2A96-31

SALMON SPAWNING GROUND SURVEYS

IN THE BRISTOL BAY AREA, ALASKA, 1995

by

Thomas E. Brookover, James B. Browning, Jeffrey R. Regnart, Richard B. Russell, and Keith A. Weiland

Regional Information Report[1] No. 2A96-31

Alaska Department of Fish and Game
Division of Commercial Fisheries Management and Development
333 Raspberry Road
Anchorage, Alaska 99518-1599

August 1996

---

[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports.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 timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data; this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries Management and Development.

AUTHORS

Thomas E. Brookover is the Nushagak Area Management Biologist for the Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, P.O. Box 230, Dillingham, AK 99576-0230.

James B. Browning is the Togiak Area Management Biologist for the Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, P.O. Box 230, Dillingham, AK 99576-0230.

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

Richard B. Russell is the Egegik Area Management Biologist for the Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, P.O. Box 37, King Salmon, AK 99613-0037.

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

ACKNOWLEDGMENTS

We would like to thank the U.S. Fish and Wildlife Service and the University of Washington, Fisheries Research Institute for equipment, personnel and funding they provided to help gather escapement data in 1995. Critical review of this manuscript by Stephen M. Fried is gratefully acknowledged.

TABLE OF CONTENTS

Page

LIST OF TABLES iv

LIST OF FIGURES v

LIST OF APPENDICES vi

INTRODUCTION 1

- Naknek/Kvichak District 1
- Egegik District 1
- Ugashik District 2
- Nushagak District 2
- Togiak District 3

METHODS 4

- Naknek/Kvichak District 4
- Egegik District 5
- Ugashik District 5
- Nushagak District 5
- Togiak District 6

RESULTS AND DISCUSSION 7

- Naknek-Kvichak District 7
- Egegik District 8
- Ugashik District 9
- Nushagak District 10
- Togiak District 12

LITERATURE CITED 13

TABLES 15

FIGURES 32

APPENDICES 42

LIST OF TABLES

Table		Page
1.	Aerial survey counts of sockeye salmon, Alagnak River system, 1995	15
2.	Aerial survey counts of chinook, chum, pink, and coho salmon, Naknek-Kvichak District, 1995	16
3.	Aerial survey peak counts of chinook salmon escapement, Egegik District, 1995	17
4.	Aerial survey peak counts of chum salmon escapement, Egegik District, 1995	18
5.	Aerial survey peak counts of coho salmon escapement, Egegik District, 1995	19
6.	Aerial survey peak counts of sockeye salmon escapement, King Salmon and Dog Salmon Rivers, Ugashik District, 1995	21
7.	Peak survey counts of chinook salmon escapement, Ugashik District, 1995	22
8.	Peak survey counts of chum salmon escapement, Ugashik District, 1995	23
9.	Peak aerial counts of live sockeye salmon and total escapement estimates, Wood River system, 1995	24
10.	Peak aerial counts and total escapement estimates of sockeye salmon, Tikchik Lakes system, 1995	26
11.	Peak aerial counts of live sockeye salmon and total escapement estimates, Lake Nunavaugaluk drainage, 1995	27
12.	Peak aerial counts of live sockeye salmon and total escapement estimates, Togiak District, 1995	28
13.	Peak aerial counts of live chinook salmon and total escapement estimates, Togiak District, 1995	29

LIST OF TABLES (Continued)

Table		Page
14.	Peak aerial counts of live chum salmon and total escapement estimates, Togiak District, 1995	30
15.	Peak aerial counts of live coho salmon and total escapement estimates, Togiak District, 1995	31

LIST OF FIGURES

Figure		Page
1.	Bristol Bay management area, Alaska	32
2.	Alagnak River drainage, Bristol Bay, Alaska	33
3.	Egegik River drainage, Bristol Bay, Alaska	34
4.	Ugashik River drainage, Bristol Bay, Alaska	35
5.	Wood River Lakes system, Bristol Bay, Alaska	36
6.	Lake Nunavaugaluk system, Bristol Bay, Alaska	37
7.	Nushagak-Mulchatna River system, Bristol Bay, Alaska	38
8.	Tikchik Lakes system, Bristol Bay, Alaska	39
9.	Togiak River system, Bristol Bay, Alaska	40
10.	Kulukak River system, Bristol Bay, Alaska	41

LIST OF APPENDICES

Table		Page
1.	Sockeye salmon total escapement estimates, Naknek-Kvichak District, 1955-1995	43
2.	Aerial survey counts of chinook salmon escapements, Naknek River drainage, 1970-1995	44
3.	Chinook salmon escapement survey history, mainstem Naknek River, 1929-1995	45
4.	Chinook salmon escapement survey history, Big Creek, Naknek River drainage, 1963-1995	47
5.	Chinook salmon escapement survey history, King Salmon Creek, Naknek River drainage, 1964-1995	49
6.	Chinook salmon escapement survey history, Paul's Creek, Naknek River drainage, 1971-1995	51
7.	Chinook salmon escapement survey history, Alagnak River, 1963-1995	52
8.	Chinook salmon escapement survey history, Kvichak River, 1932-1995	54
9.	Chinook salmon escapement data, Naknek-Kvichak District, 1970-1995	55
10.	Chum salmon escapement survey history, Alagnak River, 1961-1995	56
11.	Pink salmon escapement survey history, Alagnak River, 1968-1995	58
12.	Pink salmon escapement survey history, Kvichak River, 1966-1995	59
13.	Pink salmon escapement survey history, Naknek River, 1974-1995	60
14.	Aerial survey counts of chinook salmon escapement, Egegik District, 1981-1995	61
15.	Aerial survey counts of chum salmon escapement, Egegik District, 1982-1995	62

LIST OF APPENDICES (Continued)

Table		Page
16.	Aerial survey counts of pink salmon escapement, Egegik District, 1974-1995	63
17.	Aerial survey counts of coho salmon escapement, Egegik District, 1981-1995	64
18.	Aerial survey counts of chinook salmon escapement, Ugashik District, 1980-1995	65
19.	Aerial survey counts of chum salmon escapement, Ugashik District, 1980-1995	66
20.	Aerial survey counts of pink salmon escapement, Ugashik District, 1980-1995	67
21.	Aerial survey counts of coho salmon escapement, Ugashik District, 1981-1995	68
22.	Spawner distribution and total escapement estimates of sockeye salmon, Wood River system, 1959-1995	69
23.	Peak aerial counts of live sockeye salmon in selected index areas of the Nushagak District, 1977-1995	70
24.	Peak aerial counts of live sockeye salmon, Lake Nunavaugaluk drainage, 1975-1995	71
25.	Peak aerial counts of live chinook salmon in selected index areas of the Nushagak River system, 1967-1995	72
26.	Total escapement estimates of pink salmon, Nushagak and Togiak Districts, 1962-1994	73
27.	Aerial estimates of sockeye salmon escapements, Togiak District 1975-1995	74
28.	Peak aerial counts of live sockeye salmon, Togiak River drainage, 1975-1995	75
29.	Peak aerial counts of live sockeye salmon, Togiak District, 1975-1995	76
30.	Peak aerial counts of live chinook salmon, Togiak River drainage, 1975-1995	77
31.	Peak aerial counts of live chinook salmon, Togiak District, 1975-1995	78
32.	Peak aerial counts of live chum salmon, Togiak River drainage, 1975-1995	79

LIST OF APPENDICES (Continued)

Table		Page
33.	Peak aerial counts of live chum salmon, Togiak District, 1975-1995	80
34.	Peak aerial counts of live coho salmon, Togiak River drainage, 1980-1995	81
35.	Peak aerial counts of live coho salmon, Togiak District, 1980-1995	82

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. 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 1995 salmon spawning ground surveys conducted in the Bristol Bay area.

Naknek/Kvichak District

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. Escapement of other salmon species into Naknek-Kvichak District drainages have been estimated using aerial surveys.

Egegik District

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

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 systems flow into the intertidal reaches of Ugashik River and Ugashik Bay.

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

Nushagak District

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 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 of these systems empty into Nushagak Bay.

Abundance and age composition of sockeye salmon escapements in the Wood River Lake system has been estimated annually from counting towers at the outlet of Lake Aleknagik since 1953.

Sockeye salmon distribution in the Wood River Lake system is an important element in establishing escapement goals and measuring success in achieving escapement goals for this system. 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 minimize overcrowding of spawners in the interconnecting rivers while taking advantage of the extensive beach spawning areas and numerous tributary streams.

ADF&G staff have conducted aerial surveys to assess sockeye spawner distribution within the Wood River Lake system each year. Personnel from the University of Washington, Fisheries Research Institute also conduct ground surveys on major creeks and some rivers of the system. 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.

Salmon escapement in the Nushagak River is estimated by a sonar project, located on the Nushagak River below Portage Creek, approximately 32 km (20 miles) upstream from the river mouth. The Nushagak River sonar project has been used since 1980 to estimate annual escapements for all salmon species in the entire Nushagak drainage (Miller 1996). Prior to the advent of the sonar project, sockeye escapement was estimated by a counting tower project on the Nuyakuk River (1959-1988). Aerial surveys of the Nushagak-Mulchatna system were conducted annually beginning in 1966. Initial surveys provided escapement estimates for chinook and chum salmon, and surveys in the Nushagak and Mulchatna systems since 1977 were used to estimate sockeye abundance in that system. Together, the combined estimates from the counting tower and aerial surveys were used by fishery managers as estimates of the Nushagak River drainage sockeye escapement.

ADF&G staff continued to survey the upper Nushagak and Mulchatna areas after the development of the sonar project to provide a comparison with sonar estimates and document spawner distribution for all species except coho salmon. Chum salmon surveys were discontinued in the Nushagak District in 1980, and surveys of the Nushagak-Mulchatna Rivers for all other species were discontinued in 1991 due to the success of the sonar project and limited funding. After terminating the Nuyakuk tower project in 1988, and terminating surveys of the Nushagak and Mulchatna systems in 1991, little information was available to assess sockeye spawning distribution in the Nushagak River.

Aerial surveys were conducted sporadically in the Tikchik Lakes system from 1954 to 1987 to assess spawner distribution of sockeye salmon. Surveys of the Tikchik Lakes were conducted sporadically since 1990 to document an apparent change in spawner distribution, evidenced by changes observed in the age composition of Nushagak River sockeye escapement, and supported by reports of low numbers of spawners in the Tikchik Lake system. These surveys have documented lower than expected numbers of spawners in the Tikchik Lakes system, based on sonar estimates in the lower Nushagak River and historical distribution patterns (Weiland et. al. 1994). However, few corresponding surveys were conducted in the Nushagak and Mulchatna drainages to completely assess distribution.

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, et. al. 1992). Spawning escapement and distribution of sockeye salmon in the Snake Lake system was estimated annually by aerial surveys, but funding was not available for these surveys from 1991 through 1994.

Togiak District

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. 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 USFWS and Togiak National Wildlife Refuge 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 were flown by refuge staff pilots in USFWS aircraft. Salmon were counted by Alaska Department of Fish and Game (ADF&G) 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 salmon 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 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

misidentified 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 10 and 18, 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 August 5 and August 21, and the Kvichak River chinook escapement survey was flown August 14. 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 14, 15, and September 4, and the results were documented in Regnart (1995). 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 1995. Aerial surveys of all known chinook and chum salmon spawning areas in both the Egegik and King Salmon Rivers were flown on July 25 and August 5. Additionally, several of the more important chum spawning streams were also flown July 15. With funding provided by USFWS, aerial surveys were flown on September 27 and 29 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. August 14 aerial survey counts should be considered only an index of total abundance.

Nushagak District

Areas of the Nushagak District surveyed in 1995 included the Wood River Lakes, Tikchik Lakes, Nushagak and Mulchatna River systems and the Snake Lake system. Aerial counts were obtained for sockeye salmon in each of these areas to assess spawning distribution. In addition, aerial counts were obtained for chinook salmon in the Nushagak and Mulchatna River systems to document spawning distribution for that species.

Survey methods and data analysis for the Nushagak District were similar to those described by Nelson (1979), Bucher (1981), and Russell, Bill and Bucher (1990). Surveys were timed to coincide with peak spawning activity for each system and species targeted. Counts for both chinook and sockeye were obtained simultaneously for the Nushagak River estimates.

Snake Lake sockeye counts were doubled to estimate total escapement, based on methods described in Nelson (1967 and 1979). Nelson states that peak aerial counts in the Igushik, Snake, and Tikchik systems generally account for 50% (range 29%-65%) of the total escapement, estimated by tower or weir counts on those systems.

Sockeye salmon escapements for each spawning stream, beach, or river in the Wood River have been estimated using the proportion of sockeye salmon observed at a given location in relation to the tower count. Different expansion factors were 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 were similar to those described by Nelson (1979), Bucher (1981), and Russell, et. al. (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 USFWS and an ADF&G observer.

Peak 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, peak aerial counts of sockeye salmon in systems without counting towers (i.e. Kulukak River, 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 generally 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.

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).

RESULTS AND DISCUSSION

Naknek/Kvichak District

Aerial surveys of sockeye salmon escapement into the Alagnak River and its tributaries were conducted on August 10 and 18. The sockeye salmon escapement index count totaled 215,713 for this system (Table 1). This count was approximately 5% above the mean (1977-1994) aerial count of 204,000, and was approximately 16% 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. Total sockeye salmon escapements estimated from 1995 tower counts for the Kvichak and Naknek Rivers were 10,038,720 and 1,111,140 respectively (Appendix Table 1).

Aerial surveys of chinook salmon escapements into the Naknek River drainage were flown from August 5 through August 21. 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 4,960 chinook salmon were counted. The largest components of this total were counts of 1,905 chinook in Big Creek on August 15, and 2,790 chinook in the mainstem Naknek River on August 21 (Table 2). Over the period from 1970-1994 there have been 15 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 15 years has ranged from a low of 2,691 in 1992 to a high of 11,730 in 1988. The 1995 count was slightly below the 1970-1994 average count of 5,213.

Alagnak River drainage chinook salmon escapement was surveyed on August 10, yielding a count of 6,860 (Table 2). From 1970-1994, 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 4,366 (Appendix Table 9). The 1995 count was 57% greater than the 1970-1994 average. An aerial survey of chinook salmon escapement into the Kvichak River was conducted on August 14 and yielded a count of 96. The 1995 Kvichak River count was 40% less than the 1970-1994 average.

The Naknek-Kvichak District chinook escapement index, the sum of counts for the Alagnak, Kvichak and Naknek river drainage, was 11,916. This total is the sixth largest count on record and about 20% greater than the average count of 9,490.

Chum salmon were counted only during the August 10 Alagnak River aerial surveys. Alagnak River has been the principal chum salmon producing system in the Naknek-Kvichak District. A total of 132,000 spawning chum salmon were observed during the 1995 survey. The 1995 chum count was approximately four times the 1963-1994 average count of 38,162 (Appendix Table 10).

No surveys were flown to count pink salmon escapements into the Naknek-Kvichak District drainage during 1995 (Appendix Tables 11-13).

Escapement surveys for coho salmon were not flown in Naknek-Kvichak District drainage during 1995 since funding was not available.

Egegik District

The 1995 Egegik River sockeye escapement past the counting towers totaled 1,281,678, slightly above the desired point goal (1.0 million) but below the upper range of the goal (1.4 million). Although no system-wide aerial surveys were flown, an additional 830 sockeye salmon were observed on August 5 in Lake 592, a tributary of Contact Creek, bringing the district-wide sockeye escapement total to 1,282,508.

Aerial survey peak counts of all known chinook spawning areas in the district's drainages yielded a total count of 1,307 chinook salmon (Table 3). An additional 60 chinook were counted past Egegik River counting towers bringing the district escapement index to 1,367. This total was slightly above the 1981-1994 average of 1,335 chinook (Appendix Table 14). The commercial chinook harvest in the Egegik District totaled just 680, 77% below the 1975-1994 average harvest of 2,908. Closing the commercial fishery from June 16 to June 19 and prohibiting usage of large mesh gillnets (greater than 5.5 inch mesh) from June 1-July 5 facilitated passage of chinook salmon through the commercial fishing district, but small harvests June 19-23 (the traditional peak chinook harvest period) suggested the chinook run was below normal strength. These management measures were effective as an above average escapement index was obtained in spite of decreased run strength.

The peak chum salmon escapement index was obtained August 5 and totaled 1,769 (Table 4). An additional 144 chums were counted past the Egegik River counting tower, bringing the district-wide escapement index to 1,913. The 1995 index was well below the 1982-1994 average of 11,911 (Appendix Table 15). The 1995 commercial chum harvest from the Egegik District totaled approximately 62,000, 37% below the 1975-1994 average of 98,000. Escapement indices of less than 10,000 chum salmon have been recorded in the district in each of the last seven years, a concern to district managers. Short "window" closures in the commercial fishery were employed during the 1995 season to provide opportunity for chum escapement while still permitting harvest of abundant sockeye salmon. These short closures, while probably helpful, did not provide enough escapement relief to turn the declining escapement trend around. Due to the murky waters in the lower sections of Egegik River and throughout the King Salmon River, daily monitoring of chum and chinook salmon cannot be

accomplished without either a weir or sonar 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 required to harvest surplus sockeye salmon.

