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SALMON SPAWNING GROUND SURVEYS

IN THE BRISTOL BAY AREA, ALASKA, 1996

by

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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 1996 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 1997). 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 (Brookover et. al. 1995). 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 fifth 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 12 and 17, to provide estimates of Alagnak River drainage sockeye, chinook, and chum escapements. Additionally, all major chinook spawning areas in the Naknek River drainage were surveyed between August 5 and August 21, and the Kvichak River chinook escapement survey was flown August 17. 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 17, 18, and September 3, and the results were documented in Regnart (1996). 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 1996. Aerial surveys of all known chinook and chum salmon spawning areas in both the Egegik and King Salmon Rivers were flown on August 5. With funding provided by the Alaska Department of Fish and Game, aerial surveys were flown on September 27 and 28 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. Aerial surveys of all known chinook and chum salmon spawning areas in the Ugashik drainage were flown on August 12. With funding provided by the Alaska Department of

Fish and Game, aerial surveys were flown on September 27 and 28 to estimate coho salmon escapements. Aerial survey counts should be considered only an index of total abundance.

Nushagak District

Aerial surveys were conducted to assess spawning distribution of sockeye salmon in the Wood River system in 1996. 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).

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 provided primarily by an ADF&G biologist, with some counts provided by a USFWS biologist.

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. During the 1996 surveys, the 2.5 factor was applied to the tributaries of the Togiak River, however, due to water turbidity in the mainstem, a factor of 4.0 was used. 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 12 and 17. The sockeye salmon escapement index count totaled 306,750 for this system (Table 1). This count was approximately 50% above the mean (1977-1994) aerial count of 204,000, and was approximately 165% greater than the escapement point goal of 185,000.

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 5,010 chinook salmon were counted. The largest components of this total were counts of 1,576 chinook in Big Creek on August 16, and 2,965 chinook in the mainstem Naknek River on August 21 (Table 2). Over the period from 1970-1995 there have been 16 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 1996 count was slightly below the 1970-1994 average count of 5,213.

Alagnak River drainage chinook salmon escapement was surveyed on August 12, yielding a count of 9,885 (Table 2). From 1970-1995, 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 1996 count was 57% greater than the 1970-1995 average. An aerial survey of chinook salmon escapement into the Kvichak River was conducted on August 18 and yielded a count of 132. The 1996 Kvichak River count was 40% less than the 1970-1995 average.

Chum salmon were counted only during the August 12 Alagnak River aerial surveys. Alagnak River has been the principal chum salmon producing system in the Naknek-Kvichak District. A total of 145,000 spawning chum salmon were observed during the 1996 survey. The 1996 chum count was approximately four times the 1963-1995 average count of 38,162 (Appendix Table 10).

Escapement surveys for coho salmon were flown on September 30 in the Naknek-Kvichak District drainages. A total of 5,895 coho were observed in the Naknek drainage, 2,665 in the Branch and 850 in the Kvichak drainage. These estimates should be considered low since timing and distribution of fish were not known as this was the first year of a three year assesment program.

Egegik District

The 1996 Egegik River sockeye escapement past the counting towers totaled 1,076,460 fish, slightly above the desired point goal (1.0 million) but below the upper range of the goal (1.4 million). No additional sockeye salmon were observed on any post season aerial surveys.

Aerial survey peak counts of all known chinook spawning areas in the Egegik drainage yielded a total count of 804 chinook salmon (Table 3). An additional 42 chinook were counted past Egegik River counting towers bringing the district escapement index to 846 fish. This total was 37% below the 1981 to 1995 average of 1,342 chinook (Appendix Table 14). The commercial chinook harvest in the Egegik District totaled just 961 fish, or 67% below the 1976 to 1995 average harvest of 2,934. Prohibiting usage of large mesh gillnets (greater than 5.5 inch mesh) from June 3 to July 1 facilitated passage of chinook salmon through the commercial fishing district. Given the catch and escapement figures above, the Egegik chinook salmon removal rate for 1996 is around 50%.

The peak chum salmon escapement index was obtained August 5 and totaled 1,649 fish (Table 4). An additional 12 chums were counted past the Egegik River counting tower, bringing the district-wide escapement index to 1,661 fish. The 1996 index was well below the 1982 to 1995 average of 11,085 fish (Appendix Table 15). The 1996 commercial chum harvest from the Egegik District totaled approximately 83,000 fish, or 18% below the 1976 to 1995 average of 101,586. Escapement indices of less than 10,000 chum salmon have been recorded in the district in each of the last eight years.

No pink salmon were noted during the August 5 aerial surveys, but 103,200 were counted past the Egegik River counting towers. Only 53 pink salmon were reported from the commercial catch. The 1974 to 1996 pink salmon escapement indices are listed in Appendix Table 16.

The coho salmon escapement was documented with aerial surveys conducted on September 27 and 28 (Table 5). Funding for these surveys was provided this year by the Alaska Department of Fish and Game. A combined total of 9,043 coho salmon were counted in the King Salmon and Egegik Rivers and in numerous tributaries of Becharof Lake. Of this total, 8,464 fish were counted upstream of the Egegik River counting towers. For the third consecutive year the Egegik River counting towers were in operation beyond the sockeye season. From August 7 to September 11 the towers were operated by department personnel funded jointly by ADF&G and the U.S. Fish and Wildlife Service. A total of 24,918 coho salmon were counted past Egegik River counting towers, which was the highest count of the three year study. These coho counts are incomplete since the counting towers were not operated for all of the coho run. The commercial harvest of approximately 39,300 fish was 14% above the 1976 to 1995 average of 34,600. Deliveries occurred until August 30, though officially the fishery was open until September 30. Historical aerial survey counts are listed in Appendix Table 17.

Ugashik District

The 1996 sockeye salmon escapement past Ugashik River counting tower was approximately 667,500 fish, or 4.6% below the point goal of 700,000. No system-wide aerial surveys were conducted because of a lack of funding. However, an additional 17,420 and 7,230 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 12 and yielded a count of 2,728 fish (Table 7). Additionally, 60 chinook salmon were counted past the tower, bringing the Ugashik chinook escapement count to 2,788. The King Salmon River count of 1,200 was the largest escapement component for the system. The 1996 escapement count was 47% below the 1980 to 1995 average count of 5,292 chinook salmon (Appendix Table 18). The Ugashik District's commercial catch of 520 chinook was 87% below the average harvest of 3,940. Overall, the Ugashik chinook run was probably below average.

Aerial surveys of Dog Salmon, King Salmon, and Ugashik Rivers on August 12, yielding a count of 27,200 chum salmon (Table 8). The survey was considered to be slightly after the peak of spawning abundance. The 1996 aerial count was 24% below the 1980 to 1995 average of 35,800 (Appendix Table 19). The District's commercial chum salmon harvest was approximately 103,400 fish, which was 55% above the 1976 to 1995 average of 66,500.

The Ugashik pink salmon returns have historically been very small, and this year seems to be no exception. The reported commercial catch of only 59 fish bears witness to that fact. A total of 550 pink salmon were observed on the escapement survey flown on August 12 and only 66 pinks were counted past the tower before it ceased operation on July 27 (Appendix Table 20).

This year with funding provided by the Alaska Department of Fish and Game, coho escapement surveys were conducted on major systems in the Ugashik drainage. Aerial coho counts are listed in Table 9 and a total of 8,275 coho were observed. Historically, higher coho escapements have been observed (Appendix Table 21), but most of those surveys were conducted at much earlier dates. The commercial harvest of approximately 9,200 fish is one of the lowest on record and it was 66% below the recent 20-year (1976- 1995) average of 26,900. Effort, however; was light and the final commercial deliveries occurred on August 27. Funding for coho escapement surveys should continue for the next two to three years. The areas that should be the focus of these surveys are listed in Table 9.

Nushagak District

Spawning escapement of sockeye salmon in the Wood River system was estimated to be 1.65 million fish, 65% greater than the escapement goal. Two- and three-ocean sockeye comprised an approximately equal mix in the Wood River escapement, hence the escapement goal was not

adjusted in season. Poor sockeye escapement in the Nushagak River prompted conservative management of the Nushagak District commercial fishery in 1996, and conservation concerns for coho salmon prompted a closure in Nushagak Section July 15. The combination of these management actions was the primarily reason for the large escapement in the Wood River system in 1996.

Spawning sockeye salmon were estimated to be evenly distributed between creek, river and beach habitat in 1996 (Table 8, Appendix Table 22). Most spawning was observed on lake beaches, followed by interconnecting rivers and creeks. Relative abundance was estimated to be higher than average in the lake tributaries and, conversely, lower than average in beach and river areas. Spawning also appeared to be evenly distributed within creek, beach and rivers, not skewed to specific or isolated locations. Large schools, in the order of tens of thousands, were observed but not recorded near D Slough Beach in Little Togiak Lake, along the south shore of Lake Nerka west of River Bay, in Anvil Bay and along Silver Horn beaches in Lake Beverley.

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 1996. (Table 12) The expanded aerial survey estimate of 30,220 sockeye salmon for the Togiak River and its tributaries below the counting tower was 13% above the 1976-1995 average of 26,681 fish (Appendix Table 24). Escapement past the counting tower was 156,954 sockeye, 5% 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 18,980 fish, only 63% of the 1986-1995 average of 29,916. Peak aerial sockeye salmon counts into the mainstem portion of the Togiak River, the Gechiak River,and the Ongivinuck River were above the 1976-1995 average (Appendix Tables 25 and 26), while counts for Pungokepuk and Kemuk Rivers were below average. Total sockeye salmon escapement for Togiak District was 212,524 fish, with the Quigmy and Ungalikthluk Rivers uncounted. Due to weather, surveys were conducted after the peak of spawning on several sytems, while the majority of systems were surveyed at peak spawning levels in 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 1996 (Table 13). The minimum expanded escapement estimate for Togiak District was 11,476 chinook salmon, with the Ungalikthluk River remaining uncounted. The 1996 district-wide chinook escapement was 8% below the 1986-1995 average of 12,335 fish (ADF&G, 1996). The aerial peak live count for the Togiak River and tributaries was 37% below the 1976-1995 average, and aerial counts for all chinook systems in the Togiak District combined were 44% below the 20-year average (Appendix Tables 30 and 31). This was the first year since 1992 in which the escapement goal of 10,000 chinook salmon into the Togiak River was not achieved. Reductions in the weekly fishing schedule in the commercial fishery, during the last two weeks of June, the traditional peak of the chinook salmon fishery, have been implemented by emergency order for the past 5 years. However, chinook run strength to the Togiak River has declined 30+% over the last

two years. Chinook peak aerial counts for smaller river systems within the district were generally all below average. Kulukak River escapement estimate (1,745 chinook) was poor and comprised only 36% of the 1976-1995 average.

