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A STUDY OF CHINOOK SALMON IN SOUTHEAST ALASKA[1]

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ABSTRACT

Estimated total escapements of wild stock chinook salmon to southeast Alaska and transboundary rivers increased for the sixth consecutive year in 1988. Preliminary data on 11 indicator systems indicates that the estimated total escapement of chinook salmon for all southeast Alaska and transboundary rivers increased to 60,500 chinook salmon or roughly 95 percent of the total management escapement goal of 64,000. The 1988 total escapement increased by 8,500 chinook salmon, or 16 percent over the estimated 1987 total escapement of 52,000. Compared to the 1975 to 1980 base period average of 26,000 chinook salmon, the 1988 escapement represented an increase of 133 percent or 34,500 fish.

Although total chinook salmon escapements increased in 1988 compared to 1987, the increase was due primarily to increased escapements in the transboundary Stikine (53 percent) and Taku rivers (50 percent). Escapements in eight of the 11 index systems decreased by an average of 33 percent in 1988 compared to 1987. The weakness in 1988 chinook salmon escapements generally occurred throughout the region except as noted above. Escapements of chinook salmon to southern systems such as the Unuk, Chickamin, Blossom, and Keta rivers, declined in 1988, reversing the trend of increasing escapements seen in recent years. Chinook salmon escapements to the Alsek and Chilkat rivers are still well below management escapement goals.

Recoveries of coded-wire tags from chinook salmon 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, exploitations rates on these stocks are in the range of 30 to 40 percent. These stocks are harvested by commercial and recreational fisheries throughout southeast Alaska and northern British Columbia with over 40 percent 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 and Chilkat rivers was initiated in 1985 and expanded in 1988. Sufficient recoveries for estimating harvest rates and migratory patterns of these stocks will not be available until 1990. However, preliminary tag recovery data indicates that some Chilkat River chinook salmon rear for extended periods as immature fish in the inside waters of northern Southeast Alaska and are available for harvest in commercial and recreational fisheries.

KEY WORDS: Chinook, *Oncorhynchus tshawytscha*, escapement, juveniles, coded-wire tagging, migration, Taku River, Stikine River, Alsek River, Chilkat River, Unuk River, Chickamin River, Blossom River, Keta River, Marten River, Wilson River, Chilkat River, King Salmon River, Situk River, Andrew Creek, Behm Canal, carcass recovery, southeast Alaska, U.S./Canada Treaty, exploitation rate, harvest rate, fishery contribution, maturity.

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). 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 3 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. While rebuilding is substantially ahead of schedule for the more southerly Unuk, Chickamin, Blossom, and Keta rivers, it is unlikely that chinook salmon stocks in northern Southeast rivers such as the Taku, Stikine, Alsek, Chilkat, and Situk rivers will obtain management goals by 1995 (Figure 1).

In accordance with the US/Canada Salmon Treaty (Mecum and Seibel 1988), escapement indices from the Project 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 (Table 1). Fishery regulations are promulgated based on comparing these expansions with similarly constructed historical estimates of escapement.

Chilkat River chinook salmon are extremely important to the Haines marine recreational fishery. The Haines Chinook Salmon Derby is one of the largest and most successful derbies in southeast Alaska and expenditures by anglers fishing for chinook salmon contribute substantially to the Haines area economy. In recent years, however, total escapements of chinook salmon to the Chilkat River have declined from an average of 1,184 during 1981-1985 to 744 during 1986-1988, only 37% of the management escapement goal. Because of the decreases in escapements, fishing time and area restrictions were imposed on the Haines marine recreational fishery in 1987 and 1988. There is an urgent need to determine the areas of exploitation, run timing, fishery contributions of Chilkat River chinook salmon to commercial and recreational fisheries. It is possible that Chilkat River chinook salmon are harvested in mixed-stock fisheries at immature life stages thus contributing to the slow progress of rebuilding for this important stock.

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. Estimates of escapements by brood year will be used to investigate the relationship between spawners and subsequent recruitment. The Project provides these estimates of escapement on the major portion of the stocks of chinook salmon in southeast Alaska and transboundary rivers to fishery

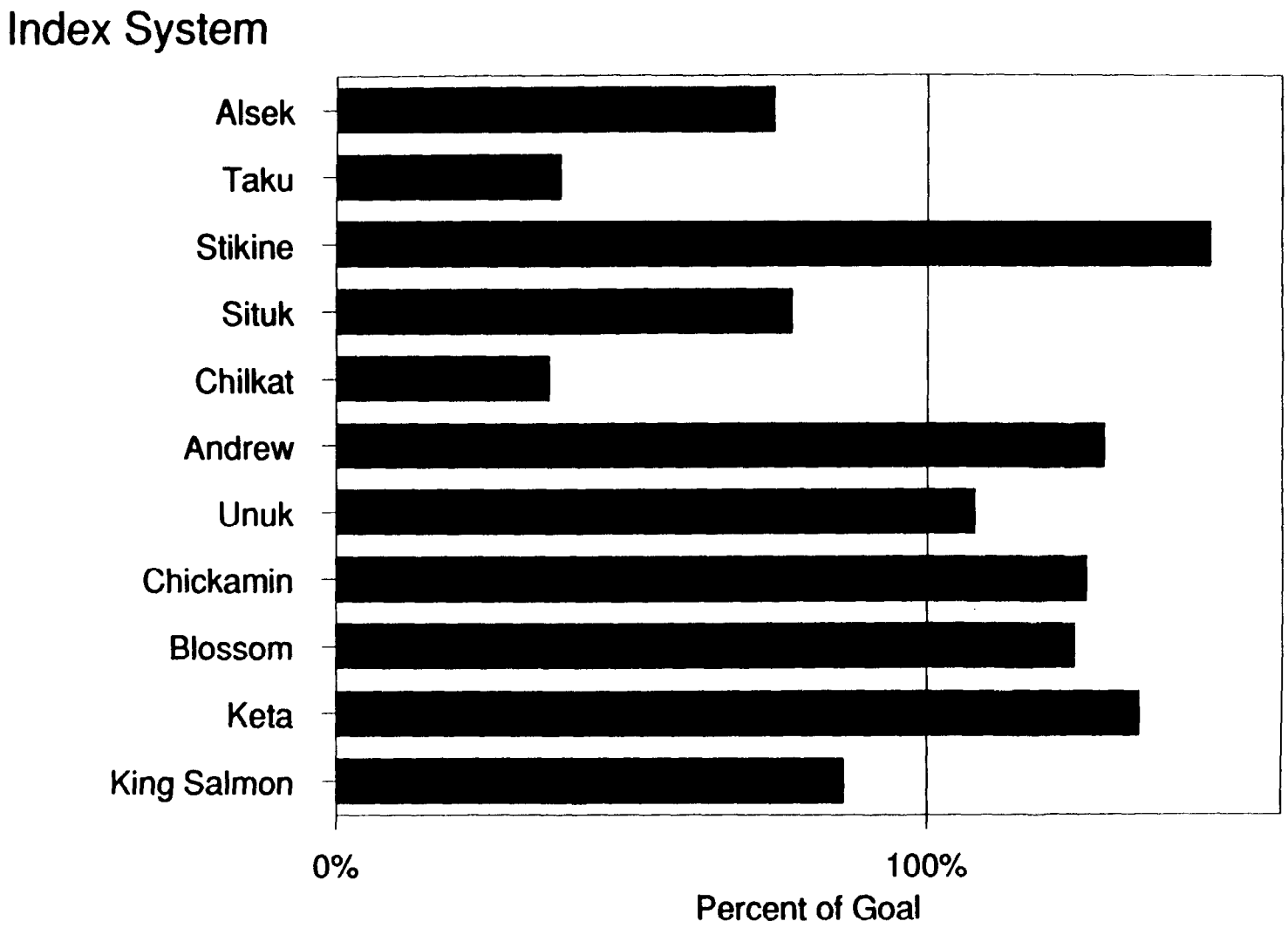


Figure 1. Average percent of escapement goals obtained in southeast Alaska and transboundary river index systems, 1986-1988.

Table 1. Preliminary 1988 estimates of total escapements of chinook salmon to southeast Alaska and transboundary rivers (includes age 1.3 and 1.4 fish only).[1]

System(Index Tributaries)	Index Systems: 1988 Escapement Index		Survey Expansion Factor	Tributary Expansion Factor	Estimated Total Escapement	Category Expansion Factor	Estimated Total Escapement
Major Category (Transboundary) Systems (3 total)							
Alsek (Klukshu)	1,987	(W)	1	1/.64	3,105		
Taku (Nakina and Nahlin)	6,035	(A)	1/.75	1/.60	13,411		
Stikine (Little Tahltan)	7,292	(W)	1	1/.25	29,168		
Major Subtotals	15,314				45,684	1	45,684
Medium Category Systems (9 total)							
Situk	885	(W)	1	1	885		
Chilkat (Big Boulder)	175	(F)	1/.80	1/.28	781		
Andrew Creek	470	(F)	1/.625	1	752		
Behm Canal Systems							
Unuk	1,746	(A)	1/.625	1	2,794		
Chickamin	786	(A)	1/.625	1	1,258		
Blossom	384	(A)	1/.625	1	614		
Keta	575	(A)	1/.625	1	920		
Subtotals	3,491				5,586		
Medium Subtotals	5,021				8,004	9/7	10,291
Minor Category Systems (22 total)							
King Salmon River	206	(W)	1	1	206		
Minor Subtotals	206				206	22/1	4,532
All Systems Totals	20,541				53,894		60,506

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

[1] Total escapement estimates = (index escapements) x (expansion factors)

managers on an annual basis. In 1988, the Chinook Salmon Research Project consisted of four separate studies. The first study examined escapements of chinook salmon in southeast Alaska. The objectives of this study were to:

1. Estimate the peak escapement of age 1.3 and 1.4 chinook salmon to the Taku River, including the Nakina, Nahlin, Dudidontu, and Tatsamenie Rivers and Kowatua and Tseta Creeks.

2. Estimate the peak escapement of age 1.3 and 1.4 chinook salmon to the Stikine River, including the Little Tahltan and Tahltan rivers and Beatty and Andrew creeks.

3. Estimate the peak escapement of age 1.3 and 1.4 chinook salmon to the Alsek River, including the Klukshu, Takhanne, and Blanchard rivers and Village, Mile 112, and Goat creeks.

4. Estimate the peak escapement of age 1.3 and 1.4 chinook salmon to the Unuk River, including Eulachon, Cripple, Genes Lake, Clear, Lake, and Kerr creeks.

5. Estimate the peak escapement of age 1.3 and 1.4 chinook salmon to the Chickamin River, including the South Fork River and Barrier, Leduc, Butler, Indian, Humpy, King, and Clear Falls creeks.

6. Estimate the peak escapement of age 1.3 and 1.4 chinook salmon to the Chilkat River, including Big Boulder and Stonehouse creeks.

7. Estimate the peak escapement of age 1.3 and 1.4 chinook salmon to the King Salmon, Keta, Blossom, Wilson, Marten, and Klahini rivers and Grant Creek.

The second study consisted of two parts, coded-wire tagging of juvenile chinook salmon on the Chilkat River and stock assessment research on Nahlin River chinook salmon. The specific objectives were to:

1. Estimate the contribution of Chilkat River chinook salmon to ocean commercial and recreational and in-river subsistence fisheries.

2. Estimate the juvenile chinook salmon catch per trap-day by trapping site and by river section in the Chilkat River.

3. Estimate the size composition of juvenile chinook salmon in the Chilkat River.

4. Estimate the percent of tag loss for coded-wire tagged juvenile chinook salmon in the Chilkat River.

5. Estimate the age, sex, and length composition of the chinook salmon escapement to the Nahlin River in 1988.

6. Document the run timing and spawning ground distribution of chinook salmon in the Nahlin River.

7. Estimate the total population size of the Nahlin River chinook salmon stock in 1988 and compare this estimate with aerial surveys of spawning abundance.

The third 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 1988.

2. Estimate the size, age, sex, and length composition of the chinook salmon escapements to the Unuk and Chickamin rivers in 1988.

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

1. Describe the migratory timing, harvest rates, and migration routes of Alsek River chinook salmon.

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

3. Evaluate the relative efficiency of inclined plane traps and baited minnow traps in capturing juvenile chinook salmon.

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

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 2). The names, locations, and detailed descriptions of spawning distribution and timing of chinook salmon in these index areas are summarized in Appendix Table 1. Aerial or foot surveys were conducted shortly before, during, or shortly after the peak of spawning. Peak spawning times, defined as the period when the largest number of adult chinook salmon are actively spawning in a particular stream or river, are well documented from previous surveys of the same index areas conducted over the past 15 years (Kissner 1982). These escapement counts have been used as a comparable index of escapements on an annual basis since 1975.

Surveys were conducted on foot or from a Bell 206 or Hughes 500D helicopter during periods of peak spawning. An attempt was made to survey each of the index areas twice unless turbid water or unsafe flying conditions precluded the second survey. The pilot was directed to fly the helicopter from 6 to 15 meters above the river bed at a speed 6 to 16 kilometers per hour. The helicopter door on the side of the observer was removed and the helicopter was hovered sideways with observations made out of the open space. Only age 1.3 and 1.4 chinook salmon >660 mm fork length (FL) or 28 in. total length (TL) were enumerated during aerial or foot surveys. No attempt was 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).

Chinook escapement counts were also obtained from fish counting weirs operated by the Canadian Department of Fisheries and Oceans (CDFO) on the Little Tahltan (Stikine), Tatsamenie (Taku), and Klukshu (Alsek) Rivers, and by the Alaska Department of Fish and Game (ADFG) on the King Salmon River (Admiralty Island) and Situk River. Except for the Situk River where aerial surveys are not

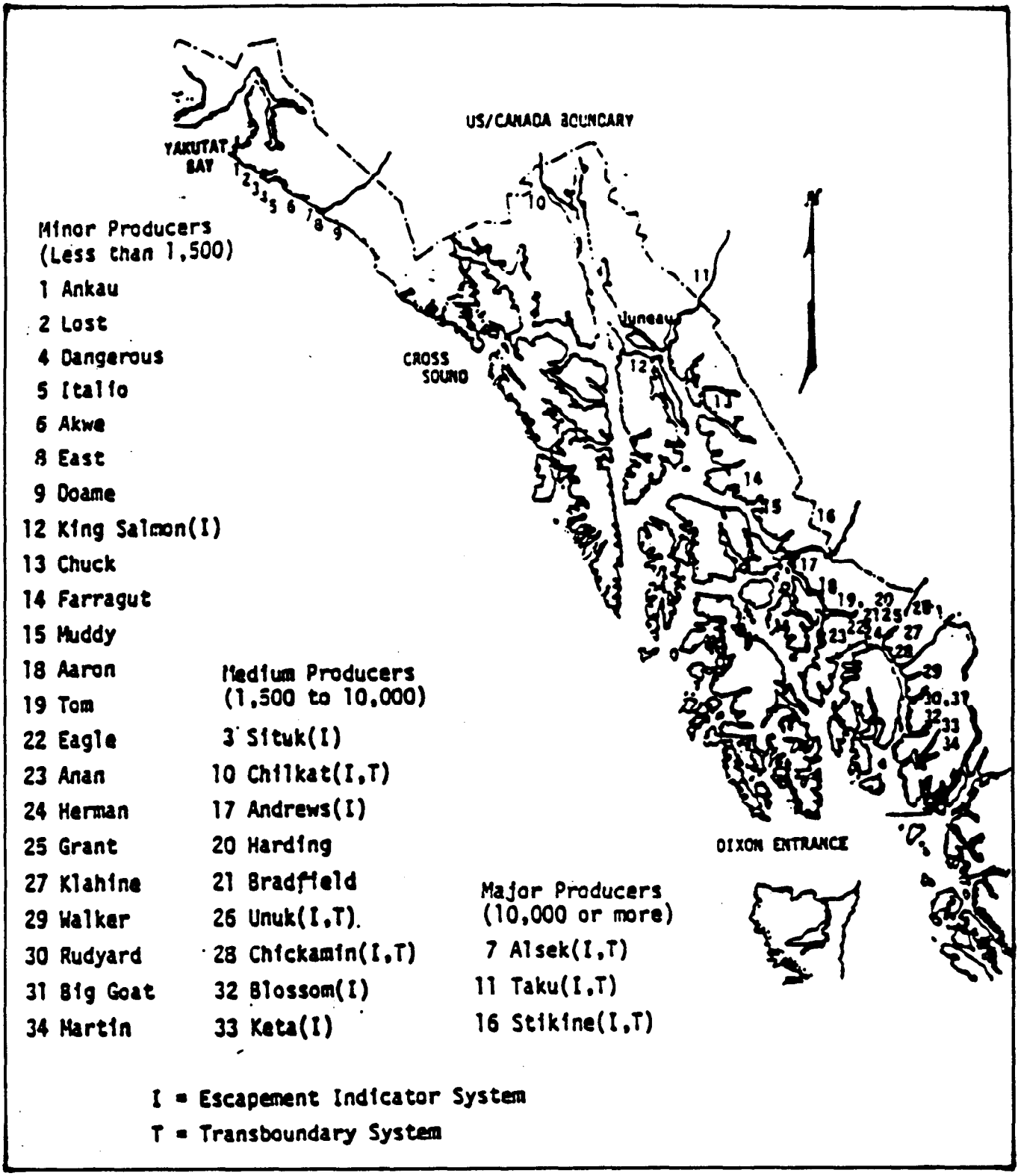


Figure 2. Approximate locations of natural chinook salmon producing systems in southeast Alaska and transboundary river areas.

practical due to overhanging vegetation, weir counts were compared with aerial or foot surveys to determine the relative accuracy of surveys of peak escapement in predicting total escapements.

