CHINOOK SALMON STOCK ASSESSMENT

IN SOUTHEAST ALASKA, 1989

By:

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ABSTRACT

Recoveries of coded-wire tags from chinook salmon (*Oncorhynchus tshawytscha*) tagged as juveniles indicate that most Unuk and Chickamin River chinook salmon rear in the inside waters of southeast Alaska for an extended period and are available to southeast Alaska fisheries throughout their marine life history. As a result, exploitation rates on these stocks are in the range of 30 to 40%. These stocks are harvested by commercial and recreational fisheries throughout southeast Alaska and northern British Columbia with over 40% of the total catch occurring in Alaskan fishing Districts 101 and 102 and in northern British Columbia commercial net and troll fisheries.

Coded-wire tagging of juvenile chinook salmon in the Alsek River was initiated in 1987 and continued in 1989. A total of 18,130 young-of-the-year (YOY) chinook salmon were coded-wire tagged in 1989. Adult recoveries will be used for estimating harvest rates and migratory patterns of these stocks. Recoveries are expected to begin in 1991.

Chinook salmon were captured by fishwheel at Canyon Island on the Taku River from April 29 to July 23, 1989. A total of 808 large (>660mm MEF) chinook salmon were captured and tagged. Radio tags were inserted in 383 of the large fish and the remaining 425 fish were tagged only with gray spaghetti tags. Escapement was estimated by two methods and compared with the aerial survey estimate of 15,462 large chinook salmon. The estimate based on the ratio of aerial surveyed fish to the expanded number of radio tagged fish ranged from 15,522 to 18,376 fish. A mark/unmarked ratio of spawning ground recoveries was used to derive the third estimate of 37,124 fish.

Tissue samples for genetic stock identification (GSI) studies were collected from spawning chinook salmon at 17 sites in Southeast Alaska and the transboundary rivers.

KEY WORDS: Chinook, *Oncorhynchus tshawytscha*, escapement, juveniles, coded-wire tagging, migration, Taku River, Alsek River, Unuk River, Chickamin River, carcass recovery, southeast Alaska, U.S./Canada Treaty, exploitation rate, harvest rate, fishery contribution, mark-recapture, genetic stock identification.

INTRODUCTION

Since 1971, the Chinook Salmon Research Project has concentrated on stock assessment by compiling statistics on terminal gill net harvests, escapement indices, and catches in mixed-stock fisheries for stocks from watersheds in Southeast Alaska (Kissner 1973-1980, 1982, 1984, 1985; Kissner and Hubbartt, 1986; Kissner and Bethers 1981; Hubbartt and Kissner 1987; Mecum and Kissner 1989). In cooperation with other projects and agencies, information obtained by the Chinook Salmon Project is used to determine the productivity of chinook salmon stocks in Southeast Alaska and northern British Columbia.

A management program designed to rebuild depressed stocks of chinook salmon in Southeast Alaska and transboundary rivers (rivers originating in British Columbia and flowing into coastal waters of Southeast Alaska) began in the mid-1970's with regulatory closures of commercial and recreational fisheries in terminal and near-terminal areas. In 1981, a 15-year (roughly three life cycles) rebuilding program was initiated for the transboundary Taku, Stikine, Alsek, Unuk, Chickamin, and Chilkat Rivers and the non-transboundary Blossom, Keta, Situk, and King Salmon Rivers. The objective of this program, which was part of a broader, coastwide, rebuilding program for natural stocks of chinook salmon implemented under the U.S./Canada Pacific Salmon Treaty, was to rebuild spawning escapements to management goals by 1995.

In accordance with the US/Canada Salmon Treaty (Mecum and Seibel 1988), escapement indices from the ADF&G Sport Fish Division are used to ascertain progress towards meeting escapement goals for the currently depressed chinook salmon stocks of Southeast Alaska and transboundary rivers. The Joint Chinook Technical Committee of the Pacific Salmon Commission combines the indices of escapements of the major, medium, and minor stocks obtained through this Project and makes expansions to total estimates of escapements according to set formulas (Mecum and Kissner 1989). Fishery regulations are promulgated based on comparing these expansions with similarly constructed historical estimates of escapement. Estimates of escapements by brood year are used to investigate the relationship between spawners and subsequent recruitment. The Sport Fish Division provides these estimates of escapement to fishery managers on an annual basis.

The overall goal of the Chinook Salmon Research Project is to collect information needed to manage commercial and recreational fisheries to ensure maximum sustained yield of chinook salmon populations of Southeast Alaska and transboundary rivers. In 1989 research consisted of four separate studies. The first study, recovery of adult coded-wire tagged chinook salmon on the Unuk and Chickamin Rivers, had the following objectives:

1. Estimate the migration routes, run timing, exploitation rates and contribution to commercial and recreational fisheries of chinook salmon returning to the Unuk and Chickamin Rivers in 1989.

2. Estimate the size, age, sex, and length composition of the chinook salmon escapements to the Unuk and Chickamin Rivers in 1989.

The second study involved coded-wire tagging of juvenile chinook salmon in the Alsek River. The objectives were to:

1. Describe the migratory timing, exploitation rates, migration routes, and contribution to commercial and recreational fisheries of Alsek River chinook salmon.

2. Estimate the relative abundance, growth rates, and length composition of juvenile chinook salmon in the Alsek River.

3. Investigate the feasibility of capturing and coded-wire tagging chinook salmon smolts during the spring of 1989.

The third study was an adult tagging program on the Taku River. In cooperation with the National Marine Fisheries Service (NMFS) and the Canadian Department of Fisheries and Oceans (CDFO) the objectives of this study were to:

1. Estimate the total escapement of age-1.3, -1.4 and older chinook salmon to the Taku River, including the Nakina, Nahlin, Dudidontu, and Tatsamenie Rivers and Kowatua and Tseta Creeks and compare this estimate with aerial surveys of spawning abundance.

2. Estimate the age, sex, and length composition of the chinook salmon escapement to the Nakina, Nahlin, Tatsamenie, and Kowatua Rivers in 1989.

3. Document the run timing of chinook salmon in the Nakina, Nahlin, Tatsamenie and Kowatua Rivers.

The final project was to provide NMFS with tissue samples from spawning populations of chinook salmon in Southeast Alaska and transboundary rivers for genetic stock identification studies. Genetic stock identification (GSI) has been used by several fisheries agencies and investigators since the early 1980's to provide direct estimates of stock contribution to various Pacific salmon mixed-stock fisheries. The genetic procedures, in certain cases, provide estimates of stock composition with greater detail and precision than has previously been possible. Two conditions must be met prior to implementing a GSI study. First, known genetic differences must exist among populations contributing to a particular fishery. Second, a data base of calculated genotypic frequencies must be developed for those populations that are likely to compose a fishery (Utter et al 1987). The data base is incomplete for Southeast Alaska and transboundary river chinook salmon stocks. The objective of this project was to provide frozen tissue (eye, heart, liver, muscle) from freshly killed chinook salmon from all major spawning populations in Southeast Alaska and transboundary rivers.

METHODS

Enumeration of Adult Chinook Salmon

Chinook salmon escapements were enumerated in selected index areas of 31 tributaries of nine river systems in Southeast Alaska, northwest British Columbia, and the Yukon Territory, Canada (Figure 1). The names, locations, and detailed descriptions of spawning distribution and timing of chinook salmon in these index areas are summarized in Mecum 1990. These escapement counts have been used as a comparable index of escapements on an annual basis since 1975. No attempt is made to accurately count age 1.2 chinook salmon ($\leq$ 660 mm FL or 28 in. TL) because of the difficulty in correctly identifying other species of salmon in this same size range (e.g., sockeye and pink salmon).

Coded-Wire Tagging of Juvenile Chinook Salmon

From 1983 to 1988, a total of 42,475 pre-smolt and 20,531 young-of-the-year (YOY) chinook salmon were captured, coded-wire tagged, and released in mainstem areas of the Unuk River (Appendix A1). Unuk River YOY chinook salmon averaged 63 mm fork length in October. The average fork length of pre-smolt chinook salmon in the Unuk River was approximately 68 mm during March and April which is similar to that observed for other transboundary rivers (Kissner 1982; Hubartt and Kissner 1987). Juvenile chinook salmon were captured primarily in the mainstem from a point just above the confluence of Genes Lake Creek downstream to approximately 1.5 km below the confluence with Lake Creek. Highest catches during the spring occurred in or near large organic debris (e.g., root wads of large spruce trees and log jams) in water 1 to 2 meters deep along the margin of the mainstem or in braided sidechannel areas with low current velocity. High mortality of juvenile chinook salmon has been observed during the spring in these braided-channel areas after winters with prolonged cold temperatures, thick ice, and snow cover, and comparatively low spring water flows due to delayed break-up of river ice. This mortality likely results from low dissolved oxygen levels or physical damage from freezing in overwintering habitats. This was especially evident during the spring of 1985 when thick ice jams and delayed break-up appeared to reduce densities of juvenile chinook salmon in marginal habitats. Conversely, during the spring of 1988 relatively mild winter conditions resulted in high densities of juvenile chinook salmon in these overwintering areas.

From 1983 through 1988, 30,501 pre-smolt chinook salmon were captured, coded-wire tagged, and released in mainstem and tributary areas of the Chickamin River (Appendix A2). Average size of juvenile Chickamin River chinook salmon is similar to other populations of chinook salmon in other transboundary rivers in Southeast Alaska (Kissner 1982; Hubartt and Kissner 1987). The highest densities of juvenile chinook salmon were found in mainstem areas during early spring (mid-March to mid-April) before the peak of downstream emigration. The highest trap catches were recorded from the junction of the Leduc River and mainstem Chickamin

Rivers downstream to the confluence with King Creek. As has been observed on other large mainland glacial rivers like the Taku, Stikine, Alsek, and Unuk Rivers, the greatest catches of juvenile chinook salmon occurred in braided areas with good concentrations of large organic debris (LOD). Trapping was also conducted in the lower Leduc and upper Chickamin Rivers but trap catches were much lower.

Juvenile chinook salmon were captured and coded-wire tagged in the Alsek River from September 12 through October 16, 1989. Juvenile chinook were captured exclusively with standard minnow traps (Gee brand)[1] baited with clusters of salmon roe. Between 50 and 100 minnow traps were fished; traps were checked, the juveniles removed, and the traps baited again and reset on a daily (approximately 24 hours) basis. The salmon roe was disinfected prior to use, by immersion in a dilute solution of betadyne at a ratio of 1:90 (1 part Betadyne per 90 parts water) for 15 minutes.

Juvenile chinook salmon were transported from the various capture sites in live tanks to the field camp site and held in live pens near tagging sheds. Chinook salmon young-of-the-year (YOY) were then anesthetized with tricaine methanesulfonate (MS 222), marked by removal of the adipose fin, and injected with a coded-wire tag using a Northwest Marine Technology (NMT) tag injector. The tag injector was modified to function under remote conditions by conversion to a 24 volt battery system (Koerner 1977). The 120 fish/pound head mold was used for tagging YOY in the fall.

The coded-wire tags were made of Type 302 stainless steel wire and were 1.0 mm in length and 0.25 mm in diameter. Each tag has a series of binary codes etched into the surface to identify the agency conducting the tagging study and the specific treatment of each tag lot. Coded-wire tags must be properly implanted in the cartilaginous wedge of the snout to ensure maximum retention. Tag placement was observed on several chinook salmon each day by making a vertical incision through the dorsal median plane to the oral cavity. Head mold depth was adjusted accordingly if improper placement of tags was observed. Bisection and adjustment continued until tags were properly placed. Implanted coded-wire tags were magnetized by dropping tagged fish, head first, through a ring magnet into a bucket of water and then passing the fish through a NMT field sampling detector to check for the presence of a magnetized tag. Tagged juvenile chinook were then released in mainstem areas above or below the areas being trapped at the time of their release to minimize recaptures.

All juvenile chinook salmon with missing adipose fins that were recaptured after being tagged were checked with a NMT magnetic tag detector for the presence of a coded wire tag. This procedure was used to estimate the percentage of fish that had lost their tags. The total number of tags released was then adjusted for this in-river tag loss percentage. Approximately 40 fish/week of the coded-wire tagged chinook salmon were measured from the tip of the snout to the fork of tail to the nearest millimeter. Mean length of juvenile chinook salmon was

[1] Mention of trade names does not constitute endorsement by ADF&G.

calculated along with the associated standard error and 95% confidence intervals following procedures outlined in Zar (1974).

Recovery of Adult Coded-Wire Tagged Chinook Salmon

Dead or nearly dead chinook salmon in post-spawning condition were sampled on various tributaries of the Unuk (Cripple, Genes Lake, Clear, Lake Creeks and the Eulachon River) and Chickamin (Barrier, South Fork, Indian, Leduc, Clear Falls, Butler, and Humpy Creeks) Rivers. Spears were used to collect dead or nearly dead, spawned-out chinook salmon. Sampled chinook salmon were enumerated and examined for a missing adipose fin, measured mid-eye to fork of tail, and sexed. Once sampled, all carcasses were slashed to prevent double sampling.

To determine the age of sampled chinook salmon adults, four scales were removed from the left side of the fish (right side if scales were regenerated) at the posterior edge of the dorsal fin, two scale rows above the lateral line. The heads of all carcasses with missing adipose fins were tagged with a numbered strap inserted through the mouth and were then submitted to the Tag Lab in Juneau operated by the ADFG Division of Fisheries Rehabilitation and Enhancement for dissection and decoding of coded-wire tags. Tag recovery was conducted from August 11 to August 24 on the Unuk River and from August 22 to August 28 on the Chickamin River.

Fishery Contribution and Exploitation Rates

The harvest of chinook salmon from the Unuk and Chickamin Rivers was estimated from random recoveries of coded-wire tags in commercial and recreational fisheries obtained through sampling programs conducted by the ADFG Divisions of Commercial and Sport Fisheries. Coded-wire tag recoveries were first expanded by the ratio of total catch divided by the number sampled in the particular statistical area by statistical period. The total fishery contribution by tag code was estimated by multiplying tag recoveries by the appropriate sampling and tagging ratios (refer to Suchanek and Bingham 1989, and Clark and Bernard 1987 for a more detailed description of procedures for estimating coded-wire tag contributions). Personnel from the FRED Tag Lab totaled the numbers of tags found on the spawning grounds by tag code.

The fraction of the escapement tagged by brood year, was estimated from sampling of chinook salmon carcasses on the spawning grounds.

The following assumptions were necessary for expanding fishery and spawning ground recoveries:

1) During the survey of peak spawning abundance, 50% of the total escapement of large chinook salmon to a particular tributary was observed.

2) Marks were equally distributed among tributary stocks in fall mainstem and spring pre-smolt tagging.

3) Recreational fisheries were sampled at 20 %.

4) If no random recoveries of a particular tag lot were observed in a recreational fishery during a given year, each select recovery was given a fishery contribution of 1.0.

5) Spawning ground recoveries of coded-wire tagged chinook salmon were expanded as follows:

$$\text{Expanded Spawning Ground Recoveries} = \frac{(\text{CWT Recoveries}) * (\text{Total Escapement of That Brood Year})}{\text{Total Sample of That Brood}}$$

6) Spawning ground recoveries for age composition and CWT recovery were representative of the total escapement.

Taku River Population Estimate

The Taku River originates in northern British Columbia and flows into the ocean 48 km east of Juneau, Alaska. The Taku River drainage covers over 16,000 km^2 and flows range from 40m^3/sec in the winter to 2,489 m^3/sec during flood stages, averaging 740m^3/sec in June (McGregor and Clark 1989). Principal tributaries include the Sloko, Nakina, Sheslay, Inklin, and Nahlin Rivers. The clearwater Nakina and Nahlin Rivers contribute less than 25% of the total drainage discharge with most of the remainder originating from glaciated areas on the eastern slope of the Coast Range of British Columbia. The drainage above the abandoned mining community of Tulsequah, British Columbia, remains in pristine condition; no mining, logging, or other development activities have ever occurred. The upper Taku River area is extremely remote with no road access and few year-round residents. All of the important chinook salmon spawning areas in the Taku River are found in tributaries in the upper drainage in British Columbia. These include the Nakina, Nahlin, Dudidontu, Tatsamenie, Hackett, and Kowatua Rivers and Tseta Creek.

Currently, the escapement of chinook salmon to the Taku River is estimated from ADFG aerial surveys of the Nakina and Nahlin Rivers conducted during the peak of spawning activity. Peak aerial counts are expanded by the proportion of the total escapement to the Taku River believed to be represented by the surveyed tributaries (Mecum and Kissner 1989). No independent estimate of the total Taku River chinook salmon escapement has ever been developed. In 1983, a joint ADFG and CDFO stock assessment program was begun at Canyon Island on the lower Taku River to tag sockeye (*Oncorhynchus nerka*), coho (*O. kisutch*), chum (*O. keta*) and pink salmon (*O. gorbuscha*) with the objective of estimating the escapements of these species with mark-recapture methods (Clark et al. 1986). Tagged fish are recovered in a Canadian commercial drift net fishery upstream of the fishwheel site and on the spawning grounds. It is not possible to generate escapement

estimates for chinook salmon from marked to unmarked ratios in the inriver fishery because the inriver fishery begins after most of the chinook salmon migration has occurred.

In 1988, the tagging program at the Canyon Island fishwheel was extended to the cover the early portion of the chinook salmon migration and spawning ground recovery was expanded to include the Nahlin River (McGregor and Clark 1989). The Nahlin River stock is thought to be the earliest spawning stock in the Taku River drainage. In 1989 the NMFS tagged a random sample of large (>660mm MEF) chinook salmon with both radio and spaghetti tags for use in migration studies and population estimation. The remaining large and medium (440 - 660mm) fish were marked only with grey spaghetti tags. Capture and tagging procedures are detailed in McGregor and Clark (1989) and Eiler et al. (1988). Migratory timing data of Taku River chinook salmon past the Canyon Island fishwheel was collected along with age, sex, and size composition data.

Spawning ground tag recovery was concentrated in four locations in British Columbia. Age, sex, size composition and tags were recovered from carcass weirs operated by CDFO and ADF&G on the Nakina, Tatsamenie, and Kowatua Rivers in 1989. An intensive foot survey was made of the spawning areas on the Nahlin River. All fish sampled were closely examined for scars or holes indicating lost tags. Radio tracking flights were made several times per week by NMFS biologists. Details of the migration patterns and distribution of radio-tagged salmon are reported by the NMFS (Eiler *in press*).

Total escapement of age-1.3 and -1.4 chinook salmon was estimated by two methods and compared to the aerial survey index estimate. One estimate was based on the ratio of aerial surveyed fish to the expanded number of radio-tagged fish and the other estimate was based on the marked/unmarked ratio of fish sampled on the spawning grounds.

Two aerial survey/radio tag ratio estimates were derived using surveys approximately oen week apart. While all large uninjured chinook salmon captured in the fishwheels were tagged, only a proportion of the catch was also radio tagged. Each radio tagged fish tracked to the spawning grounds was expanded by the proportion of fish radio tagged the same week to give an estimate of total large tagged fish in an index area. This number represented (R), the number of recaptures in the Petersen estimate. The aerial survey count represented (C), the catch and the expanded number of radio tags released minus mortalities was (M), the number of marked fish. The escapement of large chinook was then estimated by the equation:

$$N = (M+1)(C+1)/(R+1) \qquad \text{(Ricker 1975, pg 78)}$$

The second population estimate method was a standard Petersen mark-recapture estimate using the total number of large tagged fish minus mortalities as (M), the number of carcasses examined on the spawning grounds (C) and the number of tagged fish recovered on the spawning grounds (R). Mortalities included tagged fish captured in commercial fisheries, sport fisheries, and tagging mortality

estimated by the mortality rate of radio tagged fish. Confidence intervals were determined as described in Seber 1982 (pg 62).

Mark-recapture estimates are based on several assumptions which generally fall into two categories; those relating to biasing of the tagged:untagged ratio in the recovery sample through loss of tags from the sampled population, and those concerning the distortion of this ratio away from the true value due to irregularities in the distribution of tagged fish with respect to the total population, or a consistant bias in both tagged and recovered samples. Assumptions belonging to the first category include:

1) There is no increased mortality (handling, fishing, predation) in marked fish.

2) There is no loss of tags and all tags are recognized and reported.

Violation of one or more of these assumptions will result in a selective reduction of the proportion of tagged fish in the population, equivalent to a reduction in the number of fish tagged. The result of this type of bias, if not detected and accomodated in the estimation procedure, will be a reduction in the number of tags available for recovery and an overestimation of the escapement.

The second catagory of assumptions concerns the distribution of tagged salmon within the total population and the recovery sample and requires random mixing of tagged fish throughout the entire population. However, if the marking is done randomly throughout the run or the spawning ground surveys are done randomly, an unbiased estimate can be obtained (Ricker 1975).

GSI Sampling

Tissue samples were collected in conjunction with other spawning ground studies. Up to 100 spawned-out, nearly dead fish were killed and sampled from each location. From each fish the eyes, the heart, a piece of liver the size of the heart, and cheek muscle were placed in a single Whirlpak bag. A waterproof label was placed in the bag, the air was forced out and the bag closed and placed on ice as soon as possible. The samples were then transported within two days to a freezer and from there on to the Auke Bay Lab where they were transferred immediately to a supercold (-85 C) freezer where the tissues remain stable indefinitely. The electrophoretic analysis will be done by the Auke Bay Lab and preliminary results are expected in late 1990.

RESULTS

Unuk River Studies

Escapements of chinook salmon to the Unuk River are the largest of any river system in Behm Canal and only the Taku, Stikine, and Alsek Rivers support larger runs of chinook salmon in Southeast Alaska. The Unuk River originates in a heavily glaciated area of northern British Columbia and flows for 129 km to Burroughs Bay 85 km northeast of Ketchikan, Alaska; only the lower 39 km of the river are in Alaska. The Unuk River drainage encompasses an area of approximately 3,885 km^2 (Figure 2). Most Unuk River chinook salmon spawn in tributaries in the lower 39 km of the U.S. portion of the river including the Eulachon River and Cripple, Genes Lake, Clear, Lake, and Kerr creeks.

Escapement

The first intensive spawning ground surveys of the Unuk River were conducted in 1961 (Anthony et al. 1965). Methods for surveying chinook salmon escapements to the Unuk River were standardized beginning in 1977. Chinook salmon escapements to the Unuk River are enumerated annually in index tributaries by foot or helicopter surveys near the peak of spawning activity. In 1989, 1,149 age 1.3 and 1.4 chinook salmon were observed in index areas of the Unuk River (Table 1). This escapement was 84% of the previous 10-year average of 1,366 and only 64% of the management escapement goal of 1,800 chinook salmon. The 1989 escapement was the fourth year in a row of declining escapements. The spawning distribution of chinook salmon in the different Unuk River index tributaries varies considerably between years (Mecum and Kissner 1989).

Recovery of Adult Coded-Wire Tagged Chinook Salmon

Through 1989, 131 fishery (unexpanded for fishery sampling and tagging ratios) and 83 spawning ground recoveries of coded-wire tagged chinook salmon were made. (Appendix A3). Expansion of fishery and spawning ground recoveries by the appropriate sampling fractions indicates that approximately 218 fishery and 445 spawning ground recoveries would have occurred at a 100% sampling rate, a 32.8% overall exploitation of the 1982, 1983, and 1984 brood years (Table 2). Further expansion of the estimated fishery recoveries by the tagging fraction results in an estimated contribution of 3,726 age- 1.2, 1.3, and 1.4 chinook salmon from the 1982 brood year and 3,028 age- 1.1, 1.2, 1.3 and 1.4 chinook salmon from the 1983 brood year. A preliminary expansion of the 1984 brood year estimated a contribution of 1,607 age- 1.1, 1.2, and 1.3 fish. Chinook salmon sampled on Unuk River were primarily age-1.4 and -1.3 (Appendix Table 3).

The distribution of the harvest of Unuk River chinook salmon based on recoveries of coded-wire tagged fish is presented in Figure 7. Over 41% of the total catch has occurred in Districts 101 and 102 and in northern British Columbia. The

remainder of the harvest was distributed throughout most fishing districts of Southeast Alaska (Figure 5). This distribution is similar to that observed for wild Chickamin River chinook salmon and for the Unuk and Chickamin River stocks cultured and released at the Whitman Lake and Neets Bay (SSRAA), Deer Mountain (ADFG), and Tamgas (Metlakatla Indian Community, MIC) hatcheries, all located in the Ketchikan area. In contrast, the harvest distribution of Unuk and Chickamin River stock released at the Little Port Walter Hatchery (National Marine Fisheries Service, NMFS) located on Baranof Island on the outer coast of Southeast Alaska is very different from the distribution of the natural stocks and enhanced stocks released at the Ketchikan hatcheries (Table 3). Over 60% of the harvest of Unuk and Chickamin River stock chinook salmon released at Little Port Walter Hatchery occurs in the southern intermediate area (districts 105, 109, and 110). Only 10% to 24% of the Unuk and Chickamin wild stocks and Unuk and Chickamin stocks released at Ketchikan area enhancement facilities are harvested in these areas.