Conditions and timing were fair to poor for most of the chinook salmon systems surveyed. A standard multiplier of 2.5 was applied to most of the aerial counts, however, due to turbid water conditions in the mainstem of theTogiak River, a 4.0 multiplier was used. 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 117,240 (Table 14). The 1996 estimate is 43% below the 1986-1995 average (207,454 chum) reported by ADF&G (*1996*). Peak counts of chum salmon were well below the 1976-1995 average in all streams surveyed within the Togiak District (Appendix Tables 29 and 30).

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 2.0 was still used.

Aerial surveys yielding peak live counts and expanded escapement estimates for coho salmon were successfully completed for most major systems in Togiak District for 1996. Total coho escapement for Togiak River and tributaries was estimated to be 64,980 fish (Table 15). This was 71% above the 1980-1995 average of 12,683 fish. District-wide coho escapement counts were 53% above the average for the same period (Appendix Tables 31 and 32). Coho salmon appeared to be mostly on spawning beds with few schools observed, and no carcasses were visible, indicating that the survey was probably at or near the peak of spawning activity.

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Table 1. Aerial survey counts of sockeye salmon, Alagnak River system, 1996[1]

Location	Number of Fish	Percent of Total
Nonvianuk River	0	0
Nonvianuk Lake	1.800	0,6
Kulik River	82.950	27,0
Kulik Lake	1.450	0,5
Alagnak River	0	0,0
Kukaklek Lake	900	0,3
Nanuktuk Creek	63.825	20,8
Battle River	31.500	10,3
Battle Lake	1.700	0,6
Spectacle Creek	97.900	31,9
Funnel Creek	24.725	8,1
Total	306.750	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, 1996.

Location	Survey Date	Number of Salmon	
		Chinook	Chum
Kvichak River	Aug. 18	132	
Alagnak River	Aug. 12	9.885	147.000
Naknek River:			
Paul's Creek	Aug. 05	157	0 [a]
King Salmon Creek	Aug. 05	312	0 [a]
Big Creek	Aug. 12	1.576	0 [a]
Mainstem Naknek River	Aug. 21	2.965	
Total		15.027	147.000

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

[a] Incidental observation.

Table 3. Aerial survey peak counts of chinook salmon escapement, Egegik District, 1996.

Location	Survey Date	Number of Chinook Salmon Counted
Egegik River	Sept. 11[a]	42
Shosky Creek	August 05	102
Whale Mountain Creek	August 05	8
Mossy Creek	August 05	38
Mink Creek	August 05	20
Gertrude Creek	August 05	230
Kaye's Creek	August 05	74
Takayoto Creek	August 05	123
Angle Creek	August 05	6
Contact Creek	August 05	203
Mainstem King Salmon River	August 05[b]	
Total		846

[a] Tower count.

[b] No counts due to turbid water conditions.

Table 4. Aerial survey peak counts of chum salmon escapement, Egegik District, 1996.

Location	Survey Date	Number of Chum Salmon Counted
Egegik River	Sept.11 [a]	12
Shosky Creek	August 05	0
Whale Mountain Creek	August 05	438
Mossy Creek	August 05	4
Mink Creek	August 05	20
Gertrude Creek	August 05	530
Kaye's Creek	August 05	0
Takayoto Creek	August 05	24
Angle Creek	August 05	0
Contact Creek	August 05	633
Mainstem King Salmon River	August 05 [b]	
Total [c]		1.661

[a] Tower count.
[b] No counts due to turbid water conditions.
[c] Total count should be considered as a low estimate of the total escapement.

Table 5. Aerial survey counts of coho salmon escapement, Egegik District, 1996.

Location	Survey Date	Number of Coho Salmon Counted	Comments
Egegik River Drainage[1]			
Egegik Lagoon	September 27	40	
Egegik River Rapids	September 27	2,800	Many schooled off mouth of Myers Creek
Stream 148.2	September 27	0	
Stream 146.4	September 27	0	
Stream 141.5 (Rusty Creek)	September 27	22	All schooled off mouth
Stream 136.8	September 27	0	
Stream 131.9	September 27	0	
Stream 117.5	September 27	275	
Stream 115.8 (Featherly Creek)	September 27	450	All schooled off mouth
Stream 112.8	September 27	0	
Stream 108.7	September 27	150	All schooled off mouth
Stream 107.6 (Burl's Creek)	September 27	350	All schooled off mouth
Stream 99.2 (Frank's Creek)	September 27	150	All schooled off mouth
Stream 96.2 (Ruth River)	September 27	0	
Ruth Lake	September 27	145	All schooled off mouths of 2 tributaries
Stream 95.0	September 27	0	
Stream 93.5 (Otter Creek)	September 27	0	
Stream 90.3 (Salmon Creek)	September 27	1,200	Most schooled up off mouth.
Stream 89.8	September 27	200	
Stream 87.0 (Bear Creek)	September 27	300	Most schooled up off mouth.
Stream 86.0	September 27	30	All schooled off mouth
Stream 84.7	September 27	125	All schooled off mouth
Stream 83.9	September 27	0	
Stream 81.2 (Cleo Creek)	September 27	0	
Stream 73.5 (Becharof Creek)	September 27	575	Most of these upstream
Stream 48.1 (Kejulik River)	September 27	1,638	Includes Margaret & Albert Creeks
Stream 46.3 (Marie Creek)	September 27	4	
Stream 35.5	September 27	20	All in stream.
Stream 35.1 through 1.7	September 27	30	All in stream.
Shosky Creek			Did not survey
Swampy Creek			Did not survey
Sub-total		8,504	
King Salmon River Drainage			
Whale Mountain Creek	September 28	122	
Mossy Creek			Did not survey
Mink Creek			Did not survey
Gertrude Creek	September 28	75	
Kaye's Creek			Did not survey
Takayoto Creek			Did not survey
Angle Creek			Did not survey
Contact Creek	September 28	342	
Mainstem King Salmon River			Did not survey
Sub-total		539	
District Total		9,043	

[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, 1996.

Location	Survey Date	Number of Sockeye Salmon
Ugashik River:		
Grassy Creek	Aug. 12	0
Sub-total		0
King Salmon River:		
Needle Lake	Aug. 12	650
Volcano Creel	Aug. 12	0 [a]
Painter Creek	Aug. 12	6.580
Mainstem King Salmon River	Aug. 12	0
Sub-total		7.230
Dog Salmon River:		
Figure-Eight Creek	Aug. 12	15.000
Goblet Creek	Aug. 12	130
Oldham Creek	Aug. 12	289
Wandering Creek	Aug. 12	2.000
Mainstem Dog Salmon River	Aug. 12	0
Sub-total		17.419
Total		24.649

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

Table 7. Peak survey counts of chinook salmon escapement, Ugashik District, 1996.

Location	Survey Date	Number of Chinook Salmon
King Salmon River System		
Old Creek	Aug. 12	30
Pumice Creek	Aug. 12	0
Painter Creek	Aug. 12	403
Mainstem King Salmon River	Aug. 12	1,200
Mother Goose Lake	Aug. 12	0
Indecision Creek	Aug. 12	0
Volcano Creek	Aug. 12	0 [a]
Sub-total		1,633
Dog Salmon River System		
Figure-Eight Creek	Aug. 12	670
Goblet Creek	Aug. 12	29
Oldham Creek	Aug. 12	180
Wandering Creek	Aug. 12	200
Mainstem Dog Salmon River	Aug. 12	0
Sub-total		1,079
Ugashik River System		
Mainstem Ugashik River	Aug. 12	0
Grassy Creek	Aug. 12	16
Sub-total		16
Total		2,728

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

Table 8. Peak survey counts of chum salmon escapement, Ugashik District, 1996.

Location	Survey Date	Number of Chum Salmon
King Salmon River System		
Old Creek	Aug. 12	2,500 [a]
Pumice Creek	Aug. 12	7,400 [a]
Painter Creek	Aug. 12	700
Mainstem King Salmon River	Aug. 12	16,500
Mother Goose Lake	Aug. 12	0
Indecision Creek	Aug. 12	0
Volcano Creek	Aug. 12	0 [b]
Sub-total		27,100
Dog Salmon River Syste:		
Figure-Eight Creek	Aug. 12	0
Goblet Creek	Aug. 12	35
Oldham Creek	Aug. 12	40
Wandering Creek	Aug. 12	10
Mainstem Dog Salmon River	Aug. 12	0
Sub-total		85
Ugashik River System		
Mainstem Ugashik River	Aug. 12	0
Grassy Creek	Aug. 12	0
Sub-total		0
Total		27,185 [c]

[a] Includes carcasses.

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

[c] Total count should be considered as a low estimate of the total escapement.

Table 9. Aerial survey counts of coho salmon escapement, Ugashik District, 1996.