Coded-Wire Tagging of Juvenile Chinook Salmon

Juvenile chinook salmon were captured and coded-wire tagged in the Unuk, Chickamin, Alsek, and Chilkat Rivers during 1988. Tagging on the Unuk and Chickamin Rivers was conducted from March 19 through April 25 and from September 20 through October 31 on the Alsek and Chilkat Rivers. Juvenile chinook were captured exclusively with standard minnow traps (Gee brand) baited with clusters of salmon roe. Between 50 and 100 minnow traps were fished daily during both the spring and fall tagging periods. All 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) during fall tagging operations or pre-smolts (spring tagging) 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 and the 65 fish/pound head mold for tagging pre-smolts during the spring.

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. Therefore, tag placement was observed on several chinook salmon smolts or YOY 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 5% 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 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. Gaffs and carcass weirs 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 2 to August 30 on the Unuk River and from August 16 to August 20 on the Chickamin River.

Fishery Contribution and Exploitation Rates

Harvest of coded-wire tagged chinook salmon 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 in prep. 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. Proportions of fish tagged by brood year were calculated along with their standard errors.

The fraction of the escapement tagged was estimated from sampling of chinook salmon carcasses on the spawning grounds. The tagging fraction and the associated confidence interval was estimated according to procedures outlined by Cochran 1977 (equation 3.19, page 57).

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 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:

$$\frac{\text{CWT Recoveries}}{X} = \frac{\text{Total Sample of That Brood Year}}{\text{Total Escapement of That Brood}}$$

Taku River Population Estimate

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 represented by the surveyed tributaries. 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, coho, and pink salmon with the objective of estimating the escapement of these species with mark-recapture methods. Tagged fish are recovered in a Canadian commercial drift net fishery upstream of the fishwheel site and on the spawning grounds. However, this method is not suitable for estimating chinook salmon escapements as the in-river 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. The Nahlin River stock is considered to be the earliest spawning stock in the Taku River drainage. Migratory timing data of Nahlin River chinook salmon past the Canyon Island fishwheel was collected along with age, sex, and size composition data. Tag recovery data was combined with similar data from weirs operated by CDFO on the Nakina, Tatsamenie, Kowatua and Hackett Rivers to estimate the total escapement of chinook salmon to the Taku River in 1988. A more detailed description of methods used to estimate the total population size of Taku River chinook salmon is contained in McGregor (in preparation).

Two approaches were used to sample post spawning chinook salmon on the Nahlin River. First a wooden, tripod weir with aluminum pickets was operated from July 25 to September 23 on the Nahlin River at the downstream end of Index Area II (Kissner 1982). All chinook salmon carcasses collecting on the weir during this time period were sampled for tags, scales, sex, and lengths. Secondly, from July 31 to August 21 foot surveys were conducted by weir personnel every two or three days from the weir downstream approximately 3km and from the weir upstream approximately 8 km. Foot surveys were also conducted by additional sampling personnel from July 31 to August 8, 1988 from the upper end of Index Area I downstream to the weir.

RESULTS

Taku River Studies

The Taku River originates in northern British Columbia and flows into the ocean 48 km east of Juneau, Alaska (Figure 3). The Taku River drainage covers over 16,000 km^2 and annual flows range from 787 to 2,489 m^3. 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 been allowed. The upper Taku River area is extremely remote with no road access and no 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.

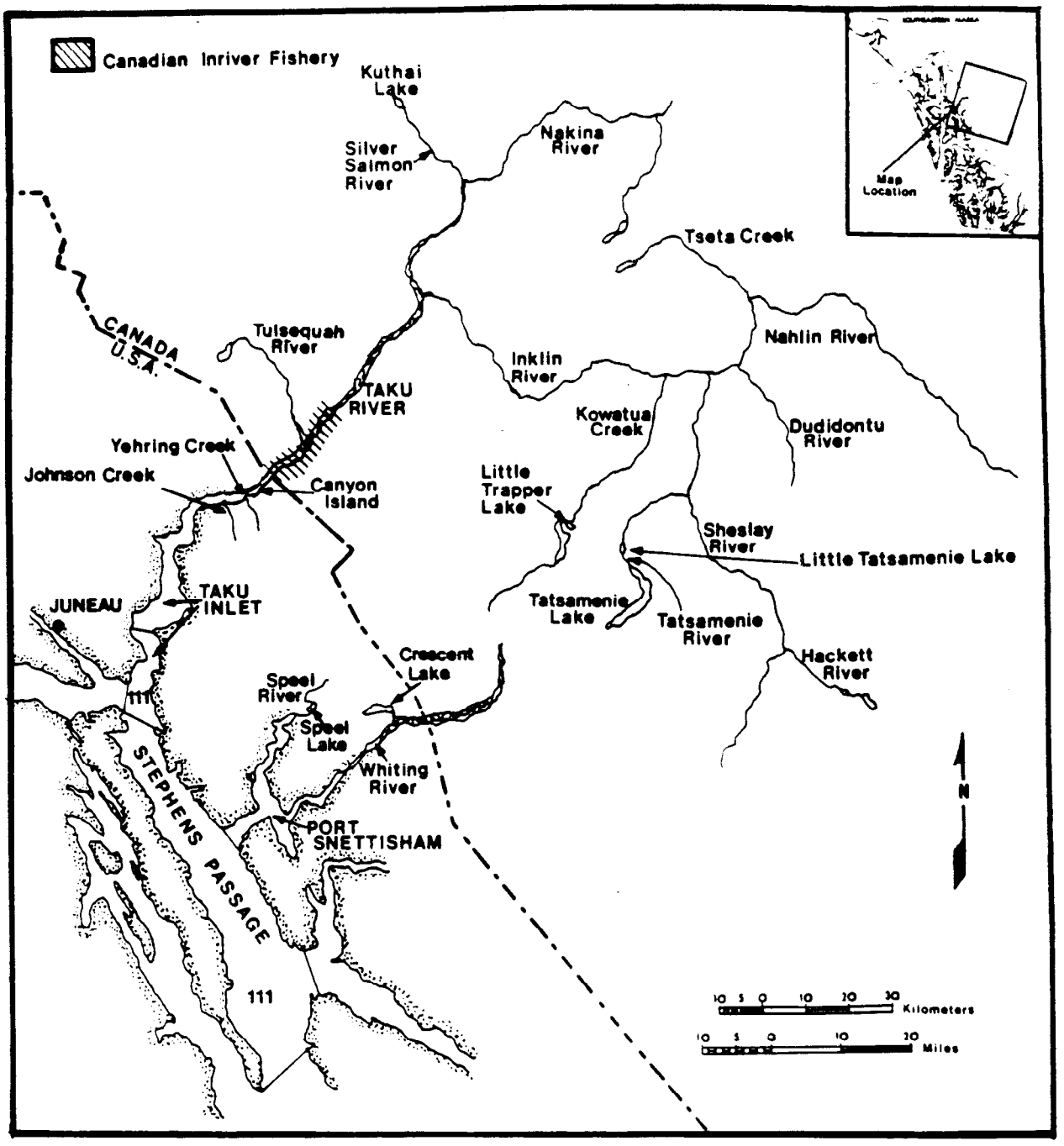


Figure 3. Taku River drainage.

Escapement:

The observed escapement of 8,626 age 1.3 and 1.4 chinook salmon into index tributaries of the Taku River was the second largest escapement observed since 1958 (Table 2). The 1988 escapement was 54% above the previous 10-year average and 73.9% above the 1973 to 1987 average (methods for conducting aerial escapement surveys were standardized in 1973). Despite the improvement in escapements in 1988, the 1986 to 1988 average escapement to the Taku was still less than 40% of the management escapement goal of 25,600 age 1.3 and 1.4 chinook salmon.

All of the Taku index tributaries were surveyed every year from 1981 to 1988, except for 1984, when the escapement surveys were conducted by CDFO personnel. Compared to the 1981 to 1988 average, escapements to the Trapper Lake (Kowatua River) and Tatsamenie Lake (Tatsamenie River) systems increased by 4% (Table 3). Escapements to the Nahlin River (-6%), Tseta Creek (-3%), and Dudidontu River (-1%) were slightly below the 1981 to 1988 average.

A total of 740 chinook salmon were sampled on the Nahlin River in 1988. Of these, 34 were enumerated moving upstream through the weir, 59 collected as carcasses on the weir, and 647 were sampled during foot surveys conducted above and below the weir (Table 4). Only 5 of the 740 sampled chinook salmon were spaghetti tagged (one additional chinook salmon with a tagging scar was observed indicating that the tag had been lost). All of the tagged chinook salmon were caught and released at the Canyon Island fishwheel during the period from May 29 to June 25 (Table 5). In comparison, six of the 14 spaghetti tagged chinook salmon sampled at the Tatsamenie River weir were tagged after June 26, reflecting the earlier migratory timing of Nahlin River chinook salmon.

The 1988 escapement of chinook salmon to the Nahlin River was comprised of 16% age 1.1 males (1985 brood year), 39.1% age 1.2 males (1984 brood year), 15.8% age 1.3 males (1983 brood year) and 36.7% age 1.4 males (1982 brood year). Of the female chinook salmon sampled 1.0% were age 1.2 females, 17.0% age 1.3 females, and 81.4% age 1.4 females (Table 6).

Stikine River Studies

The Stikine River (Figure 4) originates in northern British Columbia and flows to the sea approximately 32 km south of Petersburg, Alaska. The Stikine River drainage encompasses approximately 52,000 km^2. The Stikine River's principal tributaries include the Tahltan, Chutine, Skud, Iskut, and Tuya rivers. Approximately 90% of the river system is inaccessible to anadromous fish due to natural barriers and velocity blocks and the lower river and most tributaries are glacially occluded (e.g., Chutine, Skud, and Iskut rivers). Only 2% of the Stikine River drainage is in Alaska (Beak Consultants Limited 1981) and the majority of the chinook salmon spawning areas in the Stikine River are located in British Columbia, Canada in the mainstem Tahltan and Little Tahltan rivers (including Beatty Creek). However, Andrew Creek, in the lower Stikine River, also supports a significant spawning run of chinook salmon.

Escapement:

The peak aerial count of 3,796, age 1.3 and 1.4 chinook salmon in the index area of the Little Tahltan was the largest escapement ever recorded. The 1988 escapement to the Little Tahltan was 217% above the previous 10-year average and was 80% above the management escapement goal. Record escapements were also observed in the mainstem Tahltan River and Beatty Creek (Table 7). In contrast,

Table 2. Peak escapement counts of chinook salmon for tributaries of the Taku River, 1951-1988.[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	-	-	-	-	-	1,500[2]
1958	2,500	-	-	4,500 (A)	-	2,500 (A)	9,500[2]
1959	4,000	-	-	-	-	-	4,000[2]
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	3700 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	3500 (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)	279 E(H)	616 E(H)	-	176 (H)	951 (H)	3,909[3]
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

(F) = Foot Survey; (A) = Fixed-wing aircraft; (H) = Helicopter
P = Survey conditions hampered by glacial or turbid waters
N = Normal water flows and turbidities; average survey conditions
E = Survey conditions excellent
[1] Escapement counts before 1975 may not be comparable due to changes in survey dates and methods
[2] Partial survey of Nakina River in 1957-59; comparisons made from carcass weir counts
[3] Surveys in 1984 conducted by CDFO; partial survey of Tseta Creek and Nahlin

Table 3. Percentages of escapement observed in tributaries of the Taku River during years when all index tributaries were surveyed.

Year	Nakina River	%	Kowatua River	%	Tatsamenie River	%	Dudidontu River	%	Tseta Creek	%	Nahlin River	%	Total
1981	5,110	52	560	6	839	9	74	1	258	3	2,945	30	9,786
1982	2,533	53	289	6	387	8	130	3	228	5	1,246	26	4,813
1983	968	47	171	8	236	11	117	6	179	9	391	19	2,062
1985	2,647	37	699	10	848	12	475	7	303	4	2,239	31	7,211
1986	3,868	51	548	7	886	12	413	5	193	3	1,612	21	7,520
1987	2,906	51	570	10	678	12	287	5	180	3	1,122	20	5,743
1988	4,500	52	1,010	12	1,272	15	243	3	66	1	1,535	18	8,626
Average	3,219	49	550	8	735	11	248	4	201	4	1,584	24	6,537

Table 4. Nahlin River chinook salmon escapement, 1988.

Date	Through Weir	Carcasses on Weir	Foot Survey	Foot Survey Upriver	Comments
July 25		1			
26					
27	7	3			Tag C00784
28	2	2			
29	3				
30	3	1		40	1 missing tag
31	3		1	60	
Aug. 1	2	2	16	30	
2	5	1		70	
3	2		14	50	
4	3	3	1		Tag C00420
5	3		29	47	
6				45	
7		4	36	49	Tag C00515
8		4	25	3	
9		6	14		
10		4	20		
11		3			
12		4	34		
13		5	22		Tag C01040
14			18		
15		7			
16			18		Tag C00643
17	1				
18	1	3			
19		2			
20		2	4		
21					
22		1			
23					
24		1			
Totals	35	59	252	394	5 Tags

Table 5. Recovery of tagged chinook salmon at spawning sites in the Taku River drainage in 1988, by statistical week of tagging at Canyon Island.

	Statistical Week of Tagging													
Location	20	21	22	23	24	25	26	27	28	29	30	31	32	Total
Tatsamenie River					2	3	5	1	4	1	1			17
Nakina River	1	2	3	6	8	4	2							26
Hackett River			2		1	1	1	1						6
Nahlin River				2	1	2								5
Trapper Lake		1												1
Total	1	3	5	8	12	10	8	2	4	1	1			59

Table 6. Age composition of chinook salmon sampled on the Nahlin River, 1988.

