

**SALMON SPAWNING GROUND SURVEYS
IN THE BRISTOL BAY AREA,
ALASKA, 1993**

By

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ABSTRACT

Aerial surveys were conducted during 1993 in the Naknek-Kvichak, Egegik, Ugashik, Nushagak, and Togiak Districts of Bristol Bay, Alaska, to obtain indices of chinook, chum and sockeye salmon escapement and provide information on salmon distribution. Additionally, visual counts from towers were used to estimate sockeye salmon escapement into the Kvichak, Naknek, Egegik, Ugashik, Wood, Igushik, Wood and Togiak river systems, while sonar was used to estimate chinook, sockeye, chum, pink and coho salmon escapement into the Nushagak River drainage. Alagnak River aerial index counts totaled 347,975 sockeye, 10,170 chinook, and 4,600 chum salmon. Total sockeye salmon escapements estimated from tower counts for the Kvichak and Naknek Rivers were 4,025,166 and 1,535,658 respectively. Naknek River drainage aerial index counts for chinook salmon yielded a total of 8,016 spawners. Egegik District aerial index counts totaled 1,143 chinook, and 2,304 chum salmon. Total sockeye salmon escapement estimated from tower counts for the Egegik River was 1,516,980 fish, the eighth largest tower count on record for this system. Ugashik District aerial index counts totaled 23,920 sockeye (Dog Salmon and King Salmon Rivers), 4,586 chinook, and 10,985 chum salmon. The total sockeye escapement estimated from tower counts for the Ugashik River was 1,389,534 fish. Escapements of salmon into the Nushagak-Mulchatna River system estimated from sonar counts totaled 715,099 sockeye, 97,812 chinook, 217,230 chum, 0 pink, and 42,742 coho. Total sockeye salmon escapements estimated from tower counts in the Wood and Igushik Rivers totaled 1,176,126 and 405,564 fish, respectively. Total sockeye salmon escapement into the Togiak Lake system estimated from tower counts totaled 177,185, while aerial surveys of the mainstem Togiak River and its tributaries downstream of the tower yielded an additional escapement estimate of 15,930. The sockeye salmon escapement estimate from aerial counts of Kulukak Bay drainages totaled 31,800. Chinook and chum salmon escapements estimated from aerial surveys of the Togiak and Kulukak Rivers combined were estimated at 13,060 and 75,400 fish. Weather prevented aerial surveys during the peak of coho salmon spawning, coho salmon escapement could not be estimated.

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

INTRODUCTION

Aerial surveys of salmon spawning streams have been conducted in the Bristol Bay area of Alaska (Figure 1) for many years to provide biologists with information regarding the abundance and distribution of sockeye salmon (*Oncorhynchus nerka*), chinook salmon (*O. tshawytscha*), chum salmon (*O. keta*), pink salmon (*O. gorbuscha*), and coho salmon (*O. kisutch*) escapements. This information is important to fishery managers for a variety of reasons. It supplements data gathered at counting towers on the mainstem rivers, provides data from rivers where counting towers are not utilized, and provides data for time periods and species not covered by counting tower operations. The data collected is used to: 1) evaluate escapement goals and escapement-return relationships, 2) forecast future returns, 3) identify possible management problems relating to escapements, and 4) design strategies to solve escapement problems. This report summarizes the 1993 salmon spawning ground surveys conducted in the Bristol Bay area.

Naknek/Kvichak District

The Naknek-Kvichak District is comprised of three major drainages (Figure 2): 1) Kvichak River, draining Iliamna Lake and its tributaries, 2) the Alagnak (Branch) River draining Kukaklek and Nonvianuk Lakes, and 3) the Naknek River draining Naknek Lake and its tributaries. All these systems empty into Kvichak Bay.

Sockeye salmon escapements in the Kvichak River have been estimated each year since 1955 using counting towers on the mainstem river just downstream of the Iliamna Lake outlet. Sockeye salmon escapement counts from the Naknek River were obtained from 1950-1957 using a weir on the mainstem river just upstream of tidal influence. From 1958 to the present escapements have been estimated using counting towers in the Naknek River "Rapids" downstream of the outlet of Naknek Lake. Alagnak River sockeye salmon escapements were estimated from 1957-1976 using a counting tower near the upper extent of tidal influence on the lower river. Since 1977 Alagnak sockeye salmon escapement estimates have been index counts based on aerial surveys. All escapement estimates of other salmon species into Naknek-Kvichak District drainages have been obtained using aerial surveys.

Egegik District

The Egegik River system contains two major river drainages:

1) Egegik River proper, draining Becharof Lake and nearby coastal lowlands, and 2) the King Salmon River, draining runoff from the Kejulik Mountains and southern portions of Katmai National Park (Figure 3). Both these rivers empty into the head of Egegik Bay near Egegik village.

Sockeye salmon escapement counts in the Egegik River were obtained from 1952-1956 using a weir at the base of the Egegik River "Rapids". From 1957 to the present sockeye salmon escapement estimates have been obtained using counting towers situated between the outlet of Becharof Lake and Egegik Lagoon. Escapement estimates for other salmon species have been obtained through use of aerial surveys.

Ugashik District

The Ugashik River system is comprised of four major drainages: (1) Ugashik River proper, draining Ugashik Lakes and nearby coastal lowlands, (2) Dog Salmon River, fed by glacial melt and runoff from peaks in the Aleutian Range, (3) King Salmon River, draining Mother Goose Lake and three major runoff tributaries, and (4) Dago Creek, draining a large area of coastal lowlands (Figure 4). All these drainages empty into the intertidal reaches of Ugashik River and Ugashik Bay.

Sockeye salmon escapement counts in the Ugashik River were obtained from 1949-1956 using a weir just downstream of the outlet of Lower Ugashik Lake. From 1957 to the present sockeye salmon escapement estimates have been obtained using counting towers situated between the outlet of Lower Ugashik Lake and Ugashik Lagoon. Escapement estimates for other salmon species have been obtained through use of aerial surveys.

Nushagak District

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

Sockeye salmon escapement into the Wood River Lake system is estimated from counting towers at the outlet of Lake Aleknagik. Sockeye spawner distribution within the Wood River Lake system is assessed each year through use of aerial surveys conducted by the department, and by ground surveys conducted on major creeks and some rivers of the system by staff of the University of Washington, Fisheries Research Institute. On streams and rivers where both aerial and ground counts are conducted, the ground count is generally considered more accurate.

Sockeye salmon distribution in the Wood River Lake system is used in measuring management success in obtaining escapement goals for this system. The few interconnecting rivers between the large lakes in the system are primarily used by three-ocean sockeye salmon for spawning, while the lake beaches and tributary streams are more heavily used by two-ocean sockeye salmon. Knowledge of the age composition of the sockeye salmon run gives managers the ability to adjust escapements to avoid overcrowding of spawners in interconnecting rivers, while taking advantage of extensive beach spawning areas and numerous tributary streams. Surveys of the actual spawning distribution within the creeks, rivers, and beaches of the system provide a measure of management success in obtaining the desired spawning distribution.

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

Distribution of spawning sockeye salmon in the Tikchik Lake system based on aerial surveys has not been documented since 1991. Typically, most sockeye salmon entering the Nushagak River are bound for the Tikchik Lakes system. However, 1990 and 1991 sockeye salmon spawners were most abundant in the Nushagak-Mulchatna system, with below average numbers in the Tikchik Lakes system. The most recent spawner distribution information obtained for salmon in the Nushagak-Mulchatna and Tikchik Lake drainages was presented in Russell, Regnart, and Brookover (1992).

Sockeye salmon escapement is measured in the Igushik Lakes system at a counting tower located at the outlet of Amanka Lake. Spawner distribution has not been documented annually, and surveys have not been conducted on the Igushik system for sockeye salmon and other species since 1991 (Russell, Regnart, and Brookover 1992). Spawning escapement and distribution of sockeye salmon in the Snake

Lake system used to be estimated annually by aerial surveys, but funding has not been available for these surveys since 1991.

In 1993, the operating budget did not contain enough money to conduct aerial spawning ground surveys within Nushagak District. However, funding was obtained from the University of Washington, Fisheries Research Institute, to conduct aerial surveys of the Wood River Lakes system sockeye salmon spawning population. Surveys were not conducted on the Nushagak-Mulchatna, Tikchik Lake, or Snake Lake systems.

Togiak District

Togiak District is comprised of two major river drainages: 1) Togiak River, draining Togiak, Gechiak, Pungokepuk, and Ongivinuck Lakes and Nayorurun and Kemuk Rivers (Figure 9), and 2) Kulukak River, draining Kulukak Lake (Figure 10). Various smaller systems also occur within the district, including Tithe Creek Ponds and the Quigmy, Matogak, Osviak, Slug, Negukthlik, and Ungalikthluk Rivers. The Kulukak River and 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 tower, as well as all 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 third consecutive year, the operating budget did not contain sufficient funds to conduct aerial surveys in the Togiak District. However, the U.S. Fish and Wildlife Service, Togiak National Wildlife Refuge, provided the department with 34 hours of aerial survey time, through both private aircraft charters and use of U.S. Fish and Wildlife Service aircraft and personnel, to collect information on salmon species other than sockeye salmon. U.S. Fish and Wildlife Service involvement in the survey program is based on their interest in monitoring and maintaining species diversity and anadromous fish runs in Refuge systems.

METHODS

Most survey flights were conducted from small, fixed-wing, high-wing, wheeled aircraft (Super Cub, Cessna 180, or Cessna 185) chartered from local air charter companies and flown by experienced survey pilots. Several surveys in the Togiak National Wildlife Refuge were flown by staff pilots in U.S. Fish and Wildlife Service aircraft. During most surveys, salmon were counted by Department of Fish and Game biologists familiar with the streams and target species. Some surveys of waters on National Wildlife Refuge lands were flown by U.S. Fish and Wildlife Service personnel. All 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 increase the visibility of salmon to observers. Surveys were scheduled to coincide as closely as possible with historic peak spawning periods for target species, although weather, water conditions, and aircraft availability also influenced survey scheduling. The peak spawning period was defined as the time when the greatest number of spawning salmon occupied redds. During surveys, counts were registered on a hand tally counter or recorded on a tape player. This information was transferred to survey data forms either sometime during the survey or upon returning to the office.

Aerial spawning ground surveys account for only a portion of a spawning population (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 index 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 drainages 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 9 and 17, to provide estimates of Alagnak River drainage sockeye, chinook, and chum salmon escapements. Additionally, all major chinook salmon spawning areas in the Naknek River drainage were surveyed between July 31 and August 23, and a Kvichak River chinook salmon escapement index survey was flown August 16. These index counts were not expanded to provide instantaneous population estimates, although expansions have been made in some earlier years based on subjective criteria. Tower counts were used to obtain

total sockeye salmon escapement estimates in the Kvichak and Naknek Rivers. A late summer survey of sockeye salmon spawning distribution in the Kvichak River system was accomplished, and results were documented in Regnart (1993). All survey counts in this 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 1993. Aerial surveys of all known chinook and chum salmon spawning areas in both the Egegik and King Salmon Rivers were flown on August 6, and a follow-up survey of some chum spawning areas was flown August 16. No funding was available to conduct aerial surveys to estimate pink or coho salmon escapements. All survey counts in 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 during the August 16 aerial surveys and should be considered only an index of total abundance.

Nushagak District

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

Peak aerial counts for sockeye salmon from the Wood, Igushik, Snake, and Tikchik Lakes systems have generally accounted for 50% (range 29%-65%) of the total escapements estimated at towers or weirs on those systems (Nelson, 1967 and 1979). In the Igushik, Snake, and Tikchik systems, peak aerial counts of sockeye salmon are typically expanded by a factor of 2.0 to estimate total escapement. However, other factors may be applied at the discretion of the surveyor depending upon weather, visibility, and survey timing. In the Wood River system, sockeye salmon escapements for each spawning stream, beach, or river have been estimated using the proportion of sockeye salmon observed at a given location in relation to the total tower count. Different expansion factors have been assigned to each type of spawning

habitat. For a more detailed description of the analysis of Wood River survey counts, see Nelson (1973).

Togiak District

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

Aerial survey counts for sockeye salmon in the Togiak Lake system above the counting tower have generally accounted for 47% (range: 40%-50%) of the escapement estimated at the tower (Nelson 1967). Therefore, aerial counts of sockeye salmon in systems without counting towers (i.e. Kulukak River and the mainstem and tributaries of the Togiak River below the towers) were multiplied by 2.0 to estimate total escapement. Since 1980, aerial counts of chinook salmon in the Togiak District have typically been multiplied by 2.5 to estimate escapement. Since 1968, aerial counts of chum salmon have generally been multiplied by 2.0 (Nelson 1968). Since 1978, pink salmon escapements have also been estimated by multiplying aerial counts by 2.0. An expansion factor of 3.0 was felt to be appropriate for coho salmon based on results of a stream-life study in the Gechiak River (Minard 1986), and has been used for that species in all areas of the Togiak District since the initiation of coho surveys in 1980. Expansion factors have been subjectively adjusted based on weather conditions, visibility, and survey timing with respect to the peak spawning activity.

RESULTS AND DISCUSSION

Naknek-Kvichak District

Aerial surveys of sockeye salmon escapement into the Alagnak River and its tributaries were conducted on August 9 and 17. The sockeye salmon escapement index count totaled 347,975 for this system (Table 1). This count was greater than any obtained since the aerial survey program was started in 1977 (Appendix Table 1), and

was approximately 88% greater than the escapement point goal of 185,000 sockeye salmon. Total sockeye salmon escapement into this system was probably greater than the index count, which was not expanded to represent an estimate of total escapement. Total sockeye salmon escapements estimated from 1993 tower counts for the Kvichak and Naknek Rivers were 4,025,166 and 1,535,658 respectively (Appendix Table 1).

Aerial surveys of chinook salmon escapement into the Naknek River drainage were flown from July 31 through August 23. Chinook salmon escapement indices were obtained for the four main spawning areas: mainstem Naknek River, Big Creek, King Salmon Creek, and Paul's Creek. A total index of 8,016 chinook salmon was obtained for the entire Naknek drainage. The largest components of this index were counts of 1,710 chinook salmon in Big Creek on August 17 and 5,520 chinook salmon in the mainstem Naknek River on August 23 (Table 2). Over the period 1970-1993 there have been 14 years in which chinook salmon escapement indices have been obtained for all four main spawning areas (Appendix Tables 2-6). The chinook escapement index for these 14 years has ranged from a low of 2,691 in 1992 to a high of 11,730 in 1988. The 1993 index was the third largest on record, well above the 1970-1992 mean chinook salmon escapement index of 4,859.

The Alagnak River drainage chinook salmon escapement was surveyed on August 9, yielding an index of 10,170 fish (Table 2). Chinook salmon index counts for the Alagnak River drainage from 1970-1993 have ranged from a low of 824 in 1973 to a high of 11,650 in 1978 with a 1963-1992 average of 3,513 fish (Appendix Table 7). The 1993 count was almost three times greater than the 1963-1992 average. An aerial survey of chinook salmon escapement into the Kvichak River was conducted on August 16 and yielded an index of 115 fish (Table 2). The 1993 index count was about half the 1980-1992 average of 304 fish for the Kvichak (Appendix Table 8).