Location	Survey Date	Number of Coho Salmon Counted	Comments
	Ugashik Drainage		
Upper Ugashik Lake			
Ugashik Creek	September 27	36	Upstream
Crooked Creek	September 27	400	Upstream
Deer Creek	September 27	357	300 schooled off mouth of Creek
Narrows"	September 27	30	Between Upper and Lower Lakes
Lower Ugashik Lake			
Black Creek to Cabin	September 27	375	Along lake shore
Black Creek to Elizabeth Lake	September 27	1.200	Along lake shore
Lenora Lake Creek	September 27	150	
Unnamed Creek South Shore	September 27	50	
Ugashik Outlet	September 27	450	
King Salmon River Tributaries			
Pumice Creek	September 28	822	
Old Creek	September 28	1.334	
Dog Salmon River Tributaries			
Painter Creek	September 28	2.531	
Figure Eight Creek	September 28	540	
District Total		8.275	
Stream 46.3 (Marie Creek)	September 27	4	
Stream 35.5	September 27	20	All in stream.
Stream 35.1 through 1.7	September 27	30	All in stream.
Shosky Creek			Did not survey
Swampy Creek			Did not survey
Sub-total		16.604	
King Salmon River Drainage			
Whale Mountain Creek	September 28	122	
Mossy Creek			Did not survey
Mink Creek			Did not survey
Gertrude Creek	September 28	75	
Kaye's Creek			Did not survey
Takayoto Creek			Did not survey
Angle Creek			Did not survey
Contact Creek	September 28	342	
Mainstem King Salmon River			Did not survey
Sub-total		539	
District Total		17.143	

[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 10 Peak aerial live counts and total escapement estimates of sockeye salmon in the Wood River system, 1996.

Area	Date	Aerial Count [1]		Population Estimate	Distribution %
Wood River	**21-Aug**	**11.900**		**17.700**	**1,1%**
Lake Aleknagik		**27.454**		**248.900**	**15,1%**
Eagle Creek	14-Aug	889	a		
Hansen Creek	06-Aug	4.868	a		
Happy Creek	08-Aug	3.129	a		
Bear Creek	05-Aug	3.266	a		
Yako Creek	01-Aug	2.847	a		
Whitefish Creek	11-Aug	410	a		
Ice Creek	09-Aug	7.490	ab		
Mission Creek	12-Aug	705	a		
Sunshine Creek	14-Aug	1.460			
Youth Creek					
Northshore Beaches	04-Sep	1.190			
Southshore Beaches	04-Sep	450			
Yako Beach	04-Sep	750			
Agulowok River & lower River Bay	**21-Aug**	**200.000**		**298.500**	**18,1%**
Lake Nerka		**60.644**		**549.900**	**33,3%**
Fenno Creek	10-Aug	2.003	a		
Pike Creek	14-Aug	1.260			
Stovall Creek [2]	14-Aug	1.420			
Bear Creek	14-Aug	30			
Teal Creek	14-Aug	300			
Pick Creek	21-Aug	2.684	a		
Elva Creek	21-Aug	53	a		
Kema Creek	14-Aug	4.380			
Hidden Lake Creek	22-Aug	1.641	a		
Lynx Creek	20-Aug	4.053	a		
Upper River Bay Beaches, N	04-Sep	900			
Upper River Bay Beaches, S	04-Sep	2.700			
Allan Cr. - Ross Cr. Beaches	04-Sep	3.000			
N6 - River Bay Beach	04-Sep	9.000			
Pick Creek Beach	04-Sep	1.100			
Elva Creek Beach	04-Sep	1.700			
Amakuk Arm Beaches	04-Sep	1.100			
Amakuk Arm - Ott's Bay Beac	04-Sep	2.100			
Ott's Bay Beach	04-Sep	2.400			
Anvil Bay Beaches	04-Sep	9.300			
Anvil Bay - Elbow Pt. Beach	04-Sep	3.800			
Elbow Pt. - Lynx Cr. Beach					
Lynx Cr. - Teal Cr. Beach	04-Sep	3.700			
Kema Lake Beaches [2]	14-Aug	0			
Hidden Lake Beaches	14-Aug	750			
Lynx Lake Beaches	04-Sep	1.270			

Table 10 Continued.

Area	Date	Aerial Count [1]		Population Estimate	Distribution %
Little Togiak River	**26-Aug**	**4.196**	[a]	**6.300**	**0,4%**
Little Togiak Lake		**2.460**		**22.300**	**1,4%**
Northshore Beaches	04-Sep	200			
Southshore Beaches	04-Sep	860			
D Slough Beaches	04-Sep	1.400			
Agulukpak River	**24-Aug**	**150.000**		**223.900**	**13,6%**
Lake Beverley		**14.758**		**133.800**	**8,1%**
Tsun Creek					
Moose Creek	16-Aug	428	[ab]		
Hope Creek					
Hardluck Bay Beaches	10-Sep	7.200			
Sam's Beach	10-Sep	600			
Golden Horn Beaches	10-Sep	750			
Silver Horn Beaches	10-Sep	4.380			
B12 & B9 Beaches	10-Sep	1.400			
Hope Lake Beach					
Peace River	**24-Aug**	**1.500**		**3.000**	**0,2%**
Lake Mikchalk		**1.750**		**15.900**	**1,0%**
Narrows	24-Aug	400			
Northshore Beaches	25-Aug	1.000			
Southshore Beaches	26-Aug	350			
Wind River	**24-Aug**	**900**		**1.800**	**0,1%**
Lake Kulik		**11.360**		**103.000**	**6,2%**
K1 & K2 Creeks	24-Aug	3.680			
K5 Creek - Grant River Beac	10-Sep	520			
Grant River - K2 Creek Beac	10-Sep	6.200			
Southshore Beaches	10-Sep	960			
Grant River	**21-Aug**	**12.300**		**24.600**	**1,5%**
Total		499.222		1.649.600	100,0%

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 Partial count.

Table 11. Peak aerial counts of live sockeye salmon and total escapement estimates, Togiak District, 1996.

Stream	Aerial Counts		Total Escapement Estimate	
	Date	Number	Factor [1]	Number
Togiak Section				
Togiak Tower				156,954
Togiak River mainstem	18-Aug	9,160	2.0	18,320
Gechiak Lake System	18-Aug	2,270	2.0	4,540
Pungokepuk Lake	18-Aug	150	2.0	300
Nayorurun River	18-Aug	100	2.0	200
Kemuk River	18-Aug	240	2.0	480
Ongivinuk Lake System	18-Aug	3,190	2.0	6,380
Subtotal		15,110		30,220
Kulukak Section				
Kulukak River	18-Aug	1,880	2.0	3,760
Kulukak Lake	18-Aug	610	2.0	1,220
Tithe Creek Ponds	18-Aug	7,000	2.0	14,000
Subtotal		9,490		18,980
Matogak, Osviak, and Cape Pierce Sections				
Matogak River [2]	03-Aug	360	2.0	720
Osviak River [2]	03-Aug	780	2.0	1,560
Slug River [2]	19-Jul	1,045	2.0	2,090
Subtotal		2,185		4,370
Other				
Quigmy River				
Negukthlik River [2]	02-Aug	1,000	2.0	2,000
Ungalikthluk River				
Subtotal		1,000		2,000
Total		27,785		212,524

[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. Sockeye salmon count obtained during chinook and chum surveys.

Table 12. Peak aerial counts of live chinook salmon and total escapement estimates, Togiak District, 1996.

River	Aerial Counts		Total Escapement Estimates	
	Date	Number	Factor [1]	Number
Togiak Section				
Togiak River mainstem				
A	06-Aug	75	4.0	300
B	06-Aug	150	4.0	600
C	06-Aug	160	4.0	640
D	06-Aug	100	4.0	400
E	06-Aug	255	4.0	1,020
F	06-Aug	625	4.0	2,500
Subtotal		1,365		5,460
Gechiak River	06-Aug	335	2.5	838
Pungokepuk River	06-Aug	120	2.5	300
Nayorurun River	06-Aug	120	2.5	300
Kemuk River	06-Aug	235	2.5	588
Ongivinuk River	06-Aug	325	2.5	813
Subtotal		1,135		2,839
Togiak River Drainage Total		2,500		8,299
Kulukak Section				
Kulukak River[2]	17-Jul	698	2.5	1,745
Matogak, Osviak, and Cape Pierce Sections				
Matogak River[2]	03-Aug	35	2.5	88
Osviak River[2]	03-Aug	71	2.5	176
Slug River[2]	19-Jul	30	2.5	75
Subtotal		136		339
Other				
Quigmy River[2]	06-Aug	35	2.5	88
Negukthlik River[2]	02-Aug	402	2.5	1,005
Ungalikthluk River				
Subtotal		437		1,093
Total		2406		11,476

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 13. Peak aerial counts of live chum salmon and total escapement estimates, Togiak District, 1996.

River	Aerial Counts		Total Escapement Estimate	
	Date	Number	Factor [1]	Estimate
Togiak Section				
Togiak River mainstem				
A	06-Aug	3,700	2.0	7,400
B	06-Aug	10,250	2.0	20,500
C	06-Aug	5,500	2.0	11,000
D	06-Aug	1,300	2.0	2,600
E	06-Aug	5,750	2.0	11,500
F	06-Aug	8,250	2.0	16,500
Subtotal		34,750		69,500
Gechiak River	06-Aug	2,600	2.0	5,200
Pungokepuk River	06-Aug	750	2.0	1,500
Nayorurun River	06-Aug	900	2.0	1,800
Kemuk River	06-Aug	550	2.0	1,100
Ongivinuk River	06-Aug	3,400	2.0	6,800
Subtotal		42,950		85,900
Kulukak Section				
Kulukak River [2]	17-Jul	7,560	2.0	15,120
Matogak, Osviak, and Cape Pierce Sections				
Matogak River [2]	03-Aug	560	2.0	1,120
Osviak River [2,3]	03-Aug	810	2.0	1,860
Slug River [2,3]	19-Jul	2,670	2.0	11,240
Subtotal		4,040		14,220
Other				
Quigmy River [2]	06-Aug	960	2.0	1,920
Negukthlik River [2]	02-Aug	40	2.0	80
Ungalikthluk River				
Subtotal		1,000		2,000
Total		55,550		117,240

1 Derived by expanding peak live count to reflect fish not counted due to variables and dead fish, late or poor survey conditions, bad weather, etc..

2 U.S. Fish and Wildlife Service estimate. Surveys were past peak of spawning, e

Table 14. Peak aerial counts of live coho salmon and total escapement estimates, Togiak District, 1996.

