213[a]
1987	150	19,000	3,770	2,850	0	2,780	1,016	29,566
1988	500	4,400	5,200	3,200	0	1,600	200	15,100
1989	0	5,200	1,100	200	0	0	150	6,650
1990	72[b]	4,875[c]	2,975[c]	1,050[c]	0	80	150	9,202
1991	0	1,500	990	480	0	280	170	3,420
1992[d]	50	680	4,500	3,630	0	400	240	9,500
1993	100	1,020	1,075	100	0	0	9	2,304
Total	2,072	43,300	52,350	30,025	5,905	5,943	2,445	142,040
Average	207	4,811	4,363	2,502	537	660	245	13,325[e]
1994[d]	0	1,700	760	260	30	175	12	2,937
Deviation 1994[f]	-100%	-65%	-83%	-90%	-94%	-73%	-95%	

[a] Survey done 10 to 14 days later than normal.
[b] Tower counts.
[c] Total derived by adding Aug. 02 count to one half the counts obtained on Aug. 07, 12, 17, and 28.
[d] Helicopter surveys.
[e] Sum of mean indices for all locations.
[f] 1994 deviation from 1982-1993 average.

Appendix Table 16. Aerial survey counts of pink salmon escapement, Egegik District, 1982-1994.

Year	Number of Surveys	Pink Salmon Count	Comments
1982	2	15,000	Spawning in Egegik River "Rapids" on August 26.
1983	0	58	Counted during float trip of Gertrude Creek.
1984	3	17,000	Peak count for Egegik River was 13,000 on August 31.
1985	3	0	
1986	1	2,500	Count made August 19.
1987	6	0	
1988	6	23,000	Peak count made September 7.
1989	8	300	
1990	6	17,000	Peak count made on August 23.
1991	1	0	
1992[a]	0		No pink salmon surveys flown.
1994[ab]	1	605	Aerial count made on August 6.

[a] Helicopter surveys.
[b] The Egegik River Tower was maintained through September 11 and approximately 21,282 pink salmon were counted.

Appendix Table 17. Aerial survey counts of coho salmon escapement, Egegik District, 1981-1994.

Year	Number of Surveys	Coho Salmon Count	Comments
1981	1[a]	4,000	Only Becharof tributaries surveyed.
1982	1	20,000	Surveyed on August 20.
1983	0		No surveys done.
1984	3	43,225	40,000 counted in Ege. Lagoon on August 15.
1985	3	5,260	Peak survey on August 26.
1986	1	12,575	Surveyed August 19.
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 Mtn Creeks.
1990	7	13,400	Peak survey on August 17.
1991	0	220	Incidental observation made August 6.
1992[b]	0	200	Incidental obs. in Egegik River August 6.
1993	0	1,130	Incidental obs. from Egegik River August 16.
1994[bc]	2	7,412	Included King Salmon River & tributaries.

[a] Survey done by USFWS personnel.
[b] Helicopter surveys.
[c] The Egegik River Tower was maintained through September 11 and approximately 10,140 coho salmon were counted.

Appendix Table 18. Aerial survey counts of chinook salmon escapement, Ugashik District, 1980-1994.

Year	Ugashik River	Dog Salmon River[1]	King Salmon River	Painter Creek	Pumice Creek	Old Creek	Total
1980			900	1,000			1,900
1981			50	300			350
1982			700	700			1,400
1983	50	965	525	635	1,800	660	4,635
1984	108[a]	840	4,100	1,880	1,100	880	8,908
1985	200[b]	560	4,601	410	930	410	7,111
1986	66[b]	252	1,777	646	705	739	4,185
1987	138[b]	751	981	1,051	1,602	1,155	5,678
1988	249[c]	900	5,820	1,170	1,025	660	9,824
1989	226[bc]	848	1,670	1,030	510	520	4,804
1990	55[c]	540	1,500	590	450	610	3,745
1991	91[ac]	449	700	365	375	420	2,400
1992[d]	200[ac]	821	1,260	855	750	815	4,701
1993	123[ac]	579	1,970	865	450	635	4,637
Total	1,506	7,505	26,554	11,497	9,697	7,504	64,278
Average	137	682	1,897	821	882	682	5,101[e]
1994[d]	233[ac]	1,741	2,225	1,005	2,530	1,490	9,224
Deviation 1994[f]	+70%	+155%	+17%	+22%	+187%	+118%	+81%

[1] Includes Figure-Eight, Goblet, Oldham, & Wandering Creeks.
[a] Ugashik River tower count.
[b] Tower count plus later aerial survey counts of main river.
[c] Survey included Grassy Creek.
[d] Helicopter surveys.
[e] Sum of mean indices for all locations.
[f] 1994 deviation from 1980-1993 average.

