State of Alaska
Department of Fish and Game
Division of Sport Fish

Nomination Form
Anadromous Waters Catalog

Region: SWT

USGS Quad(s): listed

AWC Number of Water Body: listed

Name of Water body: listed ☐ USGS Name ☐ Local Name

☐ Addition ☐ Deletion ☐ Correction ☐ Backup Information

For Office Use

Nomination # 140257		Fisheries Scientist	Date
Revision Year: 2015		Habitat Operations Manager	Date 7/29/14
Revision to: Atlas ____ Catalog ____ Both ____		AWC Project Biologist	Date
Revision Code: F-1		GIS Analyst	Date

OBSERVATION INFORMATION

Species	Date(s) Observed	Spawning	Rearing	Present	Anadromous
see attached					☐
					☐
					☐
					☐
					☐

IMPORTANT: Provide all supporting documentation that this water body is important for the spawning, rearing or migration of anadromous fish, including: number of fish and life stages observed; sampling methods, sampling duration and area sampled; copies of field notes; etc. Attach a copy of a map showing location of mouth and observed upper extent of each species, as well as other information such as: specific stream reaches observed as spawning or rearing habitat; locations, types, and heights of any barriers; etc.

Comments **Nomination substantiates Wood River area listed in FRI-UW-9803 "Spawning Ground Surveys in the Wood River Lakes", water bodies listed on following pages w/report attached.**

Name of Observer (please print): J. D Johnson

Signature:

Date: 7/29/14

Agency: ADF&G SF

Address: 333 Raspberry Rd
99518

This certifies that in my best professional judgment and belief the above information is evidence that this waterbody should be included in or deleted from the Anadromous Waters Catalog.

Signature of Area Biologist: _____ Date: _____ Revision 11/13

Name of Area Biologist (please print):

REGION	QTMQUADS	ITMQUAD	EDITCODE	NOMNUMBR	AWCNUMBR	STRMNAME	YEAR
SWT	069	A-7	F-1	14-257	325-30-10100-2031	Wood River	2015
SWT	069	B-8	F-1	14-257	325-30-10100-2031-3077-4001	Whitefish Creek	2015
SWT	069	B-8	F-1	14-257	325-30-10100-2031-3080	Eagle Creek	2015
SWT	069	B-8	F-1	14-257	325-30-10100-2031-3081	Yako Creek	2015
SWT	069	B-8	F-1	14-257	325-30-10100-2031-3086	Hansen Creek	2015
SWT	069	B-8	F-1	14-257	325-30-10100-2031-3087	Bear Creek	2015
SWT	069	B-8	F-1	14-257	325-30-10100-2031-3090	Happy Creek	2015
SWT	069	B-8	F-1	14-257	325-30-10100-2031-3099	Ice Creek	2015
SWT	069	B-8	F-1	14-257	325-30-10100-2031-3118	Agulowak River	2015
SWT	069	B-8	F-1	14-257	325-30-10100-2031-3118-4006	Fenno Creek	2015
SWT	069	B-7	F-1	14-257	325-30-10100-2031-3118-4062	Pick Creek	2015
SWT	069	B-8	F-1	14-257	325-30-10100-2031-3118-4070	Stovall Creek	2015
SWT	069	B-8	F-1	14-257	325-30-10100-2031-3118-4112	Lynx Creek	2015
SWT	070	C-1	F-1	14-257	325-30-10100-2031-3118-4119-5013	Little Togiak Creek	2015
SWT	070	C-1	F-1	14-257	325-30-10100-2031-3118-4121	Elva Creek	2015
SWT	069	C-8	F-1	14-257	325-30-10100-2031-3118-4158	Hidden Lake Creek	2015
SWT	069	C-8	F-1	14-257	325-30-10100-2031-3118-4172	Kema Creek	2015
SWT	069	C-7	F-1	14-257	325-30-10100-2031-3118-4212	Agulukpak River	2015
SWT	069	C-7	F-1	14-257	325-30-10100-2031-3118-4212-5032	Moose Creek	2015
SWT	069	D-8	F-1	14-257	325-30-10100-2031-3118-4212-5074-6011-7043	Grant River	2015

FRI-UW-9803
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SPAWNING GROUND SURVEYS IN THE WOOD RIVER LAKES

D.E ROGERS AND B.J. ROGERS

ACKNOWLEDGMENTS

Many people have participated in the annual spawning ground surveys in the Wood River Lakes, enduring the constant battle with mosquitoes and the presence of brown bears. However, Ken Roberson was especially important for establishing consistent methods for ground surveys during the 1960s. The Alaska Department of Fish and Game conducted the aerial surveys after 1959 and Mike Nelson (ADF&G Dillingham) was responsible for standardizing the aerial survey methods. Our work was supported by the National Marine Fisheries Service during 1961–80 and by Bristol Bay salmon processors through the Pacific Seafood Processors Association in the remaining years.

KEY WORDS

counting fish, maps, otoliths, sockeye salmon, spawning, Wood River Lakes

Spawning Ground Surveys in the Wood River Lakes

D.E. ROGERS AND B.J. ROGERS

INTRODUCTION

Since 1946, the Fisheries Research Institute (FRI) has conducted research studies on the adult spawning populations of sockeye salmon (*Oncorhynchus nerka*) within the Wood River Lakes system, Alaska (Figs. 1-5). These studies have included population enumeration by aerial surveys and ground counts (Gilbert 1968) and determination of sex ratios, fecundity, and age composition. A primary objective is to study the relationship between parent escapements and adult returns for individual spawning areas and to study the differences in relative production and age at maturity among spawning areas. Consistency must be maintained in the field procedures to compare data on individual spawning areas among years. The purpose of this manual is to establish specific procedures that were originally set forth in a manual written in the 1950s (anonymous). Spawning surveys through 1962 and descriptions of the spawning grounds are presented in Marriott (1964) and current aerial survey methods are given in Nelson (1973).

FIELD PROCEDURES

Materials

A small backpack is handy to carry survey supplies. Hip boots and rain gear are essential for surveys. The following list of materials is recommended:

1. tally counters (4)
2. fine-nosed forceps (4)
3. plastic vials
4. waterproof (Rite-in-Rain) notebook
5. butcher knives
6. sharpening stone
7. gaff hook
8. polarized sunglasses
9. rifle or shotgun and shells
10. pencils and a Sharpie
11. 15-foot pole with spear end for rivers and beaches
12. calipers and measuring board if lengths are taken
13. 50-foot plastic coated clothesline (optional)
14. lots of bug dope (essential)

Otolith Collection

One hundred fish of each sex are sampled for otoliths in selected sampling areas. Although several techniques exist for removing the otoliths, the one described as follows is probably the easiest.

Grasp the salmon with the left hand just in front of the gills and raise it to a position with the belly of the fish on the ground and the dorsal surface upward. With a thin-bladed butcher knife sever the head of the fish nearly off just behind the opercular opening. Next, make a mid-line sagittal cut on the head to expose the brain for removal of the otoliths. It is desirable to split the brain directly in half in order that the knife blade does not fracture one of the otolith bones. If this is done, one otolith should remain in each side of the split head. To make the mid-line sagittal cut, grasp the fish head in the left hand with the four fingers behind the opercular flap and the thumb in the eye socket. Raise the head of the fish to a vertical position with the front of the head facing you. With the knife in your right hand, slice the head in half (sagittally) starting from the top and posterior part of the head. Do not attempt to cut through the lower jaw as it is unnecessary and will tend to dull the knife blade. After the sagittal cut is made, the two halves of the head should be easy to spread apart. Next, remove both otoliths with a pair of sharp pointed forceps. The otoliths lie in two depressions just off the mid-line of the fish. These depressions are beneath the beginning of the medulla oblongata. Since the otoliths are enclosed in a gelatinous sac, they may be difficult to see, but after removing a few otoliths, it is a relatively simple job to find them.

The otoliths must be cleaned of the gelatinous sheath after removal from the fish. It is easiest to grasp the otolith with the forceps and then pull away the sheath with forefinger and thumb of the other hand. Be sure that each otolith is free of all gelatinous material. Place the better of the two otoliths in a vial marked "male" or "female," whichever is

appropriate. Choose the otolith that shows the alternating white and translucent bands most clearly. Some otoliths show more crystalline and irregular borders or are nearly clear.

Later, back at the camp, take one vial and dump its otoliths into a bowl of soapy water. Clean each otolith by rubbing it between the thumb and forefinger. Count the cleaned otoliths from one spawning area and one sex onto folded sheets of paper towels. Write the name of the spawning area, the sex of the fish and the number of otoliths with a Sharpie marker on the outside of a new, clean plastic vial. Make sure that the otoliths are dried; then put the otoliths into the new vial. Pack folded dry paper toweling firmly above them. It is important to keep the otoliths dry in the new vials; otherwise, by the time they reach Seattle in the fall, they may be moldy and unreadable.

Length Measurements

Fish for trunk stream fecundity samples are measured from the middle of the eye to the fork of the tail. The tip-of-snout to fork-of-tail measurement is not used in spawning ground fish as the disfigurement of the snout and the erosion of the fin rays cause great variability in the measurements. Samples taken on the spawning grounds should be measured from the middle of the eye to the hypural plate. In instances where seagulls have removed the eyes of the fish, the measurer must estimate the position of the middle of the eye. The end of the hypural plate may be found by grasping the end of the fin rays of the tail and bending upward. Usually a natural crease will form where the caudal fin rays connect with the hypural plate. In order not to bias the length measurements, the end of the hypural plate is marked before measuring. This is performed by placing the tip of a knife at the end of the hypural plate and pushing it through the fish. When undertaking spawning ground work for the first time, one should remove the tail of a salmon to see the position of the hypural plate.

Place the fish on a level board for measurement. Never make a measurement without using the board. Straighten the fish out in a natural position, checking that the backbone of the fish is intact and is not broken. Discard fish with broken backs. Spread the calipers until one pointer is directly over the middle of the eye and the other one is over the incision at the end of the hypural plate. Then read the measurement and record it on the data sheet.

Spawner Counts

The procedures vary for surveys of the three types of sampling areas: creeks, rivers, and lake beaches. Surveys are best accomplished with a crew of three to four people; however, two people may do for short creeks where only counts are made (e.g., Mission and Elva creeks). All numbers should be recorded in a field notebook and then transferred to the spawning survey log when back at camp.

Creek Surveys

Sixteen creeks are usually sampled each year. Complete surveys (counts and otoliths) are conducted on eight creeks, otoliths and a partial count are made on three creeks with aerial survey estimates used for number of spawners, and counts alone are made on an additional seven creeks. In addition to the regular collection of otoliths from each area, supplementary data are taken from each creek. They are (1) water temperatures at creek mouth, (2) distance of creek surveyed, (3) number of live and dead (natural and bear kill) fish in area surveyed, (4) relative water level, (5) spawning activity, and (6) notes on other species observed, especially approximate numbers of other salmon species. When the stream is approached by boat, an estimate should be made of the number of salmon schooled off the mouth. The distance surveyed should be carefully noted and should be to a described landmark easily recognizable from ground or air. Record the time to walk to the end of the counting. Most creeks take 1-2 hours to count. To be comparable, the counts must be made to the same place each year. The total stream should be enumerated whenever possible, and counts recorded by recognizable section used in previous years, if possible. When making creek surveys, two or more people walk up the creek, one person counting the dead fish and one person counting the live. Hand tallies are used to make the counts. The person counting the live fish should proceed first so as to achieve a more accurate count. The person in the lead should always remain in visual contact with the person(s) behind and the lead person should carry the rifle for safety from bears.

After walking to the end of the survey, the crew collects the 200 fish for the sample. Care must be taken to achieve an unbiased sample. Every fish should be collected that is seen until 200 fish (100 of each sex) are collected, unless the condition of the fish prohibits the taking of otoliths. Sometimes, the use of a plastic-coated clothesline as a stringer can be helpful to collect 40-50 fish at a time. Line up each group of fish to be sampled by sex on a gravel bar. Keep track of the head counts on two hand tallies—one for each sex.

River Surveys

Three large and two small rivers are surveyed in the Wood River system (i.e., Wood, Agulowak and Agulukpak; Grant and Little Togiak). Because of the nature of these rivers, collection and sampling of the fish is rather difficult. One of the easiest methods of collecting the fish is to concentrate the collection near the mouth and at other places where carcasses accumulate. The technique of lining up the fish is also used here. Usually, counts of live and dead fish are not made because of the size of the rivers, and aerial survey estimates of only live fish are used. Water temperature data should be collected. Notes on abundance and progress of spawning should be included in the field survey notebook as well as the approximate abundance of other species of salmon.

Lake Beach Surveys

Collection of fish samples from beach spawning areas is more difficult than from any other type of area. Depending on the area to be sampled, collecting is done either by spearing the dead fish on the bottom of the lake or by collecting them on the shore. In either case, a boat is usually used to hold the fish. The fish are lined up on the beach in a similar manner as those fish are on the gravel bars of creeks. A level beach should be chosen to work on as it makes the sampling process much easier. Estimates of abundance should be made whenever conditions permit, and notes on progress of spawning should be included on the field survey form. Water temperatures should be taken.