Tag recoveries and maturity sampling indicate that a portion of Unuk River chinook salmon rear in marine waters in the general vicinity of the Unuk River (Mecum and Kissner 1989). Examination of the reproductive tracts of Unuk River stock chinook salmon released from the Tamgas Creek (MIC), Neets Bay, and Whitman Lake Hatcheries also indicates that immature fish from these releases also rear in marine waters in the Ketchikan area.

Unlike Taku and Stikine River origin chinook salmon, Unuk River chinook salmon contribute to fisheries in Southeast Alaska at both immature and mature life stages throughout the year. Estimated harvest rates of 32.9% and 33.1% of the 1982 and 1983 brood years, respectively, are similar to those observed for the same brood years released at the Whitman Lake, Neets Bay, and Little Port Walter hatcheries (1986 and 1987 return years)(ADF&G 1988). Because of this migratory pattern, it would be difficult to reduce harvests of Unuk River chinook salmon in areas other than terminal and near-terminal areas in the event of observed declines in escapements without severely restricting the commercial troll fishery.

Chickamin River Studies

The Chickamin River ranks fifth in chinook production in Southeast Alaska behind the Taku, Stikine, Alsek, and Unuk Rivers. This large, glacial river originates in northern British Columbia, flowing into Behm Canal approximately 32 km southeast of Burroughs Bay and 65 km northeast of Ketchikan, Alaska (Figure 3). Important tributaries for spawning chinook salmon are the South Fork of the Chickamin and Barrier, Butler, Indian, Leduc, Humpy, King, and Clear Falls Creeks.

Escapement

Chinook salmon have been enumerated by foot or helicopter surveys in index tributaries of the Chickamin River each year since 1977 (Table 4). The 1989 observed escapement of 934 age 1.3 and 1.4 chinook salmon was 20% above the previous 10-year average of 743 and met the management escapement goal of 900 age 1.3 and 1.4 chinook salmon. However, escapements in 1988 were the lowest observed since 1983.

Coded-Wire Tag Recovery

Through 1989, 133 fishery recoveries (unexpanded) and 14 spawning ground recoveries (unexpanded) of coded-wire tagged Chickamin River chinook salmon have been obtained (Appendix A4). Expansion of the fishery recoveries by the appropriate fishery sampling rates results in an estimate of 217 fishery recoveries. Further expansion of these recoveries by the appropriate tagging ratio results in a total contribution to commercial and recreational fisheries of 661 age 1.3 and 1.4 chinook salmon from the 1982 brood year (Table 5) and 781 chinook salmon were harvested from the 1983 brood year (age 1.2 and 1.4). Age and length composition of the Chickamin River escapement was similar to that of the Unuk River stocks (Appendix A7, A8).

Approximately 44.7% of the total harvest of Chickamin River chinook salmon from the 1982 and 1983 brood years occurred in Districts 101, 102, and in the northern British Columbia net and troll fisheries. The remainder of the harvest was distributed throughout most fishing districts of Southeast Alaska (Figure 6). This harvest distribution is very similar to that observed for the wild Unuk River stock and for the Unuk and Chickamin River stock transplanted to hatcheries in the immediate vicinity of Ketchikan including the Neets Bay, Whitman Lake, Deer Mountain, and Tamgas Creek Hatcheries (Table 6).

Chickamin River chinook salmon contribute to fisheries in Southeast Alaska and northern British Columbia throughout the year and at all stages of maturity. The exploitation rate for the 1982 brood year during 1987 was 31.6% and 11.1% during 1988. The exploitation rate on the 1983 brood year from the Chickamin River was 37% for age 1.2 fish harvested during 1987 and 20% for age-1.4 in 1989. The exploitation rate in 1989 on the 1984 brood year (age-1.3) was estimated to be 69%, the highest rate ever estimated for Unuk or Chickamin stocks.

Alsek River Studies

The Alsek River originates in the Yukon Territory, Canada and flows in a southerly direction until it empties into the Gulf of Alaska approximately 75 km southeast of Yakutat, Alaska (Figure 7). The Dezadeash and Tatshenshini Rivers are the largest tributaries of the Alsek River. Similar to the glacial Taku and Stikine Rivers, velocity barriers and blockages prohibit migration of anadromous salmonids to most of the Alsek River drainage. The Alsek River is considered a

major producer of chinook salmon; only the Taku and Stikine River support larger spawning populations in Southeast Alaska. Most of the significant chinook salmon spawning areas are found in tributaries of the Tatshenshini River including the Klukshu, Blanchard, and Takhanne Rivers and Village and Goat creeks.

Alsek River chinook salmon are harvested incidentally to the taking of sockeye salmon in a U.S. commercial set gill net fishery at the mouth of the Alsek River and in Canadian recreational and subsistence fisheries on the Klukshu and Tatshenshini Rivers. The chinook salmon harvest in the U.S. gill net fishery has been extremely variable, ranging from 22,282 in 1920 to only 60 fish in 1984 (Hubartt and Kissner 1987). At present the abundance of the Alsek River stock of chinook salmon is depressed relative to historical levels.

Escapement

Escapement data on Alsek River chinook salmon has been collected since 1962 (Table 7). Since 1976, the CDFO has operated a counting weir at the junction of the Klukshu and Tatshenshini Rivers to enumerate chinook, sockeye, and coho salmon into the Klukshu River drainage. Prior to 1976, chinook salmon escapement surveys were usually conducted from fixed-wing aircraft. Helicopter surveys of chinook salmon escapements to index tributaries of the Alsek River have been conducted by ADFG since 1981. The ADF&G interim management escapement goal for the Alsek River is 5,000 chinook salmon, or 3,200 to the Klukshu index system. The Transboundary Technical Committee of the Pacific Salmon Commission (PSC) set interim escapement goals of 7,200 to 12,500 chinook salmon to the Alsek River. The escapement of 2,456 chinook salmon through the Klukshu River weir in 1989 was equal to the average escapement observed since 1976 and only 76.7% of the management escapement goal of 3,200 age 1.3 and 1.4 fish.

Coded-Wire Tagging of Juvenile Chinook Salmon

Wild YOY chinook salmon were captured, adipose-clipped, coded-wire tagged, and released in the Tatshenshini River from September 12 through October 16, 1989. Trapping efforts were concentrated on a section of the Tatshenshini River approximately 0.5 km upstream of the abandoned settlement of Dalton Post, Y.T., downstream to the confluence of Village Creek and also on the lower 1.5 km of the Klukshu River.

A total of 18,130 YOY chinook salmon were captured and coded-wire tagged during the study period (Table 8). Estimated tag loss (derived from the tagged to untagged ratio of recaptured, adipose-clipped fish) was 0% giving a total of 18,130 YOY chinook salmon with valid tags released. Fork lengths were taken from a sample of 266 YOY chinook salmon. These YOY chinook salmon averaged 61.2 mm fork length (range = 43 mm to 90 mm; n = 266; 95% CI = 60.3mm to 62.1mm).
The highest trap catches of juvenile chinook salmon were observed in areas of the Tatshenshini River with large organic debris such as root wads and log jams and in shallow, braided, riffle areas with low current velocities and large rock cobble. This pattern of habitat utilization by juvenile chinook salmon has been

observed during previous tagging studies conducted on the Alsek, Stikine, Taku, Unuk, Chickamin, and Chilkat Rivers (Kissner 1973-1980, 1982, 1984; Mecum 1989).

A low-level, helicopter survey of the Tatshenshini River from Dalton Post to the confluence with the mainstem Alsek River was conducted by ADFG on August 3, 1986. This survey was designed to determine the feasibility of conducting minnow trapping and coded-wire tagging of juvenile chinook salmon below Dalton Post. The Tatshenshini River appears to be navigable by riverboat from about 35 km below Dalton Post to the Alsek River junction. Aquatic habitat in this section of the Tatshenshini River appears to be typical, high quality, rearing habitat for juvenile chinook salmon, particularly between the junction of Kudwat Creek downstream to the O'Connor River.

In addition to the ADF&G coded-wire tagging project the CDFO is also tagging juvenile chinook salmon on the Klukshu River. Since 1988 a small egg-take and incubation box has been operated on the Klukshu. The emerging fry were supplementally fed, and approximately 9,000 fish were tagged and released in September 1989.

Taku River Studies

Tag Recoveries

Radio-tags and grey spaghetti tags were implanted in 383 large and 46 medium chinook and 425 large and 378 medium fish were marked only with grey spaghetti tags. A total of 5,270 large and 1,174 medium chinook salmon were examined on the spawning grounds for tag/untagged ratios, age, sex, and length data and the incidence of tag loss (Tables 9 and 10).

A total of 493 large (>660mm MEF) chinook salmon were sampled during foot surveys of the Nahlin River from July 29 - August 11, 1989. Only 5 of the sampled chinook salmon were spaghetti tagged and no tag loss was observed on large fish. Of 49 medium (440-660mm) fish examined three out of five tagged chinook had lost spaghetti tags.

Nine tagged fish were recovered from 636 large chinook carcasses examined at a carcass weir installed on Tatsatua Creek, downstream from Little Tatsamenie Lake. Eight out of 198 medium fish observed were tagged. Four large fish and 2 medium fish had lost their spaghetti tags.

At the Kowatua River carcass weir 601 large and 120 medium chinook were examined and 7 large and 3 medium fish were tagged. Three of the large marked fish were missing spaghetti tags (Table 11).

CDFO personnel examined 3,450 large chinook carcasses at the Nakina River carcass weir; 51 large tagged chinook were recovered including 12 radio-tagged fish with missing spaghetti tags. A total of 807 medium chinook carcasses were examined and 22 tags recovered. Eleven out of 28 (39%) of the large and one of two medium

radio-tagged fish were missing spaghetti tags while no other missing tags were reported. Live fish migrating through the weir had a much higher tagging ratio: 49 tags in 1,165 large chinook salmon.

Tagging Mortality

A total of 37 of 383 (9.6%) large, radio tagged fish died or regurgitated their tags below the Canadian border (Table 10). A loss of 41 more large tagged fish was estimated by expanding that mortality rate over the 425 large fish tagged only with spaghetti tags. Ten large tagged fish were captured in the District 111 gillnet fishery and 49 in the Canadian inriver gillnet fishery. An additional 17 large radio tagged chinook salmon died in the mainstem Taku River in the King Salmon Flats area. No chinook salmon spawning has been documented in this area and these fish may also be mortalities. These mortalities were subtracted from the 808 large fish tagged leaving a total of 654 tags at risk.

Five of 46 (10.9%) medium radio tagged fish died or regurgitated the tag below the border. This rate expanded over 424 fish spaghetti tagged also estimates an additional 41 mortalities. Two medium tagged fish were captured in the District 111 gillnet fishery and 20 in the inriver fishery. Two medium radio tags were returned from sport fishermen on the Nakina River. Medium tags at risk was therefore reduced to 354 fish.

Escapement

The 1989 observed escapement by helicopter survey of 9,480 age-1.3 and-1.4 chinook salmon into the index areas of the Nakina and Nahlin Rivers was the second largest escapement observed since 1958 (Table 12). The index expansion for the total Taku River drainage was 15,462 fish (Table 13).

The number of age-1.3 and -1.4 chinook salmon in the Taku River escapement was estimated using the ratio of large radio-tagged fish in index areas (expanded by tagging fraction) to large fish observed by helicopter survey on two separate occasions (Table 14). The first estimate which included surveys of the Nahlin, Nakina, Kowatua, Tatsamenie, and Dudidontu Rivers and Tseta Creek was 15,495 fish (95% CI = 14,206 to 16,782). The second estimate which did not include the Dudidontu River or Tseta Creek was 18,345 fish (95% CI = 16,852 to 19,835).

The escapements of large and medium fish were estimated using the marked/unmarked ratio of fish sampled on the spawning grounds (Table 10). Without using any tag loss factor the estimate of large chinook was 47,295 fish (95% CI = 37,207 to 57,381). Using a tag loss factor of 40% for the Nakina River samples, the estimate of large chinook dropped to 37,124 (95% CI = 30,233 to 44,013). If only the live fish examined passing through the weir are used to represent the Nakina River, the estimate is reduced to 27,777 fish (95% CI = 21,779 to 33,774)

The recovery of tagged chinook salmon at spawning sites in the Taku River drainage by statistical week of tagging is shown in Table 17. As seen in 1988,

the Nahlin and Nakina Rivers have earlier migratory timing than the Tatsamenie and Kowatua Rivers.

Age compositions and lengths

The 1989 escapement of chinook salmon to the Taku River was comprised of primarily age-1.3 and -1.4 fish in comparison with 1988 when the age-1.3. segment of the return was very weak (Appendices A9-A12). Weekly catches at the Canyon Island fishwheels ranged from 43 to 55% age-1.3 while spawning ground samples ranged from 33.3% on Tseta Creek to 59% age-1.3 on the Nahlin River. Lengths ranged from under 300mm to over 1,100mm MEF.

Genetic Stock Identification Sampling

Tissue samples were collected from 17 areas in 10 different river systems (Table 16).

DISCUSSION

Migratory Patterns and Exploitation Rates of Transboundary River Stocks of Chinook Salmon

Unuk and Chickamin River chinook salmon, unlike those of the Taku and Stikine Rivers, contribute to fisheries in Southeast Alaska at both immature and mature life stages throughout the year and in all fisheries in Southeast Alaska. Observed harvest rates of between 30% and 40% for 1982 and 1983 brood year Unuk and Chickamin River stocks are similar to those observed for the same brood years released at the Whitman Lake, Neets Bay, and Little Port Walter hatcheries (1986 and 1987 return years). Because these stocks are harvested throughout the region over a long time period, it would be difficult to reduce harvests of Unuk and Chickamin River chinook salmon in areas other than terminal and near-terminal areas in the event of observed declines in escapements without severely restricting the commercial troll or other mixed-stock fisheries.

Six age 1.2 and one age 1.1 coded-wire tagged chinook salmon from the Chickamin River were recovered in 1986 in the Ketchikan area during a research troll fisheries conducted by ADFG and NMFS. These fish were determined to be immature upon examination of their reproductive tracts. This information indicates that a portion of Chickamin River chinook salmon rear for extended periods of time in the immediate vicinity of their natal stream throughout their marine life history.

Since the mid-1970's the harvest of Alsek River chinook salmon has been limited to incidental catches in the U.S. commercial sockeye salmon setnet fishery in the lower river and in Canadian sport and subsistence fisheries in the upper portions of the drainage in the Yukon Territory. Although harvests have been reduced, chinook salmon escapements to the Alsek River are still below management escapement goals. Some researchers and many Alsek River commercial fishermen have hypothesized that predation on chinook salmon by marine mammals, in particular harbor seals, may be contributing to the slow rebuilding progress of this stock. Harbor seals congregate in large numbers in the tidal area and are found upriver 23 km in the Alsek Basin (Gmelch 1982). An estimated 5% of all salmon caught in set gill nets in the lower Alsek River are lost to harbor seals (Gmelch 1982).

From May 20 to July 30, 1985, ADFG and NMFS researchers attempted to capture chinook salmon smolts in the lower Alsek River in Dry Bay with beach seines and traps. Only 81 chinook salmon smolt were captured along with 217 coho and 998 sockeye salmon smolts. These catches of chinook salmon were much lower than expected, leading some researchers to postulate that increased siltification and subsequent changes in channel morphology (Gmelch 1982) in the lower Alsek River estuary in Dry Bay may be contributing to reduced survival of juvenile chinook salmon emigrating from the Alsek River. Other possible explanations for the slow progress of rebuilding are 1) the management escapement goal for the Alsek River stock is higher than it should be to achieve optimum sustained production and 2) Alsek River chinook salmon are harvested to a greater extent in mixed stock domestic or high seas foreign gill net fisheries than previously believed.

The tagging fraction for a brood year is estimated from sampling adults which have returned to spawn, for age and CWTs. Unless sample sizes are large we introduce non-normal error into the contribution estimates and we must use a binomial or poisson estimate of the variance around the tagging fraction.

The assumptions necessary for expansion of the fishery and spawning ground recoveries are used as absolutes without any estimates of uncertainty. These numbers all have unknown variances which could lead to misleading confidence intervals for expansions.

We recommend that coded-wire tagging studies be continued to determine migratory patterns and harvest rates of Alsek River chinook salmon be continued. This research will provide information on migration routes, areas and timing of harvest, and exploitation rates and may provide insight into the primary reasons for the decline of the stock. In addition, this information will be useful in developing management and conservation measures required to rebuild this chinook salmon stock to desired escapement goals.

Taku River Escapement Estimation

In 1988, 630 medium and 333 large chinook salmon were tagged at Canyon Island and 24 medium and 3 large tags were recovered on the spawning grounds (McGregor and

Clark 1989). The tagging ratio was much higher in the inriver fishery than in the escapement and some tag loss was observed but could not be quantified, so the escapement was not estimated using mark-recapture techniques.

It is apparent when comparing the three methods of estimating 1989 escapement that some assumptions have not been met. The aerial survey index area method and the aerial survey/expanded radio tag ratio method gave the lowest estimates (14,000 to 20,000). The Petersen mark-recapture method gave the highest estimate (35,000 to 59,000).

The aerial survey index method was standardized in 1975. Peak counts from spawning ground surveys are used primarily as indices of total escapement. Therefore the consistency of the method to maximize precision of index counts from year to year is as important as the accuracy of the counts in obtaining escapement estimates that may be reliably compared between years. Aerial surveys are regularly done on two systems that also have adult chinook salmon counting weirs. The King Salmon River is a small system with less than 500 spawners. The peak aerial count has ranged from 50% to 80% of the weir count. The Little Tahltan River is the major chinook salmon spawning area in the Stikine River drainage. Chinook escapements are similar to those on the Nakina River and peak aerial counts are consistently close to 50% of the live count through the weir (Mecum and Kissner 1989).

The present index expansion model assumes 75% of the large chinook in the Nakina and Nahlin Rivers are observed in the index areas and that the two systems combined represent 60% of the total Taku River run. Radio tag distribution indicates that although the Nakina and Nahlin Rivers account for 63% of the chinook escapement, the index areas of the two rivers only account for 49% (Table 17). The Nakina and Nahlin index areas made up an average of 72.5% of the observed escapement of chinook salmon during the years when all major tributaries were surveyed (Table 18).

In 1988, aerial survey estimates of coho salmon escapement to the Nahlin River were compared with weir counts (Shaul 1989). He found that even with an intensive aerial survey by helicopter he could only count 52.5% of the escapement.

The aerial survey/radio-tag ratio method of estimating escapement is based not only on the mark-recapture assumptions but also on the assumption that a similar proportion of the escapement in each tributary is observed. If the radio tags were applied evenly through all portions of the run and if the same proportion of each tributaries' escapement is observed then the aerial survey to expanded radio-tag ratio should be similar for all areas surveyed. This was not the case as the ratio ranged from 13 fish per radio tag on the Nakina to 100 fish/radio-tag on the Nahlin River.

Nahlin River chinook are one of the earliest migrating stocks in the Taku River. If a significant portion of the stock migrated past Canyon Island prior to the beginning of fishwheel operations on May 5 then the proportion of fish tagged would be smaller than that of later migrating stocks. This was also observed in the spaghetti tag recoveries where the Nahlin River had the fewest tags per large

fish examined. In addition counting conditions in the Nahlin are better than in some other systems, in particular the glacially occluded Kowatua River If a higher proportion of the Nahlin escapement was enumerated that would also decrease the ratio of radio tagged fish to observed fish.

The low ratio of observed fish to radio-tags in the Nakina River is more difficult to explain. The Nakina River stock is the largest in the Taku River and has the most protracted migratory timing. Fishwheel catches at Canyon Island catches were high from week 21 - 25 (May 21 - June 24) when the peak of the Nakina migration was entering the river and the stock is assumed to have been marked in proportion to run size. Fishwheel CPUE is related to river level, water temperatures, and perhaps other factors. If the catch was not proportional to the run size then the tagging ratios could vary by area introducing Type 2 errors into the mark-recapture estimates. The peak survey count above the weir was 3,223 large chinook salmon, while 3,540 large carcasses were sampled at the weir. If the actual proportion of the Nakina River observed escapement is less than 75%, then the fish/radio tag ratio and the aerial survey method will underestimate the actual population.

Although the Nakina weir is designed to sample dead and dying fish drifting downriver, a significant number of fish actively migrating upstream do pass through the weir. The proportion of fish passed live through the weir that were tagged was much higher than the proportion of tagged carcasses sampled at the weir. A total of 49 of the 1,165 (24 fish/tag) large chinook passed through the weir alive were tagged, while only 51 of 3,540 (69 fish/tag) large carcasses examined were tagged. A similar trend was observed in pink salmon where the proportion of tagged fish passed live through the weir was 212 fish/tag, while the ratio was 749 fish/tag in carcasses examined at the weir. This could be the result of delayed migration of tagged fish resulting in different spawning ground distribution. Increased predation on tagged fish on the spawning grounds could also explain some of this variability. Pink salmon are tagged with orange spaghetti tags which may increase predation by birds, bears and other predators. For this reason chinook salmon were tagged with grey spaghetti tags, similar in color to spawning chinook and more difficult to see than orange tags. Predation on salmon by brown bears can be high on the Nakina River although whether it is more significant than on other tributaries is difficult to assess (Meehan 1961). Spaghetti tag loss on the spawning grounds could also be the result of courtship and spawning behavior where tags would be torn off by other fish. Detailed analysis of radio tracking data may give more insight into predation on tagged fish.

The method of aerial survey/radio tag population estimation may give misleadingly small confidence intervals since there are sources of error in this method which were not taken into account in the formula for the variance. The formula used relies on the assumption that the number of animals marked, and the number recaptured are known exactly, which is not the case. The variances associated with the number marked and the number recaptured were not taken into account and therefore confidence intervals arrived at using this method will be too narrow.

Tag Loss

A basic assumption of any mark and recapture study is that there is no significant loss of marks over the duration of the study. In this study, 72 large fish which had been marked were recovered. A total of 49 were recovered from areas where each fish was carefully examined for tag loss. Of those fish 63.2% of the males (13 of 20) and 24% of the females (7 of 29) were missing the grey spaghetti tag, as determined either by the presence of a radio tag or tagging wound. This number is conservative as fish from the largest spawning population, the Nakina River, were not examined closely for tagging wounds and the only tag loss reported is from radio tagged fish. Grey spaghetti tags are difficult to see on live fish in the water and tagging wounds are impossible to see without careful examination of a fish. The hole remaining behind the dorsal fin was usually obvious in fish that had lost the spaghetti tag. Higher tag loss in males could be the result of fighting among males during spawning and courtship. Tag loss in medium males was much lower (29.4%). The ratio of fish/tag observed from a distance on live fish in the Nahlin River (195) was twice that of the ratio observed on individually examined fish (99). For this reason only the tag recovery data from individually examined fish was used in the population estimates. If each fish used in the mark-recapture estimate is examined for tag loss and occurrence of tag loss is obvious then the loss can be accounted for in the estimate and will not invalidate the assumption of no loss of marks. Undetected tag loss would result in overestimation of population size.

The sex ratio of large chinook salmon examined on the spawning grounds was 56.8% male, while 40.7% of large fish captured and tagged at Canyon Island were male. The difference in sex ratio may be due to differences in spawning ground behavior of males and females. Hubartt and Kissner (1987) found that the majority of males die earlier than females. Females tend to die in shallow water areas near their redds, while males typically wandered or remained in midstream and subsequently washed downstream after death. This same phenomenon has been found in sockeye (Peterson 1954), pink (Ward 1959) and coho salmon (Eames and Hino 1981). This could result in higher proportions of males drifting onto carcass weirs while foot surveys might tend to overestimate females. Jack males (age-1.1) are especially difficult to sample in foot surveys but are very efficiently collected at carcass weirs.

Overestimation of populations in mark-recapture studies increases with the distance traveled from the tagging site to the recovery site (Cousens et al. 1982). In the Taku River, sockeye salmon escapement estimates are generated from tags recovered in the Canadian fishery within 30km. Tag loss in fish recaptured in the fishwheels has been virtually nonexistent. Tag ratios in the Canadian fishery are slightly higher than ratios observed at the adult weirs at Little Tatsamenie and Trapper Lakes which may indicate some type 1 violations of assumptions due to tag loss or mortality (ADF&G McGregor' personal communication). Fish travel 75km to the Nakina weir and over 140km to Kowatua, Nahlin and Tatsamenie River weirs.