Appendix Table 19. Aerial survey counts of chum salmon escapement, Ugashik District, 1980-1994.

Year	Ugashik River	Dog Salmon River[1]	King Salmon River	Painter Creek	Pumice Creek	Old Creek	Other	Total
1980	18[a]		7,000	3,000				10,018
1981	0[a]		200					200
1982	12[a]		19,000	35,000			650	54,662
1983	0[a]	3,150	2,700	4,000	20,000[b]	3,300		33,150
1984	132[a]	750	119,000	16,000	16,000	14,500	2,500	168,882
1985	42[c]	350	20,000	1,925	6,000	670	300	29,287
1986	0[c]	120	8,650	1,200	2,000	630	125	12,725
1987	130[c]	340	9,750	2,290	10,340	2,090	40	24.980
1988	752[cd]	2,290	25,000	10,500	11,650	5,800	950	56,942
1989	600[cd]	1,005	7,500	3,700	2,200	2,010	625	17,640
1990	300[d]	170	7,600	1,150	1,630	410	10	11,270
1991	225[d]	240	7,400	750	2,550	2,525	130	13,820
1992[e]	460[ac]	1,210	8,525	4,000	14,000	15,000	0	43,195
1993	87[c]	105	7,000	720	2,040	1,025	8	10,985
Total	2,758	9,730	249,325	84,235	88,410	47,960	5,338	487,756
Average	197	885	17,809	6,480	8,037	4,360	485	38,253[f]
1994[e]	66[ac]	851	9,150	1,625	12,750	6,975	150	31,567
Deviation 1994[g]	-66%	-4%	-49%	-75%	+59%	+60%	-69%	-17%

[1] Includes Figure Eight, Goblet, Oldham, & Wandering Creeks.
[a] Tower Counts.
[b] Float count done from a raft.
[c] Includes Grassy Creek (tributary downstream of Ugashik Lagoon).
[d] Includes tower count plus later aerial survey count.
[e] Helicopter surveys.
[f] Sum of mean indices for all locations.
[g] 1994 deviation from 1980-1993 average.

Appendix Table 20. Aerial survey counts of pink salmon escapement, Ugashik District, 1980-1994.

Year	Number of Surveys	Pink Salmon Count	Comments
1980	1	2,000	
1982	1	6,000	4,000 in King Salmon River, 2,000 in Painter Creek.
1983	2	803	Survey of Dog Salmon River conducted by USFWS.
1984	3	656	650 counted in King Salmon River during September 21 float trip.
1985	3	0	
1986	1	350	Observed in King Salmon River on August 19.
1987	2	1	
1988	7	2,800	Peak count on August 23; 2,000 in King Salmon River.
1989	8	50	Observed in Ugashik River on August 9.
1990	5	2,000	Peak count on August 13.
1991	0	660	Ugashik River tower count.
1992[a]	0	1,728	Ugashik River tower count.
1994[a]	0	425	Obs. near Ugashik Lake Outlet on August 11.

[a] Helicopter survey.

Appendix Table 21. Aerial survey counts of coho salmon escapement, Ugashik District, 1981-1994.

Year	Number of Surveys	Coho Salmon Count	Comments
1981	1	13,300	Surveyed on September 7.
1982	1	10,000	Surveyed August 26.
1983	0		
1984	1	6,100	Surveyed on August 31.
1985	2	18,880	16,500 in King Salmon River on September 12.
1986	2	8,455	Surveyed on August 19 and 25.
1987	2	17,000	16,700 in King Salmon River on August 23.
1988	7	28,280	12,900 in King Salmon River 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.

[a] Helicopter survey.

Appendix Table 22. Spawner distribution and total escapement estimates of sockeye salmon, Wood River system, 1959-1994.