Areas and Time of Sampling

One of the most important procedures that must be standardized is the area to be sampled. The time for conducting each survey is also important since each spawning area is ready for sampling over a limited time interval. The areas to be surveyed and the dates of the surveys are listed in Table 1. It may be just as important to sample at the correct time interval as it is to sample the same creeks year after year. At the present time, we have little information on the differential time of spawning in relationship to the age of the fish. The possibility may exist that the .2- and .3-age salmon of the same creek may tend to spawn at different times. Sampling at different times could possibly alter the estimate of the age composition of a population. Thus it is best to sample each area over the time interval listed in Table 1. Physical descriptions of the spawning grounds are given in Table 2.

THE SAMPLING AREAS

Hansen Creek

A small creek with excellent production, surveyed in its entirety. About one mile upstream from the mouth, a small branch forks to the east for 200 feet to a small pond (Figs. 2 and 6). Fish usually spawn in the pond and should be included in live and dead counts. The main branch of the creek terminates in a large beaver pond. Spawning occurs in the terminal pond also. Live and dead counts should be made of the entire creek. Since 1990, the creek has been surveyed daily for a study of bear predation and to estimate total number of spawners. Annual survey counts have ranged from 200 to over 15,000 (Table 3).

Yako Creek

A long stream with 2 branches; however, spawning is usually concentrated in lower 1.5 miles (Fig. 2). Estimates of fish off the mouth should be made only for fish very near the mouth as many beach spawners are in the area. No otoliths are collected (counts only); therefore, the creek is usually surveyed before the peak of spawning. Annual counts have ranged from less than 100 to nearly 7,000, including estimated numbers off the mouth. The largest number counted in the creek was in 1997 and was about 6,000 (Table 4).

Bear Creek

A small creek with fairly consistent numbers of spawners over the years (Figs. 2 and 7). Live and dead counts are made to point "B." Count forks from "B" and side channels if any appreciable numbers are present. Fork at "A" is usually blocked. Spawner counts have ranged from a low of 600 (1949) to a high of 10,100 (1978) with an average annual count of about 4,000 (Table 5).

Happy Creek

A small creek with recent large numbers of spawners. A second creek mouth opened into Hansen Bay in 1973 (Figs. 2 and 6). It now appears to have the major flow. The creek is very brushy and difficult to walk. Survey to "D," separating counts for "A," "B," "C," and "D." Count to "E" if salmon are present in any numbers. Annual counts have ranged from under 200 (1973) to nearly 26,000 in 1991 and have exceeded 5,000 each year since 1985 (Table 6).

Ice Creek

A long creek of large size. It is the longest creek surveyed and requires a full day. Survey from "E" to the mouth (Figs. 2 and 8). The lower .25 mile is rocky with no spawning. Surveyors must walk over tundra for 1.5 miles to the creek, then make the survey to the mouth. Take two boats and leave one at the stream mouth while the other returns to camp after dropping off the survey crew at the walk-in bay. Since the survey does not cover the entire stream, the aerial survey estimate is often used for number of spawners; however, in many years the partial ground count was greater than the aerial survey estimate of live fish only. Ground counts have ranged from less than 1,000 to almost 40,000 (Table 7).

Eagle Creek

A short creek with the mouth at the head of a shallow bay east of Hansen Bay (Fig. 2). Count to the end of spawners (no otoliths). Ground counts did not begin until 1970. Annual counts have ranged from less than 100 (1973) to over 7,000 in 1980 (Table 8).

Fenno Creek

A long creek flowing into River Bay (Figs. 2 and 9). Surveys are usually made from the mouth to a rocky region with a swift flow and steep gradient, where rocks are 4-5 inches in diameter (point "C"). Stream markers may no longer be visible. Often surveyed past the peak of spawning. A consistent producer with annual counts ranging from 400 to almost 16,000 (Table 9).

Whitefish Creek

Big Whitefish Creek (1.6 miles) and Little Whitefish (a .8-mile branch to the right) are located at the head of Whitefish Bay on Lake Aleknagik (Fig. 2). Record the counts separately. No otoliths are collected. Some high counts in the 1940s and early 1950s; since then, counts have ranged from less than 100 to about 2,000 in 1995 (Table 10).

Mission Creek

A very small creek originating in springs near the outlet of Aleknagik (Fig. 2). It takes about 2 hours to count (no otoliths). Ground counts since 1982 have ranged from 100 to nearly 3,000 in 1993 (Table 11).

Pick Creek

An average-sized creek with excellent spawning populations. It is surveyed from the mouth to the main pond area and in the tributary entering the pond from the east (if open to spawners). Record the counts separately for the creek and ponds. Since 1983, the ponds have had few spawners whereas in earlier years most fish spawned in the upper ponds (Figs. 3 and 10). Numbers of spawners exceeded 50,000 in 1946 and 1959 and 30,000 in 1980 (Table 12). It is the highest-producing creek in the lake system.

Moose Creek

A good-sized creek that is the largest-producing creek flowing into Lake Beverley (Fig. 4). The creek is very long and spawning occurs throughout (Fig. 11). Aerial surveys are used for total count. Ground survey from mouth to "A"; however, if there are insufficient dead fish for 200 otoliths, continue counts to "B" or "C." Aerial counts of live fish have ranged from 200 to nearly 26,000 and have averaged about 4,100 (Table 13).

A and C Creeks

Very small spring-fed creeks (1/4 mile long) with excellent gravel located on the north shore of Little Togiak Lake (Fig. 12). Intense bear predation occurs on spawners, which tend to be very small fish. Otoliths were not collected in recent years due to scarcity of spawners. Ground surveys have been done sporadically. Live and dead counts are made for the entire creek.

Hidden Lake Creek

A small creek located in Anvil Bay (Figs. 3 and 13). The lower area of the creek (3/4 mile) is very steep and rocky and contains only a few fish. The upper area of the creek is level and contains good spawning gravel. Just above the lower area are three spring ponds (close together), which serve as the major spawning area of the creek. Samples of fish are usually taken from these ponds and are processed there. The beach spawning area of Hidden Lake is not sampled or surveyed. Hidden Lake is about 1/5 mile west of the three spring ponds. Survey from mouth to "A" and "C." Creek is characterized by large variation in numbers from year to year. Counts have ranged from about 100 to 16,000 in 1959 (Table 14).

Grant River

An excellent spawning area with major populations. This river was counted in earlier years, but we now collect otoliths from the lower portion and use the aerial survey estimate for numbers. However, relative density and approximate percent dead near the mouth (Fig. 5) should be recorded. Aerial survey estimates of live fish have averaged 10,100. Some ground counts were larger than the aerial counts even though the ground counts were not extended to the end of spawning (Table 15).

Lynx Creek

Amedium-sized creek flowing fromLynx Lake to Lake Nerka. It is surveyed from the mouth to a rocky area close to the lake (Figs. 3 and 14). Surveys have often been conducted too early with too few dead fish available for otoliths. Lynx Creek is a rather consistent producer with an average count of 3,100 and a maximum observed count of 17,000 in 1980 (Table 16).

Stovall Creek

A medium-sized creek of considerable length that originates in Stovall Lake (Figs. 3 and 15). An aerial survey is used for the total count. Ground count from the mouth should proceed upstream until about 300 dead have been counted. Record live and dead counts, then collect otoliths. Beaver dams have often blocked the upstream extent of spawning. Aerial survey estimates of live fish have ranged from 200 (1973) to 75,000 in 1959 (Table 17).

Kema Creek

A medium-sized creek that originates in small lakes and often contains several beaver dams (Figs. 3 and 16). An aerial survey is used for the total spawner count. Ground survey is done as for Stovall Creek: count upstream until sufficient dead for otoliths, record the counts, and then collect otoliths. Aerial counts have averaged about 4,500 live when surveyed in mid-August. Ground surveys have been conducted later to ensure the collection of otoliths (Table 18).

Elva Creek

A long creek from Elva Lake to Lake Nerka A falls about 1.5 miles up from mouth stops salmon. Usually there are very low numbers in the creek but considerable beach spawning near the mouth. Counts are made only in creek, and no otoliths are collected (Fig. 3). Counts have averaged only 300 (off mouth, live and dead) and the largest number observed in the creek was about 900 in 1947 (Table 19).

Little Togiak River

A very short river flowing from Little Togiak lake into Cabin Bay on Lake Nerka (Figs. 1 and 12). Most dead fish wash out of the river and pile up at 25-30' depths at the mouth. It is best to collect otoliths on repeated visits during August 27–30. Aerial estimates of live fish have averaged 7,000 and expanded estimates have averaged 13,000 (Table 20). This river can be counted from the ground by 3-4 people walking upstream with each person counting a section of the width.

Agulukpak River

An river with excellent production, between Lakes Beverley and Nerka (Fig. 1). Counts of live and dead fish are not made by ground surveys; instead, aerial survey estimates of live fish are expanded to estimate total spawning population. Live fish school at the head of the river prior to spawning in the upper half of the river. Fish are collected by spear off the river mouth or near beaches on each side of the mouth. Sufficient dead fish are often available in late August, but otoliths are often collected about September 8 when they are also collected fromAnvil Bay. Aerial estimates have averaged about 100,000 and expanded estimates of total spawners have averaged about 140,000 (Table 20). The expanded number for 1980 is likely too high because a rather small proportion of the lake system escapement (tower count) was accounted for in the aerial surveys (Table 21).

Agulowak River

A large river and a good salmon producer of mostly 3-ocean fish, this river flows between lakes Nerka and Aleknagik (Fig. 1). Spawning is concentrated in the upper third of the river (wide shallow area); however, most dead fish congregate below the lower "rollers" and are sometimes available in late August. Aerial estimates, which include fish in lower River Bay, have averaged about 108,000 and expanded estimates about 167,000. The expanded estimate of 1,000,000 for 1980 is likely too high (Table 20).

Wood River

A large river flowing from Lake Aleknagik (Fig. 1) that contains two distinct types of spawners—small, narrow-bodied fish that spawn in a shallow spring area, and larger fish that spawn along the river bank. Otoliths should be collected from both areas with most from the springs near the island (second river bend) and the rest from the shoreline on the opposite bank just upstream. Aerial survey estimates have varied considerably from year to year, ranging from less than 1,000 to 91,000 (Table 20).

N4-N6 Beach

A series of beach spawning areas around the mouths of N4, N5, and N6 creeks on the south arm of Lake Nerka (Fig. 3). Otoliths are collected from the beaches but spearing fish off the bottom is usually required also. These beaches are often sampled while the crew is traveling from Aleknagik to the Nerka camp. Aerial survey estimates of spawners have averaged about 7,000 (Table 22). There have been approximately equal percentages of 2-ocean and 3-ocean sockeye salmon since 1978, whereas in earlier years 2-ocean fish predominated.

Anvil Bay Beaches

The most productive beach spawning area on Lake Nerka (Fig. 3). Dead fish are collected from the west end of the bay and some spearing is usually necessary. Through the 1970s, 2-ocean sockeye salmon predominated, but in recent years the ocean ages have been about equal. Aerial counts have averaged 15,300 since 1953 with a maximum estimate of 51,000 in 1959 (Table 22).

Little Togiak Beaches

There are beach spawning areas along the north and south shores of the lake; however, the largest concentrations are at the head (D slough) and near A Creek (Fig. 12). Surveys are often conducted too early and thus it has been difficult to collect a complete sample. These populations have often contained high percentages of age 2.2 fish, and 2-ocean fish usually predominate. Aerial survey estimates have averaged about 8,000 (Table 22). Tower counts of the escapement are available for 1961 and 1975–82.

North Shore Kulik

Spawning is scattered along most of the north shore of Lake Kulik from K3 Creek to K11 Creek (Fig. 5). In years of good abundance, enough fish can be picked up off the beach for a sample after September 10th. Sampling has been sporadic since 1976; however, over 80% of the fish were 2-ocean sockeye salmon in past years. Aerial survey estimates of beach spawners (both shores) have averaged about 20,000 with a cycle of low numbers every 4 years starting in 1949 (Table 22).

N.W Mikchalk

A beach spawning area located on the northwest shore of Lake Mikchalk (Fig. 5). It is moderately productive with predominantly 2-ocean sockeye salmon; however, the last otoliths were collected in 1980. Fish usually can be collected from the shores and the sample may include spawners from the narrows near the lodge. Aerial estimates of beach spawners in the lake have averaged 6,000 (Table 22).

B4-B6 Beach

These beaches are along Hardluck Bay on the north side of Lake Beverley (Fig. 4). Fish are usually collected from the shores with some spearing needed. Sampling has been sporadic since 1975, but spawners were mostly 2-ocean fish. Aerial estimates averaged about 16,000 with a cycle of low abundance every 4 years, which has been typical for upper lakes beach spawners (Table 22).

B9-B12 Beach

These are steep beaches that are along the south shore of Lake Beverley (Fig. 4). The heaviest concentrations of dead fish are usually near B9 and B12 Creeks. This area has not been sampled since 1988, but in past years spawners were about 80% 2-ocean fish. Aerial survey estimates averaged 6,000 during 1953-96 (Table 22).

Silver Horn Beach

The fish are collected on beaches at the west end of Silver Horn on Lake Beverley (Fig. 4). This is usually the last area to be sampled as spawning peaks in mid-September. Timing rather than lack of fish has been a problem and the last year that otoliths were collected was 1987. One of the most productive beach spawning areas in the lake system. Aerial survey counts have averaged 20,000, but since 1983 the annual counts have been much lower (Table 22).