Stream	Aerial Counts		Total Escapement Estimate	
	Date	Number	Factor [1]	Number
Togiak Section				
Togiak River mainstem				
A	05-Oct	2,550	3.0	7,650
B	05-Oct	1,090	3.0	3,270
C	05-Oct	150	3.0	450
D	05-Oct	250	3.0	750
E	05-Oct	1,600	3.0	4,800
F	05-Oct	5,020	3.0	15,060
Subtotal		10,660		31,980
Gechiak River	05-Oct	2,080	3.0	6,240
Pungokepuk River	05-Oct	1,170	3.0	3,510
Nayorurun River	05-Oct	575	3.0	1,725
Kemuk River	05-Oct	725	3.0	2,175
Ongivinuk River	05-Oct	6,450	3.0	19,350
Subtotal		11,000		33,000
Kulukak Section				
Kulukak River	05-Oct	10,290	3.0	30,870
Matogak, Osviak, and Cape Pierce Sections				
Matogak River [3]	27-Sep	3,062	3.0	9,186
Osviak River [3]	27-Sep	2,805	3.0	8,415
Slug River [3]	27-Sep	1,944	3.0	5,832
Subtotal		7,811		23,433
Other				
Quigmy River [2]	07-Oct	1,211	3.0	3,633
Negukthlik River[2]	07-Oct	851	3.0	2,553
Ungalikthluk River [2]	07-Oct	5,917	3.0	17,751
Subtotal		7,979		23,937
Total		47,740		143,220

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

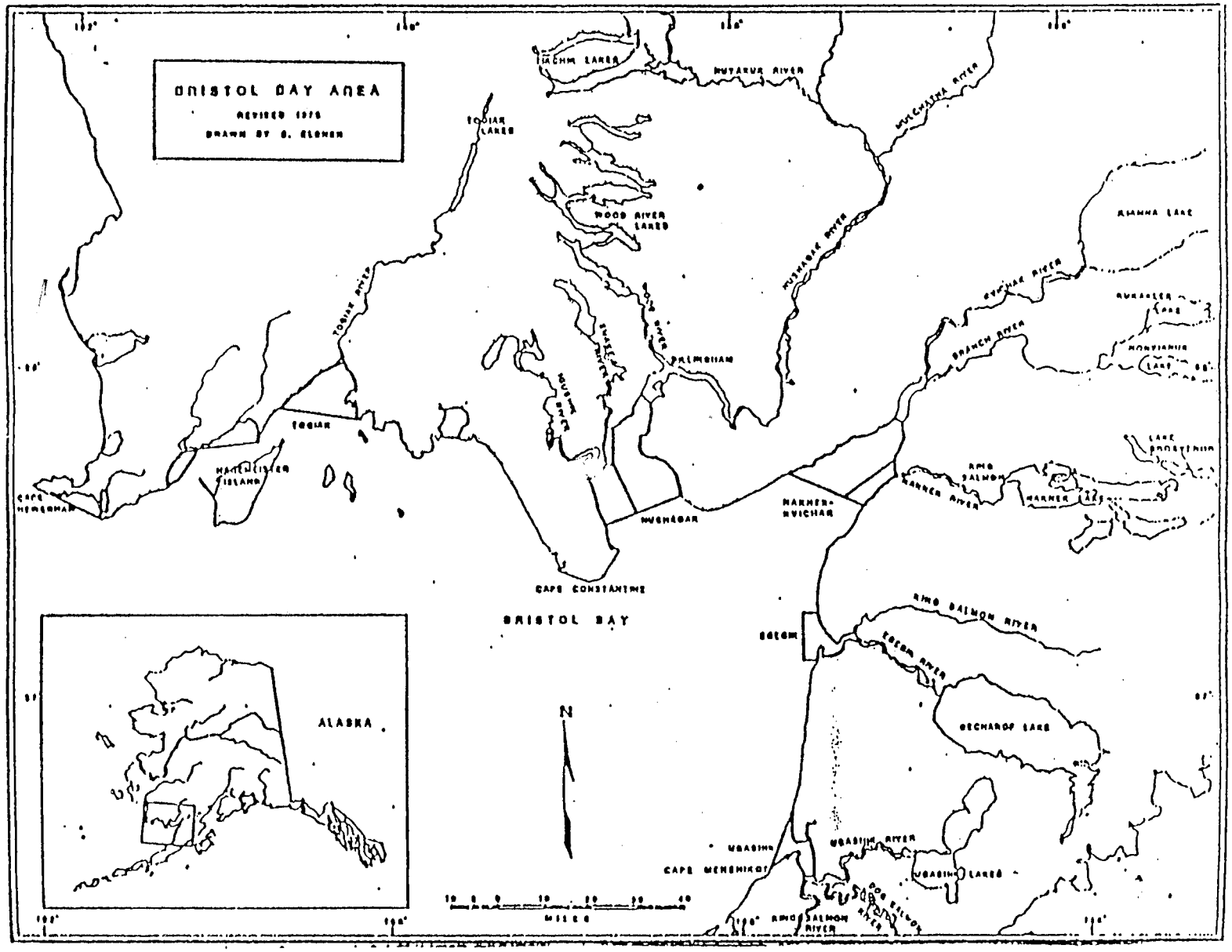

Figure 1. Bristol Bay management area, Alaska.

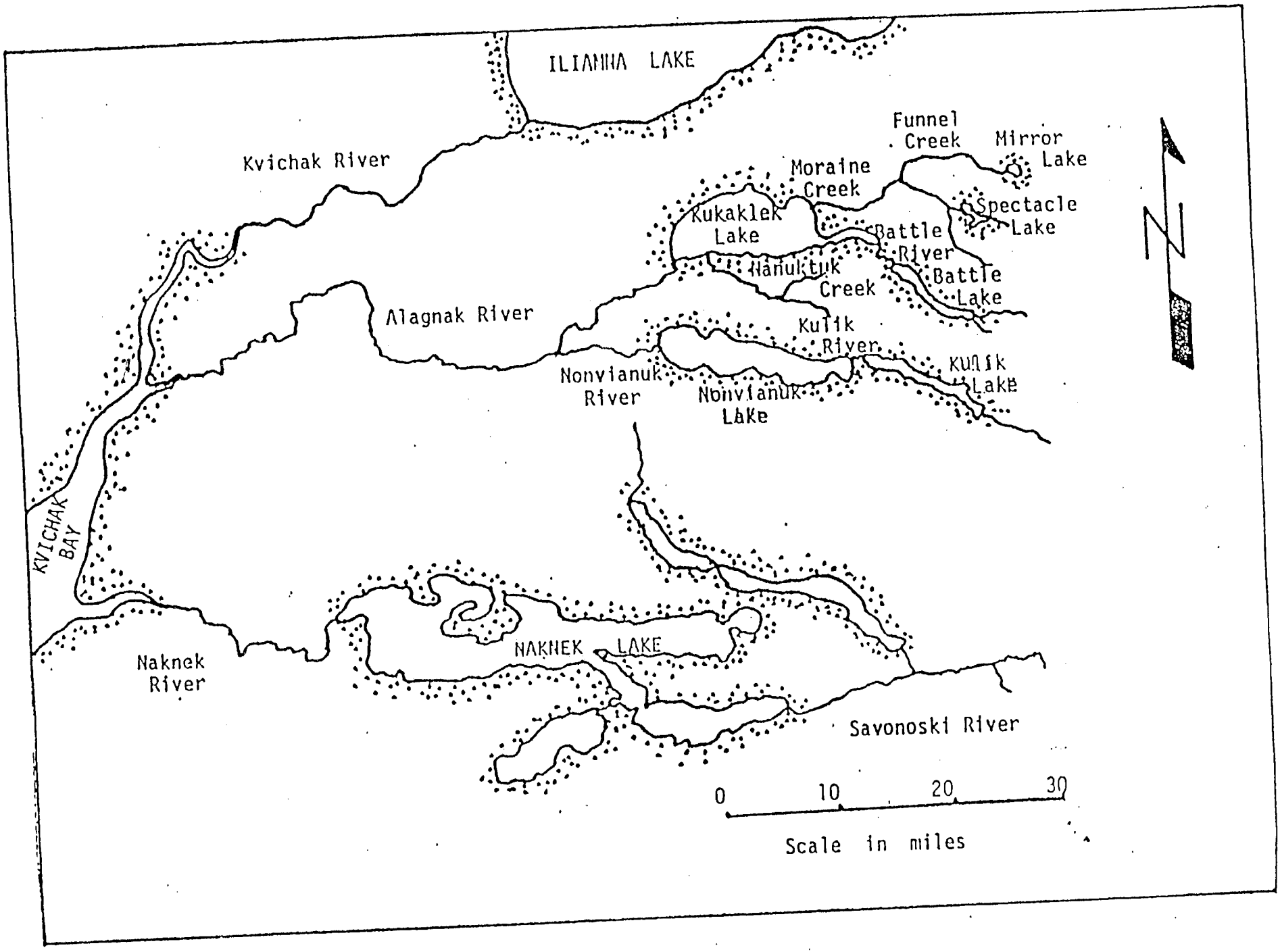

Figure 2. Alagnak River drainage, Bristol Bay, Alaska.