No pink salmon were noted during the August 5 aerial surveys, which is expected for an odd-numbered year (Appendix Table 16). Only 24 pink salmon were counted past the Egegik River counting towers, and none were reported from the commercial catch.

The coho salmon escapement was documented with aerial surveys conducted on September 27 and 29 (Table 5). Funding for these surveys was provided by the USFWS. A combined total of 5,258 coho salmon were counted in the King Salmon and Egegik Rivers and in numerous tributaries of Becharof Lake. Of this total, approximately 4,740 coho salmon were counted upstream of the Egegik River counting towers. For the second consecutive year the Egegik River counting towers were in operation beyond the sockeye season. From July 23 through August 30 the towers were operated by Department personnel funded jointly by ADF&G and the USFWS. A total of 7,470 coho salmon were counted past Egegik River counting towers, slightly below the 1994 count of 10,140 (Appendix Table 17). These counts should be considered an index only since counting towers were not operated at all in September, and coho salmon could have been present in the turbid waters of mainstem King Salmon river and some of its tributaries. The commercial harvest totaled approximately 22,000 coho salmon, well below the 1975-1994 average of 33,500. Due to low commercial catch rates and modest escapement rates past the counting towers, the Egegik District commercial coho fishery was closed effective August 25, and it remained closed through the end of the commercial salmon season September 30.

Ugashik District

The 1995 sockeye salmon escapement past Ugashik River counting tower was approximately 1,320,000, the ninth largest escapement on record and 89% above the point goal of 700,000. No system-wide aerial surveys were conducted because of a lack of funding. However, an additional 9,400 and 7,650 sockeye salmon were counted in the Dog Salmon and King Salmon Rivers, respectively, during a chinook and chum salmon survey (Table 6).

Chinook salmon escapement surveys of Dog Salmon, King Salmon, and Ugashik Rivers were flown on August 14 and yielded a count of 2,819 (Table 7). Additionally, 24 chinook salmon were counted past the tower, bringing the Ugashik chinook escapement count to 2,843. The King Salmon River count of 1,812 was the largest escapement component for the system. The 1995 escapement count was 48% below the 1980-1994 average count of 5,466 chinook salmon (Appendix Table 18). The Ugashik District commercial catch of 1,530 chinook was less than half the average harvest. Overall, the Ugashik chinook run was probably below average.

Aerial surveys of Dog Salmon, King Salmon, and Ugashik Rivers on August 14, yielding a count of 9,830 chum salmon (Table 8). The survey was considered to be near the peak of spawning abundance.

The 1995 aerial count was 71% below the 1980-1994 average of 37,692 (Appendix Table 19). The District commercial harvest included approximately 63,300 chum salmon. The catch was slightly below the 1975-1994 average of 63,500.

Ugashik pink salmon runs have historically been very small, particularly during odd-numbered years. This year's reported commercial catch included only 2 pink salmon. No pink salmon were observed on the escapement survey flown on August 14 and only 36 pink salmon were counted past the tower before it ceased operation on July 27 (Appendix Table 20).

No aerial surveys for coho salmon were made in Ugashik drainage in 1995 because funds were not available (Appendix Table 21). Daily commercial coho catch statistics for set gillnet gear were about average and the District remained on normal fishing time for the entire coho season. The coho salmon harvest of about 8,500 was well below average.

Nushagak District

Survey timing and visibility was good for all creeks, beaches and rivers of the Wood River system. Age-.2 sockeye comprised 72% of the escapement estimated at the Wood River counting tower in 1995. As a result, the escapement goal was adjusted in season to 1.2 million sockeye, or the upper end of the escapement goal range (800,000 - 1,200,000). However, the poor escapement into the Nushagak River prompted conservative management of the commercial fishery in the Nushagak District, which resulted in additional escapement into the Wood River system. The 1995 Wood River tower count of 1,474,740 sockeye salmon was greater than the escapement goal of 1,200,000 by 23% (Table 9).

Sockeye spawning in the Wood River system was distributed predominantly to creek and beach habitat. Spawning activity in the major rivers was much lighter than average. (Appendix Table 22). Spawning was particularly heavy in Anvil Bay in Lake Nerka, and in the Hardluck Bay and Silver Horn Beach areas of Lake Beverly. Large schools, in the order of tens of thousands, were observed in these and other beach areas in addition to those recorded. Other areas with large schools present included D Slough Beach in Little Togiak Lake, River Bay and south shore beaches in Lake Nerka, and B12 and B9 beaches in Lake Beverley.

Nushagak River sockeye escapement was very poor in 1995. Sockeye salmon escapement in the Nushagak River drainage was estimated by sonar at 281,307 in 1995 (Miller 1996). This level represents only 51% of the escapement goal of 550,000, and the second lowest annual sockeye escapement documented in the Nushagak River in the history of the sonar project.

Sockeye escapement into the Tikchik Lakes system was estimated in 1995 by a counting tower on the Nuyakuk River, operated for the first year since 1988. Escapement past the Nuyakuk tower was estimated at 69,702 sockeye, the sixth lowest count in the 31-year history of the project. The 1995

tower count provided the most reliable documentation of escapement to the Tikchik Lakes since the tower was last operated, in 1988.

The difference between the Nushagak sonar and Nuyakuk tower counts suggests that 75% of the Nushagak River sockeye escapement spawned in the Nushagak River tributaries and mainstem in 1995. Aerial surveys conducted of the Tikchik and Nushagak-Mulchatna systems support that notion. Only 11,035 sockeye were observed in the entire Tikchik system (Table 10). Aerial counts were much lower than average in every area surveyed, with the single exception of the Allen River. The 1995 surveys of the Tikchik Lake system provided the lowest aerial count documented during any of the 21 years when the Tikchik system was surveyed, since 1954. Timing of the Tikchik surveys was good, with few dead or schooled salmon observed. Visibility was good in beach areas, fair in most creek and river areas, but poor in the section of the Tikchik River below Cow Creek and very poor in Cow Creek.

Observed levels of sockeye salmon in the Nushagak and Mulchatna system tributaries were lower than average, but were not as poor as the levels observed in the Tikchik Lake system (Appendix Table 23). Tributaries surveyed in 1995 account for an average (1977-1990) of 57% of all salmon observed. The Nushagak and Mulchatna Rivers are responsible for the remainder (33% average) of the historical distribution. Weather and visibility precluded reasonable estimates from these main stem areas in 1995. Based on the areas surveyed, spawning escapement in the Nushagak-Mulchatna was approximately half that of expected, or average levels.

Corresponding aerial surveys of the Tikchik Lake system with a tower count on the Nuyakuk River provided the first opportunity to qualify aerial surveys conducted since 1990. The number of sockeye observed during aerial surveys of the Tikchik Lakes system in 1995 represented 16% of the Nuyakuk tower count. Conversely, the Nuyakuk tower count was 6.3 times greater than the aerial count. This is an important observation because surveyors changed prior to the 1990 aerial surveys; the 1995 tower count provides the only available comparison for the current surveyors to a more reliable escapement estimate in this system.

Sockeye salmon escapement into the Snake Lake system was estimated to be 17,380 (Table 11). Spawner abundance and distribution appeared normal with most observed along west shore beaches (Appendix Table 24).

Chinook salmon escapement into the Nushagak River drainage was estimated to be 85,622 at the Portage Creek sonar counter, or 14% above the inriver goal of 75,000 (Miller 1996). The 1995 inriver escapement was 87% of the 1975-1994 average, but very similar to the 1985-1994 average.

Based on the magnitude of the chinook escapement at the Portage Creek sonar counter, we would expect aerial survey results to be similar to average long-term survey counts. The 1995 estimate for the King Salmon River was well above average (1967-1990), while estimates for the Klutispaw and Koktuli Rivers were similar to average levels (Appendix Table 25). However, abundance in the Stuyahok River was much less than expected. The Stuyahok River count of 660 chinook comprised only 27% of average levels and resembled the fifth lowest peak aerial count recorded for chinook in that system.

The 1995 chum salmon escapement into the Nushagak River was estimated to be 212,612. This was 68% of the 1975-1994 average escapement of 312,977 (Miller 1996). Coho salmon escapement again fell well short of the interim inriver escapement goal of 100,000 due to a very poor run. The 1995 escapement of 46,340 coho salmon was 54% below the escapement goal. No aerial surveys were conducted for coho salmon.

Togiak District

Peak aerial counts and total population estimates were derived from aerial surveys for sockeye salmon in major river systems of the Togiak District in 1995. (Table 12) The aerial survey count of 25,508 sockeye salmon for the Togiak River and its tributaries below the counting tower was slightly above the 1985-1994 average of 24,722 (Appendix Table 27). Escapement past the counting tower was estimated to be 185,718 sockeye, 24% over the escapement goal of 150,000. The spawning escapement of sockeye salmon in Kulukak Section, including Kulukak River, Kulukak Lake, and Tithe Creek Ponds, was estimated to be 14,620, only 45% of the 1985-1994 average of 32,114. Peak aerial sockeye salmon counts into the mainstem portion of the Togiak River, and the Pungokepuk River were considerably less than the 1975-1994 average (Appendix Table 28 and 29). Counts for Gechiak and Ongivinuck Rivers were at average levels, while the Kemuk River was well above the long-term average. Total sockeye salmon escapement for Togiak District was 240,266. Surveys were conducted close to the peak of spawning for all areas of the Togiak and Kulukak River drainages.

Aerial surveys for peak live counts and expanded escapement estimates for chinook salmon were conducted in all the major drainages within the Togiak District for 1995 (Table 13). District wide escapement was estimated at 16,438 chinook. The 1995 escapement was equal to the 1975-1994 average reported in ADF&G (in press), and 36% above the 1985-1994 average of 12,112. The Togiak River drainage chinook escapement of 12,600 fish was 16% above the 1975-1994 average. This was the third consecutive year in which the escapement goal of 10,000 chinook salmon was achieved. Commercial closures during the last two weeks of June, the traditional peak of the chinook salmon fishery, played a substantial role in the increased chinook escapement. Chinook escapement estimates for smaller river systems within the district were generally below average (Appendix Tables 30 and 31). Kulukak River escapement (1,075 chinook) was poor and comprised only 25% of the 1985-1994 average.

Conditions and timing were good for all chinook salmon areas surveyed. A standard multiplier of 2.5 was applied to all the aerial counts. Surveys for streams west of Togiak River, Negukthlik and Ungalikthluk Rivers were flown in conjunction with USFWS. Spawning activity for chinook appeared to peak on or near August 1 in the Togiak District.

Chum salmon escapement for the entire Togiak District was estimated to be 182,160 (Table 14). The 1995 estimate is 15% below the 1985-1994 average (212,350 chum) reported by ADF&G (in press). Peak counts of chum salmon were greater than the 1975-1994 average in all streams

surveyed within the Togiak River drainage (Appendix Table 32). However, Quigmy, Kulukak, Matogak, Osviak, Negukthlik, and Ungalikthluk River counts were all below average for the same period (Appendix Table 33).

Chum salmon counts were conducted coincidentally with the chinook salmon surveys. Survey timing was generally post-peak for spawning activity. Significant numbers of chum salmon carcasses were observed in all rivers surveyed. However, a multiplier of two (2) was still used because of favorable survey conditions.

Coho salmon escapement was not estimated during 1995 due to incomplete surveys. 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 Gechiak, Kemuk, and Ongivinuk Rivers, but could not be completed in the mainstem Togiak River or other tributaries because of poor water conditions (Table 15). Counts obtained on October 3 were considered to be conservative. Coho salmon appeared to be still spreading out onto spawning beds and no carcasses were visible, indicating that the survey was probably before the peak of spawning activity. Using subjective indicators of inriver abundance such as commercial catch, average run timing, in season survey estimates, and reports from sport and subsistence users, coho escapement in the Togiak River was poor to fair relative to other years (Appendix Tables 34 and 35).

LITERATURE CITED

ADF&G (Alaska Department of Fish and Game). In press. Annual Management Report, 1994, Bristol Bay Area. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division. Anchorage.

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. 1996. Sonar enumeration of pacific salmon escapement into the Nushagak River, 1995. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Regional Information Report No. 2A96-08, 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.

LITERATURE CITED (Continued)

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. 1995. Kvichak River sockeye salmon spawning ground surveys, 1955-1995. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report No. 2A95-48, Anchorage.

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.

Weiland, K.A., R.B. Russell, J.R. Regnart and T.E. Brookover. 1994. Salmon spawning ground surveys in the Bristol Bay area, 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 2A94-034, Anchorage.

Table 1. Aerial survey counts of sockeye salmon, Alagnak River system, 1995[1]

Location	Number of Fish	Percent of Total
Nonvianuk River	0	0
Nonvianuk Lake	1,050	0.5
Kulik River	34,100	16.0
Kulik Lake	1,200	0.6
Alagnak River	0	0
Kukaklek Lake	350	0.2
Nanuktuk Creek	42,488	19.4
Battle River	31,800	15.0
Battle Lake	1,300	0.6
Spectacle Creek	67,725	31.3
Funnel Creek	35,700	16.4
Total	215,713	100.0

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

Table 2. Aerial survey counts of chinook, chum, pink, and coho salmon, Naknek-Kvichak District, 1995.

Location	Survey Date	Number of Salmon			
		Chinook	Chum	Pink	Coho
Kvichak River	Aug. 14	96			
Alagnak Rover	Aug. 10	6,860	132,000		
Naknek River :					
Paul's Creek	Aug. 05	26	0 [a]		
King Salmon Creek	Aug. 05	239	20 [a]		
Big Creek	Aug. 15	1,905	18,000 [a]		
Mainstem Naknek River	Aug. 21	2,790			
Total		11,916	150,020		

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

Table 3. Aerial survey peak counts of chinook salmon escapement, Egegik District, 1995. [1]

Location	Survey Date	Number of Chinook Salmon Counted
Egegik River	August 30[a]	60
Shosky Creek	August 05	32
Whale Mountain Creek	July 15	10
Mossy Creek	August 05	53
Mink Creek	August 05	103
Gertrude Creek	August 05	456
Kaye's Creek	August 05	248
Takayoto Creek	August 05	130
Angle Creek	August 05[b]	
Contact Creek	August 05	275
Mainstem King Salmon River	August 05[b]	
Total		1,367

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

Table 4. Aerial survey peak counts of chum salmon escapement, Egegik District, 1995. [1]

Location	Survey Date	Number of Chum Salmon Counted
Egegik River	August 30 [a]	144
Shosky Creek	August 05	2
Whale Mountain Creek	August 05	395
Mossy Creek	August 05	15
Mink Creek	August 05	30
Gertrude Creek	August 05	560
Kaye's Creek	August 05	162
Takayoto Creek	August 05	5
Angle Creek	August 05 [b]	
Contact Creek	August 05	600
Mainstem King Salmon River	August 05 [b]	
Total		1,913

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

Table 5. Aerial survey counts of coho salmon escapement, Egegik District, 1995.

Location	Survey Date	Number of Coho Salmon Counted	Comments
Egegik River Drainage[1]			
Egegik Lagoon	September 27	50	
Egegik River Rapids	September 27	1,700	Most schooled off mouth of Myers Creek
Myers Creek	September 27	4	
Stream 146.4	September 27	50	All schooled off mouth
Stream 141.5 (Rusty Creek)	September 27	62	50 of these schooled off mouth
Stream 136.8	September 27	0	
Stream 131.9	September 27	0	
Stream 115.8 (Featherly Creek)	September 27	280	150 of these schooled off mouth
Stream 112.8	September 27	0	
Stream 108.7	September 27	40	All schooled off mouth
Stream 107.6 (Burl's Creek)	September 27	130	120 of these schooled off mouth
Stream 99.2 (Frank's Creek)	September 27	30	All schooled off mouth
Stream 96.2 (Ruth River)	September 27	0	
Ruth Lake	September 27	120	All schooled off mouths of 4 tributaries
Stream 95.0	September 27	15	All schooled off mouth
Stream 93.5 (Otter Creek)	September 27	50	10 of these schooled off mouth
Stream 90.3 (Salmon Creek)	September 27	900	800 of these schooled off mouth
Stream 87.0 (Bear Creek)	September 27	190	160 of these schooled off mouth
Stream 86.1	September 27	100	All schooled off mouth
Stream 84.7	September 27	35	All schooled off mouth
Stream 83.9	September 27	40	All schooled off mouth
Stream 81.2 (Cleo Creek)	September 27	19	5 of these schooled off mouth
Stream 73.5 (Becharof Creek)	September 27	310	All instream
Stream 48.1 (Kejulik River)	September 27	640	Includes Margaret & Albert creeks

(continued)

Table 5. Continued

Stream 46.3 (Marie Creek)	September 27	0	
Stream 35.5	September 27	25	All instream
Stream 35.1 through 1.7	September 27	0	
Shosky Creek	September 29	18	All instream
Swampy Creek	September 29		Did not survey... too turbid
Sub-total		4,808	
King Salmon River Drainage			
Whale Mountain Creek	September 29	122	
Mossy Creek	September 29	15	
Mink Creek	September 29	33	
Gertrude Creek	September 29	170	
Kaye's Creek	September 29	4	Most of stream quite milky
Takayoto Creek	September 29		Too turbid to count
Angle Creek	September 29		Too turbid to count
Contact Creek	September 29	106	
Mainstem King Salmon River	September 29		Too turbid to count
Sub-total		450	
District Total		5,258	

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

Table 6. Aerial survey peak counts of sockeye salmon escapement, King Salmon and Dog Salmon Rivers, Ugashik District, 1995.