LAB PROCEDURES

Otolith Reading

Prior to attempting age determination by otoliths, one should read the thesis by Kim (1963) in the FRI library. For a quick review of the otolith parts, see Kim and Roberson (1968). Initially, it is most useful to be guided by an experienced Wood River otolith reader. Even with this help, experience is necessary to gain proficiency in otolith reading.

To read the otoliths, dump the contents of one vial into a small, black plastic jar lid, or any other small, low container with a dark background that is filled with water. With a pair of fine, pointed jeweler's forceps, turn all the otoliths over so that the convex (medial) surface is down and the slightly concave lateral surface faces up. The lateral surface shows the growth rings. Under the microscope, pick out and read one age group at a time. If you are reading age 1.3s, remove a 1.3, count "one," remove it from the container, and place it on a paper towel to dry. Place the 1.3s in groups of 10 and count and remove all the 1.3s that you can see in the container. Keep track of that tally on the "Scale Reading Data Form." Place the 1.3 otoliths in a coin envelope that has been labeled with the name of the spawning ground, the sex, and the date of collection. Repeat this procedure for the remaining age groups. Difficult and overlooked otoliths will probably remain. Repeat the procedure for the 1.3s, etc., and tally the counts together on the data form. Add these otoliths to the original envelope. Staple all the envelopes for a given spawning location together and store them.

Data Entry

All stream survey counts and important comments should be added to existing computer datasets (currently in Excel). In addition, each year's survey numbers are presented in our annual report to Bristol Bay processors and the Alaska Department of Fish & Game (ADF&G). Age compositions from otolith reading are also added to existing computer datasets and presented in the annual report. When aerial survey counts are received from ADF&G, those counts, along with our ground survey counts, are added to existing datasets containing annual counts for all major spawning grounds in the lake system.

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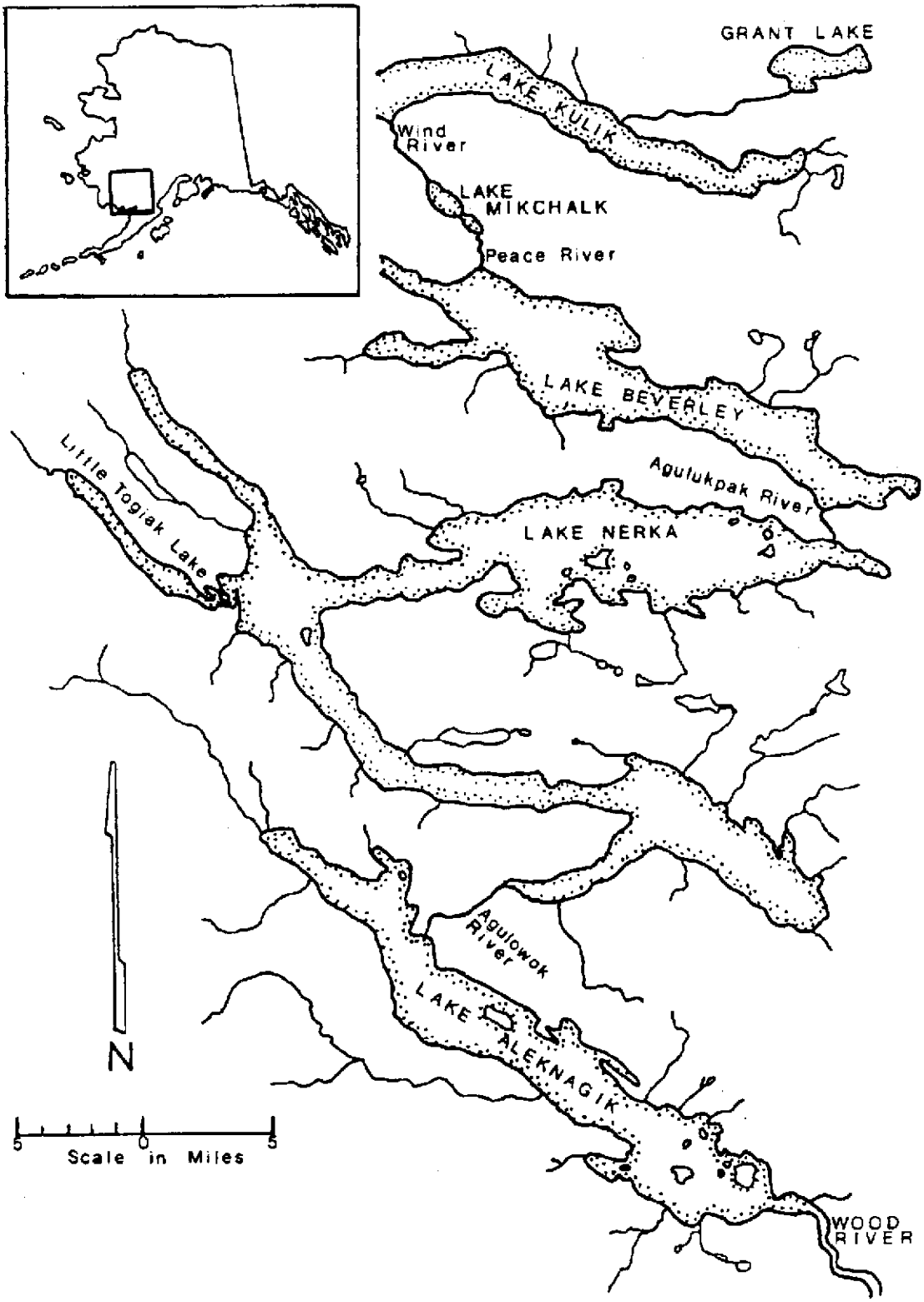

FIGURE 1. Wood River Lakes system, Bristol Bay, Alaska.

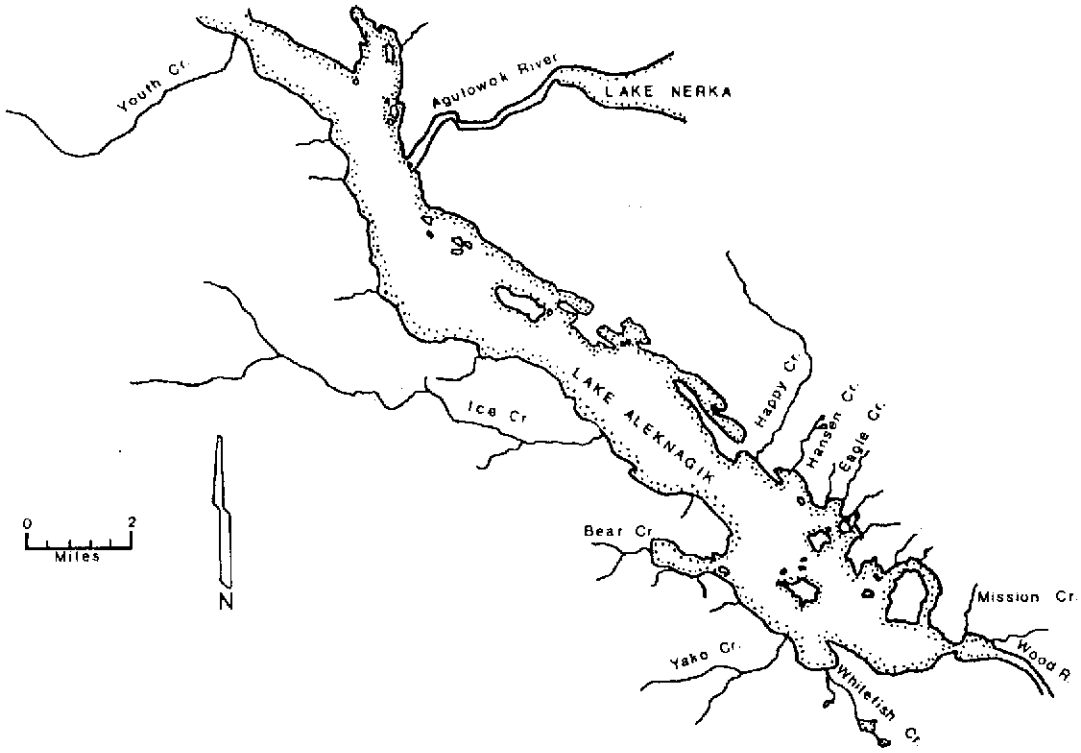

FIGURE 2. Tributaries to Lake Aleknagik.

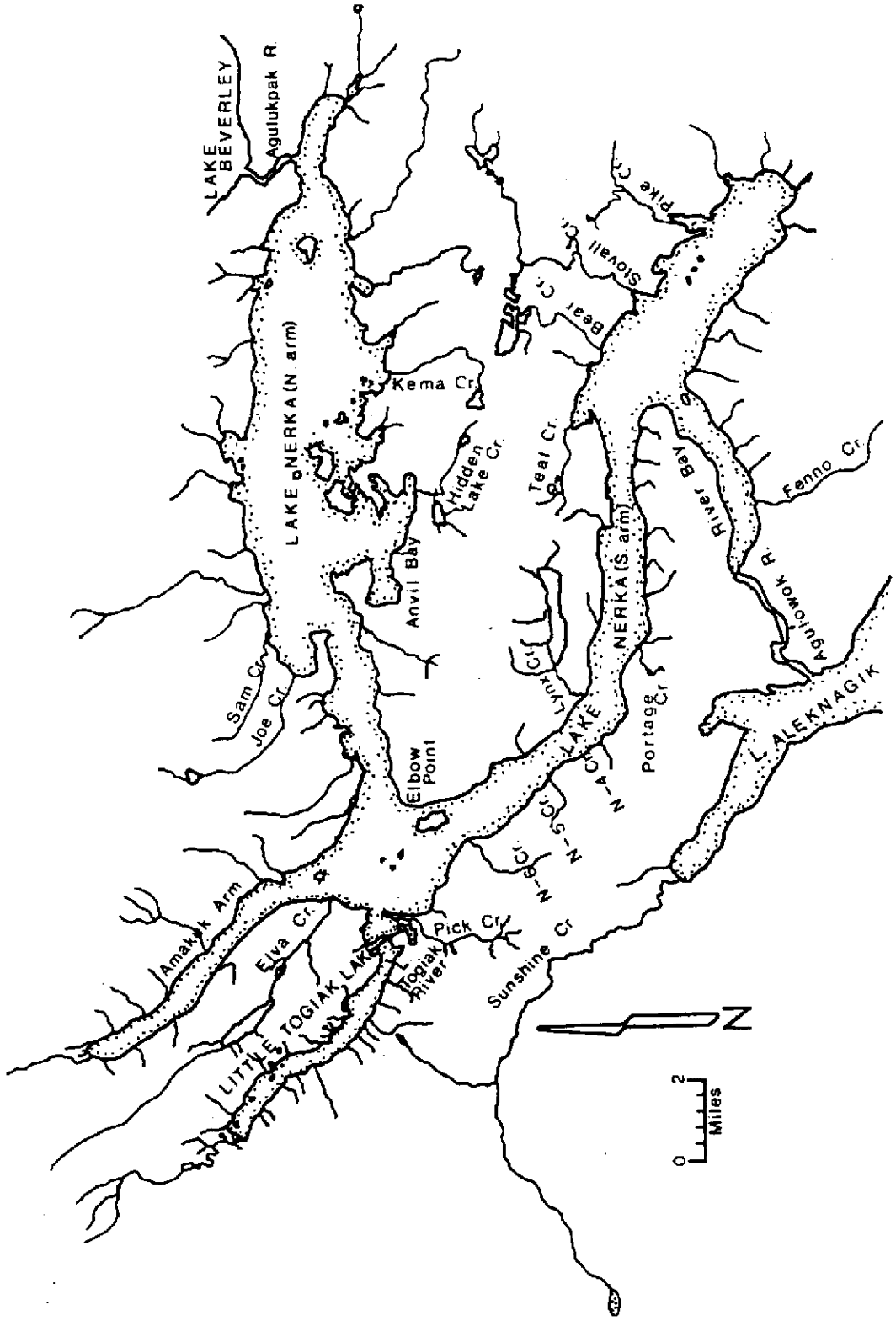

FIGURE 3. Tributaries to Lake Nerka.

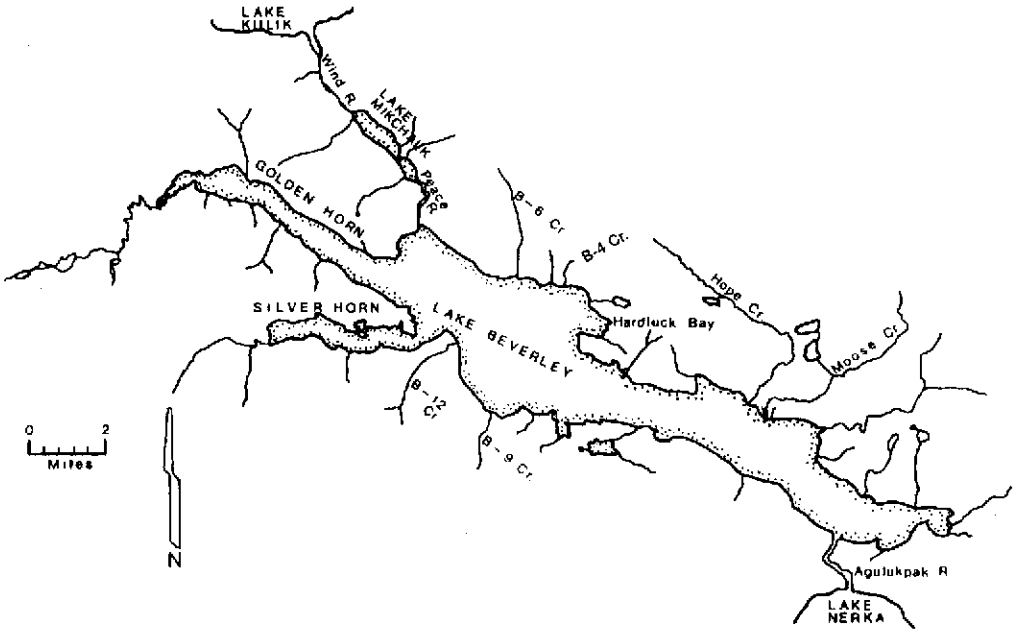

FIGURE 4. Tributaries to Lake Beverley.