ADF&G believed that the fish wheels they used in the 1950's on the Taku River were size selective, catching higher proportions of smaller and younger fish than

were present on the spawning grounds (Meehan 1961). A similar trend was observed in 1988. While the age composition of fishwheel catches and escapement samples varies, the range of lengths in both samples is very similar. The fishwheels may not actually be missing large fish, the differences may be artifacts of escapement sampling techniques. Size selectivity was anticipated and compensated for by dividing tagging and recovery data into size groups and analyzing each group independently (Ricker 1975).

The actual escapement of large chinook salmon to the Taku River is probably somewhere between the 49,000 fish estimated by mark-recapture and the low estimate by aerial survey index areas of 15,400. The mark-recapture method overestimates the population due to type 1 errors of tag loss, non recorded tags, and increased predation on tagged fish. The aerial survey method may underestimate the population by using too small an expansion factor for proportion of fish observed.

These problems can be addressed in several ways. First, tag loss must be accurately assessed and, if possible, decreased. A secondary mark, applied along with the primary mark at Canyon Island would enable field personnel to more accurately assess the occurrence of tag loss. A small fin clip in the last three rays of the dorsal fin could be easily applied and would not be obscured by fungus on carcasses. Radio tags would again provide another check on tag loss. It will be essential that each fish observed on the spawning grounds be carefully examined for each of the three potential tags and tag loss be carefully documented. Second, the operation of an upstream migrant weir would address several problems. Migrating fish could be examined carefully for tag loss prior to spawning and any change in migration behavior due to tagging could be assessed. The total count of migrating fish could be compared with various other methods of estimating escapement (i.e., aerial survey and foot survey) for further refinement. The actual age and length composition of the escapement could be compared with that of Canyon Island catches to determine if either fishwheel or spawning ground surveys are size-selective giving type 2 errors to mark/recapture estimates. If individually marked fish could be observed at the weir and on the spawning grounds the stream life of spawning chinook salmon could be estimated allowing further refinement of aerial survey methods.

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Table 1. Peak escapement counts of chinook salmon to index tributaries of the Unuk River, 1960-1989[a]

Year	Cripple Creek	Genes Lake Creek	Eulachon River	Clear Creek	Lake Creek	Kerr Creek	Total
1960	-	-	250 (A)	-	-	-	250
1961	3 (F)	200 (F)	270 (F)	65 (F)	-	53 (F)	591
1962	-	150 (A)	145 (A)	100 (A)	30 (A)	-	425
1963	100 (A)	750 (A)	150 (A)	25 (A)	-	-	1,025
1964	-	-	25 (A)	-	-	-	25
1965	-	-	-	-	-	-	-
1966	-	-	-	-	-	-	-
1967	-	-	60 (H)	-	-	-	60
1968	-	-	75 (H)	-	-	-	75
1969	-	-	150 (H)	-	-	-	150
1970	-	-	-	-	-	-	-
1971	-	-	30 (A)	-	-	-	30
1972	95 (A)	35 (A)	450 (A)	90 (A)	55 (A)	-	725
1973	-	-	64 (H)	-	-	-	64
1974	-	-	68 (H)	-	-	-	68
1975	-	-	17 (H)	-	-	-	17
1976	-	-	3 (A)	-	-	-	3
1977	529 (F)	339 (F)	57 (H)	34 (H)	-	15 (H)	974
1978	394 (F)	374 (F)	218 (H)	85 (H)	20 (H)	15 (H)	1,106
1979	363 (F)	101 (F)	48 (H)	14 (H)	30 (H)	20 (H)	576
1980	748 (F)	122 (F)	95 (H)	28 (H)	5 (H)	18 (H)	1,016
1981	324 (F)	112 (F)	196 (H)	54 (H)	20 (H)	25 (H)	731
1982	538 (F)	329 (F)	384 (H)	24 (H)	48 (H)	28 (H)	1,351
1983	459 (F)	338 (F)	288 (H)	24 (H)	12 (H)	4 (H)	1,125
1984	644 (F)	647 (F)	350 (H)	113 (H)	32 (H)	51 (H)	1,837
1985	284 (F)	553 (F)	275 (H)	37 (H)	22 (H)	13 (H)	1,184
1986	532 (F)	838 (F)	486 (H)	183 (F)	25 (H)	62 (H)	2,126
1987	860 (F)	398 (F)	520 (H)	107 (H)	37 (H)	51 (H)	1,973
1988	1068 (F)	154 (F)	146 (F)	292 (H)	60 (H)	26 (H)	1,746
1989	351 (F)	302 (F)	298 (H)	128 (H)	27 (F)	43 (H)	1,149
1990							

(F) = Foot survey; (A) = Fixed-wing aircraft; (H) = Helicopter;

[a] Escapement counts prior to 1975 may not be comparable due to differences in survey dates and counting methods.

Table 2. Recoveries, exploitation rates, and fishery contributions of wild Unuk River chinook salmon from the 1982 through 1985 brood years.

Return Year	Age	Unexpanded Fishery Recoveries	Expanded by sampling fraction	Unexpanded spawning grounds	Expanded by sampling fraction	Exploitation Rate*	Tagging Fraction	Fishery Contribution
				1982 Brood				
1985	1.1	13	8	1	No Sampling	-		
1986	1.2	45	86	17	104	45.3%	4.7%	1,830
1987	1.3	24	43	7	49	46.7%	2.6%	1,654
1988	1.4	12	15	25	141	9.6%	6.2%	242
				1983 Brood				
1986	1.1	2	5	5	31	13.9%	1.7%	294
1987	1.2	7	14	5	35	28.6%	1.8%	778
1988	1.3	12	25	4	21	54.4%	1.8%	1,389
1989	1.4	2	6	2	14	30.0%	1.1%	567
				1984 Brood				
1987	1.1	3	5	3	21	19.2%	2.3%	217
1988	1.2	2	2	4	22	8.3%	1.9%	105
1989	1.3	4	9	1	7	56.7%	0.7%	1,285
1990	1.4							
				1985 Brood				
1988	1.1	0		0				
1989	1.2	4	7	2	14	33.3%	3.1%	226
1990	1.3							
1991	1.4							

Table 3. Percent distribution of harvest (expanded recoveries) by fishing district, of wild[a] (all gear) and hatchery[b] (commercial troll only) Unuk River stock chinook salmon.

Statistical Area	Unuk Wild Stock	Neets Bay	Deer Mtn	Tamgas Creek	Whitman Lake	Little Port Walter
101,102	40	34	25	31	39	1
103,104	10	11	11	6	15	2
105,109,110	24	14	24	23	10	62
106,107,108	10	19	7	7	3	0
111	3	0	0	1	0	0
112,114	10	10	8	16	9	18
113,154	7	10	22	12	19	12
116	4	2	4	4	5	3
Total Catch[c]	203	11,898	3,945	1,679	2,009	10,021

[a] Wild stock distribution 1985-1989.
[b] Hatchery stock distribution 1980-1988. Chinook Salmon Plan for Southeast Alaska, 1989 Annex.
[c] Excludes Canadian harvest. Preliminary data.

Table 4. Peak escapements of chinook salmon to tributaries of the Chickamin River, 1960-1989.[a]

Year	South Fork Creek	Barrier Creek	Butler Creek	Leduc Creek	Indian Creek	Humpy Creek	King Creek	Clear Falls Creek	Total
1960	-	-	-	-	-	3 (A)	-	-	3
1961	-	36 (A)	77 (A)	42 (A)	5 (A)	120 (A)	48 (A)	-	328
1962	400 (A)	35 (A)	-	-	-	150 (A)	-	-	585
1963	350 (A)	115 (A)	-	-	-	3 (A)	200 (A)	-	668
1964	-	-	-	-	-	-	-	-	-
1965	-	-	-	-	-	-	75 (A)	-	75
1966	-	-	-	-	-	50 (F)	-	-	50
1967	-	-	-	-	-	-	45 (H)	-	45
1968	-	-	-	-	-	30 (H)	20 (H)	-	50
1969	-	-	-	-	-	10 (H)	45 (H)	-	55
1970	-	-	-	-	-	-	-	-	-
1971	-	-	-	-	-	-	-	-	-
1972	350 (A)	25 (A)	-	85 (A)	-	65 (A)	510 (A)	-	1,035
1973	-	-	-	-	-	14 (A)	65 (A)	-	79
1974	144 (H)	-	-	-	-	-	11 (H)	-	155
1975	141 (H)	9 (H)	66 (H)	6 (H)	90 (H)	7 (H)	30 (H)	-	349
1976	46 (H)	10 (H)	15 (H)	12 (H)	9 (H)	-	-	-	92
1977	52 (H)	66 (H)	30 (H)	26 (H)	53 (H)	0 (H)	-	-	227
1978	21 (H)	94 (H)	4 (H)	42 (H)	20 (H)	-	-	-	181
1979	63 (H)	17 (H)	29 (H)	0 (H)	31 (H)	-	-	-	140
1980	56 (H)	62 (H)	104 (H)	17 (H)	22 (H)	-	-	-	261
1981	51 (H)	105 (H)	51 (H)	25 (H)	12 (H)	4 (F)	105 (F)	31 (H)	384
1982	84 (H)	149 (H)	37 (H)	36 (H)	30 (F)	37 (F)	165 (F)	33 (H)	571
1983	28 (H)	138 (H)	91 (H)	30 (H)	47 (H)	-	212 (F)	30 (H)	576
1984	185 (H)	171 (H)	124 (H)	15 (H)	103 (H)	88 (F)	388 (F)	28 (H)	1,102
1985	163 (H)	129 (H)	92 (H)	8 (H)	125 (H)	50 (H)	377 (H)	12 (H)	956
1986	562 (H)	168 (H)	203 (H)	20 (H)	120 (H)	-	564 (H)	40 (H)	1,677
1987	261 (H)	76 (H)	120 (H)	19 (H)	115 (H)	26 (H)	310 (H)	48 (H)	975
1988	280 (H/F)	82 (H/F)	159 (H)	25 (H/F)	32 (H)	19 (H/F)	164 (H)	25 (H/F)	786
1989	226 (H/F)	90 (H)	137 (H)	57 (H)	84 (H)	22 (H/F)	224 (H)	94 (H)	934

(F) = Escapement surveyed by walking stream
(H) = Escapement surveyed by helicopter
(A) = Escapement surveyed by fixed-wing aircraft
(H/F) = Escapement surveyed by combination of walking and helicopter
\- = No survey conducted or data not comparable
[a] - Escapement counts conducted prior to 1975 may not be comparable due to differences in survey dates and counting methods.

Table 5. Recoveries, exploitation rates, and fishery contributions of wild Chickamin River chinook salmon from the 1981-85 brood years.

Return Year	Age	Unexpanded Fishery Recoveries	Expanded by sampling fraction	Unexpanded spawning grounds	Expanded by sampling fraction	Exploitation Rate	Tagging Fraction	Fishery Contribution
				1982 Brood				
1985	1.1	2	1					
1986	1.2	23	33					
1987	1.3	11	18	4	39	31.6%	3.1%	581
1988	1.4	1	2	2	16	11.1%	2.5%	80
1989	1.5	1	2	0				
				1983 Brood				
1986	1.1	3						
1987	1.2	9	17	3	29	37.0%	3.2%	531
1988	1.3	15	19	0				
1989	1.4	1	2	1	8	20.0%	0.8%	250
				1984 Brood				
1986	1.0	2	0					
1987	1.1	5	1	1	10		3.3%	30
1988	1.2	14	34					
1989	1.3	12	18	1	8	69.0%	1.2%	1,500
1990	1.4							
				1985 Brood				
1988	1.1	1	5	0				
1989	1.2	2	3	0				
1990	1.3							

Table 6. Percent distribution of harvest (expanded recoveries) by fishing district of wild (all gear) and hatchery (commercial troll only) Chickamin River stock chinook salmon.[a]

Statistical Area	Wild Stock	Whitman Lake	Little Port Walter
101,102	46	38	0
103,104	10	19	1
105,109,110	16	14	63
106,107,108	11	17	0
111	3	0	2
112,114	5	7	21
113,154	9	2	11
116	0	0	2
Total Catch	186	1,771	3,291

[a] Excludes Canadian harvest. Preliminary data.

Table 7. Peak escapement and weir counts of chinook salmon for tributaries of the Alsek River, 1960-1989[a].

Year	Village System	Mile 112 Creek	Klukshu System	Blanchard System	Takhanne River	Goat Creek	Total
1962	-	-	86	-	-	-	86
1963	-	-	-	-	-	-	-
1964	-	-	20	-	-	-	20
1965	-	-	100	100	250	-	450
1966	-	-	1,000	100	200	-	1,300
1967	-	-	1,500	200	275	-	1,975
1968	-	-	1,700	425	225	-	2,350
1969	-	72	700	250	250	-	1,272
1970	100	-	500	100	100	-	800
1971	50	60	300	-	-	-	410
1972	-	32	1,100	12 (A)	250	-	1,394
1973	-	-	-	-	49 (A)	-	49
1974	14	183	62	52 (A)	132	-	443
1975	17	-	58	81 (A)	177 (A)	-	333
1976	-	-	1,244 (W)	-	-	-	1,244
1977	-	-	3,144 (W)	-	-	-	3,144
1978	-	-	2,976 (W)	-	-	-	2,976
1979	-	-	4,403 (W)	-	-	-	4,403
1980	-	-	2,637 (W)	-	-	-	2,637
1981	0	-	2,113 (W)	35 (H)	11 (H)	-	2,159
1982	-	-	2,369 (W)	59 (H)	241 (H)	13 (H)	2,682
1983	-	-	2,537 (W)	108 (H)	185 (H)	-	2,830
1984	-	-	1,672 (W)	304 (H)	158 (H)	28 (H)	2,162[b]
1985	-	-	1,458 (W)	232 (H)	184 (H)	-	1,874
1986	-	-	2,709 (W)	556 (H)	358 (H)	142 (H)	3,765
1987	-	-	2,615 (W)	624 (H)	395 E(H)	85 (H)	3,719
1988	-	-	2,018 (W)	437 (H)	169 E(H)	54 (H)	2,678[c]
1989	-	-	2,456 (W)	-	158 E(H)	34 E(H)	2,648[c]

(F) = Foot survey; (A) = Fixed-wing aircraft; (H) = Helicopter; (W) = Weir count

[a] = Escapement counts prior to 1975 may not be comparable due to differences in survey dates and counting methods
[b] = Aerial surveys of Blanchard, Takhanne, and Goat Creek by CDFO in 1984
[c] = Jacks included in total Klukshu River weir count

Table 8. Summary of trapping and coded-wire tagging of YOY chinook salmon on the Alsek River from September 13 to October 14, 1989.

Date	Traps Checked	Chinook Tagged	Number Recap.	Tags Retained	Tag Code	Mean Length (mm)	Sample Size
13-Sep	23						
14-Sep	9						
15-Sep	73						
16-Sep	73						
17-Sep	24						
18-Sep	43						
19-Sep	17	2,677			4-31-12	64.6	48
20-Sep	52	3,100	5	5	4-31-12		
21-Sep	96						
22-Sep	74						
23-Sep	51						
24-Sep		2,353	85	85	4-31-12	58.3	52
25-Sep	60						
26-Sep	105[a]						
27-Sep	111						
28-Sep	26	2,149			4-31-12	58.7	41
29-Sep	120	1,020	245	245	4-31-15		
30-Sep	132						
01-Oct	108						
02-Oct	68						
03-Oct		2,821	345	345	4-31-15	61.1	41
04-Oct	103	1,102	106	106	4-31-15	61.2	42
05-Oct		518	24	24	4-31-15		
06-Oct							
07-Oct	88						
08-Oct	44						
09-Oct	72						
10-Oct	13						
11-Oct	126						
12-Oct	94						
13-Oct		1,865	209	209	4-31-15	63.3	42
14-Oct	57						
15-Oct		525	61	61			
Total	1,862	18,130	1,080	1,080		61.2	266

Overall Statistics

Catch/trap	9.7		Valid Tags Released:
Tag Rentent.	100.0		(4-31-12) = 10,279
Mean Length	61.2		(4-31-15) = 7,851
Range	43mm to 90mm		
Stand. Dev.	7.5	95% CI = 60.3 to 62.1	
Stand. Error	0.46		
Count	266		

[a] Some traps checked twice in 24 hour period.

Table 9. Catches, number tagged, and CPUE (catch/wheel hour) of chinook salmon in fish wheels at Canyon Island, 1989.

			Radio Tags				Spaghetti Tags											
			Medium		Large[a]													
	Daily Chinook Catch	Cumul. Chinook Catch	Daily	Cum	Daily	Cum	Daily Medium Tagged	Med Cum	Daily Large Tagged	Lg Cum	Cumul. Med Tagged	Cumul. Large Tagged	weekly prop large radio	Daily Cpue	Daily Proport. Cpue	Cumul. Proport. Cpue	Fishwheel Hours	River Depth
prior 5	13	13	3	3	10	10	0	0	0	0	3	10						
05-May	2	15	0	3	2	12	0	0	0	0	3	12		0.162	0.004	0.004	12.33	611
06-May	3	18	0	3	3	15	0	0	0	0	3	15	1.00	0.125	0.003	0.007	24	705
07-May	5	23	0	3	3	18	0	0	0	0	3	18		0.208	0.005	0.011	24	801
08-May	4	27	1	4	2	20	0	0	0	0	4	20		0.190	0.004	0.016	21	805
09-May	0	27	0	4	0	20	0	0	0	0	4	20		0.000	0.000	0.016	0	809
10-May	1	28	0	4	1	21	0	0	0	0	4	21		0.000	0.000	0.016	0	805
11-May	8	36	3	7	5	26	0	0	0	0	7	26		1.143	0.026	0.042	7.00	710
12-May	35	71	4	11	25	51	0	0	0	0	11	51		1.680	0.038	0.080	20.83	605
13-May	19	90	2	13	9	60	0	0	0	0	13	60	1.00	0.792	0.018	0.098	24.00	602
14-May	5	95	0	13	1	61	1	1	0	0	14	62		0.208	0.005	0.102	24.00	604
15-May	5	100	1	14	1	62	0	1	0	0	15	62		0.159	0.004	0.106	31.50	511
16-May	8	108	3	17	3	65	0	1	0	0	18	65		0.167	0.004	0.110	48.00	511
17-May	17	125	2	19	10	75	0	1	0	0	20	75		0.354	0.008	0.118	48.00	500
18-May	21	146	3	22	10	85	2	3	0	0	25	85		0.452	0.010	0.128	46.50	411
19-May	37	183	3	25	22	107	7	10	0	0	35	107		0.771	0.017	0.146	48.00	407
20-May	30	213	2	27	11	118	13	23	0	0	50	118	1.00	0.625	0.014	0.160	48.00	406
21-May	23	236	4	31	12	130	1	24	0	0	55	130		0.504	0.011	0.171	45.66	406
22-May	17	253	3	34	7	137	2	26	0	0	60	137		0.370	0.008	0.180	46.00	506
23-May	33	286	5	39	15	152	1	27	0	0	66	152		0.783	0.018	0.197	42.17	510
24-May	50	336	0	39	3	155	17	44	6	6	83	161		1.181	0.027	0.224	42.35	600
25-May	69	405	0	39	3	158	10	54	31	37	93	195		1.500	0.034	0.258	46.00	510
26-May	77	482	0	39	0	158	12	66	31	68	105	226		1.723	0.039	0.297	44.68	508
27-May	79	561	0	39	0	158	25	91	38	106	130	264	3.65	1.717	0.039	0.336	46.00	601
28-May	54	615	0	39	4	162	18	109	20	126	148	288		1.168	0.027	0.363	46.25	610
29-May	31	646	0	39	4	166	13	122	7	133	161	299		0.662	0.015	0.378	46.83	706
30-May	29	675	0	39	7	173	6	128	9	142	167	315		0.665	0.015	0.393	43.60	902
31-May	12	687	0	39	7	180	5	133	0	142	172	322		0.254	0.006	0.399	47.24	1008
01-Jun	27	714	3	42	9	189	5	138	7	149	180	338		0.592	0.013	0.412	45.60	1008
02-Jun	48	762	0	42	9	198	8	146	21	170	188	368		1.036	0.024	0.436	46.35	910
03-Jun	56	818	0	42	0	198	14	160	28	198	202	396	3.30	1.222	0.028	0.463	45.83	808
04-Jun	55	873	1	43	7	205	12	172	25	223	215	428		1.192	0.027	0.490	46.16	809
05-Jun	22	895	0	43	3	208	3	175	9	232	218	440		0.475	0.011	0.501	46.33	1000
06-Jun	26	921	0	43	11	219	2	177	4	236	220	455		0.590	0.013	0.515	44.08	909
07-Jun	28	949	0	43	7	226	7	184	3	239	227	465		0.603	0.014	0.528	46.42	806
08-Jun	62	1011	0	43	12	238	14	198	17	256	241	494		1.370	0.031	0.559	45.25	707
09-Jun	58	1069	0	43	9	247	17	215	20	276	258	523		1.270	0.029	0.588	45.67	711
10-Jun	64	1133	0	43	0	247	17	232	37	313	275	560	3.35	1.446	0.033	0.621	44.26	708
11-Jun	49	1182	0	43	9	256	11	243	15	328	286	584		1.081	0.025	0.645	45.34	707
12-Jun	55	1237	0	43	8	264	21	264	11	339	307	603		1.229	0.028	0.673	44.75	708
13-Jun	44	1281	1	44	12	276	9	273	9	348	317	624		0.971	0.022	0.695	45.33	709
14-Jun	47	1328	0	44	0	276	7	280	20	368	324	644		1.046	0.024	0.719	44.92	800
15-Jun	30	1358	0	44	9	285	8	288	5	373	332	658		0.672	0.015	0.734	44.67	808

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			Radio Tags				Spaghetti Tags											
			Medium		Large													
	Daily Chinook Catch	Cumul. Chinook Catch	Daily	Cum	Daily	Cum	Daily Medium Tagged	Med Cum	Daily Large Tagged	Lg Cum	Cumul. Med Tagged	Cumul. Large Tagged	weekly prop large radio	Daily Cpue	Daily Proport. Cpue	Cumul. Proport. Cpue	Fishwheel Hours	River Depth
16-Jun	26	1384	0	44	3	288	3	291	4	377	335	665		0.877	0.020	0.754	29.66	705
17-Jun	44	1428	0	44	9	297	9	300	4	381	344	678	2.36	0.963	0.022	0.776	45.67	603
18-Jun	41	1469	0	44	1	298	8	308	10	391	352	689		0.913	0.021	0.797	44.92	511
19-Jun	43	1512	0	44	8	306	10	318	5	396	362	702		0.965	0.022	0.819	44.58	505
20-Jun	34	1546	1	45	6	312	10	328	2	398	373	710		0.750	0.017	0.836	45.34	505
21-Jun	16	1562	1	46	1	313	2	330	2	400	376	713		0.346	0.008	0.844	46.19	509
22-Jun	16	1578	0	46	3	316	1	331	0	400	377	716		0.343	0.008	0.851	46.59	609
23-Jun	2	1580	0	46	1	317	0	331	0	400	377	717		0.224	0.005	0.857	8.92	700
24-Jun	29	1609	0	46	13	330	5	336	0	400	382	730	1.58	0.890	0.020	0.877	32.59	610
25-Jun	28	1637	0	46	8	338	7	343	3	403	389	741		0.715	0.016	0.893	39.17	705
26-Jun	24	1661	0	46	4	342	3	346	0	403	392	745		0.912	0.021	0.914	26.33	608
27-Jun	28	1689	0	46	6	348	4	350	0	403	396	751		0.619	0.014	0.928	45.25	609
28-Jun	21	1710	0	46	5	353	5	355	1	404	401	757		0.466	0.011	0.938	45.08	700
29-Jun	17	1727	0	46	5	358	4	359	1	405	405	763		0.374	0.008	0.947	45.50	706
30-Jun	8	1735	0	46	4	362	0	359	1	406	405	768		0.186	0.004	0.951	42.92	700
01-Jul	6	1741	0	46	2	364	0	359	2	408	405	772	1.24	0.134	0.003	0.954	44.67	701
02-Jul	12	1753	0	46	3	367	1	360	6	414	406	781		0.273	0.006	0.960	44.00	703
03-Jul	15	1768	0	46	0	367	4	364	3	417	410	784		0.343	0.008	0.968	43.67	703
04-Jul	4	1772	0	46	0	367	3	367	0	417	413	784		0.090	0.002	0.970	44.42	611
05-Jul	2	1774	0	46	0	367	1	368	0	417	414	784		0.044	0.001	0.971	45.41	610
06-Jul	1	1775	0	46	0	367	1	369	0	417	415	784		0.022	0.001	0.972	45.25	608
07-Jul	3	1778	0	46	3	370	0	369	0	417	415	787		0.067	0.002	0.973	44.91	610
08-Jul	3	1781	0	46	1	371	1	370	1	418	416	789	2.43	0.068	0.002	0.975	44.42	705
09-Jul	11	1792	0	46	4	375	2	372	1	419	418	794		0.267	0.006	0.981	41.16	710
10-Jul	7	1799	0	46	1	376	3	375	1	420	421	796		0.180	0.004	0.985	38.84	800
11-Jul	1	1800	0	46	1	377	0	375	0	420	421	797		0.030	0.001	0.985	32.80	809
12-Jul	0	1800	0	46	0	377	0	375	0	420	421	797		0.000	0.000	0.985	21.42	810
13-Jul	3	1803	0	46	1	378	1	376	0	420	422	798		0.116	0.003	0.988	25.84	900
14-Jul	4	1807	0	46	2	380	1	377	0	420	423	800		0.108	0.002	0.991	36.92	900
15-Jul	3	1810	0	46	2	382	0	377	0	420	423	802	1.18	0.089	0.002	0.993	33.67	805
16-Jul	0	1810	0	46	0	382	0	377	0	420	423	802		0.000	0.000	0.993	30.17	705
17-Jul	1	1811	0	46	1	383	0	377	0	420	423	803		0.023	0.001	0.993	42.92	607
18-Jul	0	1811	0	46	0	383	0	377	0	420	423	803		0.000	0.000	0.993	43.09	607
19-Jul	1	1812	0	46	0	383	0	377	0	420	423	803		0.022	0.001	0.994	44.58	611
20-Jul	0	1812	0	46	0	383	0	377	0	420	423	803		0.000	0.000	0.994	38.16	611
21-Jul	0	1812	0	46	0	383	0	377	0	420	423	803		0.000	0.000	0.994	40.50	610
22-Jul	3	1815	0	46	0	383	0	377	2	422	423	805	3.00	0.066	0.002	0.995	45.34	700
23-Jul	2	1817	0	46	0	383	1	378	1	423	424	806		0.045	0.001	0.996	44.17	706
24-Jul	3	1820	0	46	0	383	0	378	1	424	424	807		0.075	0.002	0.998	40.17	611
25-Jul	1	1821	0	46	0	383	0	378	0	424	424	807		0.025	0.001	0.998	40.42	606
26-Jul	0	1821	0	46	0	383	0	378	0	424	424	807		0.000	0.000	0.998	43.25	511
27-Jul	0	1821	0	46	0	383	0	378	0	424	424	807		0.000	0.000	0.998	43.34	509
28-Jul	0	1821	0	46	0	383	0	378	0	424	424	807		0.000	0.000	0.998	44.83	601
29-Jul	0	1821	0	46	0	383	0	378	0	424	424	807		0.000	0.000	0.998	36.30	603
30-Jul	0	1821	0	46	0	383	0	378	0	424	424	807		0.000	0.000	0.998	38.09	605
31-Jul	0	1821	0	46	0	383	0	378	0	424	424	807		0.000	0.000	0.998	44.25	607