The Naknek-Kvichak District chinook escapement index, the sum of counts for the Alagnak, Kvichak and Naknek river drainages, totaled 18,301 fish (Appendix Table 9). This total is the largest on record, much greater than the 1970-1992 mean district chinook salmon escapement index of 7,831.

Chum salmon were counted only during the August 9 Alagnak River aerial surveys (Table 2). The Alagnak River has been the principal chum salmon producing drainage in the Naknek-Kvichak District. A total of only 4,600 spawning chum salmon were observed during the 1993 survey. The 1993 chum index was one of the lowest on record, much less than the 1976-1992 average index of 34,977 (Appendix Table 10).

No surveys were flown to count pink salmon escapements into Naknek-Kvichak District drainages during 1993. Surveys are only flown

during even years, when pink salmon are most abundant in this district (Appendix Tables 11-13).

Escapement surveys for coho salmon were not flown in Naknek-Kvichak District drainages during 1993 since funding was not available. Low daily and cumulative commercial catches indicated that coho runs were low resulting in a total commercial closure of the coho fishery for the remainder of the season on August 9.

Egegik District

The 1993 Egegik River sockeye salmon escapement past the counting towers totaled 1,516,980 fish, the eighth largest count on record for this system. Although no system-wide aerial surveys were flown, an additional 20 sockeye salmon were counted in Shosky Creek. No surveys to determine distribution sockeye salmon within the Egegik River system were flown since funding was not available.

Aerial surveys of all known chinook salmon spawning areas were conducted August 6, yielding a total index count of 1,143 chinook salmon (Table 3). This index was slightly below the 1981-1992 mean index of 1,068 for this system (Appendix Table 14). The 1993 Egegik District commercial harvest of 1,412 chinook salmon was just 48% of the 1974-1992 mean harvest of 2,971 chinook salmon. The commercial fishery was closed from June 1-19 to pass chinook salmon through the district and into the escapement. Overall it was apparent that the 1993 Egegik District chinook salmon run was well below average.

A total of 2,304 chum salmon were counted during surveys of all known spawning areas within Egegik District on August 6 and 16 (Table 4). The 1993 index indicated that chum salmon escapement was well below the 1982-1992 average of 12,703 (Appendix Table 15). The 1993 commercial chum salmon harvest from the Egegik District totaled only 49,480 fish, the smallest in the last 14 years. Thus it was evident that the run was far below average. Escapement indices of less than 10,000 chum salmon fish have been obtained in the district each of the last five years, which greatly concerns district managers. However, due to the murky water, daily monitoring of chum and chinook salmon escapements into the King Salmon River cannot be accomplished without either a weir or hydroacoustic equipment. Since the peak of the chum salmon run closely overlaps the peak of the sockeye salmon run, the much less abundant chum salmon resource suffers when sockeye escapement needs have been met and extensive commercial fishing is needed to harvest surplus sockeye salmon.

No pink salmon or coho salmon surveys were conducted in the Egegik drainage in 1993 due to lack of funding (Appendix Tables 16 and

17). The commercial pink salmon harvest in the Egegik District totaled less than 100 fish, which was to be expected for an odd-year when pink salmon are not abundant. The commercial coho salmon harvest totaled 40,791 fish, well above the 1974-1992 average of 30,590, suggesting that run size was at least average.

Ugashik District

The 1993 sockeye salmon escapement count past Ugashik River counting tower totaled 1,389,534 fish, the sixth largest escapement on record and nearly twice the desired point goal of 700,000. Unfortunately, funding was not available to conduct aerial surveys documenting the distribution of this large escapement. However, an additional 1,350 and 22,570 sockeye salmon were counted in the Dog Salmon and King Salmon River drainages, respectively, during chinook salmon surveys (Table 5).

Chinook salmon escapement aerial surveys of Dog Salmon, King Salmon, and Ugashik River drainages were flown August 16, yielding a total index count of 4,586 for the entire system. The King Salmon River chinook index of 3,920 fish was the largest escapement component for the system (Table 6). The 1993 total escapement index was similar to the 1980-1992 mean escapement index of 4,588 chinook salmon (Appendix Table 18). However, only 2,754 chinook salmon were harvested commercially in 1993, well below the 1974-1992 average of 3,788. Therefore, the Ugashik District chinook salmon run was probably below average.

Chum salmon were also counted during aerial surveys of the Dog Salmon, King Salmon, and Ugashik River drainages on August 16, yielding a total escapement index count of 10,985 (Table 7). Although surveys were probably conducted near the time of peak of spawning abundance, the 1993 escapement index was the smallest obtained since 1983, when annual surveys were first made for all these drainages (Appendix Table 19). It was far below the 1983-1992 mean index of 41,189. The commercial harvest of chum salmon in the Ugashik District totaled 67,565 fish, slightly above the 1974-1992 mean commercial harvest of 60,307.

The Ugashik District pink salmon run has historically been very small during odd years, and this year was no exception (Appendix Table 20). There was no reported commercial catch of pink salmon and none were observed seen during the August 16 aerial surveys.

Although 705 coho salmon were observed during August 16 aerial surveys, funds were not available to conduct surveys specifically directed at coho salmon escapement into Ugashik District drainages (Appendix Table 21). Daily and cumulative commercial coho salmon

catches were so small that the district was closed to commercial fishing on August 20 for the remainder of the season.

Nushagak District

Peak aerial estimates and total population estimates of sockeye salmon were made for the Wood River lakes system in 1993 (Table 8). Survey timing and visibility was good for all creeks and rivers surveyed. Fall storms delayed surveys of the lake beaches, and high water made it difficult to see sockeye salmon when beach surveys were finally conducted. Counts could not be made in the western arms of Lake Beverley, Nerka, and Aleknagik, typically prime spawning areas, due to particularly turbid water conditions. Additionally, all beach surveys were made after the peak of spawning, since several hundred carcasses were observed.

The 1993 Wood River tower count of 1,176,126 sockeye salmon was greater than the escapement goal of 1,000,000 fish, but within the desired escapement range for that system (800,000 - 1,200,000). The percent of the spawners utilizing rivers within the system, 25%, was lower than the 1959-1992 average, 38% (Appendix Table 22). Escapement into most creeks was above average. This was evident not only in counts of sockeye salmon actually spawning in the creeks, but also in observations of large numbers of both dead and schoA large portion of the 1992 escapement was also composed of 0.-freshwater fish, however, aerial surveys of the Tikchik and Nushagak-Mulchatna systems were precluded in 1992 and the actual spawner distribution is unknown. oled sockeye salmon in creeks which were not counted. Problems encountered in surveying beaches in 1993 made it difficult to determine the extent of spawning in these areas. This component of the spawning population was probably more abundant than survey counts suggested.

Sockeye salmon escapement into the Nushagak River drainage was estimated to be 715,099 fish in 1993 (J. Miller, ADF&G, Anchorage, personal communications), above the desired point escapement goal of 550,000 but still within the desired range of 340,000 - 760,000. Generally, most sockeye salmon entering the Nushagak River drainage spawn within the Tikchik Lake system. However, beginning in 1990, a large numbers of sockeye salmon began to spawn within the upper Nushagak and Mulchatna Rivers. Coincident with this shift in spawner distribution, the percentage of age-0. sockeye salmon in the escapement increased to 44%. In 1993, the percentage of age-0. sockeye salmon in the escapement declined to 25%, but funding was not available for aerial surveys and spawner distribution could not be determined.

Although sockeye salmon escapement into Lake Nunavaugaluk (also referred to as Snake Lake) was not estimated in 1993, local

residents reported that spawners were abundant on lake beaches (Appendix Table 23).

Chinook salmon escapement into the Nushagak River drainage was estimated to be 97,812 at the Portage Creek sonar counter, 30% above the inriver goal of 75,000 (Appendix Table 24). The 1993 escapement was similar to the 1974-1992 average of 96,900 and greater than the 1984-1992 average of 79,012.

Chum salmon escapement into the Nushagak River was estimated to be 217,230 fish (Appendix Table 25). This was only 62% of the escapement goal of 350,000 fish and only 72% of the 1974-92 average escapement of 303,336.

Coho salmon escapement fell far short of the escapement goal of 100,000 due to a poor run. The 1993 escapement of 42,742 coho salmon was the third lowest escapement documented during the 13 year history of sonar operations. Funding was not available to conduct aerial surveys for coho salmon.

Pink salmon are not abundant in Nushagak District during odd years, and no aerial surveys were made during 1993 (Appendix Table 26).

Togiak District

Peak aerial estimates and total population estimates were made for sockeye salmon in major spawning systems of Togiak District in 1993 (Table 9). The aerial survey count of 15,900 sockeye salmon for the Togiak River and its tributaries below the counting tower was considerably less than the 1984-1992 average of 26,978 (Appendix Table 27). Escapement past the counting tower, however, was estimated at 177,185. This was 18% greater than the point escapement goal of 150,000, but well within the desired range of 140,000-250,000. The spawning population in the Kulukak River Section, including Tithe Creek Ponds, was estimated to be 31,800 sockeye salmon, 93% of the 1984-1992 average of 34,378 and 91% of the escapement goal of 35,000 fish. Examination of peak aerial counts within the Togiak River drainage and throughout Togiak District for 1974-1993 showed that escapements into the mainstem portion of the Togiak River, the Gechiak and Pungokepuk Lake systems, and Tithe Creek Ponds were generally all below average, while escapements into the Kulukak, Negukthlik and Ungalikthluk Rivers were generally above average (Appendix Tables 28 and 29). The total sockeye salmon escapement for the entire district was 242,475 fish.

Surveys were made close to the peak of spawning activity for Tithe Creek Ponds, Ongivinuck Lake and the upper Togiak River. However, surveys were made after the peak of spawning activity for Gechiak

and Pungokepuk Lakes. Spawning activity appeared to peak for sockeye salmon in Kulukak Lake between July 21 and July 26, based on the ratio of schooled to dead sockeye salmon observed on earlier surveys. Spawning activity in this lake appears to peak at a much earlier date than has been observed for other Togiak District systems. The earliest recorded date peak spawning occurred in this system was July 16.

Aerial counts of sockeye salmon in the Slug, Matogak, Osviak, Negukthlik, Ungalikthluk, and Kulukak Rivers were obtained incidentally during chum and chinook salmon escapement surveys, following the methods used by Nelson (1979). Estimates were obtained for the Matogak, Osviak, and Slug Rivers later in the season as well. Escapement estimates used for most of these rivers were based on the earlier surveys, keeping with the methodology described in Nelson (1979). Neither early or late season counts for the Slug, Matogak, and Osviak Rivers were included in the district summary, however, due to the presence of many schooled sockeye salmon during early surveys and the large number of carcasses during later surveys.

An expansion factor of 2.0 was applied to aerial counts in most areas to estimate sockeye spawning escapement. A factor of 3.0 was applied to the sockeye salmon counts in the Gechiak and Pungokepuk Lake systems to account for the late timing of these surveys.

Aerial live counts and expanded escapement estimates of chinook salmon were conducted of all major spawning drainages in 1993 (Table 10). The total district escapement of 16,035 chinook salmon was the greatest documented since 1984, 29% above the 1984-92 average of 12,436 and very similar to the 1974-1992 average of 16,312 (Appendix Table 24). The chinook salmon escapement of 10,200 into the Togiak River represented the first time the escapement goal of 10,000 for that system has been reached since 1985. The estimated escapement of 2,850 chinook salmon into the Kulukak River was also the greatest documented since 1984, and exceeded the average 1980-1991 escapement of 2,450 chinook salmon for that system. An extended closure during the traditional peak of the commercial chinook fishery probably played a large role in obtaining improved chinook salmon escapements.

Aerial live counts of chinook salmon in Togiak District drainages were also made in 1993 (Appendix Tables 30 and 31). Counts were generally similar to or greater than those in recent years. Only counts for the Kemuk River appeared to much less than those for recent years.

Conditions and timing were good for all chinook salmon areas surveyed. An expansion factor of 2.5 was applied to most aerial chinook salmon counts. Due to high and turbid water, however, a factor of 3.0 was applied to counts for lower Togiak River

sections. Surveys of the Togiak River system were flown during the preferred time described in Nelson (1979), between the peak of spawning for both chum and chinook salmon. Progression of the chinook spawning activity appeared to be typical in most areas, and peaked during the week of August 1. Spawning had not yet peaked in the Negukthlik River, however, where most chinook were observed in large schools of 40 - 80 fish each.

The chum salmon escapement for the entire district was estimated to be 98,470, the third lowest escapement ever documented for Togiak District (Table 11, Appendix Table 25). The total district escapement of 45,040 was only 39% of the 1974-1992 average of 115,803, and the Togiak River escapement of 61,500 was only 31% of the goal of 200,000. Peak counts of chum salmon were poor in most major river systems surveyed in Togiak District (Appendix Tables 32 and 33).

Chum salmon counts were made during the same surveys used to count chinook salmon. Survey timing for chum salmon generally appeared to be at the peak of spawning for most systems. However, large numbers of carcasses were observed in the Nayorurun, Kemuk, and Ungalikthluk Rivers, indicating that peak spawning had already occurred in these areas. Surveys of the Osviak and Matogak also appeared to be late. An expansion factor of 2.5, instead of 2.0, was applied to systems for which surveys had been flown after the peak of spawning. A factor of 2.5 was also applied to the lower portions of the Togiak River to compensate for poor visibility.

Extensive fall rains resulted in extremely high and turbid water during the peak of coho salmon spawning activity, preventing the conduct of aerial surveys. This was the third year that coho salmon escapements into the Togiak and Kulukak Rivers were not documented since the inception of the coho salmon aerial survey program in 1980 (Tables 34 and 35).

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Table 1. Aerial survey counts of sockeye salmon, Alagnak River system, 1993.

System Location	Number of Fish			Total	Percent of Total
	Spawning	Dead	Schooled		
Nonvianuk River	0	0	0	0	0
Nonvianuk Lake:					
South Beach	0	0	0	0	0
North Beach	0	0	550	550	0
Kulik River	10,400	0	24,700	35,100	10
Kulik Lake:					
South Beach	0	0	1,400	1,400	0
North Beach	0	0	450	450	0
Alagnak River	0	0	0	0	0
Kukaklek Lake:					
South Beach	0	0	100	100	0
North Beach	0	0	100	100	0
Nanuktuk Creek	51,000	6,700	16,000	73,700	21
Battle River	10,500	0	26,600	37,100	11
Battle Lake:					
South Beach	300	0	500	800	0
North Beach	0	0	400	400	0
Spectacle Creek	51,000	6,875	86,500	144,375	42
Funnel Creek	34,000	4,900	15,000	53,900	15
Total	157,200	18,475	172,300	347,975	100

Table 2. Aerial survey counts of chinook, chum, pink, and coho salmon, Naknek-Kvichak District, 1993.

Location	Survey Date	Number of Salmon			
		Chinook	Chum	Pink	Coho
Kvichak R.	Aug. 16	115			
Alagnak R.	Aug. 09	10,170	4,600		
Naknek R.:					
Paul's Creek	July 31	86		0 ^a	
King Salmon Creek	July 31	700		22 ^a	
Big Creek	Aug. 17	1,710			
Mainstem Naknek R.	Aug. 23	5,520			
Total		18,301	4,622		

^a Incidental observation.

Table 3. Aerial survey peak counts of chinook salmon escapement, Egegik District, 1993.