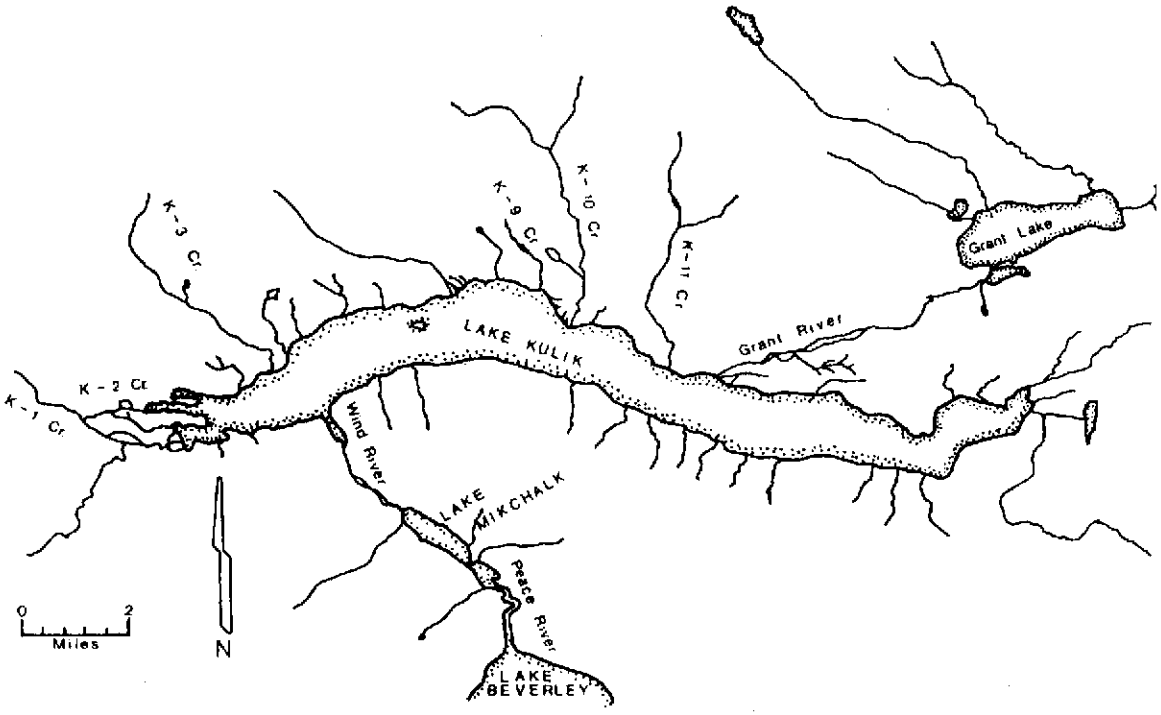

FIGURE 5. Tributaries to Lake Kulik.

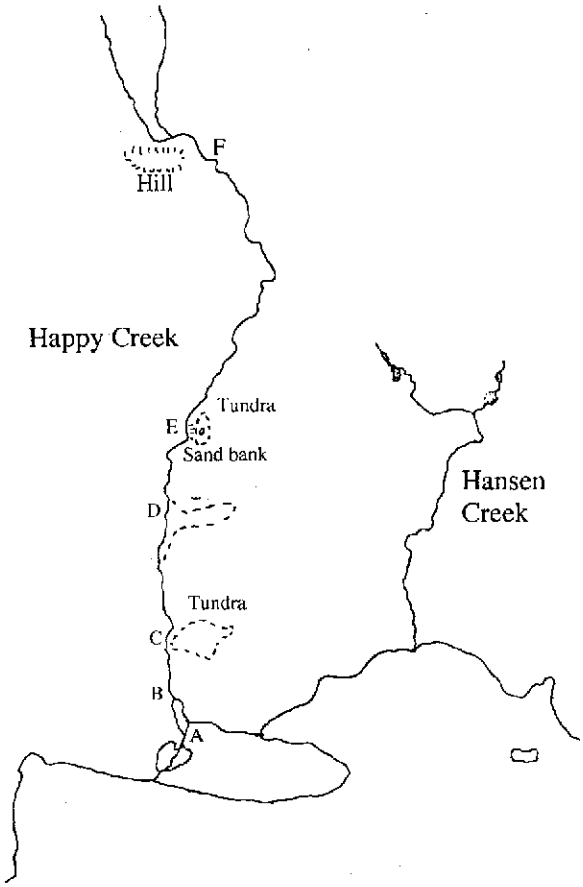

FIGURE 6. Happy and Hansen Creeks on Lake Aleknagik.

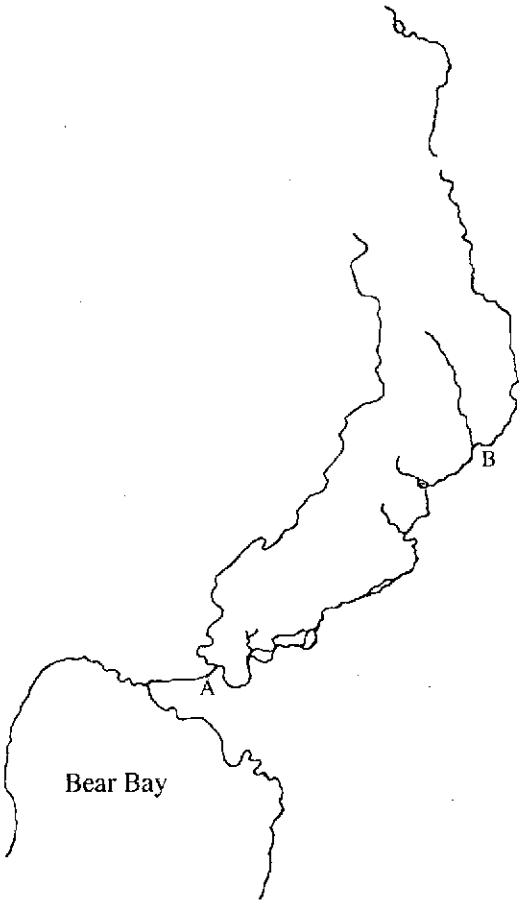

FIGURE 7. Bear Creek, Lake Aleknagik.

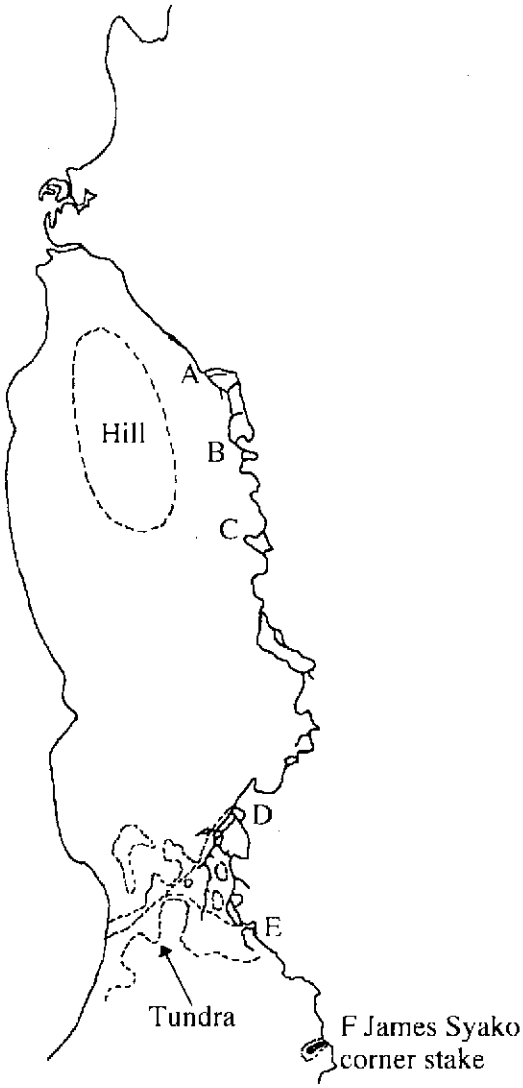

FIGURE 8. Ice Creek, Lake Aleknagik.

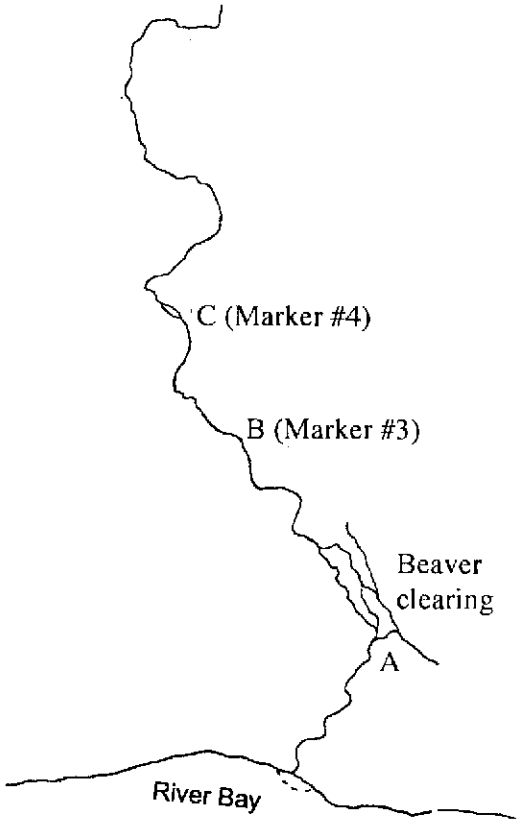

FIGURE 9. Fenno Creek, Lake Nerka.

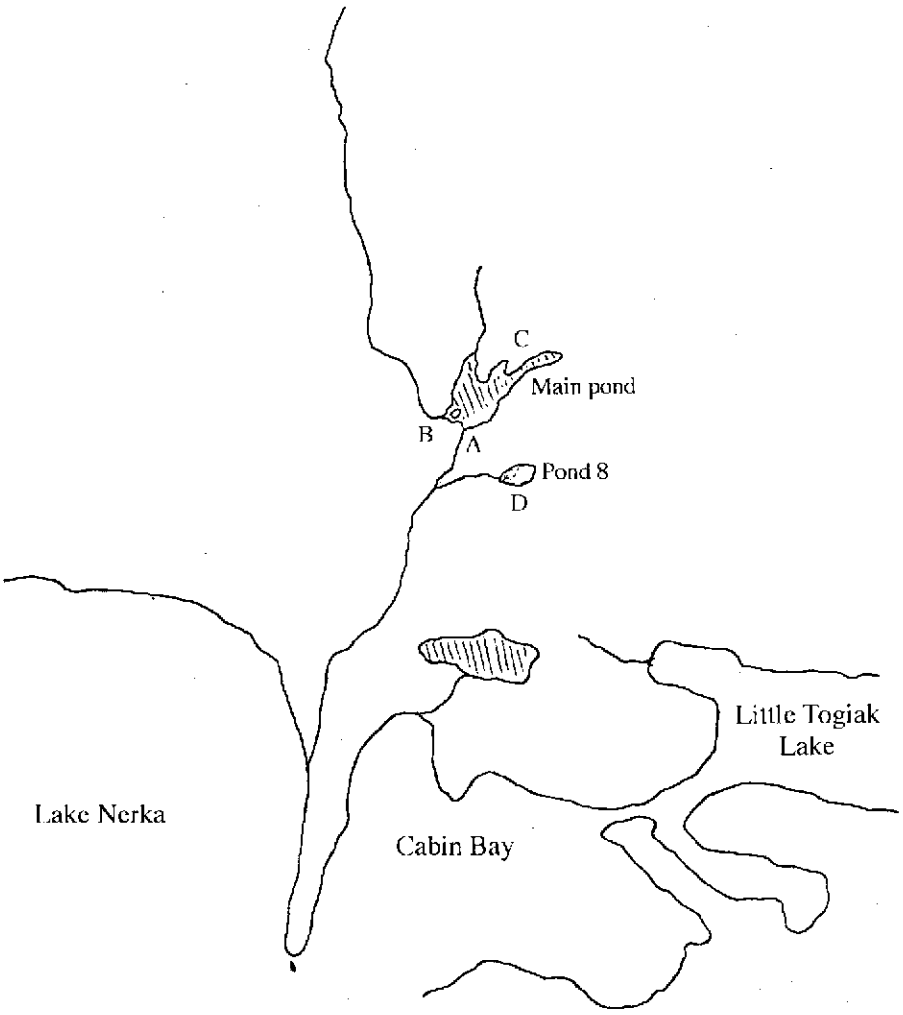

FIGURE 10. Pick Creek, Lake Nerka.

