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Escapements of Chinook Salmon in Southeast Alaska and Transboundary Rivers in 1991

by

Keith A. Pahlke

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ABSTRACT

The estimated total escapement of chinook salmon *Oncorhynchus tshawytscha* for all Southeast Alaska and transboundary rivers declined from 52,000 fish in 1990 to 47,200 fish in 1991, the third decline in a row, following a trend of increasing escapements observed over the previous six years. The total escapement of chinook salmon in 1991 was 8% or 4,300 fish less than in 1990 and only 75% of the escapement goal of 64,000 chinook salmon. The 1991 escapement represented an increase of approximately 74% or 20,200 chinook salmon over the 1975–1980 average of 27,500 chinook salmon, and an increase of 15% or 6,000 chinook salmon over the 1981–1985 average of 41,700.

Although total escapements of chinook salmon declined in 1991, increases were still observed in the Stikine (3%), Alsek (37%), Situk (25%), Unuk (29%) and Chilkat Rivers (>200%). Chinook salmon escapements declined in 6 of the 11 index systems. The largest declines occurred in the Taku River, where the 1991 escapement of 16,254 chinook salmon was 23% (4,854 fish) below the 1990 escapement of 21,278 fish, and in the Keta River, which declined 55% from 970 in 1990 to only 435 in 1991. Escapements of chinook salmon also declined in the Chickamin (down 14%), Blossom (down 7%), King Salmon (down 20%) Rivers and Andrew Creek (down 40%).

KEY WORDS: Chinook, *Oncorhynchus tshawytscha*, escapement, 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, Southeast Alaska, U.S./Canada Treaty.

INTRODUCTION

Populations of chinook salmon *Oncorhynchus tshawytscha* are known to occur in some 34 river systems throughout Southeast Alaska, northwestern British Columbia, and the Yukon Territory, Canada. In the mid-1970's it became apparent that the majority of chinook salmon stocks in the Southeast Alaska region were depressed relative to historical levels of production (Kissner 1974). As a result, a fisheries management program was implemented to rebuild depressed stocks of chinook salmon in Southeast Alaska and transboundary rivers (rivers that originate in Canada and flow into Southeast Alaska coastal waters)(ADF&G 1981). Initially, this management program included regulatory closures of commercial and recreational fisheries in terminal and near-terminal areas. This program was formalized and expanded in 1981 to a 15-year (roughly 3 life-cycles) rebuilding program for the transboundary Taku, Stikine, Alsek, Unuk, Chickamin, and Chilkat rivers and the non-transboundary Blossom, Keta, Situk, and King Salmon rivers (ADF&G 1981). The objective of this program, which included regionwide, all-gear catch ceilings for chinook salmon, was to rebuild spawning escapements to goals by 1995 (ADF&G 1981). Then, in 1985, the Southeast Alaska rebuilding program was incorporated into a broader, coastwide, rebuilding program for natural stocks of chinook salmon under the auspices of the U.S./Canada Pacific Salmon Treaty (PST).

In accordance with the PST, escapement indices are used to ascertain progress towards meeting escapement goals for the chinook salmon stocks of Southeast Alaska and transboundary rivers (Mecum 1990). The Joint Chinook Technical Committee of the Pacific Salmon Commission combines the indices of escapements of the major, medium, and minor stocks and makes expansions to total estimates of escapements for each system and for all Southeast Alaska, according to set formulas (Mecum 1990)(Appendix A1). These expansions are compared with similarly constructed historical estimates of escapement and appropriate fishery regulations are promulgated.

The overall goal of the Chinook Salmon Escapement 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. In 1991, the objective of this project was to estimate peak escapement of large (age 1.3, 1.4 and 1.5) chinook salmon to tributaries and mainstem areas of the Taku, Stikine, Alsek, Situk, Unuk, Chickamin, Chilkat, Blossom, Keta, Marten, King Salmon rivers and Andrew Creek.

METHODS

Of the 34 river systems with documented spawning populations of wild chinook salmon, three--the transboundary Taku, Stikine, and Alsek--are classified as major producers of chinook salmon, with total production in each river potentially exceeding 10,000 fish. Nine systems are considered medium producers, with run sizes between 1,500 and 10,000 fish. The remaining 22 rivers are placed in the minor production category, with run sizes less than 1,500 chinook salmon. Although chinook salmon have been observed in small numbers in other Southeast Alaska streams, successful spawning has not been documented.

Many areas in the known chinook salmon spawning streams are surveyed annually to document escapements and to expand the database for Southeast Alaska. In

addition, of the surveys conducted in the rivers and streams with documented runs of chinook salmon, results from three major, seven medium, and one minor producing system are used to calculate an index of abundance for all Southeast Alaska chinook salmon spawning streams. Index areas were selected on the basis on their historical importance in local fisheries, size of stocks, geographic distribution, historical and ongoing database, and ease of collecting escapement data. Descriptions of the index areas and expansion methods are summarized in the following text and in Appendix A2 and A3. A detailed description of survey areas and spawning distribution in index tributaries can also be found in Mecum and Kissner (1989).

Spawning escapements of these stocks are assessed by the Pacific Salmon Commission (PSC) as one measure of rebuilding progress since implementation of conservation actions (PSC 1991a). Assessment is focused on changes in average escapements since the base period years; comparison of recent escapement with a linear trend from the escapement base period to the goal at the rebuilding target date; and trends in escapements since PST implementation.

Description of Study Areas

The Taku River originates in northern British Columbia and flows into the ocean 48 km east of Juneau, Alaska (Figure 1). 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 without any mining, logging, or other development activities. The upper Taku River area is extremely remote with no road access and few year-round residents. All of the important chinook salmon spawning areas in the Taku River are found in tributaries in the upper drainage in British Columbia. These include the Nakina, Nahlin, Dudidontu, Tatsamenie, Hackett, and Kowatua rivers and Tseta Creek.

The Stikine River originates in northern British Columbia and flows to the sea approximately 32 km south of Petersburg, Alaska (Figure 2). The Stikine River drainage encompasses approximately 52,000 km^2. The Stikine River's principal tributaries include the Tahltan, Chutine, Scud, 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, Scud, 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 (Figure 3).

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 4). 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

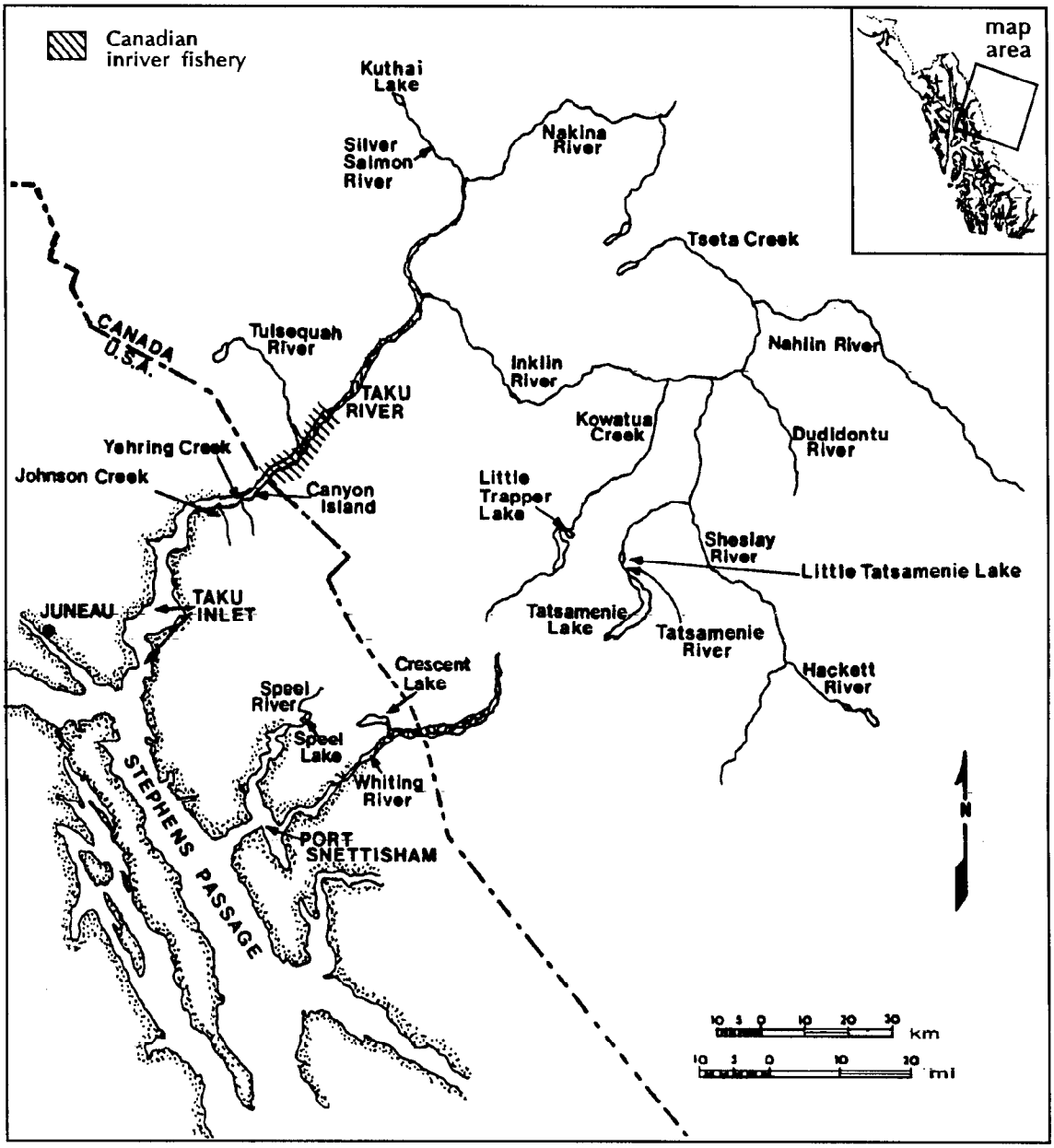

Figure 1. Taku River drainage, northwestern British Columbia and Southeast Alaska.

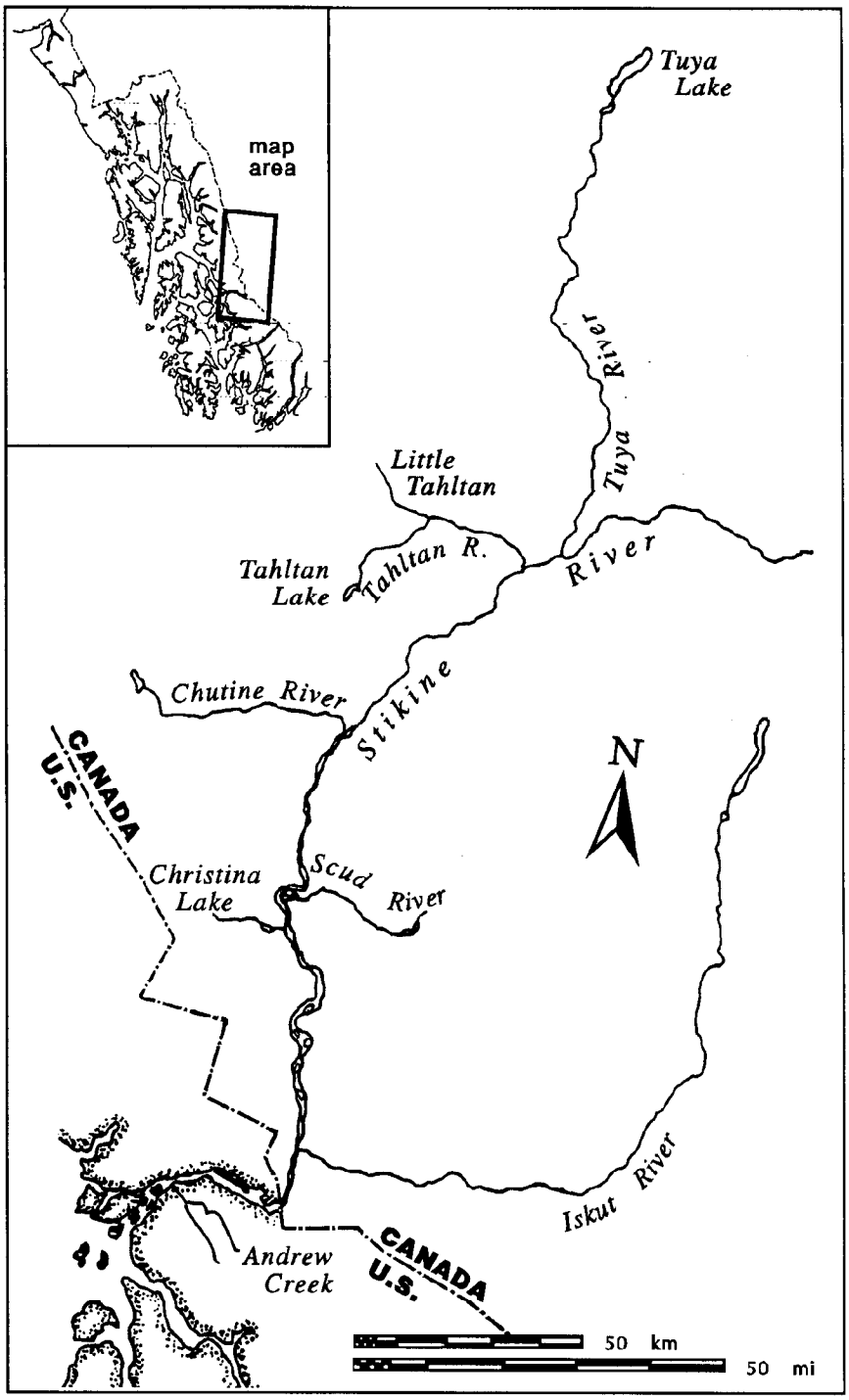

Figure 2. Stikine River drainage, northwestern British Columbia and Southeast Alaska.