Location	Survey Date	Number of Chinook Salmon
Egegik River	Aug. 06	80
Shosky Creek	Aug. 06	58
Whale Mountain Creek	Aug. 16	6
Mossy Creek	Aug. 06	38
Mink Creek	Aug. 06	6
Gertrude Creek	Aug. 06	350
Kaye's Creek	Aug. 06	170
Takayoto Creek	Aug. 06	200
Angle Creek	Aug. 06	^a
Contact Creek	Aug. 06	235
Mainstem King Salmon R.	Aug. 06	^a
Total		1,143

^a No counts made due to murky water.

Table 4. Aerial survey peak counts of chum salmon escapement, Egegik District, 1993.

Location	Survey Dates	Number of Chum Salmon
Egegik River	Aug. 16	100
Shosky Creek	Aug. 06	0
Whale Mountain Creek	Aug. 16	1,020
Mossy Creek	Aug. 06	8
Mink Creek	Aug. 06	1
Gertrude Creek	Aug. 06	1,075
Kaye's Creek	Aug. 06	0
Takayoto Creek	Aug. 06	0
Angle Creek	Aug. 06	^a
Contact Creek	Aug. 06	100
Mainstem King Salmon R.	Aug. 06	^a
Total		2,304

^a Murky water.

Table 5. Aerial survey peak counts of sockeye salmon escapement, King Salmon and Dog Salmon Rivers, Ugashik District, 1993.

Location	Survey Date	Number of Sockeye Salmon
Ugashik River:		
Grassy Creek	Aug. 16	0
Subtotal		0
King Salmon River:		
Needle Lake	Aug. 16	800
Mother Goose Lake	Aug. 16	20
Painter Creek	Aug. 16	10,750
Mainstem King Salmon R.	Aug. 16	11,000
Subtotal		22,570
Dog Salmon River:		
Figure-Eight Creek	Aug. 16	400
Goblet Creek	Aug. 16	0
Oldham Creek	Aug. 16	650
Wandering Creek	Aug. 16	300
Mainstem Dog Salmon R.	Aug. 16	0
Subtotal		1,350
Grand Total		23,920

Table 6. Peak survey counts of chinook salmon escapement, Ugashik District, 1993. All counts from aerial surveys unless otherwise noted.

Location	Survey Date	Number of Chinook Salmon
King Salmon River System:		
Old Creek	Aug. 16	635
Pumice Creek	Aug. 16	450
Painter Creek	Aug. 16	865
Mainstem King Salmon River	Aug. 16	1,970
Mother Goose Lake	Aug. 16	0
Indecision Creek	Aug. 16	0
Volcano Creek	Aug. 16	^a
Subtotal		3,920
Dog Salmon River System:		
Figure-Eight Creek	Aug. 16	515
Goblet Creek	Aug. 16	14
Oldham Creek	Aug. 16	35
Wandering Creek	Aug. 16	0
Mainstem Dog Salmon River	Aug. 16	15
Subtotal	Aug. 16	579
Ugashik River System:		
Ugashik Narrows	July 16	1
Mainstem Ugashik River	July 16	50
Grassy Creek	Aug. 16	36
Subtotal		87
Grand Total		4,586

^a No counts made due to murky water.

Table 7. Peak survey counts of chum salmon escapement, Ugashik District, 1993. All counts from aerial surveys unless otherwise noted.

Location	Survey Date	Number of Chum Salmon
King Salmon River System:		
Old Creek	Aug. 16	1,025
Pumice Creek	Aug. 16	2,040
Painter Creek	Aug. 16	720
Mainstem King Salmon River	Aug. 16	7,000
Mother Goose Lake	Aug. 16	0
Indecision Creek	Aug. 16	8
Needle Lake	Aug. 16	0
Subtotal		10,793
Dog Salmon River System:		
Figure-Eight Creek	Aug. 16	105
Goblet Creek	Aug. 16	0
Oldham Creek	Aug. 16	0
Wandering Creek	Aug. 16	0
Mainstem Dog Salmon River	Aug. 16	0
Subtotal		105
Ugashik River System:		
Mainstem Ugashik River	July 16	75
Grassy Creek	Aug. 16	12
Subtotal		87
Grand Total		10,985

Table 8. Peak aerial live counts and total escapement estimates of sockeye salmon, Wood River system, 1993.

Area	Aerial Counts ¹		Total Escapement Estimate	
	Date	Number	Number	Percent
Wood River	8/15	13,300	26,600	2.3
<u>Lake Aleknagik</u>				
Eagle Creek	8/10	1,200 ^a		
Hansen Creek	8/06	1,480 ^a		
Happy Creek	8/07	2,520 ^{ab}		
Bear Creek	8/06	2,400 ^a		
Yako Creek	8/02	1,510 ^a		
Whitefish Creeks	8/14	450 ^a		
Ice Creek	8/09	4,700		
Mission Creek	8/13	2,090 ^a		
Sunshine Creek	8/09	2,300		
Northshore Beaches	9/07	2,770		
Southshore Beaches	9/07	30		
Yako Beach	9/07	870		
Youth Creek		-		
Total		22,320	203,600	17.3
Agulowak River & Lower River Bay	8/16	66,000	110,000	9.4
<u>Lake Nerka</u>				
Fenno Creek	8/11	4,720 ^{ac}		
Upper River Bay Beaches, NW	9/07	1,460		
Upper River Bay Beaches, SE	9/07	3,200		
Allan Cr. to Ross Cr. Beaches	9/07	4,730		
Pike Creek	8/09	1,720		
Stovall Creek ²	8/09	900		
Bear Creek ²	8/09	50		
Teal Creek	8/09	900		
N4 to River Bay Beach	9/07	430		
N4-N6 Beach	9/07	5,600		
Pick Creek Beach	9/07	570		
Pick Creek	8/13	2,960 ^a		
Elva Creek Beach	9/07	870		
Elva Creek	8/09	200		
Amakuk Arm Beaches	9/07	420 ^b		
Amakuk Arm Beach/Ott's Bay Beach	9/07	1,150		
Ott's Bay Beaches	9/07	950		
Kema Creek ²	8/09	3,800		
Kema Creek Lake Beaches ²		-		

(continued)

Table 8. (page 2 of 3)

Area	Aerial Counts ²		Total Escapement Estimate	
	Date	Number	Number	Percent
<u>Lake Nerka</u> (continued)				
Hidden Lake Creek ²	8/09	1,200		
Hidden Lake Beaches ²		-		
Anvil Bay Beaches	9/07	5,730		
Anvil Bay Beach/Elbow Pt. Beach	9/07	3,110		
Elbow Pt. Beach/Lynx Creek Beach	9/07	1,950		
Lynx Creek/Teal Creek Beaches	9/07	350		
Lynx Creek	8/19	3,020 ^a		
Lynx Lake Beaches	9/07	1,610		
Total		51,600	470,800	40.0
Little Togiak River	8/15	5,600	11,000	0.9
<u>Little Togiak Lake</u>				
Northshore Beaches	9/07	370		
Southshore Beaches	9/07	600		
D Slough Beach	9/07	1,260 ^b		
Total		2,230	20,300	1.7
Agulukpak River	8/15	76,000	127,000	10.8
<u>Lake Beverley</u>				
Hardluck Bay Beaches	9/07	2,700		
Sam's Beach	9/07	20		
Golden Horn Beaches	9/07	40 ^b		
Silver Horn Beaches	9/07	1,210 ^b		
B12 & B9 Beaches	9/07	120		
Tsun Creek	8/09	10		
Moose Creek	8/09	9,200		
Hope Creek	8/09	2,300		
Hope Creek Lake Beach		-		
Total		15,600	142,300	12.1
Peace River	8/15	900	2,000	0.2

(continued)

Table 8. (page 3 of 3)

Area	Aerial Counts ²		Total Escapement Estimate	
	Date	Number	Number	Percent
<u>Lake Mikchalk</u>				
Narrows	9/07	230		
Northshore Beaches	9/07	40		
Southshore Beaches				
Total		270	2,500	0.2
Wind River	8/15	550	1,100	0.1
<u>Lake Kulik</u>				
K5 Creek/Grant River Beaches	9/07	540		
Grant River to K2 Creek Beaches	9/07	500		
Southshore Beaches	9/07	510		
K1 and K2 Creeks	8/15	3,150		
Total		4,700	42,900	3.6
Grant River	8/15	8,100	16,000	1.4
TOTAL		267,170	1,176,126	100.0

¹ All counts rounded to nearest 10 fish.

² Lake access blocked by beaver dams.

^a Ground survey counts conducted by F.R.I., University of Washington.

^b Minimal estimate due to late survey or poor conditions.

^c Includes carcass count due to late survey.

Table 9. Peak aerial live counts and total escapement estimates of sockeye salmon, Togiak District, 1993.

Stream	Aerial Count		Total Escapement Estimate	
	Date	Number	Factor ¹	Number
TOGIAK SECTION				
Togiak Tower				177,185
Togiak River (Mainstem)	8/16	2,300	2.0	4,600
Gechiak Lake System	8/16	1,270	3.0	3,810
Pungokepuk Lake System	8/16	540	3.0	1,620
Nayorurun River ²				
Kemuk River ²				
Ongivinuck Lake System	8/16	2,950	2.0	5,900
Subtotal		7,060		15,930
KULUKAK SECTION				
Kulukak River ³	7/26	4,580	2.0	9,160
Kulukak Lake	7/26	5,020	2.0	10,040
Tithe Creek Ponds	8/16	6,300	2.0	12,600
Subtotal		15,900		31,800
MATOGAK, OSVIAK, and CAPE PIERCE SECTIONS				
Matogak River ²				
Osviak River ²				
Slug River ²				
Subtotal				
OTHER RIVERS				
Quigmy River ²				
Negukthlik River ³	7/29	3,100 ^a	2.0	6,200
Ungalikthluk River ³	7/29	5,680	2.0	11,360
Subtotal		8,780		17,560
TOTAL		31,740		242,475

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

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

³ Sockeye salmon count obtained during chinook and chum salmon surveys.

^a Primarily schooled fish.

Table 10. Peak aerial live counts and total escapement estimates of chinook salmon, Togiak District, 1993.

Stream	Aerial Counts		Total Escapement Estimate	
	Date	Number	Factor ¹	Number
TOGIAK SECTION				
Togiak River Mainstem				
A	7/27	170	3.0	510
B	7/27	120	3.0	360
C	7/27	220	3.0	660
D	7/27	160	3.0	480
E	7/26			
F	7/26	1,810 ^a	2.5	4,525
Subtotal		2,480		6,535
Gechiak River	7/27	595	2.5	1,488
Pungokepuk River	7/27	240	2.5	600
Naorurun River	7/27	130	2.5	325
Kemuk River	7/27	65	2.5	163
Ongivinuk River	7/26	440	2.5	1,100
Subtotal		3,950		10,210
KULUKAK SECTION				
Kulukak River	7/26	1,140	2.5	2,850
MATOGAK, OSVIAK, and CAPE PIERCE SECTIONS				
Matogak River ²	7/26	80	2.5	200
Osviak River ²	7/26	110	2.5	275
Slug River ²	7/26	100	2.5	250
Subtotal		290		725
OTHER RIVERS				
Quigmy River ³				
Negukthlik River	7/29	830	2.5	2,075
Ungalikthluk River	7/29	70	2.5	175
Subtotal		900		2,250
TOTAL		6,280		16,035

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

² USFWS estimate.

³ No aerial surveys conducted.

^a Includes count for Section E.

Table 11. Peak aerial live counts and total escapement estimates of chum salmon, Togiak District, 1993.

Stream	Aerial Counts		Total Escapement Estimate	
	Date	Number	Factor ¹	Number
TOGIAK SECTION				
Togiak River Mainstem				
A	7/27	6,500	2.5	16,250
B	7/27	3,500	2.5	8,750
C	7/27	2,300	2.5	5,750
D	7/27	60	2.5	150
E	7/26			
F	7/26	4,400 ^a	2.0	8,800
Subtotal		16,760		39,700
Gechiak River	7/27	1,950	2.0	3,900
Pungokepuk River	7/27	450	2.0	900
Naorurun River	7/27	4,380	2.0	8,760
Kemuk River	7/27	620	2.0	1,240
Ongivinuk River	7/26	3,500	2.0	7,000
Subtotal		27,660		61,500
KULUKAK SECTION				
Kulukak River	7/26	6,950	2.0	13,900
MATOGAK, OSVIAK, and CAPE PIERCE SECTIONS				
Matogak River ²	7/26	1,970	2.0	3,940
Osviak River ²	7/26	1,360	2.5	3,400
Slug River ²	7/26	3,060	2.5	7,650
Subtotal		6,390		14,990
OTHER RIVERS				
Quigmy River ³				
Negukthlik River	7/29	20	2.0	40
Ungalikthluk River	7/29	4,020	2.0	8,040
Subtotal		4,040		8,080
TOTAL		45,040		98,470

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

² USFWS estimate.

³ No aerial survey conducted.

^a Includes counts for Section E.

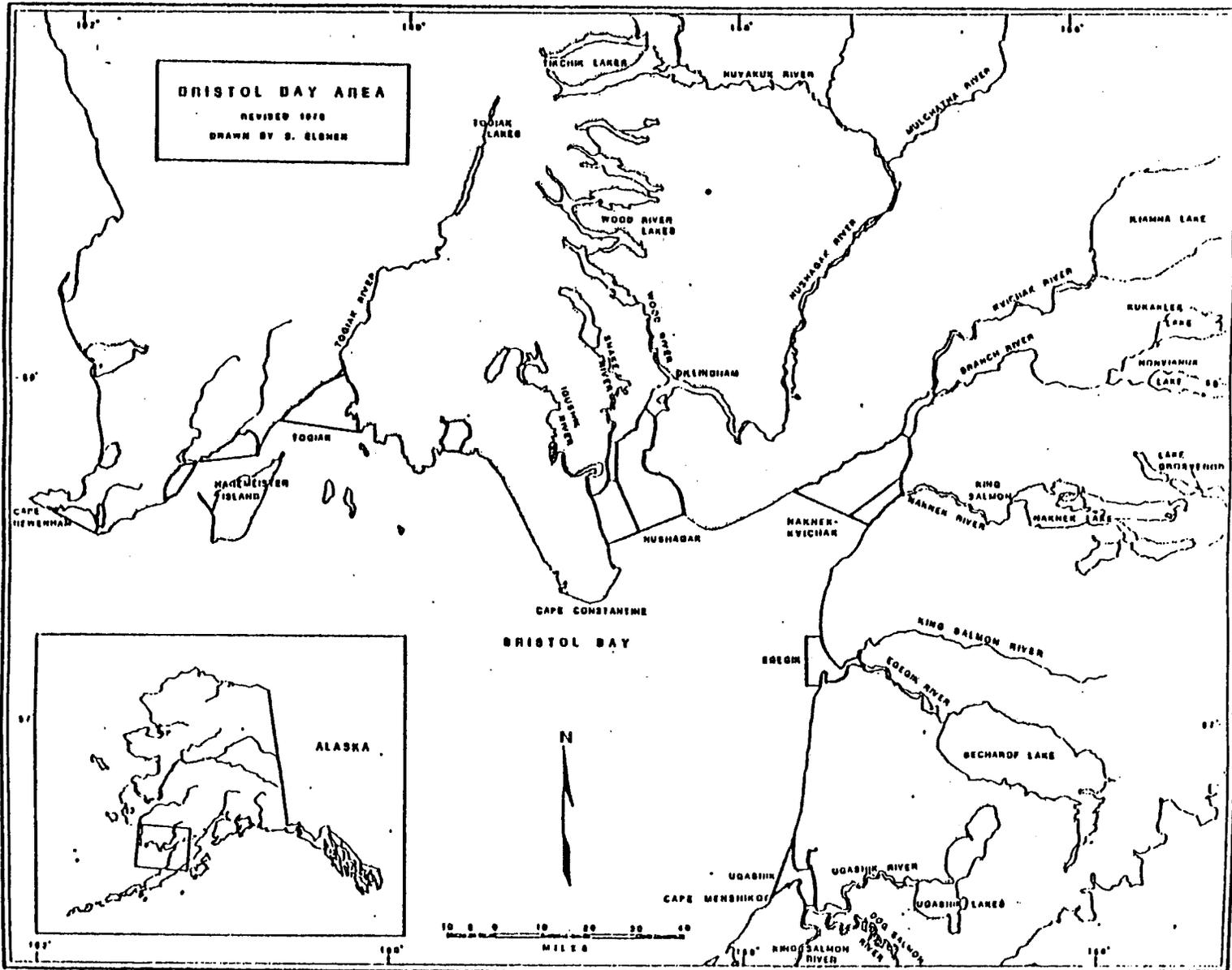


Figure 1. Bristol Bay management area, Alaska.