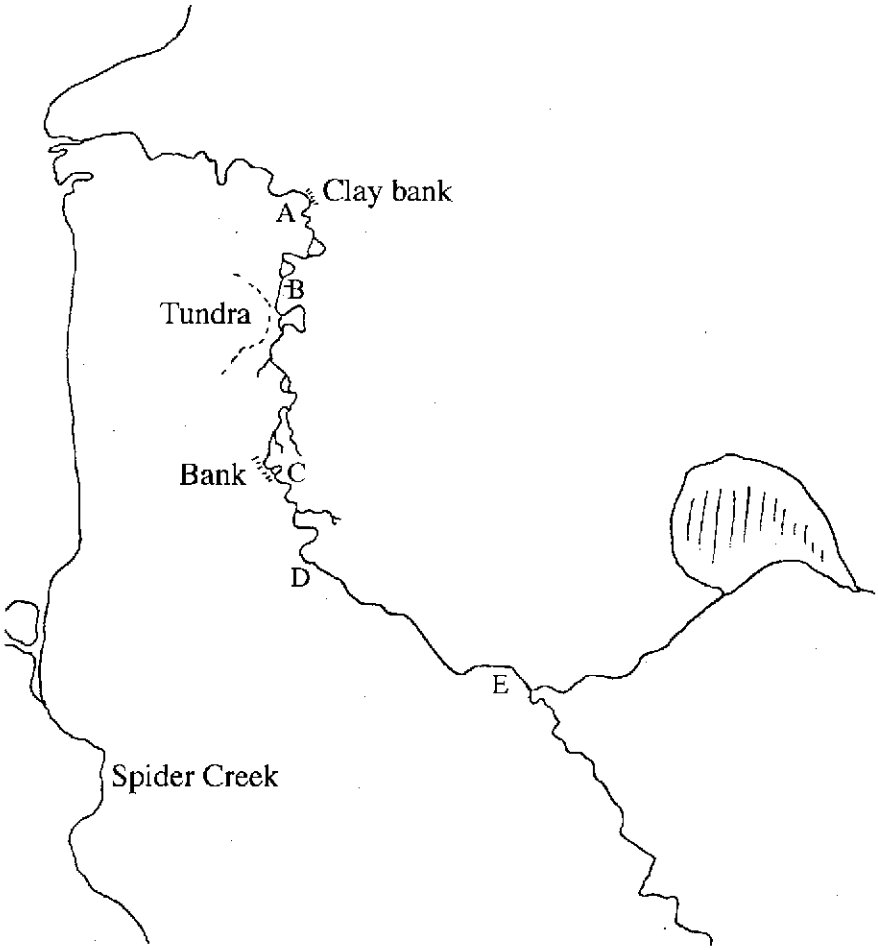

FIGURE 11. Moose Creek, Lake Beverley.

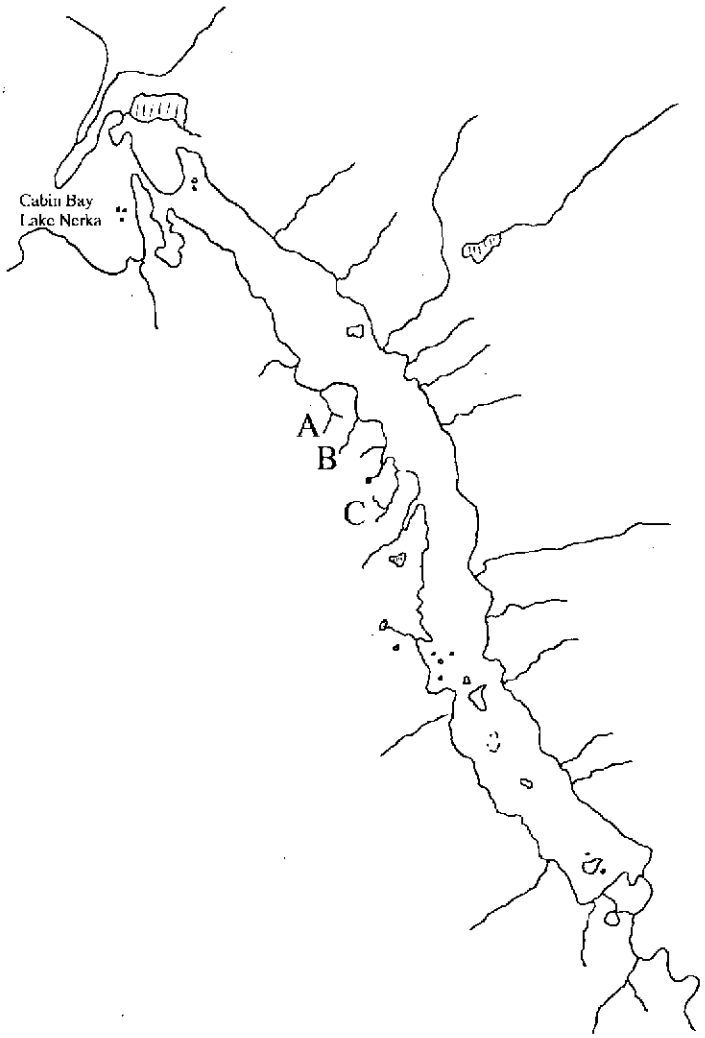

FIGURE 12. A and C Creeks, Little Togiak Lake.

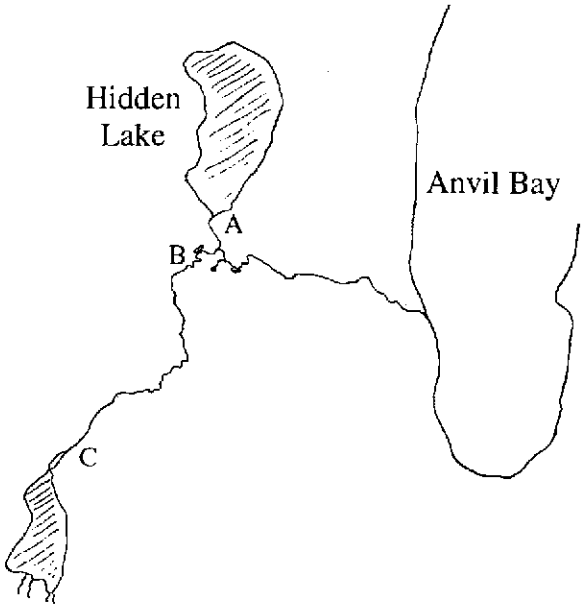

FIGURE 13. Hidden Lake Creek, Lake Nerka.

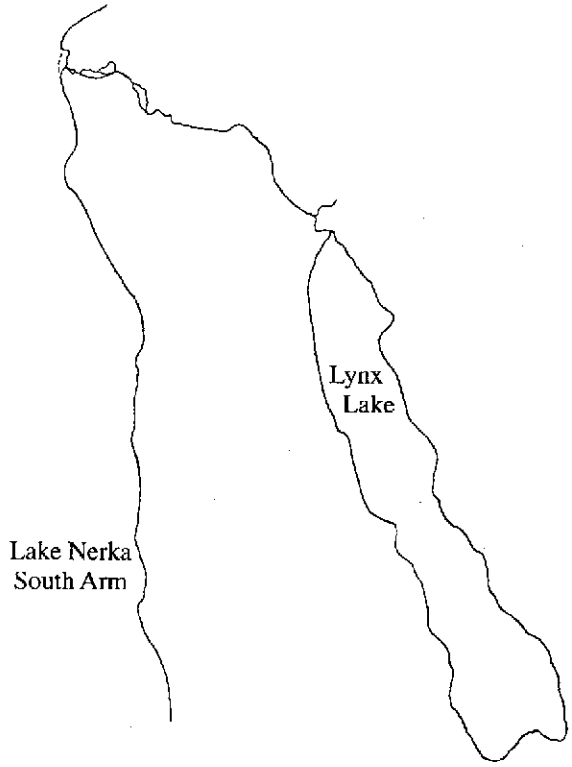

FIGURE 14. Lynx Creek, Lake Nerka.

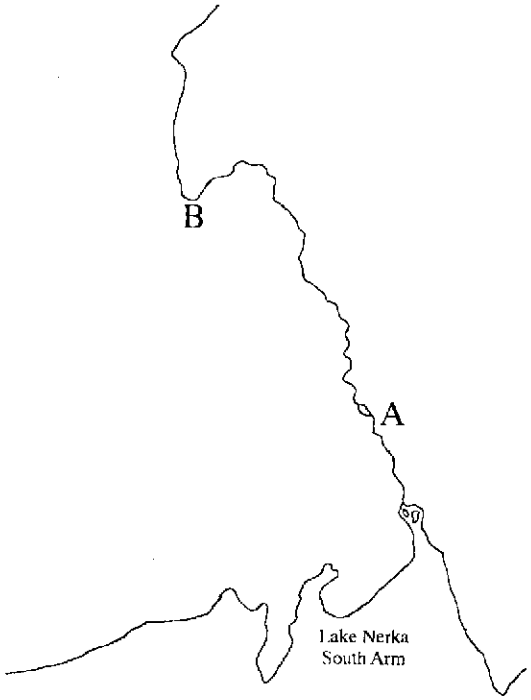

FIGURE 15. Stovall Creek, Lake Nerka.

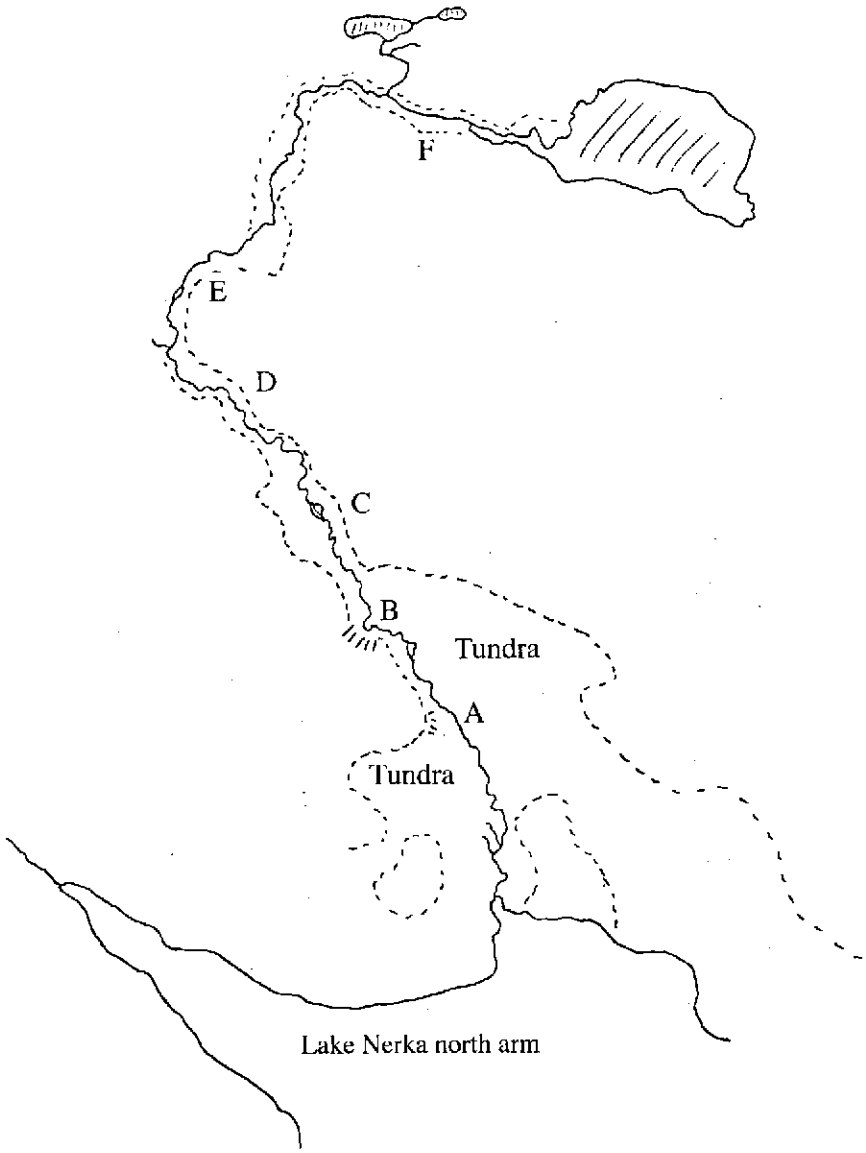

FIGURE 16. Kema Creek, Lake Nerka.

TABLE 1. Locations and dates of spawning ground surveys in the Wood River lakes.