	Sample Size	Age				
		1.1	1.2	1.3	1.4	1.5
Male	368	7.6%	39.1%	15.8%	36.7%	0.8%
Female	312	0.0%	1.0%	17.0%	81.4%	0.6%

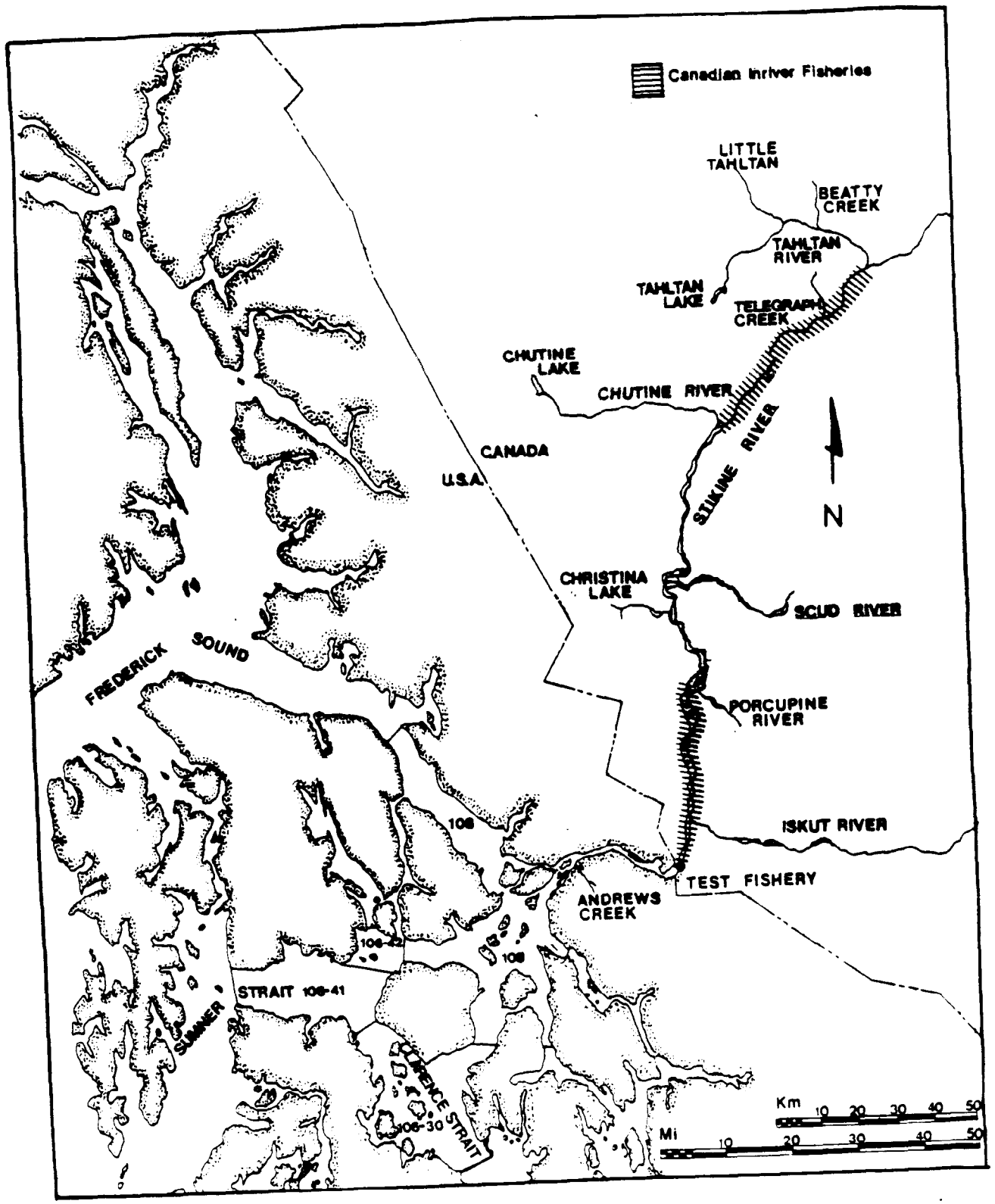


Figure 4. Stikine River drainage.

Table 7. Peak escapement and weir counts of chinook salmon for tributaries of the Stikine River, 1956-1988.[1]

Year	Little Tahltan River	Mainstem Tahltan River	Beatty Creek	Andrew Creek	Total
1956	493 (F)	-	-	4,500 (A)	4,993
1957	199 (F)	-	-	3,000 (F/A)	3,199
1958	790 (F)	-	-	2,500 (F/A)	3,290
1959	198 (F)	-	-	150 (F/A)	348
1960	346 (F)	-	-	287 N(F)	633
1961	-	-	-	103 (F)	103
1962	-	-	-	300 (A)	300
1963	-	-	-	500 (A/H)	500
1964	-	-	-	400 (H)	400
1965	-	85	-	100 (A)	185[2]
1966	-	318	-	75 (A)	393[2]
1967	800 N(H)	-	-	30 (A)	830
1968	-	-	-	15	15
1969	-	-	-	12 (A)	12
1970	-	-	-	-	-
1971	-	-	-	305 (A)	305
1972	-	-	-	-	-
1973	-	-	-	40 (A)	40
1974	-	-	-	129 (A)	129
1975	700 E(H)	2,908 E(H)	-	260 (F)	3,868
1976	400 N(H)	120 (H)	-	468 (W)	988[3]
1977	800 P(H)	25 (A)	-	534 (W)	1,359
1978	632 E(H)	756 P(H)	-	400 (W)	1,788
1979	1,166 E(H)	2,118 N(H)	-	382 (W)	3,666
1980	2,137 N(H)	960 P(H)	122 E(H)	362 (W)	3,581
1981	3,334 E(H)	1,852 P(H)	558 E(H)	629 (W)	6,373
1982	2,830 N(H)	1,690 N(F)	567 E(H)	910 (W)	5,997
1983	594 E(H)	453 N(H)	83 E(H)	444 (W)	1,574
1984	1,294 (H)	-	126 (H)	355 (W)	1,775[4]
1985	3,146 (W)	1,490 N(H)	147 N(H)	319 E(F)	5,102
1986	2,893 (W)	1,400 P(H)	183 N(H)	707 N(F)	5,183
1987	4,777 (W)	1,390 P(H)	312 E(H)	651 E(H)	7,130
1988	7,292 (W)	4,384 N(H)	593 E(H)	400 N(H)	12,669

(F) = Foot survey; (A) = Fixed-wing aircraft; (H) = Helicopter
(W) = Weir count
(F/A) = Combined foot and aerial count
N = Normal survey conditions
P = Survey conditions hampered by glacial or turbid waters
E = Excellent survey conditions
[1] Escapement counts prior to 1975 may not be comparable due to differences in survey dates and counting methods
[2] Chinook lifted over barrier on mainstem Tahltan in 1965 and 1966
[3] Late count om mainstem Tahltan, minimal number
[4] Surveys of Little Tahltan and Beatty Creek by CDFO in 1984

the observed escapement to Andrew Creek in the lower Stikine drainage was lower than observed in recent years (Table 8).

Low level helicopter surveys of the Little Tahltan River index area have been conducted every year since 1975. Starting in 1985, the CDFO has operated a fish counting weir at the mouth of the Little Tahltan River. During this time, aerial surveys have been conducted without prior knowledge of the escapement through the weir so that the relationship between peak aerial counts and total escapement could be quantified. From 1985 to 1988, the percentage of the total escapement of chinook salmon observed during peak aerial surveys has varied from 41.5% in 1986 to 56.6% in 1987 and averaged 50.3% (Table 9). The low percentage of the total escapement observed in 1986, resulted from poor survey conditions caused by a mudslide that occurred approximately 1.5 km above the weir site. In 1985, 1988, and 1989, the percentage of the total escapement observed during helicopter surveys ranged from 50.8% to 56.6% and averaged 53.2%.

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 5). 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 (Hubbartt 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 10). 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 escapement of 2,030 chinook salmon through the Klukshu River weir in 1988 was 81.5% of the average escapement observed since 1976 and only 63.4% of the management escapement goal of 3,200 age 1.3 and 1.4 fish. The 1988 peak escapement count of 437 chinook salmon in the Blanchard River was 30% less than in 1987 but was 20% above the previous five-year average. In the Takhanne River, the 1988 escapement was 57% below 1987 and 34% below the previous five-year average. Escapements of chinook salmon were not estimated for Village Creek and Mile 112 Creek in 1988.

Table 8. Peak escapement and weir counts of chinook salmon for Andrew Creek, 1976-1988.

Year	Adult Males Above Weir	Adult Males Spawned for Hatchery	Jacks Above Weir	Adult Females Above Weir	Adult Females Egg Take	Adult[1] Males Below Weir	Adult Females Below Weir	Total Adults Below Weir	Total Adult Male Return	Total Adult Female Return	Total Adult Return	Total Adult Male Spawners	Total Adult Female Spawners	Total Adult Spawners	Survey Date or Weir Removed
1976	151	29	50	200	35	23	30	53	203	265	468	174	230	404 (W)	8/23
1977	224	24	36	172	54	31	29	60	279	255	534	255	201	456 (W)	8/22
1978	165	5	75	178	7	22	23	45	192	208	400	187	201	388 (W)	8/09
1979	154	27	89	135	28	20	18	38	201	181	382	174	153	327 (W)	8/06
1980	80	39	272	160	42	15	26	41	134	228	362	95	186	281 (W)	8/13
1981	250	57	119	190	61	39	32	71	346	283	629	289	222	511 (W)	8/22
1982	224	109	124	300	166	46	65	111	379	531	910	270	365	635 (W)	8/21
1983	143	31	38	173	47	22	28	50	196	248	444	165	201	366 (W)	8/30
1984	124	0	200	191	0	16	24	40	140	215	355	140	215	355 (W)	8/25
1985	-	-	-	-	-	-	-	-	-	-	-	147	172	319 (F)	8/11[2]
1986	-	-	-	-	-	-	-	-	-	-	-	325	382	707 (F)	8/14
1987	-	-	-	-	-	-	-	-	-	-	-	299	352	651 (H)	8/11
1988	-	-	-	-	-	-	-	-	-	-	-	184	216	400 (H)	8/12

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

[1] Adult males below weir = (males through weir/total adults) x (total adults below weir).
Adult females below weir = (females through weir/total adults) x (total adults below weir).
Total adults below weir = for 1976-1978, 1980, 1981, 1983 estimated from ratio of adult chinook through weir to adults below weir during 1979, 1982, and 1984.

[2] Total adult male spawners for 1985-1988 = ratio of males to females in prior years (0.459) x total adult return
Total adult female spawners for 1985-1988 = ratio of females to males in prior years (0.541) x total adult return
Total adult return (spawners) for 1985-1988 = peak escapement count (helicopter survey)

Table 9. Comparison of weir counts and aerial survey estimates of chinook salmon escapements to the Little Tahltan River, 1985-1988.

Date	Weir Count	Low Level Helicopter Count	Percent of Escapement Observed From Helicopter
8/02/85	2,379	1,262	53.1
8/06/85	2,864	1,598	55.8
Seasonal	3,146	1,598	50.8
8/01/86	2,323	1,101	47.4
8/05/86	2,646	1,143	43.2
Seasonal	2,893	1,201	41.5
7/31/87	3,903	2,446	62.7
8/03/87	4,456	2,706	60.7
Seasonal	4,781	2,706	56.6
7/30/88	5,573	3,484	62.5
8/05/88	6,822	3,796	55.6
Seasonal	7,292	3,796	52.1

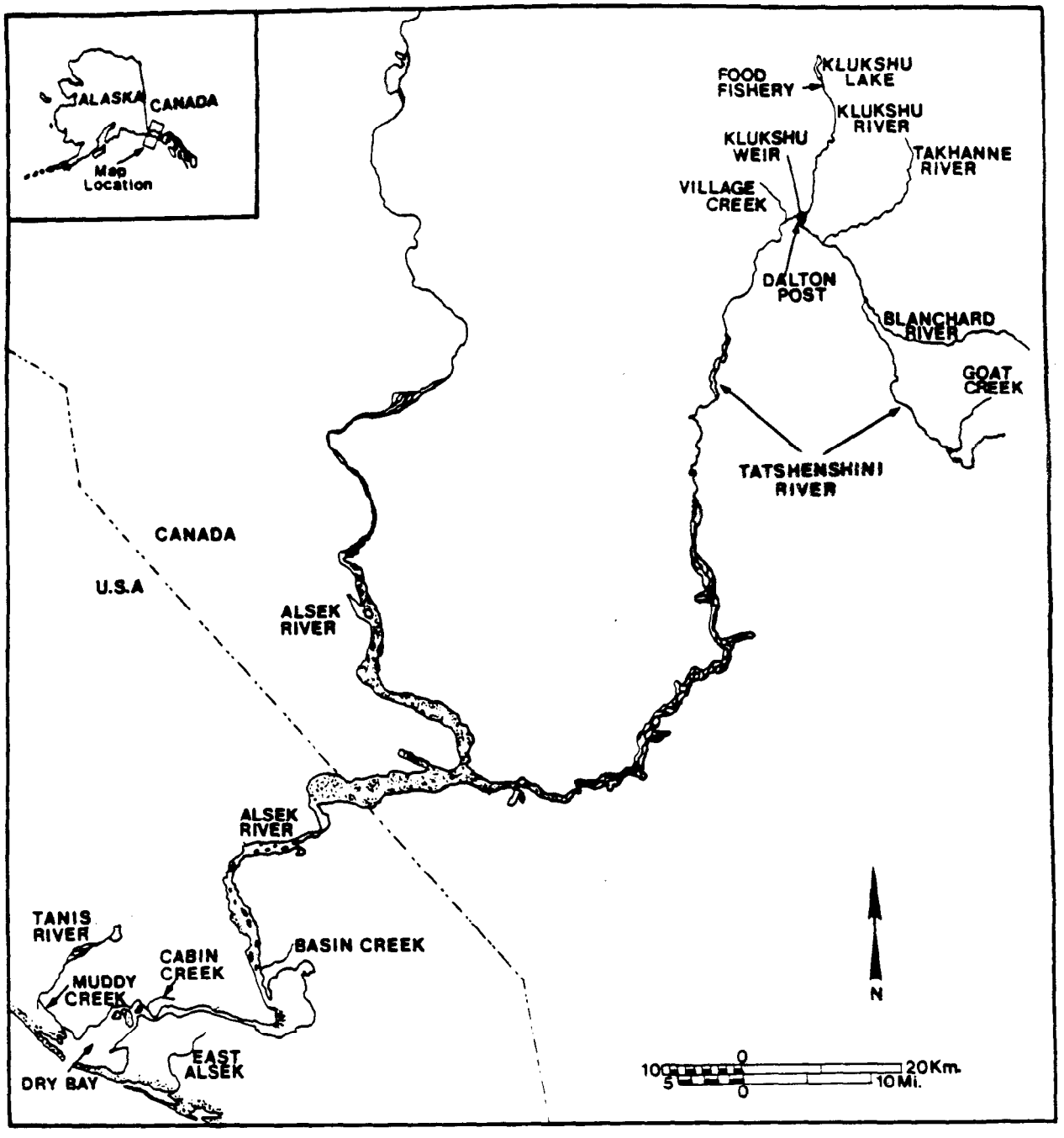


Figure 5. Alsek River drainage.

Table 10. Peak escapement counts of chinook salmon for tributaries of the Alsek River, 1960-1988[1].

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[2]
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 (H)	85 (H)	3,719
1988	-	-	2,018 (W)	437 (H)	169 (H)	54 (H)	2,678[3]

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

[1] = Escapement counts prior to 1975 may not be comparable due to differences in survey dates and counting methods
[2] = Aerial surveys of Blanchard, Takhanne, and Goat Creek by CDFO in 1984
[3] = Jacks included in total Klukshu River weir count in 1988

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 21 through October 28, 1988. 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. Minnow trapping on the Klukshu River near the confluence of Vand Creek was discontinued after a short time due to low trap catches. One of the objectives of this study was to evaluate the relative efficiency of inclined plane traps (IPT) in capturing downstream migrating juvenile chinook salmon in the lower Klukshu River. Unfortunately, these traps were not available from CDFO until well after the study was initiated. In addition, minnow trap catches proved to be adequate in capturing sufficient numbers of juvenile chinook salmon.

A total of 16,631 YOY chinook salmon were captured and coded-wire tagged during the study period (Table 11). Adjusting for an estimated tag loss percentage of 1.3% (derived from the tagged to untagged ratio of recaptured, adipose-clipped fish) a total of 16,148 YOY chinook salmon with valid tags were released. Fork lengths were taken from a sample of 530 YOY chinook salmon. These YOY chinook salmon averaged 64.4 mm fork length (range = 48 mm to 88 mm; n = 529; 95% CI = 63.9 mm to 65.0 mm).

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 in shallow, braided, riffle areas with low current velocities. This pattern of habitat utilization by juvenile chinook salmon has been observed during previous tagging studies conducted on the Stikine, Taku, Unuk, Chickamin, and Chilkat Rivers (Kissner 1973-1980, 1982, 1984).

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.

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 heavily glaciated area of northern British Columbia and flows for 129 km t 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 6). 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

Table 11. Summary of trapping and coded-wire tagging of juvenile chinook salmon on the Alsek River from September 21 to October 28, 1989.