Location	Survey Date	Number of Sockeye Salmon
Ugashik River:		
Grassy Creek	Aug. 14	0
Sub-total		0
King Salmon River:		
Needle Lake	Aug. 14	3,300
Volcano Creel	Aug. 14	50
Painter Creek	Aug. 14	4,300
Mainstem King Salmon River	Aug. 14	0
Sub-total		7,650
Dog Salmon River:		
Figure-Eight Creek	Aug. 14	4,600
Goblet Creek	Aug. 14	3,000
Oldham Creek	Aug. 14	1,800
Wandering Creek	Aug. 14	0 [a]
Mainstem Dog Salmon River	Aug. 14	0
Sub-total		9,400
Total		17,050

[a] No fish were observed due to turbid water conditions.

Table 7. Peak survey counts of chinook salmon escapement, Ugashik District, 1995.

Location	Survey Date	Number of Chinook Salmon
King Salmon River System		
Old Creek	Aug. 14	505 [a]
Pumice Creek	Aug. 14	501 [a]
Painter Creek	Aug. 14	366
Mainstem King Salmon River	Aug. 14	440
Mother Goose Lake	Aug. 14	0
Indecision Creek	Aug. 14	0
Volcano Creek	Aug. 14	0
Sub-total		1,812
Dog Salmon River System		
Figure-Eight Creek	Aug. 14	606
Goblet Creek	Aug. 14	0
Oldham Creek	Aug. 14	200
Wandering Creek	Aug. 14	76
Mainstem Dog Salmon River	Aug. 14	0 [b]
Sub-total		882
Ugashik River System		
Mainstem Ugashik River	Aug. 14	0 [b]
Grassy Creek	Aug. 14	125
Sub-total		125
Total		2,819

[a] Includes carcasses.
[b] No fish were observed due to turbid water conditions.

Table 8. Peak survey counts of chum salmon escapement, Ugashik District, 1995.

Location	Survey Date	Number of Chum Salmon
King Salmon River System		
Old Creek	Aug. 14	1800
Pumice Creek	Aug. 14	2600
Painter Creek	Aug. 14	1370
Mainstem King Salmon River	Aug. 14	3900
Mother Goose Lake	Aug. 14	0
Indecision Creek	Aug. 14	0
Volcano Creek	Aug. 14	0
Sub-total		9,670
Dog Salmon River Syste:		
Figure-Eight Creek	Aug. 14	0
Goblet Creek	Aug. 14	0
Oldham Creek	Aug. 14	0
Wandering Creek	Aug. 14	160
Mainstem Dog Salmon River	Aug. 14	0 [a]
Sub-total		160
Ugashik River System		
Mainstem Ugashik River	Aug. 14	0 [a]
Grassy Creek	Aug. 14	0
Sub-total		0
Total		9,830

[a] No fish were observed due to turbid water conditions.

Table 9. Peak aerial counts of live sockeye salmon and total escapement estimates, Wood River system, 1995.

Area	Date	Aerial Count [1]	Population Estimate	Distribution %
Wood River			0	0.0%
Lake Aleknagik				
Eagle Creek	14-Aug	1,647 [a]		
Hansen Creek	06-Aug	7,680 [a]		
Happy Creek	08-Aug	5,274 [a]		
Bear Creek	03-Aug	2,983 [a]		
Yako Creek	01-Aug	1,715 [a]		
Whitefish Creek	11-Aug	1,852 [a]		
Ice Creek	11-Aug	2,594 [a]		
Mission Creek	20-Aug	1,182 [a]		
Sunshine Creek	13-Aug	1,400		
Youth Creek				
Northshore Beaches	25-Aug	1,450		
Southshore Beaches	26-Aug	240		
Yako Beach	27-Aug	350		
Total		28,367	272,700	18.4%
Agulowok River & lower River Bay	21-Aug	70,000	104,500	7.1%
Lake Nerka				
Fenno Creek	10-Aug	3,282 [a,b]		
Pike Creek	14-Aug	3,410		
Stovall Creek [2]	14-Aug	480		
Bear Creek	14-Aug	40		
Teal Creek	14-Aug	540		
Pick Creek	14-Aug	3,400		
Elva Creek	08-Aug	239 [a]		
Kema Creek	14-Aug	4,500		
Hidden Lake Creek	14-Aug	1,040		
Lynx Creek	21-Aug	940		
Upper River Bay Beaches, NW	11-Sep	600		
Upper River Bay Beaches, SE	11-Sep	4,400		
Allan Cr. - Ross Cr. Beaches	11-Sep	4,350		
N6 - River Bay Beach	11-Sep	5,400		
Pick Creek Beach	11-Sep	270		
Elva Creek Beach	11-Sep	1,050		
Amakuk Arm Beaches	11-Sep	780		
Amakuk Arm - Ott's Bay Beach	11-Sep	500		
Ott's Bay Beach	11-Sep	1,700		
Anvil Bay Beaches	11-Sep	11,900		
Anvil Bay - Elbow Pt. Beach	11-Sep	1,400		
Elbow Pt. - Lynx Cr. Beach	11-Sep	2,350		
Lynx Cr. - Teal Cr. Beach	11-Sep	200		
Kema Lake Beaches [2]				
Hidden Lake Beaches	14-Aug	600		
Lynx Lake Beaches				
Total		53,371	513,000	34.6%
Little Togiak River	21-Aug	3,000	4,500	0.3%

(continued)

Table 9. Continued

Little Togiak Lake				
Northshore Beaches	11-Sep	570		
Southshore Beaches	11-Sep	830		
D Slough Beaches	11-Sep	1,800		
Total		3,200	30,800	2.1%
Agulukpak River	21-Aug	50,000	74,600	5.0%
Lake Beverley				
Tsun Creek				
Moose Creek	14-Aug	3,500		
Hope Creek	14-Aug	640		
Hardluck Bay Beaches	11-Sep	12,200		
Sam's Beach	11-Sep	1,400		
Golden Horn Beaches	11-Sep	1,100		
Silver Horn Beaches	11-Sep	10,300		
B12 & B9 Beaches	11-Sep	4,050		
Hope Lake Beach	14-Aug	520		
Total		33,710	324,000	21.9%
Peace River	21-Aug	2,800	5,600	0.4%
Lake Mikchalk				
Narrows				
Northshore Beaches	11-Sep	2,900 [a]		
Southshore Beaches				
Total		2,900	27,900	1.9%
Wind River	21-Aug	600	1,200	0.1%
Lake Kulik				
K1 & K2 Creeks	14-Aug	3,340		
K5 Creek - Grant River Beaches	11-Sep	1,350		
Grant River - K2 Creek Beaches	11-Sep	6,300		
Southshore Beaches	11-Sep	750 [b]		
Total		11,740	112,800	7.6%
Grant River	21-Aug	5,300	10,600	0.7%
Total		264,988	1,482,200	100%

[1] All counts rounded to the nearest 10 fish.
[2] Access blocked by beaver dams.
[a] Ground survey counts conducted by FRI, University of Washington..
[b] Includes carcass count.
[c] Includes all areas of Lake Mikchalk

Table 10. Peak aerial counts and total escapement estimates of sockeye salmon, Tikchik Lakes system, 1995.

Area	Date	Aerial Counts			Mean Live Count[1]	Factor[2]	Escapement Estimate
		Live	Dead	Total			
Tikchik Lake							
Creek A	13-Aug	270		270	2,195		
Creek B	13-Aug	530		530	3,333		
Creek C	13-Aug	125		125	343		
Subtotal		925	0	925	5,871		
Tikchik River							
Tikchik River (Mainstem	13-Aug	3,400		3,400	19,847		
Cow Creek					3,450		
Koneruk Creek					0		
Subtotal		3,400	0	3,400	23,297		
Nuyakuk Lake							
Northshore Beaches	21-Aug	515		515	1,530		
Southshore Beaches	21-Aug	230		230	2,611		
Portage Arm	21-Aug	145		145	416		
Mirror Bay	21-Aug	505		505	2,726		
Rapids	13-Aug	700		700	1,854		
Subtotal		2,095	0	2,095	9,177		
Lake Chauekuktuli							
Creek #1	13-Aug	0		0	71		
Allen River Beach	13-Aug	3,200		3,200	14,729		
Allen River	13-Aug	580		580	447		
Northshore Beaches	21-Aug	695		695	2,550		
Southshore Beaches	21-Aug	130		130	359		
Shadow Bay	21-Aug	10		10	5		
Sub-Total		4,615	0	4,615	18,160		
Total		11,035	0	11,035 *	56,505	6	69,702

* Total escapement estimate does not include an estimate for Cow and 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, 1991 and 1994. Surveys conducted in other years due to unusually large escapements were not included.

[2] Derived by dividing Nuyakuk tower count by peak aerial live count.

Table 11. Peak aerial counts of live sockeye salmon and total escapement estimates, Lake Nunavaughuluk drainage, 1995.

Location	Aerial Counts[a]		Total Escapement Estimate	
	Date	Number	Factor[1]	Number
Snake River	25-Aug	80	2	160
Snake R. - Eagle Cr. Beach	25-Aug	2,350	2	4,700
Westshore Beach	25-Aug	3,000	2	6,000
Eastshore Beach	25-Aug	1,860	2	3,720
Eagle Lake	13-Aug	320	2	640
Eagle Cr.	13-Aug	50	2	100
Killian Cr.	13-Aug	1,000	2	2,000
East Cr.	13-Aug	30	2	60
Total		8,690		17,380

[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 12. Peak aerial counts of live sockeye salmon and total escapement estimates, Togiak District, 1995.

Stream	Aerial Counts		Total Escapement Estimate	
	Date	Number	Factor [1]	Number
Togiak Section				
Togiak Tower				185,718
Togiak River mainstem	15-Aug	3,260	2.0	6,520
Gechiak Lake System	15-Aug	1,745	2.5	4,363
Pungokepuk Lake	15-Aug	1,000	2.5	2,500
Nayorurun River				
Kemuk River	15-Aug	4,200	1.5	6,300
Ongivinuk Lake System	15-Aug	2,330	2.5	5,825
Subtotal		12,535		25,508
Kulukak Section				
Kulukak River	15-Aug	1,040	2.0	2,080
Kulukak Lake	15-Aug	1,960	2.0	3,920
Tithe Creek Ponds	15-Aug	4,310	2.0	8,620
Subtotal		7,310		14,620
Matogak, Osviak, and Cape Pierce Sections				
Matogak River [2]	03-Aug	610	2.0	1,220
Osviak River [2]	03-Aug	1,470	2.0	2,940
Slug River [2]	24-Jul	2,820	2.0	5,640
Subtotal		4,900		9,800
Other				
Quigmy River [2]	03-Aug	200	2.0	400
Negukthlik River [2]	03-Aug	390	2.0	780
Ungalikthluk River [2]	04-Aug	1,720	2.0	3,440
Subtotal		2,310		4,620
Total		27,055		240,266

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

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

Table 13. Peak aerial counts of live chinook salmon and total escapement estimates, Togiak District, 1995.

River	Aerial Counts		Total Escapement Estimates	
	Date	Number	Factor [1]	Number
Togiak Section				
Togiak River mainstem				
A	27-Jul	120	2.5	300
B	27-Jul	220	2.5	550
C	27-Jul	750	2.5	1,875
D	27-Jul	255	2.5	638
E	27-Jul	800	2.5	2,000
F	27-Jul	800	2.5	2,000
Subtotal		2,945		7,363
Gechiak River	27-Jul	715	2.5	1,788
Pungokepuk River	27-Jul	140	2.5	350
Nayorurun River	27-Jul	425	2.5	1,063
Kemuk River	27-Jul	520	2.5	1,300
Ongivinuk River	27-Jul	295	2.5	738
Subtotal		5,040		12,600
Kulukak Section				
Kulukak River	04-Aug	430	2.5	1,075
Matogak, Osviak, and Cape Pierce Sections				
Matogak River[2]	03-Aug	65	2.5	163
Osviak River[2]	03-Aug	135	2.5	338
Slug River[2]	24-Jul	50	2.5	125
Subtotal		250		625
Other				
Quigmy River[2]	03-Aug	35	2.5	88
Negukthlik River[2]	03-Aug	740	2.5	1,850
Ungalikthluk River[2]	04-Aug	80	2.5	200
Subtotal		855		2,138
Total		6,575		16,438

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.

Table 14. Peak aerial counts of live chum salmon and total escapement estimates, Togiak District, 1995.

River	Aerial Counts		Total Escapement Estimate	
	Date	Number	Factor [1]	Estimate
Togiak Section				
Togiak River mainstem				
A	27-Jul	15,700	2.0	31,400
B	27-Jul	7,100	2.0	14,200
C	27-Jul	4,700	2.0	9,400
D	27-Jul	1,800	2.0	3,600
E	27-Jul	6,800	2.0	13,600
F	27-Jul	5,900	2.0	11,800
Subtotal		42,000		84,000
Gechiak River	27-Jul	4,800	2.0	9,600
Pungokepuk River	27-Jul	1,900	2.0	3,800
Nayorurun River	27-Jul	9,700	2.0	19,400
Kemuk River	27-Jul	2,700	2.0	5,400
Ongivinuk River	27-Jul	8,200	2.0	16,400
Subtotal		69,300		138,600
Kulukak Section				
Kulukak River	04-Aug	3,800	2.0	7,600
Matogak, Osviak, and Cape Pierce Sections				
Matogak River [2]	03-Aug	2,600	2.0	5,200
Osviak River [2]	03-Aug	6,960	2.0	13,920
Slug River [2]	24-Jul	3,220	2.0	6,440
Subtotal		12,780		25,560
Other				
Quigmy River [2]	03-Aug	1,100	2.0	2,200
Negukthlik River [2]	03-Aug	500	2.0	1,000
Ungalikthluk River [2]	04-Aug	3,600	2.0	7,200
Subtotal		5,200		10,400
Total		91,080		132,160

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. Surveys were past peak of spawning.

Table 15. Peak aerial counts of live coho salmon and total escapement estimates, Togiak District, 1995.

Stream	Aerial Counts		Total Escapement Estimat	
	Date	Number	Factor [1]	Number
Togiak Section				
Togiak River mainstem [2]				
A				
B				
C				
D				
E				
F				
Subtotal				
Gechiak River	03-Oct	1,450	3.0	4,350
Pungokepuk River [2]				
Nayorurun River [2]				
Kemuk River	03-Oct	200	3.0	600
Ongivinuk River	03-Oct	1,180	3.0	3,540
Subtotal		2,830		8,490
Kulukak Section				
Kulukak River	28-Sep	1,185	3.0	3,555
Matogak, Osviak, and Cape Pierce Sections				
Matogak River [3]	26-Sep	1,392	3.0	4,176
Osviak River [3]	26-Sep	1,080	3.0	3,240
Slug River [3]	26-Sep	1,149	3.0	3,447
Subtotal		3,621		10,863
Other				
Quigmy River [3]	26-Sep	855	3.0	2,565
Negukthlik River				
Ungalikthluk River [3]	27-Sep	5,196	3.0	15,588
Subtotal		6,051		18,153
Total		N/A		N/A

[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] U.S.F.W.S. survey, includes schooled fish, indicating pro-peak timing. Nequkthlik & Ungalikthluk Rivers combined.