	Area	Lake	Dates of survey		Dates of occupancy
			Mid-date	Range	
1	Hansen Creek	Aleknagik	Aug. 5	1--7	7/20-8/25
2	Yako Creek*	Aleknagik	Aug. 5	1--7	7/24-8/20
3	Bear Creek	Aleknagik	Aug. 6	4--7	7/25-8/25
4	Happy Creek	Aleknagik	Aug. 7	5--9	7/25-8/25
5	Ice Creek	Aleknagik	Aug. 8	7--11	7/26-8/26
6	Eagle Creek*	Aleknagik	Aug. 10	8--12	8/1-8/25
7	Fenno Creek	Nerka	Aug. 11	8--12	7/28-8/20
8	Whitefish Creek*	Aleknagik	Aug. 12	12--17	7/30-8/25
9	Mission Creek*	Aleknagik	Aug. 13	12--17	8/1-8/20
10	Pick Creek	Nerka	Aug. 15	14--17	7/25-9/2
11	Moose Creek	Beverley	Aug. 16	14--17	8/5-9/1
12	A and C Creeks*	Little Togiak	Aug. 18	17--21	8/5-9/2
13	Hidden Lake Creek	Nerka	Aug. 21	18--22	8/1-9/1
14	Grant River	Kulik	Aug. 22	20--25	7/30-8/30
15	Lynx Creek	Nerka	Aug. 23	20--25	7/30-8/31
16	Stovall Creek	Nerka	Aug. 24	20--25	8/4-9/4
17	Kema Creek	Nerka	Aug. 25	20--25	8/1-9/1
18	Elva Creek*	Nerka	Aug. 26	20--27	8/6-9/1
19	Little Togiak River	Nerka	Aug. 30	8/27-9/2	8/6-9/10
20	Agulukpak River	Nerka	Aug. 31	8/30-9/7	8/10-9/16
21	Agulowak River	Aleknagik	Sept. 3	1--7	8/10-9/25
22	Wood River	Aleknagik	Sept. 5	3--8	8/10-9/20
23	N4-N6 Beaches	Nerka	Sept. 8	6--10	8/15-9/20
24	Anvil Bay Beach	Nerka	Sept. 9	6--10	8/15-9/20
25	Little Togiak Beaches	Little Togiak	Sept. 10	10--15	8/15-9/30
26	Kulik Beaches (north)	Kulik	Sept.	10--15	8/15-9/30
27	N.W. Mikchalk Beach	Mikchalk	Sept.	12--15	8/15-9/30
28	B4-B6 Beaches	Beverley	Sept.	12--15	8/15-9/30
29	B9-B12 Beaches	Beverley	Sept.	12--15	8/15-9/30
30	Silver Horn Beach	Beverley	Sept.	14--16	8/20-10/10

* counts only-- no otoliths are usually collected.

TABLE 2. Physical descriptions of spawning streams in the Wood River Lakes.

	Area	Lake	Length (mi)	Mean width (ft)	Mean depth (in)	Spawning area (acres)	Bottom composition (%) Boulder	Rubble	Gravel	Mud/sand	Velocity (fps)	Flow (cfs)
1	Hansen Creek	Aleknagik	1.3	13	4	2.05	0	0	100	0	2.3	9
2	Yako Creek	Aleknagik	3.5	14	10	2.97	0	30	70	0	2.8	26
3	Bear Creek	Aleknagik	2.0	16	8	3.30	0	0	90	10	2.3	20
4	Happy Creek	Aleknagik	4.0	10	10	3.88	0	0	90	10	3.0	34
5	Ice Creek	Aleknagik	10.0	50	20	51.51	0	0	90	10	2.8	123
6	Eagle Creek	Aleknagik	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7	Fenno Creek	So. Nerka	3.2	25	14	6.21	0	5	90	5	2.8	104
8	Big Whitefish Creek	Aleknagik	1.6	10	12	1.45	0	30	50	20	2.8	15
	Little Whitefish	Aleknagik	0.8	5	5	0.47	0	0	100	0	2.2	5
9	Mission Creek	Aleknagik	1.0	5	4	0.37	0	50	50	0	n/a	n/a
10	Pick Creek	C. Nerka	2.5	15	18	4.10	0	0	80	20	2.3	22
11	Moose Creek	Beverley	6.0	60	22	26.18	0	10	70	20	2.5	230
12	A Creek	Little Togiak	0.3	4	4	0.18	0	0	100	0	1.8	1
	C Creek	Little Togiak	0.3	7	4	0.21	0	10	90	0	1.8	3
13	Hidden Lake Creek	No. Nerka	2.6	15	10	3.16	0	30	70	0	2.0	27
14	Grant River	Kulik	4.5	65	18	33.67	0	0	100	0	2.6	174
15	Lynx Creek	So. Nerka	1.4	25	14	2.55	0	50	50	0	3.2	106
16	Stovall Creek	So. Nerka	4.3	35	18	13.68	10	10	70	10	2.0	57
17	Kema Creek	No. Nerka	3.2	22	15	7.00	0	0	90	10	2.0	41
18	Elva Creek	C. Nerka	3.0	15	17	0.82	10	50	30	10	3.3	92
19	Little Togiak R.	C. Nerka	0.3	175	16	6.44	10	40	50	0	2.4	265
20	Agulukpak R.	No. Nerka	1.8	250	30	43.64	20	50	30	0	3.5	2000
21	Agulowak River	Aleknagik	4.0	200	30	72.72	20	60	20	0	3.2	1500
22	Wood River	Aleknagik	19.0	400	11	n/a	10	50	30	10	n/a	5048
	Other streams											
	Sunshine Creek	Aleknagik	15.0	90	24	135.80	0	0	60	40	2.8	390
	Youth Creek	Aleknagik	13.0	45	42	70.89	0	70	10	20	3.5	250
	Pike Creek	So. Nerka	2.8	25	10	7.18	0	0	80	20	n/a	22
	Bear Creek	So. Nerka	3.0	15	12	2.80	10	80	10	0	n/a	n/a
	Teal Creek	So. Nerka	1.7	14	14	2.05	0	0	80	20	n/a	6
	Sam Creek	No. Nerka	3.1	24	13	7.30	0	10	90	0	n/a	n/a
	Joe Creek	No. Nerka	4.8	26	13	12.00	0	50	50	0	n/a	n/a
	Little Togiak Creek	Little Togiak	6.0	40	24	24.74	0	0	100	0	3.0	185
	Tsun Creek	Beverley	3.0	50	18	11.82	0	0	90	10	2.8	169
	Hope Creek	Beverley	6.6	31	26	16.33	0	0	80	20	n/a	33
	Peace River	Beverley	1.8	250	36	27.28	0	10	60	30	1.7	1190
	Wind River	Mikchalk	2.0	125	36	22.72	20	50	30	0	3.0	960
	K1 Creek	Kulik	4.5	55	35	42.19	0	0	70	30	3.4	310

Length and area are those accessable to salmon spawning.

TABLE 3. Hansen Creek survey counts, 1947–97.

Year	Date August	Off mouth	In creek Live	In creek Dead	Total	% dead	Remarks
47	8	50	418	941	1409	67	4 surveys, 8/1-8
48	13		35	763	798	96	early spawning
49	6				794		weir count; 4 surveys, 8/1-10
50	5	100	1454	721	2275	32	5 surveys
51	4	150	1415	980	2545	39	3 surveys, new spawners on 8/8
52	3	50	662	315	1027	31	very low water; 3 surveys
53	6	150	432	737	1319	56	total est=1600; 3 surveys
54	15	150	8640	incl.	8790		total est=8840; 6 surveys
55	8	500	9892	1916	12308	16	total est.= 12800; 10 surveys
56	2	500	1120	689	2309	30	total est.=4500; air est=7500 (8/28)
57	7/31	100	389	105	594	18	total est.=700; air est.=700
58	9	200	1968	1572	3740	42	air est.=1600 (8/7)
59	11	350	4483	5301	10134	52	3 surveys
60	9		2875	incl.	2875		
61	6		159	281	440	64	air est.=700
62	8	350	3037	1492	4879	31	air est.=3860 (8/4)
63	2	1200	826	691	2717	25	
64	12				2600		ground and aerial estimate
65	2	65	2052	1324	3441	38	air est.=3620 (8/1)
66	7	600	12818	1840	15258	12	air est.=10000(8/6)
67	2	35	1080	2252	3367	67	air est.=1200 (8/5)
68	7/31	200	880	1310	2390	55	air est.=1700 (8/4)
69	7/30	300	1097	1397	2794	50	air est.=700
70	4	300	1668	898	2866	31	2 surveys
71	2	500	625	130	1255	10	
72	5	50	530	226	806	28	2 surveys
73	5	50	6	153	209	73	
74	1	1000	3117	1118	5235	21	2 surveys
75	6	200	1825	1252	3277	38	2 surveys
76	2	300	382	647	1329	49	
77	1	32	82	58	172	34	
78	7/30	400	5636	779	6815	11	
79	7/31	530	2647	1705	4882	35	
80	6	0	4568	1911	6479	29	2 surveys
81	1	55	220	890	1165	76	early spawning
82	6	50	578	168	796	21	2 surveys
83	4	800	878	1475	3153	47	3 surveys
84	9	300	418	949	1667	57	3 surveys
85	9	1	18	218	237	92	2 surveys
86	8	100	18	505	623	81	heavy bear kill; 2 surveys
87	3	500	3527	1114	5141	22	fish getting into upper beaver pond
88	4	150	100	768	1018	75	2 surveys
89	6	150	1071	161	1382	12	3 surveys
90	6	25	4105	743	4873	15	daily counts; total est.=6733
91	6	500	8670	3735	12905	29	daily counts; total est.=16296
92	6	50	3518	2886	6454	45	daily counts; total est.=7292
93	6	200	1492	1573	3265	48	daily counts; total est.=4212
94	6	500	3205	1947	5652	34	daily counts; total est.=7413
95	6	100	7680	4423	12203	36	daily counts; total est.=17589
96	6	200	4868	3021	8089	37	daily counts; total est.=9736
97	6	300	2163	3804	6267	61	daily counts; total est.=8845
98							
47-97 Means	5	269	2436	1317	3863	42	

TABLE 4. Yako Creek survey counts, 1946–97.

Year	Date Aug.	Off mouth	In creek Live	In creek Dead	Total	% dead	Remarks
46	3		4500	1104	5604	20	
47	-1				5600		
48	11	200	288	355	643	55	
49							no survey
50	-4	250	263	3	266	1	2nd survey
51	0	700	616	15	631	2	2nd survey
52	2		164	7	171	4	heavy native fishery
53	5		1130	316	1446	22	3 surveys
54	7				3200		3 surveys
55	9		1023	148	1171	13	6-7000 native catch
56	6	500			4000		3 surveys; no native fishery
57	2		227	258	485	53	heavy native fishery
58	8		400	6	475	1	
59	8	1000			500		air est.; heavy native fishery
60	10	100			675		
61	8		61	0	61	0	air =100; very heavy fishery
62	9		822	55	877		air=1360(8/5);moderate fishery
63	3				100		air
64	12				1100		air
65	2				920		air
66	6				1500		air
67	5				200		air
68	4				400		air
69	6				250		air
70	1	500	669	62	1231	8	
71	2	100	452	2	554	0	suveyed to end of fish
72	4	200	473	44	717	9	
73	4	0	63	7	70	10	entire creek
74	-3	450	669	113	1232	14	100 of dead from native fishery
75	0	300	560	28	888	5	all dead from bear kills
76	3	200	1154	97	1451	8	walked to end of fish (1hr)
77	2	0	322	14	336	4	
78	0	300	3563	53	3916	1	
79	1	600	1367	358	2325	21	
80	1	500	2909	278	3687	9	1.75hr to end of fish
81	2	1000	1536	759	3295	33	2.5hrs to end of fish
82	4	100	1005	200	1305	17	most dead were bear kills
83	-1	1300	2085	325	3710	13	walked to beaver dam (2.5hrs)
84	9	200	1392	1180	2772	46	
85	3	400	1346	217	1963	14	
86	4	200	1359	110	1669	7	
87	5	10	2301	410	2721	15	
88	0	300	1277	231	1808	15	
89	1	300	358	132	790	27	
90	1	500	3611	64	4175	2	
91	3	3000	3431	455	6886	12	mouth??; dead incl. 196 bear kills
92	2	1700	2849	137	4686	5	walked 1.5hr.;incl. 8 bear kills
93	2	300	1506	523	2329	26	
94	5	300	1725	42	2067	2	includes 13 bear kills
95	1	2000	1715	232	3947	12	
96	1	1000	2847	407	4254	13	includes 180 bear kills
97	1	500	2917	3077	6494	51	7/28 air=2,000; incl. 1657 bear kills
98							
46-97 means	4	559	1409	303	1991	15	

TABLE 5. Bear Creek survey counts, 1946–97.