Date	Traps Checked	Number Tagged	Number Recap.	Tags Retained	Tag Code	Mean Length (mm)	Sample Size
09/21	12						
09/22	42						
09/23	53	2,125			4-29-29		
09/24	0	541			4-29-29	63.4	150
09/25	19						
09/26	19						
09/27	1						
09/28	39						
09/29	46	1,438	30	30	4-29-29		
09/30	57	1,212	53	52	4-29-29		
10/01	0						
10/02	44						
10/03	50						
10/04	25	1,745	26	26	4-29-29		
10/05	10						
10/06	44						
10/07	62						
10/08	64	412	45	45	4-29-29	65.4	128
10/09	65	1,364	101	99	4-29-29		
10/10	66						
10/11	55	1,519	60	59	4-29-30		
10/12	87	1,208					
10/13	80	1,016	60	60	4-29-30		
10/14	0	775	60	59	4-29-30		
10/15	14						
10/16	80						
10/17	11						
10/18	39						
10/19	0						
10/20	64	700	56	56	4-29-30	65.9	103
10/21	48						
10/22	88						
10/23	0	1,455	116	112	4-29-30		
10/24	0						
10/25	65						
10/26	33						
10/27	23						
10/28	17	851	92	92	4-29-30	63.6	148
Totals	1,422	16,361	699	690		64.6	529

Overall Statistics:
Catch/trap 11.5
Tag Retent. 98.7%
Mean Length 64.6
Range = 48 mm to 88 mm
Standard Error = 0.503

Valid Tags Released: (4-29-29) = 8,722
(4-29-30) = 7,426

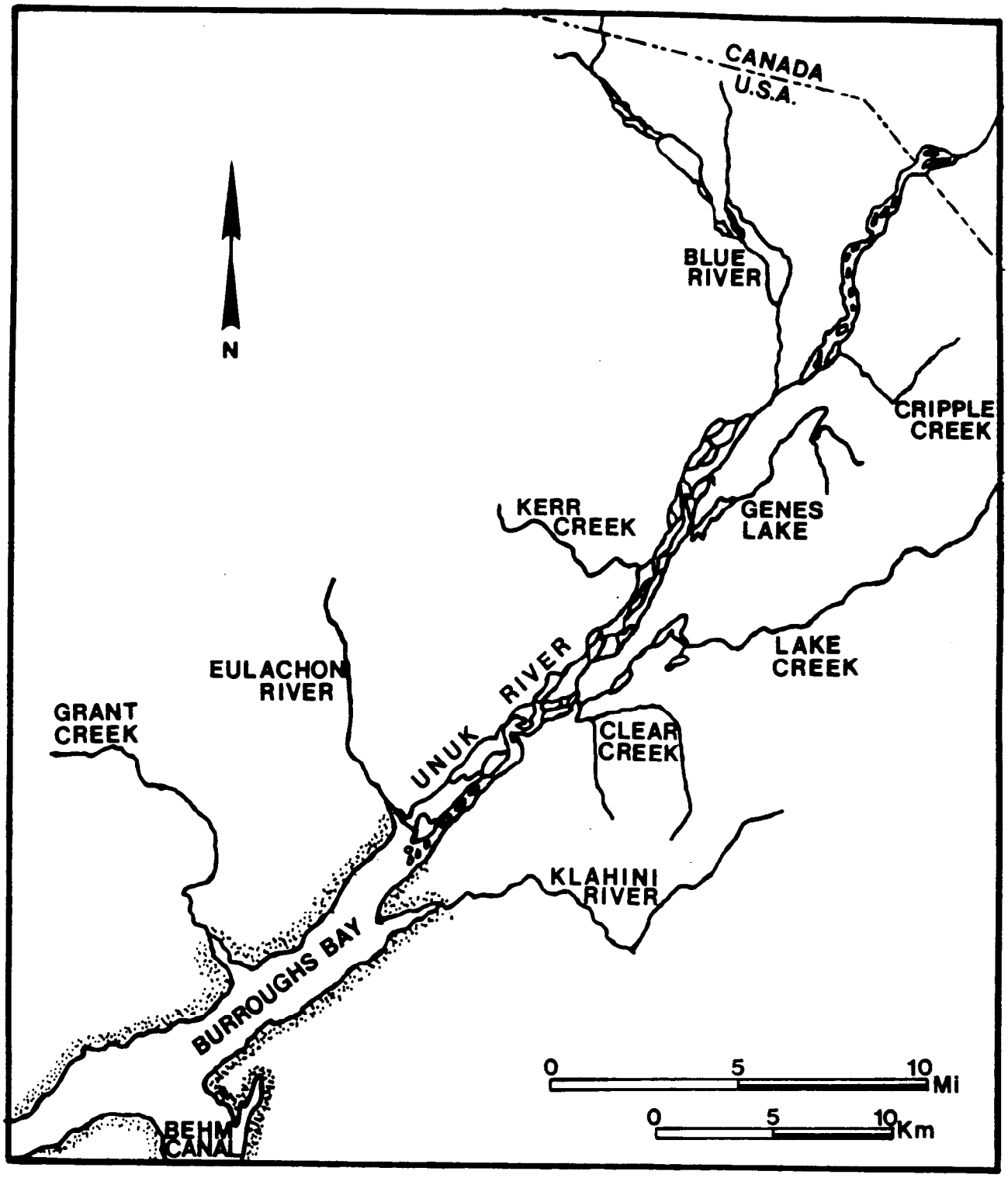


Figure 6. Unuk River drainage.

foot or helicopter surveys near the peak of spawning activity. In 1988, 1,746 age 1.3 and 1.4 chinook salmon were observed in index areas of the Unuk River (Table 12). This escapement was 34% above the previous 10-year average and approximately 97% of the management escapement goal of 1,800 chinook salmon. The 1988 escapement was 12% and 18% below the 1987 and 1986 escapements, respectively. The spawning distribution of chinook salmon in the different Unuk River index tributaries changed considerably in 1988 compared to previous years (Table 13). Escapements were much lower than average in the Eulachon River and Genes Lake Creek and higher than average in Cripple Creek and Clear Creek. Escapements to Genes Lake Creek represented only 9% of the 1988 total escapement compared to an average of 26%. The reasons for this change in spawner distribution are not known but survey conditions were poorer in 1988 than in recent years due to extremely high and turbid water conditions and the overall accuracy of the 1988 counts may have been lower relative to recent years.

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 (Tables 14 and 15). 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 (Table 16) during March and April which is similar to that observed for other transboundary rivers (Kissner 1982; Hubbartt 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. During the fall of 1982, YOY chinook salmon were captured in the same areas as during the spring but the highest fish densities were observed in areas with water depths less than 1 m in mainstem braided areas near large organic debris.

Recovery of Adult Coded-Wire Tagged Chinook Salmon:

Through 1988, 120 fishery (unexpanded for fishery sampling and tagging ratios) and 71 spawning ground recoveries of coded-wire tagged chinook salmon were made. (Appendix Table 2). Expansion of fishery and spawning ground recoveries by the appropriate sampling fraction indicates that approximately 203 fishery and 424 spawning ground recoveries would have occurred at a 100% sampling rate, a 32.4% overall exploitation of the 1982, 1983, and 1984 brood years (Table 17). Further expansion of the estimated fishery recoveries by the tagging fraction results in an estimated contribution of 3,765 age 1.2, 1.3, and 1.4 chinook salmon from the 1982 brood year and 2,461 age 1.1, 1.2, and 1.3 chinook salmon from the 1983 brood year.

Table 12. Peak escapement counts of chinook salmon to index tributaries of the Unuk River, 1960-1988.[1]

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

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

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

Table 13. Percentages of total escapements of chinook salmon to tributaries of of the Unuk River during years when all index tributaries were surveyed.

Year	Cripple Creek	%	Genes Lake Creek	%	Eulachon River	%	Clear Creek	%	Lake Creek	%	Kerr Creek	%	Total
1978	394	36	374	34	218	20	85	8	20	2	15	1	1,107
1979	363	63	101	18	48	8	14	2	30	5	20	3	577
1980	748	74	122	12	95	9	28	3	5	0	18	2	1,017
1981	324	44	112	15	196	27	54	7	20	3	25	3	732
1982	538	40	329	24	384	28	24	2	48	4	28	2	1,352
1983	459	41	338	30	288	26	24	2	12	1	4	0	1,126
1984	644	35	647	35	350	19	113	6	32	2	51	3	1,838
1985	284	24	553	47	275	23	37	3	22	2	13	1	1,185
1986	532	25	838	39	486	23	183	9	25	1	62	3	2,127
1987	860	44	398	20	520	26	107	5	37	2	51	3	1,974
1988	1068	61	154	9	146	8	292	17	60	3	26	1	1,747
Mean	565	44	361	26	273	20	87	6	28	2	28	2	1,344

Table 14. 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[1]	20,531	42,475				

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

Table 15. Summary of trapping and coded wire-tagging of juvenile chinook salmon on the Unuk River from March 15 to April 30, 1988.

Date	Traps Checked	Number Tagged	Number Recaps	Tags Retained	Tag Code	Mean Length	Sample Size
03/26	55	-	-	-			
03/27	73	-	-	-			
03/28	0	1,151	-	-	4-29-33		
03/29	82	-	-	-			
03/30	0	628	-	-	4-29-33	69.8	109
03/31	54	-	-	-			
04/01	0	-	-	-			
04/02	17	292	-	-	4-29-33		
04/03	69	-	-	-			
04/04	74	391	2	2	4-29-33		
04/05	79	303	1	1	4-29-33		
04/06	78	461	7	7	4-29-33		
04/07	79	383	1	1	4-29-33		
04/08	91	951	11	11	4-29-33		
04/09	83	384	2	2	4-29-33		
04/10	37	518	6	6	4-29-33		
04/11	68	-	-	-			
04/12	80	746	4	4	4-29-33		
04/13	73	1,320	13	13	4-29-33	70.3	101
04/14	67	-	-	-			
04/15	87	1,585	31	31	4-29-33		
04/16	19	-	-	-			
04/17	67	-	-	-			
04/18	57	970	19	19	4-29-33	69.0	113
04/19	54	940	4	4	4-29-40		
04/20	26	-	-	-			
04/21	13	-	-	-			
04/22	52	-	-	-			
04/23	42	-	-	-			
04/24	34	460	16	16	4-29-40	69.4	100
Totals	1,610	11,483	117	117		69.6	423

Overall Statistics:
Catch/Trap = 7.1
Tag Retention = 100%
Mean Length = 66.9
Range = 52mm to 91mm
STDERR = 0.255

Valid Tags Released:
(4-29-33) = 10,083
(4-29-40) = 1,400

Table 16. Mean fork length (mm) of juvenile chinook salmon sampled from the Unuk River from the 1977 and 1981-1986 brood years.

Brood Year	October		November		December		March		April		May	
	n	mean	n	mean	n	mean	n	mean	n	mean	n	mean
1977					50	64.7						
1981					246	68.2						
1982	200	63.8	300	63.8					650	67.4		
1983							203	68.3	450	69.0	50	71.6
1984							200	65.8	200	66.2		
1985									541	66.3	100	70.5
1986							109	69.8	314	69.5		

Table 17. Recoveries, exploitation rates, and fishery contributions of wild Unuk River chinook salmon from the 1982 through 1984 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							
				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							
1990	1.4							

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 (see Figure 8 for location of fishing districts). 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 18). 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 with the majority of the harvest occurring in the southern inside area (districts 101, 102, and 150).

Four age 1.2 chinook salmon coded-wire tagged and released in the Unuk River in 1983 were recovered in Districts 101 and 102 in an experimental troll fishery conducted in the Ketchikan area during the spring of 1986. Examination of the reproductive tracts of these fish indicated that they were immature "feeders" and not mature jacks returning to spawn in the Unuk River. A chinook salmon captured on troll gear, and externally tagged with a Peterson disc tag in the vicinity of Ketchikan in the 1950's was recovered on the spawning grounds in the Unuk River one year after tagging indicating that this fish was also immature and rearing in the local area. In addition, a chinook salmon tagged at Foggy Point (District 101 near Cape Fox) by NMFS researchers during a study of ocean migration patterns of juvenile chinook salmon (Orsi 1988) was subsequently recovered on the Unuk River spawning grounds at Cripple Creek 554 days later. These recoveries indicate that a portion of Unuk River chinook salmon rear in marine waters in the general vicinity of the Unuk River. 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. Observed harvest rates of 32.9% and 33.6% 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). 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 9). Important tributaries for spawning chinook salmon are the South Fork of the Chickamin and Barrier, Butler, Indian, Leduc, Humpy, King, and Clear Falls Creeks.

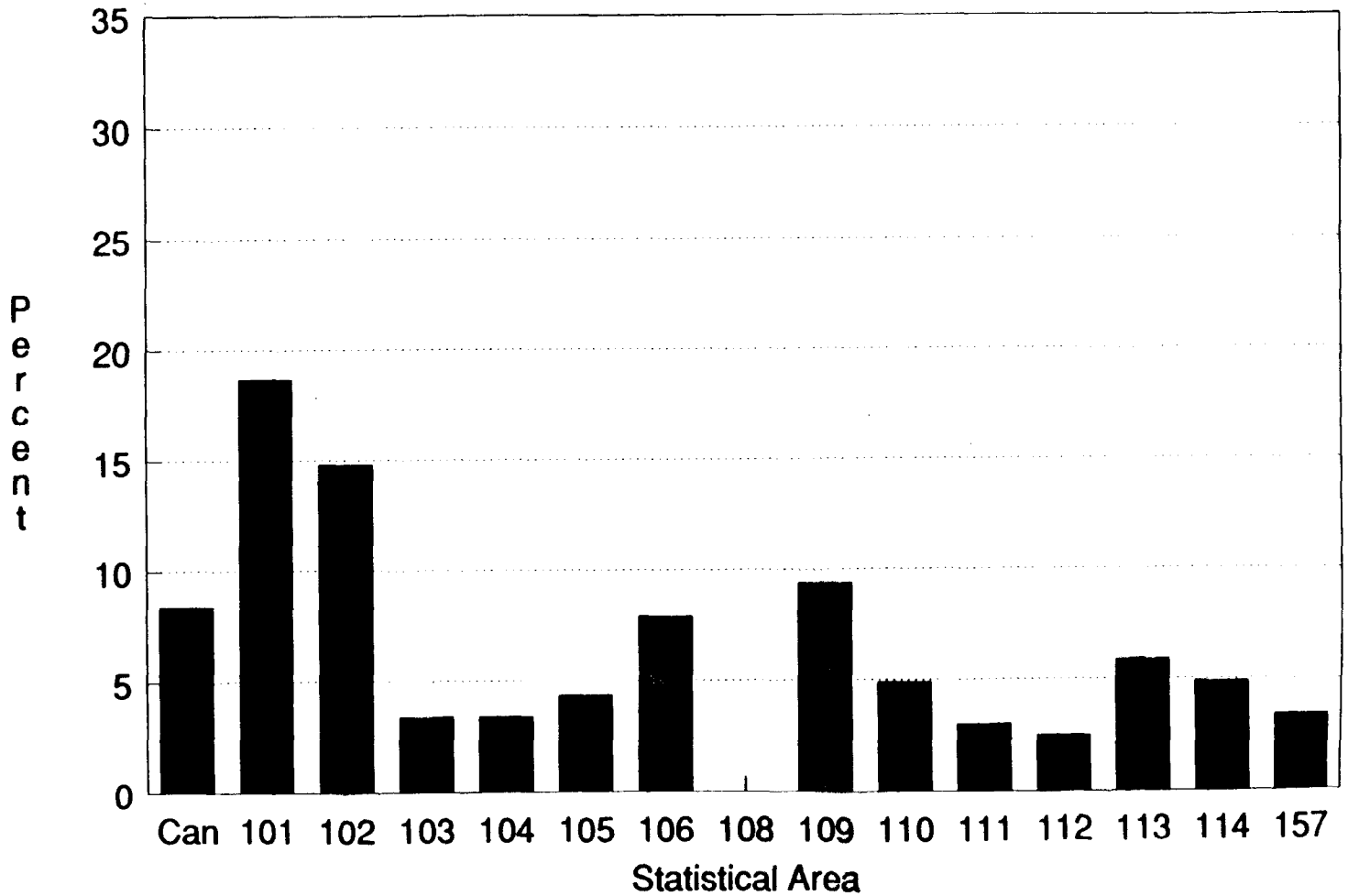


Figure 7. Distribution of the harvest of wild Unuk River chinook salmon (percent of harvest by statistical area)