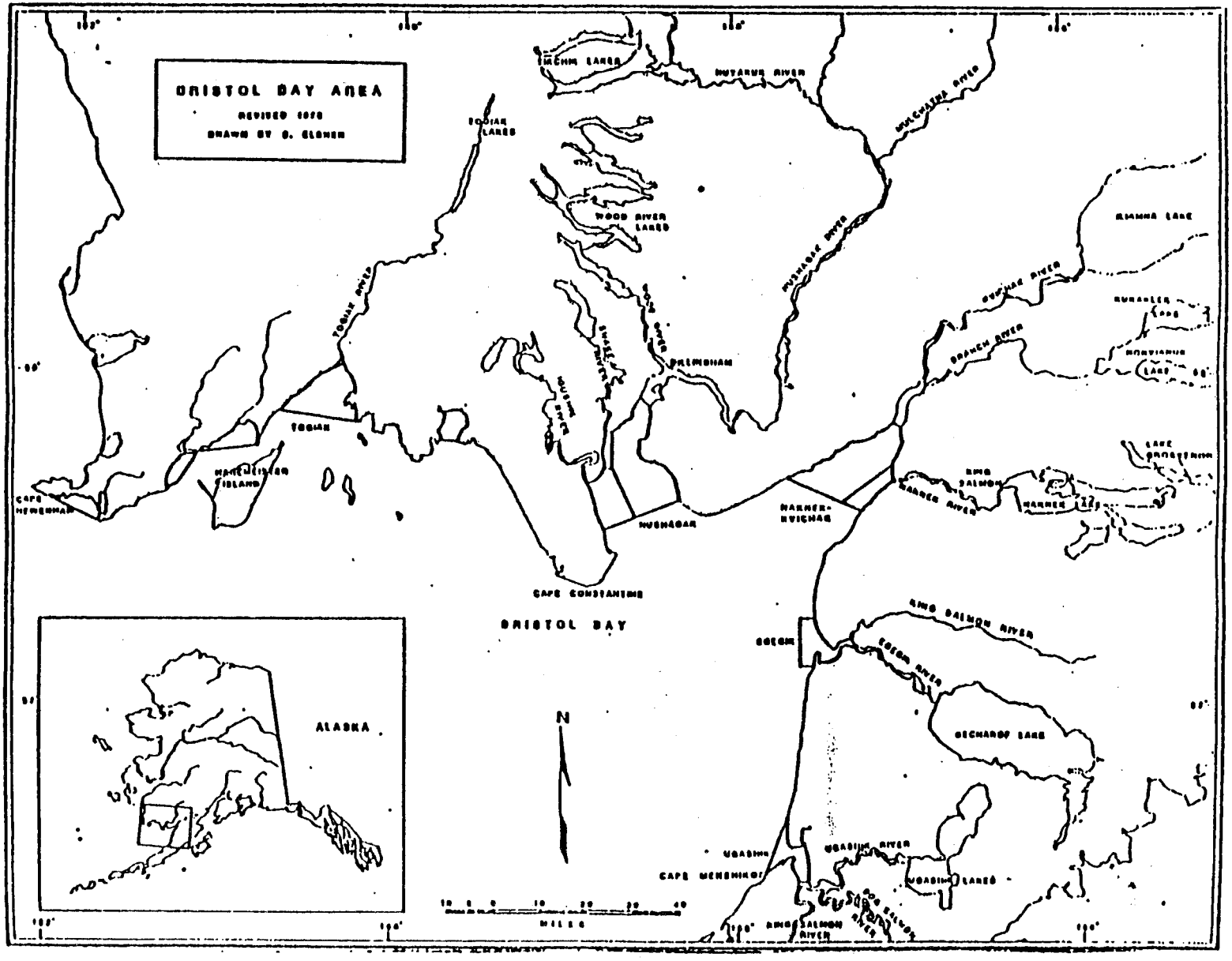

Figure 1. Bristol Bay management area, Alaska.

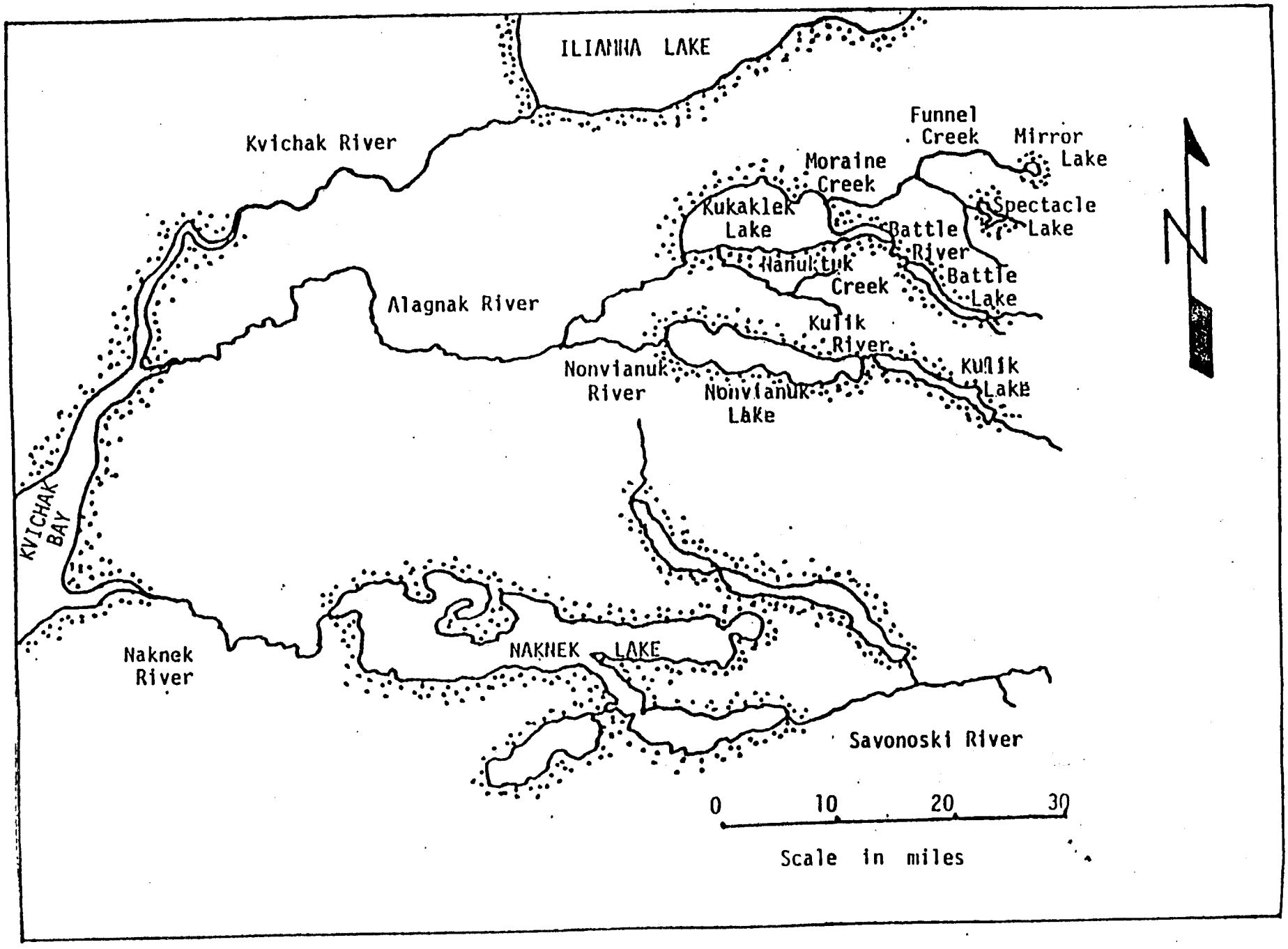

Figure 2. Alagnak River drainage, Bristol Bay, Alaska.

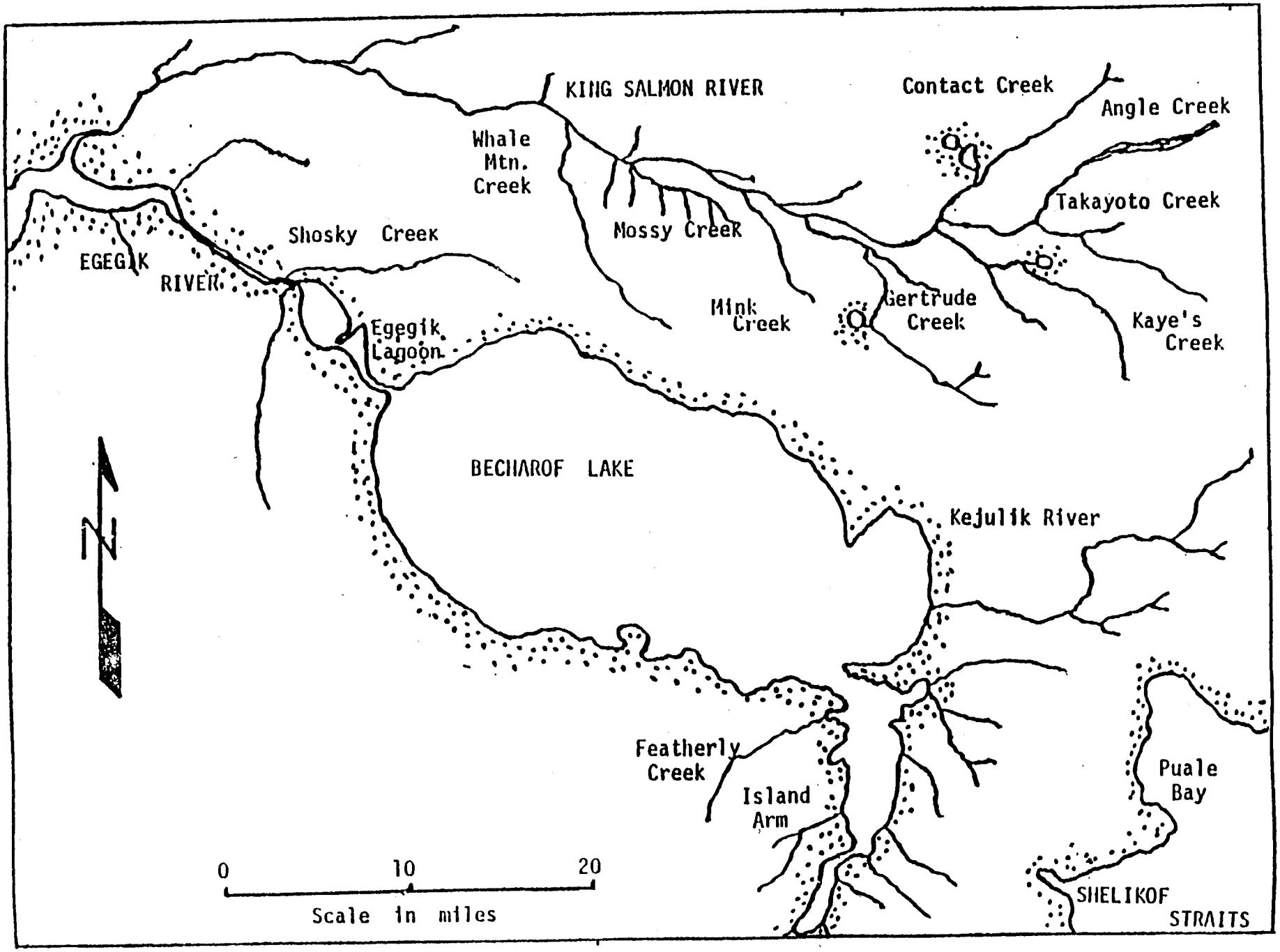

Figure 3. Egegik River drainage, Bristol Bay, Alaska.

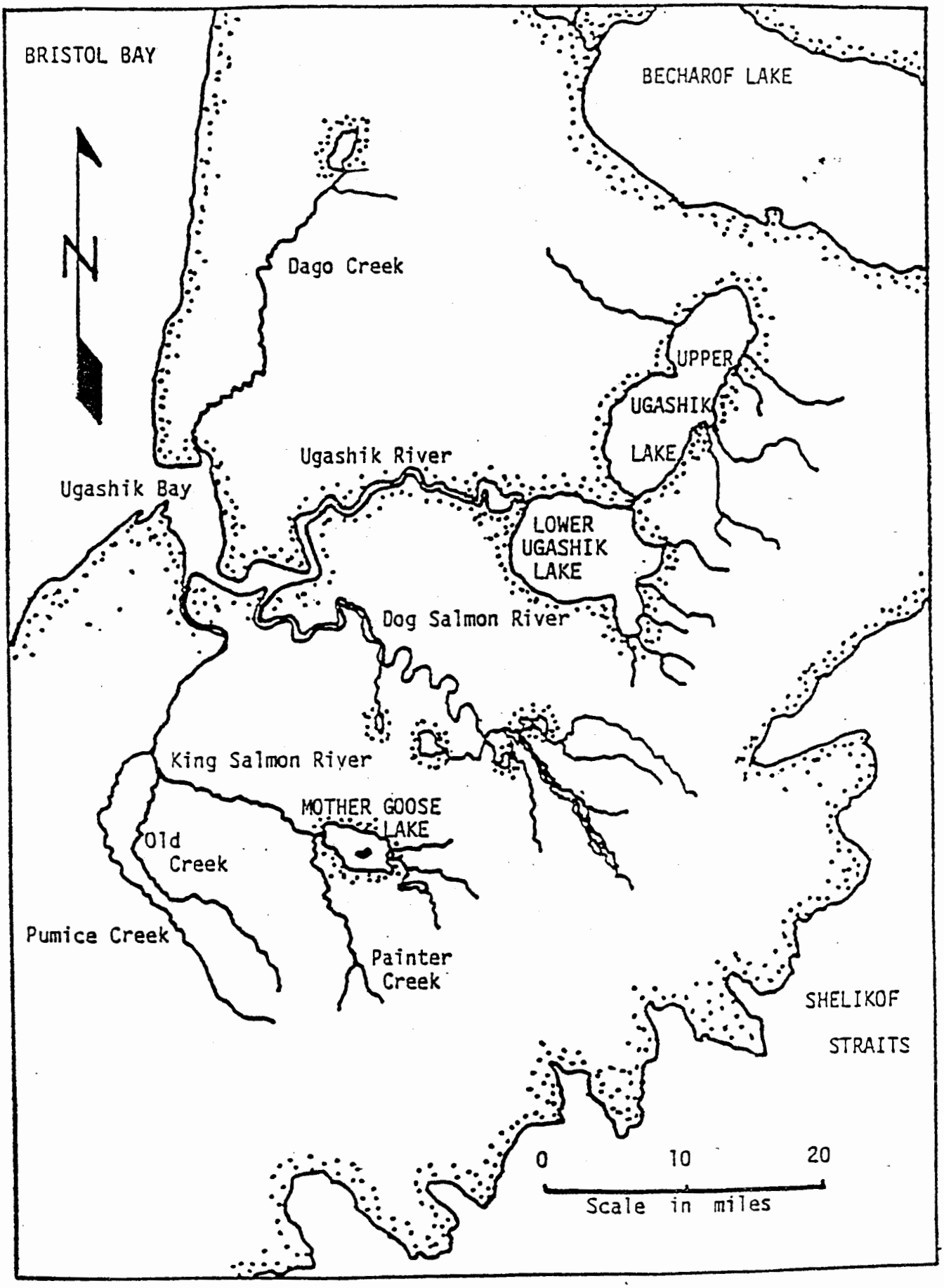

Figure 4. Ugashik River System, Bristol Bay, Alaska.