	Spawner Distribution (%)			
Year	Creeks	Beaches	Rivers	Total Escapement[1]
1959	32.8	50.3	16.9	2,209,300
1960	27.4	55.5	17.1	1,016,100
1961	11.4	32.3	56.3	460,700
1962	24.0	65.2	10.8	873,900
1963	12.1	68.5	19.4	721,400
1964	18.9	64.0	17.1	1,076,100
1965	40.6	11.1	48.3	675,100
1966	16.4	54.9	28.7	1,208,700
1967	9.3	66.2	24.5	515,800
1968	9.9	50.8	39.3	649,300
1969	8.6	42.4	49.0	604,300
1970	14.0	52.4	33.6	1,162,000
1971	11.2	56.8	32.0	851,200
1972	17.4	45.1	37.5	430,600
1973	11.5	23.9	64.6	330,500
1974	14.1	63.9	22.0	1,708,800
1975	14.5	34.4	51.1	1,270,100
1976	12.7	33.5	53.8	817,000
1977	11.3	39.5	49.2	561,800
1978	14.2	51.3	34.5	2,267,200
1979	7.3	60.4	32.3	1,706,400
1980	20.8	24.5	54.7	2,969,000
1981	23.0	20.7	56.3	1,233,000
1982	14.0	17.2	68.8	976,400
1983	14.3	60.9	24.8	1,361,000
1984	11.4	27.6	61.0	1,002,800
1985	18.6	22.2	59.1	939,000
1986	16.1	23.3	60.6	819,000
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
Average	18.2	43.6	37.6	1,099,954
1994	25.5	36.4	38.1	1,471,900
Deviation 1994[a]	+ 40%	- 17%	+ 1%	+34%

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

[a] 1994 deviation from 1959-1993 average.

Appendix Table 23. Peak aerial counts of live sockeye salmon, Lake Nunavaugaluk drainage, 1975-1994.

Year	Snake River	Snake R.-Eagle Cr. Beach	Eagle Creek	Eagle Lake	Westshore Beach	Killian Creek	Eastshore Beach	East Creek	Southshore Beach	Total
1975	80	1,200	90	260	1,250	780	710	0	100	4,470
1976	40	3,000	240		2,820	470	1,270		220	8,060
1977	410	1,520	90	120	2,690	650	1,430		50	6,960
1978	100	1,400	110	180	5,510	1,700	1,630		150	10,780
1979[a]										
1980[a]										
1981[a]										
1982	300	1,220	150	500	1,170	900	1,470	100	10	5,820
1983	0	560			400	110	470	0	10	1,550
1984	500	3,980	800	0	2,570	2,200	3,830	1,600	1,440	16,920
1985	100	4,070	0	700	5,040	3,600	2,240	1,200	490	17,440
1986		2,900	500	690	1,600	400	840	1,400	60	8,390
1987[a]										
1988[a]										
1989		2,800	1,000		5,290	1,200	2,060	700	980	14,030
1990	30	2,840	250	300	4,300	2,600	3,280	200	620	14,420
1991	120	2,050	50	340	1,480	240	870	10	300	5,460
1992[a]										
1993[a]										
1994	560	2,450	70	480	3,880	880	2,100	20	800	11,240
Average	204	2,307	279	357	2,923	1,210	1,708	523	402	9,913[b]
Percent	2.1%	23.3%	2.8%	3.6%	29.5%	12.2%	17.2%	5.3%	4.1%	100.0%

[a] No survey conducted.
[b] Sum of means for all areas.

Appendix Table 24. Inshore commercial catch and escapement of chinook salmon in the Nushagak and Togiak Districts, in numbers of fish, Bristol Bay, 1974-1994.[1]