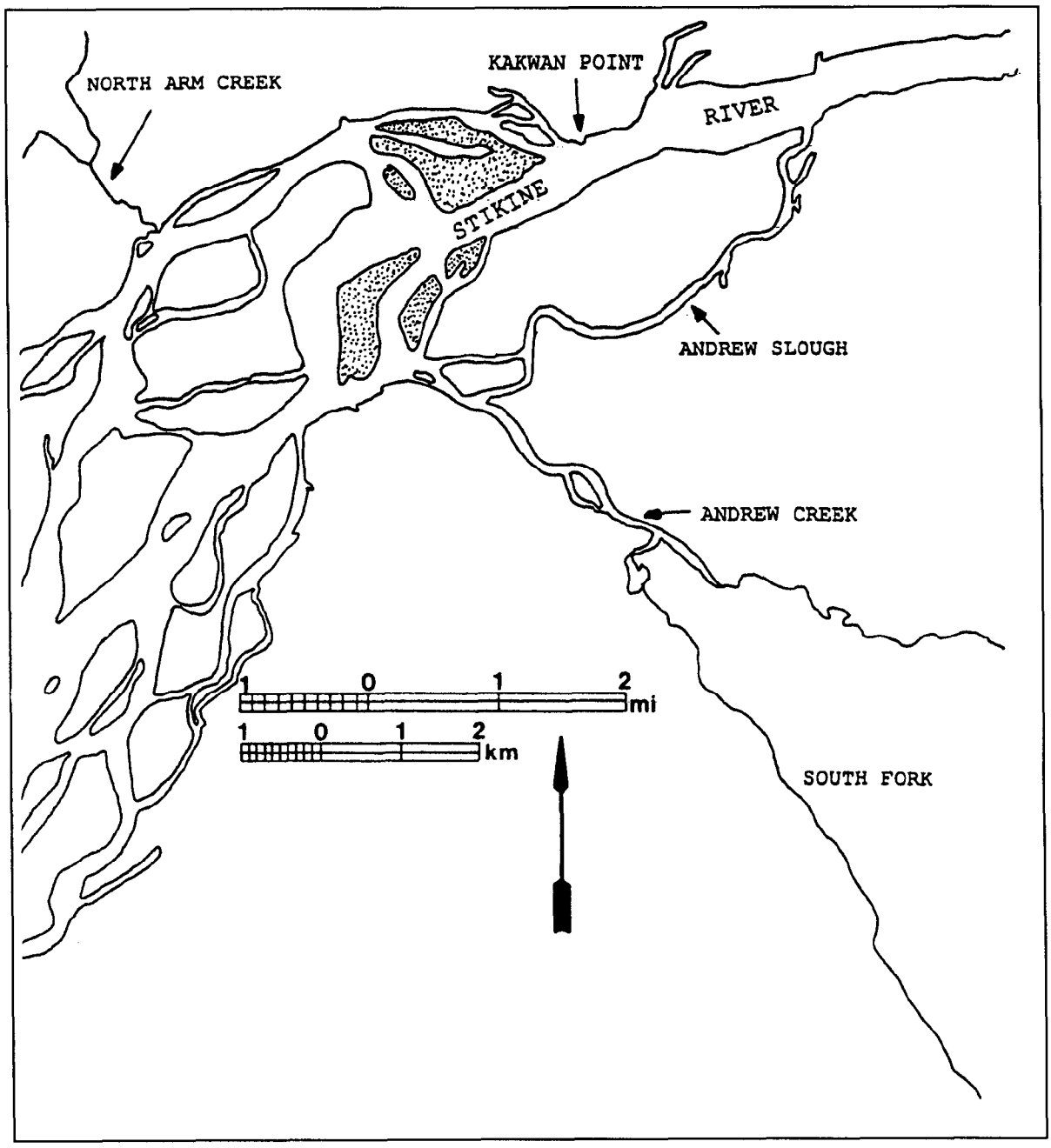

Figure 3. Andrew Creek, Southeast Alaska.

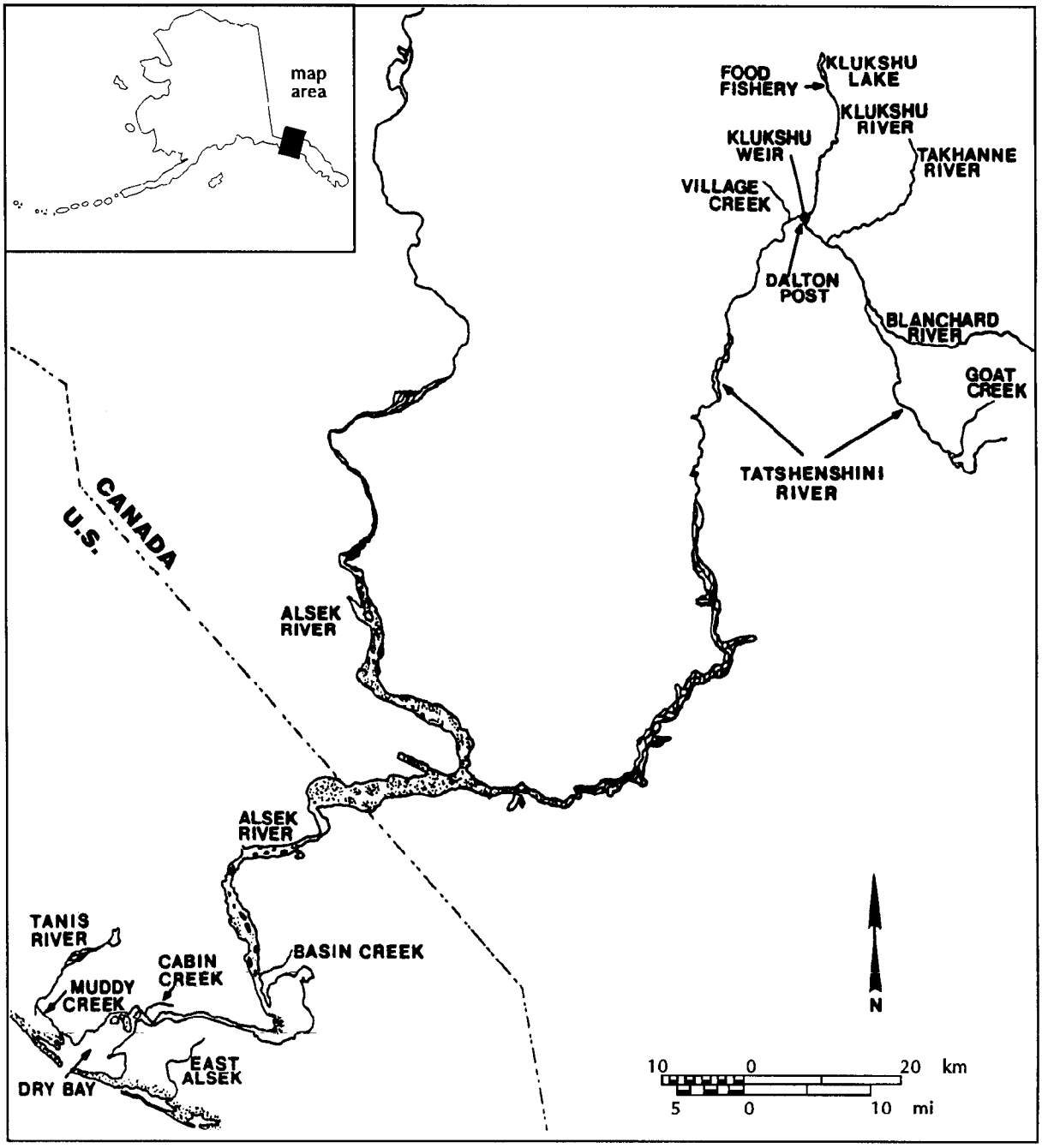

Figure 4. Alsek River drainage, northwestern British Columbia and northern Southeast Alaska.

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.

The Unuk River originates in a heavily glaciated area of northern British Columbia and flows for 129 km to Burroughs Bay 85 km northeast of Ketchikan, Alaska; only the lower 39 km of the river are in Alaska (Figure 5). The Unuk River drainage encompasses an area of approximately 3,885 km^2. Most Unuk River chinook salmon spawn in tributaries in the lower 39 km of the U.S. portion of the river, including the Eulachon River and Cripple, Genes Lake, Clear, Lake, and Kerr creeks. Cripple Creek and Genes Lake Creek can not be surveyed from the air because of heavy vegetation and the escapements are counted by foot surveys.

The Chickamin River ranks fifth in chinook salmon 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 (Figure 6). Important tributaries for spawning chinook salmon are the South Fork of the Chickamin and Barrier, Butler, Indian, Leduc, Humpy, King, and Clear Falls creeks.

The Chilkat River originates in the Yukon Territory and flows into Chilkat Inlet at the head of northern Lynn Canal near Haines, Alaska (Figure 7). Lynn Canal is bounded by the U.S.-Canadian border to the north and west and by 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). Important tributaries for spawning chinook salmon include Stonehouse, Nataga and Big Boulder Creeks and Tahini and Kelsall Rivers.

The Blossom, Keta, Wilson, and Marten rivers are non-transboundary rivers that flow into Behm Canal approximately 45 km east of Ketchikan (Figure 8). These rivers lie within the boundaries of the Misty Fjords National Monument in southern Behm Canal that has received considerable attention in recent years due to potential development of a large-scale molybdenum mine (Quartz Hill) near the divide of the Blossom and Keta rivers. Chinook salmon escapements to the Wilson and Marten rivers have been monitored on an intermittent basis in recent years. The Marten River, the most southern of the four rivers, flows into Marten Arm near Boca de Quadra.

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 about 48 km south of Juneau (Figure 9). The King Salmon River is the only Southeast Alaska river system located on an island that supports a significant population of spawning chinook salmon. The only other island system with a documented run of chinook salmon is Wheeler Creek, also on Admiralty Island. An upstream weir has been operated by the Alaska Department of Fish and Game (ADF&G), on the King Salmon River since 1983 to collect chinook salmon eggs for developing broodstock for the Snettisham Hatchery.

The Situk River is located about 16 km east of Yakutat, Alaska (Figure 10). The Situk River supports a large run of sockeye salmon *O. nerka* which are harvested in commercial and subsistence set gill net fisheries concentrated at the mouth of the Situk River. Situk River chinook salmon have been harvested incidentally in the set gill net fishery and a recreational fishery in the lower river. A weir was operated on the Situk River at the upper limit of the intertidal area

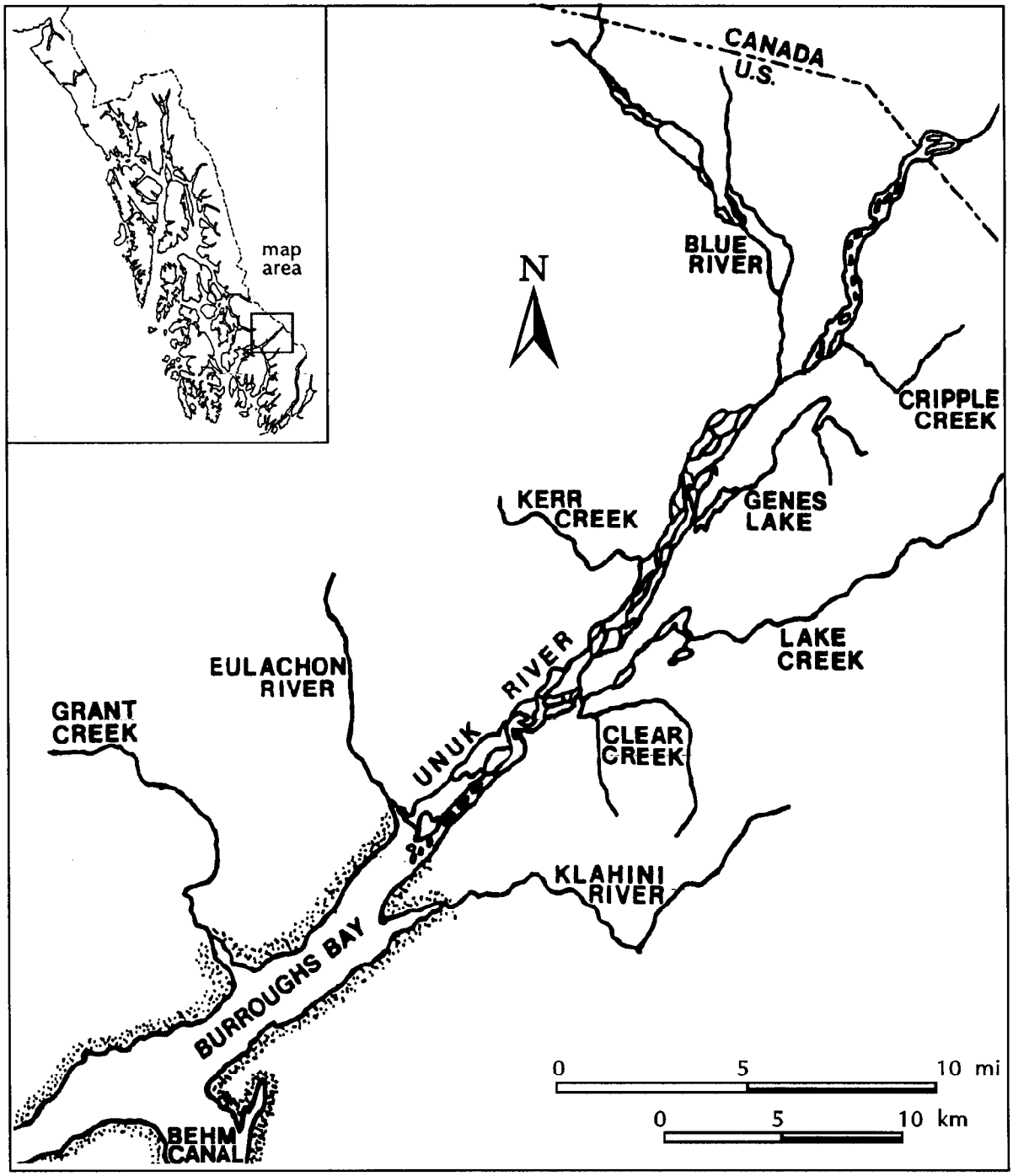

Figure 5. Unuk River drainage, northwestern British Columbia and southern Southeast Alaska.