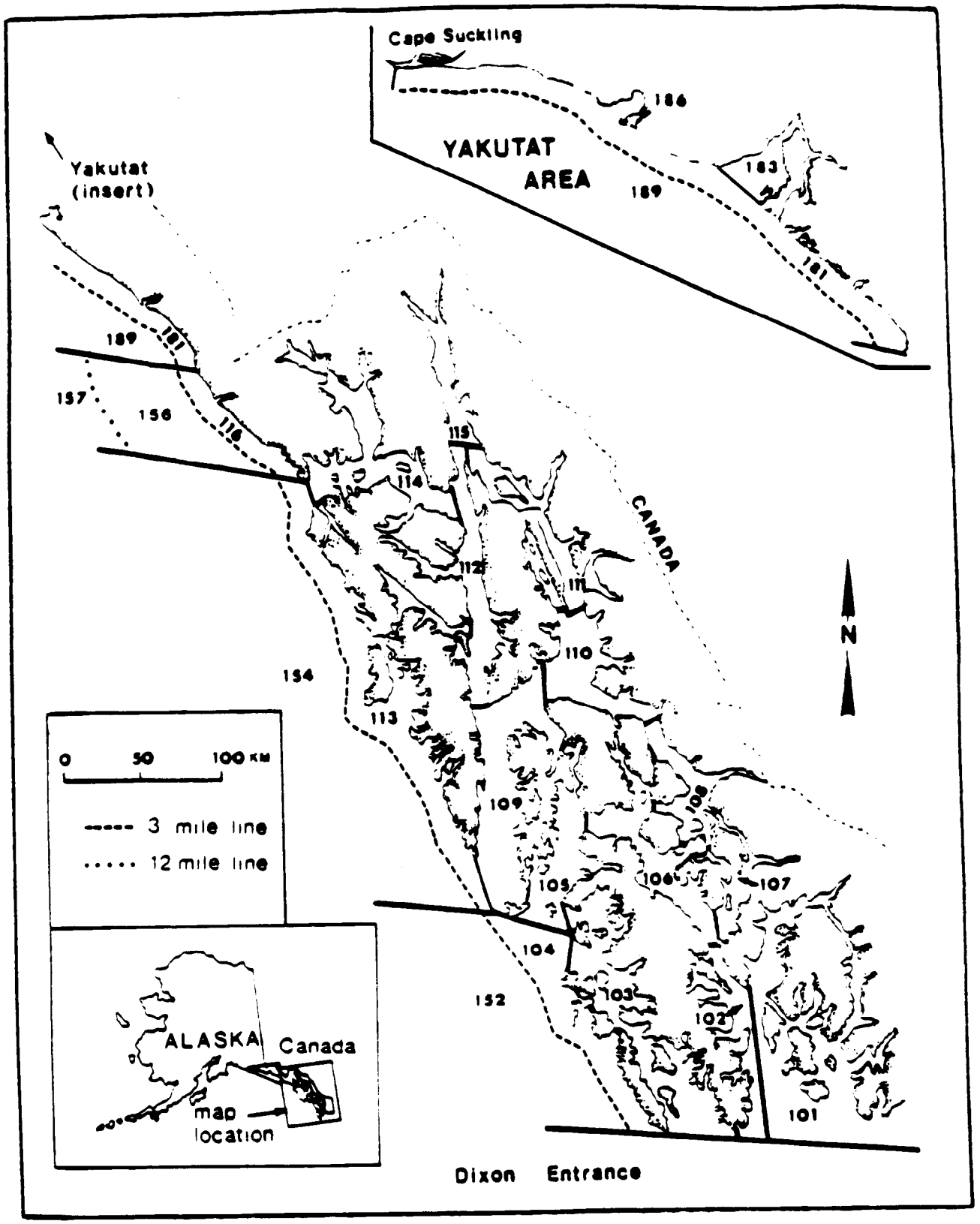


Figure 8. Location of commercial fishing districts in southeast Alaska.

Table 18. Percent distribution of harvest (expanded recoveries) by fishing district, of wild[1] (all gear) and hatchery[2] (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	38	34	25	31	39	1
103,104	10	11	11	6	15	2
105,109,110	21	14	24	23	10	62
106,107,108	9	19	7	7	3	0
111	3	0	0	1	0	0
112,114	8	10	8	16	9	18
113,154	7	10	22	12	19	12
116	4	2	4	4	5	3
Total Catch[3]	203	11,898	3,945	1,679	2,009	10,021

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

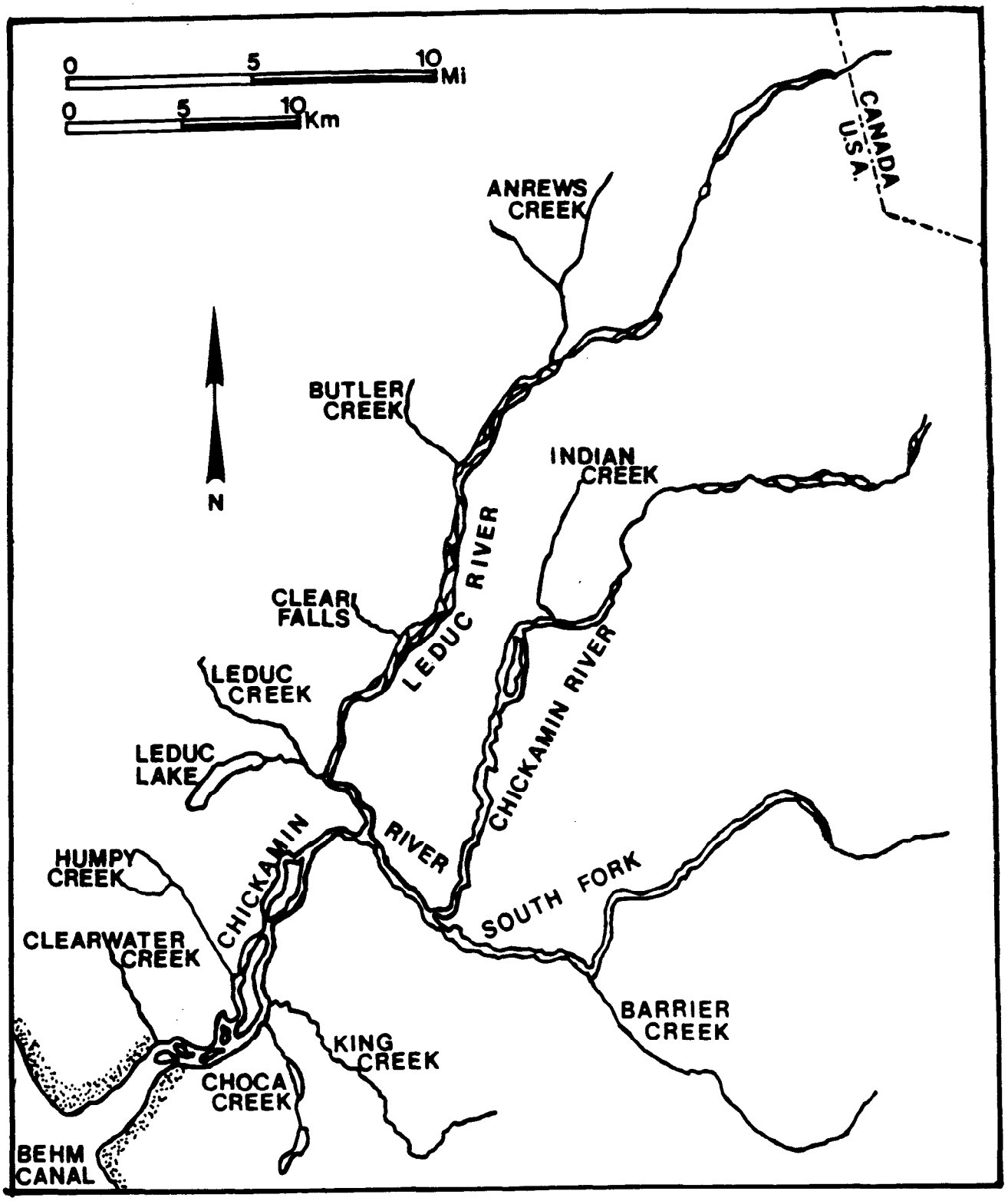


Figure 9. Chickamin River drainage.

Escapement:

Chinook salmon have been enumerated by foot or helicopter surveys in index tributaries of the Chickamin River each year since 1977. The 1988 observed escapement of 786 age 1.3 and 1.4 chinook salmon was 15% above the previous 10-year average and 87% of the management escapement goal of 900 age 1.3 and 1.4 chinook salmon. However, escapements in 1988 were the lowest observed since 1983 and were 19% and 53% below escapements observed in 1987 and 1986, respectively (Table 19). Escapements to Barrier and King Creeks were below average and above average in the South Fork of the Chickamin and Butler Creek (Table 20).

Coded-Wire Tagging of Juvenile Chinook Salmon:

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 (Tables 21 and 22). Comparative size of juvenile chinook salmon by brood year is summarized in Table 23. 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 and Hubbartt 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.

Coded-Wire Tag Recovery:

Through 1988, 113 fishery recoveries (unexpanded) and 11 spawning ground recoveries (unexpanded) of coded-wire tagged Chickamin River chinook salmon have been obtained (Appendix Table 3). Expansion of the fishery recoveries by the appropriate fishery sampling rates results in an estimate of 186 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 24). An additional 531 chinook salmon were harvested from the 1983 brood year (age 1.2).

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 10). 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 25). In contrast, the distribution of wild Unuk and Chickamin River chinook salmon is very different from the harvest distribution of Unuk and Chickamin River stock transplanted to the Little Port Walter Hatchery on Baranof Island.

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

Table 19. Peak escapement counts of chinook salmon for tributaries of the Chickamin River, 1960-1988.[1]

Year	South Fork Creek	Barrier Creek	Butler Creek	Leduc Creek	Indian Creek	Humpy Creek	King Creek	Clear Falls	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

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

[1] Escapement counts conducted prior to 1975 may not be comparable due to differences in survey dates and methods

Table 20. Percentages of total escapements of chinook salmon to tributaries of the Chickamin River for years when all index tributaries were surveyed.

Year	South Fork Creek	%	Barrier Creek	%	Butler Creek	%	Leduc Creek	%	Indian Creek	%	Humpy Creek	%	King Creek	%	Clear Falls	%	Total
1981	51	13	105	27	51	13	25	7	12	3	4	1	105	27	31	8	384
1982	84	15	149	26	37	6	36	6	30	5	37	6	165	29	33	6	571
1984	185	17	171	16	124	11	15	1	103	9	88	8	388	35	28	3	1,102
1985	136	14	156	16	93	10	8	1	125	13	50	5	377	39	12	1	957
1987	261	27	76	8	120	12	19	2	115	12	26	3	310	32	48	5	975
1988	280	36	82	10	159	20	25	3	32	4	19	2	164	21	25	3	786
Average	166	20	123	17	97	12	21	3	70	8	37	4	252	31	30	4	796

Table 21. 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[1]				

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

Table 22. Summary of trapping and coded wire-tagging of juvenile chinook salmon on the Chickamin River from March 15 to April 30, 1988.

Date	Traps Checked	Number Tagged	Number Recaps	Tags Retained	Tag Code	Mean Length (mm)	Sample Size
03/19	29	-	-	-			
03/20	49	-	-	-			
03/21	49	-	-	-			
03/22	41	1,079	0	0	4-29-38	69.8	101
03/23	37	-	-	-			
03/24	64	-	-	-			
03/25	59	-	-	-			
03/26	57	1,370	6	6	4-29-38		
03/27	51	-	-	-			
03/28	71	-	-	-			
03/29	68	-	-	-			
03/30	61	1,385	62	62	4-29-38	71.0	114
03/31	65	-	-	-			
04/01	34	-	-	-			
04/02	29	-	-	-			
04/03	0	645	25	24	4-29-38		
04/04	48	-	-	-			
04/05	75	-	-	-			
04/06	75	-	-	-			
04/07	76	-	-	-			
04/08	0	1,001	65	65	4-29-38	66.6	106
04/09	74	-	-	-			
04/10	69	-	-	-			
04/11	58	-	-	-			
04/12	91	-	-	-			
04/13	0	914	73	73	4-29-38		
04/14	91	-	-	-			
04/15	91	-	-	-			
04/16	79	-	-	-			
04/17	91	-	-	-			
04/18	0	776	50	50	4-29-38	67.1	111
04/19	91	-	-	-			
04/20	90	-	-	-			
04/21	89	-	-	-			
04/22	88	-	-	-			
04/23	88	962	65	65	4-29-38		
04/24	88	-	-	-			
04/25	88	409	57	57	4-29-38		
04/25	88	204	11	11	4-29-39	68.8	110
Totals	2,392	8,745	414	413		68.7	542

Overall Statistics:
Catch per trap = 3.7
Tag Retention = 99.8%
Mean Length = 72.5
Range = 56 mm to 91 mm (STDERR = 0.237)

Valid Tags Released:
(4-29-38) = 8,524
(4-29-39) = 204

Table 23. Mean fork length (mm) of juvenile chinook salmon sampled on the Chickamin River from the 1981 through 1986 brood years.

Brood Year	December		March		April		May	
	n	mean	n	mean	n	mean	n	mean
1981	205	67.1			115	68.6		
1982			199	68.8	100	72.1		
1983			156	77.0	440	77.1	106	80.7
1984			199	64.7	201	67.3		
1985			200	71.2	505	72.5	102	74.8
1986			215	70.4	327	67.5		

Table 24. 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
				1981 Brood				
1984	1.1	0						
1985	1.2	16	29	1				
1986	1.3	10	25					
1987	1.4	1	2					
				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
				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							
				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							
1990	1.4							
				1985 Brood				
1987	1.1	1	5					
1988	1.2							
1989	1.3							

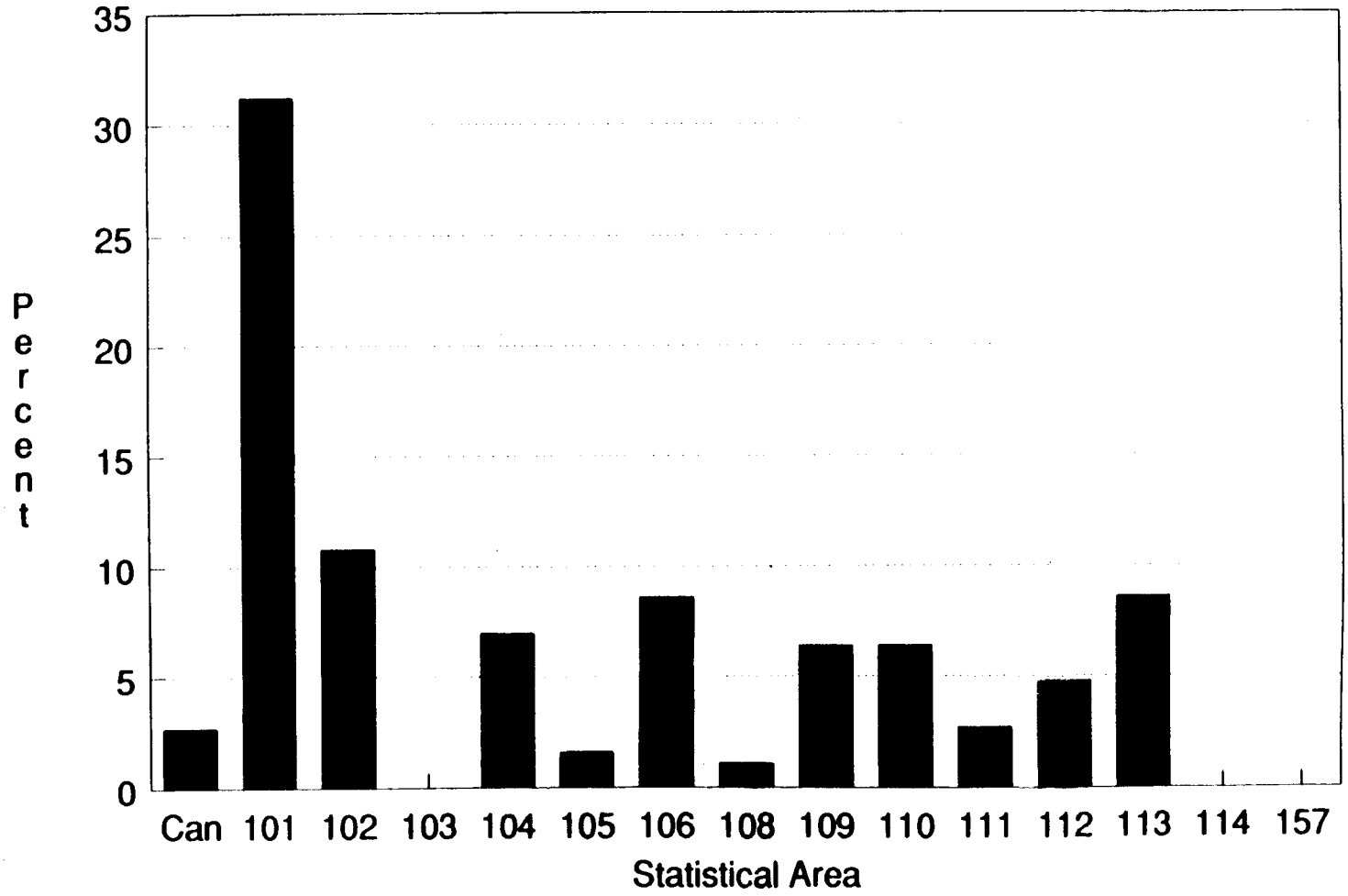


Figure 10. Distribution of the harvest of wild Chickamin River chinook salmon (percent of harvest by statistical area).