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			Radio Tags				Spaghetti Tags											
			Medium		Large													
	Daily Chinook Catch	Cumul. Chinook Catch	Daily	Cum	Daily	Cum	Daily Medium Tagged	Med Cum	Daily Large Tagged	Lg Cum	Cumul. Med Tagged	Cumul. Large Tagged	weekly prop large radio	Daily Cpue	Daily Proport. Cpue	Cumul. Proport. Cpue	Fishwheel Hours	River Depth
01-Aug	0	1821	0	46	0	383	0	378	0	424	424	807		0.000	0.000	0.998	44.92	609
02-Aug	0	1821	0	46	0	383	0	378	0	424	424	807		0.000	0.000	0.998	43.08	606
03-Aug	0	1821	0	46	0	383	0	378	0	424	424	807		0.000	0.000	0.998	43.67	607
04-Aug	0	1821	0	46	0	383	0	378	0	424	424	807		0.000	0.000	0.998	44.17	606
05-Aug	0	1821	0	46	0	383	0	378	0	424	424	807		0.000	0.000	0.998	46.08	510
06-Aug	0	1821	0	46	0	383	0	378	0	424	424	807		0.000	0.000	0.998	44.92	510
07-Aug	1	1822	0	46	0	383	0	378	1	425	424	808		0.022	0.001	0.999	44.50	604
08-Aug	0	1822	0	46	0	383	0	378	0	425	424	808		0.000	0.000	0.999	45.58	508
09-Aug	0	1822	0	46	0	383	0	378	0	425	424	808		0.000	0.000	0.999	45.25	501
10-Aug	1	1823	0	46	0	383	0	378	0	425	424	808		0.022	0.000	0.999	45.92	411
11-Aug	0	1823	0	46	0	383	0	378	0	425	424	808		0.000	0.000	0.999	46.17	509
12-Aug	0	1823	0	46	0	383	0	378	0	425	424	808		0.000	0.000	0.999	45.08	608
13-Aug	0	1823	0	46	0	383	0	378	0	425	424	808		0.000	0.000	0.999	42.17	705
14-Aug	1	1824	0	46	0	383	0	378	0	425	424	808		0.026	0.001	1.000	38.25	800
15-Aug	0	1824	0	46	0	383	0	378	0	425	424	808		0.000	0.000	1.000	38.25	910

[a] Large fish MEF length >= 661mm, medium 440-660mm.

Table 10. Mark-recapture population estimates of chinook salmon escapement to the Taku River, 1989.

	Large Fish				Medium Fish			
	# Fish Examined	Tags	Tag Ratio	Population Estimate[a]	# Fish Examined	Tags	Tag Ratio	Population Estimate
Kowatua R.[b]	601	7	86	49,289	120	3	40	14,318
Tatsamenie[c]	636	9	71	41,724	198	8	25	8,831
Nahlin R.[d]	493	5	99	53,928	49	5	10	3,550
Nakina R.	3,540	51	69	44,603	807	22	37	13,038
Total	5,270	72	73	47,295	1,174	38	31	10,977
Total[e]	5,270	92	57	37,124				

[a]N = (M+1)(C+1)/(R+1) where M = # tags at risk,
C = # fish examined for tags
R = # of tags randomly recovered.
# of large tags at risk = 808-mortalities = 654
# of medium tags at risk = 424-mortalities = 354
[b]Tag recoveries include 4 large fish missing tags, doesn't include 3 tags recovered nonrandomly at sockeye weir.
[c]Tag recoveries include 4 large and 2 medium fish missing tags.
[d]Tag recoveries include 3 medium fish missing tags.
[e]Nakina River recoveries expanded for 40% tag loss

Table 11. Incidence of spaghetti tag loss in Taku River chinook salmon, 1989.

		Large		Medium		Total		
Location		Tagged	Lost Tags	Tagged	Lost Tags	Tagged	Lost Tags	Total
Kowatua	male	2	4	3	0	5	4	9
	female	1	0	-	-	1	0	1
	total	3	4	3	0	6	4	10
Tatsamenie	male	1	2	6	2	7	4	11
	female	4	2	-	-	4	2	6
	total	5	4	6	2	11	6	17
Nahlin	male	1	0	2	3	3	3	6
	female	4	0	-	-	4	0	4
	total	5	0	2	3	7	3	10
Nakina	male	3	7	1	1	4	8	12
	female	13	5	-	-	13	5	18
	total[a]	16	12	1	1	17	13	30
Total	male	7	13 (65%)	12	6 (33%)	19	19(50%)	38
	female	22	7 (24%)	-	-	22	7 (24%)	29
	total	29	20 (41%)	12	6 (33%)	41	26(39%)	67

[a] Nakina data from radio-tagged fish only.

Table 12. Peak escapements of chinook salmon to Taku River tributaries, 1951-1989. \1

Year	Nakina River	Kowatua River	Tatsamenie River	Dudidontu River	Tseta Creek	Nahlin River	Total
1951	5,000 (F)	-	-	400 (F)	100 (F)	1,000 (F)	6,500
1952	9,000 (F)	-	-	-	-	-	9,000
1953	7,500 (F)	-	-	-	-	-	7,500
1954	6,000 (F)	-	-	-	-	-	6,000
1955	3,000 (F)	-	-	-	-	-	3,000
1956	1,380 (F)	-	-	-	-	-	1,380
1957	1,500 \2	-	-	-	-	-	1,500
1958	2,500 \2	-	-	4,500 (A)	-	2,500 (A)	9,500
1959	4,000 \2	-	-	-	-	-	4,000
1962	-	-	-	25 (A)	81 (A)	216 (A)	322
1965	3,050 (H)	200 P(A)	50 P(A)	110 (A)	18 (A)	35 (A)	3,463
1966	3,700 P(A)	14 P(A)	100 P(A)	252 (A)	150 (A)	300 (A)	4,516
1967	700 (A)	250 P(A)	-	600 (A)	350 (A)	300 P(A)	2,200
1968	300 P(A)	1,100 (A)	800 E(A)	590 (A)	230 (A)	450 (A)	3,470
1969	3,500 (A)	3,300 (A)	800 E(A)	-	-	-	7,600
1970	-	1200 P(A)	530 E(A)	10 (A)	25 (A)	26 (A)	1,791
1971	500 (A)	1,400 E(A)	360 E(A)	165 (A)	- (A)	473 (A)	2,898
1972	1,000 (F)	170 (A)	132 (A)	102 (A)	80 P(A)	280 (A)	1,764
1973	2,000 N(H)	100 N(H)	200 E(H)	200 E(H)	4 (A)	300 E(H)	2,804
1974	1,800 E(H)	235 (A)	120 (A)	24 (A)	4 (A)	900 E(H)	3,083
1975	1,800 E(H)	-	-	15 N(H)	-	274 E(H)	2,089
1976	3,000 E(H)	341 P(A)	620 E(H)	40 (H)	-	725 E(H)	4,726
1977	3,850 E(H)	580 E(H)	573 E(H)	18 (H)	-	650 E(H)	5,671
1978	1,620 E(H)	490 N(H)	550 E(H)	- (H)	21 E(H)	624 E(H)	3,305
1979	2,110 E(A)	430 N(H)	750 E(H)	9 E(H)	-	857 E(H)	4,156
1980	4,500 E(H)	450 N(H)	905 E(H)	158 E(H)	-	1,531 E(H)	7,544
1981	5,110 E(H)	560 N(H)	839 E(H)	74 N(H)	258 N(H)	2,945 E(H)	9,786
1982	2,533 E(H)	289 N(H)	387 N(H)	130 N(H)	228 N(H)	1,246 E(H)	4,813
1983	968 E(H)	171 E(H)	236 E(H)	117 E(H)	179 N(H)	391 N(H)	2,062
1984	1,887 (H) \3	279 E(H) \3	616 E(H) \3	-	176 (H) \4	951 (H) \5	3,909
1985	2,647 N(H)	699 E(H)	848 E(H)	475 (H)	303 E(H)	2,236 E(H)	7,208
1986	3,868 (H)	548 E(H)	886 E(H)	413 E(H)	193 E(H)	1,612 E(H)	7,520
1987	2,906 E(H)	570 E(H)	678 E(H)	287 E(H)	180 E(H)	1,122 E(H)	5,743
1988	4,500 E(H)	1,010 E(H)	1,272 E(H)	243 E(H)	66 E(H)	1,535 E(H)	8,626
1989	5,141 E(H)	601 (W) \6	1,228 E(H)	204 E(H)	494 E(H)	1,812 E(H)	9,480

(F) = Escapement survey conducted by walking river
(A) = Escapement survey conducted from fixed-wing aircraft
(H) = Escapement survey conducted from helicopter
P = Survey conditions hampered by glacial or turbid waters
N = Average counting conditions
E = Survey conditions ideal
- = No survey conducted or data not comparable
\1 Escapements before 1975 may not be comparable due to changes in survey methods.
\2 Counts of total river not conducted; comparisons made from carcass weir counts.
\3 Surveys conducted by CDFO
\4 Surveyed only upper two miles (partial survey)
\5 Surveyed only above beaver dam valley (count = 521; adjusted for total with spawning distribution data as follows: above dams = 54.8%, between dams = 23.2%, below dams to Telegraph Trail = 22.0%)
\6 Count from carcass weir; turbid water conditions precluded accurate aerial survey.

Table 13 . Preliminary 1989 estimates of total escapements of chinook salmon to southeast Alaska and transboundary rivers (includes 3- and 4-ocean chinook only).

System (Tributary)	Escapement Index Count	Survey Expansion Factor	Tributary Expansion Factor	Estimated Total Escapement	Category Expansion Factor	Estimated Total Escapement [1]
Index Systems						
Major Category (Transboundary) Systems (3 total)						
Alsek (Klukshu) [2]	2,456 (W)	1	1/.64	3,838		
Taku (Nakina and Nahlin)	6,953 (A)	1/.75	1/.60	15,451		
Stikine (Little Tahltan)	4,715 (W)	1	1/.25	18,860		
Major Subtotals	14,124			38,149	1	38,149
Medium Category Systems (9 total)						
Situk	652 (W)	1	1	652		
Chilkat (Big Boulder) [3]	305 (F)	1/.80	1/.28	1,362		
Andrew Creek	530 (F)	1/.625	1	848		
Behm Canal Systems						
Unuk	1,149 (A)	1/.625	1	1,838		
Chickamin	934 (A)	1/.625	1	1,494		
Blossom	344 (A)	1/.625	1	550		
Keta	1,155 (A)	1/.625	1	1,848		
Subtotals	3,582			5,731		
Medium Subtotals	5,069			8,593	9/7	11,048
Minor Category Systems (22 total)						
King Salmon River [4]	238 (W)	1	1	238		
Minor Subtotals	238			238	22/1	5,236
All Systems Totals	19,431			46,979		54,433

(W) = weir count; (A) = aerial survey estimate; (F) = foot survey estimate.

[1] Total escapement estimates = (index escapements) x (expansion factors)
[2] Alsek escapement = weir count incl. some jacks - subs. catch unknown
[3] Stonehouse Creek added to index in 1981
[4] Does not include 40 fish used for ADF&G Snettisham egg take but does include 29 fish below weir when pulled

Table 14. Population estimate of age-1.3 and -1.4 Taku River chinook salmon based on the ratio of radio-tagged fish to total fish counted by aerial survey, 1989.

	First Survey				Second Survey			
Location	Aerial Count C	Lg. Radio Tags	expand radio R	Tag Ratio C/R	Aerial Count	Lg. Radio Tags	expand radio R	Tag Ratio C/R
Nahlin	1,000	9	10	100	1,221	11	16	76
Nakina	3,219	97	239	13	5,141	104	260	20
Tseta	494	2	7	71				
Dudidontu	204	4	7	29				
Kowatua	501	10	17	29	601	9	14	43
Tatsamenie	1,228	13	21	58	1,140	12	20	57
Overall	6,646	135	301	22	8,103	136	310	26
Population Estimate		N=MC/R		15,522				18,376
		N*=(M+1)(C+1)/(R+1)		15,495				18,345
		95% CI =		14,206 to 16,782		95% CI = 16,852 to 19,835		

		expanded by tagging proportion
Number large radio tags released	383	808
Canadian Fishery catch	19	31
Lower River Mortality	37	63
Taku Inlet Gillnet	5	11
Remaining lg radio-tagged fish at risk	322 = M	703

Aerial survey estimate.

Index Tributaries	1989 Escapement Index	Survey Expansion Factor	Tributary Expansion Factor	Estimated Total Escapement
Nakina/Nahlin	6,958	1/.75	1/.60	15,462

Table 15. Recovery of tagged chinook salmon at spawning sites in the Taku River drainage in 1989, by statistical week of tagging at Canyon Island.

Recovery Location	Statistical Week of Tagging													
	18	19	20	21	22	23	24	25	26	27	28	29	30	Total
L. Tatsamenie					2	2	2	3	4	4	4	1		22
Nakina River		1	4	10	21	15	10	9	2	0	1			73
Nahlin River	1		2	2		3								8
Kowatua River					1	1	2	1	6	2				13
Dudidontu River			1											1
Total	1	1	7	12	24	21	14	13	12	6	5	1	0	117

Table 16 . Chinook salmon GSI samples collected in 1989.

Stock	Tributary	Date Sampled	Collector	Sample Size	Sample Type
King Salmon R.	King Salmon R.	07/24/89	ADFG/FRED	31	adults
Chilkat River	Tahini River	07/31/89	ADFG/SF	26	adults
Taku River	Nahlin River	08/05/89	ADFG/CF	81	adults
	Tseta Creek	08/10/89	ADFG/CF	83	adults
	Kowatua R.	08/25/89	ADFG/CF	94	adults
	Tatsamenie R.	08/30/89	ADFG/CF	111	adults
	Nakina River	08/24/89	CDFO	104	adults
Stikine River	Little Tahltan R.	08/11/89	CDFO	101	adults
	Andrew Creek	08/17/89	ADFG/CF	56	adults
	North Arm Creek	08/17/89	ADFG/CF	18	adults
Alsek River	Klukshu River	08/ /89	CDFO	105	adults
Unuk River	Genes Lake Cr.	08/30/89	ADFG/CF	67	adults
	Clear Creek	08/30/89	ADFG/CF	33	adults
Harding River	Harding River	08/26/89	ADFG/FRED	44	adults
Farragut River	Farragut River	08/22/89	NSRAA	8	adults
Keta River	Keta River	09/06/89	ADFG/CF	15	adults
Chickamin River	South Fork	08/24/89	ADFG/CF	100	adults

Table 17. Proportion of Taku River chinook salmon escapement by tributary determined by distribution of NMFS radio-tagged fish.

Location	Expanded Tags	Proportion of Total Run
Spawning Totals	651	100
Nakina River	329	50.54
Nahlin River	80	12.29
Kowatua River	47	7.22
Yeth Creek	31	4.76
Dudidontu	24	3.69
Tatsatua	25	3.84
Hackett River	28	4.30
Sloko River	25	3.84
		90.48
Nakina Index Areas	273	41.94
Nahlin Index Areas	43	6.61
	316	48.54

Proportion of Nakina/Nahlin total observed in the Nakina/Nahlin Index Areas 316/409 = 77.26

Table 18 . Percentages of escapement observed in Taku River tributaries during years when all areas surveyed.

Year	Nakina River	%	Kowatua River	%	Tatsamenie River	%	Dudidontu River	%	Tseta Creek	%	Nahlin River	%	Total
1981	5,110	52.2	560	5.7	839	8.6	74	0.8	258	2.6	2,945	30.1	9,786
1982	2,533	52.6	289	6.0	387	8.0	130	2.7	228	4.7	1,246	25.9	4,813
1983	968	46.9	171	8.3	236	11.4	117	5.7	179	8.7	391	19.0	2,062
1985	2,647	36.7	699	9.7	848	11.8	475	6.6	303	4.2	2,239	31.0	7,211
1986	3,868	51.4	548	7.3	886	11.8	413	5.5	193	2.6	1,612	21.4	7,520
1987	2,906	50.6	570	9.9	678	11.8	287	5.0	180	3.1	1,122	19.5	5,743
1988	4,500	52.2	1,010	11.7	1,272	14.7	243	2.8	66	0.8	1,535	17.8	8,626
1989	5,141	54.2	601	6.3	1,228	13.0	204	2.2	494	5.2	1,812	19.1	9,480
Mean	3,459	49.0	556	8.4	797	11.2	243	4.1	238	3.8	1,613	23.5	6,905

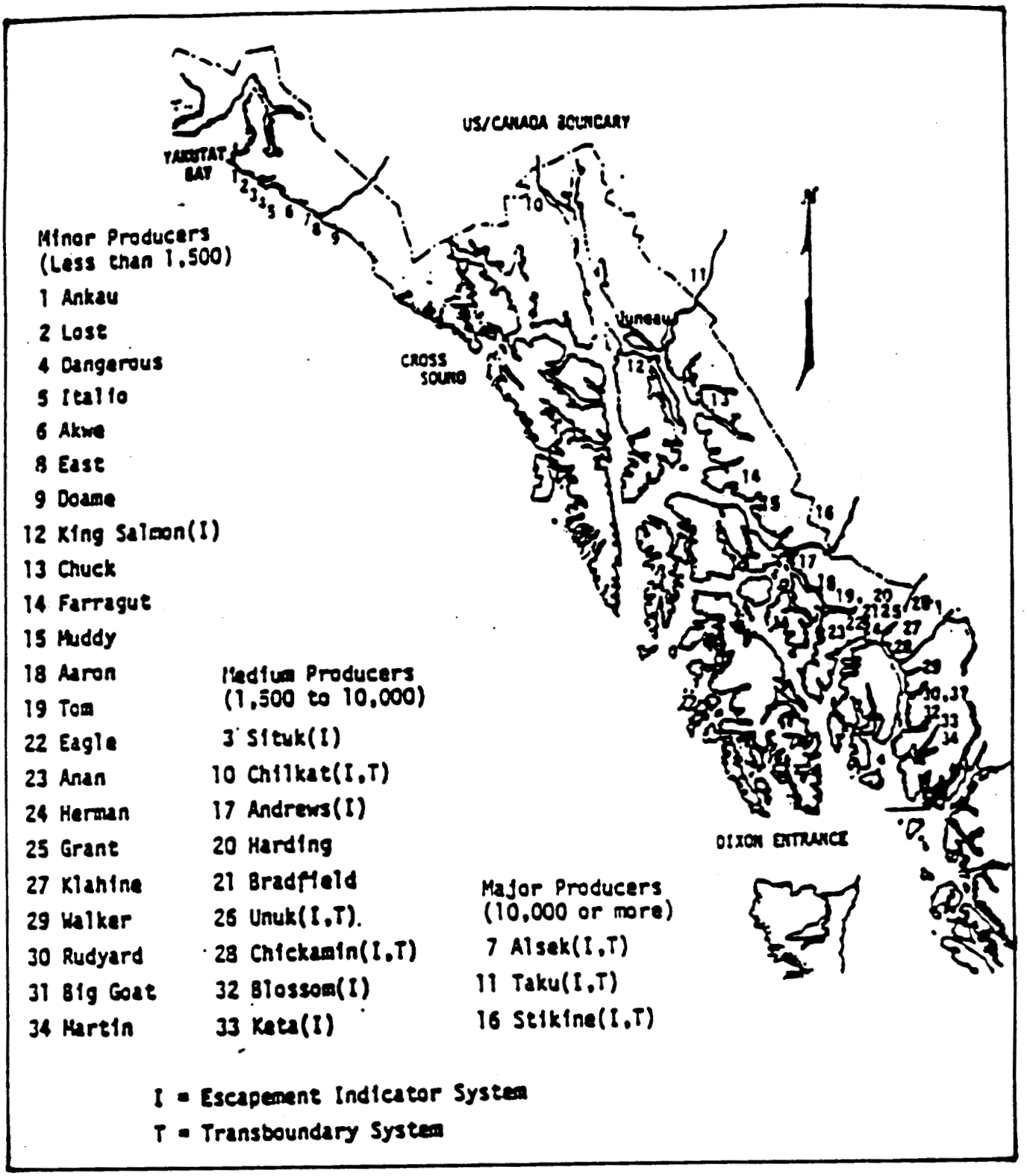

Figure 1. Approximate locations of natural chinook salmon producing systems in Southeast Alaska and transboundary river areas.