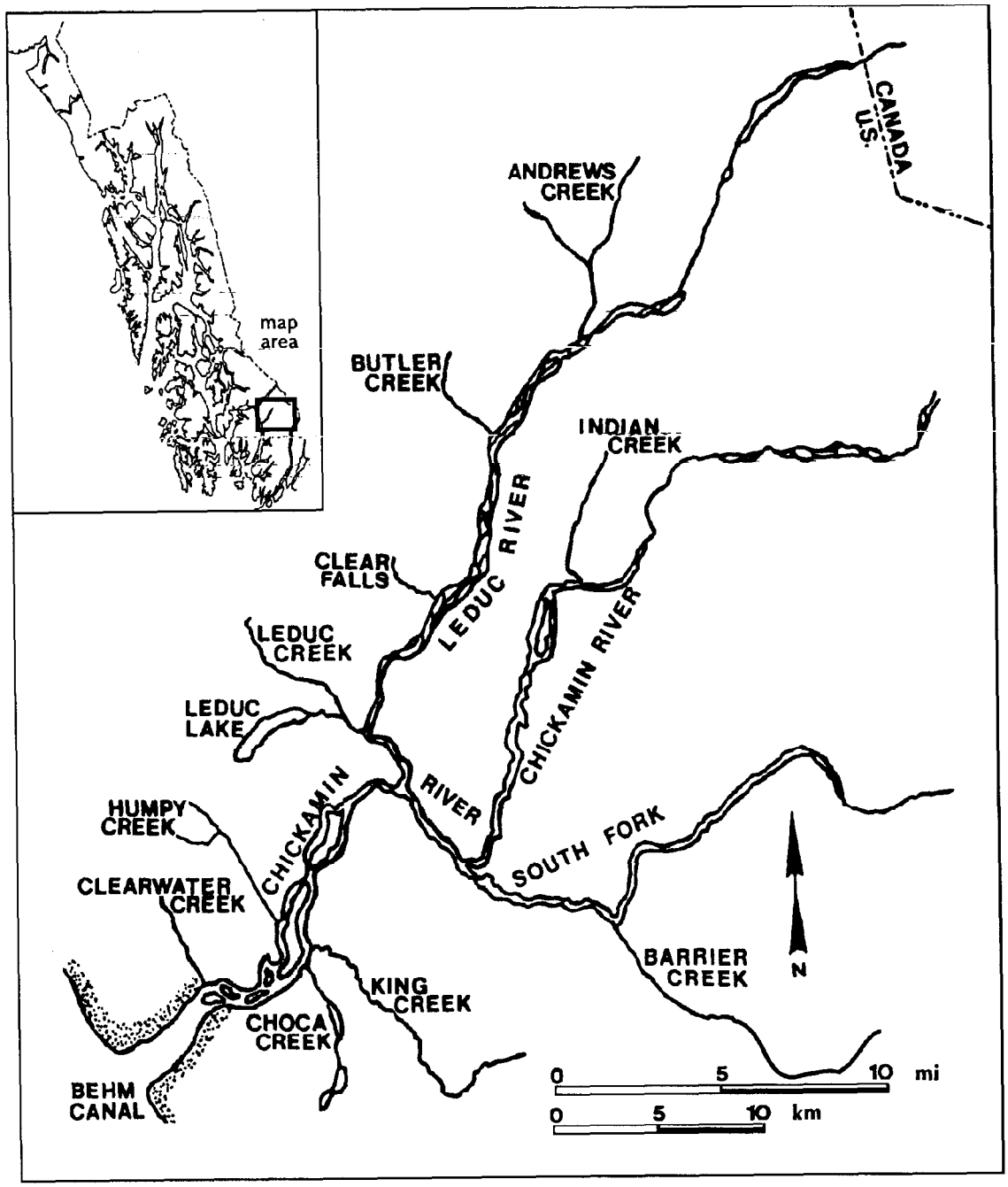

Figure 6. Chickamin River drainage, southern Southeast Alaska.

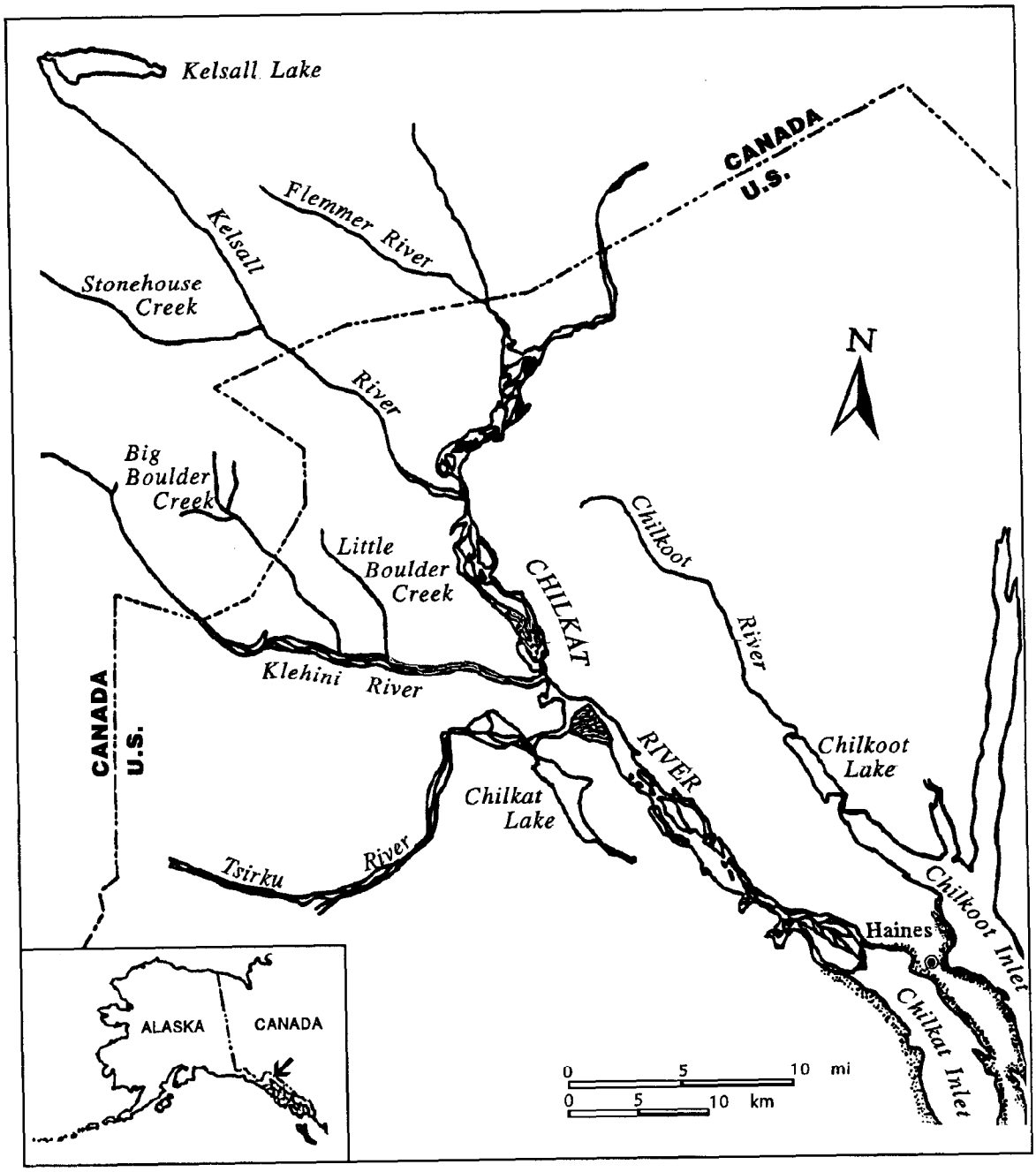

Figure 7. Chilkat River drainage, northwestern British Columbia and northern Southeast Alaska.

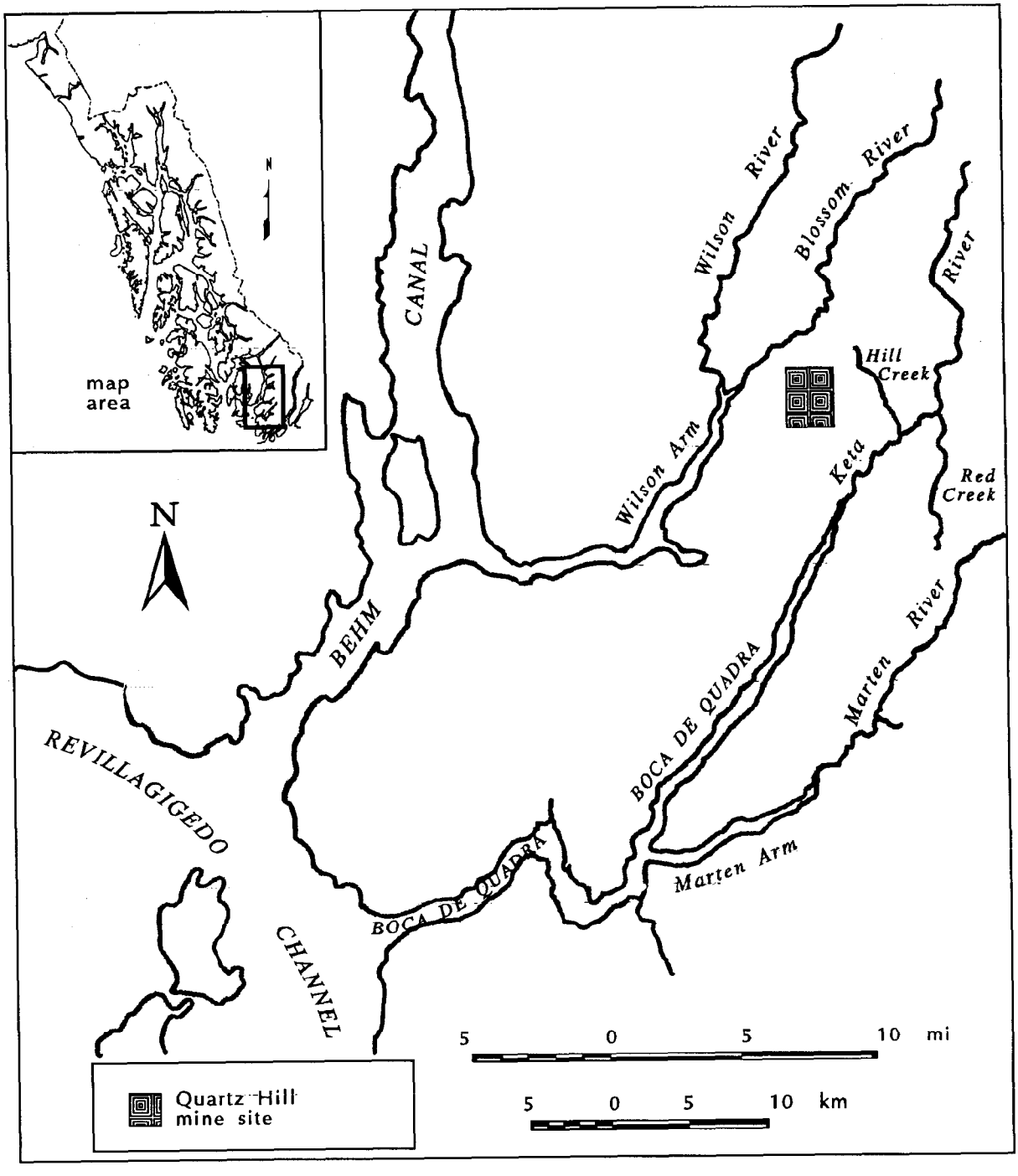

Figure 8. Blossom, Keta, Wilson, and Marten river drainages, southern Southeast Alaska.

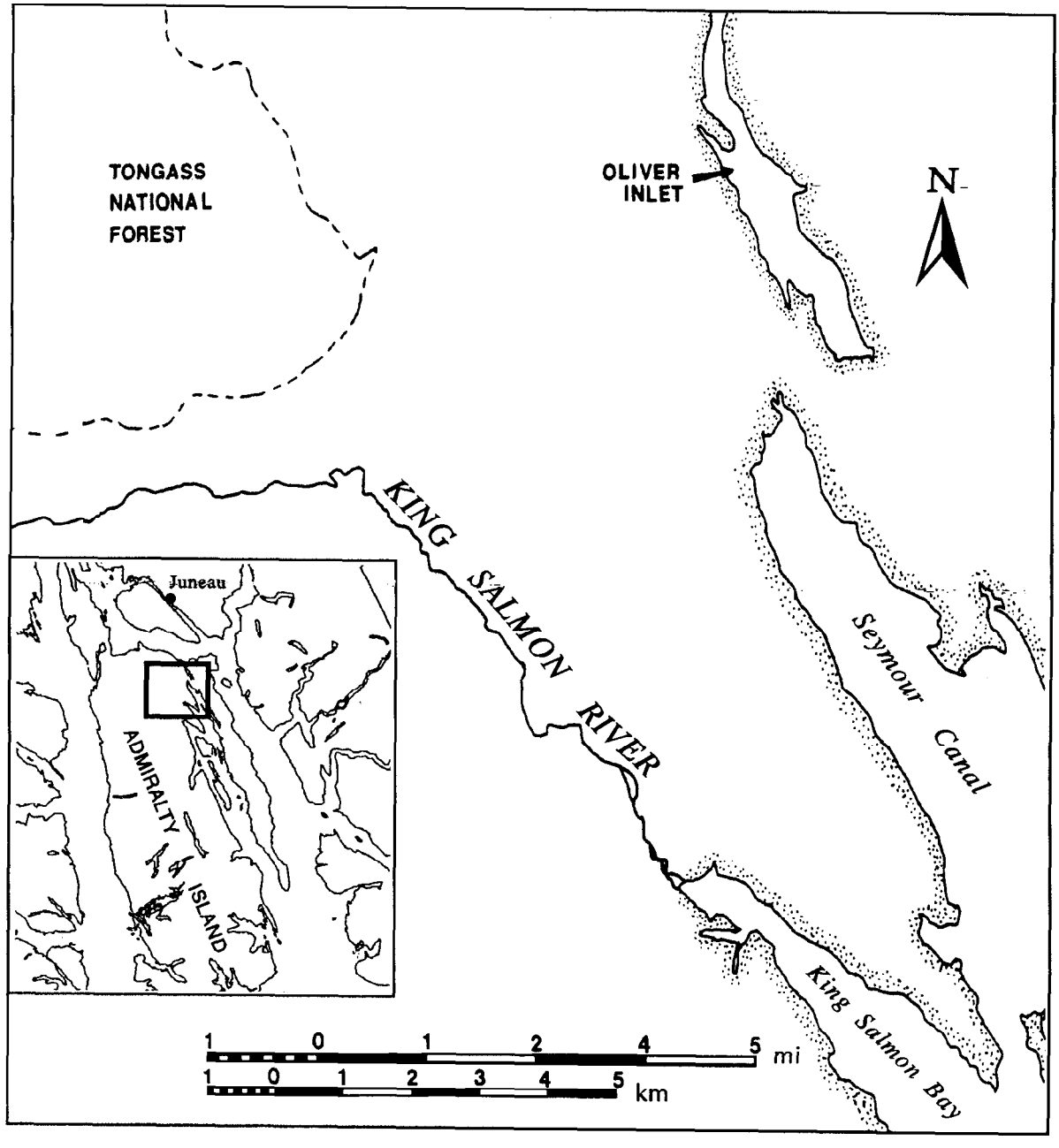

Figure 9. King Salmon River drainage, Admiralty Island, Southeast Alaska.