Year	Nushagak District			Togiak District		
	Catch	Escapement[2]	Total Run	Catch	Escapement[3]	Total Run
1974	32,053	70,000	102,053	10,798	15,000	25,798
75	21,454	70,000	91,454	7,226	11,000	18,226
76	60,684	100,000	160,684	29,744	14,000	43,744
77	85,074	65,000	150,074	35,218	20,000	55,218
78	118,548	130,000	248,548	57,000	40,000	97,000
1979	157,321	95,000	252,321	30,022	20,000	50,022
80	64,958	141,000	205,958	12,543	12,000	24,543
81	193,461	150,000	343,461	23,911	27,000	50,911
82	195,287	147,000	342,287	33,786	17,000	50,786
83	137,123	162,000	299,123	38,497	22,000	60,497
1984	61,378	81,000	142,378	22,179	26,000	48,179
85	67,783	116,000	183,783	37,106	14,000	51,106
86	65,783	43,434	109,217	19,880	8,000[a]	27,880
87	45,983	84,309	130,292	17,217	11,000	28,217
88	16,648	56,905	73,553	15,606	10,000	25,606
1989	17,637	78,302	95,939	11,366	10,739	22,105
90	14,812	63,955	78,767	11,130	9,107	20,237
91	22,898	104,357	124,075	6,039	12,667	18,706
92	47,897	82,848	130,745	12,614	10,413	23,027
93	62,294[b]	97,812	160,106	11,649[b]	16,035	27,684
20-Year Ave.	74,295	96,946	171,241	22,177	16,298	38,475
1974-83 Ave.	106,596	113,000	219,596	27,875	19,800	47,675
1984-93 Ave.	41,993	80,892	122,886	16,479	12,796	29,275
1994	118,643[b]	95,954	214,597	10,629[b]	19,353	29,982

[1] Escapement estimates supersede those previously reported.
[2] Escapements were estimated from the following:
1974-81 - comprehensive aerial surveys.
1982-85 - correlation between index counts and total escapement estimates when aerial surveys were complete.
1986-94 - sonar estimate.
Estimates for 1974-85 are rounded to the nearest thousand fish.
[3] Escapement estimates based on comprehensive aerial surveys.
Estimates for 1974-88 are rounded to the nearest thousand fish.
[a] Minimal estimate based on incomplete data.
[b] Preliminary.

(Sources: 1,5 and 13)

Appendix Table 25. Inshore commercial catch and escapement of chum salmon in the Nushagak and Togiak Districts, in numbers of fish, Bristol Bay, 1974-1994.[1]

Year	Nushagak District			Togiak District		
	Catch	Escapement[2]	Total Run	Catch	Escapement[3]	Total Run
1974	157,941	100,000	257,941	80,710	161,000	241,710
75	152,891	80,000	232,891	87,058	114,000	201,058
76	801,064	500,000	1,301,064	153,559	392,000	545,559
77	899,701	609,000	1,508,701	270,649	496,000	766,649
78	651,743	293,000	944,743	274,967	396,000	670,967
1979	440,279	166,000	606,279	219,942	293,000	512,942
80	681,930	969,000	1,650,930	299,682	415,000	714,682
81	795,143	177,000	972,143	229,886	331,000	560,886
82	434,817	256,000	690,817	151,000	86,000	237,000
83	725,060	164,000	889,060	322,691	165,000	487,691
1984	850,114	362,000	1,212,114	336,660	204,000	540,660
85	396,740	288,000	684,740	203,302	212,000	415,302
86	488,375	168,275	656,650	270,057	330,000[a]	600,057
87	416,476	147,433	563,909	419,425	361,000	780,425
88	371,196	186,418	557,614	470,132	412,000	882,132
1989	523,903	377,512	901,415	203,178	143,890	347,068
90	378,223	329,793	708,016	102,861	67,460	170,321
91	463,780	287,280	751,060	246,589	149,210	395,799
92	313,034[a]	302,678	615,712	174,017[a]	120,000	294,017
93	414 879[a]	217,230	632,109	152,871[a]	98,470	251,341
20-Year Ave.	517,864	299,031	816,895	233,462	247,352	480,813
1974-83 Ave.	574,057	331,400	905,457	209,014	284,900	493,914
1984-93 Ave.	461,672	266,662	728,334	257,909	209,803	467,712
1994	293,205	378,928	672,133	232,492	175,650	408,142

[1] Escapement estimates supersede those previously reported.

[2] Escapements were estimated from the following:
1974 - tower enumeration and aerial survey data;
1975-78 - aerial survey data;
1979-94 - adjusted sonar estimate from Portage Creek site.
Estimates for 1974-85 are rounded to the nearest thousand fish.