Year	Date August	Off mouth	In creek Live	In creek Dead	Total	% Dead	Remarks
46	7	1500	3305	562	5367	10	total estimate=10000
47	9		1903	743	2646	28	total estimate =6000
48	11		1341	1898	3239	59	incl. off mouth,total est.=3880
49	9	150	168	266	584	46	
50	2	200	1264	531	1995	27	
51	2	700	1262	356	2318	15	3 surveys
52	2	300	1561	273	2134	13	3 surveys
53	8		1887	698	2585	27	14 surveys
54	15	125	1213	944	2282	41	3 surveys
55	10	50	7656	1260	8966	14	2 surveys
56	3	400	2882	250	3532	7	
57	2	2000			1600		aerial estimate=5000
58	8	1000	1319	incl.	2319		air=4000
59	8	300	2500	incl.	2800		air=3500
60	8	0			1735		
61	5	0	588	374	962	39	air=1200
62	8	250	827	168	1245	13	air=1240
63	3		911	98	1009	10	air=1500
64	9	700	2476	213	3389	6	air=2400
65	8	500	3323	323	4146	8	air=3650
66	5	108	4403	293	4804	6	air=3100
67	-3	600	1355	168	2123	8	air=1000
68	2	200	2616	158	2974	5	air=2300
69	4	500	2047	869	3416	25	air=1100
70	8	200	1650	611	2461	25	
71	11	200	4121	365	4686	8	
72	7	350	1773	766	2889	27	
73	11	100	566	643	1309	49	
74	7	300	3430	1377	5107	27	
75	7	250	1854	782	2886	27	
76	8	200	3079	1380	4659	30	
77	6	0	1291	700	1991	35	
78	4	600	8282	1254	10136	12	
79	4	700	2393	1574	4667	34	
80	5	800	7039	2151	9990	22	
81	6	300	4987	2305	7592	30	
82	4	90	3608	1227	4925	25	
83	5	1000	1733	1104	3837	29	
84	5	500	1692	1281	3473	37	
85	7	500	3952	565	5017	11	
86	6	500	3559	689	4748	15	
87	8	500	1925	716	3141	23	
88	6	150	1263	754	2167	35	
89	6	250	4208	777	5235	15	4 surveys
90	7	700	5982	663	7345	9	
91	7	700	5597	3194	9491	34	incl. 1021 bear kills
92	6	300	2490	726	3516	21	incl. 244 bear kills
93	6	500	2402	1081	3983	27	incl. 447 bear kills
94	6	500	2708	314	3522	9	incl. 95 bear kills
95	25	250	771	3269	4290	76	incl 984 bear kills; 2% dead on 8/3
96	19	300	1659	3981	5940	67	incl 1431 bear kills
97	5	400	2434	1565	4399	36	incl 602 bear kills
98							
46-94	6	439	2732	832	3815	23	

TABLE 6. Happy Creek survey counts, 1946–97.

Year	Date August	Off mouth	In creek Live	In creek Dead	Total	% dead	Remarks
46	7	5500	6358	4919	16777	29	Total est.=14000
47	8		268	292	560	52	1 mi survey. Total est.=1000
48	14		41	145	186	78	high water. Total est.=550
49	15		127	194	321	60	3 surveys. Total est.=650
50	7	150	452	559	1161	48	total est.=2400
51	7		1194	551	1745	32	total est.=2500
52	0		445	59	504	12	2 surveys,total est.=1000
53	-2		684	325	1009	32	4 surveys, total est.=1950
54	7	225	4118	incl	4343		4 surveys, total est.=4350
55	7	750	3750	incl	4500		air est=3000, total est.=4500
56	5	200	4537	incl.	4737		ave. of 2 counts, total est.=5700
57	-1	300	1116	1935	3351	58	4 surveys, total est.=3550
58	8		968	incl.	968		
59	3	500	2454	180	3134	6	8/10 air est.=4000
60	11		653	incl.	653		
61	5		595	439	1034	42	
62					650		aerial estimate
63	6	50	586	66	702	9	total est=850
64	7	250	1536	40	1826	2	8/12 air=1700,total est.=1850
65	7	50	2029	437	2516	17	
66	6		2941	948	3889	24	
67	0	45	718	134	897	15	
68	1		832	409	1241	33	
69	1	200	1515	166	1881	9	
70	6	200	795	20	1015	2	
71	14	0	547	120	667	18	
72	10	10	769	181	960	19	
73	12	0	100	55	155	35	new outlet into Hansen Bay
74	0	200	2128	297	2625	11	mostly bear kills, too early
75	9	150	1276	189	1615	12	2 beaver dams
76	13	250	935	964	2149	45	8 in outlet to Hansen,late survey
77	7	0	531	548	1079	51	
78	7	51	1748	1423	3222	44	
79	6	200	2691	1666	4557	37	
80	6	0	2942	1498	4440	34	
81	5	200	1712	2427	4339	56	
82	5	75	2980	2128	5183	41	
83	4	2000	3513	1681	7194	23	
84	6	100	1121	2178	3399	64	
85	8	200	3509	1648	5357	31	
86	7	200	3784	2501	6485	39	
87	7	200	8549	4475	13224	34	
88	5	200	6375	6329	12904	49	
89	2	150	11293	2228	13671	16	
90	8	0	4326	4731	9057	52	dead incl. 1028 bear kills
91	8	20	10616	15077	25713	59	dead incl. 2169 bear kills
92	7	500	3531	4354	8385	52	dead incl. 230 bear kills
93	7	200	2521	16269	18990	86	dead incl. 3052 bear kills
94	7	1000	4676	2799	8475	33	dead incl. 537 bear kills
95	8	0	5274	3648	8922	41	about 15% bear kills
96	8	200	3129	5729	9058	63	dead incl. 1770 bear kills
97	6	300	1235	4630	6165	75	dead incl. 2747 bear kills
98							
46-97	6	371	2559	2209	4761	37	

TABLE 7. Ice Creek survey counts, 1946–97.

	Aerial count		Ground count (partial)						
	Date	No.	Date	Off	In creek			%	
Year	Aug.	Live	Aug.	mouth	Live	Dead	Total	dead	Remarks
46			6	300	10719	incl.	11019		
47			10		385	589	974	60	lower 2 mi.
48							0		no survey
49			8		153	incl.	153		heavy native fishery
50			13		631	738	1369	54	lower 2 mi.; total est.=7665
51			17		491	1663	2154	77	middle 1.5 mi.; totalest.=3986
52			13		85	405	490	83	middle 1.5 mi.;total est.=2759
53			10		629	1323	1952	68	mid 1.5 mi.; total est.=1952
54			8		1083	incl.	1083		mid 1.5mi.
55	3	9000	18		2407	7309	9716	75	mid 1.5mi.
56	7	7500			4700	incl.	4700		mid 1.5mi.
57	-5	3500	7		1504	761	2265	34	mid 1.5mi.
58	7	2100	20		166	377	543	69	too late; total est=2200
59	10	4500							no survey
60	9	7000							no survey
61	6	2500	7		1515	161	1676	10	
62	9	2000							no survey
63	10	2000	10		2455	222	2677	8	In at tunda then count to mouth
64	12	4800	12		3609	447	4056	11	
65	10	11300	10		7617	3666	11283	32	
66	6	10400	9		8204	4486	12690	35	
67	5	2500	3	0	3815	576	4391	13	
68	4	4200	7		4892	3021	7913	38	
69	6	1800	11		3799	2253	6052	37	
70	11	6400	10	0	5851	1237	7088	17	
71	13	4900	13	0	4375	737	5112	14	
72			12	100	5560	980	6640	15	
73	10	5700	13	0	3967	2624	6591	40	
74	10	7300	5	600	8066	1724	10390	17	
75	5	9700	10	100	4960	3107	8167	38	
76	10	9500	11	0	9610	2883	12493	23	
77	9	3700	9	0	3372	3309	6681	50	
78	7	7100	8	200	3521	13502	17223	78	
79			7	145	1951	4344	6440	67	
80			8		6298	8347	14645	57	
81			7	300	6600	7730	14630	53	
82			7	500	12149	11937	24586	49	
83	5	5800	6	0	5435	1507	6942	22	
84			7	0	3848	2166	6014	36	
85	6	7300	10	200	3172	1809	5181	35	
86	12	5300	10	300	279	137	716	19	lower 1mi. only; high water
87	9	4700	9	1	1401	2446	3848	64	
88	8	3530	8	3	3028	3848	6879	56	
89			10	0	2681	2784	5465	51	incl. 924 bear kills
90			9	0	8183	2869	11052	26	incl. 406 bear kills
91			9	1500	19582	15884	36966	43	incl. 1757 bear kills
92			9	200	6557	3512	10269	34	lower 1.5mi.;incl. 388 bear kills
93	9	4700	9	150	3449	2481	6080	41	incl. 658 bear kills
94	8	7400	11	200	5765	1467	7432	20	incl. 162 bear kills
95			11	0	2594	1552	4146	37	incl. 109 bear kills
96			9	3000	7490	2955	13445	22	incl. 228 bear kills
97	-3	600	7	300	5128	3544	8972	40	incl. 1045 bear kills
98									
46-97	7	5443	10	279	4453	3169	7372	40	

TABLE 8. Eagle Creek survey counts, 1957–97.

Year	Date Aug.	Off mouth	In creek Live	In creek Dead	Total	% dead	Remarks
57					100		aerial estimate
58					800		
59					6700		
60					400		
61					100		
62					1400		
63					100		
64							
65					500		
66					3700		
67					500		
68					1000		
69					300		
70	7	200	2127	132	2459	6	dead all bear kills
71	2	150	244	1	400	0	
72	5	50	198	2	250	1	
73	9	0	43	2	45	4	dead all bear kills
74	-3	200	1300	17	1517	1	
75	3	200	1290	32	1522	2	
76							
77	4	0	505	22	527	4	counted to end of fish
78	1	500	2306	22	2828	1	too early
79	9	300	2941	228	3469	7	2 beaver dams in 1st 300yds
80	7	800	6438	189	7427	3	walked up for 2.5 hrs
81	3	100	524	33	657	6	fish could not pass 2nd dam
82	5	50	380	7	437	2	3 beaver dams near mouth
83	0	500	1285	2	1787	0	walked up for 1.5 hrs
84	8	60	922	116	1098	11	fish bunched at 3rd dam
85	4	200	462	11	673	2	fish blocked at 2nd dam
86	5	300	143	27	470	16	fish blocked by beaver dams
87	8	150	920	43	1113	4	1st & 2nd dams broken, 3rd active
88	7	100	1141	55	1296	5	stopped at beaver dam (3rd)
89	3	300	248	68	616	22	
90	12	200	767	136	1103	15	also other surveys; dam broken
91	10	100	666	102	868	13	incl. 95 bear kills; dam not repaired
92	10	25	70	29	124	29	incl. 14 bear kills
93	10	200	1200	50	1450	4	incl. 45 bear kills
94	12	20	781	196	997	20	incl. 180 bear kills
95	14	15	1647	172	1834	9	incl. 95 bear kills
96	14	2	889	304	1195	25	incl. 182 bear kills
97	11	150	551	246	947	31	incl. 185 bear kills
98							
70-97 means	7	180	1111	83	1374	9	

TABLE 9. Fenno Creek survey counts, 1946–97.

Year	Date in August	Off mouth	In creek Live	In creek Dead	Total	% dead	Remarks
46	14		4950	1150	6100	19	
47	13		229	2527	2756	92	total estimate 3135
48-50							no surveys
51	9	0	1192	255	1447	18	total estimate 1750
52	10	0	706	58	764	8	total estimate 1100
53	8	0	904	289	1193	24	
54	9				1604		
55	20	0	130	3540	3670	96	
56	9				5000		Aerial estimate
57	4				1000		Aerial estimate
58	10	0	1549	372	1921	19	
59	7	0	12185	3424	15609	22	
60	9				5000		Aerial estimate
61	6				1200		Aerial estimate
62	12	0	475	427	902	47	air=1000
63	14	0	636	2433	3069	79	air=5000
64	16	0	488	2575	3063	84	air=3060
65	14	0	533	1085	1618	67	
66	11	0	1973	431	2404	18	air=3500
67	1	0	764	166	930	18	air=700
68	8	0	1483	1988	3471	57	air=1400
69	14	0	197	4446	4643	96	air=850
70	11	0	3037	718	3755	19	
71	16	0	1680	132	1812	7	
72	14	0	997	1449	2446	59	
73	19	0	190	227	417	54	
74	12	0	836	2183	3019	72	
75	13	0	322	649	971	67	
76	14	2	2292	1031	3325	31	
77	11	2	954	571	1527	37	
78	10	1	648	1185	1834	65	
79	11	132	236	1016	1252	81	
80	11	25	2201	12240	14466	85	
81	10	1	176	1241	1418	88	
82	13	3	546	506	1055	48	
83	10	10	545	249	804	31	
84	11	1	234	2187	2421	90	
85	11	50	539	935	1524	61	
86	8	0	1486	151	1637	9	
87	11	0	740	580	1320	44	
88	11	0	587	1550	2137	73	
89	14	10	224	2467	2701	91	
90	13	0	443	2086	2529	82	incl. 237 bear kills
91	11	0	592	1196	1788	67	incl. 200 bear kills
92	8	50	3379	3012	6441	47	incl. 218 bear kills
93	11	10	408	4722	5140	92	incl. 1695 bear kills
94	10	0	2673	397	3070	13	incl. 31 bear kills
95	10	0	841	2441	3282	74	about 2% bear kills
96	10	0	2003	1661	3664	45	incl. 53 bear kills
97	8	0	1736	2770	4506	61	incl. 890 bear kills; air est.=3520
98							
46-97 means	11	7	1340	1698	3013	54	

TABLE 10. Whitefish Creeks survey counts, 1946–97.