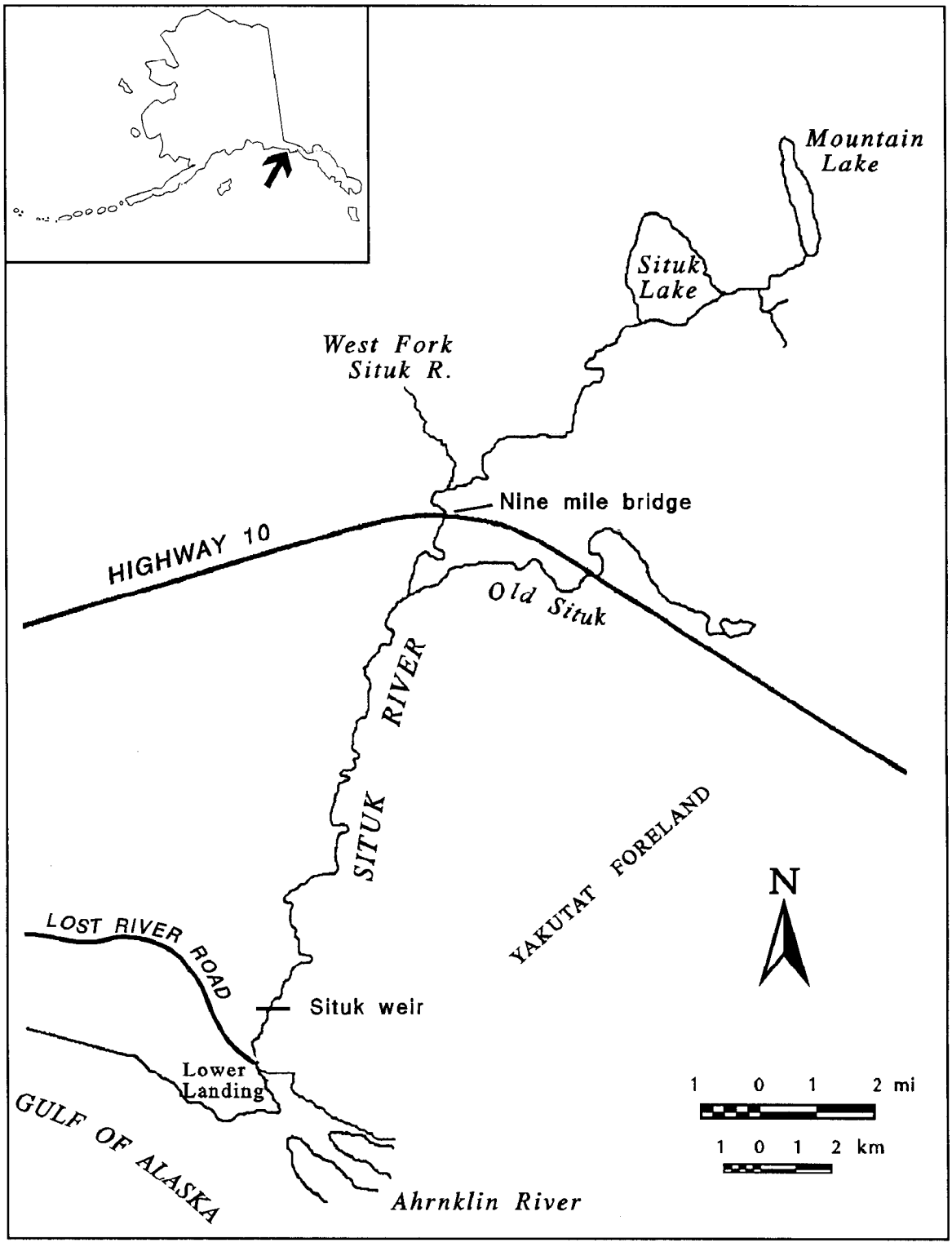

Figure 10. Situk River drainage, northern Southeast Alaska.

from 1928 to 1955 to enumerate all five species of Pacific salmon spawning in the river. From 1976 to 1988, a weir was operated further upstream near the 9-mile road bridge, primarily to enumerate chinook and sockeye salmon. This weir was moved downstream closer to the old weir location in 1988 and operated there from 1988 through 1991.

Enumeration of Adult Chinook Salmon

Escapements of chinook salmon in selected index areas of nine river systems in Southeast Alaska, northwest British Columbia, and the Yukon Territory, Canada are estimated annually. Peak escapement surveys are conducted on foot or from a Bell206 or Hughes 500D helicopter during periods of peak spawning. Peak spawning times, defined as the period when the largest number of adult chinook salmon actively spawn 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 comparable indices of escapements since 1975. A subset of these areas (Appendix A1) was used to form an index of abundance for Southeast Alaska. In accordance with the U.S./Canada Pacific Salmon Treaty, this abundance index was used to determine the progress of rebuilding for the chinook salmon stocks of Southeast Alaska and transboundary rivers.

An attempt was made to survey each of the index areas twice unless turbid water or unsafe flying conditions precluded the second survey. Pilots were directed to fly the helicopter from 6 to 15 meters above the river bed at a speed of 6-16 km/h. The helicopter door on the side of the observer was removed, and the helicopter was flown sideways while observations of spawning chinook salmon were made from the open space. Only large (age-.3, -.4 and -.5) chinook salmon >660 mm mideye-to-fork length (MEF) were counted during aerial or foot surveys. No attempt was made to accurately count small (age-.1 and -.2) chinook salmon that are typically <660 mm MEF (Mecum 1990). These small chinook salmon, also called jacks, are early maturing, precocious males that are considered to be surplus to spawning escapement needs. These small chinook salmon are easy to visually separate from their larger age counterparts under most conditions, due to their short, compact body configuration and lighter coloration.

Escapement counts of selected index spawning areas are expanded by a factor which represents the estimated percentage of the total season escapement observed during the peak spawning period. These expansion factors vary according to the difficulties encountered in observing spawning chinook salmon due to overhanging vegetation, turbid water conditions, presence of other salmon species (i.e., pink *O. gorbuscha* and chum *O. keta* salmon), or protraction of run timing. Survey expansion factors range from 1/0.80 for Big Boulder and Stonehouse creeks to 1/0.625 for most other systems (Appendix A1). Survey expansions are not necessary for those systems where upstream counting weirs are used to enumerate spawning chinook salmon. Peak aerial, foot, or weir counts were also expanded for the percentage of the total escapement to the entire drainage observed in index tributaries (i.e., not all tributaries or spawning areas were surveyed). Tributary expansion factors range from 1/0.25 for Little Tahltan River to 1/0.64 for Klukshu River (Appendix A1).

The expansion factors represent estimates whose validity is unknown for the majority of the index systems. In fact, comparison of aerial surveys with weir counts on some systems indicates the survey expansion factors for the larger systems may be too low. However, these expansion factors have been used since

1981 and have been adopted by the Joint Chinook Salmon Technical Committee (CTC) of the Pacific Salmon Commission (PSC). Therefore, a formal review of these index expansion methods by ADF&G, the Canadian Department of Fisheries and Oceans (CDFO) and the CTC would be necessary before modifications could be made. In 1991, the Transboundary Technical Committee (TBTC) of the PSC reviewed the escapement goals for the Taku, Stikine and Alsek Rivers and developed jointly accepted goals which are different from the goals discussed in the 1990 escapement report (Pacific Salmon Commission 1991b). In the process of revising escapement goals the aerial survey index method was modified for the Taku River to include 6 index areas rather than the two areas used since 1981. A radio-tagging study conducted in 1989 and 1990 was used to calculate the revised expansion formula for the Taku River (Eiler et al. in press). ADF&G is reviewing all available material on escapement counts and the relationships between the various methods and a summary of the findings is in preparation (N.J. Sands, ADF&G, Juneau, personal communication).

Chinook escapement counts are also obtained from fish-counting weirs operated by the CDFO on the Little Tahltan (Stikine), Tatsamenie (Taku), and Klukshu (Alsek) rivers, and by ADF&G on the King Salmon River (Admiralty Island) and Situk River. Except for the Situk River, where aerial surveys were not practical because of 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.

RESULTS

Thirty-five index locations were surveyed in 1991 (Appendix A3). Surveys generally progressed as planned, and poor weather and water conditions precluded only one aerial survey. The Klukshu River was the only survey not completed, however total counts to that system are enumerated at a weir and the surveys are primarily for calibration of survey technique. Some surveys of the Behm Canal systems (Unuk, Chickamin, Blossom, Keta, and Marten rivers) were rescheduled once because of poor weather. The Wilson River was not surveyed, due to time and funding constraints.

Taku River

The observed peak escapement of 10,153 large chinook salmon into the six major spawning tributaries of the Taku River was the second largest escapement observed since surveys began in 1951 (Table 1). Escapements were above recent year averages in all tributaries except Tseta Creek (Table 2). Expanding the Nakina (5,610) and Nahlin (1,781) river index escapement counts by the survey (1/0.75) and tributary (1/0.60) expansion factors resulted in a total escapement estimate for the Taku River of 16,424 large chinook salmon. The expanded total Taku River chinook salmon escapement in 1991 decreased for only the second time since 1983. Despite this increasing trend the estimated escapement for 1991 is 36% below the old management escapement goal of 25,600 large chinook salmon (Figure 11). The six tributary total count of 10,153 is also below the escapement goal, as revised in 1991 for those six systems, of 13,200 fish (PSC 1991b).

Stikine River

Low-level helicopter surveys of the Little Tahltan River index area have been conducted every year since 1975. Since 1985, CDFO has operated a fish counting

Table 1. Peak escapement counts of chinook salmon for tributaries of the Taku River, 1951–1991.[a,b]

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 (F,W)	-	-	-	-	-	1,500[c]
1958	2,500 (F,W)	-	-	4,500 (A)	-	2,500 (A)	9,500[c]
1959	4,000 (F,W)	-	-	-	-	-	4,000[c]
1962	-	-	-	25 (A)	81 (A)	216 (A)	322
1965	3,050 (H)	200 P(A)	50 P(A)	110 (A)	18 (A)	35 (A)	3,463
1966	3,700 P(A)	14 P(A)	100 P(A)	252 (A)	150 (A)	300 (A)	4,516
1967	700 (A)	250 P(A)	-	600 (A)	350 (A)	300 P(A)	2,200
1968	300 P(A)	1,100 (A)	800 E(A)	590 (A)	230 (A)	450 (A)	3,470
1969	3,500 (A)	3,300 (A)	800 E(A)	-	-	-	7,600
1970	-	1,200 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)	-	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[d]
1985	2,647 N(H)	699 E(H)	848 E(H)	475 (H)	303 E(H)	2,236 E(H)	7,208
1986	3,868 (H)	548 E(H)	886 E(H)	413 E(H)	193 E(H)	1,612 E(H)	7,520
1987	2,906 E(H)	570 E(H)	678 E(H)	287 E(H)	180 E(H)	1,122 E(H)	5,743
1988	4,500 E(H)	1,010 E(H)	1,272 E(H)	243 E(H)	66 E(H)	1,535 E(H)	8,626
1989	5,141 E(H)	601 (W)	1,228 E(H)	204 E(H)	494 E(H)	1,812 E(H)	9,480[e]
1990	7,917 E(H)	614 (W)	1,068 N(H)	820 E(H)	172 N(H)	1,658 E(H)	12,249[e]
1991	5,610 E(H)	570 N(H)	1,164 E(H)	804 E(H)	224 N(H)	1,781 E(H)	10,153

[a] - = No survey conducted.
(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.

[b] Escapement counts before 1975 may not be comparable due to changes in survey dates and methods. Early foot surveys may have included jacks.

[c] Partial survey of Nakina River in 1957-59; comparisons made from carcass weir counts.

[d] Surveys in 1984 conducted by CDFO; partial survey of Tseta Creek and Nahlin.

[e] Carcass weir at Kowatua River used to partially enumerate escapement due to unfavorable water conditions.