Table 25. Percent distribution of harvest (expanded recoveries) by fishing district of wild (all gear) and hatchery (commercial troll only) Chickamin River salmon.[1]

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

[1] Excludes Canadian harvest. Preliminary data.

in the immediate vicinity of their natal stream throughout their marine life history.

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.

Chilkat River Studies

The Chilkat River (Figure 11) originates in the Yukon Territories, Canada and flows into northern Lynn Canal near Haines, Alaska. Lynn Canal is bounded by the U.S.-Canadian border to the north and west and the Takhinsha Mountains and the ice fields of Glacier Bay National Park to the south. This large, glacial river flows through a broad flood plain, forming numerous, braided stream channels, gravel bars and islands covered with dense stands of willow and cottonwood (Mills et al. 1983). The transboundary Chilkat River supports large runs of sockeye, chum, and coho salmon and moderate runs of chinook salmon that are very important to local recreational and subsistence fisheries as well as commercial drift gillnet fisheries.

Escapement:

Most Chilkat River chinook salmon spawn in Big Boulder and Stonehouse Creeks and in the glacial Kelsall and Tahini Rivers. Big Boulder and Stonehouse Creeks are clearwater streams that are used to index escapements to the entire drainage. Escapements of chinook salmon to the Chilkat River have declined in recent years (Table 26). The 1988 observed escapement of 175 age 1.3 and 1.4 chinook salmon in Big Boulder and Stonehouse Creeks was 85% of the previous 7-year average and only 39% of the management escapement goal of 450 age 1.3 and 1.4 chinook salmon in both index tributaries. The 1988 escapement increased compared to 1985 and 1986 when 120 and 29 chinook salmon were observed, respectively, but was 39% less than the 1988 escapement of 288 chinook salmon. The poor escapements of chinook salmon in recent years have occurred despite reductions in fishing time and area imposed on the Chilkat Inlet marine recreational fishery.

Coded-Wire Tagging of Juvenile Chinook Salmon:

Wild, juvenile chinook salmon were captured, adipose-clipped, coded-wire tagged and released in the Chilkat River from September 21 through November 28, 1988. The primary areas trapped were 1) the Tahini River from the confluence of the Flemer River downstream to the confluence of the Tahini and mainstem of the Chilkat River, 2) the Kelsall River from the confluence with the mainstem of the Chilkat River upstream approximately 5 km, 3) the Klehini River from the mouth upstream to the Wells Bridge crossing, and 4) the mainstem Chilkat River from the Tahini River confluence downstream to a point opposite mile 17 on the Haines Highway.

The average catch per trap-day was less than one chinook salmon in areas trapped in the Klehini and mainstem Chilkat Rivers and around two fish per trap-day on the Tahini River. These trap catches were much lower than those observed during previous fall trapping studies conducted on the Taku, Stikine, Unuk, Chickamin, and Alsek Rivers (Kissner and Hubbart 1987). In contrast, trap catches on the Kelsall River were much higher, averaging nearly 20 fish per trap-day. Because of the poor trapping success in other areas during the early part of the study, activities were concentrated on the Kelsall River for the remainder of the study period.

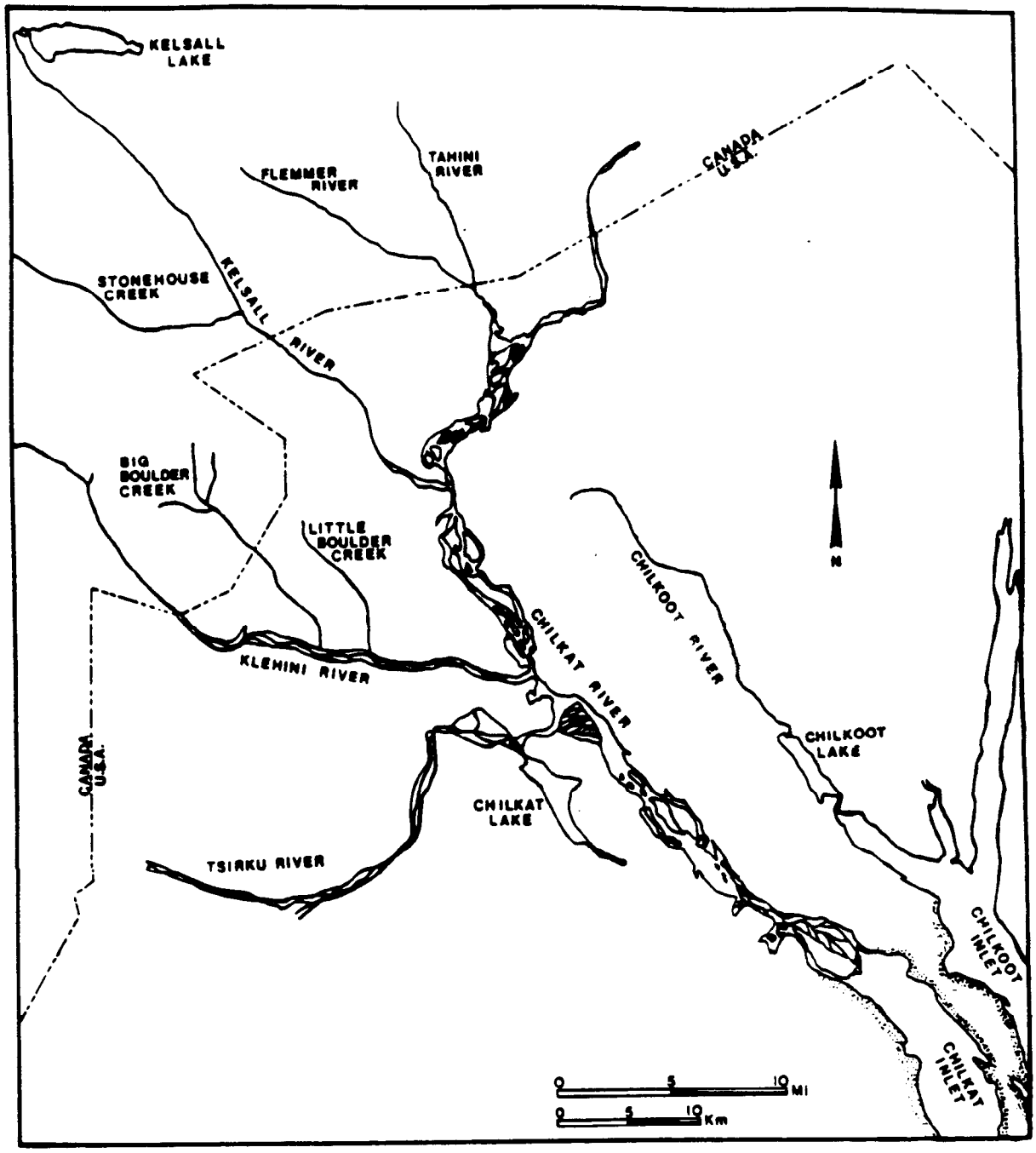


Figure 11. Chilkat River drainage.

Table 26. Peak escapement counts of chinook salmon for tributaries of the Chilkat River, from 1960-1988.[1]

Year	Big Boulder	Stonehouse Creek	Total
1960	316 (F)	-	316
1961	88 (F)	-	88
1962	-	-	-
1963	-	-	-
1964	-	-	-
1965	-	-	-
1966	330 (F)	-	330
1967	150 (F)	-	150
1968	259 (F)	-	259
1969	-	-	-
1970	176 (F)	-	176
1971	56 (F)	-	56
1972	-	-	-
1973	-	-	-
1974	0 (F)	-	0
1975	21 (F)	-	21
1976	25 (F)	-	25
1977	25 (F)	-	25
1978	-	-	-
1979	-	-	-
1980	-	-	-
1981	187 (H/F)	69 (H)	256
1982	56 (H/F)	123 (H)	179
1983	121 (H/F)	126 (H)	247
1984	229 (H/F)	104 (H)	333
1985	70 (H/F)	50 (H)	120
1986	20 (F)	9 (H)	29
1987	98 (F)	190 (H)	288
1988	86 (F)	89 (H)	175

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

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

During the first week of October, high river flows resulted in over a 50% reduction in minnow trap CPUE in the Kelsall River. Trap catches continued to decline through the rest of October perhaps due to downstream migration of juvenile chinook salmon from the Kelsall River to mainstem areas of the Chilkat River. This behavior has been observed during fall coded-wire tagging studies on other large transboundary rivers (Kissner 1979 and 1982).

During the study period, 4,553 YOY chinook salmon were coded-wire tagged and released (Table 27). An additional 2,076 YOY were captured but were lost when floodwaters overturned one of the fish holding pens in the Tahini River. Tag retention was estimated at 100% based on recaptures of 65 previously tagged chinook salmon YOY and a sample of 157 YOY held for 24 hours. Juvenile chinook salmon from the Chilkat River captured during the study period averaged 72.9 mm (range = 64 mm to 88 mm; n = 330; 95% CI = 72.2 mm to 73.6 mm). In comparison, pre-smolt chinook salmon captured on the Unuk and Chickamin Rivers from 1983 to 1987 averaged less than 70 mm. On the Alsek River, YOY chinook salmon averaged less than 65 mm fork length.

Except for the Kelsall River, there appears to be a lack of high quality rearing habitat for juvenile chinook salmon in the Chilkat River drainage. The input of large organic debris is low compared to other large glacial rivers like the Taku, Stikine, and Unuk Rivers. In addition, most of the river is heavily silted and major shifts in river channels occur during periods of high water. Dolly Varden char and coho salmon were very abundant in trap catches in both the Tahini and Kelsall Rivers and predation and competition for food by these species may negatively impact juvenile chinook salmon in the Chilkat River.

Escapement Studies on Other Systems

The Blossom and Keta Rivers are non-transboundary rivers that flow into Behm Canal approximately 45 km east of Ketchikan, Alaska (Figure 12). These rivers lie within the boundaries of the Misty Fjords National Monument in an area known as Boca de Quadra that has received considerable attention in recent years due to the potential development of a large scale molybdenum mine (Quartz Hill) located near the divide of the Blossom and Keta Rivers. Chinook salmon escapements are monitored annually in the Blossom and Keta Rivers which are classified as medium producers of chinook salmon (annual escapements greater than 1,500 age 1.3 and 1.4 fish).

The King Salmon River drains an area of approximately 100 km^2 on Admiralty Island flowing into King Salmon Bay in the eastern portion of Stephens Passage approximately 48 km south of Juneau, Alaska (Figure 13). The King Salmon River is classified as a minor producer of chinook salmon (annual escapements <1,500) and is the only island river system in southeast Alaska that supports a significant (>100 chinook salmon per year) population of spawning chinook salmon. Escapement counts in the King Salmon River are used to index escapements to the other 22 minor chinook salmon producing rivers in southeast Alaska. An upstream weir has been operated by the ADFG, FRED Division on the King Salmon River since 1983 to collect chinook salmon eggs for developing broodstock for the ADFG Snettisham Hatchery.

The Situk River is located approximately 16 km east of Yakutat, Alaska (Figure 14). The Situk River supports a large run of sockeye salmon which are harvested in a set gill net fishery concentrated at the mouth of the Situk River. The Situk River is classified as a medium producer of chinook salmon with annual escapements estimated to range from 1,500 to 10,000 adults. Situk River chinook salmon are harvested incidentally in the set gillnet fishery and in a popular

Table 27. Summary of trapping and coded wire-tagging of juvenile chinook salmon on the Chilkat River from September 21 through October 28, 1988.

Date	Traps Checked	Number Tagged	Number Recap.	Tags Retained	Tag Code	Mean Length (mm)	Sample Size
09/21	21						
09/22	44						
09/23	41						
09/24	30	219			4-27-17		
09/25	26	778			4-27-17		
09/26	35						
09/27	32						
09/28	38						
09/29	49						
09/30	0	1,641	38	38	4-27-17		
10/01	52						
10/02	64						
10/03	65						
10/04	16						
10/05	0						
10/06	0						
10/07	13						
10/08	16						
10/09	0						
10/10	0						
10/11	31						
10/12	39						
10/13	66						
10/14	51						
10/15	4	1,034	14	14	4-27-17	73.4	105
10/16	23						
10/17	24						
10/18	39						
10/19	0						
10/20	39	496	7	7	4-27-17	73.7	125
10/21	40						
10/22	67						
10/23	67						
10/24	36						
10/25	9	385	6	6	4-27-17	71.4	100
10/26	11						
10/27	33						
10/28	39						
Totals	1,160	4,553	65	65			330

Overall Statistics:
Catch/Trap = 3.9
Tag Retention = 100%
Mean Length = 72.9
Range = 55mm to 100 mm
STDERR = 0.359

Valid Tags Released:
(4-27-17) = 4,553

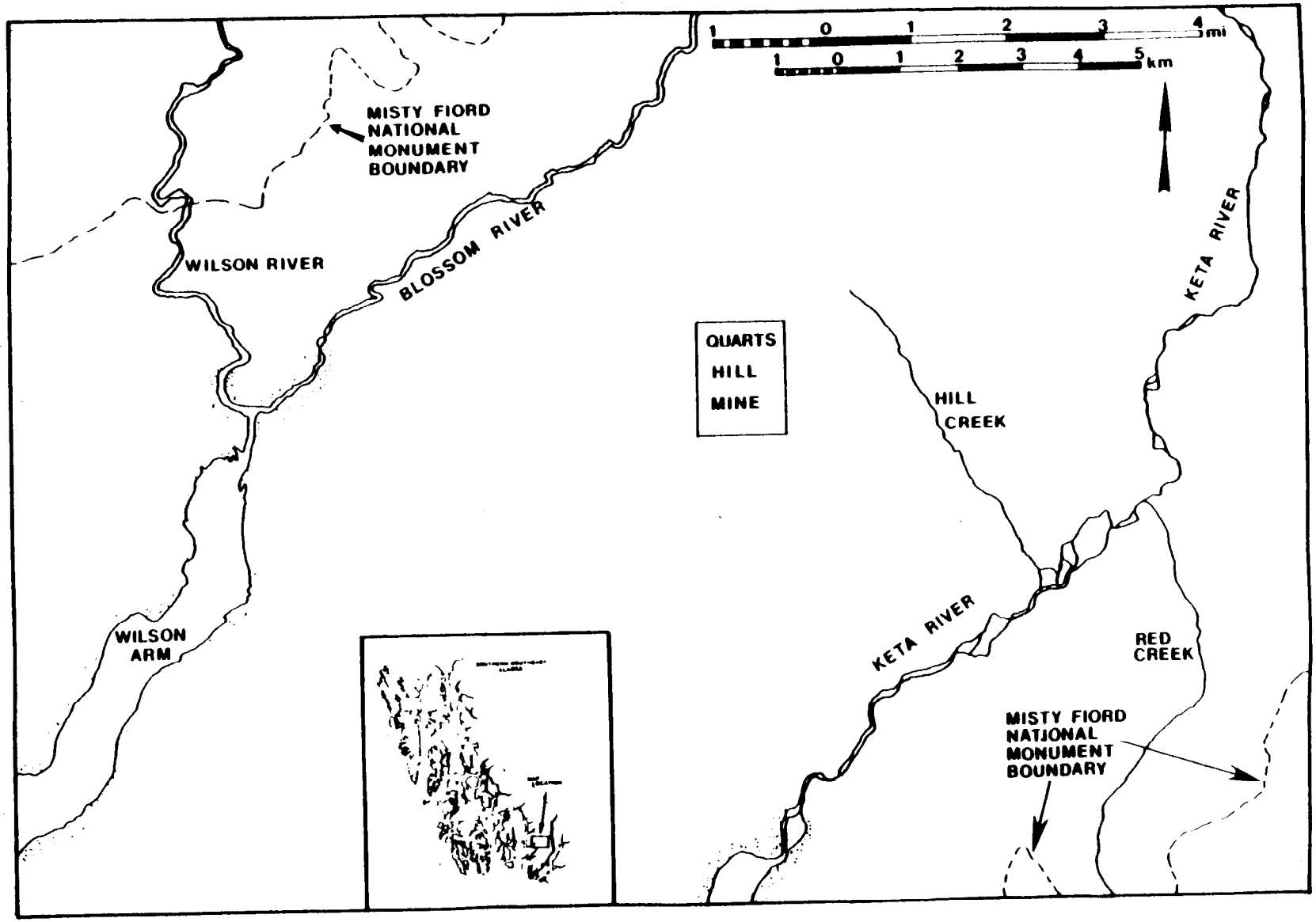


Figure 12. Blossom and Keta River drainages.