[3] Escapement estimates based on aerial surveys; however, surveys were not conducted in 1986 due to budget constraints. Estimate based on catch/escapement proportion using most recent 10-year average data. Estimates for 1974-88 rounded to the nearest thousand fish.

[a] Preliminary.

(Sources: 1,5 and 13)

Appendix Table 26. Total escapement estimates of pink salmon, Nushagak and Togiak Districts, 1962-1994.[1]

Year	Nushagak District[2]	Togiak District[3]
1962	543,000	
1964	910,560	
1974	585,520	8,620[c]
1976	863,430	37,570
1978	9,386,480	150,000[c]
1980	2,785,200	102,820
1982	1,656,660	44,300
1984	2,926,450	269,950
1986	72,190[a]	80,000[c]
1988	494,610[a]	142,500[c]
1990	801,730[a]	207,000
1992	[b]	235,000[c]
Average	1,911,439	127,776
1994	192,780[a]	88,000[c]

1 Only those years of comprehensive aerial coverage are included; even years only; all counts rounded to the nearest 10 fish.
2 Includes Wood, Igushik, Snake, Nushagak, & Nuyakuk Rivers, and Ice, Youth, & Sunshine Creeks, unless otherwise noted.
3 Includes Togiak, Matogak, Osviak, & Slug Rivers.
a Sonar estimate of Nushagak-Mulchatna Rivers only.
b No escapement estimate.
c Togiak River estimate only.

Appendix Table 27. Aerial estimates of sockeye salmon escapement, Togiak District, 1974-1994.[1]

Year	Togiak River & Tributaries[2]	Kulukak Systems[3]
1974	20,600	4,900
75	19,600	8,600
76	31,200	11,200
77	15,600	40,100
78	30,600	33,900
1979	23,700	26,600
80	50,700	45,700
81	39,700	58,800
82	25,300	52,800
83	13,200	27,000
1984	30,900	49,800
85	8,800	36,600
86	35,000	42,800
87	28,600	37,800
88	32,400	31,700
1989	19,800	10,800
90	47,100	49,600
91	23,700	23,900
92	16,500	26,400
93	15,900	31,800
1974-93 Ave. (20-Year)	19,420	29,740
1974-83 Ave. (10-Year)	27,020	30,960
1984-93 Ave. (10-Year)	25,870	34,120
1994	24,722	32,114

[1] All counts are rounded to the nearest hundred.
[2] Estimates do not include fish spawning above the counting tower (Togiak Lake outlet); estimates for Ungalikthluk, Osviak, Matogak, & Slug Rivers are not included in the 1977-93 data as reported earlier in Data Reports 73 and 81.
[3] Includes Kulukak River, Kulukak Lake, and Tithe Creek Ponds.

Appendix Table 28. Peak aerial counts of live sockeye salmon, Togiak River drainage, 1974-1993.

Year	Togiak Mainstem	Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivinuck River	Total
1974	6,000	1,700	1,100			1,500	10,300
1975	6,100	830	1,450			1,380	9,760
1976	11,000	3,300	2,600			2,200	19,100
1977	2,200	500	2,000			3,100	7,800
1978	10,000	2,020	1,200			4,620	17,840
1979	7,100	520	750			2,800	11,170
1980	18,600	3,200	2,500	500	3,200	2,000	30,000
1981	14,100	2,700	3,150			3,400	23,350
1982	2,300	3,600	2,500	0	100	4,800	13,300
1983	4,800	1,100	700	0	0	1,200	7,800
1984	10,550	2,800	2,450	0	0	2,300	18,100
1985	1,800	400	500	0	0	1,700	4,400
1986	13,500						13,500
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
Ave.	7,617	2,088	1,704	63	731	2,479	14,682[a]
Percent	51.9%	14.2%	11.6%	0.4%	5.0%	16.9%	100.0%
1994	3,100	560	1,870			3,900	9,430

[a] Sum of the averages for all streams.

Appendix Table 29. Peak aerial counts of live sockeye salmon, Togiak District, 1974-1994.