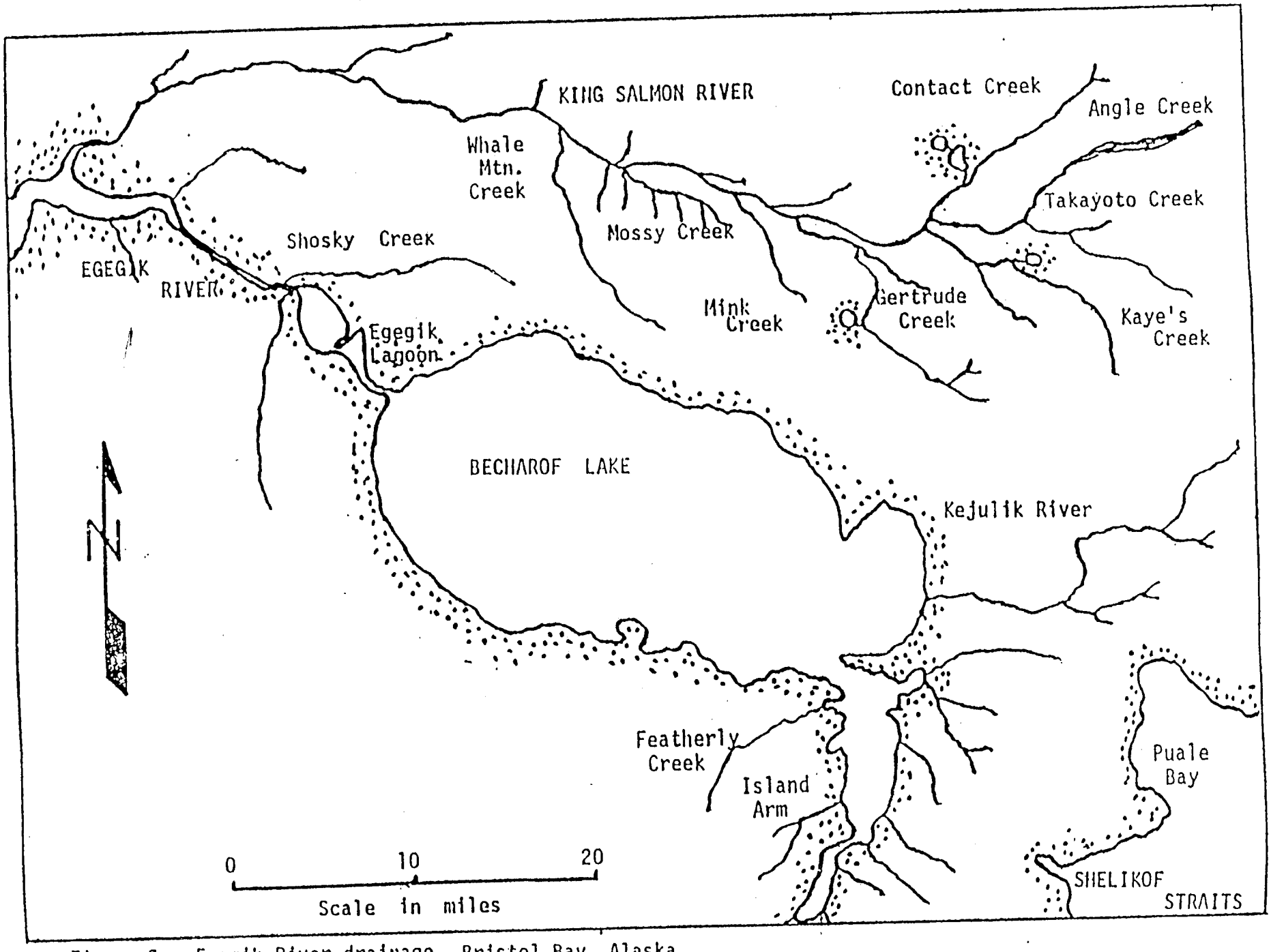

Figure 3. Egegik River drainage, Bristol Bay, Alaska.

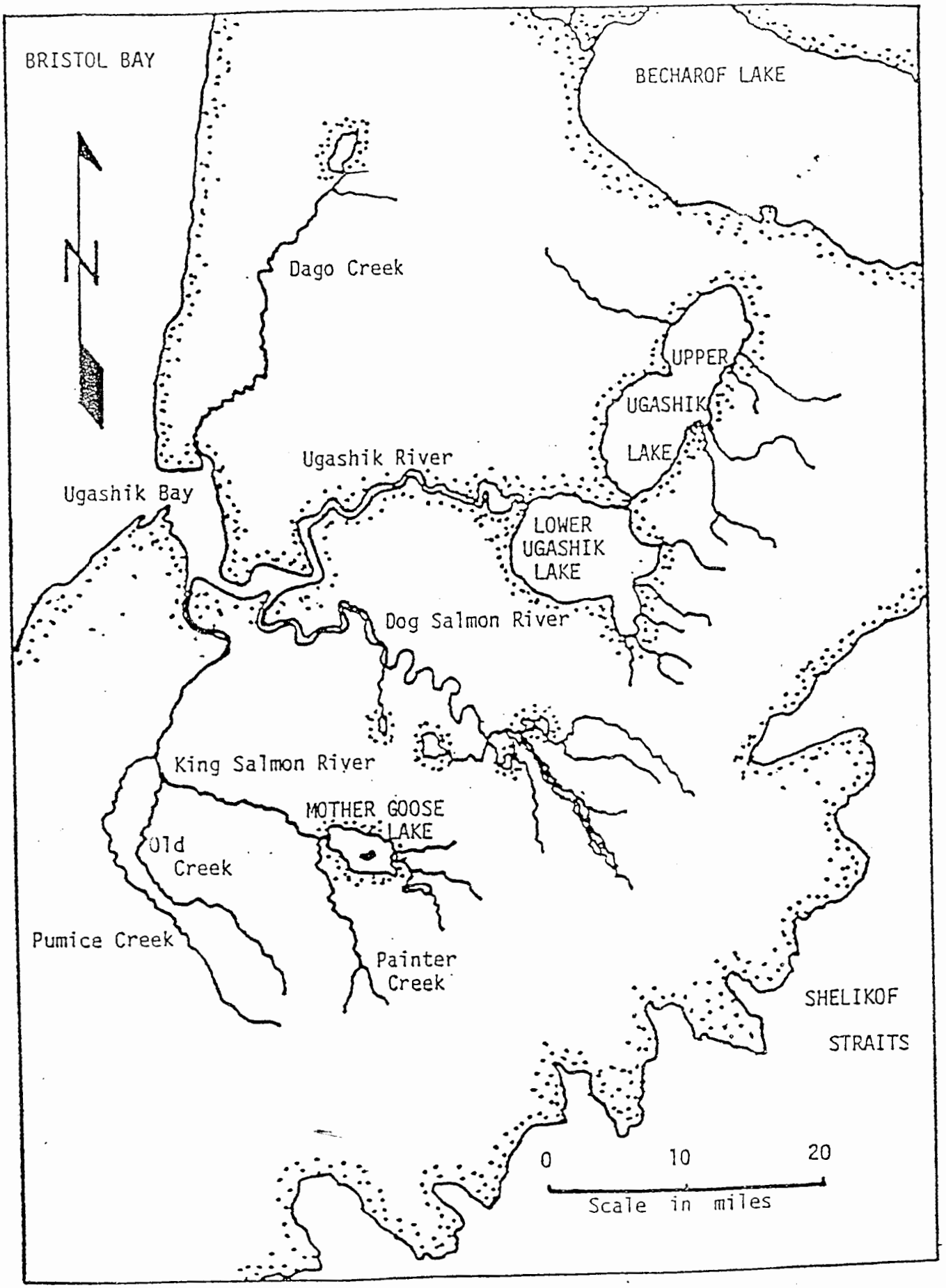

Figure 4. Ugashik River System, Bristol Bay, Alaska.

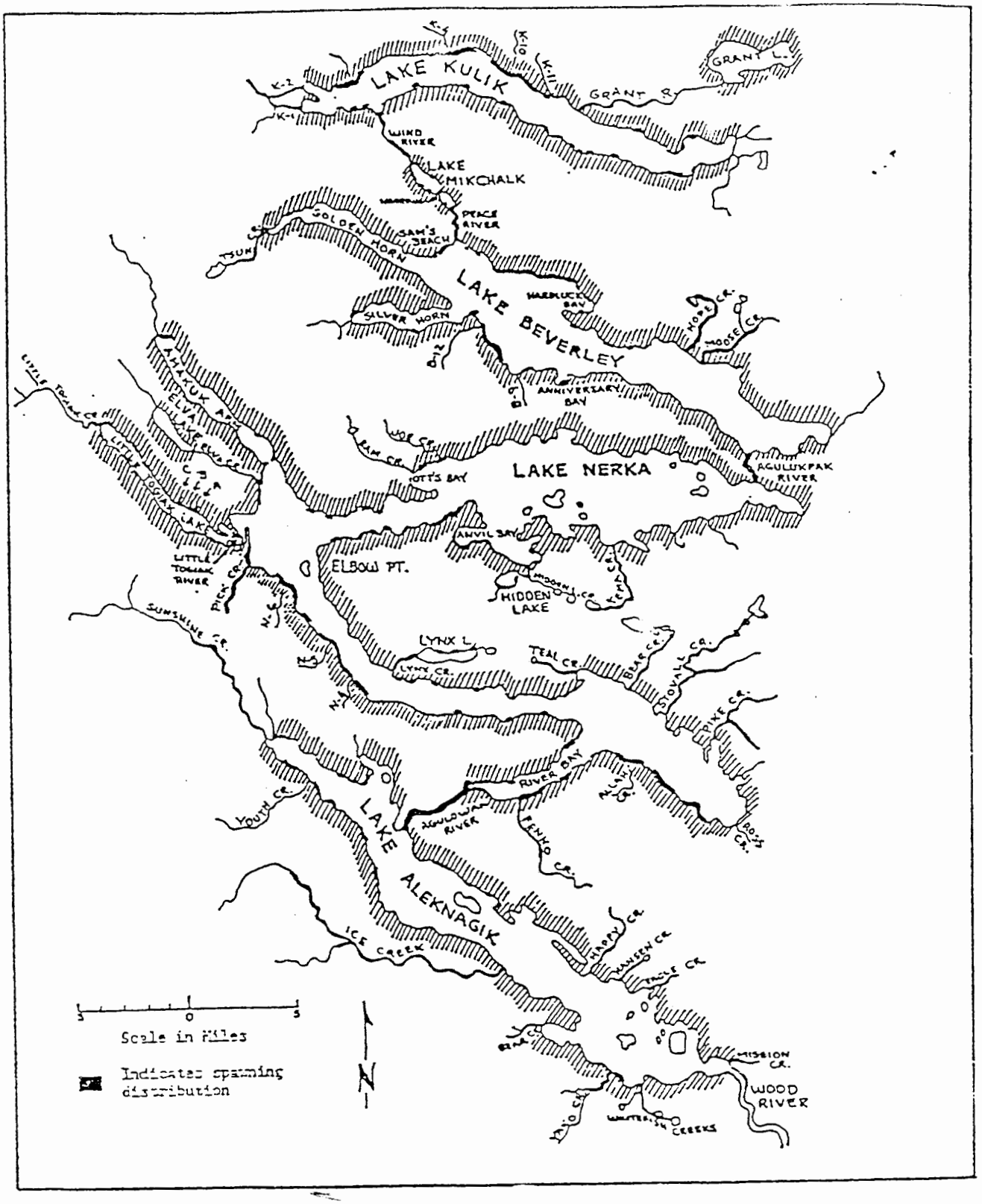

Figure 5. Wood River Lakes system, Bristol Bay, Alaska.