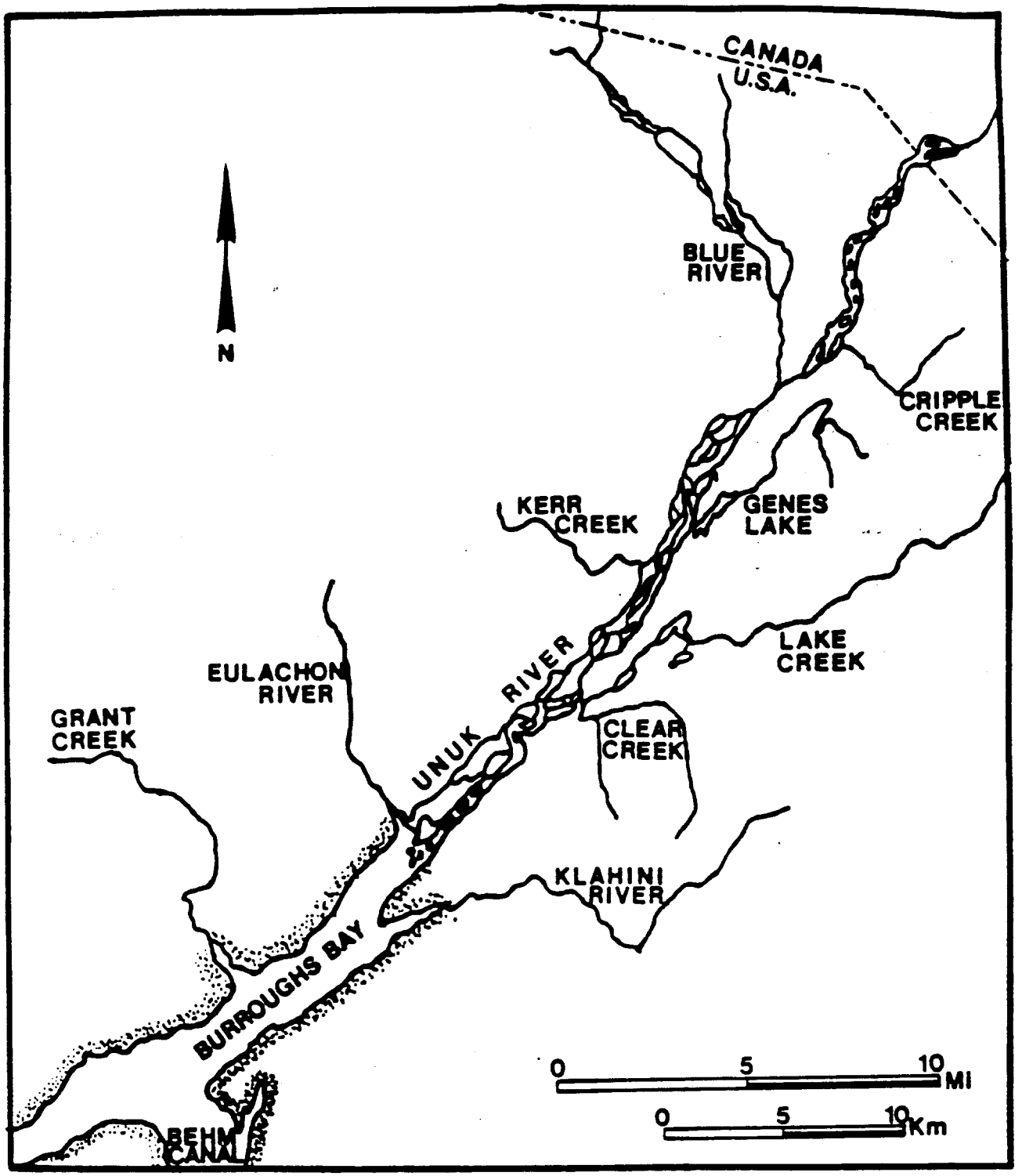

Figure 2. Unuk River drainage.

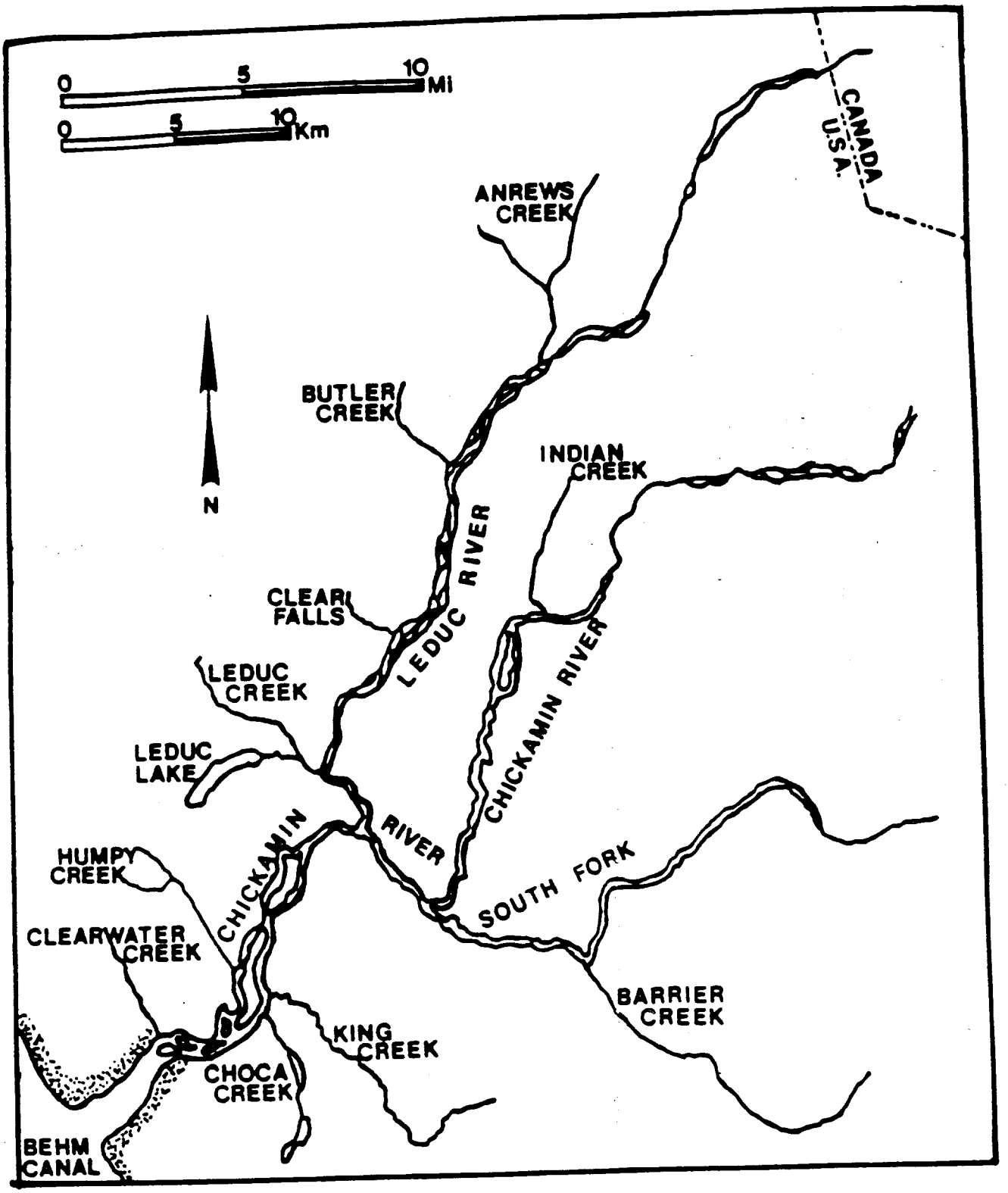

Figure 3. Chickamin River drainage.

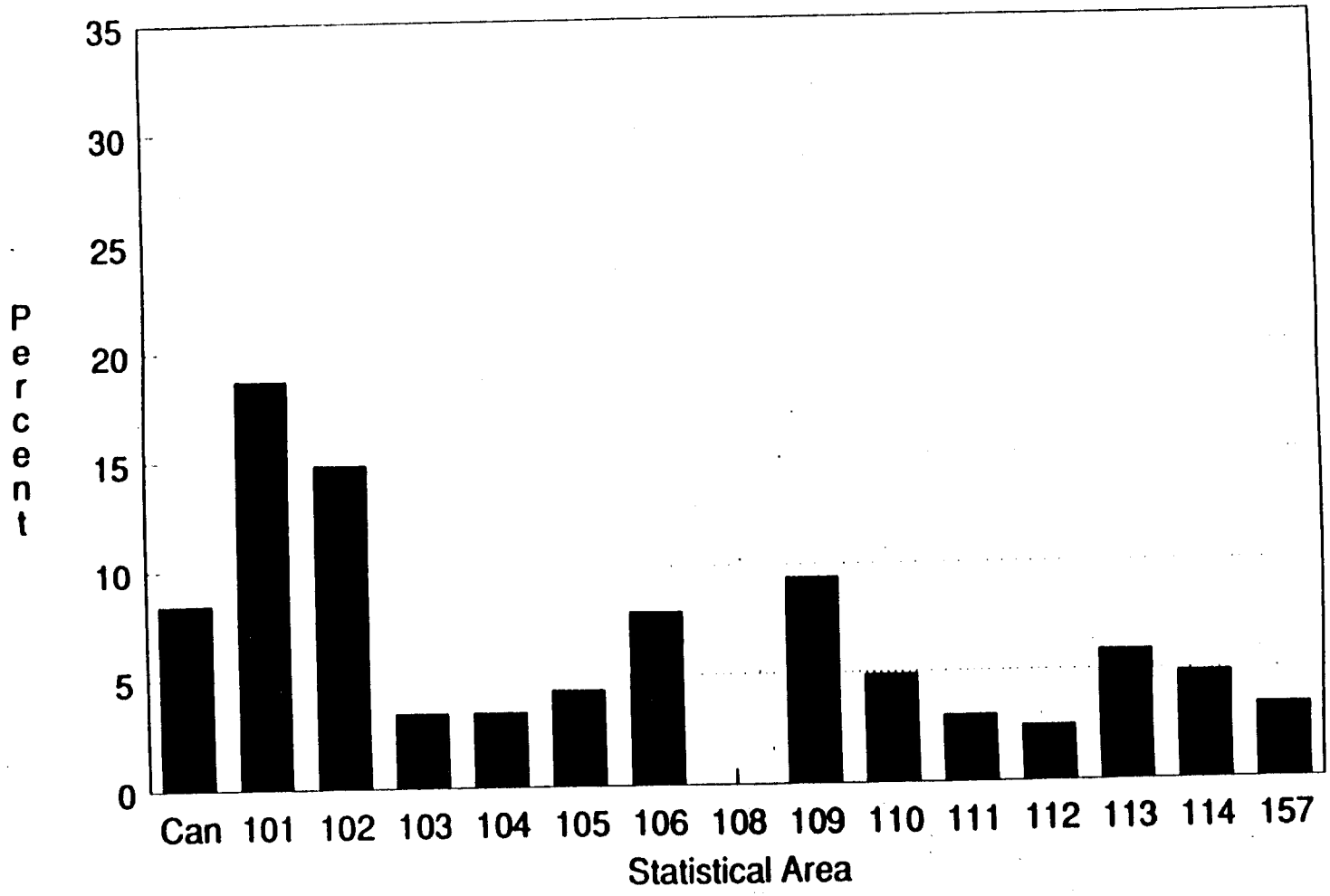

Figure 4. Distribution of th eharvest of wild Unuk River chinook salmon (percent catch by statistical area).

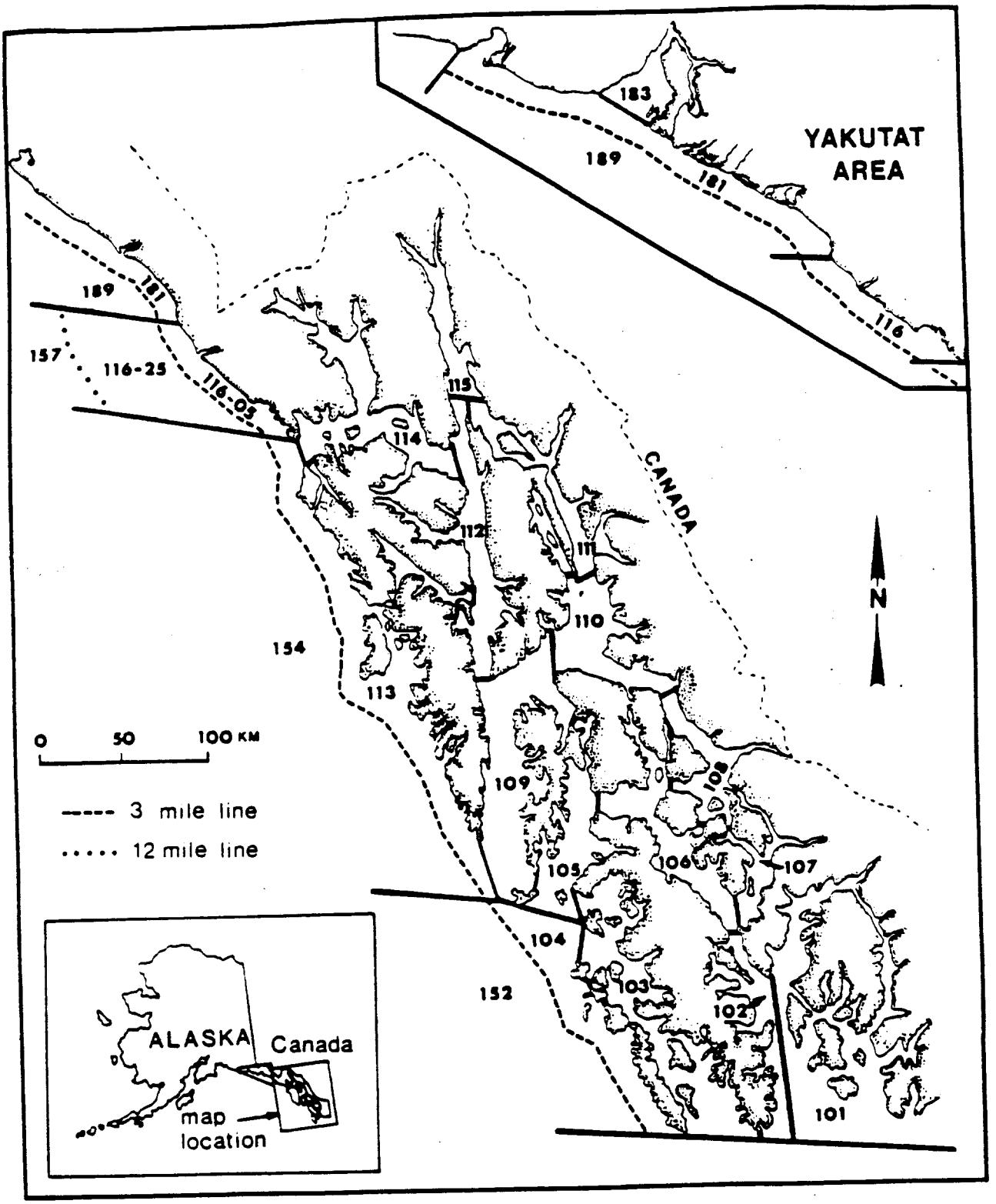

Figure 5. Southeast Alaska commercial fishing districts and statistical areas.

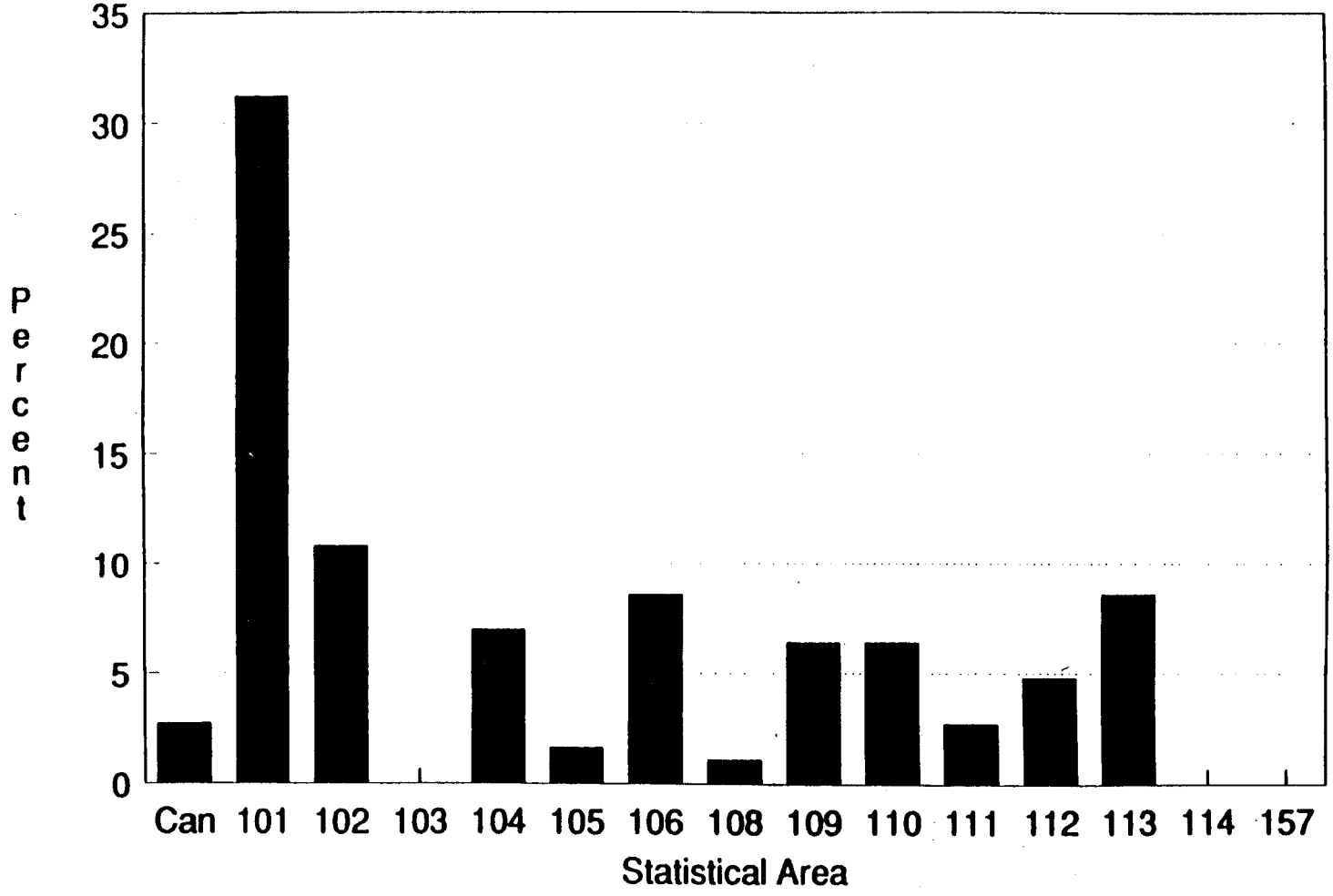

Figure 6. Distribution of the harvest of wild Chickamin River chinook salmon (percent of harvest by statistical area).

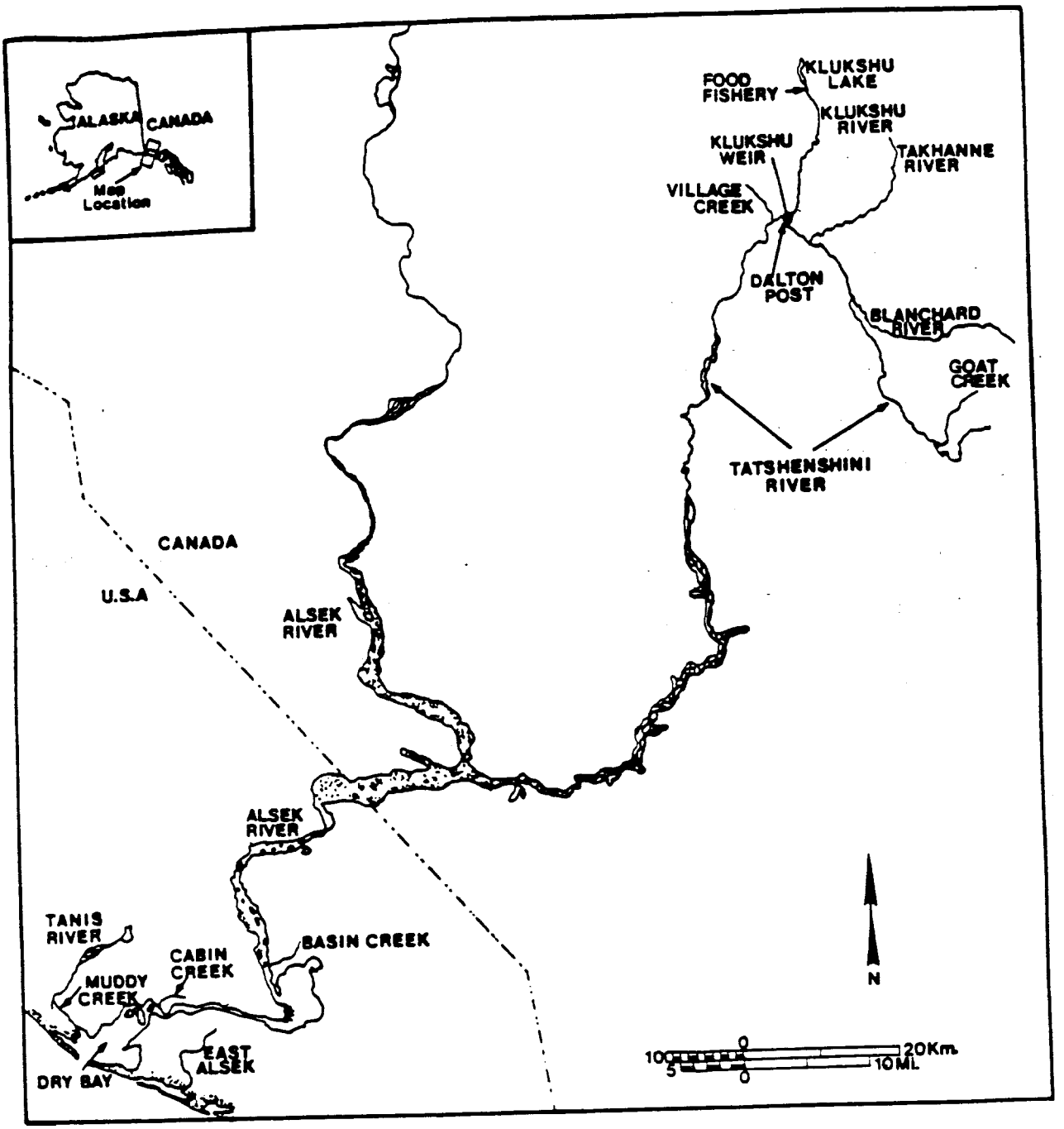

Figure 7. Alsek River drainage.

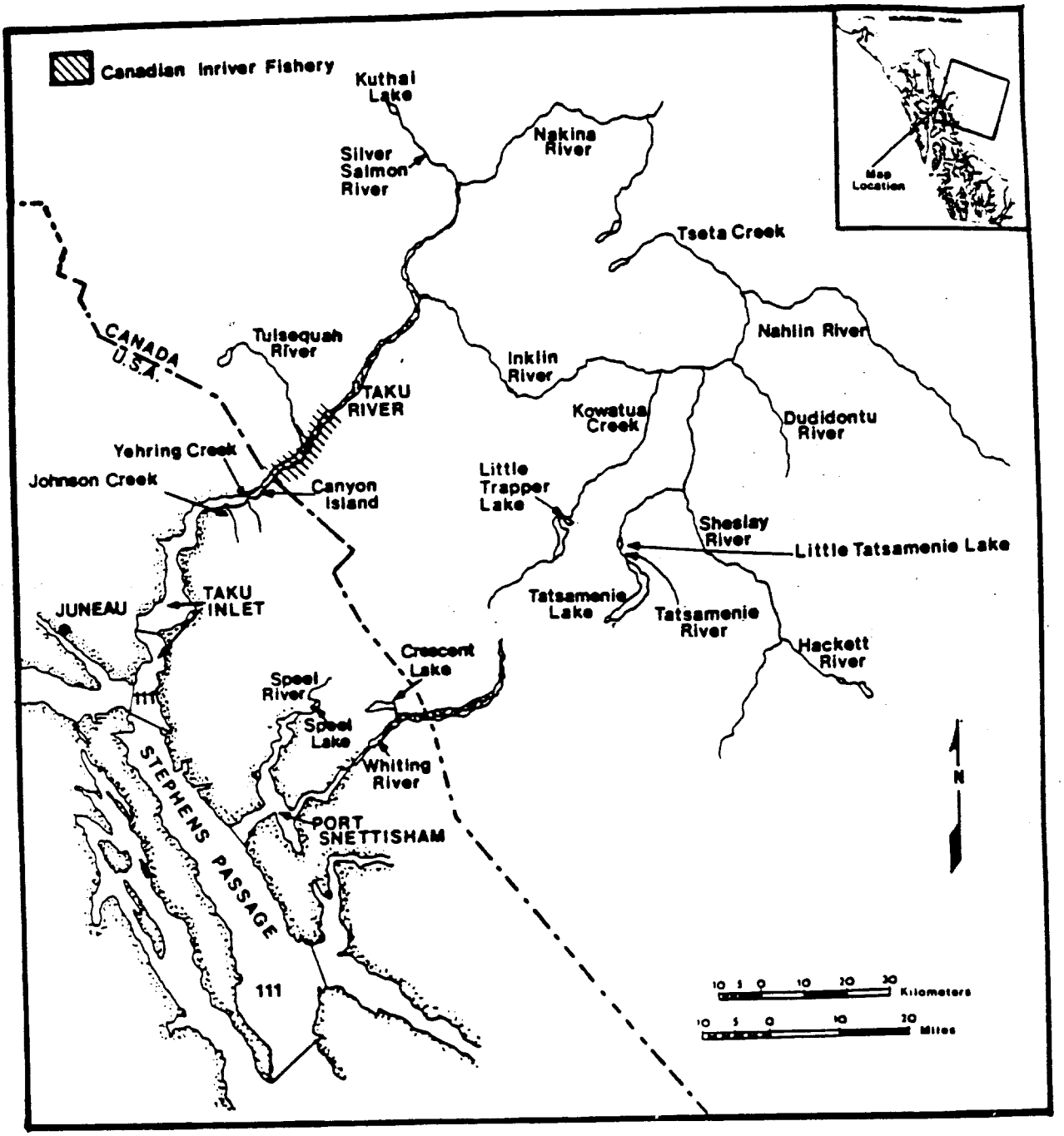

Figure 8. Taku River drainage, showing locations of District 111 gill net and Canadian inriver fisheries.