Year	Togiak River[1]	Kulukak River[2]	Tithe Creek Ponds	Quigmy River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
1974	10,300	750	1,700							12,750
1975	9,760	780	3,500							14,040
1976	19,100	1,460	4,150							24,710
1977	7,800	6,400	18,200		200	2,000	2,700		1,700	39,000
1978	17,840	8,100	11,800						1,000	38,740
1979	11,170	4,600	10,800		200	200		600	700	28,270
1980	30,000	12,200	14,200		500	200	1,900			63,500[a]
1981	23,350	15,700	18,250		700	6,400	5,900	3,900	12,800	87,000
1982	13,300	11,900	19,300		0	1,000	5,500	300	2,400	53,700
1983	7,800	8,430	2,720		80	20	2,000	230	940	22,220
1984	18,100	7,400	14,000		200	6,800		100	5,200	51,800
1985	4,400	6,700	11,600		0	200	2,300	260	1,310	26,770
1986	13,500	10,900	14,000							38,400
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	24,140	10,600	14,200	100	400	2,200	3,540	9,700	3,800	68,680
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
Ave.	14,682	9,102	9,357	106	295	2,106	3,174	2,533	3,434	44,788[b]
Percent	32.8%	20.3%	20.9%	0.2%	0.7%	4.7%	7.1%	5.7%	7.7%	100.0%
1994	9,430	10,270	4,600	580	990	1,750	6,070	2,230	3,240	39,160

[1] Includes all surveyed sections of Togiak River proper and all tributaries to the Togiak River.
[2] Includes surveys of Kulukak Lake. Counts prior to 1977 include Kulukak Lake only and are not included in the mean.
[a] Includes a combined count for the Negukthlik and Ungalikthluk of 4,500 fish.
[b] Sum of averages for all streams.

Appendix Table 30. Peak aerial counts of live chinook salmon, Togiak River drainage, 1974-1994.

Year	Togiak River Section [1]						Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivinuck River	Total
	A	B	C	D	E	F						
1974	610	650	830	300	570	860	620	200	120	160	180	5,100
1975	280	240	240	160	210	760	350	240	140	580	470	3,670
1976	210	250	510	260	450	790	550	350	270	290		3,930
1977							1,190	500	230	120	120	2,160
1978	940	1,240	1,390	810	1,060	1,850	2,150	590	780	220	220	11,250
1979	370	250	330	150	560	890	1,060	360	250	170	220	4,610
1980	180	120	340	230	120	140	910	200	510	170	190	3,110
1981	420	390	500	200	300	740	980	310	370	390	290	4,890
1982					80	320	470	170	190	130	470	1,830
1983	120	220	370	290	360	850	820	240	340	430	350	4,390
1984	250	560	900	560	820	1,920	760	580	270	580	430	7,630
1985	270	320	640	340	470	970	470	250	290	310	460	4,790
1986	150	80	160	30	110	350						880
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[a]	595	240	130	65	440	3,950
Average	275	289	485	270	427	874	694	266	238	249	253	4,320[b]
Percent	6.4%	6.7%	11.2%	6.2%	9.9%	20.2%	16.1%	6.2%	5.5%	5.8%	5.9%	100.0%
1994				215	815	1,580	420	267	244	272	264	4,420

[1] Section A; Togiak Bay - Gechiak River
Section B; Gechiak River - Pungokepuk River
Section C; Pungokepuk River - Nayorurun River
Section D; Nayorurun River - Kemuk River
Section E; Kemuk River - Ongivinuck River
Section F; Ongivinuck River - Togiak Lake

[a] Includes count from section E.

[b] Sum of averages for all streams.

Appendix Table 31. Peak aerial counts of live chinook salmon, Togiak District, 1974-1994.

Year	Togiak River[1]	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
1974	5,100		510				150	30	5,790
1975	3,670		1,100				220	80	5,070
1976	3,930		1,080		100		380	30	5,520
1977	2,160		1,480	60	120		440	40	4,300
1978	11,250		2,720	150	250		1,020	110	15,500
1979	4,610	20	2,260	100	210		850	130	8,180
1980	3,110	0	700	70	40		260	160	4,340
1981	4,890	0	1,290	470	1,730	350	1,460	180	10,370
1982	1,830	90	1,690	290	320		1,600	280	6,100
1983	4,390	40	2,460	190	120		1,080	260	8,540
1984	7,630	30	1,190	150	360		680	20	10,060
1985	4,790	0	540	100	50		80	90	5,650
1986	880								880
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
Average	4,320	24	1,110	125	235	96	711	103	6,724[a]
Percent	64.3%	0.4%	16.5%	1.9%	3.5%	1.4%	10.6%	1.5%	100.0%
1994	4,420	20	835	40	60	10	540	190	6,756

[1] Includes all surveyed sections of Togiak River proper and all tributaries to the Togiak River.
[a] Sum of averages for all streams.