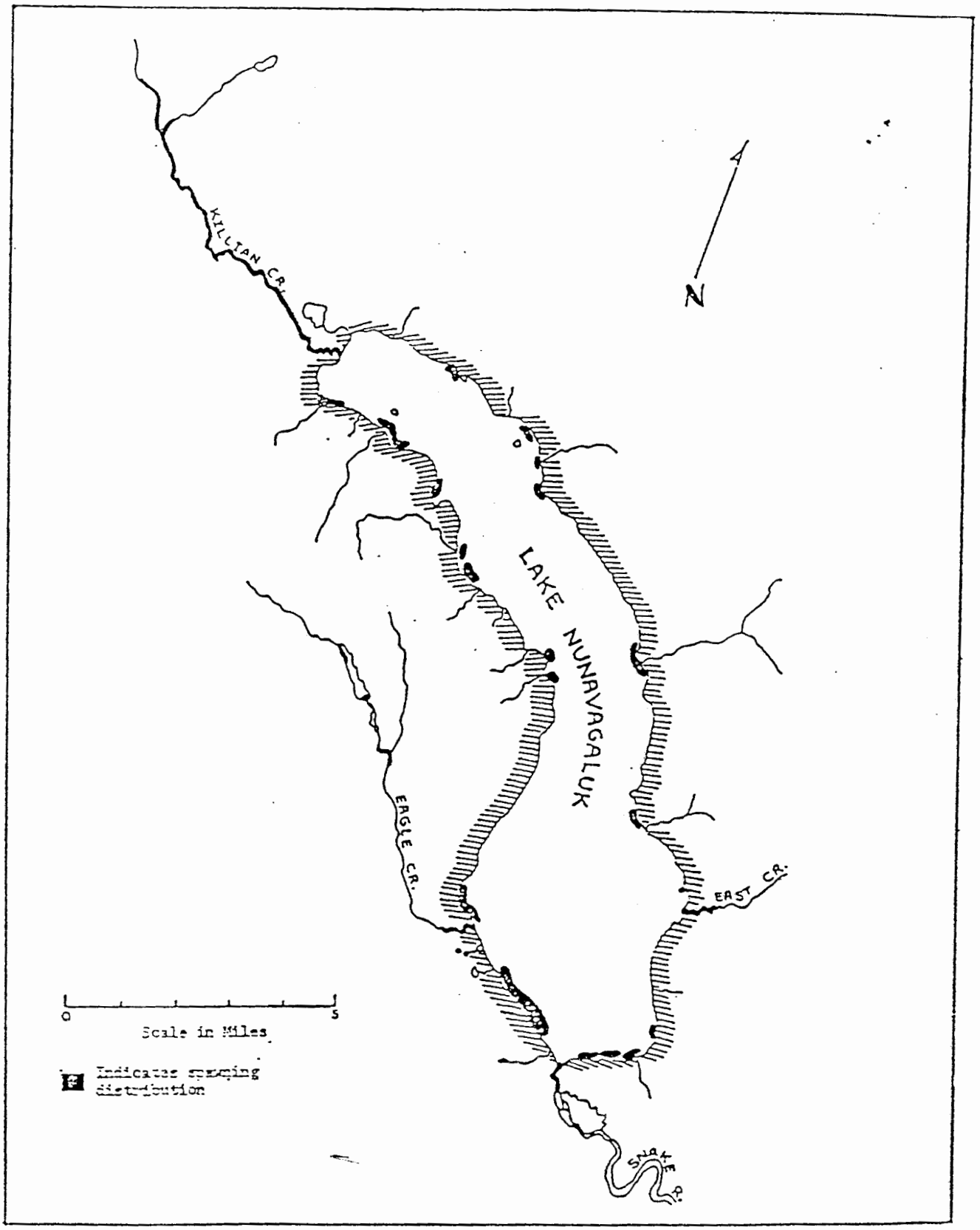

Figure 6. Lake Nunavaugaluk system, Bristol Bay, Alaska.

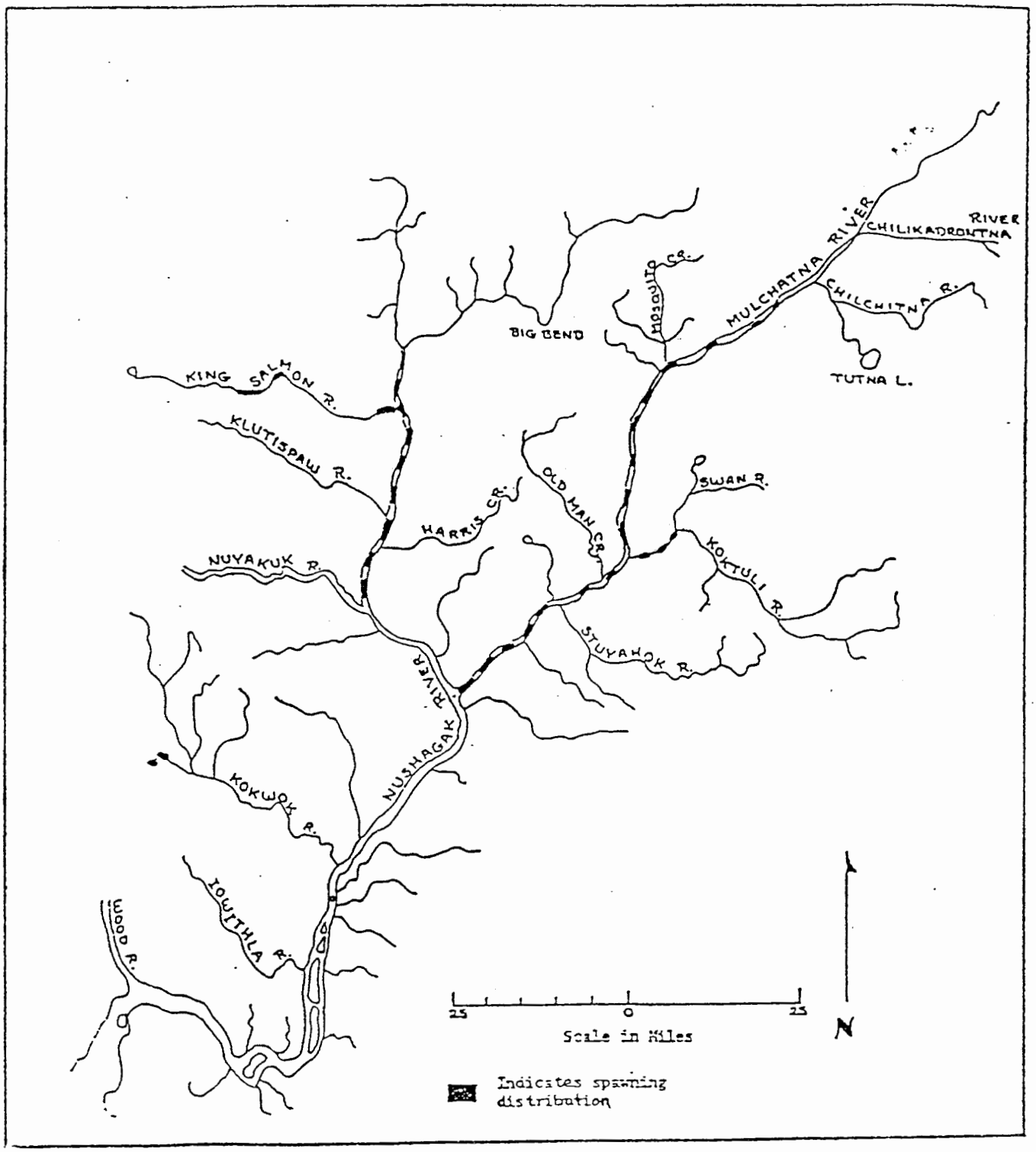

Figure 7. Nushagak-Mulchatna River system, Bristol Bay, Alaska.