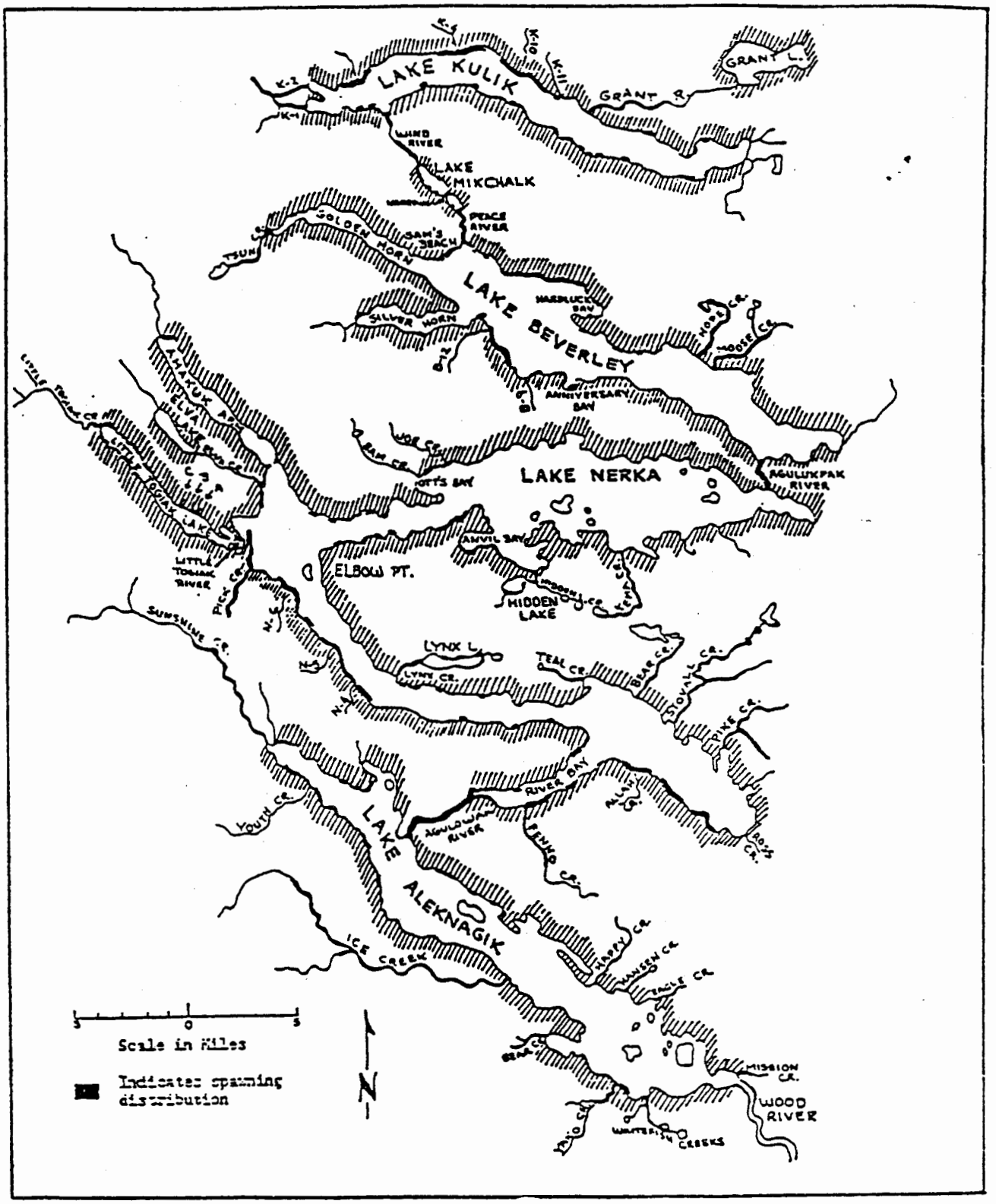

Figure 5. Wood River Lakes system, Bristol Bay, Alaska.

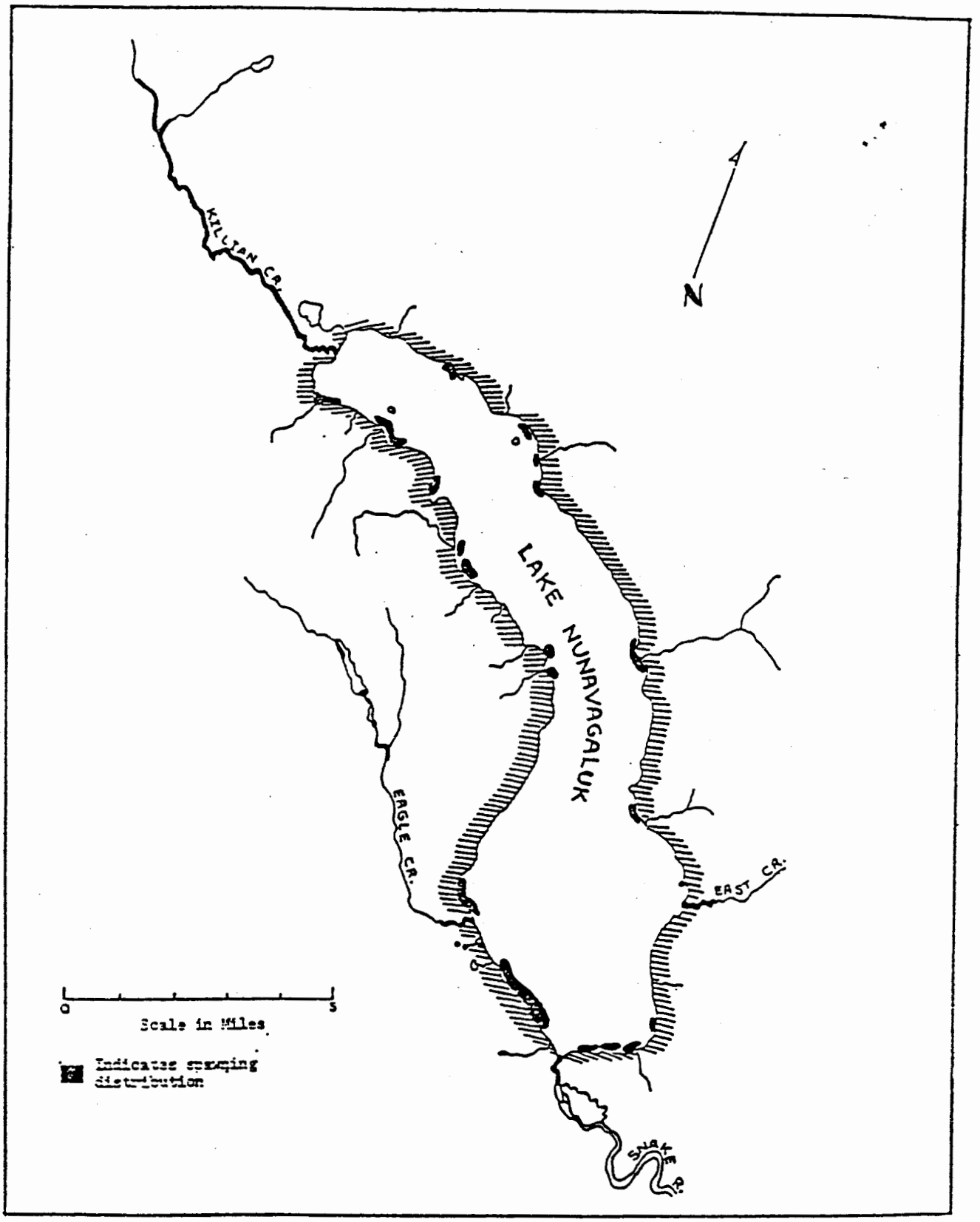

Figure 6. Lake Nunavaugaluk system, Bristol Bay, Alaska.

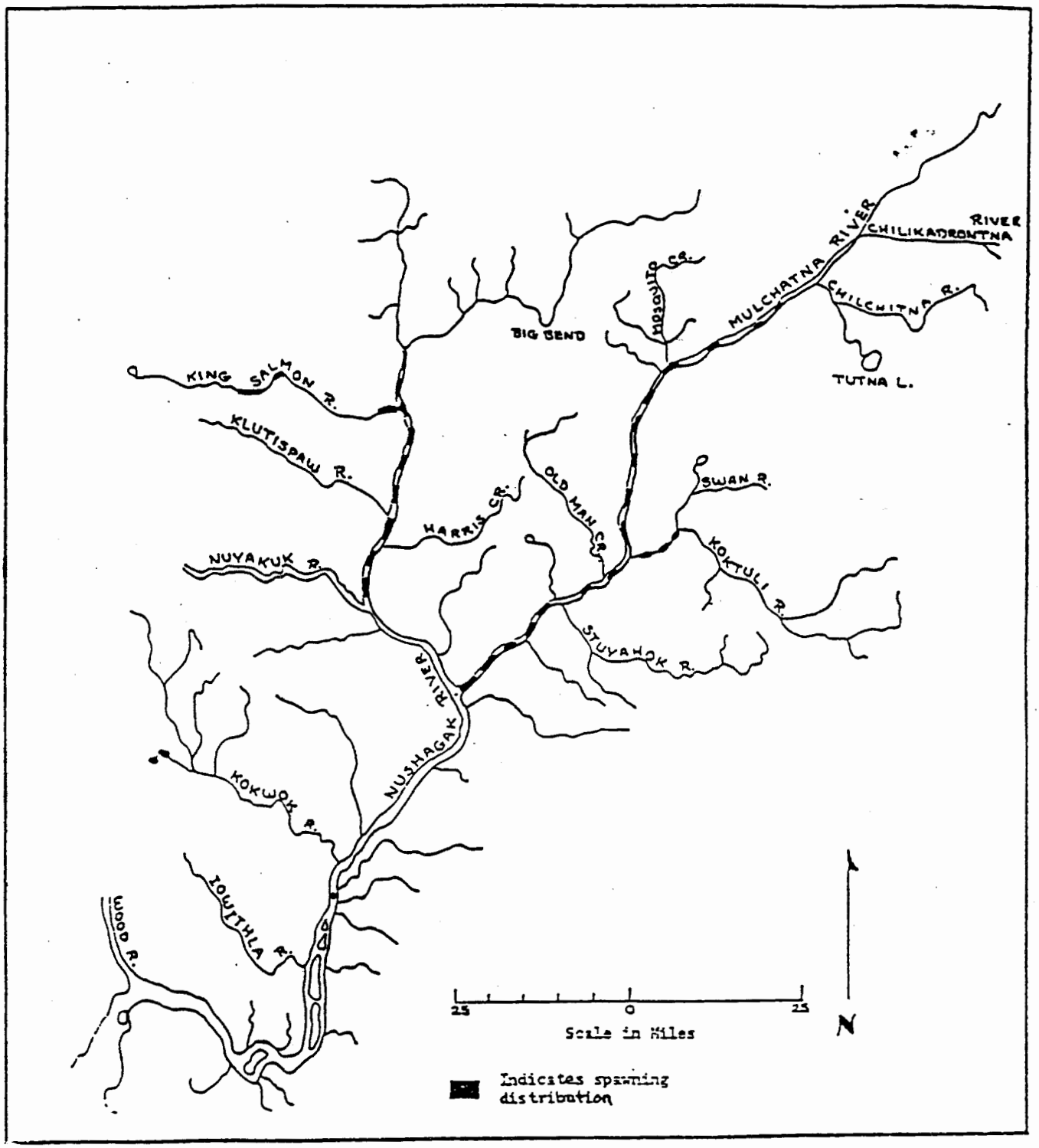

Figure 7. Nushagak-Mulchatna River system, Bristol Bay, Alaska.

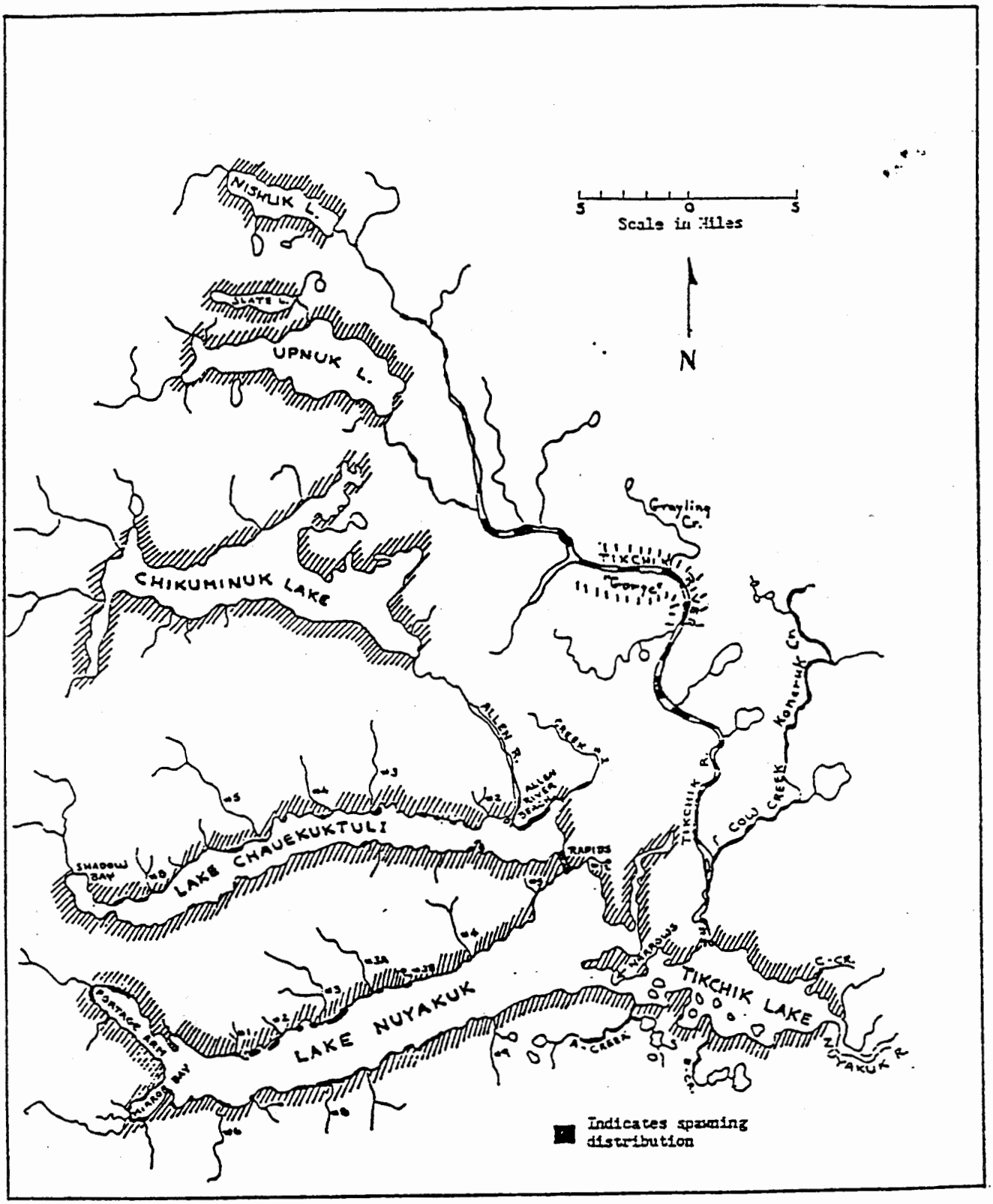

Figure 8. Tikchik Lakes system, Bristol Bay, Alaska.

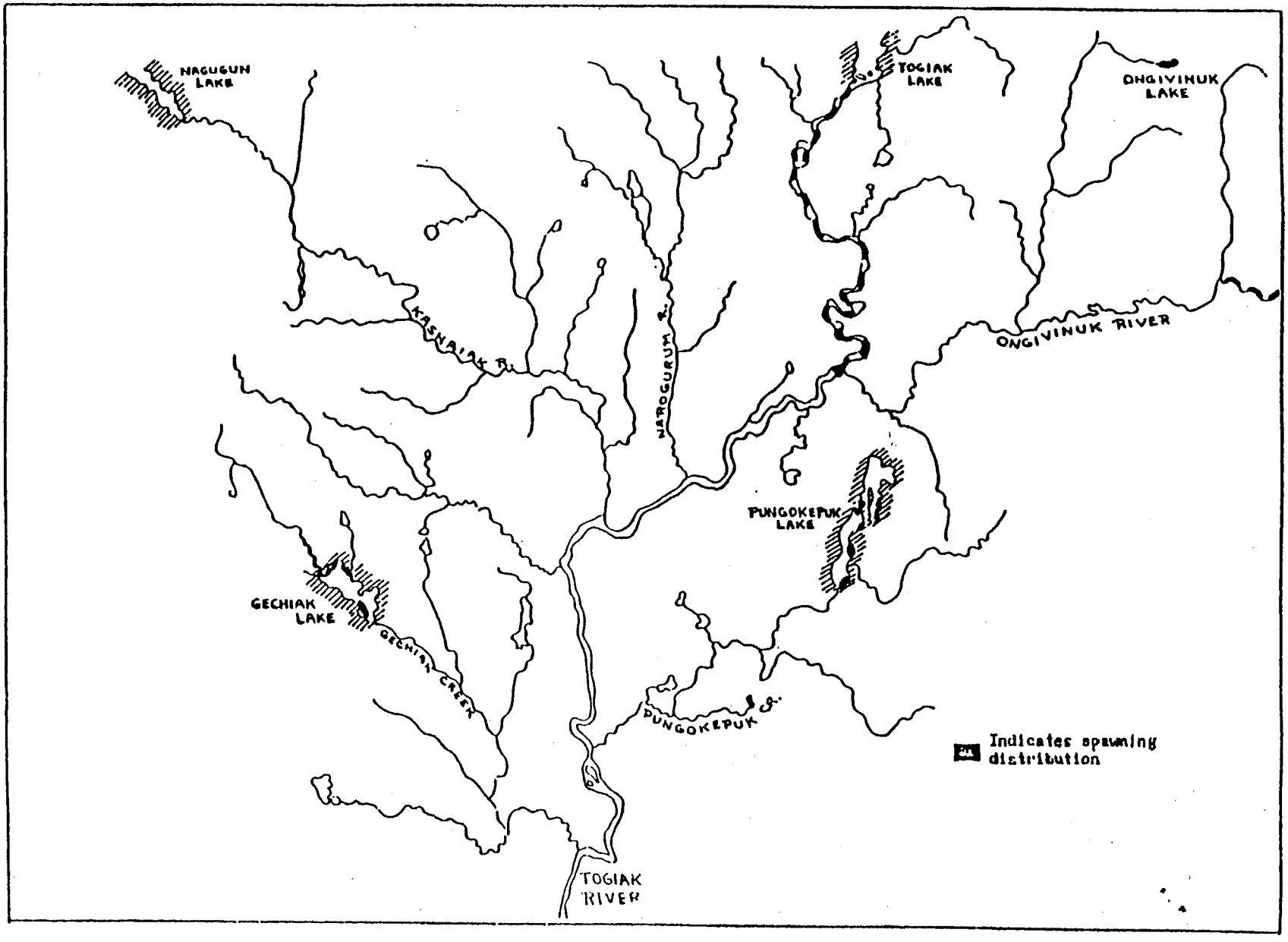

Figure 9. Togiak River system, Bristol Bay, Alaska.