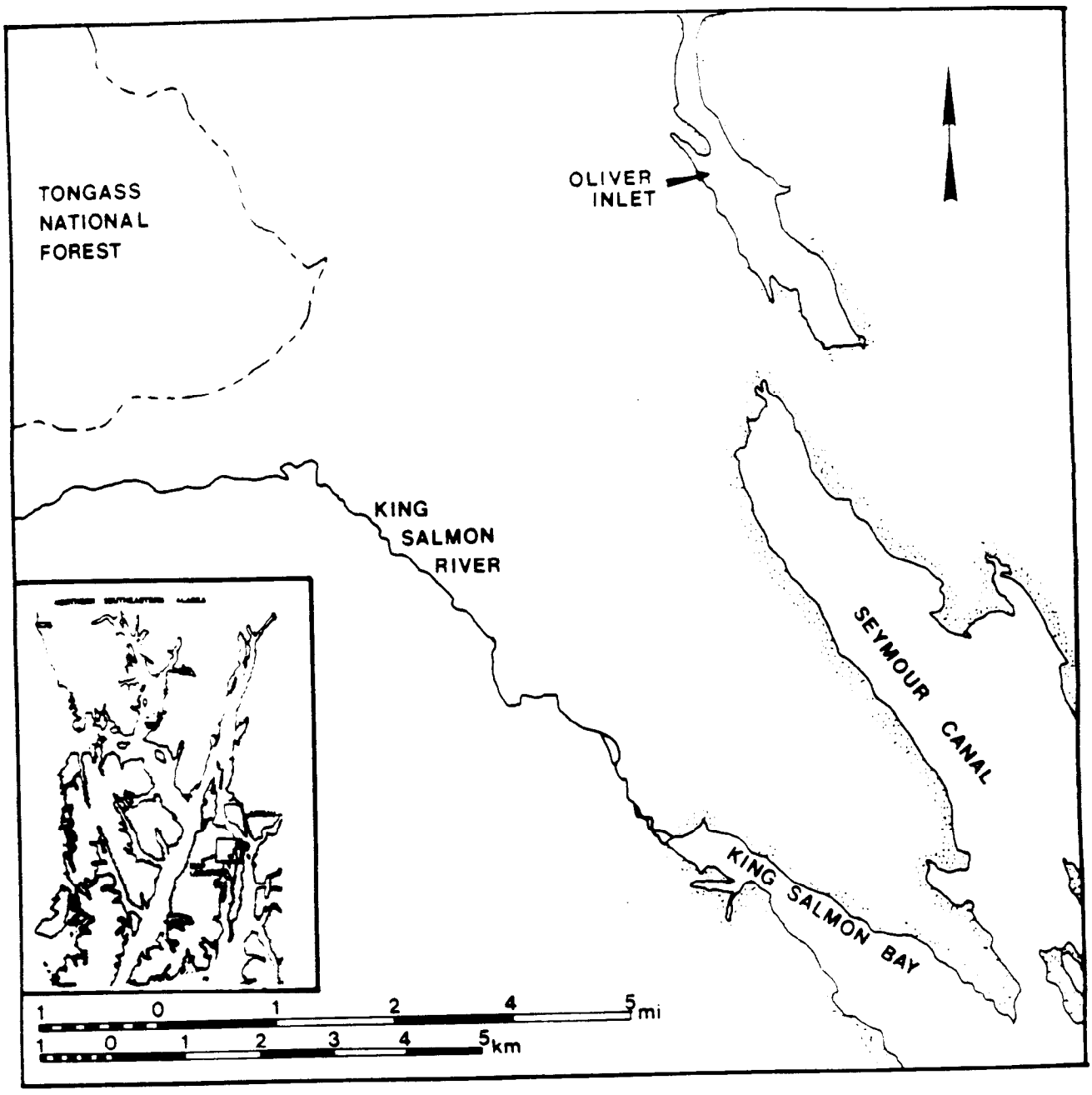
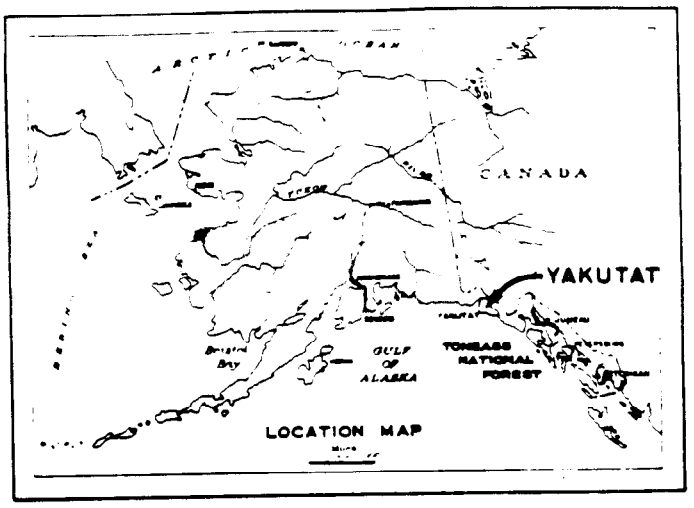


Figure 13. King Salmon River drainage.



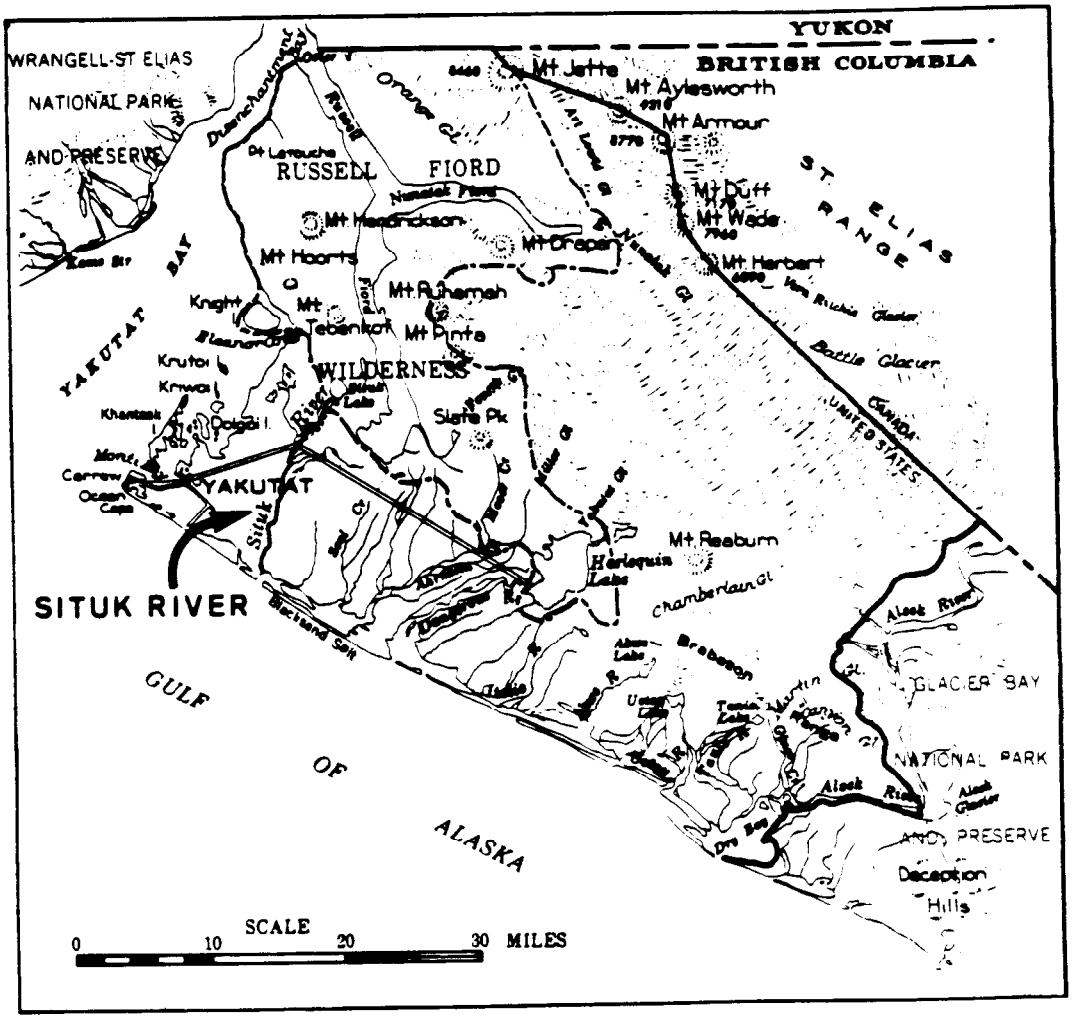


Figure 14. Situk River drainage.

sport fishery in the lower river. A weir was operated on the Situk River at the upper limit of the inter-tidal area from 1928 to 1955 to enumerate all five species of Pacific salmon spawning in the river. Since 1976, a weir has been operated further upstream near the 9-mile road bridge, primarily to enumerate chinook and sockeye salmon.

Escapement Counts:

Chinook salmon escapements to the Blossom and Keta Rivers declined significantly in 1988 compared to 1987 (Table 28). The peak escapement of 384 age 1.3 and 1.4 adult chinook salmon to the Blossom River in 1988 was 72% less than in 1987 and 70% less than in 1986 when 1,349 and 1,278 adult chinook salmon were observed, respectively. The 1988 escapement of chinook salmon to the Blossom River was 52% below the management escapement goal of 800 fish (observed). In the Keta River, the 1988 peak escapement of 575 age 1.3 and 1.4 chinook salmon was 25% (-193) below 1987 and 17% (-115) less than in 1986. However, the Keta River escapement goal of 500 adult chinook salmon (observed) was still achieved. Escapements to Grant Creek and the Wilson River were not estimated in 1988.

The 1988 weir count of 231 age 1.3 and 1.4 chinook salmon to the King Salmon River was 12% above the 1987 escapement and 5% below the 1983 to 1987 average escapement (Table 29). Adding an additional 12 adult chinook salmon observed spawning below the weir results in an estimated total return of 243 adult chinook salmon; only 7 fish below the escapement goal of 250 fish.

Escapements of chinook salmon to the Situk River in 1988 declined to 885 age 1.3 and 1.4 chinook salmon (Table 30). The 1988 escapement was 53% less than in 1987, 43% below the previous 5-year average escapement, and only 44% of the management escapement goal of 2,000 large chinook salmon.

CONCLUSIONS AND RECOMMENDATIONS

Escapements

Although the total escapements of chinook salmon to southeast Alaska and transboundary rivers increased in 1988 compared to 1987, the increase was due primarily to increased escapements in the transboundary Stikine and Taku Rivers. Escapements in 8 of the 11 index systems decreased by an average of 33% in 1988 compared to 1987. The weakness in 1988 chinook salmon escapements generally occurred throughout the region but was most evident in the Unuk, Chickamin, Blossom, and Keta Rivers in southern Southeast Alaska.

The causes for the decline in escapements of chinook salmon to the more southerly systems is not known. However, some individuals have suggested that increased harvests in the 1987-1988 commercial winter troll fishery and experimental troll fisheries conducted in the Ketchikan area in the spring of 1988 may have been a contributing factor. It is known that Unuk and Chickamin River chinook salmon are harvested in the winter troll fishery, primarily in Frederick Sound (Districts 109 and 110) and to a lesser extent in the Sitka troll fishery. Furthermore, the 1987-1988 winter troll harvest of 60,400 chinook salmon was nearly twice the previous record harvest. Still, the contribution of these stocks to the winter troll and experimental troll fisheries in 1988 would not appear to be large enough to contribute to the decline in escapements.

A more likely cause may be decreased freshwater survival due to harsh conditions during the winter of 1985 which would have affected overwintering juveniles from the 1983 brood year. During spring trapping on the Unuk and Chickamin Rivers

Table 28. Peak escapement counts of chinook salmon for selected rivers in Behm Canal from 1948-1988.[1]

Year	Keta River	Blossom River	Wilson River	Marten River	Grant Creek	Klahini River	Total
1948	500 (F)	-	-	-	-	-	500
1949	-	-	-	-	-	-	-
1950	210 (F)	-	-	-	-	-	210
1951	120 (F)	-	-	-	-	-	120
1952	462 (F)	-	-	-	-	-	462
1953	156 (F)	-	-	-	-	-	156
1954	300 (A)	-	-	-	-	-	300
1955	1,000 (A)	-	-	-	-	-	1,000
1956	1,500 (A)	-	-	-	-	-	1,500
1957	500 (A)	-	-	-	-	-	500
1958	-	-	-	-	-	-	-
1959	-	-	-	-	-	-	-
1960	-	-	-	-	-	-	-
1961	44 (F)	68 (F)	-	22 (F)	40 (A)	-	174
1962	-	-	-	-	6 (A)	100 (A)	106
1963	-	450 (A)	375 (A)	-	15 (A)	-	840
1964	-	-	-	-	-	-	-
1965	-	-	50 (A)	43 (H)	-	-	93
1966	75 (A)	200 (A)	60 (A)	10 (A)	100 (A)	3 (A)	448
1967	86 (H)	-	8 (H)	7 (H)	15 (H)	-	116
1968	-	-	-	-	4 (H)	-	4
1969	200 (A)	-	10 (A)	10 (A)	69 (H)	3 (H)	292
1970	-	100 (H)	-	-	-	-	100
1971	-	-	-	-	-	-	-
1972	255 (A)	225 (A)	275 (A)	-	25 (A)	150 (A)	930
1973	-	-	30 (A)	-	38 (A)	7 (H)	75
1974	25 (H)	166 (H)	-	-	-	-	191
1975	203 (H)	146 (H)	7 (H)	15 (H)	-	-	371
1976	84 (H)	68 (H)	-	-	-	-	152
1977	230 (H)	112 (H)	-	-	-	-	342
1978	392 (H)	143 (H)	-	2 (A)	-	-	537
1979	426 (H)	54 (H)	36 (H)	-	-	-	516
1980	192 (H)	89 (H)	-	-	-	-	281
1981	329 (H)	159 (H)	76 (F)	-	25 (H)	42 (F)	631
1982	754 (H)	345 (H)	300 (B)	75 (F)	33 (F)	79 (F)	1,586
1983	822 (H)	589 (H)	178 (B)	138 (F)	8 (A)	10 (H)	1,745
1984	610 (H)	508 (H)	133 (F)	12 (B)	124 (F)	54 (F)	1,441
1985	624 (H)	709 (H)	420 (H)	69 (F)	55 (F)	20 (F)	1,897
1986	690 (H)	1,278 (H)	-	-	-	-	1,968
1987	768 (H)	1,349 (H)	-	270 (H)	33 (A)	-	2,420
1988	575 (H)	384 (H)	-	543 (H)	-	40 (H)	1,542

(F) = Foot survey; (A) = Fixed-wing aircraft; (H) = Helicopter;
(B) = Survey by Boat

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

Table 29. Peak escapement and weir counts of chinook salmon for the King Salmon River on Admiralty Island, 1957-1988.[1]

Year	Peak Escapement		Peak Count as Percent of Weir[b]	Total Snettisham Egg Take	Total Weir Count (adults)[c]	Total Weir Count (jacks)[d]	Spawners Below Weir (Foot Count)	Total Return[e]	Total Natural Spawning[f]
	Below Weir	Above Weir							
1957	-	200 (F)	-	-	-	-	-	200	200
1960	-	20 (F)	-	-	-	-	-	20	20
1961	-	117 (F)	-	-	-	-	-	117	117
1971	-	94 (F)	-	-	-	-	-	94	94
1972	-	90 (F)	-	-	-	-	-	90	90
1973	-	211 (F)	-	-	-	-	-	211	211
1974	-	104 (F)	-	-	-	-	-	104	104
1975	-	42 (H)	-	-	-	-	-	42	42
1976	-	65 (H)	-	-	-	-	-	65	65
1977	-	134 (H)	-	-	-	-	-	134	134
1978	-	57 (H)	-	-	-	-	-	57	57
1979	-	88 (H)	-	17	-	-	-	88	71
1980	-	70 (H)	-	-	-	-	-	70	70
1981	-	101 (H)	-	11	-	-	-	101	90
1982	-	259 (F)	-	30	-	-	-	259	229
1983	25	183 (H)	0.85	37	252	20	30	282	245
1984	14	184 (H)	0.77	61	299	82	12	311	250
1985	12	105 (H)	0.65	33	194	45	10	204	171
1986	9	190 (H)	0.83	36	264	72	17	281	245
1987	19	128 (H)	0.74	34	207	62	20	227	193
1988	5	94 (H)	0.50	37	231	54	12	243	206

(F) = Foot Survey; (H) = Escapement survey conducted by helicopter

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

[b] Total aerial count above weir/(total weir count excluding jacks - egg take)

[c] Includes adult spawners used for egg take

[d] Minimum count as jacks could pass through weir

[e] Total return (adults) = weir count + spawning below weir

[f] Natural spawning (adults) = weir count - egg take + spawners below weir (83-87)

Table 30. Harvest, escapement, and minimum total run of Situk River chinook salmon, 1915-1988.