Appendix Table 32. Peak aerial counts of live chum salmon, Togiak River drainage, 1974-1994.

	Togiak River Section [1]						Gechiak	Pungokepuk	Nayorurun	Kemuk	Ongivinuck	
Year	A	B	C	D	E	F	River	River	River	River	River	Total
1974	15,900	3,900	3,800	300	4,400	6,900	4,300	2,300	1,700	100	2,600	46,200
1975	5,500	5,200	1,600	500	3,000	19,500	2,600	700	1,100	1,400	1,300	42,400
1976	21,100	12,600	8,400	2,600	13,000	2,700	9,800	2,300	13,000	900	400	86,800
1977	12,000	8,000	10,900	8,000		15,100	13,600	4,900	22,100	3,100	2,400	100,100
1978	24,500	7,400	7,500	1,600	15,200	3,300	6,300	2,500	7,300	1,800	8,100	85,500
1979	14,000	2,800	3,300	800	6,600	10,400	3,500	1,000	2,500	500	200	45,600
1980	41,300	11,000	9,200	900	6,000	3,100	10,200	2,700	10,100	800	3,500	98,800
1981	11,800	4,500	2,400	1,000	3,000	6,000	3,100	500	4,300	1,700	4,200	42,500
1982				200	1,200	2,500	500	400	1,300	100	1,000	7,200
1983	8,160	3,050	3,780	1,100	2,780	6,070	150	140	5,560	570	3,790	35,150
1984	3,900	6,300	800	0	2,600	6,400	3,700	2,000	4,200	700	3,500	34,100
1985	8,300	6,500	3,200	900	6,700	10,200	4,100	600	9,600	1,800	8,300	60,200
1986[a]												
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
Ave.	12,960	5,745	4,133	1,216	5,514	8,426	4,213	1,613	5,979	944	3,583	54,326[e]
Percent	23.9%	10.6%	7.6%	2.2%	10.1%	15.5%	7.8%	3.0%	11.0%	1.7%	6.6%	100.0%
1994				1,300	5,200	10,400	900	2,400	7,100	900	3,755	55,281

[1] Section A; Togiak Bay - Gechiak River
Section B; Gechiak River - Pungokepuk River
Section C; Pungokepuk River - Nayorurun River
Section D; Nayorurun River - Kemuk River
Section E; Kemuk River - Ongivinuck River
Section F; Ongivinuck River - Togiak Lake

[a] No aerial surveys conducted.

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

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

[d] Includes count for Section E.

[e] Sum of averages for all streams.

Appendix Table 33. Peak aerial counts of live chum salmon, Togiak District, 1974-1994.

Year	Togiak River[1]	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
1974	46,200	1,400	7,900	2,100	5,600	1,100	3,000	8,400	75,700
1975	42,400	1,800	6,000	2,600	9,000	3,000	2,300	4,700	71,800
1976	86,800	6,600	14,600	9,600	26,100	7,100	8,000	15,000	173,800
1977	100,100	5,800	21,300	15,300	31,200	2,800	20,000	20,500	217,000
1978	85,500	9,400	24,200	15,000	17,500	6,400	7,600	8,000	173,600
1979	45,600	11,000	16,400	13,400	36,200	4,000	3,800	6,600	137,000
1980	98,800	2,700	27,300	5,700	29,500	6,700	18,500	15,000	204,200
1981	42,500	10,800	11,200	21,700	53,000	3,900	3,800	14,600	161,500
1982	7,200	1,300	8,300	3,100	5,500	2,400	160	1,270	29,230
1983	35,150	4,900	12,960	7,600	11,900	1,210	300	7,360	81,380
1984	34,100	6,300	8,500	10,200	18,400		2,100	3,000	82,600
1985	60,200	1,800	7,800	2,860	5,460	8,800	130	14,650	101,700
1986[a]									
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
Average	54,326	4,694	13,467	7,552	15,436	4,228	3,980	8,395	112,079[c]
Percent	48.5%	4.2%	12.0%	6.7%	13.8%	3.8%	3.6%	7.5%	100.0%
1994	33,900	890	10,700	1,630	2,000	4,360	230	1,090	54,800