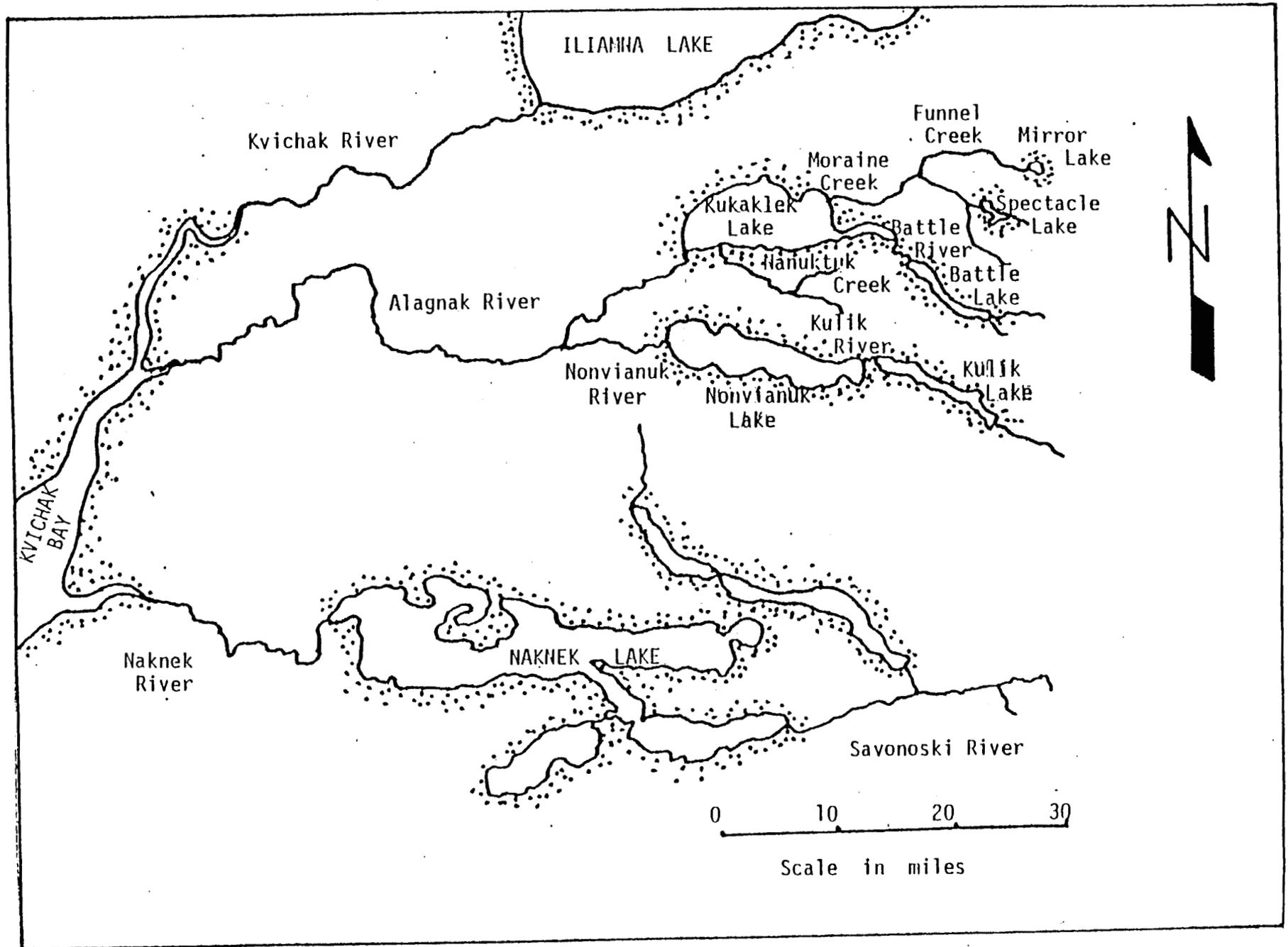


Figure 2. Alagnak River drainage, Bristol Bay, Alaska.

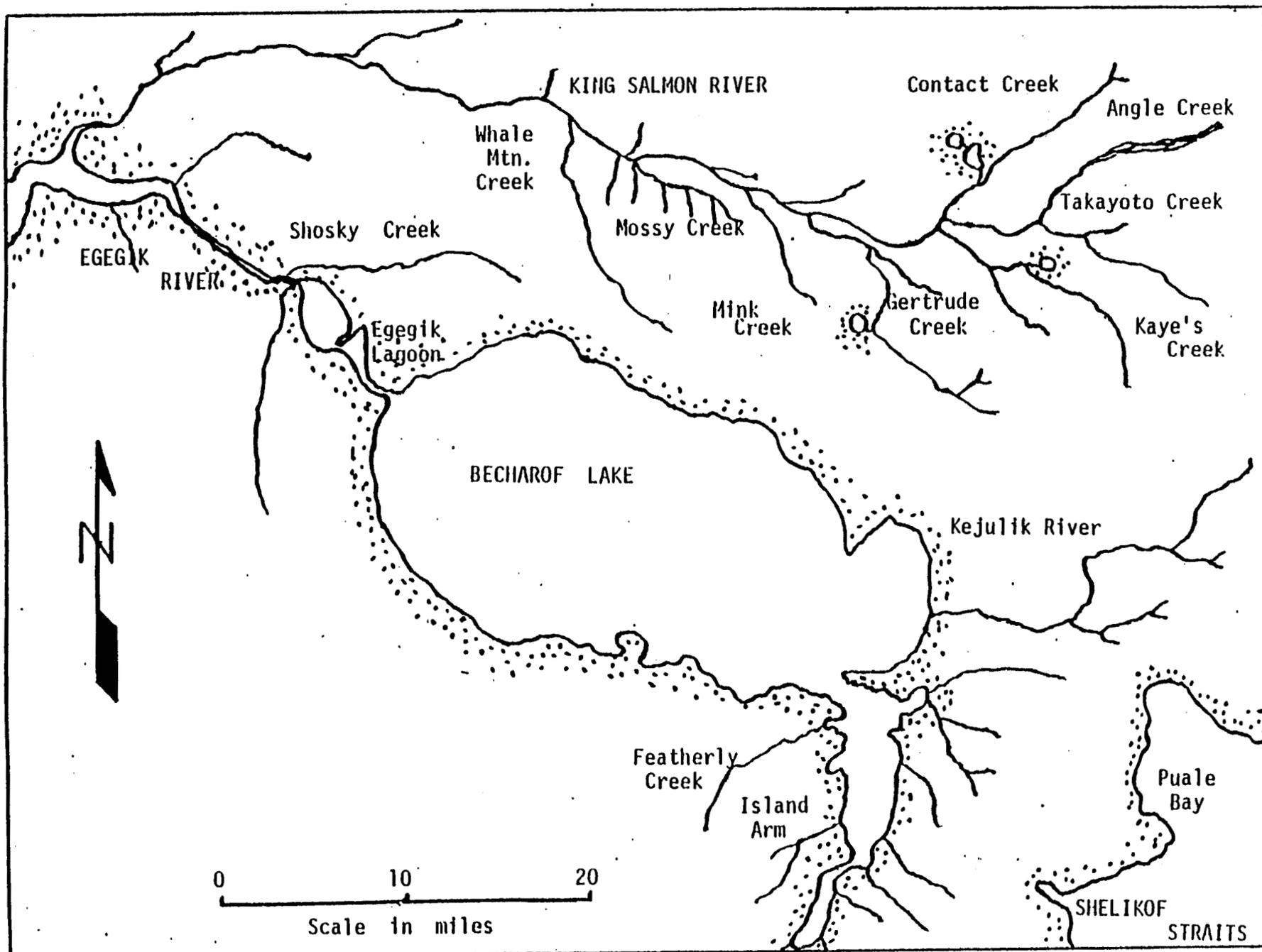


Figure 3. Egegik River drainage, Bristol Bay, Alaska.

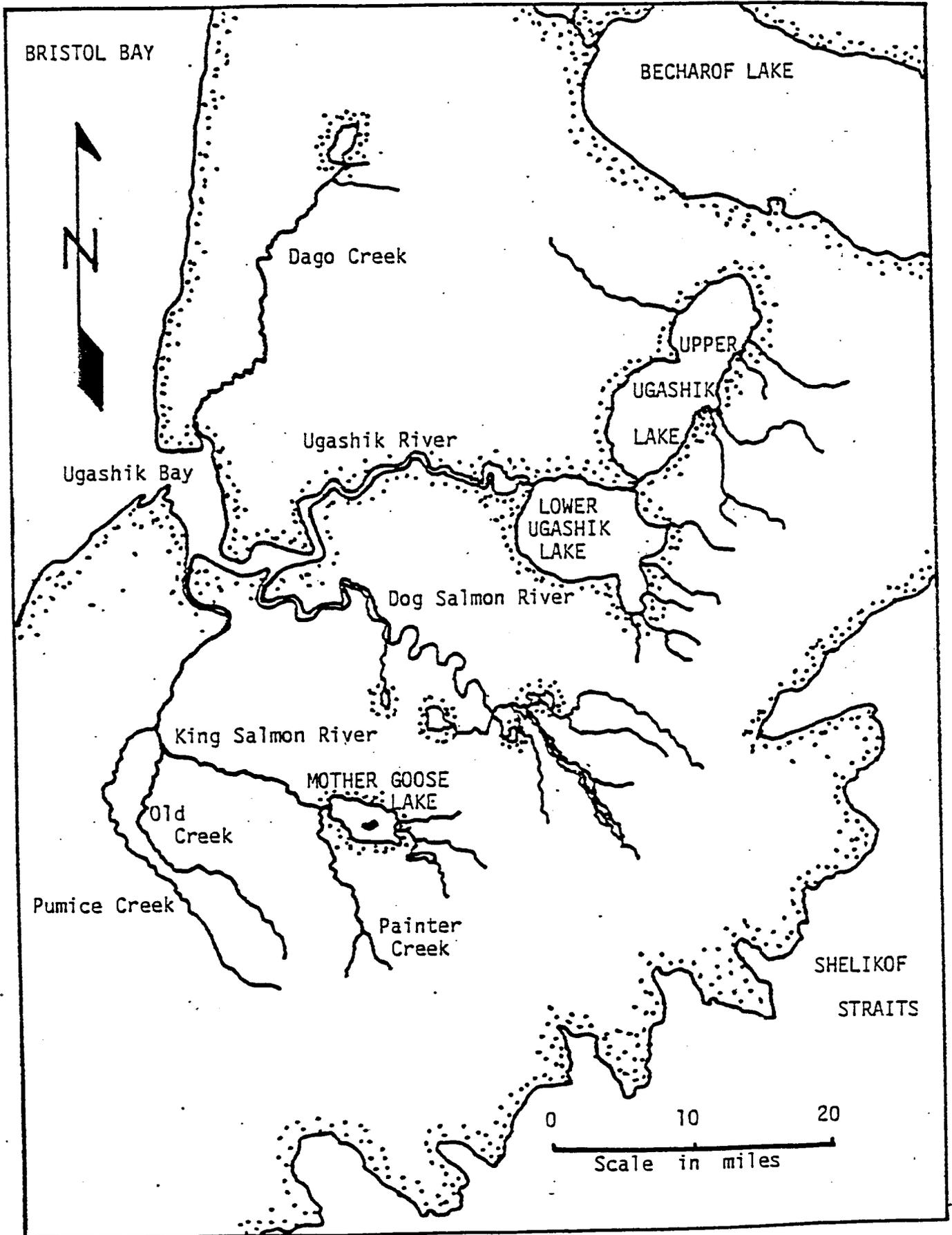


Figure 4. Ugashik River System, Bristol Bay, Alaska.

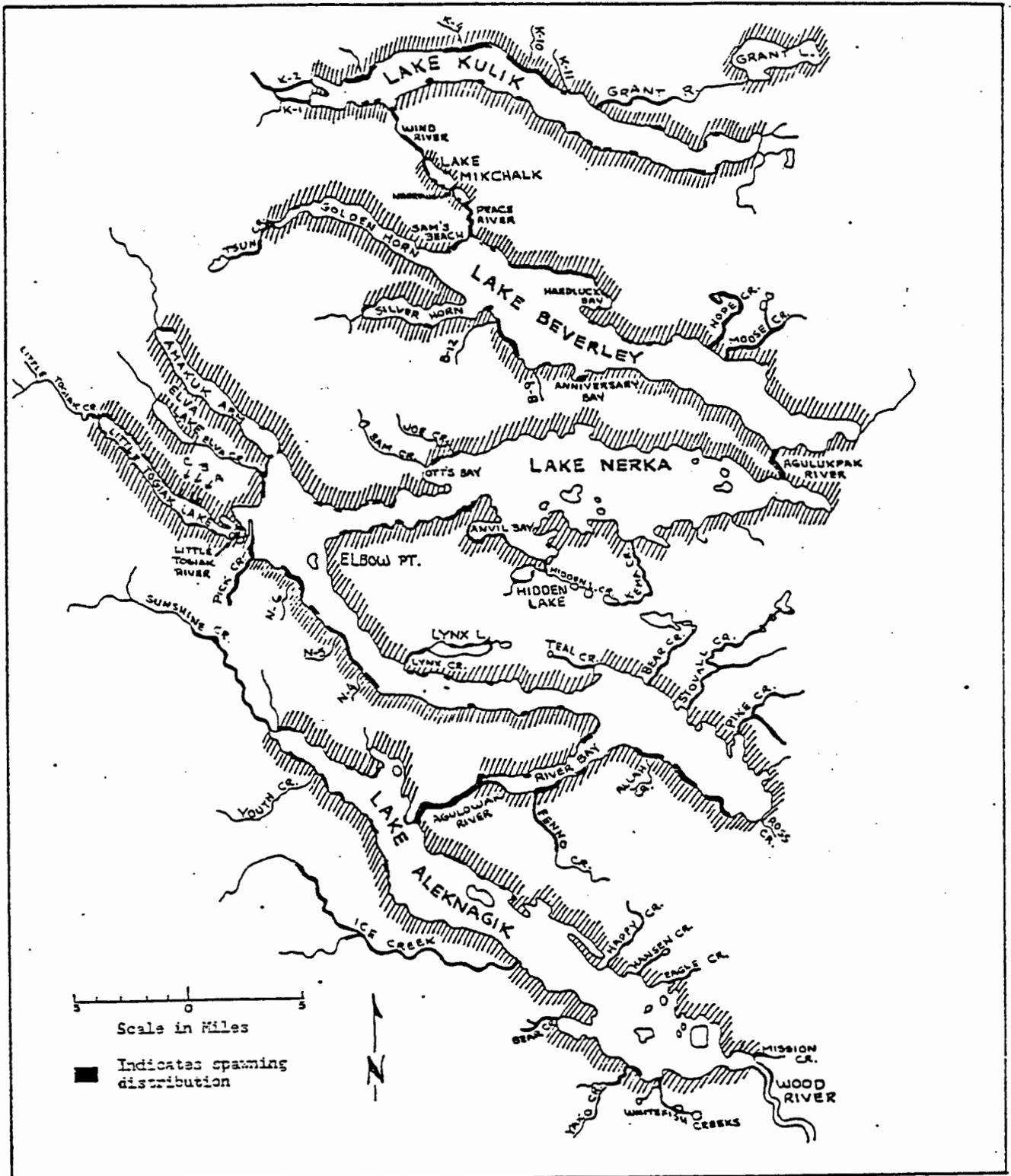


Figure 5. Wood River Lakes system, Bristol Bay, Alaska.