Table 2. 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
1989	5,141	54	601	6	1,228	13	204	2	494	5	1,812	19	9,480
1990	7,917	65	614	5	1,068	9	820	7	172	1	1,658	14	12,249
Average	3,954	51	562	8	827	11	307	4	230	4	1,618	22	7,499
1991	5,610	55	570	6	1,164	11	804	8	224	2	1,781	18	10,153

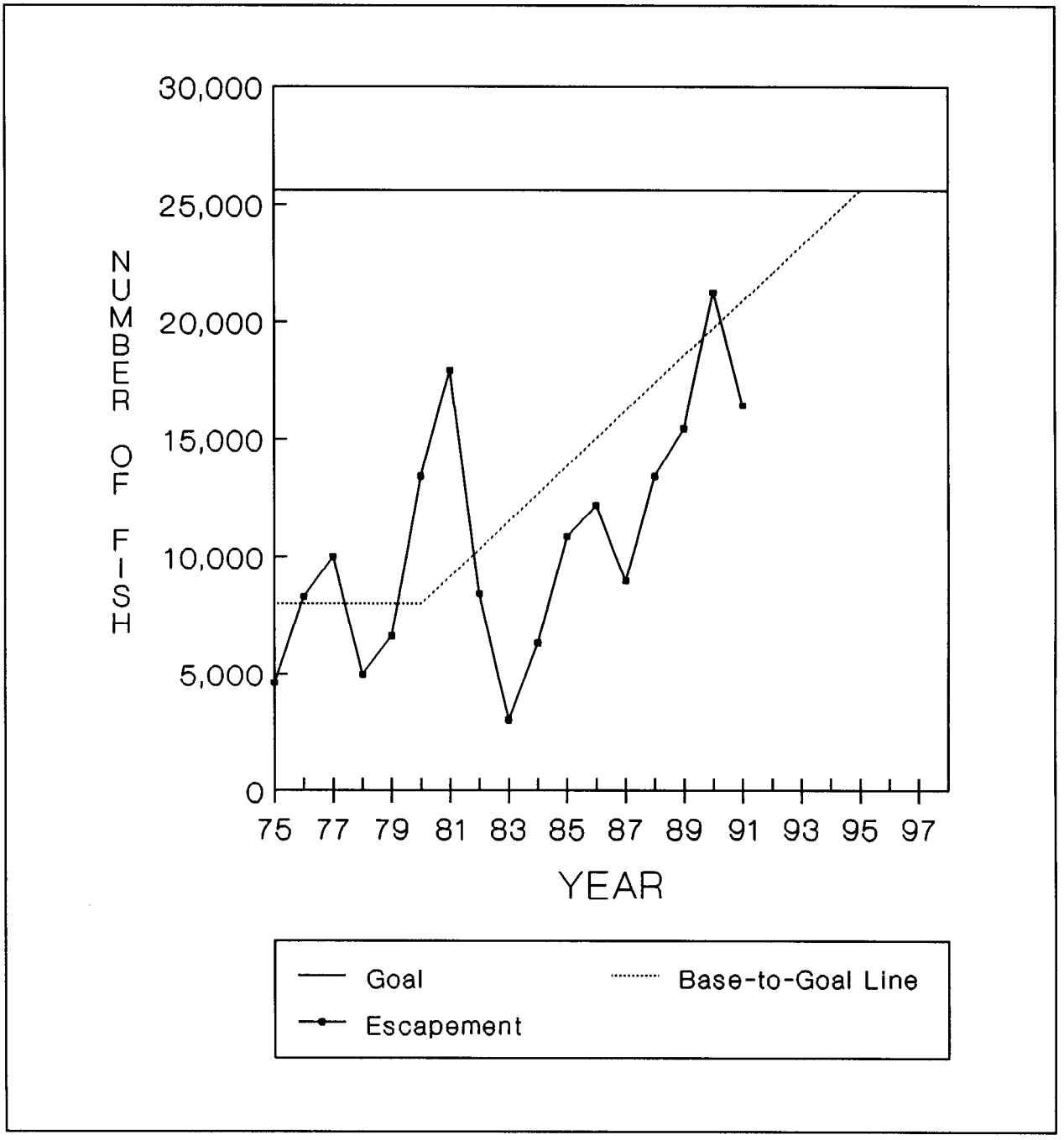

Figure 11. Estimated escapements of chinook salmon to the Taku River, 1975-1991. Base-to-goal line indicates linear rebuilding trend, starting in 1981 at average escapement level during first cycle of rebuilding (1975-1980) and ending at management escapement goal of 25,600 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

weir at the mouth of the Little Tahltan River, a tributary of the Stikine River. Aerial surveys have been conducted during this time so that the relationship between peak aerial counts and actual total escapement could be quantified. From 1985 to 1991, the percentage of the total escapement of chinook salmon observed during peak aerial surveys has varied from 39.2% in 1991 to 56.6% in 1987 and averaged 47.7% (Table 3). The low percentage of total escapement observed in 1986 resulted from poor survey conditions, caused by a mudslide that occurred approximately 1.5 km above the weir site. The low counts in 1990 and 1991 resulted in part from the formation of a new river channel through a heavily wooded area which was difficult to survey. In 1985 and 1987-1989, the percentage of the total escapement observed during helicopter surveys ranged from 50.8% to 56.6% and averaged 53.3%.

The peak aerial count in the Little Tahltan River of 1,768 large chinook salmon was almost identical to the count of 1,755 observed in 1990 (Table 4). A total of 4,506 chinook salmon was counted through the Little Tahltan weir in 1991, 3% higher than the weir count of 4,392 large chinook salmon observed in 1990. The observed escapement on the mainstem Tahltan River in 1991 of 2,445 fish was the third highest ever recorded on that glacially turbid river. The peak escapement count of 193 large chinook salmon in Beatty Creek was 29% lower than the count of 271 chinook salmon seen in 1990.

Expansion of the 1991 Little Tahltan weir count of 4,506 large chinook salmon by the tributary expansion factor (1/0.25) resulted in a total Stikine River escapement estimate of 18,024 large chinook salmon. This is 3% higher than the Stikine River escapement estimate of 17,568 in 1990 and still 34% higher than the pre-1991 management escapement goal of 13,440 large chinook salmon. Escapements of chinook salmon to the Stikine River have been well above the pre-1991 management escapement goal and linear rebuilding trend since 1987. The revised escapement goal agreed to in 1991 is 5,300 fish through the Little Tahltan River weir. The 1991 escapement was below the revised goal but above the linear rebuilding schedule required to achieve the escapement goal by 1995 (Figure 12).

Andrew Creek

The escapement of chinook salmon to Andrew Creek decreased from 664 in 1990 to 400 in 1991 (Table 4). The usual foot survey was not completed due to high water levels. An aerial survey under normal conditions was flown but was complicated by high returns of pink salmon. This was the first year since 1986 that the Andrew Creek escapement did not reach the goal of 470 fish, it did however remain above the linear rebuilding schedule (Figure 13). The stream channel changed significantly in 1987 and counts before that were revised to be consistent with the present survey. Changes were small, <40 fish except in 1987 when 137 fish were added to the count.

Alsek River

Escapement data on Alsek River chinook salmon has been collected since 1962. Since 1976, the CDFO has operated a counting weir at the confluence of the Klukshu and Tatshenshini rivers to enumerate chinook, sockeye, and coho *O. kisutch* salmon into the Klukshu River drainage. Helicopter surveys of chinook salmon escapements to index tributaries of the Alsek River have been conducted by ADF&G since 1981. Before 1976, chinook salmon escapement surveys were usually conducted from fixed-wing aircraft. Turbid water conditions during the peak spawning period resulted in a poor aerial survey of the Blanchard River in 1991.

Table 3. Comparison of weir counts and aerial survey estimates of chinook salmon escapements to the Little Tahltan River, 1985-1991.

Date	Weir count	Low level helicopter count	Percent escapement observed from helicopter
8/02/85	2,379	1,262	53.1
8/06/85	2,864	1,598	55.8
Final	3,146	1,598	50.8
8/01/86	2,323	1,101	47.4
8/05/86	2,646	1,143	43.2
Final	2,893	1,201	41.5
7/31/87	3,903	2,446	62.7
8/03/87	4,456	2,706	60.7
Final	4,781	2,706	56.6
7/30/88	5,573	3,484	62.5
8/05/88	6,822	3,796	55.6
Final	7,292	3,796	52.1
7/29/89	3,772	2,515	66.7
8/04/89	4,394	2,527	57.5
Final	4,715	2,527	53.6
7/31/90	3,780	1,658	43.8
8/07/90	4,232	1,678	39.7
Final	4,354	1,755	40.3
7/31/91	3,649	1,768	48.5
8/07/91	4,141	1,678	32.0
Final	4,506	1,768	39.2

Table 4. Peak escapement counts for Stikine River tributaries, including Andrew Creek, 1956-1991.[a,b]

Year	Little Tahltan River		Mainstem Tahltan River	Beatty Creek	Andrew Creek	Total
	Peak count	Weir count				
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[c]
1966	-	-	318	-	75 (A)	393[c]
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[d]
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)	363 (W)	3,582
1981	3,334 E(H)	-	1,852 P(H)	558 E(H)	644 (W)	6,388
1982	2,830 N(H)	-	1,690 N(F)	567 E(H)	947 (W)	6,034
1983	594 E(H)	-	453 N(H)	83 E(H)	444 (W)	1,574
1984	1,294 (H)	-	-	126 (H)	389 (W)	1,809[e]
1985	1,598 E(H)	3,114	1,490 N(H)	147 N(H)	319 E(F)	5,070[f]
1986	1,201 E(H)	2,891	1,400 P(H)	183 N(H)	707 N(F)	5,181
1987	2,706 E(H)	4,783	1,390 P(H)	312 E(H)	788 E(H)	7,273
1988	3,796 E(H)	7,292	4,384 N(H)	593 E(H)	470 E(F)	12,744
1989	2,527 E(H)	4,715	-	362 E(H)	530 E(F)	5,607
1990	1,755 E(H)	4,392	2,134 N(H)	271 E(H)	664 E(F)	7,461
1991	1,768 E(H)	4,506	2,445 N(H)	193 N(H)	400 N(A)	7,544[g]

[a] (F) = Survey conducted by walking.
(A) = Survey conducted by fixed-wing aircraft.
(H) = Survey conducted by 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.
- = No survey conducted or data not comparable.

[b] Escapement counts prior to 1975 may not be comparable because of differences in survey dates and counting methods.
[c] Chinook lifted over barrier on mainstem Tahltan.
[d] Late count on mainstem Tahltan, minimal estimate.
[e] Surveys by CDFO in 1984.
[f] Total = Little Tahltan weir count plus aerial or weir counts on other systems.
[g] Andrew Creek counts revised to include North Fork.

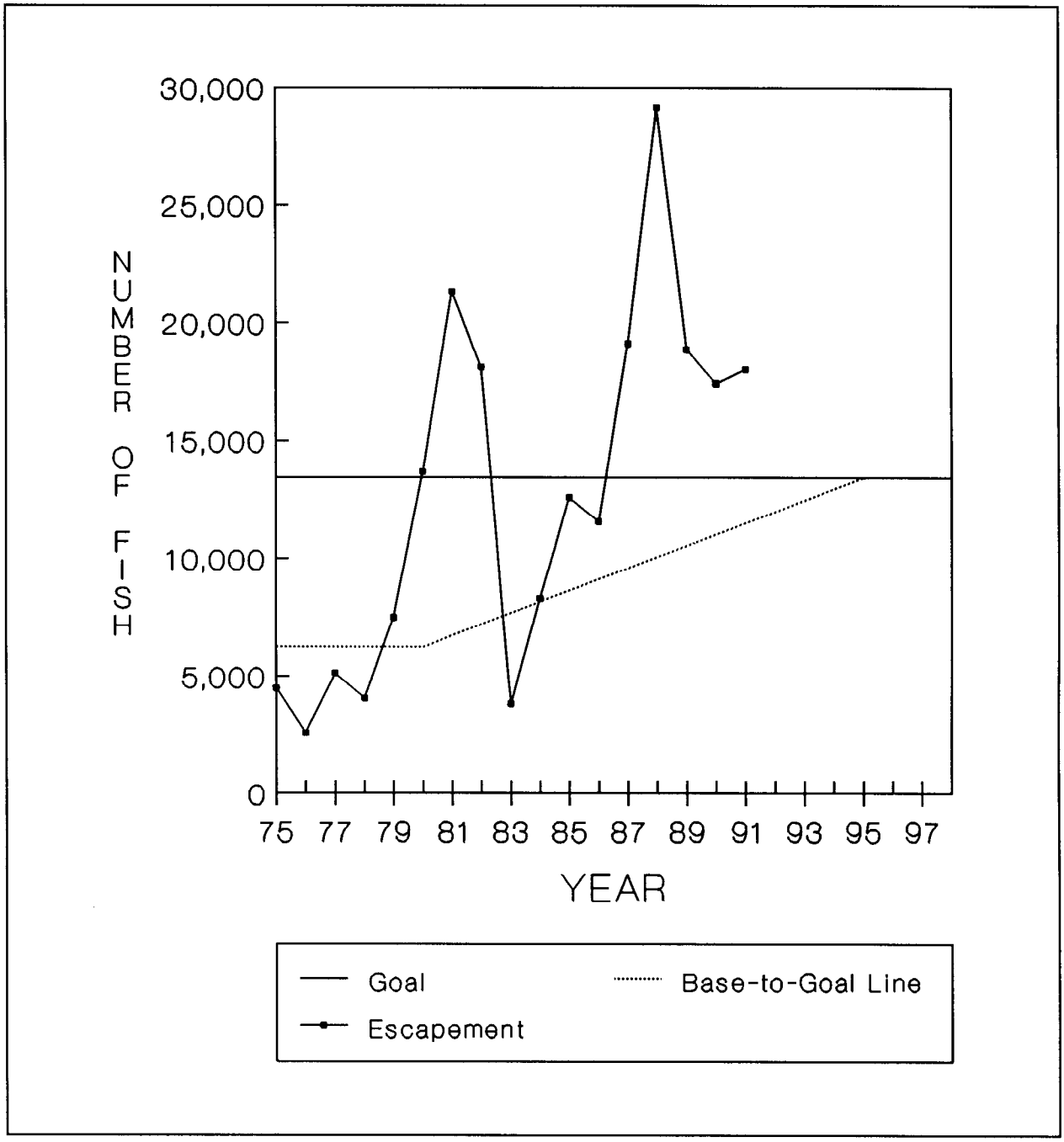

Figure 12. Estimated escapements of chinook salmon to the Stikine River, 1975-1991. Base-to-goal line shows linear rebuilding trend, starting in 1981 at average escapement level during first cycle of rebuilding (1975-1980) and ending at management escapement goal of 13,440 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