[1] Includes all surveyed sections of Togiak River proper and all tributaries to the Togiak River.
[a] No aerial surveys conducted.
[b] Preferred estimate from a management survey due to post-peak spawning ground survey.
[c] Sum of averages for all streams.

Appendix Table 34. Peak aerial counts of live coho salmon, Togiak River drainage, 1980-1994.

	Togiak River Section [1]						Gechiak	Pungokepuk	Nayorurun	Kemuk	Ongivinuck	
Year	A	B	C	D	E	F	River	River	River	River	River	Total
1980	3,620	1,010	1,740	1,270	5,080	1,860	3,460	760	1,310	860	740	21,710
1981	9,280	580	100	800	370	750	520	360	230	210	1,300	14,500
1982	2,200	1,500	150	100	1,400	1,700	1,930	1,740	510	200	11,870	23,300
1983[a]												
1984	1,440	1,190	200	120	620	1,480	4,750	2,240	990	1,110	6,140	20,280
1985	800[b]	660[b]	110[b]	70[b]	150	820	1,340	750	40	80	6,250	11,070
1986			60	400	100	400					2,560	3,520
1987	340	500	250	200	240	530	1,020	70			1,060	4,210
1988	950	370		140	210	360	1,530				4,100	7,660
1989[a]												
1990	1,650	390	400	0	540	660	920	450	260	130	1,730	7,130
1991	4,900[c]	400[c]	700[c]	600[c]	1,680[c]	140[c]					100[c]	8,520
1992	4,420	1,120	1,180	540	2,940	3,080	5,240	1,440	780	1,500	4,460	26,700
1993[a]												
Ave.	2,744	813	466	364	1,165	1,164	2,301	976	589	584	4,021	14,785[c]
Percent	18.6%	5.5%	3.1%	2.5%	7.9%	7.9%	15.6%	6.6%	4.0%	4.0%	27.2%	100.0%
1994							1,290[d]	220[d]	120[d]	95[d]	1,930	3,655

[1] Section A; Togiak Bay - Gechiak River
Section B; Gechiak River - Pungokepuk River
Section C; Pungokepuk River - Nayorurun River
Section D; Nayorurun River - Kemuk River
Section E; Kemuk River - Ongivinuck River
Section F; Ongivinuck River - Togiak Lake

[a] No aerial surveys conducted.

[b] Proportional estimates based on 1984 data.

[c] Sum of averages for all streams.

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

Appendix Table 35. Peak aerial counts of live coho salmon, Togiak District, 1980-1994.

Year	Togiak River[1]	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
1980	21,710		10,300						32,010
1981	14,500		3,790				100	840	19,230
1982	23,300		3,380						26,680
1983[a]									
1984	20,280		10,750	1,850	1,080	670			34,630
1985	11,070	200	7,790	610	420				20,090
1986	3,520								3,520
1987	4,210	30	910	440	120			130	5,840
1988	7,660	460	1,840	310	490	470	370	3,170	14,700
1989[a]									
1990	7,130	1,030	5,200	2,680	1,490	810		4,150	22,490
1991[b]	8,520		4,200						12,720
1992	26,700		12,640						39,340
1993[a]									
Average	14,785	430	6,288	1,177	720	650	235	2,073	27,439[c]
Percent	53.9%	1.6%	22.9%	4.3%	2.6%	2.4%	0.9%	7.6%	100.0%
1994	3,655[d]								

[1] Includes all surveyed sections of Togiak River proper and all tributaries to the Togiak River.
[a] No aerial surveys conducted.
[b] Timing of aerial surveys did not coincide with the period of peak spawning activity, and therefore, 1991 counts were not included in the mean or percent.
[c] Sum of means for all streams.
[d] Only Togiak River tributaries surveyed; not included in the average or percent.

analize