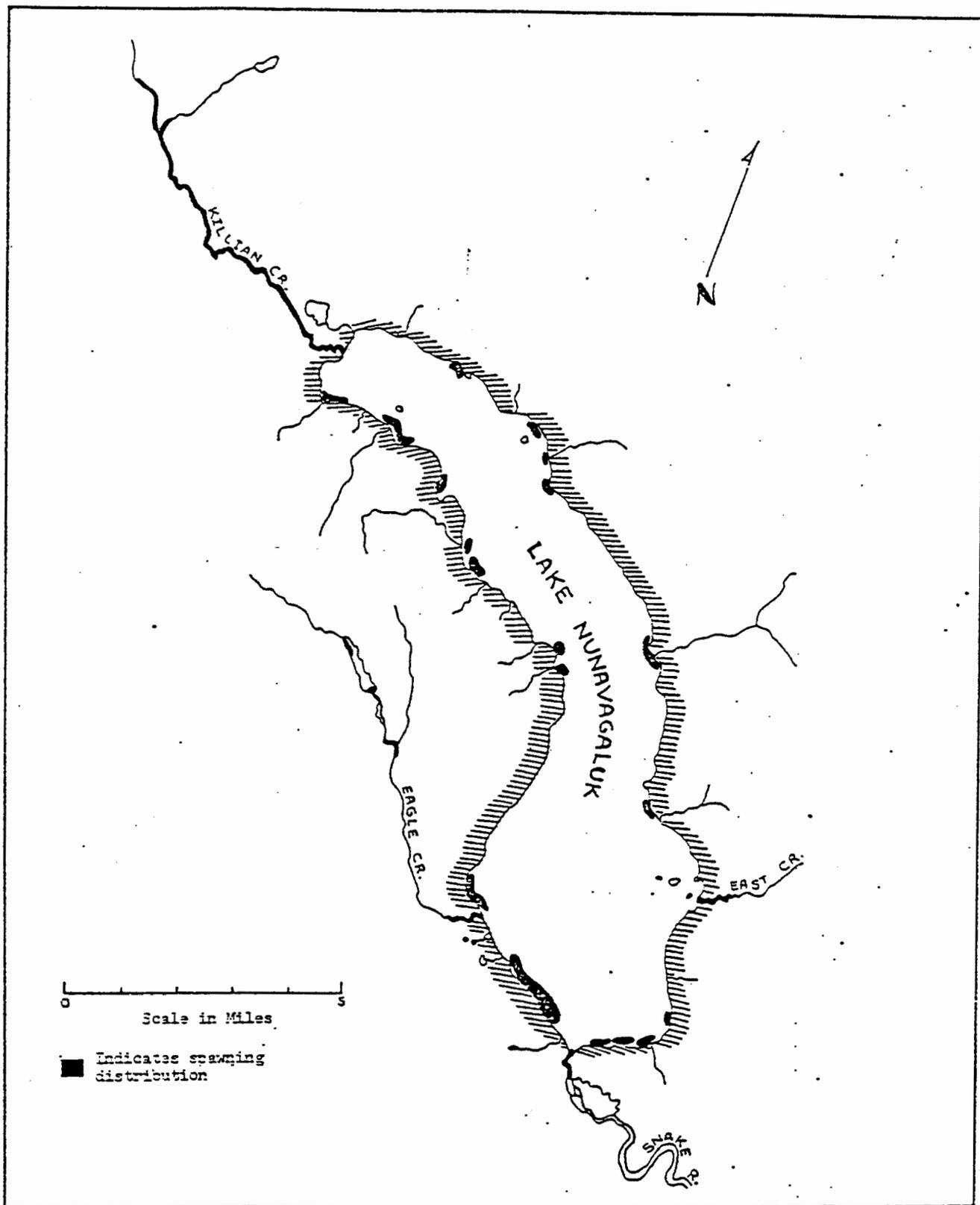


Figure 6. Lake Nunavaugaluk system, Bristol Bay, Alaska.

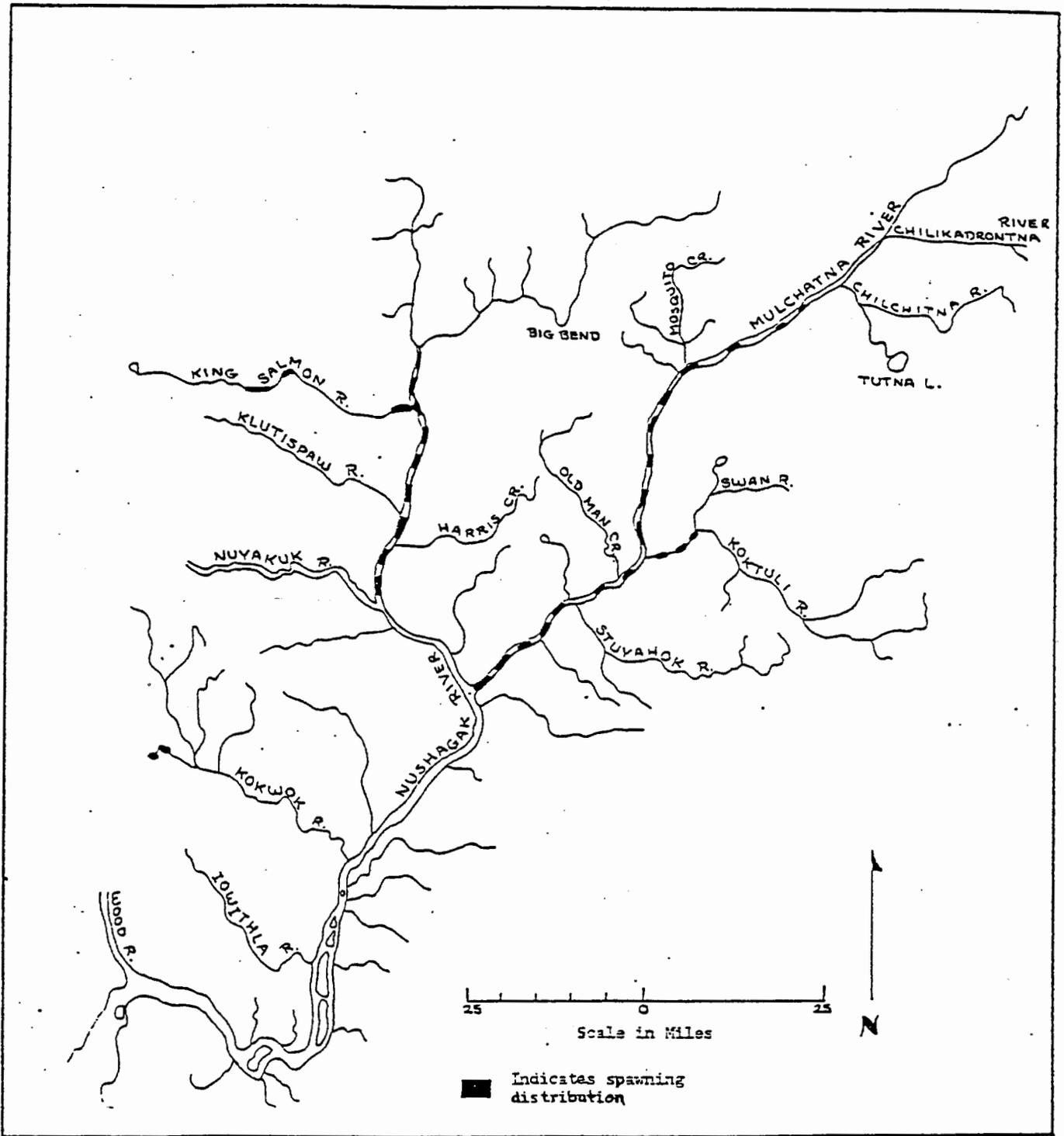


Figure 7. Nushagak-Mulchatna River system, Bristol Bay, Alaska.

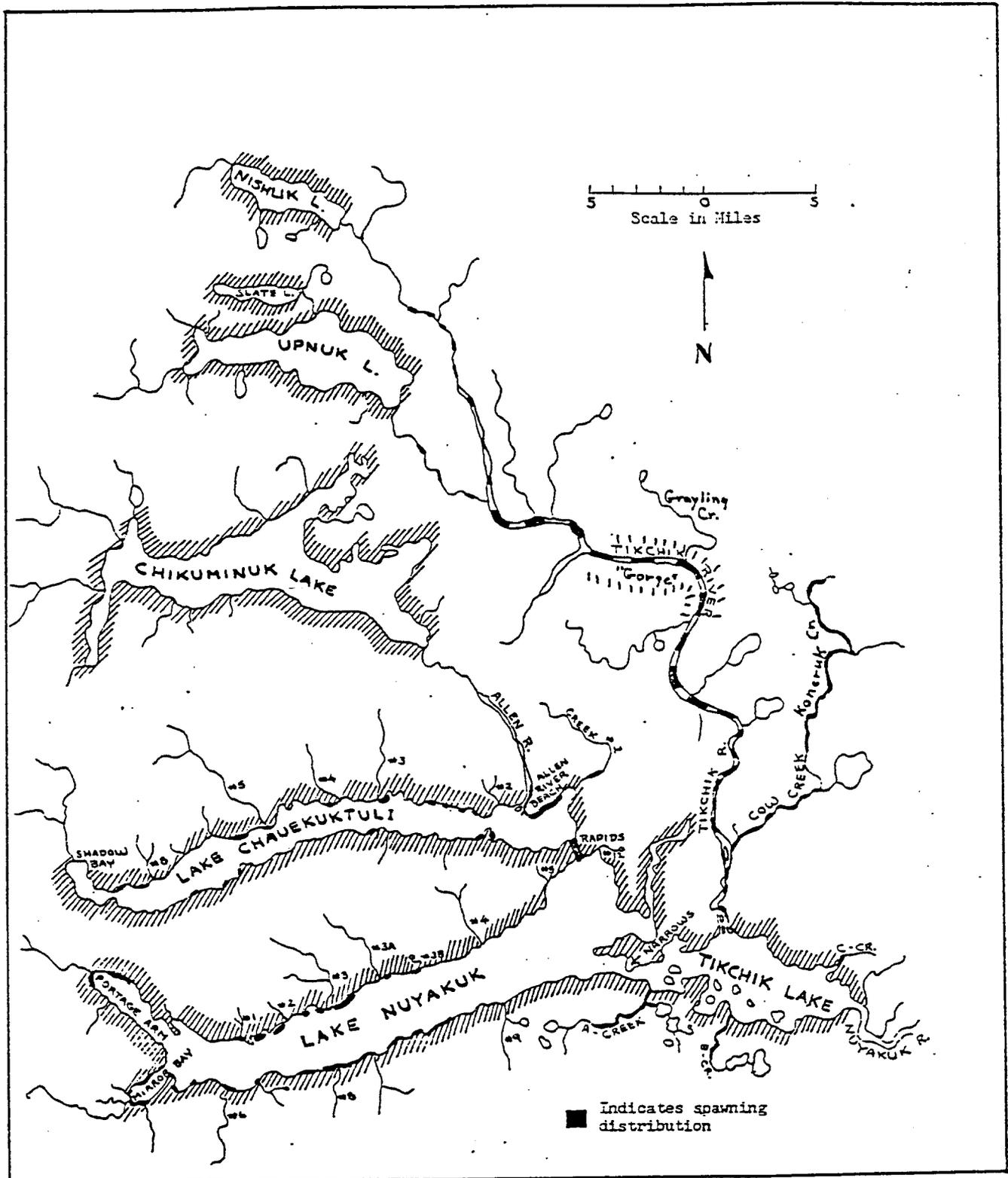


Figure 8. Tikchik Lakes system, Bristol Bay, Alaska.