Year	Date Aug.	Off mouth	In creek: Big Whitefish Live	Big Whitefish Dead	Little Whitefish Live	Little Whitefish Dead	Total	% dead	Remarks
46	30						10000		Big only; 2 surveys
47	26						1884		Big only; 4 surveys; many fish in lake
48	10						5671		4500 schooled below lake
49	16	0					422		Big only
50	18		263			818	1081		5 surveys
51	9	15	752		418		1185		
52	12		439		209		648		
53	11	150	1262		111		1523		
54	14	50	1222		1545		2817		
55	13		1318		2444	422	4184		605 in lake
56	8	350	1019	5	1152	218	2744		
57	10		85		24	24	133		
58	7						1100		Air estimate
59	11						2200		Air estimate
60	9						2000		Air
61	11		190	5			195		No count in Little Whitefish
62	10		536	17			553		51 in lake
63	10						350		Air
64	12						1100		Air
65	23						200		All in lake
66	6						1800		Air
67	5						400		Air
68	4						1100		Air; 100 in lake
69	6						250		Air; 100 in lake
70	7	300	799	10	412	0	1521	1	
71	9	300	135	13	5	55	508	13	
72	6	0	64	0	9	1	74	1	
73	6	0	17	0	0	0	17	0	All in lake
74	5	250	256	132			638	21	
75	6	50	838	7			895	1	300 estimated in lake
76	14	0	566	110			676	16	
77	8	0	553	2			555	0	
78	3	300	586	104			990	11	
79	10	0	303	154			457	34	large beaver pond
80	10	300	1047	50			1397	4	
81	4	125	558	40			723	6	6 beaver ponds; last blocked fish
82	11	10	330	7			347	2	About 50 pinks
83	8	60	468	52	83	344	1007	39	
84	8	30	337	28	23	9	427	9	Big blocked by dam at 1.5mi.
85	12	3	758	3			764	0	6 beaver dams in 1st mile
86	9	50	249	8			307	3	13 beaver dams
87									No survey
88	3	100	0	0	100	367	567	65	Big Whitefish blocked near mouth
89	7	0			23	34	57	60	Big Whitefish blocked by dam
90									No survey
91									No survey
92	13	3	337	103			443	23	incl. 60 bear kills
93	14	0	379	23	69	141	612	27	incl. 141 bear kills
94	14	0	383	34	1	14	432	11	incl. 31 bear kills
95	26	0	535	1060	0	335	1930	72	bear attack; incl. 242 bear kills
96	11	300	383	146	27	70	926	23	incl. 135 bear kills
97	17	300	639	38	12	82	1071	11	incl. 104 bear kills
98									
46-97 means	11	102	518	80	333	173	1242	18	

TABLE 11. Mission Creek survey counts, 1954–97.

Year	Date Aug.	Off mouth	In creek Live	In creek Dead	Total	% dead	Remarks
46-53							No surveys
54					1030		
55					650		
56							No survey
57							No survey
58					400		
59	11				1000		Aerial estimate
60	9				500		Air
61	6				100		Air
62	9	350	774		1124		In creek is live+dead; air=980 (8/3)
63	5				10		Air
64	12				100		Air
65	13				130		Air
66	6				250		Air
67	5				100		Air
68	4				100		Air
69	6				50		Air
70					200		Air
71-81							No surveys
82	9	8	233	0	241	0	On 8/3: 127 live & 2 dead, 40 off mouth
83	12	30	866	115	1011	11	On 8/1: 518 live & 31 dead, 500 off mouth
84	25	0	45	55	100	55	3 surveys
85	13	1	243	31	275	11	
86	9	2	288	5	295	2	
87	10	10	1609	147	1766	8	
88	9	50	315	16	381	4	
89	8	200	1126	28	1354	2	
90	17	0	1127	159	1286	12	No bear kills
91	17	85	1840	478	2403	20	169 bear kills incl. (3 bears seen)
92	16	0	509	626	1135	55	42 bear kills included.
93	13	5	2086	636	2727	23	42 bear kills incl.; 8/17- 2666 (51%dead)
94	14	30	1171	145	1346	11	71 bear kills included
95	11	200	1583	270	2053	13	about 10% bear kills
96	12	200	705	314	1219	26	135 bear kills
97	15	150	659	523	1332	39	197 bear kills
98							
82-97 means	13	61	900	222	1183	18	

TABLE 12. Pick Creek survey counts, 1946–97.

Year	Date Aug.	Off mouth	In creek Live	In creek Dead	Total	% dead	Remarks
46	17		47532	10722	58254	18	ponds=40,000; later total est. by OAM=35800
47	17				8125		2 surveys
48	31				7651		
49	17	50	177	63	290	26	total estimate= 400; count of 61 on 9/5
50	5				3913		
51	14				4652		3 surveys
52	9				2429		3 surveys
53	11				2537		1000 in ponds; 6 surveys
54	11				3207		3 surveys 8/5,11 and 27
55	22				13200		4000 in ponds; 5 surveys (7/26-9/20)
56	17				10000		6 surveys(7/28-8/29); air=7000 (8/8)
57	17				4500		air=4300 (8/8)
58	12				7100		incl. 3000 in ponds,air=5600
59	13				85000		extremely heavy; incl. 35000 in ponds
60	9				25000		incl. 14000 in ponds
61	13		3085	511	3596	14	air=4500(8/6)
62	9				12000		air estimate; ground count=4,007 live(7/30)
63	15	300	6842	2566	9708	27	air=8500 (8/10)
64	14	200	11807	3977	15974	25	air=12400 (8/15)
65	15	100	4662	2833	7595	38	air=8500 (8/15)
66	13	500	7616	1249	9365	14	air=11500(8/12)
67	8	150	3183	611	3944	16	air=6700 (8/10)
68	11	30	5116	1197	6343	19	incl. 1800 in ponds; air=4300 (8/4)
69	15	150	4625	1977	6752	30	incl. 1400 in ponds; air=5500 (8/11)
70	15	200	8635	2362	11197	21	incl. 4000 in ponds
71	22	0	3457	1297	4754	27	incl. 2500 in ponds; 3200 on 8/18
72	16	300	7131	2625	10056	27	incl. 1900 in ponds
73	16	100	1513	865	2478	36	incl. 41 in ponds,low water
74	14	100	9487	4058	13645	30	incl. 4200 in ponds
75	12	200	5739	961	6900	14	incl. 600 in ponds
76	13	300	9300	1760	11360	16	incl. 1800 in ponds
77	12	0	5230	135	5365	3	incl. 1600 in ponds
78	12	200	13737	3969	17906	22	incl. 700 in ponds
79	13	20	8932	3014	11966	25	incl. 1300 in ponds
80	14	2000	22521	8844	33365	28	incl. 8000 in ponds, low water
81	15	40	6843	4546	11429	40	incl. 2800 in ponds
82	14	100	8192	2292	10584	22	incl. 2900 in ponds
83	17	400	3588	1792	5780	33	no fish in ponds, 1-2"deep
84	15	150	5974	3565	9689	37	very low water, 2" deep
85	14	500	6392	2792	9684	30	high water
86	14	50	6340	622	7012	9	beaver pond near mouth
87	13	150	2720	1037	3907	28	only 100 in spring ponds
88	12	200	5781	2463	8444	30	no fish in ponds, 2-3" deep
89	16	100	4218	2005	6323	32	1582 bear kills; only13 in ponds; 4" deep
90	18	0	2831	2087	4918	42	1201 bear kills;only 174 in ponds; 5" deep
91	12	1	3158	1112	4271	26	incl. 929 bear kills; no fish in ponds
92	13	5	5646	962	6613	15	incl. 712 bear kills
93	15	0	2962	2201	5163	43	incl. 1068 bear kills; 62 fish in upper pond
94	17	200	5364	576	6140	10	13 fish in upper pond
95	16	200	3381	853	4434	20	incl 559 bear kills; no fish in ponds
96	21	100	2684	3069	5853	53	incl 78 bear kills; 30 fish in ponds
97	20	75	2190	3455	5720	61	incl 1448 bear kills; 43 fish in upper ponds
98							
46-97 means	15	199	7068	2395	10694	27	

TABLE 13. Moose Creek survey counts, 1955–97.

	Aerial count		Ground survey (partial)						
	Date	No.	Date	Off	In creek			%	
Year	Aug.	live	Aug.	mouth	Live	Dead	Total	dead	Remarks
46-54									No surveys
55	17	8000							
56	8	1700							
57	8	625							
58	17	3000							
59	16	1000							
60	18	2000							
61	16	2000							
62	19	11000	28	0	358	2068	2426	85	2.5 mi.; too late; 8/15 best
63	20	2100	18	0	1032	867	1899	46	
64	19		19	0	4556	8101	12657	64	To head of spawning
65	18		18	0	485	1176	1661	71	To head of spawning
66	19	4000	17	0	2624	1310	3934	33	To head of spawning
67	18	600	10	0	1684	216	1900	11	To head of spawning
68	18	700	16	0	951	2498	3449	72	
69	16	700	14	0	1009	1588	2597	61	Count to "E"
70			14	200	2286	719	3205	22	Poor visability to "C"
71	20	3000	29						late, otoliths only
72			19	0	1274	1430	2704	53	Count past "E" to end of fish
73			19	0	522	752	1274	59	Several beaver dams; count to "E"
74			16	0	2249	2791	5040	55	Many beaver dams; end short of "E"
75	18	2000	18	0	713	703	1416	50	Count to "C"
76	15	2500	23	0	440	114	554	21	Count to "A"
77	14	200	14	0	247	35	282	12	Count to "C"; high water
78	15	13100	15	10	2146	713	2869	25	Count to "C", 50% by "A"
79	21	1200	14						No count, high and muddy
80	12	25600							No survey
81			17	0	196	240	436	55	1 hr to "A"
82			15	100	1519	140	1759	8	Count to "A"
83	15	4800	15	0	1141	229	1370	17	Walked for 1.5 hr.
84	19	1000							No survey; very low water
85	16	1000	17	20	445	364	829	44	Count to "A"
86		800	16	100	382	100	582	17	.25 mi. only
87		3400	15	0	1401	168	1569	11	To above broken beaver dam
88		2000	14	0	625	46	671	7	New dam near mouth; several broken dams
89		1500	23	0	33	316	349	91	Incl. 116 bear kills; to "A"
90		1600	15	0	470	300	770	39	Incl. 48 bear kills; to "A"
91		4400	13	500	1432	272	2204	12	Walked 1.5 hr; incl 11 bear kills
92		2400	12	500	1679	198	2377	8	To "A"; incl. 101 bear kills
93	9	9200	16	0	546	406	952	43	Short of "A"; incl. 138 bear kills
94			12	0	357	287	644	45	Short of "A"; incl. 156 bear kills
95	14	3500	16	100	864	416	1380	30	Short of "A"; incl. 44 bear kills
96			16	0	428	363	791	46	to "A"; 249 bear kills
97	14	9300	14	400	1863	237	2500	9	to "A"; 128 bear kills
98									
62-97 means		4292	17	60	1124	911	2095	38	

TABLE 22. Aerial counts for selected beach spawning areas (in hundreds).

	Lake Nerka		Little	Lake Beverley				
Year	N4-N6	Anvil Bay	Togiak Lake	B4-B6	B9-B12	Silver Horn	Lake Mikchalk	Lake Kulik
46	550	400	100	350	200	1250	200	440
47	60	150	200	320	150	250	40	407
48	30	200		200	90	100	30	150
49	1	10		5	3	5	2	2
50	3	40		30	25	40	10	8
51	7	12		40	30	80	7	20
52	5	16	4	4	1	8	4	3
53	18	50	15	6	1	10	4	2
54	21	61	40	65	35	150	33	50
55	95	140	78	110	27	185	46	275
56	39	155	58	42	3	57	10	19
57	95	6	62	6	0	4	5	3
58	98	390	111	370	205	660	208	400
59	183	510	250	555	218	731	222	621
60	103	315	120	278	138	290	153	341
61	78	101	76	50	6	34	22	40
62	101	216	70	414	240	790	265	327
63	46	180	175	215	160	713	159	530
64	100	328	132	254	109	695	95	510
65	64	129	204	154	13	44	70	61
66	109	352	162	205	192	449	56	209
67	36	174	44	211	56	152	66	164
68	64	77	60	150	17	175	27	38
69	64	66	46	16	2	31	5	14
70	123	230	162	169	49	408	28	123
71	64	210	88	350	31	414	58	195
72	75	85	51	85	14	45	17	89
73	30	27	45	20	2	5	5	21
74	124	220	169	524	301	500	176	1043
75	34	68	61	97	30	132	77	239
76	59	127	93	156	41	173	17	327
77	40	62	74	57	3	31	16	71
78	151	512	123	404	200	407	100	178
79	133	201	167	454	113	404	170	572
80	52	178	45	300	47	73	36	527
81	37	111	73	34	1	65	3	5
82	63	48	29	40	68	95	8	166
83	57	240	25	250	115	350	243	498
84	108	85	52	80	37	54	21	105
85	26	72	54	35	11	12	9	46
86	39	67	57	34	29	41	20	80
87	35	200	20	71	48	50	38	134
88	64	90	27	35	14	21	25	52
89	48	57	21	18	3	4	8	25
90								
91	7	25	13	27	33	25	7	20
92	145	96	33	82	17	50	12	73
93	56	57	22	27	1	12	3	16
94	48	54	30	63	41	46	24	162
95	50	119	32	122	41	103	29	84
96	85	93	25	72	14	44	18	77
97	8	139	92	68	9	33	10	275
98								
Means 53-96	71	153	77	156	63	203	61	198