Year	Commercial Chinook Catch	Large Chinook Escapement	Jacks Chinook Escapement	Weir Escapement (Large+Jacks)	Sport Catch	Minimum Total Run (Large Only)
1915	836	-	-	-	-	-
1916	931	-	-	-	-	-
1917	2,499	-	-	-	-	-
1918	1,036	-	-	-	-	-
1919	316	-	-	-	-	-
1920	782	-	-	-	-	-
1921	1,952	-	-	-	-	-
1922	2,118	-	-	-	-	-
1923	1,761	-	-	-	-	-
1924	1,351	-	-	-	-	-
1925	1,087	-	-	-	-	-
1926	1,851	-	-	-	-	-
1927	1,687	-	-	-	-	-
1928	-	-	-	1,224	-	-
1929	-	-	-	3,559	-	-
1930	-	-	-	1,455	-	-
1931	-	-	-	2,967	-	-
1932	-	-	-	1,978	-	-
1933	267	-	-	-	-	-
1934	450	-	-	1,486	-	1,936
1935	558	-	-	638[1]	-	1,196
1936	-	-	-	816	-	-
1937	-	-	-	1,290[1]	-	-
1938	1,220	-	-	2,668[1]	-	3,888
1939	495	-	-	2,117	-	2,612
1940	164	-	-	903	-	1,067
1941	390	-	-	2,594	-	2,984
1942	430	-	-	2,543	-	2,973
1943	947	-	-	3,546[1]	-	4,493
1944	844	-	-	2,906	-	3,750
1945	692	-	-	1,458	-	2,150
1946	1,468	-	-	4,284	-	5,752
1947	885	-	-	5,077	-	5,962
1948	694	-	-	3,744	-	4,438
1949	410	-	-	1,978	-	2,388
1950	378	-	-	2,011	-	2,389
1951	948	-	-	2,780	-	3,728
1952	225	-	-	1,459	-	1,684
1953	378	-	-	1,040	-	1,418
1954	314	-	-	2,101	-	2,415
1955	740	-	-	1,571	-	2,311
1956	1,867	-	-	-	-	-
1957	1,796	-	-	1,500[2]	-	-
1958	187	-	-	300[2]	-	-
1959	426	-	-	-	-	-

-Continued-

Table 30. Harvest, escapement, and minimum total run of Situk River chinook salmon, 1915-1988. (Continued)

Year	Commercial Chinook Catch	Large Chinook Escapement	Jacks Chinook Escapement	Weir Escapement (Large+Jacks)	Sport Catch	Minimum Total Run (Large Only)
1960	312	-	-	500[2]	-	-
1961	368	-	-	400	-	-
1962	337	-	-	1,000	-	-
1963	459	-	-	-	-	-
1964	706	-	-	725	-	-
1965	442	-	-	1,500	-	-
1966	410	-	-	800	-	-
1967	203	-	-	200	-	-
1968	312	-	-	700	-	-
1969	1,020	-	-	2,500	-	-
1970	927	-	-	1,100	-	-
1971	473	-	-	964	-	1,437
1972	303	-	-	400[5]	-	703
1973	752	-	-	510	-	1,262
1974	791	-	-	702	-	1,493
1975	562	-	-	1,180	-	1,742
1976	1,002	1,543[3]	390	1,933	200	2,745
1977	833	1,732	148	1,880	244	2,809
1978	382	880[3]	223	1,103	210	1,472
1979	1,028	1,400[3]	354	1,754	282	2,710
1980	971	905	220	1,125[1]	353	2,229
1981	859	702	105	807[1]	130	1,691
1982	242	434	177	611	63	739
1983	349	592	257	849	42	983
1984	513	1,726	475	2,201	146	2,385
1985	472	1,521	461	1,982	294	2,287
1986	182	2,067	505	2,572	0	2,249
1987	752	1,884[4]	-	1,884	76	2,712
1988	299	885	193	1,078	171	1,355

[1] Weir out part of the time (corrections made for the period that the weir was inoperable in 1980 and 1981).
[2] Peak aerial survey from 1960 to 1971.
[3] The seperation of large versus jacks was not made during enumeration; estimate was derived from 1977 and 1980-1984 average percentage ofjacks versus large chinook salmon.
[4] Includes 85 chinook counted below weir.
[5] Float survey from 1972 to 1975.

in the spring of 1985, unusually heavy icing and late breakup of river ice was observed. A large proportion of juvenile chinook salmon in large glacial rivers like the Unuk and Chickamin overwinter in sidechannels and mainstem areas that contain large organic debris and that are often fed by groundwater flow. These overwintering areas are often created by scouring of the river bed during high flows just downstream from large root wadded-trees that have been washed into the river by the erosion of banks. These trees are often very large, perhaps one to two meters in diameter and over 70 meters long, and usually remain in the same location for many years. During years of very cold temperatures, heavy icing conditions, and delayed breakup during the spring, juvenile chinook salmon can become trapped in these overwinter habitats.

Another possible explanation for the decline in chinook salmon escapements to southern Southeast rivers might have been lower than average ocean survival conditions. Returns of 1983 brood year chinook salmon from Unuk and Chickamin stock released from the Neets Bay and Whitman Lake Hatcheries were lower than expected by hatchery managers. Perhaps the poor escapements observed for these stocks is best explained by a combination of increased harvest coupled with poor freshwater and ocean survival conditions.

The largest increase in chinook salmon escapements in 1988 occurred in the Stikine River where the 1988 escapement of 29,000 chinook salmon (age 1.3 and 1.4 spawners only) was 53% higher than in 1987 and 150% higher than in 1986. Taku River chinook salmon escapements were also encouraging as the 1988 escapement of 13,400 chinook salmon was the second largest escapement observed since 1975 and was 50% higher than the 1987 escapement. These strong returns resulted primarily from exceptionally strong escapements of the 1982 brood year (age 1.4). Preliminary data from the Nakina River weir and Little Tahltan weirs indicates that the age 1.4 component of the 1988 total escapement was much higher than average. We hypothesize that this strong age class experienced exceptionally favorable freshwater survival conditions. Data for this statement comes from comparing returns from 1982 brood year chinook salmon tagged in the fall of 1984 and spring of 1985 on the Unuk River. The estimated overwinter survival of this 1982 brood year was over 60%, much higher than the 15% to 30% average overwinter survival observed during coded-wire tagging studies conducted on the Taku and Stikine Rivers (Kissner 1982).

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

Unlike Taku and Stikine River origin chinook salmon, Unuk and Chickamin River chinook salmon 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.

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.

We feel that the current depressed status of the Alsek River stock of chinook salmon may have resulted from a combination of all of the factors listed above. 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.

In recent years, most mature Chilkat River chinook salmon have been harvested in the Haines area marine recreational fishery. Conservation measures imposed on this fishery in both 1987 and 1988 were continued by the Alaska Board of Fisheries for 1989 and 1990. It is clear that the decline in escapements of Chilkat River chinook salmon in recent years can be partially explained by higher than average harvests in the Chilkat Inlet marine recreational fishery. Prior to 1985, recreational harvests averaged less than 1,000 chinook salmon annually increasing to over 1,500 fish in 1985 and 1986. However, preliminary information from recoveries of coded-wire tagged chinook salmon fingerlings released in the Chilkat River in 1985 and 1986, indicate that this stock may also be harvested to a greater extent than previously thought in the Lynn Canal drift gill net fishery, the Juneau area marine recreational fishery, and in the commercial troll fishery in Icy Straits. Furthermore, it appears that loss of spawning and rearing habitat resulting from road construction activities on Big Boulder Creek and the Kelsall River have also contributed to the decline of this stock.

It is apparent that continued restriction of harvests of mature fish in the Haines marine recreational and commercial fisheries will be required to rebuild this important stock of chinook salmon. In addition, information on migratory timing, areas of harvest, and harvest rates of Chilkat River chinook salmon must be obtained from continued coded-wire tagging of juveniles and recovery of adults in commercial and recreational fisheries and on the spawning grounds. If necessary, new fishery regulations should be developed in cooperation with local advisory committees, the Alaska Board of Fisheries, and ADFG that are needed to ensure continued rebuilding of this stock. Finally, enhancement strategies should be implemented, including, remote releases of hatchery-reared smolt in areas that will offer continued protection of the natural stock while allowing recreational fishing opportunity, and improvement and restoration of damaged or lost spawning and rearing habitat in the Chilkat River drainage.

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Appendix Table 1. Survey areas, peak spawning dates, and spawner distribution of major chinook salmon index tributaries.

RIVER Tributary	Spawning Peak Dates	Survey Area	Spawner Distribution	Remarks
TAKU RIVER				
Nakina River	4 August	Grizzly Bar to canyon 3.2 km above confluence with Silver Salmon River.	Kissner (1982)	Large numbers of spawning pinks and schooled sockeye will be observed in this area.
Nahlin River	22 July	Telegraph Trail Crossing to forks about 48 km upstream. Up each fork 1.6 km.	Kissner (1982)	Many sockeye in survey area.
Tatsamenie River	23 August	Tatsatua Junction to Big Tatsamenie Lake.	Kissner (1982)	Sometimes semi-glacial. Survey should start by 10 a.m. Some sockeye in survey area.
Kowatua River	15 August	Little Trapper Lake outlet to junction of small glacial stream that flows into Kowatua from south about 8 km below Little Trapper Lake.	Evenly distributed.	Glacial survey, should start by 8 a.m. Some sockeye in survey area.
Tseta River	1 August	Upper barrier (falls) downriver to start of canyon.	Densest spawning in upper 3.2 km.	Only chinook observed in this tributary.
Dudidontu River	1 August	End of canyon upstream to 3.2 km past junction of Matsatu Creek. In some years, lower Matsatu has enough water to support chinook. Survey lower 1.6 km of this tributary.	Evenly distributed	Some sockeye sometimes present.

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Appendix Table 1. Survey areas, peak spawning dates, and spawner distribution of major chinook salmon index tributaries. (Continued).

RIVER Tributary	Spawning Peak Dates	Survey Area	Spawner Distribution	Remarks
STIKINE RIVER				
Little Tahltan River	28 July	Confluence with mainstem Tahltan up-river for 16 km to area where 762 m contour crosses the river.	Densest spawning between Salon Lake outlet and Tahltan junction (Kissner, 1982).	Usually only chinook in this system. Can be semi-glacial. Survey before noon.
Mainstem Tahltan River	4 August	Confluence with mainstem Stikine up-river to the canyon about 1.6 km upstream from junction of Little Tahltan River.	Densest spawning below junction of Little Tahltan River and above junction of Beatty Creek.	Glacial. Survey should start by 9 a.m. to avoid melt.
Beatty Creek	1 August	Confluence with mainstem Tahltan up-river for about 8 km. Fish have been observed at least 16 km above above survey area, but not in large numbers.	Evenly distributed.	A rock which was a partial barrier was removed in the fall of 1982 so more chinook may move into the upper area.
ALSEK RIVER				
Klukshu River	1 August	Confluence with Tatshenshini up-river to Klukshu Lake.	Evenly distributed.	Difficult to survey because of overhanging trees. Many sockeye present.
Takhanne River	1 August	Confluence with Tatshenshini up-river to falls.	Evenly distributed.	Survey in a.m.; windy in p.m..

- Continued -

Appendix Table 1. Survey areas, peak spawning dates, and spawner distribution of major chinook salmon index tributaries. (Continued).

RIVER Tributary	Spawning Peak Dates	Survey Area	Spawner Distribution	Remarks
Blanchard River	1 August	Confluence with Tatshenshini up-river to bridge.	Many chinook spawn up-river of bridge, but very difficult to observe. Survey to lake if clear.	Very glacial. Survey by 9 a.m..
UNUK RIVER				
Cripple Creek	4 August	Confluence with Unuk up-river for 3.2 km.	Evenly distributed.	Semi-glacial. Survey in early a.m. by foot. Poor surveys by helicopter.
Genes Lake Creek	20 August	Confluence with Genes Lake up-river for about 6.5 km.	Evenly distributed.	Many sockeye in area. Survey by foot. Poor surveys by helicopter.
Eulachon River	20 August	1.6 km below forks up left fork 1 km to barrier, right fork to barrier about 4.8 km up-stream.	Evenly distributed	Some chinook will still be in holes below forks until late August.
Clear Creek	7 August	Confluence with Lake Creek up-river for 1.6 km.	Evenly distributed	Some chinook just above narrow cut.
Lake Creek	7 August	Confluence with Clear Lake up-stream to falls.	Spawning on shallow riffles and in falls pool.	
Kerr Creek	7 August	Falls to glacial water.	Falls pool area usually has 10-20 spawning chinook.	

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Appendix Table 1. Survey areas, peak spawning dates, and spawner distribution of major chinook salmon index tributaries. (Continued).

RIVER Tributary	Spawning Peak Dates	Survey Area	Spawner Distribution	Remarks
CHICKAMIN RIVER				
South Fork	15 August	From junction of Chickamin branch up-river to junction of Barrier Creek.	Evenly distributed.	Many chums and pinks. Semi-glacial. Survey by 10 a.m..
Barrier Creek	15 August	From junction of South Fork to barrier 1.6 km upstream.	Evenly distributed	Chums in survey area.
Butler Creek	7 August	All.	Evenly distributed.	Chums in survey area.
Leduc River	7 August	Mouth to barrier.	Evenly distributed.	Chums and pinks in survey area.
Indian Creek	7 August	All.	Evenly distributed.	Chums and pinks in survey area.
King Creek	1 Sept.	All.	Evenly distributed.	Chums and pinks in survey area.
Clear Falls Creek	6 August	All.	Evenly distributed.	Chums and pinks in survey area.
CHILKAT RIVER				
Big Boulder Creek	15 August	All.	Evenly distributed.	Only chinook in system.
Stonehouse	15 August	All.	Evenly distributed.	Only chinook in system.
BLOSSOM RIVER	20 August	All.	Fairly evenly distributed. A bit higher percent spawners in headwaters.	Many pinks and chums.

- Continued -

Appendix Table 1. Survey areas, peak spawning dates, and spawner distribution of major chinook salmon index tributaries. (Continued).

RIVER Tributary	Spawning Peak Dates	Survey Area	Spawner Distribution	Remarks
KETA RIVER	20 August	All.	Fairly evenly distributed. A bit higher percent spawners in headwaters.	Many pinks and chums.
MARTEN RIVER Mainstem	20 August	All.	Fairly evenly distributed.	Many pinks and chums.
Dicks Creek	20 August	All.	Very even distribution.	Moderate pinks and chums.
WILSON RIVER	20 August	All.	Very even distribution.	Large numbers of pinks and chums.
KING SALMON RIVER	28 July	All.	Mostly in lower 4.8 km, but on years with large escapement, spawning occurs far upstream.	Many pinks and chums present.

Appendix Table 2. Recoveries of chinook salmon coded-wire tagged from the Unuk River, 1983-1988.

Tag Code	Brood Year	Age	Sex	Length	Length Type	Location QD	Location PMFC	Location 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 -

Appendix Table 2. Recoveries of chinook salmon coded-wire tagged from the Unuk River, 1983-1988. (Continued).

Tag Code	Brood Year	Age	Sex	Length	Length Type	Location QD	Location PMFC	Location 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 -

Appendix Table 2. Recoveries of chinook salmon coded-wire tagged from the Unuk River, 1983-1988. (Continued).

Tag Code	Brood Year	Age	Sex	Length	Length Type	Location QD	Location PMFC	Location 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

Appendix Table 3. Recoveries of chinook salmon coded-wire tagged from the Chickamin River, 1983-1988.

Tag Code	Brood Year	Age	Sex	Length	Length Type	Location QD	Location PMFC	Location 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	

- Continued -

Appendix Table 3. Recoveries of chinook salmon coded-wire tagged from the Chickamin River, 1983-1988. (Continued)

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		
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		
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	