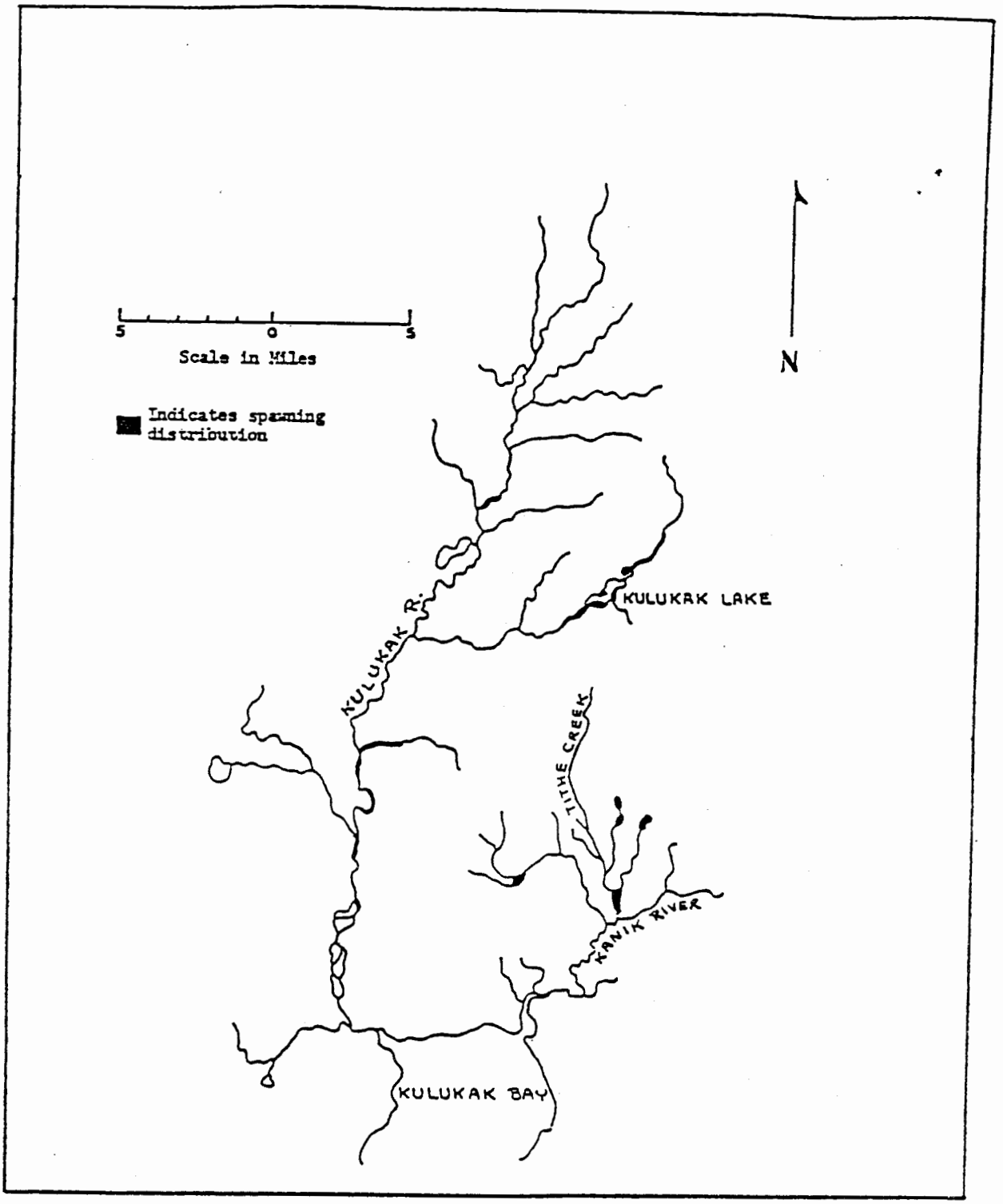

Figure 10. Kulukak River system, Bristol Bay, Alaska.

APPENDICES

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

Year	Kvichak	Naknek	Alagnak	Total	Alagnak Percent of 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	634,645 [b]	126,595	3,604,050	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
1994	8,337,840	990,810	242,595 [a]	9,571,245	3
1995	10,038,720	1,111,140	215,713 [a]	11,365,573	2
Mean	5,772,077	1,218,386	234,619	7,225,082	3

[a] Aerial survey counts.
[b] Weir counts.

Appendix Table 2. Aerial survey counts of chinook salmon escapements, Naknek River drainage, 1970-1995.

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
94	5,970	203	974	2,531	9,678
1995	2,790	26	239	1,905	4,960
Mean	2,967	130	515	1,601	5,213 [b]
Percent	57	2	10	31	100

[a] Counts unavailable.
[b] The sum of mean indices.

Appendix Table 3. Chinook salmon escapement survey history, mainstem Naknek River, 1929-1995.

Year	Count Dates	Surveyors	Actual Weir Count [1]	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate [2]	Comments
1929	7/03-7/31		1,498			Chinook count peaked 7/27.
1930	6/20-8/09		1,999			Chinook count peaked 8/09.
1931	6/17-8/09		896			Chinook count peaked 8/07.
1932	6/23-8/10		1,869			
1950	7/08-8/20		3,097			Chinook count peaked 8/09.
1951	6/28-8/07		1,876			Chinook count peaked 8/04.
1952	6/25-8/10		633			Chinook count peaked 8/06.
1953	6/24-8/10		2,074			Chinook count peaked 7/26.
1954	6/20-8/11		3,474			Chinook count peaked 8/10.
1955	6/13-8/17		4,188			Chinook count peaked 8/16.
1956	6/22-8/28		7,378			Chinook count peaked 8/18.
1957	6/28-8/04		8,504			Chinook count peaked 8/03.
1966		Redick				300 were counted 8/26 from a skiff in the Rapids.
1967	Mid-Aug.	Paddock			800	
1968					1,200	Conservative estimate.
1969					1,200	
1970	7/31	Whitehead		845		
	8/03	Siedelman		3,060		Visibility very good. Super-cub.
	8/22	Siedelman		1,540	1,750	Water high & murky. Spawning pre-peak.
	8/22	Whitehead		1,310		
	8/25	Whitehead		2,225		Counting conditions optimal.
	8/25	Siedelman		2,536	2,500	Conditions good. Spawning pre-peak.
1971	8/26	Cunningham		1,639		Fish concentrated near Rapids Camp. Few dead.
1972	8/23	Cunningham & McCurdy		351		Poor counting conditions. Post-peak.
1973	8/19	Russell		1,315		Counting conditions good. Peak near at hand.
1974	8/19	Russell			450	Count accuracy questionable. Many fish were deep.
1975	8/17	Russell		2,250		Good viewing, peak near. Still fish spawning 9/08.
1976	8/13	Bill		2,615		Spawning near peak. Very few dead.
	8/16	Russell		5,950	7,250	Pre-peak. Still lots fish holding in large groups.
1977	8/22	Russell		4,830	5,750	Pre-peak. Few dead. Some still holding deep.
1978	8/09	Gwartney			4,000	Near peak.

(continued)

Appendix Table 3. Continued

Year	Count Dates	Surveyors	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate [2]	Comments
1983	8/14	Bill	2,860	3,000	Pre-peak. Still fish holding in large groups.
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		Spawning pre-peak. Still many fish holding.
	8/19	Meyer	2,200		Peak of spawning drawing near.
1987	8/19	Meyer	2,800		Pre-peak. Fish still in large groups. Few redds.
	8/28	Bill	2,655	2,855	
1988	8/09	Minard	7,380	7,400	Approaching peak. Most fish on redds.
1989	8/14	Minard	1,700		Fish actively spawning. Few carcasses observed.
1990	8/06	Minard	4,500		
1991	8/20	Russell	1,655		Pre-peak. Still many fish schooled & waiting.
1992	8/21	Regnart	877		Water clarity poor in deeper pools.
	8/27	Regnart	1,550		At Peak...all fish on redds.
1993	8/23	Regnart	5,520		Near peak. Still some fish schooled.
1994	8/24	Regnart	5,970		Near peak. Most on redds.
1995	8/21	Regnart	2,790		Near peak. Most on redds.
Mean			3,124	2,596	

[1] Weir count did not account for estimated 15-20% of chinook that spawn downstream of weir site. Also does not account for fish that migrated upstream past the weir site before and after weir operation.

[2] Surveyor's subjective estimate of instantaneous population of chinook salmon spawners in the river at time of aerial survey, based on survey conditions, river area coverage, water clarity, etc. Does not include expansion for earlier or later run fish not available for counting at time of survey.

Appendix Table 4. Chinook salmon escapement survey history, Big Creek, Naknek River Drainage, 1963-1995.

Year	Count Dates	Surveyors	Float Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate [1]	Comments
1963	8/01	Paddock		362		Covered only half stream length. Helicopter.
	8/13	Paddock		1,345	2,690	Spawning near peak. Good survey.
1964	7/31	Paddock		484		Survey too early.
	8/15	Siedelman & Williamson		636		Survey fair to good. Near peak. Helicopter.
	8/15-8/18	Siedelman & Williamson	1,130			Peak of spawning over.
1965	8/05-8/08	Andrews	578			Fair survey. Began below Index Area No. 1.
1966	8/13-8/16	Redick	979			Spawning at peak. Included Index Area No. 1. Count affected by rain/turbid water in lower areas.
1967	8/10-8/14	Whitehead & Bury	1,129			Upstream redds occupied while those in the lower stream area were abandoned.
1968	8/10-8/14	Meyers & Preyer	3,827			Counting conditions fair to poor.
1969	8/12-8/14	Parkinson & Faro	1,012			High murky waters hampered float count.
	Mid-Aug.	??			5,000	Flown due to poor count conditions during float.
1970	7/19	Whitehead		825		
	8/15-8/17	Parkinson & Brooks	1,601			High murky waters in lower 2/3 of stream.
1971	8/13	Cunningham		490	1,200	Only upper 1/3 of stream surveyed due to murky water in lower 2/3.
	8/28	Siedelman		277		Past peak. Survey affected by winds of 30+ mph.
1972	8/08	Cunningham		695		Pre-peak.
	8/18	Siedelman		1,060		Post-peak.
1973	8/17	Russell		1,106		At peak of spawning. Many fish beaten up (fungus).
1974	8/01	Russell		520	850	Pre-peak. No dead chinook. Lots dead chums.

(continued)

Appendix Table 4. Continued

Year	Count Dates	Surveyors	Float Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate [1]	Comments
	8/11	Russell		860	1,250	Didn't survey lower 8 miles of creek 8/11. Could add 150 fish to survey as Russell saw that many in the unsurveyed portion from skiff 8/10. Near peak.
1975	8/09	Russell		779		Survey pre-peak.
1976	8/13	Bill		970	1,400	Not total stream coverage due to winds & low fuel.
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	Survey conditions..high water & gusty winds.
1986	8/08	Meyer		1,542	6,000	Excellent conditions. Fish at spawning peak.
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 spawning peak..all fish on redds, only 20 dead.
1992	8/18	Regnart		895		Est. 5-6 days post-peak. Count includes 125 dead.
1993	8/17	Regnart		1,710		Estimated survey 3-4 days past peak.
1994	8/16	Regnart		2,531		Est. 2-3 days post-peak. Count includes 159 dead.
1995	8/15	Regnart		1,905		Estimate survey was several days past peak.
Mean			1,465	1,435		

[1] Surveyor's subjective estimate of instantaneous population of chinook salmon spawners in the river at time of aerial survey, based on survey conditions, river area coverage, water clarity, etc. Does not include expansion for earlier or later run fish not available for counting at time of survey.

Appendix Table 5. Chinook salmon escapement survey history, King Salmon Creek, Naknek River drainage, 1964-1995.

Year	Count Dates	Surveyors	Float Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate [1]	Comments
1964	7/31	Paddock		378		Survey conditions fair. Helicopter.
	8/11	Paddock		55		Visibility poor. Helicopter.
	8/11-8/14	Paddock & Siedelman	104			Peak of spawning long past. Poor survey (turbid).
1966	7/31-8/03	Redick	633			Spawning at or near peak.
1967	7/24-7/26	Paddock	289			Poor visibility. Estimated 600 fish present.
1968	7/17	Whitehead		282		Pre-peak. Helicopter.
	7/17	Meyers		242		Pre-peak. Helicopter.
	7/20	Whitehead		868		Optimum coditions. Count from H-21 Helicopter.
	7/20	Meyers		575		Optimum coditions. Count from H-21 Helicopter.
	7/20-7/23	Whitehead & Meyers	2,204			Counting conditions optimum.
1969	7/23-7/25	Parkinson & Berry	2,722			Pre-peak. Count fair-to-poor last 2 days (weather).
1970	7/19	Whitehead		260		Counting conditions poor. Pre-peak.
1971	7/28	Cunningham		704		Visibility was good.
1972	7/29	Siedelman		1,224		Peak of spawning.
1973	8/01	Siedelman		115		Visibility only fair. Survey possibly post-peak.
1974	7/15	Russell		164	350	Pre-peak. Many fish holding in pools.
	7/28	Russell		495	625	At or near peak. Only one carcass obsd. Good vis.
1975	7/28	Russell		279	375	Survey pre-peak. Good viewing conditions.
	8/10	Russell	67			Floated only lower 12 miles of creek.
	8/17	Russell		0		Excellent viewing conditions. Spawning is done.
1976	8/03	Bill		180	400	Peak within next 3 days.
1977	7/29	Russell		1,860	2,350	At peak of spawning.
1978	8/09	Gwartney			350	Past peak. Viewing good. Most fish dead or spent.
1979	??	Gwartney			1,750	
1980	8/08	Bill				Creek too high & muddy to census.
1981	7/30	Russell		591	1,500	Peak of spawning in progress. Vis = fair-to-poor.
1982	8/07	Bill		980	3,920	Good visibility.
1983	8/14	Bill		460	1,400	Poor visibility. Muddy. 30% spawners dead already.

(continued)

Appendix Table 5. Continued

Year	Count Dates	Surveyors	Float Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate [1]	Comments
1984	8/08	Bill		385	1,155	
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 and water clarity only "Fair".
	8/05	Russell		275		Est. at spawning peak, most fish on redds, 2 dead.
1992	8/09	Russell		158		Post-peak as 47 dead counted & aband. redds numerous.
1993	7/31	Russell		700	900	Slightly pre-peak. Most fish on redds. Water clear.
1994	7/29	Russell		974		Slightly pre-peak. Most fish on redds. Only 6 carcasses.
1995	8/05	Russell		239		A little past peak. Several singles on redds. Vis. only
Mean			1,190	507		

[1] Surveyor's subjective estimate of instantaneous population of chinook salmon spawners in the river at time of aerial survey, based on survey conditions, river area coverage, water clarity, etc. Does not include expansion for earlier or later run fish not available for counting at time of survey.

Appendix Table 6. Chinook salmon escapement survey history, Paul's Creek, Naknek River drainage, 1971-1995.