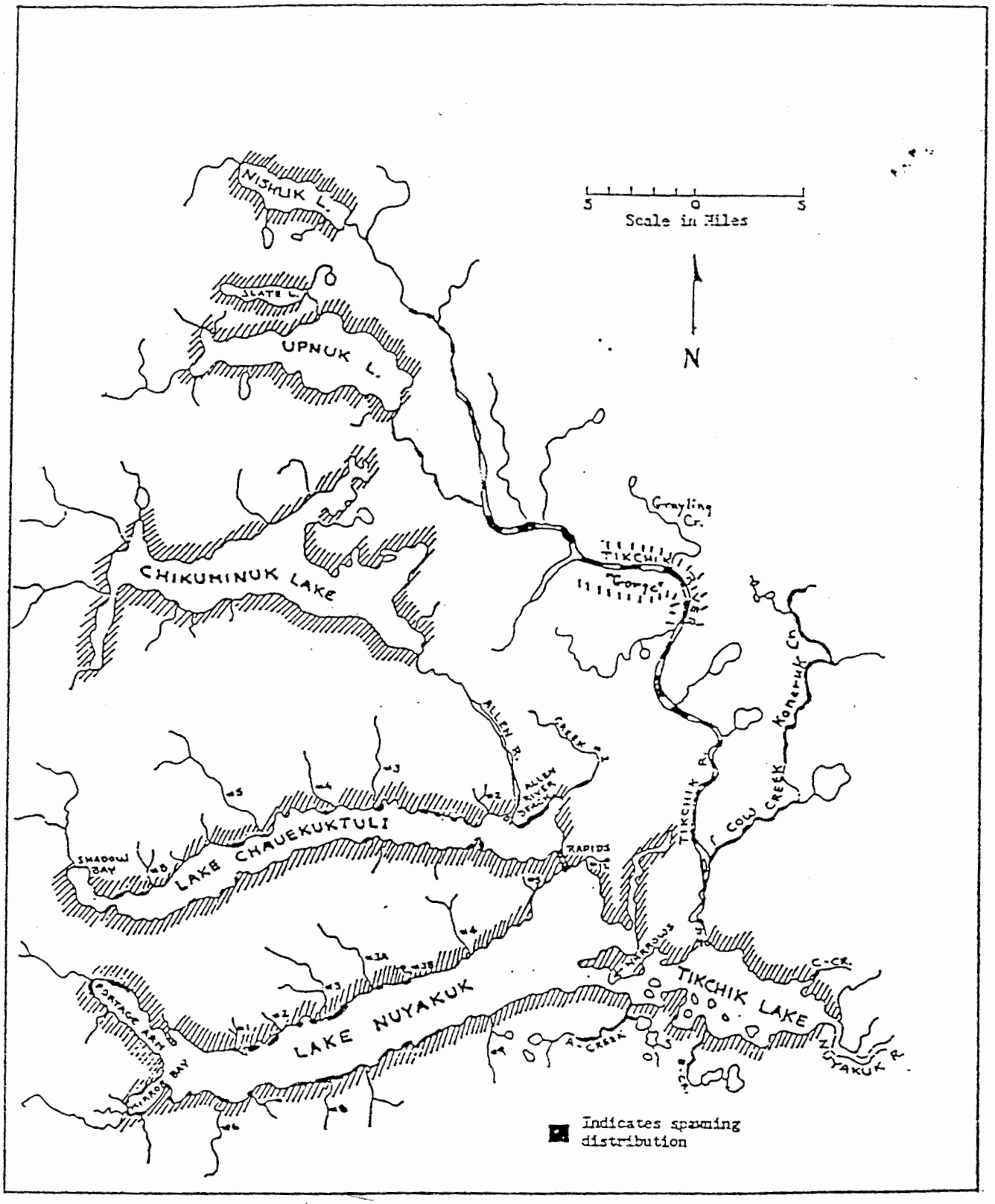

Figure 8. Tikchik Lakes system, Bristol Bay, Alaska.

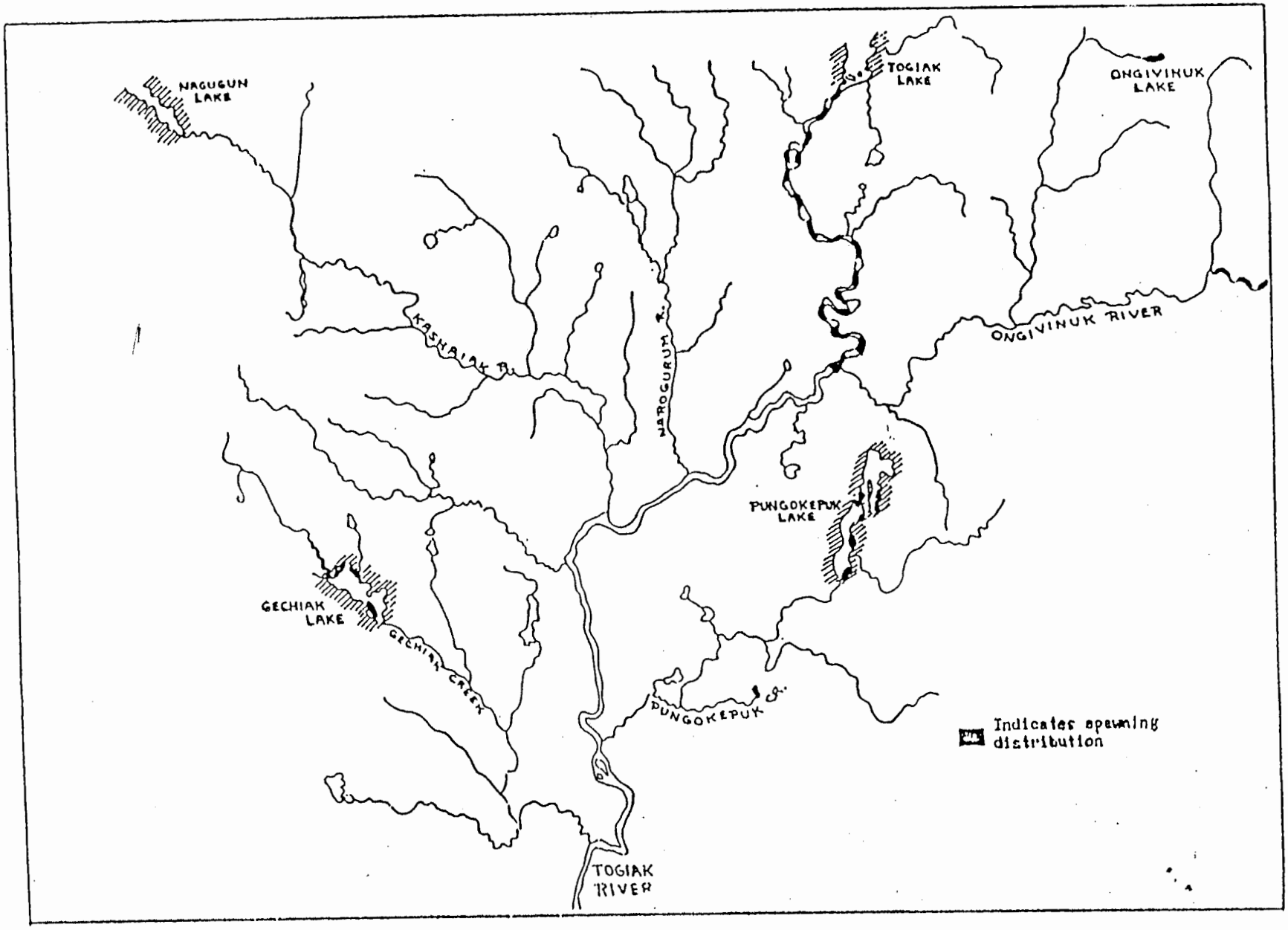

Figure 9. Togiak River system, Bristol Bay, Alaska.

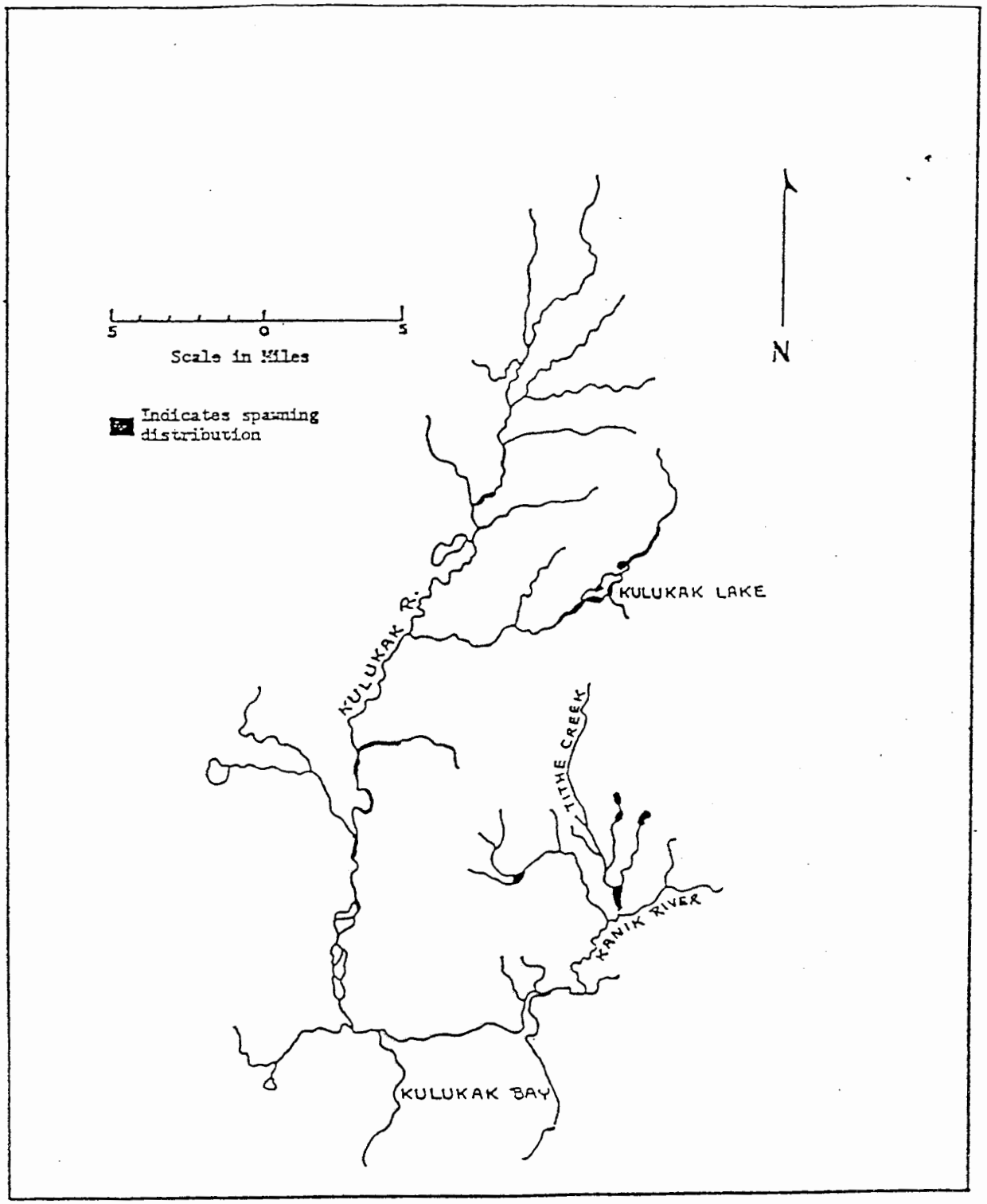

Figure 10. Kulukak River system, Bristol Bay, Alaska.

Appendix Table 1. Sockeye salmon total escapement estimates, Naknek-Kvichak District, 1955-1996. 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
1996	1,450,578	1,078,098	306,750	2,835,426	11
Mean	5,669,184	1,215,046	236,337	7,120,567	5

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

Appendix Table 2. Aerial survey counts of chinook salmon escapements, Naknek River drainage, 1970-1996.