Appendix A1. Summary of coded-wire tag releases of juvenile chinook salmon from the Unuk River, 1983-1988.

Tag Code	Young of the year Released	Smolts Released	Brood Year	Mean Length (mm)	Capture Location and Date	Percent Tag Retention
042057	9,272		1982	63.8	Mainstem Unuk, Oct. 1983	97.6
042058	9,502		1982	63.8	Mainstem Unuk, Nov. 1983	97.6
042061	1,757		1982	63.8	Mainstem Unuk, Nov. 1983	97.6
042149		681	1982	67.4	Mainstem Unuk, April, 1984	94.9
042158		8,231	1982	67.4	Mainstem Unuk, March-April, 1984	94.9
042151		1,897	1983	69.0	Mainstem Unuk, March, 1985	95.6
042154		2,051	1983	69.0	Mainstem Unuk, March-April, 1985	95.6
042520		3,525	1983	69.0	Mainstem Unuk, April-May, 1985	95.6
042529		5,932	1984	66.0	Mainstem Unuk, April 1986	100.0
042719		8,675	1985	66.9	Mainstem Unuk, March-May, 1987	99.2
042933		10,083	1986	69.6	Mainstem Unuk, March-April, 1988	100.0
042940		1,400	1986	69.6	Mainstem Unuk, April 19-24, 1988	100.0
Total[a]	20,531	42,475				

[a] Total smolts and young-of-the-year released corrected for in-river tag loss.

Appendix A2. Summary of coded-wire tag releases of wild juvenile chinook salmon from the Chickamin River, 1983-1988.

Tag Code	Smolts Released	Brood Year	Mean Length (mm)	Capture Location Date	Percent Tag Retention
042055	2,352	1981	68.6	Chickamin River, March, April 1983	100.0
042062	5,474	1982	69.9	Chickamin River, March, April 1984	94.4
042157	1,687	1983	77.6	Chickamin River, March, April 1985	95.8
042524	2,426	1983	77.6	Chickamin River, April, May 1985	95.8
042548	4,435	1984	66.0	Chickamin River, March, April 1986	98.6
042711	5,402	1985	72.5	Chickamin River, March, April 1987	99.0
042938	8,521	1986	68.7	Chickamin River, March, April 1988	99.8
042939	204	1986	68.7	Chickamin River, April 1988	99.8
Total	30,501[a]				

[a] Total smolts released corrected for in-river tag loss.

Appendix A3. Recoveries of chinook salmon coded-wire tagged from the Unuk River, 1983-1988.

Tag Code	Brood Year	Age	Sex	Length	Length Type	Location QD	PMFC	Dist-Sub Area	Recovery Date	Recovery Type	Sample Type	expanded	Comments
042057	82	1.2	M	640	(FL)	NORTHERN B.C., CANADA			09/ /86	TROLL	R	4.00	
042057	82	1.1		395	(FL)	SE	SIN	101-11	07/01/85	GILLNET	S		
042057	82	1.1		405	(FL)	NE	SNTR	110-24	07/24/85	SEINE	R	0.74	
042057	82	1.1		530	(FL)	SE	SIN	101-	08/26/85	SEINE	R		
042057	82	1.2	M	550	(FL)	SE	SIN	101-90	05/22/86	TEST TROLL	R		Mature
042057	82	1.2		660	(FL)	SE	SIN	101-90	06/01/86	SPORT	R		
042057	82	1.2		616	(FL)	SE	SIN	101-29	06/04/86	SPORT	S		
042057	82	1.2		680	(FL)	SW	SOUT	104-40	07/10/86	TROLL	R	3.83	
042057	82	1.2		611	(FL)	SE	SIN	102-70	07/13/86	SPORT	S		
042057	82	1.2				SE	CIN	106-30	07/28/86	GILLNET	S		
042057	82	1.2	M	555	(MF)	SE	SIN	101-75	08/15/86	ESCAPEMENT	R		Cripple Cr.
042057	82	1.2	M	485	(MF)	SE	SIN	101-75	08/15/86	ESCAPEMENT	R		Cripple Cr.
042057	82	1.2	M	510	(MF)	SE	SIN	101-75	08/16/86	ESCAPEMENT	R		Cripple Cr.
042057	82	1.2	M	615	(MF)	SE	SIN	101-75	08/18/86	ESCAPEMENT	R		Cripple Cr.
042057	82	1.2	M	535	(MF)	SE	SIN	101-75	08/19/86	ESCAPEMENT	R		Cripple Cr.
042057	82	1.2		705	(FL)	NW	COUT	113-91	08/26/86	TROLL	R	2.94	
042057	82	1.2		730	(FL)	SE	CIN	106-10	08/27/86	TROLL	R	2.20	
042057	82	1.2		770	(FL)	NW			09/05/86	TROLL	R	3.56	
042057	82	1.2		755	(FL)	NW	CNTR	114-70	09/10/86	TROLL	R	3.56	
042057	82	1.2		775	(FL)	NE	SNTR	109-10	10/07/86	TROLL	R	2.32	
042057	82	1.2		700	(FL)	SE	SIN	102-	03/13/87	TROLL	R	3.80	
042057	82	1.3		717	(FL)	SE	SNTR	105-10	04/06/87	TROLL	R	3.80	
042057	82	1.3		768	(MF)	NW	CNTR	114-21	04/13/87	TROLL	S		
042057	82	1.3		907	(FL)	SE	SIN	102-80	06/17/87	TROLL	R	1.33	
042057	82	1.3		795	(FL)				07/03/87	TROLL	R		
042057	82	1.3							07/08/87	TROLL	S		
042057	82	1.3	F	760	(MF)	SE	SIN	101-75	08/16/87	ESCAPEMENT	R		Cripple Cr.
042057	82	1.3	F	775	(MF)	SE	SIN	101-75	08/22/87	ESCAPEMENT	R		Cripple Cr.
042057	82	1.3	M	790	(MF)	SE	SIN	101-75	08/26/87	ESCAPEMENT	R		Eulachon R.
042058	82	1.2		605	(FL)	NORTHERN B.C., CANADA			07/ /86	GILLNET	R	5.00	
042058	82	1.1		420	(FL)	SE	SIN	101-	08/02/85	SEINE	R	1.77	
042058	82	1.1		485	(FL)	SE	SIN	102-10	08/09/85	SEINE	R	1.51	
042058	82	1.2	M	735	(FL)	SE	SIN	102-10	05/15/86	TEST TROLL	R		Mature
042058	82	1.2	M	655	(FL)	SE	SIN	101-90	05/15/86	TEST TROLL	R		Immature
042058	82	1.2		740	(FL)	SE	SIN	102-50	06/01/86	SPORT	R		
042058	82	1.2		792	(FL)	SE	CIN	106-44	06/09/86	TROLL	R	1.13	
042058	82	1.2				SE	SIN	102-50	06/14/86	SPORT	S		
042058	82	1.2		660	(FL)	SE	SIN	101-45	06/16/86	SPORT	S		
042058	82	1.2		722	(FL)	SW	SOUT	103-90	06/26/86	TROLL	R	3.83	
042058	82	1.2						-	07/10/86	TROLL	S		
042058	82	1.2		695	(FL)	SE	SIN	101-25	07/14/86	TROLL	R	3.07	
042058	82	1.2		650	(FL)	SE	SIN	101-11	07/17/86	GILLNET	R	1.91	
042058	82	1.2		720	(FL)	NE	STEP	111-50	08/03/86	SPORT	R		
042058	82	1.2	M	495	(MF)	SE	SIN	101-75	08/11/86	ESCAPEMENT	R		Cripple Cr.
042058	82	1.2	M	475	(MF)	SE	SIN	101-75	08/11/86	ESCAPEMENT	R		Cripple Cr.
042058	82	1.2	M	580	(MF)	SE	SIN	101-75	08/18/86	ESCAPEMENT	R		Cripple Cr.
042058	82	1.2	M	525	(MF)	SE	SIN	101-75	08/18/86	ESCAPEMENT	R		Cripple Cr.
042058	82	1.2	M	570	(MF)	SE	SIN	101-75	08/18/86	ESCAPEMENT	R		Cripple Cr.
042058	82	1.2				SE	SIN	101-29	08/19/86	SPORT	S		
042058	82	1.2		685	(FL)	NW	CNTR	114-27	08/22/86	TROLL	R	2.94	
042058	82	1.2		690	(FL)	SE	CIN	106-10	08/27/86	TROLL	R	2.20	
042058	82	1.2	M	600	(MF)	SE	SIN	101-75	08/30/86	ESCAPEMENT	R		Genes Lake
042058	82	1.2		710	(FL)	NE	SNTR	110-	11/17/86	TROLL	R	2.32	
042058	82	1.3		915	(FL)	SE	SIN	102-50	05/23/87	SPORT	R		
042058	82	1.3		705	(FL)	NE	SNTR	109-10	06/17/87	TROLL	R	1.42	
042058	82	1.3		862	(FL)	NE	SNTR	109-	07/05/87	TROLL	R	2.42	
042058	82	1.3		775	(FL)	SE	SNTR	105-	07/09/87	TROLL	R	2.83	
042058	82	1.3		850	(FL)				07/10/87	TROLL	R		
042058	82	1.3	M	740	(MF)	SE	SIN	101-75	08/23/87	ESCAPEMENT	R		Cripple Cr
042058	82	1.3		798	(FL)	NE	SNTR	110-	10/18/87	TROLL	R	2.05	
042060	82	1.3	M	680	(FL)	SE	SIN	101-	06/05/86	TEST TROLL	R		
042061	82	1.1	M	480	(FL)	SE	CIN	108-30	10/04/85	TEST TROLL	S		NE Zarembo
042061	82	1.2	M	645	(MF)	SE	SIN	101-75	08/28/86	ESCAPEMENT	R		Clear Cr
042061	82	1.3		730	(FL)	NE	SNTR	109-	06/26/87	TROLL	R	2.42	
042061	82	1.3	M	670	(MF)	SE	SIN	101-75	08/19/87	ESCAPEMENT	R		Cripple Cr
042149	82	1.2		645	(FL)	SE	SIN	101-11	06/20/86	GILLNET	R	1.71	
042149	82	1.3		770	(FL)				10/21/87	TROLL	S		
042151	83	1.1	M	380	(MF)	SE	SIN	101-75	08/10/86	ESCAPEMENT	R		Cripple Cr
042151	83	1.2	M	570	(MF)	SE	SIN	101-75	08/18/87	ESCAPEMENT	R		Cripple Cr
042151	83	1.2		685	(FL)	NW	COUT	113-41	10/12/87	TROLL	R	2.44	
042154	83								/86	SPORT	S		
042154	83	1.1	M	345	(MF)	SE	SIN	101-75	08/15/86	ESCAPEMENT	R		Cripple Cr
042154	83	1.1	M	340	(MF)	SE	SIN	101-75	08/19/86	ESCAPEMENT	R		Cripple Cr
042154	83	1.2		682	(FL)	NE	CNTR	112-	07/02/87	TROLL	R	2.42	
042154	83	1.2	M	450	(MF)	SE	SIN	101-75	08/15/87	ESCAPEMENT	R		Cripple Cr
042154	83	1.2	M	590	(MF)	SE	SIN	101-75	08/19/87	ESCAPEMENT	R		Cripple Cr
042154	83	1.2				NW	CNTR	114-	10/12/87	TROLL	S		
042158	82	1.1	F	560	(FL)	NW	COUT	113-91	09/26/85	TEST TROLL	S		Lisianski Inlet
042158	82	1.1		305	(FL)	SE	SIN	101-45	06/16/85	SPORT	S		
042158	82	1.1		406	(FL)	NW	COUT	113-41	07/23/85	SPORT	S		

- Continued -

Tag Code	Brood Year	Age	Sex	Length	Length Type	Location QD	PMFC	Dist-Sub Area	Recovery Date	Recovery Type	Sample Type	expanded	Comments
042158	82	1.1		387	(FL)	NE	SNTR	110-	07/23/85	SEINE	R	0.74	
042158	82	1.1		400	(FL)	NW			07/30/85	TROLL	S		
042158	82	1.1	M	435	(MF)	SE	SIN	101-75	09/03/85	ESCAPEMENT	R		Genes Lake
042158	82	1.1				SE	SIN	101-90	09/05/85	SPORT	S		
042158	82	1.1		479	(FL)	NW	CNTR	114-21	09/16/85	TROLL	S		
042158	82	1.2	M	605	(FL)	SE	SIN	102-50	05/22/86	TEST TROLL	R		Immature(W)
042158	82	1.2	M	540	(FL)	SE	SIN	102-80	05/22/86	TEST TROLL	R		Immature(R)
042158	82	1.2		705	(FL)	SE	SIN	102-50	05/31/86	SPORT	S		
042158	82	1.2		880	(FL)	SE	SIN	102-30	06/01/86	SPORT	R		
042158	82	1.2				SE	SIN	101-85	06/01/86	SPORT	S		
042158	82	1.2		749	(FL)	SE	SIN	101-	06/04/86	SPORT	S		
042158	82	1.2		555	(FL)	SE	SIN	102-80	06/18/86	TEST TROLL	R		
042158	82	1.2		700	(FL)	SW	SOUT		07/12/86	TROLL	R	3.83	
042158	82	1.2		508	(FL)	SE	SIN	102-70	07/19/86	SPORT	S		
042158	82	1.2	M	555	(MF)	SE	SIN	101-75	08/16/86	ESCAPEMENT	R		Cripple Cr
042158	82	1.2	M	625	(MF)	SE	SIN	101-75	08/19/86	ESCAPEMENT	R		Cripple Cr
042158	82	1.2	M	500	(MF)	SE	SIN	101-75	08/19/86	ESCAPEMENT	R		Cripple Cr
042158	82	1.2	M	500	(MF)	SE	SIN	101-75	08/19/86	ESCAPEMENT	R		Cripple Cr
042158	82	1.2		710	(FL)	SE	CIN	106-30	08/20/86	GILLNET	R	1.91	
042158	82	1.2	M	570	(MF)	SE	SIN	101-75	08/26/86	ESCAPEMENT	R		Genes Lake
042158	82	1.2		680	(FL)	NW	COUT	113-22	08/26/86	TROLL	R	2.94	
042158	82	1.2		685	(FL)	SE	CIN	106-10	08/27/86	TROLL	R	2.20	
042158	82	1.2		700	(FL)	NW	COUT	113-	08/27/86	TROLL	R	2.94	
042158	82	1.2		685	(FL)	NW	NOUT	157-	09/03/86	TROLL	R	3.56	
042158	82	1.2		677	(FL)	SE	SIN	102-80	09/10/86	TROLL	R	2.26	
042158	82	1.3		764	(FL)	SE	CIN	106-44	04/13/87	TROLL	R	3.80	
042158	82	1.3		736	(FL)	SE	SIN	101-90	05/09/87	SPORT	S		
042158	82	1.3				NE	SNTR	109-10	06/11/87	TROLL	R	1.42	
042158	82	1.3		805	(FL)	NE	SNTR	109-10	06/16/87	TROLL	R	1.42	
042158	82	1.3		900	(FL)	SE	SIN	101-80	06/24/87	SPORT	R		
042158	82	1.3							07/02/87	TROLL	S		
042158	82	1.3		772	(FL)	NE	SNTR	109-	07/05/87	TROLL	R	2.42	
042158	82	1.3		720	(FL)	SE	CIN	106-	07/06/87	TROLL	R	2.83	
042158	82	1.3		790	(FL)	SE	SIN	101-90	07/19/87	SPORT	S		
042158	82	1.3		800	(FL)	NE	STEP	111-50	08/05/87	SPORT	S		
042158	82	1.3	F	815	(MF)	SE	SIN	101-75	08/22/87	ESCAPEMENT	R		Cripple Cr
042158	82	1.3	F	780	(MF)	SE	SIN	101-75	09/05/87	ESCAPEMENT	R		Genes Lake
042520	83	1.1		393	(FL)	NORTHERN B.C., CANADA			07/ /86	GILLNET	R	4.00	
042520	83	1.1	M	350	(MF)	SE	SIN	101-75	08/18/86	ESCAPEMENT	R		Cripple Cr
042520	83	1.1	M	320	(MF)	SE	SIN	101-75	08/19/86	ESCAPEMENT	R		Cripple Cr
042520	83	1.2				SE	SIN	101-80	06/13/87	SPORT	R		
042520	83	1.2		700	(FL)	NE	SNTR	109-	06/25/87	TROLL	R	2.42	
042520	83	1.2		640	(FL)	SE	SIN	101-28	07/07/87	GILLNET	R	1.59	
042520	83	1.2		675	(FL)	SW	SOUT		07/13/87	TROLL	S		
042520	83	1.2	M	520	(MF)	SE	SIN	101-75	08/17/87	ESCAPEMENT	R		Cripple Cr
042520	83	1.2	M	515	(MF)	SE	SIN	101-75	08/17/87	ESCAPEMENT	R		Cripple Cr
042529	84	1.1				NORTHERN B.C., CANADA			/ /87	GILLNET	R	4.00	
042529	84	1.1	M	303	(FL)	SE	SIN	101-30	02/12/87	TEST TROLL	S		
042529	84	1.1		368	(FL)	SE	SIN	102-70	07/12/87	SPORT	S		
042529	84	1.1	M	370	(MF)	SE	SIN	101-75	08/15/87	ESCAPEMENT	R		Cripple Cr
042529	84	1.1	M	600	(MF)	SE	SIN	101-75	08/19/87	ESCAPEMENT	R		Cripple Cr
042529	84	1.1	M	335	(MF)	SE	SIN	101-75	08/21/87	ESCAPEMENT	R		Genes Lake
042057	82	1.4		965	(FL)	SE	SIN	102-	03/31/88	TROLL	R	2.24	
042057	82	1.4		965	(FL)	SE	SIN	101-80	06/23/88	SPORT	S		
042057	82	1.4	F	865	(MF)	SE	SIN	101-75	08/10/88	ESCAPEMENT	R		Cripple CR
042057	82	1.4	F	880	(MF)	SE	SIN	101-75	08/16/88	ESCAPEMENT	R		Cripple CR
042058	82	1.4		775	(FL)	SE	SIN	101-80	06/12/88	SPORT	S		
042058	82	1.4				SE	SIN	101-80	06/22/88	SPORT	S		
042058	82	1.4							07/16/88	TROLL	S		
042058	82	1.4	F	965	(MF)	SE	SIN	101-75	08/10/88	ESCAPEMENT	R		Cripple CR
042058	82	1.4	F	960	(MF)	SE	SIN	101-75	08/10/88	ESCAPEMENT	R		Cripple CR
042058	82	1.4	F	905	(MF)	SE	SIN	101-75	08/11/88	ESCAPEMENT	R		Cripple CR
042058	82	1.4	M	945	(MF)	SE	SIN	101-75	08/11/88	ESCAPEMENT	R		Cripple CR
042058	82	1.4	M	755	(MF)	SE	SIN	101-75	08/11/88	ESCAPEMENT	R		Cripple CR
042058	82	1.4	F	875	(MF)	SE	SIN	101-75	08/12/88	ESCAPEMENT	R		Cripple CR
042058	82	1.4	F	995	(MF)	SE	SIN	101-75	08/12/88	ESCAPEMENT	R		Cripple CR
042058	82	1.4	F	900	(MF)	SE	SIN	101-75	08/12/88	ESCAPEMENT	R		Cripple CR
042058	82	1.4	F	980	(MF)	SE	SIN	101-75	08/14/88	ESCAPEMENT	R		Cripple CR
042058	82	1.4	M	910	(MF)	SE	SIN	101-75	08/16/88	ESCAPEMENT	R		Cripple CR
042058	82	1.4	F	1030	(MF)	SE	SIN	101-75	08/16/88	ESCAPEMENT	R		Cripple CR
042061	82	1.4				SE	SIN	101-45	05/27/88	SPORT	S		
042061	82	1.4		1061	(FL)	SE	SIN	101-95	06/25/88	COST RECOV	R	2.96	Neets Bay
042061	82	1.4	F	820	(MF)	SE	SIN	101-75	08/10/88	ESCAPEMENT	R		Cripple CR
042061	82	1.4	F	960	(MF)	SE	SIN	101-75	08/12/88	ESCAPEMENT	R		Cripple CR
042061	82	1.4	F	830	(MF)	SE	SIN	101-75	08/16/88	ESCAPEMENT	R		Cripple CR
042149	82	1.4		965	(FL)	SE	SIN		06/12/88	SPORT	R	1.05	
042149	82	1.4		1000	(FL)	SE	SIN	101-21	06/14/88	SPORT	S		
042149	82	1.4	F	960	(MF)	SE	SIN	101-75	08/14/88	ESCAPEMENT	R		Cripple CR
042149	82	1.4	F	990	(MF)	SE	SIN	101-75	08/24/88	ESCAPEMENT	R		Clear Cr.
042151	83	1.3		910	(FL)	SE	SIN	101-26	06/13/88	TROLL	R	1.60	
042151	83	1.3		990	(FL)	SW	SOUT	104-	07/14/88	TROLL	R	2.84	
042151	83	1.3	F	880	(MF)	SE	SIN	101-75	08/14/88	ESCAPEMENT	R		Cripple CR

- Continued -

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Tag Code	Brood Year	Age	Sex	Length	Length Type	QD	Location PMFC	Dist-Sub Area	Recovery Date	Recovery Type	Sample Type	expanded	Comments
042151	83	1.3	F	830	(MF)	SE	SIN	101-75	08/16/88	ESCAPEMENT	R		Cripple CR
042154	83	1.3		805	(FL)	NE	SNTR	109-10	06/21/88	TROLL	R	1.20	
042154	83	1.3		865	(FL)	NE	CNTR	112-	07/03/88	TROLL	R	1.70	
042154	83	1.3		812	(FL)	NE	SNTR	110-14	10/07/88	TROLL	R	1.96	
042154	83	1.3		840	(FL)	NE	SNTR	110-	10/31/88	TROLL	R	1.96	
042158	82	1.4		1009	(FL)	SE	SIN	102-80	06/15/88	TROLL	R	1.62	
042158	82	1.4				SE	SIN	101-85	06/20/88	SPORT	S		
042158	82	1.4	M	1095	(MF)	SE	SIN	101-75	08/10/88	ESCAPEMENT	R		Cripple CR
042158	82	1.4	F	970	(MF)	SE	SIN	101-75	08/12/88	ESCAPEMENT	R		Cripple CR
042158	82	1.4	F	900	(MF)	SE	SIN	101-75	08/12/88	ESCAPEMENT	R		Cripple CR
042158	82	1.4	F	840	(MF)	SE	SIN	101-75	08/14/88	ESCAPEMENT	R		Cripple CR
042158	82	1.4	F	895	(MF)	SE	SIN	101-75	08/14/88	ESCAPEMENT	R		Cripple CR
042158	82	1.4	M	1015	(MF)	SE	SIN	101-75	08/16/88	ESCAPEMENT	R		Cripple CR
042158	82	1.4	M	955	(MF)	SE	SIN	101-75	08/27/88	ESCAPEMENT	R		Eulachon R.
042158	82	1.4		910	(FL)	NE	SNTR	109-10	10/28/88	TROLL	R	1.98	
042520	83	1.3		750	(FL)	SE	SIN	102-60	07/05/88	TROLL	R	1.66	
042520	83	1.3		750	(FL)	SE			07/07/88	TROLL	R	1.66	
042520	83	1.3		870	(FL)	NW	NOUT	157-	07/09/88	TROLL	R	2.86	
042520	83	1.3		817	(FL)	SW	SOUT	103-90	07/12/88	TROLL	R	2.84	
042520	83	1.3		740	(FL)	SE	SNTR	105-10	07/13/88	TROLL	R	1.66	
042520	83	1.3		840	(MF)	SE	SIN	101-75	08/16/88	ESCAPEMENT	R		Cripple CR
042520	83	1.3	M	825	(MF)	SE	SIN	101-75	08/18/88	ESCAPEMENT	R		Clear Cr.
042520	83	1.3	M	905	(FL)	NW	CNTR	114-70	11/02/88	TROLL	R	3.09	
042529	84	1.2		670	(FL)	SE	SIN	101-28	07/01/88	GILLNET	R	1.54	
042529	84	1.2							07/09/88	TROLL	S		Landed Hoonah
042529	84	1.2	M	585	(MF)	SE	SIN	101-75	08/11/88	ESCAPEMENT	R		Cripple CR
042529	84	1.2	M	630	(MF)	SE	SIN	101-75	08/12/88	ESCAPEMENT	R		Cripple CR
042529	84	1.2	M	610	(MF)	SE	SIN	101-75	08/14/88	ESCAPEMENT	R		Cripple CR
042529	84	1.2	M	510	(MF)	SE	SIN	101-75	08/14/88	ESCAPEMENT	R		Cripple CR
042149	82	1.5				SE	SIN	101-46	06/19/89	TROLL	S		
042151	83	1.4	F	975	(MF)	SE	SIN	101-75	08/12/89	ESCAPEMENT	R		Cripple CR
042154	83	1.4	F	855	(MF)	SE	SIN	101-75	08/15/89	ESCAPEMENT	R		Cripple Cr
042520	83	1.4		805	(MF)	NW	CNTR	114-27	06/07/89	TROLL	R	1.88	
042520	83	1.4		1010	(MF)	SE	SIN	101-24	06/16/89	TROLL	R	4.26	
042529	84	1.3		776	(MF)	SE	CIN	107-30	06/08/89	TROLL	R	2.03	
042529	84	1.3		905	(MF)	NW	NOUT		07/13/89	TROLL	R	3.27	
042529	84	1.3		850	(MF)	SE	SIN	101-75	08/19/89	ESCAPEMENT	R		Cripple Cr
042529	84	1.3		685	(MF)	NE	SNTR	109-45	07/02/89	TROLL	S		
042529	84	1.3				NORTHERN B.C. CANADA			/89	TROLL	R	3.53	
042719	85	1.2		644	(MF)	SE	CIN	106-41	06/20/89	GILLNET	R	1.53	
042719	85	1.2		690	(MF)	NW	CNTR	114-25	07/14/89	TROLL	R	3.30	
042719	85	1.2		670	(MF)	NE	SNTR	109-30	10/06/89	TROLL	R	1.19	
042719	85	1.2		690	(MF)	NE	SNTR	110-17	11/13/89	TROLL	R	1.19	
042719	85	1.2		460	(MF)	SE	SIN	101-75	08/24/89	ESCAPEMENT	R		Cripple Cr
042719	85	1.2		550	(MF)	SE	SIN	101-75	08/24/89	ESCAPEMENT	R		Genes Lake
042933	86	1.1	M	390	(MF)	SE	SIN	101-75	08/18/89	ESCAPEMENT	R		Clear Creek
042933	86	1.1	M	320	(MF)	SE	SIN	101-75	08/18/89	ESCAPEMENT	R		Genes Lake
042933	86	1.1	M	440	(MF)	SE	SIN	101-75	08/19/89	ESCAPEMENT	R		Cripple Creek
042933	86	1.1	M	360	(MF)	SE	SIN	101-75	08/22/89	ESCAPEMENT	R		Genes Lake
042933	86	1.1	M	385	(MF)	SE	SIN	101-75	08/25/89	ESCAPEMENT	R		Genes Lake
042933	86	1.1	M	415	(MF)	SE	SIN	101-75	08/26/89	ESCAPEMENT	R		Clear Creek
042940	86	1.1	M	425	(MF)	SE	SIN	101-75	08/17/89	ESCAPEMENT	R		Cripple Creek
042933	86	1.1				NORTH WET CANADA			/89	NET	R	2.98	

Appendix A4. Recoveries of chinook salmon coded-wire tagged from the Chickamin River, 1983-1988.