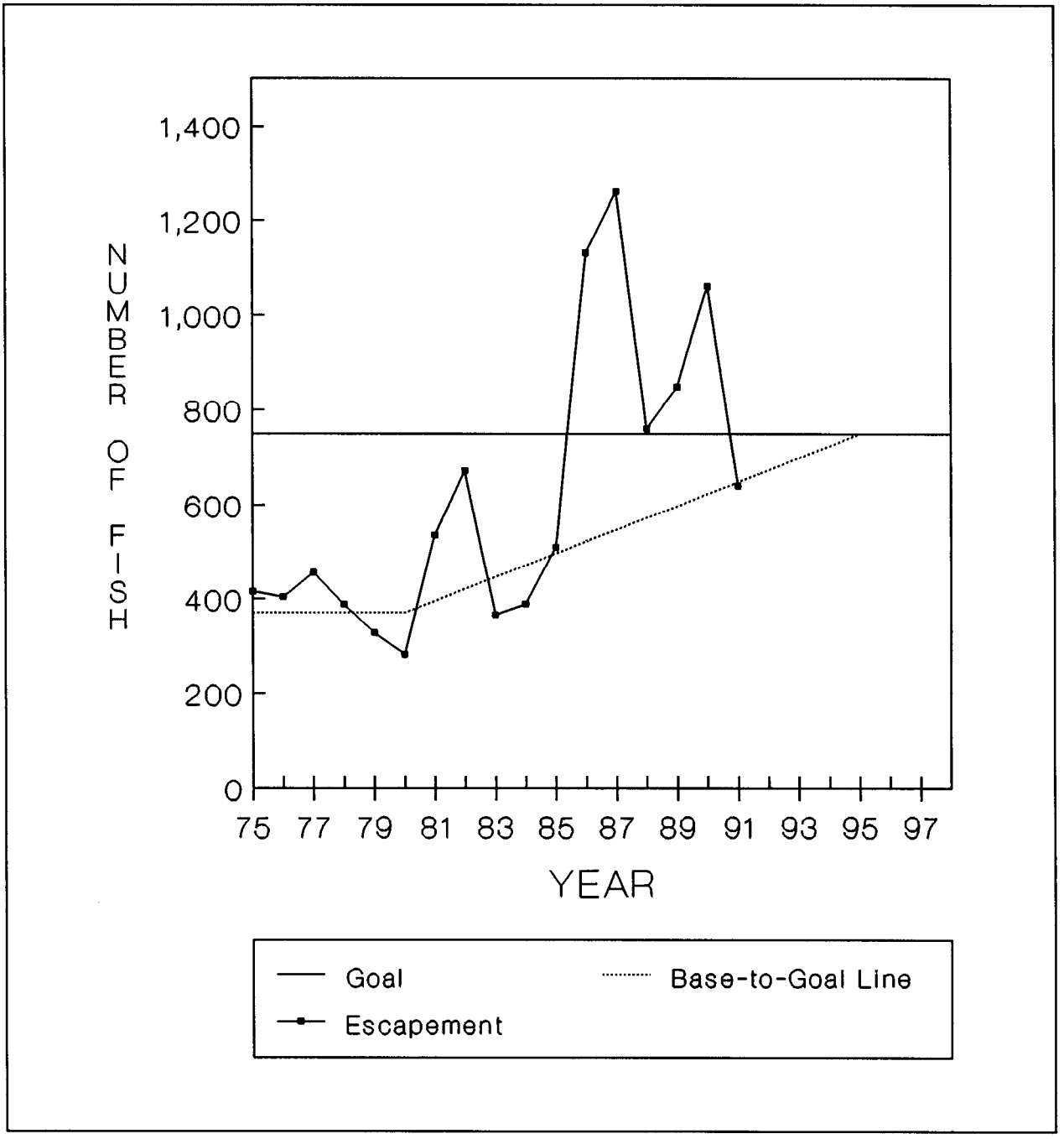

Figure 13. Estimated escapements of chinook salmon to Andrew Creek, 1975-1991. Base-to-goal line shows linear rebuilding trend, starting in 1981 at average escapement level during first cycle of rebuilding (1975-1980) and ending at management escapement goal of 750 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

The count of 2,489 large chinook salmon through the Klukshu River weir in 1991 was 37% above the 1990 count of 1,915 fish (Table 5). The escapement to the Klukshu, estimated by subtracting the subsistence harvest from the weir count was 2,153, an increase of 411 fish from 1990. No aerial survey of the Klukshu River escapement was conducted in 1991 due to high water. The 1991 peak aerial count of 86 large chinook salmon in the Takhanne River was only 26% of the 1990 count of 325 fish. The aerial count of large chinook salmon escapement to Goat Creek in 1991 was 63 fish, twice the 1990 count of 32 fish. The total escapement for the Alsek River drainage, estimated by expanding the weir escapement count for the Klukshu River by 1/0.64 (tributary expansion factor) and subtracting sport and subsistence harvest, was 3,165 large chinook salmon. This was 14% above 1990 and 36% less than the pre-1991 escapement goal of 5,000 large chinook salmon. Escapements of chinook salmon to the Alsek River have exceeded the escapement goal only once since 1976, and average escapements during the first cycle of the rebuilding program (1981-1985) actually declined relative to the 1975-1980 base period (Figure 14). In 1991, the TBTC revised the Alsek River chinook escapement goal to 4,700 large fish through the Klukshu River weir. New expansion factors were not agreed upon therefore the total escapement was estimated using the above factors.

Unuk River

Escapements of chinook salmon to the Unuk River have historically been 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. In 1991, only 763 large chinook salmon were observed in index areas of the Unuk River (Table 6). Escapements were below average in all index tributaries except Clear Creek (Table 7).

In 1991, a weir was operated on Cripple Creek, a major spawning tributary of the Unuk River. A total of 413 large chinook were counted through the weir and 100 below the weir. The weir count was reduced by a factor of 0.625 to be comparable with foot surveys previously done (Sands et al. in prep), and the 100 fish observed below the weir were added to that resulting in an index count for Cripple Creek of 358 fish. In 1991, Boundary Creek was included with the tributaries surveyed. A recent change in the river has revealed more spawning area in that tributary than previously observed.

Expansion of the peak aerial survey count by a survey expansion factor of 1/0.625 resulted in a total escapement estimate of 1,221 large chinook salmon. The 1991 estimated total escapement was 29% above the 1990 escapement of 946 chinook salmon and only 42% of the management escapement goal of 2,880 large chinook salmon. The 1991 estimated escapement of chinook salmon to the Unuk River was 39% below the average escapements observed during the first rebuilding cycle (1981-1985) and 17% below the 1975-1980 average of 1,469 chinook salmon. Escapements of chinook salmon to the Unuk River have declined every year since 1986, and have been below the linear rebuilding schedule since 1989 (Figure 15).

Chickamin River

Chinook salmon have been counted by foot or helicopter survey in index tributaries of the Chickamin River each year since 1977. The observed escapement to the eight index tributaries of the Chickamin River in 1991 was 487 large chinook salmon, compared to 564 in 1990 (Table 8). Escapements in 1991 were below average in all of the Chickamin River tributaries except Clear Falls Creek (Table 9).

Table 5. Peak escapement and weir counts of chinook salmon for tributaries of the Alsek River, 1962-1991.[a],[b]

Year	Klukshu Aerial	Klukshu Weir	Canadian Inriver Harvest IFF	Canadian Inriver Harvest Sport	Klukshu Escapement[c]	Blanchard River	Takhanne River	Goat Creek	Total[d]
1962	86				86	-	-	-	86
1963	-				-	-	-	-	-
1964	20				20	-	-	-	20
1965	100				100	100	250	-	450
1966	1,000				1,000	100	200	-	1,300
1967	1,500				1,500	200	275	-	1,975
1968	1,700				1,700	425	225	-	2,350
1969	700				700	250	250	-	1,200
1970	500				500	100	100	-	700
1971	300				300	-	-	-	300
1972	1,100				1,100	12 (A)	250	-	1,362
1973	-				-	-	49 (A)	-	49
1974	62				62	52 (A)	132	-	246
1975	58				58	81 (A)	177 (A)	-	316
1976	-	1,278	125	200	1,153	-	-	-	1,153
1977	-	3,144	250	300	2,894	-	-	-	2,894
1978	-	2,976	300	300	2,676	-	-	-	2,676
1979	-	4,404	130	650	4,274	-	-	-	4,274
1980	-	2,637	150	200	2,487	-	-	-	2,487
1981	-	2,113	150	315	1,963	35 (H)	11 (H)	-	2,009
1982	633	2,369	400	224	1,969	59 (H)	241 (H)	13 (H)	2,282
1983	917	2,537	300	312	2,237	108 (H)	185 (H)	-	2,530
1984	-	1,672	100	475	1,572	304 (H)	158 (H)	28 (H)	2,062
1985	-	1,458	175	250	1,283	232 (H)	184 (H)	-	1,699
1986	738	2,709	102	165	2,607	556 (H)	358 (H)	142 (H)	3,663
1987	933	2,616	125	367	2,491	624 (H)	395 (H)	85 (H)	3,595
1988	-	2,037	43	249	1,994	437 E(H)	169 E(H)	54 E(H)	2,654
1989	893	2,456	167	272	2,289	-	158 E(H)	34 E(H)	2,481
1990	1,381	1,915	173	555	1,742	-	325 E(H)	32 E(H)	2,099
1991	-	2,489	336	388	2,153	121 N(H)	86 E(H)	63 E(H)	2,423

[a] (A) = aerial survey from fixed wing aircraft, (H) = helicopter survey, (E) = excellent survey conditions, (N) = normal conditions, (P) = poor conditions, (-) = no survey.

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

[c] Klukshu River escapement = weir count minus Indian Food Fishery (IFF).

[d] Total escapement = Klukshu escapement plus aerial counts of other systems.

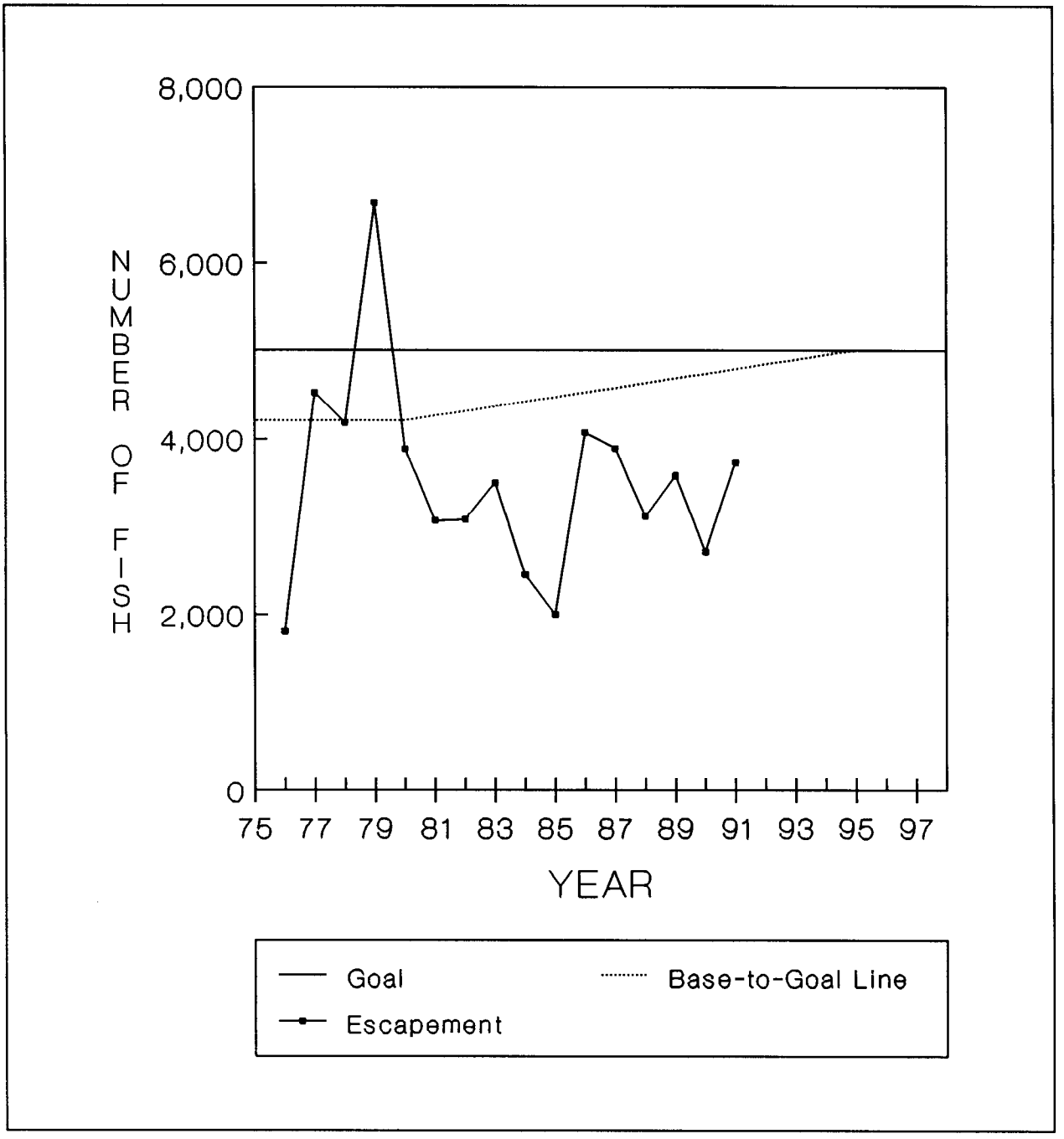

Figure 14. Estimated escapements of chinook salmon to the Alsek River, 1975–1991. Base–to–goal line indicates linear rebuilding trend, starting in 1981 at average escapement level during first cycle of rebuilding (1975–1980) and ending at the management escapement goal of 5,000 large chinook salmon in 1995 (final year of three–cycle rebuilding program).