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
96	#####	157	312	#####	5,010
Mean	2,967	110	485	1,533	5,095 [b]
Percent	58	2	10	30	100

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

Appendix Table 3. Chinook salmon escapement survey history, mainstem Naknek River, 1929-1996.

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.
1996	8/21	Regnart	2,965		At Peak...all fish on redds.
Mean			3,124	2,642	

[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, 1963-1996.

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.
1996	8/12	Regnart		1,576		At spawning peak....38 dead observed
Mean			1,465	1,370		

[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, 1964-1996.

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
1996	8/05	Regnart		312		Slightly post peak. 26 dead counted.
Mean			1,190	464		

[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, 1971-1996.

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
1996	8/05	Regnart	157		Peak of spawning. 12 dead counted.
Mean			125		

[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, 1963-1996.

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.
1987	8/22	Bill		2,420		
1988	8/12	Bill		4,600		
1989	8/15	Bill		3,650		
1990	8/08	Bill		1,720		
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.
1996	8/12	Regnart		9,885		Near peak. Most on redds.
Mean			238	4,010		

[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 8. Chinook salmon escapement survey history, Kvichak River, 1932-1996.

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		
	8/18	Regnart		132		
Mean			5,753	228		

[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, 1970-1996.

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
96	5,010	9,885	132	15,027
Mean	4,891	4,579	228	9,378

[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, 1961-1996.

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.
1996	8/12	Regnart		145,000		Near Peak
Mean			3,575	44,176		

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, 1968-1996.

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.
1996	8/12	Regnart			No pinks noted.No pinks noted.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, 1966-1996.

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.
1996					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, 1974-1996.

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.
1996					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, 1981-1996. [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
1995[d]	60 [c]	32	10	53	103	456	248	130		275		1,367
Average	62	114	21	43	26	444	186	216	2	213	15	1,342 [e]
1996	42[c]	102	8	38	20	230	74	123	6	203		846

[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 average indices for all streams.

Appendix Table 15. Aerial survey counts of chum salmon escapement, Egegik District, 1982-1996. [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
1995[d]	144 [b]	2	395	15	30	560	162	5		600		1,913
Average	174	22	3,684	45	150	3,741	571	457	0	2,185	58	11,085 [e]
1996	12 [b]	0	438	4	20	530	0	24	0	633		1661

[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, 1974-1996.[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
1995	24 [b]							24
Averag	6,258	49	41	36			3	6,387 [f]
1996	103,116 [b]							103,116

[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, 1981-1996.

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.
1995 [d]	2	5,258	Included King Salmon River & tributaries.
1996 [e]	2	9,043	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.
[d] The Egegik River Tower was maintained through August 30 and approximately 7,470 coho salmon were counted.
[e] The Egegik River Tower was maintained August 7 to September 11 and approximately 24,918 coho salmon were counted.

Appendix Table 18. Aerial survey counts of chinook salmon escapement, Ugashik District, 1980-1996.

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 [a]	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	1,155	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	1,490	9,224
1995	149 [ac]	882	440	366	501	505	2,843
Average	122	830	1,826	804	979	731	5,292[e]
1996	76 [ac]	1,079	1,200	403	0 [g]	30 [g]	2,788
Deviation[f]	-38%	30%	-34%	-50%			-47%

[1] Includes Figure-Eight, Goblet, Oldham, and Wandering Creeks.
[a] Tower counts
[b] Tower count plus later aerial survey counts of main river.
[c] Survey included Grassy Creek (tributary downstream of Ugashik Lagoon).
[d] Helicopter surveys.
[e] Sum of average indices for all locations.
[f] 1996 deviation from 1980-1995 average.
[g] Water was too turbid to see fish.

Appendix Table 19. Aerial survey counts of chum salmon escapement, Ugashik District, 1980-1996.

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	######	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 [ac]	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
1995	6 [ac]	160	3,900	1,370	2,600	1,800	0	9,836
Average	187	711	16,311	5,815	7,982	4,364	422	35,792[f]
1996	138 [a]	85	16,500	700	7,400	2,500	0	27,323
Deviation[g]	-26%	-88%	1%	-88%	-7%	-43%		-24%

[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 average indices for all locations.
[g] 1996 deviation from 1980-1995 average.

Appendix Table 20. Aerial survey counts of pink salmon escapement, Ugashik District, 1980-1996.

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.
1996	0	550	Observed in King Salmon River on August 12.

[a] Helicopter survey.

Appendix Table 21. Aerial survey counts of coho salmon escapement, Ugashik District, 1981-1996.

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		
1996	1	8,275	Surveyed on September 27 and 28.

[a] Helicopter survey.

Appendix Table 22. Spawner distribution and total escapement estimates of sockeye salmon, Wood River system, 1959-1996.

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
1995	33.5	52.9	13.6	1,482,200
Mean	18.9	43.7	36.9	1,120,338
1996	25.8	39.3	34.9	1,649,600

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

Appendix Table 23. Total escapement estimates of pink salmon, Nushagak and Togiak Districts, 1962-1996.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
1996	821,312 [b]	[c]

[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 24. Aerial estimates of sockeye salmon escapements, Togiak District, 1976 - 1996.[a]

Year	Togiak River & Tributaries[1]	Kulukak Systems[2]
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
1995	25,508	14,620
1976-95 Mean (20-Year)	26,681	34,083
1976-85 Mean (10-Year)	26,970	38,250
1986-95 Mean (10-Year)	26,393	29,916
1996	30,220	18,980

[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 25. Peak aerial counts of live sockeye salmon, Togiak River drainage, 1976 - 1996.

Year	Togiak Mainstem	Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivunuck River	Total
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
1995	3,260	1,745	1,000		4,200	2,330	12,535
Mean	7,330	2,077	1,721	63	1,117	2,655	14,962 [a]
%	49.0%	13.9%	11.5%	0.4%	7.5%	17.7%	100.0%
1996	9,160	2,270	150	100	240	3,190	15,110

[a] Sum of means for all streams.

Appendix Table 26. Peak aerial counts of live sockeye salmon, Togiak District, 1976-1996.

Year	Togiak River [1]	Kulukak River [2]	Tithe Creek Ponds	Quigmy River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
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
1995	12,535	3,000	4,310	200	610	1,470	2,820	390	1,720	27,055
Mean	13,987	8,473	9,543	201	367	2,035	3,386	2,358	3,307	43,656 [c]
%	32.0%	19.4%	21.9%	0.5%	0.8%	4.7%	7.8%	5.4%	7.6%	100.0%
1996	15,110	2,490	7,000	[b]	360	780	1,045	1,000	[b]	[b]

[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] Complete count not available
[c] Sum of means for all streams.

Appendix Table 27. Peak aerial counts of live chinook salmon, Togiak River drainage, 1976-1996.

Year	Togiak River Section [1] A	B	C	D	E	F	Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivinuck River	Total
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
1995	120	220	750	255	800	800	715	140	425	520	295	5,040
Mean	246	266	494	270	476	914	703	262	260	268	254	4,415 [b]
%	5.6%	6.0%	11.2%	6.1%	10.8%	20.7%	15.9%	5.9%	5.9%	6.1%	5.8%	100.0%
1996	75	150	160	100	255	625	335	120	120	235	325	2,500

[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 28. Peak aerial counts of live chinook salmon, Togiak District, 1976-1996.

Year	Togiak River [1]	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungo... River	Tot...
1976	3,930		1,080		100		380	30	520
1977	2,160		1,480	60	120		440	40	[illegible]
1978	11,250		2,720	150	250		1,020	110	[illegible]
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
1995	5,040	35	430	65	135	50	740	80	6,575
Mean	3,980	24	1,092	117	219	77	759	111	6,380 [b]
%	62.4%	0.4%	17.1%	1.8%	3.4%	1.2%	11.9%	1.7%	100.0%
1996	2,500	35	698	35	71	30	402	[a]	3,771 [a]

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

[a] Complete count not available.

[b] Sum of means for all streams.

Appendix Table 29. Peak aerial counts of live chum salmon, Togiak River drainage, 1976-1996.

Year	Togiak River Section [1]						Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivinuck River	Total
	A	B	C	D	E	F						
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
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
Mean	13,444	5,995	4,362	1,360	6,146	7,621	4,147	1,686	6,802	1,067	4,139	56,767 [e]
%	23.7%	10.6%	7.7%	2.4%	10.8%	13.4%	7.3%	3.0%	12.0%	1.9%	7.3%	100.0%
1996	3,700	10,250	5,500	1,300	5,750	8,250	2,600	750	900	550	3,400	42,950

[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 30. Peak aerial counts of live chum salmon, Togiak District, 1976-1996.

Year	Togiak River [1]	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
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
1995	138,600	2,200	7,600	5,200	13,920	6,440	1,000	7,200	182,160
Mean	53,891	4,688	13,699	7,664	15,505	4,675	3,754	8,112	111,988 [d]
%	48.1%	4.2%	12.2%	6.8%	13.8%	4.2%	3.4%	7.2%	100.0%
1996	42,950	960	7,560	560	810	2,670	40	[c]	55,550 [c]

[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] Complete count not available.
[d] Sum of means for all streams.

Appendix Table 31. Peak aerial counts of live coho salmon, Togiak River drainage, 1980-1996.

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	
1995[a]							1,450			200	1,180	
Mean	2,656	740	453	357	1,165	1,164	2,015	868	515	477	3,610	14,019[d]
%	18.9%	5.3%	3.2%	2.5%	8.3%	8.3%	14.4%	6.2%	3.7%	3.4%	25.8%	100.0%
1996	2,550	1,090	150	250	1,600	5,020	2,080	1,170	575	725	6,450	21,660

[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 32. Peak aerial counts of live coho salmon, Togiak District, 1980-1996.

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]										
1995		855	1,185	1,392	1,080	1,149		5,196[e]		
Mean	12,683	515	5,253	1,213	780	775	235	1,659	1,080	24,192 [d]
%	52.4%	2.1%	21.7%	5.0%	3.2%	3.2%	1.0%	6.9%	4.5%	100.0%
1996	21,660	1,211	10,290	3,062	2,805	1,944	851	5,917	[f]	47,740

[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.

[f] Complete count not available.

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