Tag Code	Brood Year	Age	Sex	Length	Length Type	Location QD	PMFC	Dist-Sub Area	Recovery Date	Recovery Type	Sample Type	expanded	Comments
042055	81	1.2		693		Central B.C. Canada			08/ /85	GILLNET	R	2.00	
042055	81	1.2		610	(FL)	SE	SIN	101-	07/05/85	TRAP	R	1.70	
042055	81	1.2		155	(HL)	SE	SIN	101-95	07/06/85	COST RECOV	R		
042055	81	1.2		633	(FL)	SE	SIN	102-10	07/08/85	TROLL	R	2.15	
042055	81	1.2							07/08/85	TROLL	R		
042055	81	1.2		672	(FL)	NE	CNTR	112-	07/12/85	TROLL	R	2.39	
042055	81	1.2		670	(FL)				07/15/85	TROLL	R		
042055	81	1.2		655	(FL)	NW	COUT	113-	07/16/85	TROLL	R	5.29	
042055	81	1.2		615	(FL)	NE	STEP	111-32	07/16/85	GILLNET	R	5.07	
042055	81	1.2				SE	SIN	101-90	07/21/85	SPORT	S		
042055	81	1.2		610	(FL)				07/24/85	SEINE	R		
042055	81	1.2		595	(FL)	SE	SIN	101-71	08/10/85	ESCAPEMENT	R		South Fork
042055	81	1.2		723	(FL)	NE	SNTR	110-	10/04/85	TROLL	R	3.29	
042055	81	1.2		690	(FL)	NE	SNTR	110-	10/04/85	TROLL	R	3.29	
042055	81	1.2		720	(FL)	SE			10/07/85	TROLL	S		
042055	81	1.2		740	(FL)	SE	SIN	102-	10/15/85	TROLL	R	3.09	
042055	81	1.3		780	(FL)	NE	CNTR	112-	07/03/86	TROLL	R	1.80	
042055	81	1.3		740	(FL)	SE	SIN	101-	07/11/86	TROLL	R	3.07	
042055	81	1.3		730	(FL)	NE			07/12/86	TROLL	R	1.80	
042055	81	1.3				SE	SIN	101-45	07/15/86	SPORT	S		
042055	81	1.3		755	(FL)	SE	CIN	106-10	07/16/86	TROLL	R	3.07	
042055	81	1.3		870	(FL)	NW	COUT	113-	07/16/86	TROLL	R	5.16	
042055	81	1.3		825	(FL)	NE	SNTR	109-	08/25/86	TROLL	R	3.22	
042055	81	1.3		768	(FL)	SE	CIN	106-	09/10/86	TROLL	R	2.26	
042055	81	1.3				NW	COUT	113-41	10/06/86	TROLL	S		
042055	81	1.4		907	(FL)	NE	SNTR	110-	04/15/87	TROLL	R	1.77	
042062	82	1.2				SE	SIN	101-45	/86	SPORT	S		
042062	82	1.2		696		Northern B.C. Canada			07/ /86	TROLL	R	3.00	
042062	82	1.1		406	(FL)	SE	SIN	101-90	05/31/85	SPORT	S		
042062	82	1.1		427	(FL)	SE	SIN	101-25	07/18/85	TROLL	S		
042062	82	1.2	M	670	(FL)	SE	SIN	101-90	05/15/86	TEST TROLL	R		Mature, Red
042062	82	1.2	F	635	(FL)	SE	SIN	101-90	05/30/86	TEST TROLL	R		Immature, Red
042062	82	1.2		584	(FL)	SE	SIN	102-50	05/31/86	SPORT	S		
042062	82	1.2	F	600	(FL)	SE	SIN	101-41	06/06/86	TEST TROLL	R		Immat.,White
042062	82	1.2		680	(FL)	SE	SIN	101-46	06/07/86	SPORT	R		
042062	82	1.2		675	(FL)	SE	SIN	101-90	06/07/86	SPORT	R		
042062	82	1.2	F	585	(FL)	SE	SNTR	105-50	06/13/86	TEST TROLL	R		Immature, Red
042062	82	1.2	M	665	(FL)	SE	SIN	101-90	06/13/86	TEST TROLL	R		Immature, Red
042062	82	1.2	F	615	(FL)	SE	SIN	101-41	06/14/86	TEST TROLL	R		Immature, Red
042062	82	1.2	F	600	(FL)	SE	SIN	102-50	06/18/86	TEST TROLL	R		Immature, Red
042062	82	1.2		770	(FL)	SE	SIN	101-11	07/17/86	GILLNET	R	1.91	
042062	82	1.2		685	(FL)	SE	SIN	101-41	08/23/86	TROLL	R	2.20	
042062	82	1.2		710	(FL)	SE	SIN	102-60	08/25/86	TROLL	S		
042062	82	1.2		728	(FL)			-	08/25/86	TROLL	R		
042062	82	1.2		708	(FL)	NE	CNTR	112-	08/26/86	TROLL	R	3.22	
042062	82	1.2		635	(FL)	SE	CIN	106-	09/10/86	GILLNET	R	1.66	
042062	82	1.2		730	(FL)	SE	SIN	102-10	09/10/86	TROLL	R	2.26	
042062	82	1.2		724	(FL)	SE	CIN	106-41	09/10/86	TROLL	R	2.26	
042062	82	1.2							10/05/86	TROLL	S		
042062	82	1.2		800	(FL)	SE	SIN	101-45	10/11/86	TROLL	R	3.79	
042062	82	1.2		720	(FL)	NE	SNTR	110-	11/17/86	TROLL	R	2.32	
042062	82	1.3		865	(FL)	SE	SIN	101-90	05/23/87	SPORT	S		
042062	82	1.3		680	(FL)	NE	SNTR	109-10	06/15/87	TROLL	R	1.42	
042062	82	1.3		940	(FL)	SE	SIN	101-80	06/24/87	SPORT	R		
042062	82	1.3		960	(FL)	SW	SOUT	104-	06/24/87	TROLL	R	3.58	
042062	82	1.3		890	(FL)	SW	SOUT	104-	06/26/87	TROLL	R	3.58	
042062	82	1.3							07/01/87	TROLL	S		
042062	82	1.3		840	(FL)	SE	SNTR	105-	07/08/87	TROLL	R	2.83	
042062	82	1.3		1000	(FL)	SE	SIN	101-28	07/08/87	GILLNET	R	1.59	
042062	82	1.3		710	(FL)	SE	SIN	101-45	07/09/87	SPORT	S		
042062	82	1.3		787	(FL)	SE	SIN	102-50	08/04/87	SPORT	S		
042062	82	1.3	F	820	(MF)	SE	SIN	101-71	08/15/87	ESCAPEMENT	R		South Fork
042062	82	1.3	F	905	(MF)	SE	SIN	101-71	08/15/87	ESCAPEMENT	R		South Fork
042062	82	1.3	M	805	(MF)	SE	SIN	101-71	08/28/87	ESCAPEMENT	R		South Fork
042062	82	1.3	F	825	(MF)	SE	SIN	101-71	09/13/87	ESCAPEMENT	R		Humpy Creek
042062	82	1.3		785	(FL)				10/12/87	TROLL	R		
042063	81	1.2		468	(FL)	SE	SIN	101-	08/01/85	GILLNET	R		
042063	81	1.3		700	(FL)	SW	SOUT		06/26/86	TROLL	R	3.83	
042157	83	1.2				SE	SIN	101-45	09/09/87	SPORT	S		
042524	83	1.1	M	415	(FL)	SE	SIN	101-	06/06/86	TEST TROLL	R		Immature, Red
042524	83	1.1		420	(FL)	SE	SIN	101-	08/01/86	SEINE	S		
042524	83	1.1		415	(FL)	SE	SIN	101-44	09/22/86	SEINE	S		
042524	83	1.2		686	(FL)	SE	SIN	101-90	05/22/87	SPORT	S		
042524	83	1.2		741	(FL)	NE	SNTR	109-	07/02/87	TROLL	R	2.42	

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Tag Code	Brood Year	Age	Sex	Length	Length Type	QD	Location PMFC	Dist-Sub Area	Recovery Date	Recovery Type	Sample Type	expanded	Comments
042524	83	1.2		680	(FL)	SE	SIN	101-	07/13/87	TROLL	R	2.83	
042524	83	1.2		680	(FL)	SE	SIN	102-	07/13/87	TROLL	R	2.83	
042524	83	1.2	M	515	(MF)	SE	SIN	101-71	08/18/87	ESCAPEMENT	R		South Fork
042524	83	1.2	M	525	(MF)	SE	SIN	101-71	08/28/87	ESCAPEMENT	R		South Fork
042524	83	1.2	M	540	(MF)	SE	SIN	101-71	08/28/87	ESCAPEMENT	R		South Fork
042524	83	1.2				SE	SIN	101-45	09/09/87	SPORT	S		
042524	83	1.2		770	(FL)	SE	SIN	101-41	10/20/87	TROLL	R	1.95	
042524	83	1.2		700	(FL)	NW	COUT	113-	10/30/87	TROLL	R	2.44	
042524	83	1.2		748	(FL)	SE	CIN	108-	11/16/87	TROLL	R	1.95	
042547	84	1.0		280	(FL)	SE	SIN	101-46	09/29/86	TEST TROLL	S		NMFS
042548	84	1.0		240	(FL)	SE	SIN	101-53	09/27/86	TEST TROLL	S		NMFS
042548	84	1.1		496	(FL)				06/13/87	SPORT	S		
042548	84	1.1	M	380	(MF)	SE	SIN	101-71	08/28/87	ESCAPEMENT	R		South Fork
042548	84	1.1		305	(FL)	SE	SIN	101-53	02/14/87	TEST TROLL	S		NMFS
042548	84	1.1		305	(FL)	SE	SIN	101-53	02/14/87	TEST TROLL	S		NMFS
042548	84	1.1		313	(FL)	SE	SIN	101-	02/22/87	TEST TROLL	S		NMFS
042548	84	1.1		305	(FL)	SE	SIN	101-53	02/14/87	TEST TROLL	S		NMFS
042062	82	1.4		940	(FL)	SE	SIN	102-	03/31/88	TROLL	R	2.32	
042062	82	1.4	F	991	(MF)	SE	SIN	101-71	08/18/88	ESCAPEMENT	R		Clear Falls
042062	82	1.4	F	880	(MF)	SE	SIN	101-71	08/19/88	ESCAPEMENT	R		South Fork
042157	83	1.3		920	(FL)	SE	SIN	101-26	06/07/88	TROLL	R	1.60	
042157	83	1.3		880	(FL)	NE	SNTR	109-10	06/29/88	TROLL	R	1.70	
042157	83	1.3		800	(FL)	SE	CIN	106-30	07/13/88	TROLL	R	1.66	
042157	83	1.3				SE	SIN			SPORT	S		
042524	83	1.3		820	(FL)	SE			04/07/88	TROLL	R	2.28	
042524	83	1.3		914	(FL)	NE	STEP	111-31	05/31/88	SPORT	S		
042524	83	1.3		755	(FL)	NE	SNTR	110-16	06/06/88	TROLL	R	1.20	
042524	83	1.3	F	753	(FL)	NE	SNTR	109-10	06/07/88	TROLL	R	1.20	immature
042524	83	1.3		740	(FL)	NE	SNTR	109-10	06/30/88	TROLL	R	1.70	
042524	83	1.3		730	(FL)	SE			07/07/88	TROLL	R	1.66	
042524	83	1.3		860	(FL)	SE	SIN	102-	07/07/88	TROLL	R	1.66	
042524	83	1.3		790	(FL)	SE	SIN	102-	07/13/88	TROLL	R	2.83	
042524	83	1.3		790	(FL)	SW	SOUT	104-	07/14/88	TROLL	R	2.71	
042524	83	1.3				SE	SIN	101-45	/88	SPORT	S		
042524	83	1.3				NE	SNTR	109-50	10/05/88	TROLL	S		
042548	84	1.2				SE	SIN		06/15/88	SPORT	S		
042548	84	1.2				SE	SIN	101-90	06/24/88	SPORT	R	12.00	
042548	84	1.2		738	(FL)	NE	CNTR	112-	07/03/88	TROLL	R	1.65	
042548	84	1.2		660	(FL)				07/04/88	TROLL	R	1.00	
042548	84	1.2		710	(FL)	SE	SIN	102-50	07/07/88	TROLL	R	1.61	
042548	84	1.2		680	(FL)	SE	SIN	102-	07/07/88	TROLL	R	1.61	
042548	84	1.2		730	(FL)	SE	CIN	106-	07/08/88	TROLL	R	1.61	
042548	84	1.2		730	(FL)	SW	SOUT	104-40	07/12/88	TROLL	R	2.75	
042548	84	1.2		705	(FL)	SE	SIN	102-60	07/13/88	TROLL	R	1.61	
042548	84	1.2		720	(FL)	SE	CIN	106-	07/13/88	TROLL	R	1.61	
042548	84	1.2		725	(FL)	NE	SNTR		10/09/88	TROLL	R	1.90	
042548	84	1.2		795	(FL)	NW	COUT	113-11	10/10/88	TROLL	R	3.00	
042548	84	1.2		740	(FL)	NE	SNTR		10/12/88	TROLL	R	1.90	
042548	84	1.2		695	(FL)	SE	CIN	106-10	10/13/88	TROLL	R	2.30	
042711	85	1.1		370	(FL)	SE	SIN	101-28	07/06/88	GILLNET	R	5.60	
042062	82	1.5		990	(FL)	NE	SNTR	109-62	06/23/89	TROLL	R	2.18	
042524	83	1.4		940	(FL)	SE	SNTR	105-	07/05/89	TROLL	R	2.47	
042524	83	1.4		915	(FL)	SE	SIN	101-71	08/23/89	ESCAPEMENT	R		Barrier Cr
042548	84	1.3		805	(FL)	NW	COUT	113-41	06/06/89	TROLL	R	1.82	
042548	84	1.3		694	(FL)	SE	CIN	106-41	06/08/89	TROLL	R	2.05	
042548	84	1.3		821	(FL)	NE	SNTR	109-62	06/24/89	TROLL	R	2.09	
042548	84	1.3		848	(FL)	NW	NOUT		07/02/89	TROLL	R	3.32	
042548	84	1.3		780	(FL)	SE	SIN	101-	07/07/89	TROLL	R	2.40	
042548	84	1.3		790	(FL)	SE	CIN	106-	07/07/89	TROLL	R	2.40	
042548	84	1.3		865	(FL)	NE			10/12/89	TROLL	R	1.21	
042548	84	1.3		830	(FL)	SE	SIN	101-71	08/22/89	ESCAPEMENT	R		
042548	84	1.3							06/09/89	TROLL	S		
042548	84	1.3							06/09/89	TROLL	S		
042548	84	1.3				NW	COUT	113-94	07/09/89	TROLL	S		
042548	84	1.3				SE			06/23/89	SPORT	S		
042548	84	1.3		827	(FL)	SE		107-40	10/30/89	TROLL	R	2.91	
041711	85	1.2		678	(FL)	NE	SNTR	109-	07/04/89	TROLL	R	2.02	
042711	85	1.2		731	(FL)	NE	SNTR	110-	10/09/89	TROLL	R	1.21	
042938	86	1.1		513	(FL)	SE	CIN	106-30	09/06/89	GILLNET	R	1.00	
042938	86	1.1		476	(FL)	SE	SIN	102-70	08/12/89	SEINE	R	4.69	
042938	86	1.1		425	(FL)	SE	SIN	101-71	08/28/89	ESCAPEMENT	R		
042938	86	1.1		475	(FL)	SE	SIN	101-	07/02/89	SEINE	S		
042938	86	1.1		440	(FL)	SE	SIN	101-23	07/22/89	SEINE	S		

Appendix A5. Age composition of chinook salmon in the Unuk River escapement by sex, age class, and tributary, 1989.

	Brood Year and Age Class					
	1986	1985	1984	1983	1982	
	1.1	1.2	1.3	1.4	1.5	Total
Eulachon Creek						
Statistical Week	33	(August 13 - 19)				
Male						
Sample Size				1		1
Percent				14.3		14.3
Std. Error				14.3		14.3
Female						
Sample Size				6		6
Percent				85.7		85.7
Std. Error				14.3		14.3
All Fish						
Sample Size				7		7
Percent				100.0		100.0
Std. Error						
Clear Creek						
Statistical Weeks	32 - 34	(August 6 - 26)				
Male						
Sample Size	19	12	9	2		42
Percent	30.6	19.4	14.5	3.2		67.7
Std. Error	5.9	5.1	4.5	2.3		6.0
Female						
Sample Size			2	18		20
Percent			3.2	29.0		32.3
Std. Error			2.3	5.8		6.0
All Fish						
Sample Size	19	12	11	20		62
Percent	30.6	19.4	17.7	32.3		100.0
Std. Error	5.9	5.1	4.9	6.0		
Gene's Lake						
Statistical Weeks	33 - 35	(August 13 - September 2)				
Male						
Sample Size	22	19	7			48
Percent	31.0	26.8	9.9			67.6
Std. Error	5.5	5.3	3.6			5.6
Female						
Sample Size			11	11	1	23
Percent			15.5	15.5	1.4	32.4
Std. Error			4.3	4.3	1.4	5.6
All Fish						
Sample Size	22	19	18	11	1	71
Percent	31.0	26.8	25.4	15.5	1.4	100.0
Std. Error	5.5	5.3	5.2	4.3	1.4	

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	Brood Year and Age Class					
	1986	1985	1984	1983	1982	
	1.1	1.2	1.3	1.4	1.5	Total
Lake Creek						
Statistical Week	32	(August 6 - 12)				
Male						
Sample Size			1	1		2
Percent			33.3	33.3		66.7
Std. Error			33.3	33.3		33.3
Female						
Sample Size				1		1
Percent				33.3		33.3
Std. Error				33.3		33.3
All Fish						
Sample Size			1	2		3
Percent			33.3	66.7		100.0
Std. Error			33.3	33.3		
Cripple Creek						
Statistical Weeks	32 - 34	(August 6 - 26)				
Male						
Sample Size	3	9	18	7		37
Percent	2.1	6.2	12.4	4.8		25.5
Std. Error	1.2	2.0	2.7	1.8		3.6
Female						
Sample Size			37	69	2	108
Percent			25.5	47.6	1.4	74.5
Std. Error			3.6	4.1	1.0	3.6
All Fish						
Sample Size	3	9	55	76	2	145
Percent	2.1	6.2	37.9	52.4	1.4	100.0
Std. Error	1.2	2.0	4.0	4.1	1.0	
Combined Tributaries						
Male						
Sample Size	44	40	35	11		130
Percent	12.7	10.5	14.0	11.1		48.4
Std. Error	1.6	1.5	6.8	7.3		7.5
Female						
Sample Size			50	105	3	158
Percent			8.8	42.2	0.6	51.6
Std. Error			1.2	7.4	0.3	7.5
All Fish						
Sample Size	44	40	85	116	3	288
Percent	12.7	10.5	22.9	53.4	0.6	100.0
Std. Error	1.6	1.5	6.9	6.9	0.3	

Appendix A6. Length composition of chinook salmon in the Unuk River tributary escapement by sex, age class, and tributary, 1989.

		Brood Year and Age Class					
		1986	1985	1984	1983	1982	
		1.1	1.2	1.3	1.4	1.5	Total
Eulachon Creek							
Statistical Week 33 (August 13 - 19)							
Male	Avg. Length				690		690
	Std. Error						
	Sample Size				1		1
Female	Avg. Length				947		947
	Std. Error				10.5		10.5
	Sample Size				6		6
All Fish	Avg. Length				910		910
	Std. Error				37.7		37.7
	Sample Size				7		7
Clear Creek							
Statistical Weeks 32 - 34 (August 6 - 26)							
Male	Avg. Length	416	624	771	895		574
	Std. Error	7.1	13.5	19.2	45.0		25.6
	Sample Size	19	12	9	2		42
Female	Avg. Length			878	930		925
	Std. Error			2.5	10.8		10.3
	Sample Size			2	18		20
All Fish	Avg. Length	416	624	790	926		687
	Std. Error	7.1	13.5	20.3	10.5		27.4
	Sample Size	19	12	11	20		62
Gene's Lake							
Statistical Weeks 33 - 35 (August 13 - September 2)							
Male	Avg. Length	407	604	771			538
	Std. Error	7.5	17.0	28.3			21.0
	Sample Size	22	19	7			48
Female	Avg. Length			825	940	1035	889
	Std. Error			12.0	14.8		16.3
	Sample Size			11	11	1	23
All Fish	Avg. Length	407	604	804	940	1035	652
	Std. Error	7.5	17.0	14.2	14.8		24.8
	Sample Size	22	19	18	11	1	71

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		Brood Year and Age Class					
		1986	1985	1984	1983	1982	
		1.1	1.2	1.3	1.4	1.5	Total
Lake Creek Statistical Week 32 (August 6 - 12)							
Male	Avg. Length			830	875		853
	Std. Error						22.5
	Sample Size			1	1		2
Female	Avg. Length				980		980
	Std. Error						
	Sample Size				1		1
All Fish	Avg. Length			830	928		895
	Std. Error				52.5		44.4
	Sample Size			1	2		3
Cripple Creek Statistical Weeks 32 - 34 (August 6 - 26)							
Male	Avg. Length	415	582	782	899		726
	Std. Error	30.1	26.8	13.5	31.5		26.0
	Sample Size	3	9	18	7		37
Female	Avg. Length			821	908	968	879
	Std. Error			6.4	5.0	42.5	5.7
	Sample Size			37	69	2	108
All Fish	Avg. Length	415	582	808	907	968	840
	Std. Error	30.1	26.8	6.6	5.3	42.5	9.6
	Sample Size	3	9	55	76	2	145
Combined Tributaries							
Male	Avg. Length	413	603	788	840		676
	Std. Error	5.1	10.9	10.0	27.7		15.3
	Sample Size	44	40	35	11		130
Female	Avg. Length			841	941	1001	924
	Std. Error			5.6	4.3	33.3	5.0
	Sample Size			50	105	3	158
All Fish	Avg. Length	413	603	808	922	1001	797
	Std. Error	5.1	10.9	5.8	4.8	33.3	11.1
	Sample Size	44	40	85	116	3	288

Appendix A7. Age composition of chinook salmon in the Chickamin River escapement by sex and age class, 1989.