Year	Count Dates	Surveyors	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate 1	Comments
1971	7/28	Cunningham	52		
1972	7/28	Siedelman	156		Prior to peak.
1973	8/01	Siedelman			Too murky to survey.
1974	7/15	Russell	2		
	7/26	Russell	91	250	Prior to spawning peak.
1975	7/28	Russell	144	225	Prior to peak. Good conditions.
1976	8/03	Bill	31	100	Poor conditions. Fish paired & spawning.
1977					No count.
1978	8/09	Gwartney		300	Past peak. 75% of fish dead.
1979					No count.
1980	8/08	Bill	17		All carcasses. Creek high & muddy.
1981					No count.
1982	8/07	Bill	340	1,020	Good visibility. Spawning near peak.
1983	8/14	Bill	290	800	Poor visibility.
1984	8/08	Bill	400	800	Fair visibility. About 25% dead already.
1985	8/06	Bill		170	Pre-peak.
1986	8/08	Meyer	73	236	Approximately 30% dead already.
1987	8/13	Russell	7		Poor survey conditions. Past peak.
	??	Meyer		400	Estimat 400 present based on jet boat surveys.
1988	8/08	Minard	150		At peak.
1989	8/14	Minard	50		Past peak. Excellent visibility.
1990	8/06	Minard	150		Excellent survey conditions.
1991	7/30	Russell	121		Slightly pre-peak.Only 1 carcass noted.
1992	8/01	Russell	88		Slightly pre-peak.Stream clarity only "Fair".
1993	7/31	Russell	86	140	Slightly pre-peak.Overflew approx 60% of stream.
1994	7/29	Russell	203	300	Pre-peak...but many fish on redds.
1995	8/05	Russell	26		Water clarity poor. 5 carcasses noted
Mean			130		

[1] Surveyor's subjective estimate of instantaneous population of chinook salmon spawners in the river at time of aerial survey, based on survey conditions, river area coverage, water clarity, etc. Does not include expansion for earlier or later run fish not available for counting at time of survey.

Appendix Table 7. Chinook salmon escapement survey history, Alagnak River, 1963-1995.

Year	Count Dates	Surveyors	Float Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate [1]	Comments
1963	8/12	Siedelman		551		Excellent conditions. No side channels flown.
1966	8/06	Redick		13		Poor conditions.
	8/06-8/10	Redick	238			Nonvianuk & mainstem portions only (not Kukaklek).
	8/11	Redick		1,465		Pre-peak. Still many fish upmigrating.
1967	8/16	VanValin		1,250		
1968	8/18	Siedelman		6,717	8,500	Fairly good survey.
1969	8/19	Siedelman		4,781	6,000	Marginal survey conditions, (20kn NW winds).
1970	8/22	Siedelman		5,250	5,000	Peak of spawning. Visibility good
	8/22	Whitehead		4,590		Peak of spawning. Visibility good
1971	8/25	Siedelman		1,420	1,500	Water high, but count okay.
	8/25	Cunningham		1,475		
1972	8/23	Cunningham		2,256	2,400	Past peak. Many dead. Many unoccupied redds.
1973	8/16	Russell		824	1,250	Near peak of spawning. No dead though.
1974	8/13	Russell		1,411	1,700	Pre-peak.
	8/19	Russell		1,596	1,900	Spawning near peak.
1975	8/17	Russell		6,620	7,250	About a week pre-peak. Some large groups holding.
1976	8/16	Bill		7,593	8,750	Pre-peak. Not many dead yet.
1977	8/18	Bill		3,634	12,000	Pre-peak. Didn't count river below Pfaff Pond.
	8/18	Sanders		9,425		Pre-peak. Didn't count river below Pfaff Pond.
1978	8/24	Bill		11,650	25,100	
1979						No survey.
1980	8/08	Bill		2,020	5,090	Pre-peak. Fog over 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 weak too early.
	8/19	Bill		3,350	5,480	Peak survey.
1983	8/15	Bill		2,980	3,500	At peak of spawning.
1984	8/14	Bill		6,090	9,135	

(continued)

Appendix Table 7. Continued

Year	Count Dates	Surveyors	Float Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate [1]	Comments
1985	8/17	Bill		3,920	9,518	About peak for chinook spawning. 30% dead already.
1986	8/11	Bill		3,090	7,200	Peak of spawning.
1991	8/09	Regnart		2,023		Pre-peak. Most fish schooled yet. Few on redds.
	8/19	Regnart		2,531		Near peak. Most fish on redds.
1992	8/10	Regnart		3,042		Pre-peak. Most fish still schooled.
	8/21	Regnart		2,275		Near peak...but water clarity worse than earlier.
1993	8/09	Regnart		10,170		Near peak. Most on redds.
1994	8/08	Regnart		8,480		About half the fish on redds. Others schooled.
1995	8/10	Regnart		6,860		About 2/3 of chinook noted on redds.
Mean			238	3,716		

[1] Surveyor's subjective estimate of instantaneous population of chinook salmon spawners in the river at time of aerial survey, based on survey river area coverage, water clarity, etc. Does not include expansion for earlier or later run fish not available for counting at time of survey.

Appendix Table 8. Chinook salmon escapement survey history, Kvichak River, 1932-1995.

Year	Count Dates	Surveyors	Weir Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate [1]	Comments
1932	6/28-8/5		5,753			Peak count was on 7/05 (1,168 fish).
1976	8/16	Bill		35	45	Survey timed to count pink salmon.
1980[a]	8/08	Bill		900	1,000	Chinook 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 in Kaskanak Flats.
1993	8/16	Regnart		115		All fish on redds in Kaskanak Flats.
1994	8/12	Regnart		306		
1995	8/14	Regnart		96		
Mean			5,753	238		

[1] Surveyor's subjective estimate of instantaneous population of chinook salmon spawners in the river at time of aerial survey, based on survey conditions, river area coverage, water clarity, etc. Does not include expansion for earlier or later run fish not available for counting at time of survey.

[a] Pecks Creek, a Kvichak River tributary, was float surveyed 7/30-8/03, 1980 by R. Russell and 99 spawning chinook salmon were counted.

Appendix Table 9. Chinook salmon escapement data, Naknek-Kvichak District, 1970-1995.

Year	Non-expanded Escapement Indices by Drainage [1]			Total
	Naknek	Alagnak	Kvichak	
1970	4,145 [a]	5,250		9,395
71	2,885	1,420		4,305
72	2,791	2,256		5,047
73	2,536 [a]	824		3,360
74	1,446 [b]	1,596		3,042
1975	3,452	6,620		10,072
76	7,131	7,593	35	14,759
77	6,690 [a]	3,634		10,324
78	[c]	11,650		11,650
79	[c]	[c]		0
1980	347 [d]	2,930	900	4,177
81	4,271 [a]	2,430		6,701
82	8,610	3,400		12,010
83	7,830	2,980		10,810
84	4,995	6,090	200	11,285
1985	590 [e]	3,920		4,510
86	3,917	3,090		7,007
87	4,450	2,420		6,870
88	11,730	4,600	190	16,520
89	2,710	3,650	100	6,460
1990	7,000	1,720	170	8,890
91	4,391	2,531		6,922
92	2,691	3,042	264	5,997
93	8,016	10,170	115	18,301
94	9,678	8,480	306	18,464
1995	4,960	6,860	96	11,916
Mean	4,886	4,366	238	9,490[f]

[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 mainstem Naknek River, Paul's Creek, & Big Creek.
[e] Naknek River mainstem only.
[f] Sum of mean indices.

Appendix Table 10. Chum salmon escapement survey history, Alagnak River, 1961-1995.

Year	Count Dates	Surveyors	Tower Counts	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			
1966						
1967			9,990			
1968			72			
1969			210			
1970			5,790			
1971			402			
1972			48			
1973						
1974						
1975						
1976	8/16	Bill		2,125	5,250	
1977	8/18	Bill		35,000		
1978	8/24	Bill		9,900		
1979						
1980	8/21	Bill		7,300	14,600	
1981	8/26	Bill		75,000	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	
1990	8/08	Bill		8,500	30,000	Pre-peak.
	8/18	Bill		48,800		Close to peak of spawning.

(continued)

Appendix Table 10. Continued

Year	Count Dates	Surveyors	Tower Counts	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate [1]	Comments
1991	8/09	Regnart		43,000		Pre-peak.
	8/19	Regnart		64,300		Peak of spawning.
1992	8/10	Regnart		114,000		Near Peak.
1993	8/09	Regnart		4,600		Near Peak.
1994	8/08	Regnart		62,900		Near Peak.
1995	8/10	Regnart		132,000		Near Peak.
Mean			3,575	31,542		

1 Surveyor's subjective istimate of instantaneous population of chum salmon spawners in the river at time of aerial survey, based on survey conditions, river area coverage, water clarity, etc. Does not include expansion for earlier or later run fish not available for counting at time of survey.

Appendix Table 11. Pink salmon escapement survey history, Alagnak River, 1968-1995.

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. Many still in lower river.
1980	8/21	Bill	121,000	242,000	
1982	8/09	Bill	21,300	63,900	
	8/19	Bill	24,800	43,000	Pre-peak.
1984	8/14	Bill	296,500	567,100	Survey too early for peak. Most fish 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		
	8/18	Bill	240,500		Estimated to be about 1 week pre-peak.
1992	8/10	Regnart	15,000		Pre-peak.
1993	8/09	Regnart			No pinks noted.
1994	8/08	Regnart			No pinks noted.
1995	8/10	Regnart			No pinks noted.
Mean			146,880		

[1] Surveyor's subjective estimate of instantaneous population of pink salmon spawners in the river at time of aerial survey, based on survey conditions, river area coverage, water clarity, etc. Does not include expansion for earlier or later run fish not available for counting at time of survey.

Appendix Table 12. Pink salmon escapement survey history, Kvichak River, 1966-1995.

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	Most still schooled.
1978	8/28	Bill	88,000	440,000	Still numerous fish migrating & some 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.
1993					No survey.
1994					No survey.
1995					No survey.
Mean			65,060		

[1] Surveyor's subjective estimate of instantaneous population of pink salmon spawners in the river at time of aerial survey, based on survey conditions, river area coverage, water clarity, etc. Does not include expansion for earlier or later run fish not available for counting at time of survey.

Appendix Table 13. Pink salmon escapement survey history, Naknek River, 1974-1995.

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	Just pre-peak. Many still 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	Most fish still schooled and holding. Pre-peak.
1988	8/24	Russell	187,000		
1990	8/18	Bill		65,000	
1992					No survey.
1993					No survey.
1994					No survey.
1995					No survey.
Mean			147,750		

[1] Surveyor's subjective estimate of instantaneous population of pink salmon spawners in the river at time of aerial survey, based on survey conditions, river area coverage, water clarity, etc. Does not include expansion for earlier or later run fish not available for counting at time of survey.

Appendix Table 14. Aerial survey counts of chinook salmon escapement, Egegik District, 1981-1995. [a]

Year	Egegik River	Shosky Creek	Whale Mountain Creek	Mossy Creek	Mink Creek	Gertrude Creek	Kaye's Creek	Takayoto Creek	Angle Creek	Contact Creek	King Salmon River	Total
1981						515						515
1982	300					900				300		1,500
1983						860		380		375		1,615
1984	40	300				600		350		110		1,400
1985	75	80	0	15	10	260	230	315		95		1,080
1986	65	150	48	0	0	150	46	40		18	15	532 [b]
1987	15	174	2	74	0	408	284	232	2	88		1,279
1988	50	151	0	12		248	120	177		110		868
1989	14	90	13	43	7	310	120	300		100		997
1990	24 [c]	85	7	35	2	260	175	175		205		968
1991	0 [c]	62	60	30	33	83	117	95		73		553
1992[d]	15	143	52	54	22	416	320	190		296		1,508
1993	80	58	6	38	6	350	170	200		235		1,143
1994[d]	66 [c]	48	32	118	77	840	214	230		705		2,330
Mean	60	122	22	42	17	443	180	224	2	208	15	1,335 [e]
1995	60 [d]	32	10	53	103	456	248	130		275		1,367

[a] Peak aerial counts unless otherwise noted. Data not expanded.
[b] Survey 10-14 days later than normal.
[c] Tower count.
[d] Helicopter surveys.
[e] Sum of mean indices for all streams.

Appendix Table 15. Aerial survey counts of chum salmon escapement, Egegik District, 1982-1995. [a]

Year	Egegik River	Shosky Creek	Whale Mountain Creek	Mossy Creek	Mink Creek	Gertrude Creek	Kaye's Creek	Takayoto Creek	Angle Creek	Contact Creek	King Salmon River	Total
1982						12,000				2,000		14,000
1983	6 [b]					5,000		3,500		6,000		14,500
1984	800	200				13,000		2,400		10,000		26,400
1985	400	0	600	200	35	2,600	800	0		500	50	5,185
1986	0	0	6,025			140	3	5	0	15	25	6,213 [c]
1987	150	0	19,000	16	1,000	3,770	2,780	0		2,850		29,566
1988	500	50	4,400	100	50	5,200	1,600	0		3,200		15,100
1989	0	10	3,200	25	100	1,100	0	0		200	14	4,649
1990	72 [b]	0	2,000	0	150	1,675	80	0		750		4,727
1991	0 [b]	0	1,500	70	100	990	280	0		480		3,420
1992[d]	50	0	680	15	25	4,500	400	0		3,630	200	9,500
1993	100	0	1,020	8	1	1,075	0	0		100		2,304
1994[d]	42 [b]	0	1,700	5	7	760	175	30		260		2,979
Mean	192	24	4,013	49	163	3,985	612	495	0	2,307	72	11,911 [e]
1995	144 [d]	2	395	15	30	560	162	5		600		1,913

[a] Peak aerial counts unless otherwise noted. Data not expanded.
[b] Tower count.
[c] Survey 10-14 days later than normal.
[d] Helicopter surveys.
[e] Sum of mean indices for all streams.

Appendix Table 16. Aerial survey counts of pink salmon escapement, Egegik District, 1974-1995.[a]

Year	Egegik River	Whale Mountain Creek	Gertrude Creek	Contact Creek	Takayoto Creek	Kaye's Creek	Other	Total
1974	3,912 [b]							3,912
1976	0 [b]							0
1977	84 [b]							84
1980	0 [b]							0
1982	15,000							15,000
1983	0		58 [c]					0
1984	17,000							17,000
1985	0							0
1986	2,500							2,500
1987	0							0
1988	23,000							23,000
1989	300							300
1990	17,000		40 [c]					17,000
1991		88 [d]	24 [d]	36 [d]				0
1992[e]	6 [b]	10					3	3
1993	50							50
1994	21,282 [b]							21,282
Mean	6,675	49	41	36	0	0	3	6,804
1995	24 [b]							0

[a] Non-expanded aerial peak counts unless otherwise noted.
[b] Tower counts.
[c] Float count.
[d] Foot survey (USFWS).
[e] Helicopter surveys.
[f] Sum of mean indices for all streams.

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	0	No surveys done.
1984	3	43,225	40,000 counted in Egegik Lagoon on August 15.
1985	3	5,260	Peak surveys 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 Mountain Creeks.
1990	7	13,400	Peak survey on August 17.
1991	0	220	Incidental observation made August 6.
1992 [b]	0	200	Incidental observation in Egegik River August 6.
1993	0	1,130	Incidental observation 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, 1980-1995.

Year	Ugashik River	Dog Salmon River	King Salmon	Painter Creed	Pumice Creek	Old Creek	Total
1980	0 [a]		900	1,000			1,900
1981	18 [a]		50	300			368
1982	0 [a]		700	700			1,400
1983	50	1,635	525	635	1,800	660	5,305
1984	108 [a]	836	4,100	1,875	1,100	880	8,899
1985	150 [b]	560	4,600	410	930	410	7,060
1986	66 [b]	252	1,777	646	705	739	4,185
1987	54 [a]	751	981	1,051	1,602	1155	5,594
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	67 [ac]	540	1,500	590	450	610	3,757
1991	131 [ac]	449	700	365	375	420	2,440
1992[d]	260 [ac]	821	1,260	855	750	815	4,761
1993	188 [ac]	579	1,970	865	450	635	4,687
1994[d]	233 [ac]	1,741	2,225	1,005	2,530	1490	9,224
Mean	120	826	1,919	833	1,019	750	5466[e]
1995	149 [ac]	882	440	366	501	505	2,843
Deviation[f]	24%	7%	-77%	-56%	-51%	-33%	-48%

[1] Includes Figure-Eight, Goblet, Oldham, and Wandering Creeks.
[a] Ugashik River tower counts
[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] 1995 deviation from 1980-1994 mean.

Appendix Table 19. Aerial survey counts of chum salmon escapement, Ugashik District, 1980-1995.

Year	Ugashik River	Dog Salmon River	King Salmon	Painter Creed	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]	1,650	2,700	4,000	20,000	3,300		31,650
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	312 [cd]	170	6,200	1,150	1,630	410	10	9,882
1991	315 [cd]	240	7,400	750	2,550	2,525	130	13,910
1992[e]	510 [acd]	1,210	8,525	4,000	14,000	15,000	0	43,245
1993	93 [cd]	105	7,000	720	2,040	1,025	8	10,991
1994[e]	66 [ac]	851	9,150	1,625	12,750	6,975	150	31,567
Mean	199	757	17,138	6,133	8,430	4,578	457	37,692[f]
1995	6 [ac]	160	3,900	1,370	2,600	1,800	0	9,836
Deviation[g]	-97%	-79%	-77%	-77%	-69%	-61%	100%	-71%

[1] Includes Figure-Eight, Goblet, Oldham, and Wandering Creeks.
[a] Tower counts
[b] Float count done from a raft.
[c] Survey included Grassy Creek (tributary downstream of Ugashik Lagoon).
[d] Included tower count plus later aerial surver count.
[e] Helicopter surveys.
[f] Sum of mean indices for all locations.
[g] 1995 deviation from 1980-1994 mean.