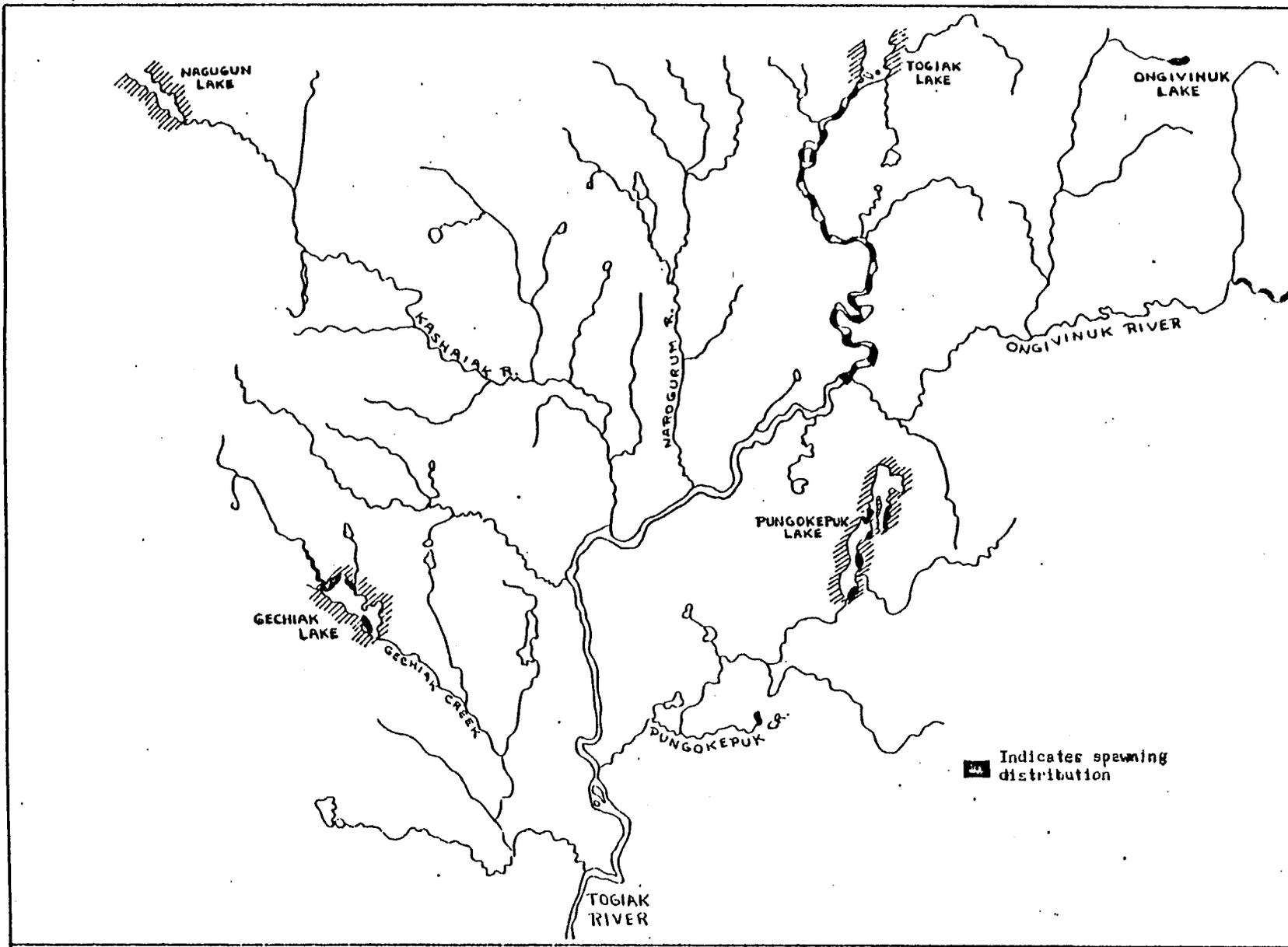


Figure 9. Togiak River system, Bristol Bay, Alaska.

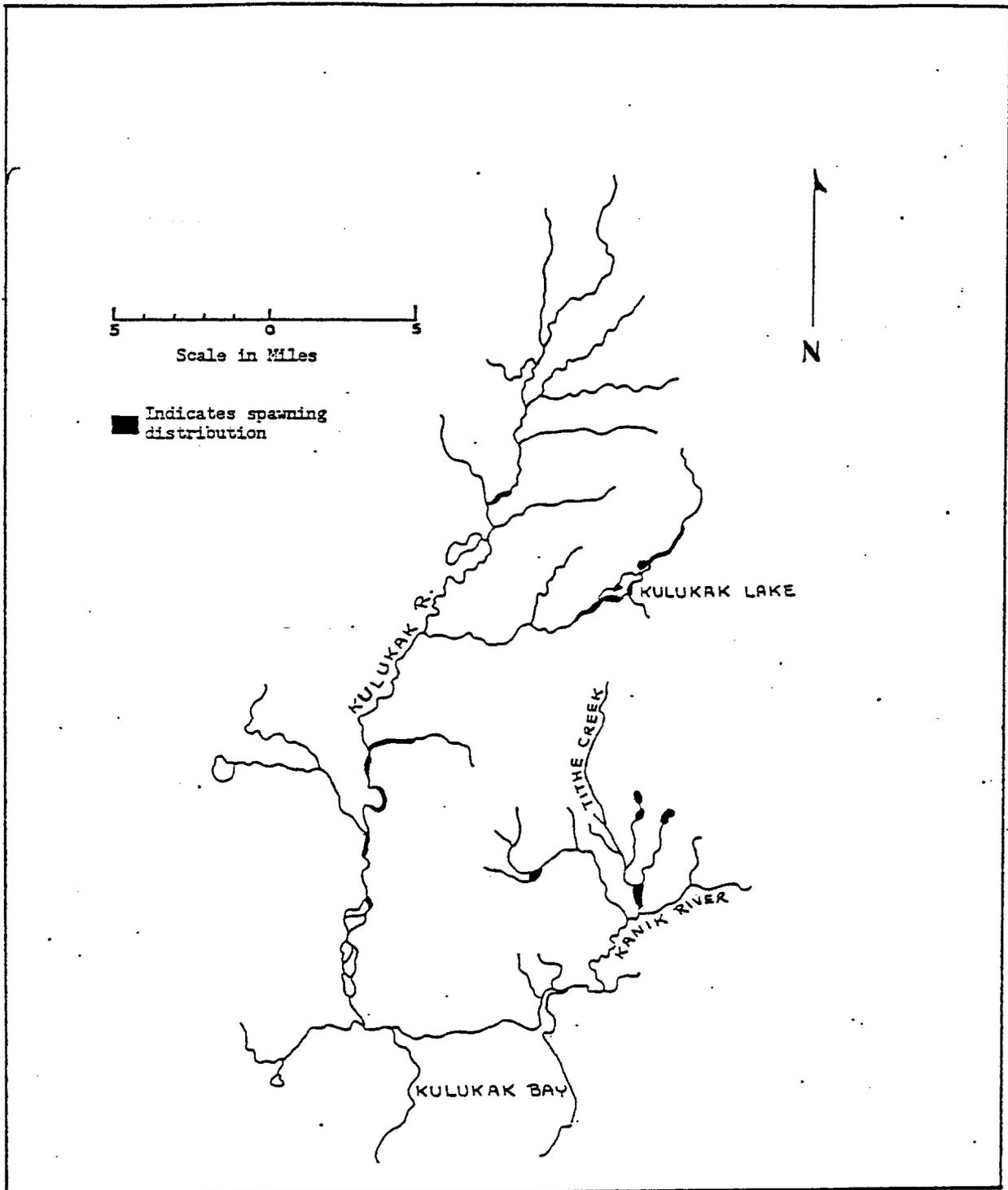


Figure 10. Kulukak River system, Bristol Bay, Alaska.

APPENDIX

Appendix Table 1. Sockeye salmon total escapement estimates, Naknek-Kvichak District, 1955-1993. Estimates based on visual counts from towers unless otherwise noted.

Year	Escapement			Total	Alagnak
	Kvichak	Naknek	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	634,655 ^b	126,595	3,604,060	4
1958	534,785	278,118	94,650	907,553	10
1959	680,000	2,231,807	825,431	3,737,238	22
1960	14,630,000	828,381	1,240,530	16,698,911	7
1961	3,705,849	351,078	90,036	4,146,963	2
1962	2,580,884	723,066	90,630	3,394,580	3
1963	338,760	905,358	203,304	1,447,422	14
1964	957,120	1,349,604	248,700	2,555,424	10
1965	24,325,926	717,798	175,020	25,218,744	1
1966	3,775,184	1,016,445	174,336	4,965,965	4
1967	3,216,208	755,640	202,626	4,174,474	5
1968	2,557,440	1,023,222	193,872	3,774,534	5
1969	8,394,204	1,331,202	122,490	9,847,896	1
1970	13,935,306	732,502	177,060	14,844,868	1
1971	2,387,392	935,754	187,302	3,510,448	5
1972	1,009,962	586,518	151,188	1,747,668	9
1973	226,554	356,676	35,280	618,510	6
1974	4,433,844	1,241,058	214,848	5,889,750	4
1975	13,140,450	2,026,686	100,480	15,267,616	1
1976	1,965,282	1,320,750	81,822	3,367,854	2
1977	1,341,144	1,085,856	100,000 ^a	2,527,000	4
1978	4,149,2881	813,378	229,400 ^a	5,192,066	4
1979	1,218,434	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
Mean	5,596,887	1,226,971	234,899	7,058,758	3

^a Aerial survey index counts.

^b Weir counts.

Appendix Table 2. Aerial survey index counts of chinook salmon escapements, Naknek River drainage, 1970-1993.

Year	Mainstem Naknek River	Paul's Creek	King Salmon Creek	Big Creek	Total
1970	3,060		260	825	4,145
1971	1,639	52	704	490	2,885
1972	351	156	1,224	1,060	2,791
1973	1,315		115	1,106	2,536
1974		91	495	860	1,446
1975	2,250	144	279	779	3,452
1976	5,950	31	180	970	7,131
1977	4,830		1,860		6,690 ^a
1978					^a
1979					
1980	300	17		30	347
1981	2,890		591	790	4,271
1982	5,360	340	980	1,930	8,610
1983	2,860	290	460	4,220	7,830
1984	790	400	385	3,420	4,995
1985	590				590
1986	2,200	73	102	1,542	3,917
1987	2,800	7	290	1,353	4,450
1988	7,380	150	600	3,600	11,730
1989	1,700	50	100	860	2,710
1990	4,500	150	350	2,000	7,000
1991	1,655	121	275	2,340	4,391
1992	1,550	88	158	895	2,691
1993	5,520	86	700	1,710	8,016
Total	59,490	2,246	10,108	30,780	102,624
Mean Index	2,833	132	505	1,539	5,009 ^b
Percent	57	3	10	31	100

^a Non-expanded index counts unavailable.

^b Sum of mean indices.

Appendix Table 3. Chinook salmon escapement survey history, Mainstem Naknek River, 1929-1993.

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

¹ Weir count provides no estimate of 15-20% of population spawning downstream of weir site, or the fish passing before and after weir in operation.

² Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

* Includes only largest index count each year.

Appendix Table 4. Chinook salmon escapement survey history, Big Creek, Naknek River drainage, 1963-1993.

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

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

^a Includes only largest index count each year.

Appendix Table 5. Chinook salmon escapement survey history, King Salmon Creek, Naknek River drainage, 1964-1993.

Year	Count Dates	Surveyor	Float Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ¹	Comments
1964	7/31	Paddock		378		Helicopter. Survey fair.
	8/11	Paddock		55		Helicopter. Poor visibility.
	8/11-8/14	Paddock	104			Past peak. Turbid.
1966	7/31-8/03	Redick	633			At or near peak.
1967	7/24-7/26	Paddock	289		600	Poor visibility.
1968	7/17	Whitehead		282		Helicopter. Pre-peak.
	7/17	Meyers		242		Helicopter. Pre-peak.
	7/20	Whitehead		868		H-21 helicopter. Good survey.
	7/20	Meyers		575		H-21 helicopter. Good survey.
	7/20-7/23	Whitehead	2,204			Count conditions optimal.
1969	7/23-7/25	Parkinson	2,722			Pre-peak. Survey fair.
1970	7/19	Whitehead		260		Pre-peak. Poor visibility.
1971	7/28	Cunningham		704		Good visibility.
1972	7/29	Siedelman		1,224		At spawning peak.
1973	8/01	Siedelman		115		Past peak. Visibility fair.
1974	7/15	Russell		164	350	Pre-peak. Fish in pools.
	7/28	Russell		495	625	At/near peak. Good visibility.
1975	7/28	Russell		279	375	Pre-peak. Good visibility.
	8/10	Russell	67			Lower 12 miles of stream.
	8/17			0		Spawning over. Good visibility.
1976	8/03	Bill		180	400	Peak within next three days.
1977	7/29	Russell		1,860	2,350	At spawning peak.
1978	8/09	Gwartney			350	Past peak. Good survey.
1979		Gwartney			1,750	
1980	8/08	Bill				Creek to murky to count.
1981	7/30	Russell		591	1,500	At peak. Visibility fair/poor.
1982	8/07	Bill		980	3,920	Good visibility.
1983	8/14	Bill		460	1,400	30% dead. Poor visibility.
1984	8/08	Bill		385	1,155	
1985	8/06	Bill			500	
1986	8/08	Meyer		70		Poor survey conditions.
	8/11	Meyer		102	284	Past peak. Fair survey.
1987	8/13	Russell		290	800	Past peak. Poor visibility.
	8/21	Meyer		13	33	Estimate based on jet boat trip, carcass samplers Past peak by 2 weeks.
1988	8/08	Minard		600		At peak.
1989	8/14	Minard		100		Past peak.
1990	8/06	Minard		350		
1991	7/30	Russell		100		Pre-peak. Survey fair.
	8/05	Russell		275		At peak. Fish on redds.
1992	8/09	Russell		158		Past peak. Includes 47 dead.
1993	7/31	Russell		700	900	Slightly pre-peak.
Totals			5,952	11,354*		
Mean			1,190	516		

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

* Includes only largest index count each year.

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

Year	Count Dates	Surveyor	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ¹	Comments
1971	7/28	Cunningham	52		
1972	7/28	Siedelman	156		Pre-peak.
1973	8/01	Siedelman			Too murky to survey.
1974	7/15	Russell	2		
	7/26	Russell	91	250	Pre-peak.
1975	7/28	Russell	144	225	Pre-peak. Good visibility.
1976	8/03	Bill	31	100	At peak. Poor visibility.
1977					No count.
1978	8/09	Gwartney		300	Past peak. 75% dead.
1979					No count.
1980	8/08	Bill	17		All carcasses. Murky.
1981					No count.
1982	8/07	Bill	340	1,020	Near peak. Good visibility.
1983	8/14	Bill	290	800	Poor visibility.
1984	8/08	Bill	400	800	Fair visibility. 25% dead.
1985	8/06	Bill		170	Pre-peak.
1986	8/08	Meyer	73	236	Approximately 30% dead already.
1987	8/13	Russell	7		Past peak. Poor survey visibility.
		Meyer		400	Estimate based on jet boat trip by carcass samplers.
1988	8/08	Minard	150		At peak.
1989	8/14	Minard	50		Past peak. Excellent visibility.
1990	8/06	Minard	150		Excellent survey conditions.
1991	7/30	Russell	121		Slightly pre-peak.
1992	8/01	Russell	81		Slightly pre-peak.
1993	7/31	Russell	86	140	A little pre-peak.
Totals			2,246 ^a		
Mean			132		

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

^a Includes only largest index count each year.

Appendix Table 7. Chinook salmon escapement survey history, Alagnak River, 1963-1993.

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

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

* Includes only largest index count each year.

Appendix Table 8. Chinook salmon escapement survey history, Kvichak River, 1932-1993.

Year	Count Dates	Surveyor	Weir Count ¹	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ²	Comments
1932	6/28-8/05		5,753			Peak Count 7/05.
1976	8/16	Bill		35	45	Survey targeting pinks.
1980	8/08	Bill		900	1,000	Actively spawning.
1984	8/14	Bill		200		
1988	8/13	Bill		190	570	Nearly all on redds.
1989	8/16	Bill		100	260	
1990	8/19	Bill		170	510	
1992	8/13	Regnart		264		All fish on redds.
1993	8/16	Regnart		115		All on Kaskanak Flats.
Totals			5,753	1,974 ^a		
Mean				247		

¹ Weir count provides no estimate of population spawning downstream of weir site, or fish passing before and after weir in operation.

² Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

^a Includes only largest index count each year.

Appendix Table 9. Chinook salmon escapement index data, Naknek-Kvichak District, 1970-1993.