Table 6. Peak escapement counts of chinook salmon to index tributaries of the Unuk River, 1960–1991. [a,b]

Year	Cripple Creek	Genes Lake Creek	Eulachon Creek	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	1,068 (F)	154 (F)	146 (F)	292 (H)	60 (H)	26 (H)	1,746
1989	351 (F)	302 (F)	298 (H)	128 (H)	27 (F)	43 (H)	1,149
1990	86 (F)	284 (F)	81 (H)	103 (F)	26 (F)	11 (H)	591
1991	358(W/F)	123 (F)	43 (H)	96 (F)	131 (F)	12 (H)	763[c]

[a] (F) = Escapement survey conducted by walking river.
(A) = Escapement Survey conducted from fixed-wing aircraft.
(H) = Escapement survey conducted from helicopter.
– = No survey conducted or data not comparable.

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

[c] Lake Creek count includes 108 from Boundary Creek, Cripple Creek weir count reduced by /0.625 to be comparable with foot surveys.

Table 7. Percentages of total escapements of chinook salmon to index tributaries of the Unuk River for years when all index tributaries were surveyed.

Year	Cripple Creek	%	Genes Lake Creek	%	Eulachon Creek	%	Clear Creek	%	Lake Creek	%	Kerr Creek	%	Total
1978	394	36	374	34	218	20	85	8	20	2	15	1	1,106
1979	363	63	101	18	48	8	14	2	30	5	20	4	576
1980	748	74	122	12	95	9	28	3	5	1	18	2	1,016
1981	324	44	112	15	196	27	54	7	20	3	25	3	731
1982	538	39	329	24	384	28	24	2	48	4	28	2	1,351
1983	459	40	338	30	288	26	24	2	12	1	4	0	1,125
1984	644	35	647	35	350	19	113	6	32	2	51	3	1,837
1985	284	24	553	47	275	23	37	3	22	2	13	1	1,184
1986	532	25	838	39	486	23	183	9	25	1	62	3	2,126
1987	860	44	398	20	520	26	107	5	37	2	51	3	1,973
1988	1,068	61	154	9	146	8	292	17	60	3	26	2	1,746
1989	351	31	302	26	298	26	128	11	27	2	43	4	1,149
1990	86	15	284	48	81	14	103	17	26	4	11	2	591
Average	512	39	350	26	260	20	92	7	28	2	28	2	1,327
1991	358	27	123	9	43	3	96	7	23	2	12	1	655

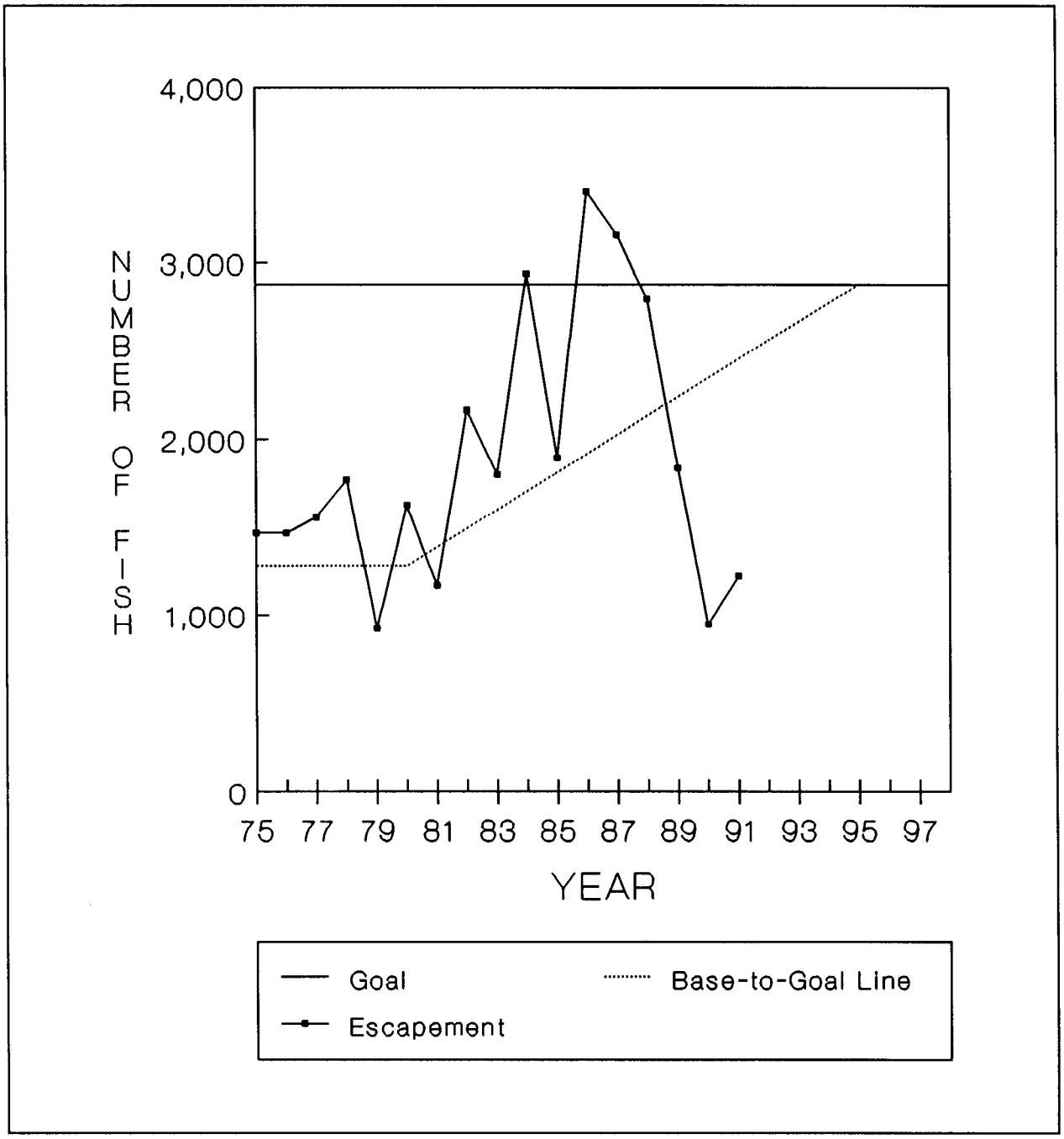

Figure 15. Estimated escapements of chinook salmon to the Unuk River, 1975-1991. Base-to-goal line shows linear rebuilding trend, starting in 1981 at average escapement level during first cycle of rebuilding (1975-1980) and ending at management escapement goal of 2,880 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

Table 8. Peak escapements of chinook salmon to tributaries of the Chickamin River, 1960-1991. [a,b]

Year	South Fork Creek	Barrier Creek	Butler Creek	Leduc Creek	Indian Creek	Humpy Creek	King Creek	Clear Falls Creek	Total
1960	-	-	-	-	-	3 (A)	-	-	3
1961	-	36 (A)	77 (A)	42 (A)	5 (A)	120 (A)	48 (A)	-	328
1962	400 (A)	35 (A)	-	-	-	150 (A)	-	-	585
1963	350 (A)	115 (A)	-	-	-	3 (A)	200 (A)	-	668
1964	-	-	-	-	-	-	-	-	-
1965	-	-	-	-	-	-	75 (A)	-	75
1966	-	-	-	-	-	50 (F)	-	-	50
1967	-	-	-	-	-	-	45 (H)	-	45
1968	-	-	-	-	-	30 (H)	20 (H)	-	50
1969	-	-	-	-	-	10 (H)	45 (H)	-	55
1970	-	-	-	-	-	-	-	-	-
1971	-	-	-	-	-	-	-	-	-
1972	350 (A)	25 (A)	-	85 (A)	-	65 (A)	510 (A)	-	1,035
1973	-	-	-	-	-	14 (A)	65 (A)	-	79
1974	144 (H)	-	-	-	-	-	11 (H)	-	155
1975	141 (H)	9 (H)	66 (H)	6 (H)	90 (H)	7 (H)	30 (H)	-	349
1976	46 (H)	10 (H)	15 (H)	12 (H)	9 (H)	-	-	-	92
1977	52 (H)	66 (H)	30 (H)	26 (H)	53 (H)	0 (H)	-	-	227
1978	21 (H)	94 (H)	4 (H)	42 (H)	20 (H)	-	-	-	181
1979	63 (H)	17 (H)	29 (H)	0 (H)	31 (H)	-	-	-	140
1980	56 (H)	62 (H)	104 (H)	17 (H)	22 (H)	-	-	-	261
1981	51 (H)	105 (H)	51 (H)	25 (H)	12 (H)	4 (F)	105 (F)	31 (H)	384
1982	84 (H)	149 (H)	37 (H)	36 (H)	30 (F)	37 (F)	165 (F)	33 (H)	571
1983	28 (H)	138 (H)	91 (H)	30 (H)	47 (H)	-	212 (F)	30 (H)	576
1984	185 (H)	171 (H)	124 (H)	15 (H)	103 (H)	88 (F)	388 (F)	28 (H)	1,102
1985	163 (H)	129 (H)	92 (H)	8 (H)	125 (H)	50 (H)	377 (H)	12 (H)	956
1986	562 (H)	168 (H)	203 (H)	20 (H)	120 (H)	-	564 (H)	40 (H)	1,677
1987	261 (H)	76 (H)	120 (H)	19 (H)	115 (H)	26 (H)	310 (H)	48 (H)	975
1988	280 (H/F)	82 (H/F)	159 (H)	25 (H/F)	32 (H)	19 (H/F)	164 (H)	25 (H/F)	786
1989	226 (H/F)	90 (H)	137 (H)	57 (H)	84 (H)	22 (H/F)	224 (H)	94 (H)	934
1990	135 (F)	107 (H)	27 (H)	20 (H)	24 (H)	35 (H)	163 (H)	53 (H)	564
1991	125 (H)	18 (H)	49 (H)	14 (H)	38 (H)	13 (H)	185 (H)	45 (H)	487

[a] (F) = Escapement surveyed by walking stream.
(H) = Escapement surveyed by helicopter.
(A) = Escapement surveyed by fixed-wing aircraft.
(H/F) = Escapement surveyed by combination of walking and helicopter.
- = No survey conducted or data not comparable.

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

Table 9. Percentages of total escapements of chinook salmon to index 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 Creek	%	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	7	36	6	30	5	37	7	165	29	33	6	571
1984	185	17	171	16	124	11	15	1	103	9	88	8	388	35	28	2	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
1989	226	24	90	10	137	15	57	6	84	9	22	2	224	24	94	10	934
1990	135	24	107	19	27	5	20	4	24	4	35	6	163	29	53	9	564
Average	170	21	117	14	94	11	26	3	66	8	35	4	237	29	41	5	784
1991	125	22	18	3	49	9	14	2	38	7	13	2	185	33	45	8	487

Expansion of the total observed peak escapement by the survey expansion factor of 1/0.625 gave an estimated total escapement to the Chickamin River drainage of 779 chinook salmon, only 44% of the management escapement goal of 1,440 large chinook salmon. The 1991 total escapement was 14% lower than in 1990 and 43% lower than 1981-1985 average escapement of 1,169; however, it was 230% higher than the 1975-1980 average of 338 fish. The 1991 escapement of chinook salmon to the Chickamin River falls below both the management escapement goal and the rebuilding schedule. Prior to 1990, total escapements had been above the linear rebuilding schedule since 1980, and close to or above the management escapement goal since 1984 (Figure 16).

Chilkat River

In 1991, 185 large chinook salmon were observed during the peak aerial surveys of the Big Boulder and Stonehouse creek index streams (Table 10). Expanding the combined peak aerial count for Big Boulder and Stonehouse Creeks by the tributary (1/0.28) and survey (1/0.80) expansion factors resulted in an estimate of 826 large chinook salmon for the Chilkat River system. Escapement of chinook salmon to the Chilkat River in 1990 was again below the linear rebuilding schedule and is still well below the total escapement goal of 2,000 large chinook salmon (Figure 17). Ongoing research on the Chilkat River has indicated that the aerial survey expansion method may not accurately reflect the actual chinook salmon escapement. The surveys will be continued on an annual basis pending conclusive results.

Other Rivers

The observed peak escapement of 239 large chinook salmon to the Blossom River in 1991 was similar to the 1990 escapement of 257 (Table 11). The expanded escapement estimate for the Blossom River of 382 fish was approximately 30% of the escapement goal of 1,280 fish. This escapement goal was exceeded in both 1986 and 1987. Since 1988, escapements of chinook salmon to the Blossom River have fallen below the linear rebuilding schedule (Figure 18).

Escapement to the Keta River in 1991 fell to 272 fish after a dramatic increase in 1989 of 1,155 large chinook salmon (Table 11). Expanding the peak aerial count by the survey expansion factor of 1/0.625 resulted in an estimate of 435 large chinook salmon, below the escapement goal of 800 fish. Prior to 1990, chinook salmon escapements to the Keta River had increased steadily since implementation of the rebuilding program in 1980, and had exceeded the management escapement goal every year since 1983 (Figure 19).

The Marten River is not used as a chinook salmon index stream and no escapement goals have been established. The escapements to this system have, however, been regularly monitored since 1982. The 1991 peak escapement count for the Marten River of 135 large chinook salmon was 47% of the 1990 count of 283 fish. Chinook salmon escapements to the Wilson River were not estimated in 1991.