1017104.age

	Brood Year and Age Class							
	1986	1985	1984	1983		1982		
	1.1	1.2	1.3	1.4	2.3	1.5	2.4	Total
Statistical Weeks	34 - 35		(August 20 - Sept. 2)					
Male								
Sample Size	8	13	34	17		3		75
Percent	4.1	6.6	17.3	8.7		1.5		38.3
Std. Error	1.4	1.8	2.7	2.0		0.9		3.5
Female								
Sample Size			32	80	1	7	1	121
Percent			16.3	40.8	0.5	3.6	0.5	61.7
Std. Error			2.6	3.5	0.5	1.3	0.5	3.5
All Fish								
Sample Size	8	13	66	98	1	10	1	197
Percent	4.1	6.6	33.5	49.7	0.5	5.1	0.5	100.0
Std. Error	1.4	1.8	3.4	3.6	0.5	1.6	0.5	

Appendix A8. Length composition of chinook salmon in the Chickamin River escapement by sex and age class, 1989.

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		Brood Year and Age Class							
		1986	1985	1984	1983		1982		
		1.1	1.2	1.3	1.4	2.3	1.5	2.4	Total
Statistical Weeks 34 - 35 (August 20 - Sept. 2)									
Male	Avg. Length	427	580	794	922		976		754
	Std. Error	10.3	19.0	13.3	20.6		38.5		20.4
	Sample Size	8	13	34	17		3		75
Female	Avg. Length			831	922	830	939	850	898
	Std. Error			9.2	5.8		28.9		6.1
	Sample Size			32	80	1	7	1	121
All Fish	Avg. Length	427	580	812	923	830	950	850	843
	Std. Error	10.3	19.0	8.4	5.9		22.8		10.0
	Sample Size	8	13	66	98	1	10	1	197

Appendix A9. Age composition of chinook salmon in the Canyon Island Taku River fishwheel catch by sex, age class, and escapement period, 1989[a].

	Brood Year and Age Class									
	1986	1985		1984		1983		1982		
	1.1	1.2	2.1	1.3	2.2	1.4	2.3	1.5	2.4	Total
Statistical Weeks 17 - 20 (April 23 - May 20)										
Male										
Sample Size	24	30	3	27	4	2	3	1		94
Percent	15.9	19.9	2.0	17.9	2.6	1.3	2.0	0.7		62.3
Std. Error	3.0	3.2	1.1	3.1	1.3	0.9	1.1	0.7		3.9
Female										
Sample Size		4		38	1	12	1	1		57
Percent		2.6		25.2	0.7	7.9	0.7	0.7		37.7
Std. Error		1.3		3.5	0.7	2.2	0.7	0.7		3.9
All Fish										
Sample Size	24	34	3	65	5	14	4	2		151
Percent	15.9	22.5	2.0	43.0	3.3	9.3	2.6	1.3		100.0
Std. Error	3.0	3.4	1.1	4.0	1.5	2.4	1.3	0.9		
Statistical Week 21 (May 21 - 27)										
Male										
Sample Size	10	36	1	36	6	2	2	1		94
Percent	5.5	19.8	0.5	19.8	3.3	1.1	1.1	0.5		51.6
Std. Error	1.7	2.9	0.5	2.9	1.3	0.8	0.8	0.5		3.7
Female										
Sample Size		9		59	1	13	5	1		88
Percent		4.9		32.4	0.5	7.1	2.7	0.5		48.4
Std. Error		1.6		3.5	0.5	1.9	1.2	0.5		3.7
All Fish										
Sample Size	10	45	1	95	7	15	7	2		182
Percent	5.5	24.7	0.5	52.2	3.8	8.2	3.8	1.1		100.0
Std. Error	1.7	3.2	0.5	3.7	1.4	2.0	1.4	0.8		
Statistical Week 22 (May 28 - June 3)										
Male										
Sample Size	1	49		43	6	6			3	108
Percent	0.6	27.2		23.9	3.3	3.3			1.7	60.0
Std. Error	0.6	3.3		3.2	1.3	1.3			1.0	3.6
Female										
Sample Size		6		40		18	3	5		72
Percent		3.3		22.2		10.0	1.7	2.8		40.0
Std. Error		1.3		3.1		2.2	1.0	1.2		3.6
All Fish										
Sample Size	1	55		83	6	24	3	5	3	180
Percent	0.6	30.6		46.1	3.3	13.3	1.7	2.8	1.7	100.0
Std. Error	0.6	3.4		3.7	1.3	2.5	1.0	1.2	1.0	
Statistical Week 23 (June 4 - 10)										
Male										
Sample Size		35		34	2	3	1	2		77
Percent		24.5		23.8	1.4	2.1	0.7	1.4		53.8
Std. Error		3.6		3.6	1.0	1.2	0.7	1.0		4.2
Female										
Sample Size		4		39	1	12	3	4	3	66
Percent		2.8		27.3	0.7	8.4	2.1	2.8	2.1	46.2
Std. Error		1.4		3.7	0.7	2.3	1.2	1.4	1.2	4.2
All Fish										
Sample Size		39		73	3	15	4	6	3	143
Percent		27.3		51.0	2.1	10.5	2.8	4.2	2.1	100.0
Std. Error		3.7		4.2	1.2	2.6	1.4	1.7	1.2	

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	Brood Year and Age Class									
	1986	1985		1984		1983		1982		
	1.1	1.2	2.1	1.3	2.2	1.4	2.3	1.5	2.4	Total
Statistical Week 24 (June 11 - 17)										
Male										
Sample Size		40		31	5	4	3	1		84
Percent		28.2		21.8	3.5	2.8	2.1	0.7		59.2
Std. Error		3.8		3.5	1.5	1.4	1.2	0.7		4.1
Female										
Sample Size		3		35	2	15	1	2		58
Percent		2.1		24.6	1.4	10.6	0.7	1.4		40.8
Std. Error		1.2		3.6	1.0	2.6	0.7	1.0		4.1
All Fish										
Sample Size		43		66	7	19	4	3		142
Percent		30.3		46.5	4.9	13.4	2.8	2.1		100.0
Std. Error		3.9		4.2	1.8	2.9	1.4	1.2		
Statistical Weeks 25 - 32 (June 18 - August 12)										
Male										
Sample Size	1	42		43	1	5	2	1		95
Percent	0.6	26.2		26.9	0.6	3.1	1.3	0.6		59.4
Std. Error	0.6	3.5		3.5	0.6	1.4	0.9	0.6		3.9
Female										
Sample Size		4		45	1	11	1	2	1	65
Percent		2.5		28.1	0.6	6.9	0.6	1.3	0.6	40.6
Std. Error		1.2		3.6	0.6	2.0	0.6	0.9	0.6	3.9
All Fish										
Sample Size	1	46		88	2	16	3	3	1	160
Percent	0.6	28.8		55.0	1.3	10.0	1.9	1.9	0.6	100.0
Std. Error	0.6	3.6		3.9	0.9	2.4	1.1	1.1	0.6	
Combined Periods (Percentages are weighted by period catches)										
Male										
Sample Size	36	232	4	214	24	22	11	6	3	552
Percent	3.8	24.3	0.4	22.3	2.5	2.3	1.2	0.7	0.3	57.7
Std. Error	0.6	1.4	0.2	1.3	0.5	0.5	0.4	0.3	0.2	1.6
Female										
Sample Size		30		256	6	81	14	15	4	406
Percent		3.1		26.6	0.7	8.5	1.4	1.6	0.5	42.3
Std. Error		0.6		1.4	0.3	0.9	0.4	0.4	0.2	1.6
All Fish										
Sample Size	36	262	4	470	30	103	25	21	7	958
Percent	3.8	27.4	0.4	49.0	3.1	10.8	2.6	2.2	0.7	100.0
Std. Error	0.6	1.4	0.2	1.6	0.6	1.0	0.5	0.5	0.3	

[a] Age-1.1 males (jacks) were not sampled after week 21.

Appendix A10. Length composition of chinook salmon in the Canyon Island Taku River fishwheel catch by sex, age class, and escapement period, 1989.

		Brood Year and Age Class									
		1986	1985		1984		1983		1982		
		1.1	1.2	2.1	1.3	2.2	1.4	2.3	1.5	2.4	Total
Statistical Weeks 17 - 20 (April 23 - May 20)											
Male	Avg. Length	323	518	330	711	615	895	745	930		542
	Std. Error	5.4	14.1	17.3	12.7	25.3	15.0	33.3			18.3
	Sample Size	24	30	3	27	4	2	3	1		94
Female	Avg. Length		585		740	730	849	750	860		754
	Std. Error		30.7		8.8		14.3				11.1
	Sample Size		4		38	1	12	1	1		57
All Fish	Avg. Length	323	526	330	728	638	856	746	895		622
	Std. Error	5.4	13.4	17.3	7.5	30.2	13.1	23.6	35.0		14.8
	Sample Size	24	34	3	65	5	14	4	2		151
Statistical Week 21 (May 21 - 27)											
Male	Avg. Length	315	568	375	738	613	775	745	1100		620
	Std. Error	6.6	10.7		10.0	20.3	5.0	55.0			15.9
	Sample Size	10	36	1	35	6	2	2	1		93
Female	Avg. Length		557		749	560	843	783	840		744
	Std. Error		21.9		6.9		12.4	9.0			9.7
	Sample Size		9		59	1	13	5	1		88
All Fish	Avg. Length	315	566	375	745	606	834	772	970		680
	Std. Error	6.6	9.6		5.7	18.8	12.3	15.2	%130.0		10.5
	Sample Size	10	45	1	94	7	15	7	2		181
Statistical Week 22 (May 28 - June 3)											
Male	Avg. Length	440	573		739	629	877			860	666
	Std. Error		8.2		11.9	15.5	25.2			38.2	11.6
	Sample Size	1	49		43	6	6			3	108
Female	Avg. Length		603		772		878	787	916		795
	Std. Error		23.7		7.9		10.7	47.6	25.3		11.0
	Sample Size		6		40		18	3	5		72
All Fish	Avg. Length	440	576		755	629	878	787	916	860	718
	Std. Error		7.8		7.4	15.5	9.9	47.6	25.3	38.2	9.5
	Sample Size	1	55		83	6	24	3	5	3	180
Statistical Week 23 (June 4 - 10)											
Male	Avg. Length		563		734	603	792	795	870		658
	Std. Error		8.2		9.5	2.5	28.3		60.0		12.3
	Sample Size		35		33	2	3	1	2		76
Female	Avg. Length		608		771	600	830	735	870	847	777
	Std. Error		9.7		7.7		14.3	30.6	22.7	44.9	9.4
	Sample Size		4		39	1	12	3	4	3	66
All Fish	Avg. Length		567		754	602	823	750	870	847	714
	Std. Error		7.8		6.4	1.7	13.0	26.3	21.1	44.9	9.3
	Sample Size		39		72	3	15	4	6	3	142

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		Brood Year and Age Class									
		1986	1985		1984		1983		1982		
		1.1	1.2	2.1	1.3	2.2	1.4	2.3	1.5	2.4	Total
Statistical Week 24 (June 11 - 17)											
Male	Avg. Length		546		720	610	900	727	1020		643
	Std. Error		10.3		18.6	13.1	20.0	%100.4			14.9
	Sample Size		40		31	5	4	3	1		84
Female	Avg. Length		597		764	673	844	750	915		778
	Std. Error		6.7		8.6	92.5	11.2		55.0		10.6
	Sample Size		3		35	2	15	1	2		58
All Fish	Avg. Length		549		743	628	856	733	950		698
	Std. Error		9.8		10.1	24.9	11.0	71.2	47.3		11.3
	Sample Size		43		66	7	19	4	3		142
Statistical Weeks 25 - 32 (June 18 - August 12)											
Male	Avg. Length	410	546		733	610	822	795	940		654
	Std. Error		10.3		12.3		47.2	55.0			13.3
	Sample Size	1	42		43	1	5	2	1		95
Female	Avg. Length		608		763	630	840	815	890	855	770
	Std. Error		51.6		6.9		13.0		40.0		9.4
	Sample Size		4		45	1	11	1	2	1	65
All Fish	Avg. Length	410	551		748	620	834	802	907	855	701
	Std. Error		10.5		7.1	10.0	16.3	32.4	28.5		9.9
	Sample Size	1	46		88	2	16	3	3	1	160
Combined Periods (Lengths weighted by period catches)											
Male	Avg. Length	372	552	353	729	613	843	761	972	860	630
	Std. Error	5.7	4.3	16.6	5.2	7.7	15.9	28.1	39.9	38.2	6.2
	Sample Size	36	232	4	212	24	22	11	6	3	550
Female	Avg. Length		593		760	639	847	770	882	851	770
	Std. Error		11.2		3.2	34.3	5.3	12.6	13.4	31.8	4.2
	Sample Size		30		256	6	81	14	15	4	406
All Fish	Avg. Length	372	556	353	746	620	847	765	918	854	689
	Std. Error	5.7	4.0	16.6	3.0	9.1	5.3	14.0	15.7	22.4	4.6
	Sample Size	36	262	4	468	30	103	25	21	7	956

Appendix A11. Age composition of chinook salmon in the Taku River tributary escapements by sex, age class, and tributary, 1989.

	Brood Year and Age Class									
	1986	1985		1984		1983		1982		
	1.1	1.2	2.1	1.3	2.2	1.4	2.3	1.5	2.4	Total
Kowatua Creek										
Statistical Weeks 34 - 36 (August 20 - September 9)										
Male										
Sample Size	66	71	4	160	12	57	4	6	1	381
Percent	13.8	14.8	0.8	33.3	2.5	11.9	0.8	1.3	0.2	79.4
Std. Error	1.6	1.6	0.4	2.1	0.7	1.5	0.4	0.5	0.2	1.8
Female										
Sample Size				43		51	1	4		99
Percent				9.0		10.6	0.2	0.8		20.6
Std. Error				1.3		1.4	0.2	0.4		1.8
All Fish										
Sample Size	66	71	4	203	12	108	5	10	1	480
Percent	13.8	14.8	0.8	42.3	2.5	22.5	1.0	2.1	0.2	100.0
Std. Error	1.6	1.6	0.4	2.2	0.7	1.9	0.5	0.6	0.2	
Little Tatsamenie weir										
Statistical Weeks 34 - 37 (August 20 - September 16)										
Male										
Sample Size	64	158	2	227	9	44		4		508
Percent	8.6	21.2	0.3	30.4	1.2	5.9		0.5		68.1
Std. Error	1.0	1.5	0.2	1.7	0.4	0.8		0.3		1.7
Female										
Sample Size		4		153		75	1	5		238
Percent		0.5		20.5		10.1	0.1	0.7		31.9
Std. Error		0.3		1.5		1.1	0.1	0.3		1.7
All Fish										
Sample Size	65	163	2	387	9	119	1	9		755
Percent	8.6	21.6	0.3	51.3	1.2	15.8	0.1	1.2		100.0
Std. Error	1.0	1.5	0.2	1.8	0.4	1.3	0.1	0.4		
Little Tatsamenie foot survey										
Statistical Week 36 (September 3 - 9)										
Male										
Sample Size	3	21		41		11	1			77
Percent	2.4	16.5		32.3		8.7	0.8			60.6
Std. Error	1.3	3.3		4.2		2.5	0.8			4.3
Female										
Sample Size				35		15				50
Percent				27.6		11.8				39.4
Std. Error				4.0		2.9				4.3
All Fish										
Sample Size	3	21		76		26	1			127
Percent	2.4	16.5		59.8		20.5	0.8			100.0
Std. Error	1.3	3.3		4.4		3.6	0.8			
Nahlin River										
Statistical Weeks 30 - 32 (July 23 - August 12)										
Male										
Sample Size	4	39		141		35		9	1	229
Percent	1.0	9.7		35.0		8.7		2.2	0.2	56.8
Std. Error	0.5	1.5		2.4		1.4		0.7	0.2	2.4
Female										
Sample Size		1		99		61	2	9	2	174
Percent		0.2		24.6		15.1	0.5	2.2	0.5	43.2
Std. Error		0.2		2.1		1.8	0.3	0.7	0.3	2.4
All Fish										
Sample Size	4	40		240		96	2	18	3	403
Percent	1.0	9.9		59.6		23.8	0.5	4.5	0.7	100.0
Std. Error	0.5	1.5		2.4		2.1	0.3	1.0	0.4	

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	Brood Year and Age Class									
	1986	1985		1984		1983		1982		
	1.1	1.2	2.1	1.3	2.2	1.4	2.3	1.5	2.4	Total
Tseta River										
Statistical Week	32	(August 6 - 12)								
Male										
Sample Size		5		19	3	7	9		1	44
Percent		6.2		23.5	3.7	8.6	11.1		1.2	54.3
Std. Error		2.7		4.7	2.1	3.1	3.5		1.2	5.6
Female										
Sample Size				8		19	8	2		37
Percent				9.9		23.5	9.9	2.5		45.7
Std. Error				3.3		4.7	3.3	1.7		5.6
All Fish										
Sample Size		5		27	3	26	17	2	1	81
Percent		6.2		33.3	3.7	32.1	21.0	2.5	1.2	100.0
Std. Error		2.7		5.3	2.1	5.2	4.5	1.7	1.2	
Dudidontu River										
Statistical Week	32	(August 6 - 12)								
Male										
Sample Size		2		2		1				5
Percent		25.0		25.0		12.5				62.5
Std. Error		16.4		16.4		12.5				18.3
Female										
Sample Size						3				3
Percent						37.5				37.5
Std. Error						18.3				18.3
All Fish										
Sample Size		2		2		4				8
Percent		25.0		25.0		50.0				100.0
Std. Error		16.4		16.4		18.9				
Nakina River										
Male										
Sample Size	84	141	2	143		59		7	2	438
Percent	13.3	22.3	.3	22.7		9.4		1.1	.3	69.4
Female										
Sample Size				82		91	2	17		193
Percent				13.0		14.4	.3	2.7		30.6
All Fish										
Sample Size	84	141	2	225		150	2	34	2	631
Percent	13.3	22.3	.3	35.7		23.8	.3	3.8	.3	100.0
Combined Tributaries[a]										
Male										
Sample Size	137	296	6	590	24	155	14	19	3	1,244
Percent	4.3	15.5	0.2	29.9	1.2	9.4	2.1	0.7	0.3	63.6
Std. Error	0.4	2.9	0.1	3.0	0.4	2.2	0.6	0.2	0.2	3.3
Female										
Sample Size		5		338		224	12	20	2	601
Percent		0.1		15.2		18.1	1.8	1.0	0.1	36.4
Std. Error		0.1		1.0		3.2	0.6	0.3	0.1	3.3
All Fish										
Sample Size	138	302	6	935	24	379	26	39	5	1,854
Percent	4.3	15.7	0.2	45.2	1.2	27.4	3.9	1.7	0.4	100.0
Std. Error	0.4	2.9	0.1	3.0	0.4	3.4	0.8	0.4	0.2	

[a] Excluding Nakina River carcass weir samples.

Appendix A12. Length composition of chinook salmon in the Taku River escapement by sex, age class, and tributary, 1989.

		Brood Year and Age Class									
		1986	1985		1984		1983		1982		
		1.1	1.2	2.1	1.3	2.2	1.4	2.3	1.5	2.4	Total
Kowatua Creek											
Statistical Week 34 - 36 (August 20 - September 9)											
Male	Avg. Length	350	566	370	756	622	890	763	950	1010	666
	Std. Error	3.2	7.6	7.9	4.5	25.1	8.2	40.6	16.0		9.7
	Sample Size	66	71	4	160	12	57	4	6	1	381
Female	Avg. Length				779		866	805	923		830
	Std. Error				5.1		5.7		22.5		6.0
	Sample Size				43		51	1	4		99
All Fish	Avg. Length	350	566	370	761	622	879	771	939	1010	700
	Std. Error	3.2	7.6	7.9	3.8	25.1	5.2	32.6	13.2		8.4
	Sample Size	66	71	4	203	12	108	5	10	1	480
Little Tatsamenie weir											
Statistical Week 34 - 37 (August 20 - September 16)											
Male	Avg. Length	349	567	341	743	633	874		981		648
	Std. Error	5.3	4.9	21.0	3.6	13.2	8.3		10.1		7.1
	Sample Size	63	158	2	227	9	43		4		506
Female	Avg. Length		567		755		842	784	926		783
	Std. Error		30.1		3.4		4.6		23.8		4.4
	Sample Size		4		152		75	1	5		237
All Fish	Avg. Length	349	567	341	747	633	853	784	950		691
	Std. Error	5.3	4.8	21.0	2.6	13.2	4.4		16.4		5.5
	Sample Size	63	162	2	383	9	118	1	9		747
Little Tatsamenie foot survey											
Statistical Week 36 (September 3 - 9)											
Male	Avg. Length	363	574		771		847	710			711
	Std. Error	57.5	16.7		9.0		11.5				15.4
	Sample Size	3	21		41		11	1			77
Female	Avg. Length				739		836				769
	Std. Error				7.3		9.3				8.6
	Sample Size				34		15				49
All Fish	Avg. Length	363	574		757		840	710			734
	Std. Error	57.5	16.7		6.2		7.2				10.3
	Sample Size	3	21		75		26	1			126
Nahlin River											
Statistical Weeks 30 - 32 (July 23 - August 12)											
Male	Avg. Length	341	599		758		883		963	1040	752
	Std. Error	10.9	8.6		4.5		8.3		21.0		7.9
	Sample Size	4	39		141		35		9	1	229
Female	Avg. Length		625		766		855	785	911	815	805
	Std. Error				3.9		5.1	30.0	18.2	5.0	4.9
	Sample Size		1		99		61	2	9	2	174
All Fish	Avg. Length	341	600		761		866	785	937	890	775
	Std. Error	10.9	8.4		3.1		4.6	30.0	14.9	75.1	5.1
	Sample Size	4	40		240		96	2	18	3	403

		Brood Year and Age Class									
		1986	1985		1984		1983		1982		
		1.1	1.2	2.1	1.3	2.2	1.4	2.3	1.5	2.4	Total
Tseta River Statistical Week 32 (August 6 - 12)											
Male	Avg. Length		641		732	657	887	756		860	749
	Std. Error		8.0		13.7	7.3	22.6	19.4			13.8
	Sample Size		5		18	3	7	9		1	43
Female	Avg. Length				791		840	770	930		819
	Std. Error				11.4		10.8	9.7	10.0		9.1
	Sample Size				8		19	8	2		37
All Fish	Avg. Length		641		750	657	853	762	930	860	782
	Std. Error		8.0		11.4	7.3	10.6	11.1	10.0		9.3
	Sample Size		5		26	3	26	17	2	1	80
Dudidontu River Statistical Week 32 (August 6 - 12)											
Male	Avg. Length		630		748		920				735
	Std. Error		10.0		7.5						53.3
	Sample Size		2		2		1				5
Female	Avg. Length						833				833
	Std. Error						44.2				44.2
	Sample Size						3				3
All Fish	Avg. Length		630		748		855				772
	Std. Error		10.0		7.5		38.0				39.4
	Sample Size		2		2		4				8
Combined Tributaries											
Male	Avg. Length	351	596	356	751	637	883	743	965	970	710
	Std. Error	3.1	3.7	9.6	2.3	13.4	4.5	16.5	11.2	55.7	4.7
	Sample Size	136	296	6	589	24	154	14	19	3	1241
Female	Avg. Length		596		766		845	786	922	815	806
	Std. Error		26.1		2.3		2.8	8.0	10.6	5.0	2.7
	Sample Size		5		336		224	12	20	2	599
All Fish	Avg. Length	351	596	356	754	637	858	762	939	920	742
	Std. Error	3.1	3.6	9.6	1.7	13.4	2.6	9.7	8.4	48.7	3.5
	Sample Size	136	301	6	929	24	378	26	39	5	1844

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