Year	Non-expanded Escapement Indices by Drainage			
	Kvichak	Naknek	Alagnak	Total
1970		4,145 ^a	5,250	9,395
1971		2,885	1,420	4,305
1972		2,791	2,256	5,047
1973		2,536 ^a	824	3,360
1974		1,446 ^b	1,596	3,042
1975		3,452	6,620	10,072
1976	35	7,131	7,593	14,759
1977		6,690 ^c	3,634	10,324
1978		^c	11,650 ^c	11,650 ^c
1979				
1980	900	347 ^d	2,930	4,177
1981		4,271 ^a	2,430	6,701
1982		8,610	3,400	12,010
1983		7,830	2,980	10,810
1984	200	4,995	6,090	11,285
1985		590 ^e	3,920	4,510
1986		3,917	3,090	7,007
1987		4,450	2,420	6,870
1988	190	11,730	4,600	16,520
1989	100	2,710	3,650	6,460
1990	170	7,000	1,720	8,890
1991		4,391	2,531	6,922
1992	264	2,691	3,042	5,997
1993	115	8,016	10,170	18,301
Totals	1,974	102,624	93,816	198,414
Mean	247	4,665	4,079	8,990 ^f

¹ Includes aerial indices from all streams surveyed in drainage.

^a No index count for Paul's Creek.

^b No index count for Naknek River.

^c No non-expanded index counts exist for this year.

^d Includes only index counts for Naknek River & Paul's Creek.

^e Naknek River mainstem only.

^f Sum of mean indices.

Appendix Table 10. Chum salmon escapement survey history, Alagnak River, 1961-1993.

Year	Count Dates	Surveyor	Tower Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ¹	Comments
1961			18,906			
1962			3,846			
1963	8/12	Siedelman	20,124	4,120		
1964			2,562			
1965			132			
1966			9,990			
1967			72			
1968			210			
1969			5,790			
1970			402			
1971			48			
1972						
1976	8/16	Bill		2,125	5,250	
1977	8/18	Bill		35,000		Only upper 1/2 river.
1978	8/24	Bill		9,900		
1980	8/21	Bill		7,300	14,600	
1981	8/26	Bill		75,000		
1982	8/09	Bill		14,000	42,000	
	8/19	Bill		12,000	30,000	
1983	8/15	Bill		8,800		Pre-peak.
1984	8/14	Bill		48,000	87,500	
1985	8/07	Bill		18,200	31,200	Includes 11,700 dead.
1986	8/11	Bill		41,400	107,000	Near peak. Lots of dead.
1987	8/22	Bill		7,800	39,000	Past peak. Lots dead.
1988	8/12	Bill		59,000		Pre-peak. Minimum estimate.
1989	8/15	Bill		3,700	4,000	
	8/28	Bill		6,000		
1990	8/08	Bill		8,500	30,000	Pre-peak.
	8/18	Bill		48,800		Near peak.
1991	8/09	Regnart		43,000		Pre-peak.
	8/19	Regnart		64,300		At peak of spawning.
1992	8/10	Regnart		114,000		Near peak.
1993	8/09	Regnart		4,600		
Totals			39,330	568,345 ^a		
Mean			3,575	31,575		

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

^a Includes only largest index count each year.

Appendix Table 11. Pink salmon escapement survey history, Alagnak River, 1968-1992.

Year	Count Dates	Surveyor	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ¹	Comments
1968	8/27	Siedelman	97,000	125,000	
1970					No survey.
1972					No survey.
1974	8/14	Bill	20,600		Big schools. Pre-peak
1976	8/16	Bill	6,375	13,000	Pre-peak.
1978	8/24	Bill	330,300	736,000	Just starting to spawn.
1980	8/21	Bill	121,000	242,000	
1982	8/09	Bill	21,300	63,900	Pre-peak.
	8/19	Bill	24,800	43,000	Pre-peak.
1984	8/14	Bill	296,500	567,100	Pre-peak. Most schooled.
1986	8/11	Bill	48,600	145,800	
1988	8/12	Bill	415,000	620,000	Pre-peak.
1990	8/08	Bill	45,100		Pre-peak.
	8/18	Bill	240,500		Estimate one week pre-peak.
1992	8/10	Regnart	15,000		Pre-peak.
Totals			2,246 [*]		
Mean			132		

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

^{*} Includes only largest index count each year.

Appendix Table 12. Pink salmon escapement survey history, Kvichak River, 1966-1992.

Year	Count Dates	Surveyor	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ¹	Comments
1966		Robertson		67,500	
1968	8/26	Siedelman		88,000	
1970					No survey.
1972					No survey.
1974	8/14	Bill		30,560	
1976	8/16	Bill		16,100	Pre-peak
1978	8/28	Bill	88,000	440,000	Still migrating and 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.
Totals			325,300		
Mean			65,060		

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

Appendix Table 13. Pink salmon escapement survey history, Naknek River, 1974-1992.

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

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

Appendix Table 14. Aerial survey index counts of chinook salmon escapement, Egegik District, 1981-1993.

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

^a Survey done 10 to 14 days later than normal.

^b Tower counts.

^c Sum of mean indices for all locations.

Appendix Table 15. Aerial survey index counts of chum salmon escapement, Egegik District, 1982-1993.

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

^a Survey done 10 to 14 days later than normal.

^b Tower counts.

^c Total derived by adding Aug. 02 count to one half the counts obtained on Aug. 07, 12, 17, and 28.

^d Sum of mean indices for all locations.

Appendix Table 16. Aerial survey index counts of pink salmon escapement, Egegik District, 1982-1992.

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

Appendix Table 17. Aerial survey index counts of coho salmon escapement, Egegik District, 1981-1993.

Year	Number of Surveys	Coho Salmon Count	Comments
1981	2	15,000	Spawning in Egegik River "Rapids" on Aug. 26.
1982	0	58	Counted during float trip of Gertrude Creek.
1983	3	17,000	Peak count for Egegik River was 13,000 on Aug 31.
1984	3	0	
1985	1	2,500	Count made Aug. 19.
1986	6	0	
1987	6	23,000	Peak count made Sept. 7.
1988	8	300	
1989	6	17,000	Peak count made Aug. 23.
1990	1	0	
1991	0		No pink salmon surveys flown.
1992			
1993			

* Survey done by USFWS personnel.

Appendix Table 18. Aerial survey index counts of chinook salmon escapement, Ugashik District, 1980-1993.

Year	Ugashik River	Dog Salmon River ^a	King Salmon River	Painter Creek	Pumice Creek	Old Creek	Total
1980			900	1,000			1,900
1981			50	300			350
1982			700	700			1,400
1983	50	965	525	635	1,800	660	4,635
1984	108 ^c	840	4,100	1,880	1,100	880	8,908
1985	200 ^c	560	4,601	410	930	410	7,111
1986	66 ^c	252	1,777	646	705	739	4,185
1987	138 ^c	751	981	1,051	1,602	1,155	5,678
1988	249 ^b	900	5,820	1,170	1,025	660	9,824
1989	226 ^{bc}	848	1,670	1,030	510	520	4,804
1990	55 ^b	540	1,500	590	450	610	3,745
1991	91 ^{bc}	449	700	365	375	420	2,400
1992	200 ^{bc}	821	1,260	855	750	815	4,701
1993	123 ^{bc}	579	1,970	865	450	635	4,637
Total	1,521	7,505	26,554	11,497	9,697	7,504	64,278
Mean	109	682	1,897	821	882	682	5,073 ^d

^a Includes Figure-Eight, Goblet, Oldham, & Wandering Creeks.

^b Survey included Grassy Creek.

^c Ugashik River tower count.

^d Sum of mean indices for all locations.

^e Tower count plus later aerial survey counts of main river.

Appendix Table 19. Aerial survey index counts of chum salmon escapement, Ugashik District, 1980-1993.

Year	Ugashik River	Dog Salmon River ^a	King Salmon River	Painter Creek	Pumice Creek	Old Creek	Other	Total
1980	18 ^b		7,000	3,000				10,018
1981	0 ^b		200					200
1982	12 ^b		19,000	35,000			650	54,662
1983	0 ^b	3,150	2,700	4,000	20,000 ^c	3,300		33,150
1984	132 ^d	750	119,000	16,000	16,000	14,500	2,500	168,882
1985	42 ^d	350	20,000	1,925	6,000	670	300	29,287
1986	0 ^d	120	8,650	1,200	2,000	630	125	12,725
1987	130 ^d	340	9,750	2,290	10,340	2,090	40	24,980
1988	752 ^{cd}	2,290	25,000	10,500	11,650	5,800	950	56,942
1989	600 ^{cd}	1,005	7,500	3,700	2,200	2,010	625	17,640
1990	300 ^c	170	7,600	1,150	1,630	410	10	11,270
1991	225 ^c	240	7,400	750	2,550	2,525	130	13,820
1992	460 ^{bd}	1,210	8,525	4,000	14,000	15,000	0	43,195
1993	87 ^d	105	7,000	720	2,040	1,025	8	10,985
Total	2,758	9,730	249,325	84,235	88,410	47,960	5,338	487,756
Mean	197	885	17,809	6,480	8,037	4,360	485	38,253 ^f

^a Includes Figure Eight, Goblet, Oldham, & Wandering Creeks.

^b Tower Counts.

^c Includes tower count plus later aerial survey count.

^d Includes Grassy Creek (tributary downstream of Ugashik Lagoon).

^e Float count done from a raft.

^f Sum of mean indices for all locations.

Appendix Table 20. Aerial survey index counts of pink salmon escapement, Ugashik District, 1980-1992.

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 done 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	0	1,728	Ugashik River tower count.

Appendix Table 21. Aerial survey index counts of coho salmon escapement, Ugashik District, 1981-1993.

Year	Number of Surveys	Coho Salmon Count	Comments
1981	1	13,300	Surveyed on September 7.
1982	1	10,000	Surveyed August 26.
1983	0		
1984	1	6,100	Surveyed 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	0	790	Incidental observation made August 11.
1993	0	705	Incidental observation made August 16.

Appendix Table 22. Spawner distribution and total escapement estimates of sockeye salmon, Wood River system, 1959-1993.

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
Mean	18.2	43.6	37.6	1,099,954

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

Appendix Table 23. Peak aerial live counts of sockeye salmon, Lake Nunavaugaluk drainage, 1974-1993.

Year	Snake River	Snake River - Eagle Cr. Beach	Eagle Creek	Eagle Lake	Westshore Beach	Killian Creek	Eastshore Beach	East Creek	Southshore Beach	Total
1974	60	1,750	130	220	4,220	2,100	2,710	70	160	11,420
1975	80	1,200	90	260	1,250	780	710	0	100	4,470
1976	40	3,000	240		2,820	470	1,270		220	8,060
1977	410	1,520	90	120	2,690	650	1,430		50	6,960
1978	100	1,400	110	180	5,510	1,700	1,630		150	10,780
1979 ^a										
1980 ^a										
1981 ^a										
1982	300	1,220	150	500	1,170	900	1,470	100	10	5,820
1983	0	560			400	110	470	0	10	1,550
1984	500	3,980	800	0	2,570	2,200	3,830	1,600	1,440	16,920
1985	100	4,070	0	700	5,040	3,600	2,240	1,200	490	17,440
1986		2,900	500	690	1,600	400	840	1,400	60	8,390
1987 ^a										
1988 ^a										
1989		2,800	1,000		5,290	1,200	2,060	700	980	14,030
1990	30	2,840	250	300	4,300	2,600	3,280	200	620	14,420
1991	120	2,050	50	340	1,480	240	870	10	300	5,460
1992 ^a										
1993 ^a										
Mean	158	2,253	284	331	2,949	1,304	1,755	528	353	9,915 ^b
Percent	1.6%	22.7%	2.9%	3.3%	29.7%	13.1%	17.7%	5.3%	3.6%	100.0%

^a No survey conducted.

^b Sum of means for all areas.

Appendix Table 24. Inshore commercial catch and escapement of chinook salmon in the Nushagak and Togiak Districts, in numbers of fish, Bristol Bay, 1974-1993.^a

Year	Nushagak District			Togiak District		
	Catch	Escapement ¹	Total Run	Catch	Escapement ¹	Total Run
1974	32,053	70,000	102,053	10,798	15,000	25,798
1975	21,454	70,000	91,454	7,226	11,000	18,226
1976	60,684	100,000	160,684	29,744	14,000	43,744
1977	85,074	65,000	150,074	35,218	20,000	55,218
1978	118,548	130,000	248,548	57,000	40,000	97,000
1979	157,321	95,000	252,321	30,022	20,000	50,022
1980	64,958	141,000	205,958	12,543	12,000	24,543
1981	193,461	150,000	343,461	23,911	27,000	50,911
1982	195,287	147,000	342,287	33,786	17,000	50,786
1983	137,123	162,000	299,123	38,497	22,000	60,497
1984	61,378	81,000	142,378	22,179	26,000	48,179
1985	67,783	116,000	183,783	37,106	14,000	51,106
1986	65,783	43,434	109,217	19,880	8,000 ^b	27,880
1987	45,983	84,309	130,292	17,217	11,000	28,217
1988	16,648	56,905	73,553	15,606	10,000	25,606
1989	17,637	78,302	95,939	11,366	10,739	22,105
1990	14,812	63,955	78,767	11,130	9,107	20,237
1991	22,898 ^c	104,357	124,075	6,039	12,667	18,706
1992	47,897 ^c	82,848	130,745	12,614 ^c	10,413	23,027
1993	62,294 ^c	97,812 ^c	160,106	11,649 ^c	16,035	27,684
20 Yr. Avg.	74,295	96,946	171,241	22,177	16,298	38,475
1974-1983 Avg.	106,596	113,000	219,596	27,875	19,800	47,675
1984-1993 Avg.	41,993	80,892	122,886	16,479	12,796	29,275

¹ Estimates were estimated from the following:

1974-1981 - comprehensive aerial surveys.

1982-1985 - correlation between index counts and total escapement estimates when aerial surveys were complete.

1986-1993 - sonar estimate.

Estimates for 1974-1985 are rounded to the nearest thousand fish.

² Escapement estimates based on comprehensive aerial surveys.

Estimates for 1974-1988 are rounded to the nearest thousand fish.

^a Escapement estimates supersede those previously reported.

^b Minimal estimate based on incomplete data.

^c Preliminary.

(sources: 1, 5, and 13)

Appendix Table 25. Inshore commercial catch and escapement of chum salmon in the Nushagak and Togiak Districts, in numbers of fish, Bristol Bay, 1974-1993.^a

Year	Nushagak District			Togiak District		
	Catch	Escapement ¹	Total Run	Catch	Escapement ²	Total Run
1974	157,941	100,000	257,941	80,710	161,000	241,710
1975	152,891	80,000	232,891	87,058	114,000	201,058
1976	801,064	500,000	1,301,064	153,559	392,000	545,559
1977	899,701	609,000	1,508,701	270,649	496,000	766,649
1978	651,743	293,000	944,743	274,967	396,000	670,967
1979	440,279	166,000	606,279	219,942	293,000	512,942
1980	681,930	969,000	1,650,930	299,682	415,000	714,682
1981	795,143	177,000	972,143	229,886	331,000	560,886
1982	434,817	256,000	690,817	151,000	86,000	237,000
1983	725,060	164,000	889,060	322,691	165,000	487,691
1984	850,114	362,000	1,212,114	336,660	204,000	540,660
1985	396,740	288,000	684,740	203,302	212,000	415,302
1986	488,375	168,275	656,650	270,057	330,000	600,057
1987	416,476	147,433	563,909	419,425	361,000	780,425
1988	371,196	186,418	557,614	470,132	412,000	882,132
1989	523,903	377,512	901,415	203,178	143,890	347,068
1990	378,223	329,793	708,016	102,861	67,460	170,321
1991	463,780	287,280	751,060	246,589	149,210	395,799
1992	313,034 ^b	302,678	615,712	174,017 ^b	120,000	294,017
1993	414,879 ^b	217,230 ^b	632,109	152,871 ^b	98,470	251,341
20 Yr. Avg.	517,864	299,031	816,895	233,462	247,352	480,813
1974-1983 Avg.	574,057	331,400	905,457	209,014	284,900	493,914
1984-1993 Avg.	461,672	266,662	728,334	257,909	209,803	467,712

¹ Escapements were estimated from the following:

1974 - tower enumeration and aerial survey data;

1975-78 - aerial survey data;

1979-93 - adjusted sonar estimate from Portage Creek site.