Appendix Table 20. Aerial survey counts of pink salmon escapement, Ugashik District, 1980-1995.

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	Observed near Ugashik Lake Outlet on August 11.
1995	0	36	Ugashik River tower count.

[a] Hilicopter survey.

Appendix Table 21. Aerial survey counts of coho salmon escapement, Ugashik District, 1981-1995.

Year	Number of Surveys	Coho Salmon Counts	Comments
1981	1	13,300	Surveyed on September 7.
1982	1	10,000	Surveyed on 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 on September 7.
1989	4	11,515	7,615 observed on August 14.
1990	5	12,610	
1991	0	400	Incidental observation made August 12.
1992 [a]	0	790	Incidental observation made August 11.
1993	0	705	Incidental observation made August 16.
1994 [a]	0	760	Incidental observation made August 11.
1995	0		

[a] Helicopter survey.

Appendix Table 22. Spawner distribution and total escapement estimates of sockeye salmon, Wood River system, 1959-1995.

Year	Spawner Distribution (%)			Total Escapement[1]
	Creeks	Beaches	Rivers	
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
1994	25.5	36.4	38.1	1,471,900
Mean	18.5	43.4	37.6	1,110,286
1995	33.5	52.9	13.6	1,482,162

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

Appendix Table 23. Peak aerial counts of live sockeye salmon in selected index areas of the Nushagak River system, 1977-95.

Year	Muklung Riv	Iowithla River	Klutispaw River	King Salmon River	Stuyahok River	Koktuli River	Nushagak River [1]	Mulchatna River [2]	Total
1977	11,900	4,700	500	14,100	800	19,700	68,700	16,700 [a]	137,100
78	1,700	100	0	5,800	300	4,700	11,400	7,400	31,400
79	6,300	400	0	4,800	600	8,400	16,000	9,200	45,700
80	5,000	1,100 [a]	100	16,100	5,200	14,300	14,600	7,800 [a]	64,200
81	2,100	700	100	11,500	800	9,900	6,300	4,400 [a]	35,800
1982	3,300	300	0	1,100	1,000	4,700	400	1,500 [a]	12,300
83	2,300	200	0	6,300	2,100	8,100	6,900	2,200	28,100
84	2,500	2,300	100	12,900	3,000	12,300	32,100	2,300	67,500
85	2,400	600	0	8,600	600	4,700	6,900	3,300 [a]	27,100
86	2,500	500	0	18,300	3,700	9,100	26,500 [a]	8,400 [a]	69,000
1987	8,200	0	0	14,200	1,100 [b]	3,500 [b]	21,000 [a]	6,700 [a]	54,700
88	2,100	2,100	0	8,400	2,500	13,800	10,400	2,700	42,000
89					1,300 [b]	3,000 [b]			
90	9,000	0	200	9,000	500	11,100	3,900	2,200	35,900
Mean [3]	4,562	992	77	10,085	1,679	9,093	16,145	4,333	46,965 [c]
%	9.7%	2.1%	0.2%	21.5%	3.6%	19.4%	34.4%	9.2%	100.0%
1995	1,460	400		6,100	520	3,400			11,880

1 Includes that section of Nushagak River between Nuyakuk River and King Salmon River.

2 Includes that section of Mulchatna River between Koktuli River and Mosquito Creek.

3 Includes only those years in which aerial coverage was complete for each specific area.

a Proportional estimates based on the mean percentage of of fish counted in these areas during years in which the entire Nushagak River system was surveyed (1978, 79, 83, and 84).

b Minimal estimate - very poor survey conditions. Included in the mean.

c Sum of means for all streams listed.

Appendix Table 24. Peak aerial counts of live sockeye salmon, Lake Nunavaugaluk drainage, 1975-1995.

Year	Snake River	Snake River Eagle Creek 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
76	40	3,000	240		2,820	470	1,270		220	8,060
77	410	1,520	90	120	2,690	650	1,430		50	6,960
78	100	1,400	110	180	5,510	1,700	1,630		150	10,780
79[a]										
1980[a]										
81[a]										
82	300	1,220	150	500	1,170	900	1,470	100	10	5,820
83	0	560			400	110	470	0	10	1,550
84	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
86		2,900	500	690	1,600	400	840	1,400	60	8,390
87[a]										
88[a]										
89		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
91	120	2,050	50	340	1,480	240	870	10	300	5,460
92[a]										
93[a]										
94	560	2,450	70	480	3,880	880	2,100	20	800	11,240
Mean	204	2,307	279	357	2,923	1,210	1,708	523	402	9,913[b]
%	2.1%	23.3%	2.8%	3.6%	29.5%	12.2%	17.2%	5.3%	4.1%	100.0%
1995	80	2,350	50	320	3,000	1,000	1,860	30		8,690

[a] No survey conducted

[b] Sum of means for all areas

Appendix Table 25. *Peak aerial counts of live chinook salmon in selected index areas of the Nushagak River system, 1967-95.*

Year	Muklung River	Iowithla River	Klutispaw River	King Salmon River	Stuyahok River	Koktuli River	Nushagak River [1]	Mulchatna River [2]	Total
1967	350	200			2,500	3,300			6,350
68 [a]	750	850	310	1,000	2,470	4,220	970	510	11,080
69	520	580	90	670	1,220	1,600	910 [b]	680 [b]	6,270
70	590	700	320	1,060	1,900	1,500	1,180 [b]	880 [b]	8,130
71	280	390							670
1972	150	170	280	900	610	1,450	690 [b]	510 [b]	4,760
73			380	1,470	1,220	950			4,020
74 [a]	1,010	860	440	2,000	2,300	3,920	2,340	2,160	15,030
75	660	1,040	670	2,900	2,530	4,080	2,320 [b]	1,710 [b]	15,910
76 [a]	840	1,110	1,180	3,510	3,750	6,710	1,760	2,580	21,440
1977 [a]	940	840	650	1,420	2,700	4,630	820	1,980	13,980
78 [a]	1,170	1,700	1,940	4,450	4,400	6,730	5,850	2,280	28,520
79 [a]	950	1,350	1,040	2,150	3,570	6,260	2,880	1,730	19,930
80	1,600	2,310 [b]	970	4,500	7,200	10,620	5,300 [b]	3,920 [b]	36,420
81	2,260	2,630	1,650	2,950	5,980	9,960	4,960 [b]	3,670 [b]	34,060
1982	790	2,520	350	8,390	3,640	6,780	4,380 [b]	3,240 [b]	30,090
83 [a]	1,830	2,430	2,090	5,990	2,910	8,060	6,330	4,260	33,900
84 [a]	1,300	1,080	770	1,780	2,010	2,860	2,800	1,060	13,660
85	1,250	1,610	1,950	4,460	2,690	4,940	3,420 [b]	2,390 [b]	22,710
86	230	270	170	380	520	290	380 [b]	260 [b]	2,500
1987	160	140	340	570	280	440	390 [b]	270 [b]	2,590
88	430	550	780	1,380	2,040	2,580	1,800	710	10,270
89					190 [c]	240 [c]			430
90	60	120	340	900	830	3,390	630	800	7,070
Mean [3]	824	1,007	796	2,516	2,498	4,153	2,618	1,807	16,218 [d]
%	5.1%	6.2%	4.9%	15.5%	15.4%	25.6%	16.1%	11.1%	100.0%
1995	210	170	630	3,150	660	2,230			7,050

[1] Includes that section of Nushagak River between Nuyakuk River and King Salmon River.

[2] Includes that section of Mulchatna River between Koktuli River and Mosquito Creek.

[3] Includes only those years in which aerial coverage was complete for each specific area.

[a] Years in which aerial survey coverage was complete for the entire Nushagak River system.

[b] Proportional estimates based on the mean proportion of fish counted in these areas during years in which the entire Nushagak River system was surveyed.

[c] Minimal estimate - very poor survey conditions. Included in the mean.

[d] Sum of means for all streams listed.

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

Year	Nushagak District [1]	Togiak District [2]
1962	543,000	
1964	910,560	
1974	585,520	8,620 [d]
1976	863,430	37,570
1978	9,386,480	150,000 [d]
1980	2,785,200	102,820
1982	1,656,660	44,300
1984	2,926,450	269,950
1986	72,190 [b]	80,000 [d]
1988	494,610 [b]	142,500 [d]
1990	801,730 [b]	207,000
1992	[c]	235,000 [d]
1994	192,780 [b]	88,000 [d]
Mean	1,768,218	124,160

[1] Includes Wood, Igushik, Snake, Nushagak, and Nuyakuk Rivers, and Ice, Youth, and Sunshine Cree unless otherwise noted.

[2] Includes Togiak, Matogak and Osviak Rivers; 1982 and 1990 also Include Slug River.

[a] Only those years of comprehensive aerial coverage are included: even years only; all counts rounded to the nearest 10 fish.

[b] Sonar estimate of Nushagak-Mulchatna Rivers only.

[c] No escapement estimate.

[d] Togiak River estimate only.

Appendix Table 27. Aerial estimates of sockeye salmon escapements, Togiak District, 1975 - 1995.[a]

Year	Togiak River & Tributaries[1]	Kulukak Systems [2]
1975	19,600	8,600
1976	31,200	11,200
1977	15,600	40,100
1978	30,600	33,900
1979	23,700	26,600
1980	50,700	45,700
1981	39,700	58,800
1982	25,300	52,800
1983	13,200	27,000
1984	30,900	49,800
1985	8,800	36,600
1986	35,000	42,800
1987	28,600	37,800
1988	32,400	31,700
1989	19,800	10,800
1990	47,100	49,600
1991	23,700	23,900
1992	16,500	26,400
1993	15,900	31,800
1994	19,420	29,740
1975-94 Mean (20-Year)	26,386	33,782
1975-84 Mean (10-Year)	28,050	35,450
1985-94 Mean (10-Year)	24,722	32,114
1995	25,508	14,620

[1] Estimates do not include fish spawning above the counting tower (Togiak Lake outlet); estimates for Ungalikthluk, Osviak,. Matogak and Slug Rivers are not included in the 1977-94 data as reported in Bristol Bay Data Reports 73 and 81.

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

[a] All counts are rounded to the nearest hundred.

Appendix Table 28. Peak aerial counts of live sockeye salmon, Togiak River drainage, 1975 - 1995.

Year	Togiak Mainstem	Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivunuck River	Total
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
1994	3,100	560	1,870			3,900	9,430
Mean	7,472	2,028	1,744	63	731	2,605	13,849 [a]
%	54.0%	14.6%	12.6%	0.5%	5.3%	18.8%	100.0%
1995	3,260	1,745	1,000		4,200	2,330	12,535

[a] Sum of means for all streams.

Appendix Table 29. Peak aerial counts of live sockeye salmon, Togiak District, 1975-1995.

Year	Togiak River [1]	Kulukak River [2]	Tithe Creek Ponds	Quigmy River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
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	24,210	10,600	14,200	100	400	2,200	3,540	9,700	3,800	68,750
1991	11,860	8,650	3,320	35	860	2,530	560	3,400	2,650	33,865
1992	7,910	7,530	4,950	40	300	3,340	1,460	3,600	3,760	32,890
1993	7,060	9,600	6,300					3,100	5,680	31,740
1994	9,430	10,270	4,600	580	990	1,750	6,070	2,230	3,240	39,160
Mean	13,849	8,362	9,502	201	348	2,078	3,437	2,509	3,420	43,707 [b]
%	31.7%	19.1%	21.7%	0.5%	0.8%	4.8%	7.9%	5.7%	7.8%	100.0%
1995	12,535	3,000	4,310	200	610	1,470	2,820	390	1,720	27,055

[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 means for all streams.

Appendix Table 30. Peak aerial counts of live chinook salmon, Togiak River drainage, 1975-1995.

Year	Togiak River Section [1]						Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivinuck River	Total
	A	B	C	D	E	F						
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
1994				215	815	1,580	420	215	225	570	380	4,420
Mean	256	267	464	265	441	912	684	267	244	272	264	4,336 [b]
%	5.9%	6.2%	10.7%	6.1%	10.2%	21.0%	15.8%	6.2%	5.6%	6.3%	6.1%	100.0%
1995	120	220	750	255	800	800	715	140	425	520	295	5,040

[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 for Section E.

[b] Sum of means for all streams.

Appendix Table 31. Peak aerial counts of live chinook salmon, Togiak District, 1975-1995.

Year	Togiak River [1]	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
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
1994	4,420	20	835	40	60	10	540	190	6,115
Mean	3,911	23	1,127	120	224	82	732	111	6,331 [2]
%	61.8%	0.4%	17.8%	1.9%	3.5%	1.3%	11.6%	1.8%	100.0%
1995	5,040	35	430	65	135	50	740	80	6,575

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

[2] Sum of means for all streams.

Appendix Table 32. Peak aerial counts of live chum salmon, Togiak River drainage, 1975-1995.

Year	Togiak River Section [1]						Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivinuck River	Total
	A	B	C	D	E	F						
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	23,260
1994				1,300	5,200	10,400	900	2,400	7,100	900	5,700	33,900
Mean	12,764	5,868	4,155	1,279	5,908	8,376	4,024	1,619	6,296	991	3,755	55,036 [e]
%	23.2%	10.7%	7.6%	2.3%	10.7%	15.2%	7.3%	2.9%	11.4%	1.8%	6.8%	100.0%
1995	15,700	7,100	4,700	1,800	6,800	5,900	4,800	1,900	9,700	2,700	8,200	69,300

[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 means for all streams.

Appendix Table 33. Peak aerial counts of live chum salmon, Togiak District, 1975-1995.

Year	Togiak River [1]	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
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
1994	33,900	890	10,700	1,630	2,000	4,360	230	1,090	54,800
Mean	48,828	4,666	13,615	7,527	15,246	4,445	3,826	7,965	106,119 [c]
%	46.0%	4.4%	12.8%	7.1%	14.4%	4.2%	3.6%	7.5%	100.0%
1995	138,600	2,200	7,600	5,200	13,920	6,440	1,000	7,200	182,160

[1] Includes all surveyed sections of Togiak River proper and 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 means for all streams.

Appendix Table 34. Peak aerial counts of live coho salmon, Togiak River drainage, 1980-1995.

Year	Togiak River Section [1] A	B	C	D	E	F	Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivinuck 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	9,430
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	8,590
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					100[c]	140[c]
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]												
1994[a]							1,290[c]	220[c]	120[c]	95[c]	1,930	
Mean	2,656	740	453	357	1,165	1,164	2,301	976	589	584	3,831	14,816[d]
%	17.9%	5.0%	3.1%	2.4%	7.9%	7.9%	15.5%	6.6%	4.0%	3.9%	25.9%	100.0%
1995[a]							1,450			200	1,180	

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

[d] Sum of means for all streams.

Appendix Table 35. Peak aerial counts of live coho salmon, Togiak District, 1980-1995.

Year	Togiak River [1]	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Creek	Total
1980	21,710		10,300							32,010
1981	14,500		3,790				100	840	1,080	20,310
1982	23,300		3,380							26,680
1983[a]										
1984	20,280		10,750	1,850	1,080	670				34,630
1985	9,430	200	7,790	610	420					18,450
1986	3,520									3,520
1987	4,210	30	910	440	120			130		5,840
1988	8,590	460	1,840	310	490	470	370	3,170		15,700
1989[a]										
1990	7,130	1,029	5,195	2,675	1,491	810		4,153		22,483
1991	140 [b]		4,200[b]							140
1992	26,700		12,640							39,340
1993[a]										
1994[a]										
Mean	14,816	430	6,288	1,177	720	650	235	2,073	1,080	27,470 [d]
%	53.9%	1.6%	22.9%	4.3%	2.6%	2.4%	0.9%	7.5%	3.9%	100.0%
1995		855	1,185	1,392	1,080	1,149		5,196[e]		

[1] Includes all surveyed sections of Togiak River proper and tributaries to the Togiak River. See Appendix Table 34.

[a] No aerial surveys conducted.

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

[c] Only Togiak River tributaries surveyed; not included in the mean or percent.

[d] Sum of means for all streams.

[e] Negukthlik and Ungalikthluk Rivers combined.

OEO/ADA Statement

The Alaska Department of Fish and Game administers all programs and activities free from discrimination on the basis of sex, color, race, religion, national origin, age, marital status, pregnancy, parenthood, or disability. For information on alternative formats available for this and other department publications, contact the department ADA Coordinator at (voice) 907-465-4120, or (TDD) 907-465-3646. Any person who believes s/he has been discriminated against should write to:

ADF&G, PO Box 25526, Juneau, AK 99802-5526; or

O.E.O., U.S Department of the Interior, Washington, DC 20240.