Estimates for 1974-85 are rounded to the nearest thousand fish.

² Escapement estimates based on aerial surveys; however, surveys were not conducted in 1986 due to budget constraints. Estimate based on catch/escapement proportion using most recent 10-year average data.

Estimates for 1974-88 rounded to the nearest thousand fish.

^a Escapement estimates supersede those previously reported.

^b Preliminary.

Appendix Table 26. Total escapement estimates of pink salmon, Nushagak and Togiak Districts, 1962-1992.^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		235,000 ^d
Mean	1,911,439	127,776

¹ Includes Wood, Igushik, Snake, Nushagak, & Nuyakuk Rivers, and Ice, Youth, & Sunshine Creeks, unless otherwise noted.

² Includes Togiak, Matogak, Osviak, & Slug Rivers.

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

^b Sonar estimate of Nushagak-Mulchatna Rivers only.

^c No escapement estimate.

^d Togiak River estimate only.

Appendix Table 27. Aerial estimates of sockeye salmon escapement, Togiak District, 1974-1993.^a

Year	Togiak River & Tributaries ¹	Kulukak Systems ²
1974	20,600	4,900
1975	19,600	8,600
1976	31,200	11,200
1977	15,600	40,100
1978	30,600	33,900
1979	23,700	26,600
1980	50,700	45,700
1981	39,700	58,800
1982	25,300	52,800
1983	13,200	27,000
1984	30,900	49,800
1985	8,800	36,600
1986	35,000	42,800
1987	28,600	37,800
1988	32,400	31,700
1989	19,800	10,800
1990	47,100	49,600
1991	23,700	23,900
1992	16,500	26,400
1993	15,900	31,800
1974-1993 Mean (20 year)	26,445	32,540
1974-1983 Mean (10 year)	27,020	30,960
1984-1993 Mean (10 year)	25,870	34,120

¹ Estimates do not include fish spawning above the counting tower (Togiak Lake outlet); estimates for Ungalikthluk, Osviak, Matogak, & Slug Rivers are not included in the 1977-93 data as reported earlier in Data Reports 73 and 81.

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

^a All counts are rounded to the nearest hundred.

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

Year	Togiak Mainstem	Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivinuck River	Total
1974	6,000	1,700	1,100			1,500	10,300
1975	6,100	830	1,450			1,380	9,760
1976	11,000	3,300	2,600			2,200	19,100
1977	2,200	500	2,000			3,100	7,800
1978	10,000	2,020	1,200			4,620	17,840
1979	7,100	520	750			2,800	11,170
1980	18,600	3,200	2,500	500	3,200	2,000	30,000
1981	14,100	3,700	3,150			3,400	23,350
1982	2,300	3,600	2,500	0	100	4,800 1,200	13,300
1983	4,800	1,100	700	0	0		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	36,000	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
Mean	7,617	2,088	1,704	63	731	2,479	14,682 ^a
Percent	51.9%	14.2%	11.6%	0.4%	5.0%	16.9%	100.0%

^a Sum of means for all streams.

Appendix Table 29. Peak aerial live counts of sockeye salmon, Togiak District, 1974-1993.

Year	Togiak River ¹	Kulukak River ²	Tithe Creek Ponds	Quigmy River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
1974	10,300	750	1,700							12,750
1975	9,760	780	3,500							14,040
1976	19,000	1,460	4,150							24,710
1977	7,800	6,400	18,200		200	2,000	2,700		1,700	39,000
1978	17,840	8,100	11,800						1,000	38,740
1979	11,170	4,600	10,800		200	200		600	700	28,270
1980	30,000	12,200	14,200		500	200	1,900			63,500 ^a
1981	23,350	15,700	18,250		700	6,400	5,900	3,900	12,800	87,000
1982	13,300	11,900	19,300		0	1,000	5,500	300	2,400	53,700
1983	7,800	8,430	2,720		80	20	2,000	230	940	22,220
1984	18,100	7,400	14,000		200	6,800		100	5,200	51,800
1985	4,400	6,700	11,600		0	200	2,300	260	1,310	26,770
1986	13,500	10,900	14,000							38,400
1987	14,300	10,500	8,400							33,200
1988	16,200	12,600	3,250	250	100	380	5,880	200	2,700	41,560
1989	9,880	2,920	2,500					5,000		20,300
1990	24,140	10,600	14,200	100	400	2,200	3,540	9,700	3,800	68,680
1991	11,860	8,650	3,320	35	860	2,530	560	3,400	2,650	33,865
1992	7,910	7,530	4,950	40	300	3,340	1,460	3,600	3,760	32,890
1993	7,060	9,600	6,300					3,100	5,680	31,740
Mean	14,682	9,102	9,357	106	295	2,106	3,174	2,533	3,434	44,788 ^b
Percent	32.8%	20.3%	20.9%	0.2%	0.7%	4.7%	7.1%	5.7%	7.7%	100.0%

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

² Includes surveys of Kulukak Lake. Counts prior to 1977 include Kulukak Lake only and are not included in the mean.

^a Includes a combined count for the Negukthlik and Ungalikthluk of 4,500 fish.

^b Sum of means for all streams.

Appendix Table 30. Peak aerial live counts of chinook salmon, Togiak River drainage, 1974-1993.

Togiak River Section ¹												
Year	A	B	C	D	E	F	Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivinuck River	Total
1974	610	50	830	300	570	860	620	200	120	160	180	5,100
1975	280	240	240	160	210	760	350	240	140	580	470	3,670
1976	210	250	510	260	450	790	550	350	270	290		3,930
1977							1,190	500	230	120	120	2,160
1978	940	1,240	1,390	810	1,060	1,850	2,150	590	780	220	220	11,250
1979	370	250	330	150	560	890	1,060	360	250	170	220	4,610
1980	180	120	340	230	120	140	910	200	510	170	190	3,110
1981	420	390	500	200	300	740	980	310	370	390	290	4,890
1982					80	320	470	170	190	130	470	1,830
1983	120	220	370	290	360	850	820	240	340	430	350	4,390
1984	250	560	900	560	820	1,920	760	580	270	580	430	7,630
1985	270	320	640	340	470	970	470	250	290	310	460	4,790
1986	150	80	160	30	110	350						880
1987	20	70	170	120	200	480	610	180	100	120	320	2,390
1988	70	70	160	160	170	710	390	180	60	70	90	2,130
1989	10	30	370			9401,0	190	80			40	1,660
1990	230	170	680	365	805	85	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	595	240	130	65	440	3,950
Mean	275	289	485	270	427	874	694	266	238	249	253	4,320 ^a
Percent	6.4%	6.7%	11.2%	6.2%	9.9%	20.2%	16.1%	6.2%	5.5%	5.8%	5.9%	100.0%

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 Sum of means for all streams.

Appendix Table 31. Peak aerial live counts of chinook salmon, Togiak District, 1974-1993.

Year	Togiak River ¹	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
1974	5,100		510				15	30	5,790
1975	3,670		1,100				220	80	5,070
1976	3,930		1,0800		100		380	30	5,520
1977	2,160		1,480	60	120		440	40	4,300
1978	11,250		2,720	150	250		1,020	110	15,500
1979	4,610	20	2,260	100	210		850	130	8,180
1980	3,110	0	700	70	40		260	160	4,340
1981	4,890	0	1,290	470	1,730	350	1,460	180	10,370
1982	1,830	90	1,690	290	320		1,600	280	6,100
1983	4,390	40	2,460	190	120		1,080	260	8,540
1984	7,630	30	1,190	150	360		680	20	10,060
1985	4,790	0	540	100	50		80	90	5,650
1986	880								880
1987	2,390		300	30	40		660	80	3,500
1988	2,130	10	490	0	40	0	650	170	3,490
1989	1,660		740				560		2,960
1990	4,315	30	635	75	60	0	930	25	6,070
1991	3,250	25	285	75	100		1,175	55	4,965
1992	2,965	15	485	40	105	30	490	35	4,165
1993	3,950		1,140	80	110	100	830	70	6,280
Mean	4,320	24	1,110	125	235	96	711	103	6,724 ^a
Percent	64.3%	0.4 %	16.5%	1.9%	3.5%	1.4%	10.6%	1.5%	100.0%

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

^a Sum of means for all streams.

Appendix Table 32. Peak aerial live counts of chum salmon, Togiak River drainage, 1974-1993.

Togiak River Section ¹												
Year	A	B	C	D	E	F	Gechiak River	Pungokebuk River	Nayorurun River	Kemuk River	Ongivinuck River	Total
1974	15,900	3,900	3,800	300	4,400	6,900	4,300	2,300	1,700	100	2,600	46,200
1975	5,500	5,200	1,600	500	3,000	19,500	2,600	700	1,100	1,400	1,300	42,400
1976	21,100	12,600	8,400	2,600	13,000	2,700	9,800	2,300	13,000	900	400	86,800
1977	12,000	8,000	10,900	8,000		15,100	13,600	4,900	22,100	3,100	2,400	100,100
1978	24,500	7,400	7,500	1,600	15,200	3,300	6,300	2,500	7,300	1,800	8,100	85,500
1979	14,000	2,800	3,300	800	6,600	10,400	3,500	1,000	2,500	500	200	45,600
1980	41,300	11,000	9,200	900	6,000	3,100	10,200	2,700	10,100	800	3,500	98,800
1981	11,800	4,500	2,400	1,000	3,000	6,000	3,100	500	4,300	1,700	4,200	42,500
1982				200	1,200	2,500	500	400	1,300	100	1,000	7,200
1983	8,160	3,050	3,780	1,100	2,780	6,070	150	140	5,560	570	3,790	35,150
1984	3,900	6,300	800	0	2,600	6,400	3,700	2,000	4,200	700	3,500	34,100
1985	8,300	6,500	3,200	900	6,700	10,200	4,100	600	9,600	1,800	8,300	60,200
1986 ^a												
1987	12,000	9,400	2,700	500	13,200	33,000	2,600	1,200	4,100	700	13,100	92,500
1988	10,000				4,900	3,800	3,700	5,000	3,500	200	3,800	34,900
1989		2,600	2,100		5,000	8,100	290	700			1,200	19,990
1990	2,200	1,275	1,350	400	650	4,200	3,150	1,150	3,400	250	125	18,150
1991	10,200	3,900	2,800	600	5,500	6,000	2,300	500	3,500	800	3,480	39,580
1992 ^b	1,800	1,800	300	100	1,200	1,500	2,000	500	1,800	900	800	22,700 ^c
1993	6,500	3,500	2,300	60		4,400	1,950	450	4,380	620	3,500	27,660
Mean	12,960	5,745	4,133	1,216	5,514	8,426	4,213	1,613	5,979	944	3,583	54,326 ^d
Percent	23.9%	10.6%	7.6%	2.2%	10.1%	15.5%	7.8%	3.0%	11.0%	1.7%	6.6%	100.0%

¹ Section A; Togiak Bay - Gechiak River
 Section B; Gechiak River - Pungokebuk River
 Section C; Pungokebuk 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 Sum of means for all streams.

Appendix Table 33. Peak aerial live counts of chum salmon, Togiak District, 1974-1993.

Year	Togiak River ¹	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
1974	46,200	1,400	7,900	2,100	5,600	1,100	3,000	8,400	75,700
1975	42,400	1,800	6,000	2,600	9,000	3,000	2,300	4,700	71,800
1976	86,800	6,600	14,600	9,600	26,100	7,100	8,000	15,000	173,800
1977	100,100	5,800	21,300	15,300	31,200	2,800	20,000	20,500	217,000
1978	85,500	9,400	24,200	15,000	17,500	6,400	7,600	8,000	173,600
1979	45,600	11,000	16,400	13,400	36,200	4,000	3,800	6,600	137,000
1980	98,800	2,700	27,300	5,700	29,500	6,700	18,500	15,000	204,200
1981	42,500	10,800	11,200	21,700	53,000	3,900	3,800	14,600	161,500
1982	7,200	1,300	8,300	3,100	5,500	2,400	160	1,270	29,230
1983	35,150	4,900	12,960	7,600	11,900	1,210	300	7,360	81,380
1984	34,100	6,300	8,500	10,200	18,400		2,100	3,000	82,600
1985	60,200	1,800	7,800	2,860	5,460	8,800	130	14,650	101,700
1986 ^a									
1987	92,500	1,500	22,000	2,300	2,160				120,460
1988	34,900	10,800	35,000	12,000	17,400	7,600	400	11,300	129,400
1989	19,990	2,820	5,580	7,450	4,900		560		41,300
1990	18,150	555	5,550	1,475	2,300	3,650	750	1,300	33,730
1991	39,580	4,420	9,540	4,730	8,700		120	3,020	70,110
1992	22,700 ^b	600	4,800 ^b	4,400	7,100	1,700	100	4,000	45,400
1993	27,660		6,950	1,970	1,360	3,060	20	4,020	45,040
Mean	54,326	4,694	13,467	7,552	15,436	4,228	3,980	8,395	112,079 ^c
Percent	48.5%	4.2%	12.0%	6.7%	13.8%	3.8%	3.6%	7.5%	100.0%

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

^a No aerial surveys conducted.

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

^c Sum of means for all streams.

Appendix Table 34. Peak aerial live counts of coho salmon, Togiak River drainage, 1980-1993.

Togiak River Section ¹												
Year	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	11,070
1986			60	400	100	400					2,560	3,520
1987	340	500	250	200	240	530	1,020	70			1,060	4,210
1988	950	370		140	210	360	1,530				4,100	7,660
1989 ^a												
1990	1,650	390	400	0	540	660	920	450	260	130	1,730	7,130
1991 ^c	4,900	400	700	600	1,680	140					100	8,520
1992	4,420	1,120	1,180	540	2,940	3,080	5,240	1,440	780	1,500	4,460	26,700
1993 ^a												
Mean	2,744	813	466	364	1,165	1,164	2,301	976	589	584	4,021	14,785 ^d
Percent	18.6%	5.5%	3.1%	2.5%	7.9%	7.9%	15.6%	6.6%	4.0%	4.0%	27.2%	100.0%

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, 1991 counts were not included in the mean or percent.

^d Sum of means for all streams.

Appendix Table 35. Peak aerial live counts of coho salmon, Togiak District, 1980-1993.

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

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

^a No aerial surveys conducted.

^b Timing of aerial surveys did not coincide with the period of peak spawning activity, and therefore, 1991 counts were not included in the mean or percent.

^c Sum of means for all streams.

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