The 1991 weir count of 146 large chinook salmon to the King Salmon River was 23% below the 1990 escapement and below the 1983 to 1990 average escapement of 236 fish (Table 12). The addition of 8 adult chinook salmon observed spawning below the weir resulted in an estimated total return of 154 adult chinook salmon; 20 large chinook salmon were taken for brood stock production at the ADF&G Snettisham hatchery, so 134 large chinook salmon spawned in the King Salmon River in 1991. Since 1983, chinook salmon escapements to the King Salmon River have been

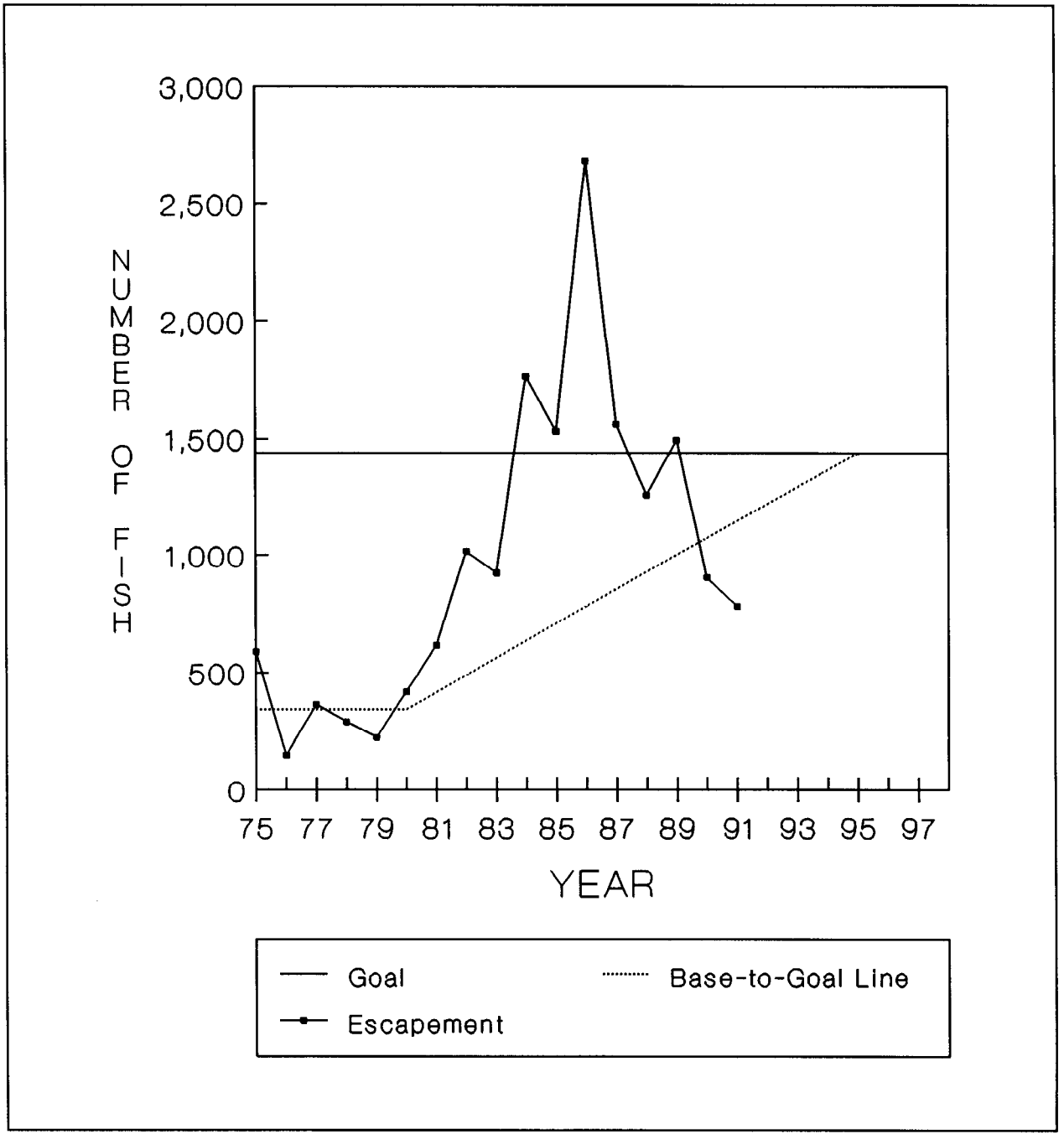

Figure 16. Estimated escapements of chinook salmon to the Chickamin River, 1975-1991. Base-to-goal line indicates linear rebuilding trend, starting in 1981 at average escapement level during first cycle of rebuilding (1975-1980) and ending at management escapement goal of 1,440 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

Table 10. Peak escapements of chinook salmon to index tributaries of the Chilkat River, 1960-1991.[a,b]

Year	Big Boulder Creek	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
1989	74 (H)	231 (H)	305
1990	19 (H)	42 (H)	61
1991	59 (F)	126 (H)	185[c]

[a] (F) = Escapement surveyed by walking stream.
(A) = Escapement surveyed from fixed-wing aircraft.
(H) = Escapement surveyed from helicopter.
(H/F) = Escapement surveyed from helicopter and by walking portions of stream.
- = No survey conducted or data not comparable.

[b] Escapement counts prior to 1975 may not be comparable because of differences in survey dates and counting methods.

[c] Big Boulder count includes 27 fish removed for egg take.

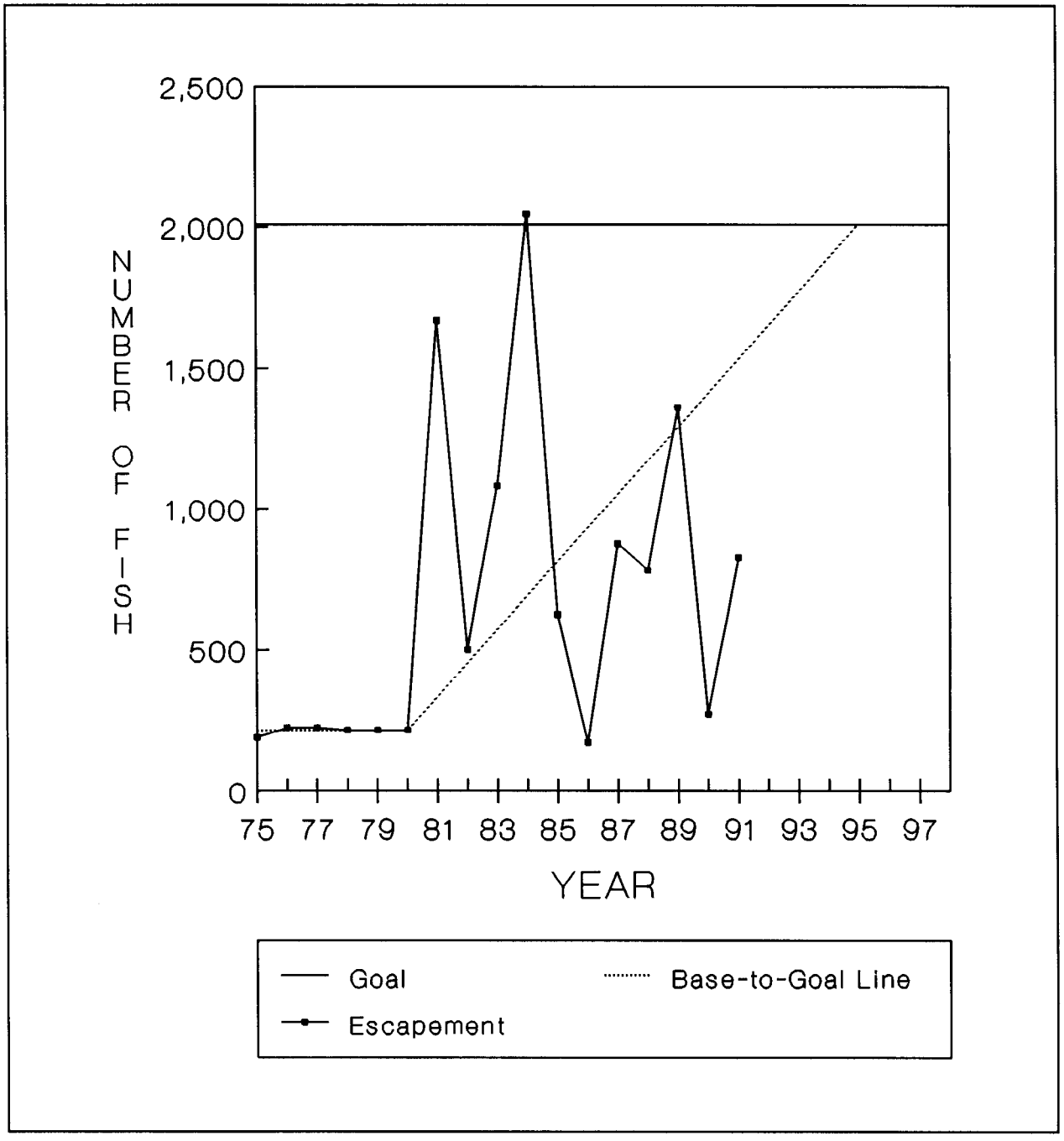

Figure 17. Estimated escapements of chinook salmon to the Chilkat River, 1975-1991. Base-to-goal line shows linear rebuilding trend, starting in 1981 at average escapement level during first cycle of rebuilding (1975-1980) and ending at management escapement goal of 2,000 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

Table 11. Peak escapement counts of chinook salmon for selected rivers in Behm Canal, 1948-1991. [a,b]

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
1989	1,155 (H)	344 (H)	-	133 (H)	-	-	1,632
1990	606 (H)	257 (H)	-	283 (H)	-	-	1,146
1991	272 (H)	239 (H)	-	135 (H)	-	-	646

[a] (F) = Escapement surveyed by walking stream.
(A) = Escapement surveyed from fixed-wing aircraft.
(H) = Escapement surveyed from helicopter.
(B) = Escapement surveyed from boat.
- = No survey conducted or data not comparable.

[b] Escapement counts prior to 1975 may not be comparable because of differences in survey dates or methods.

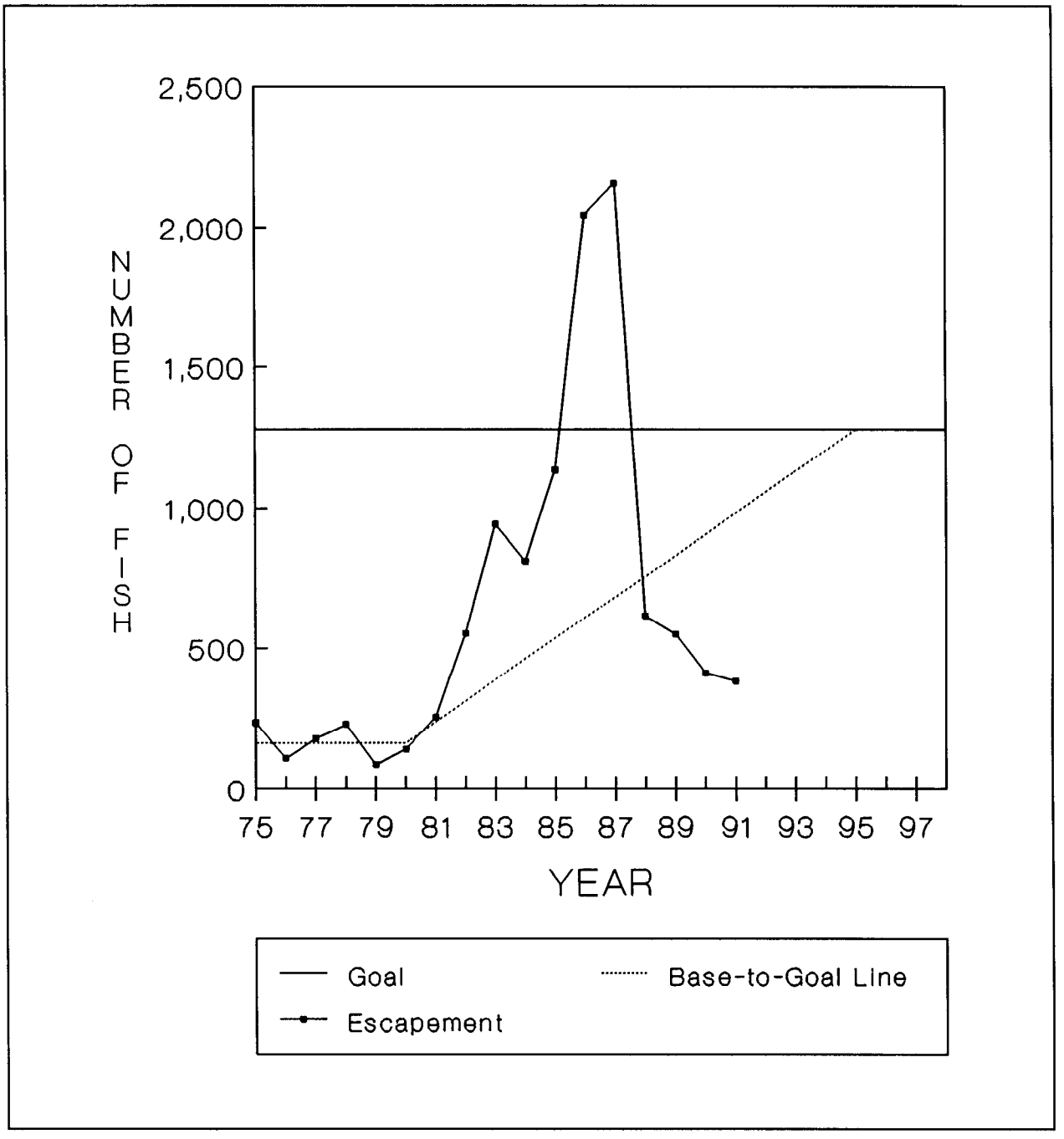

Figure 18. Estimated escapements of chinook salmon to the Blossom River, 1975-1991. Base-to-goal line shows linear rebuilding trend, starting in 1981 at average escapement level during first cycle of rebuilding (1975-1980) and ending at management escapement goal of 1,280 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

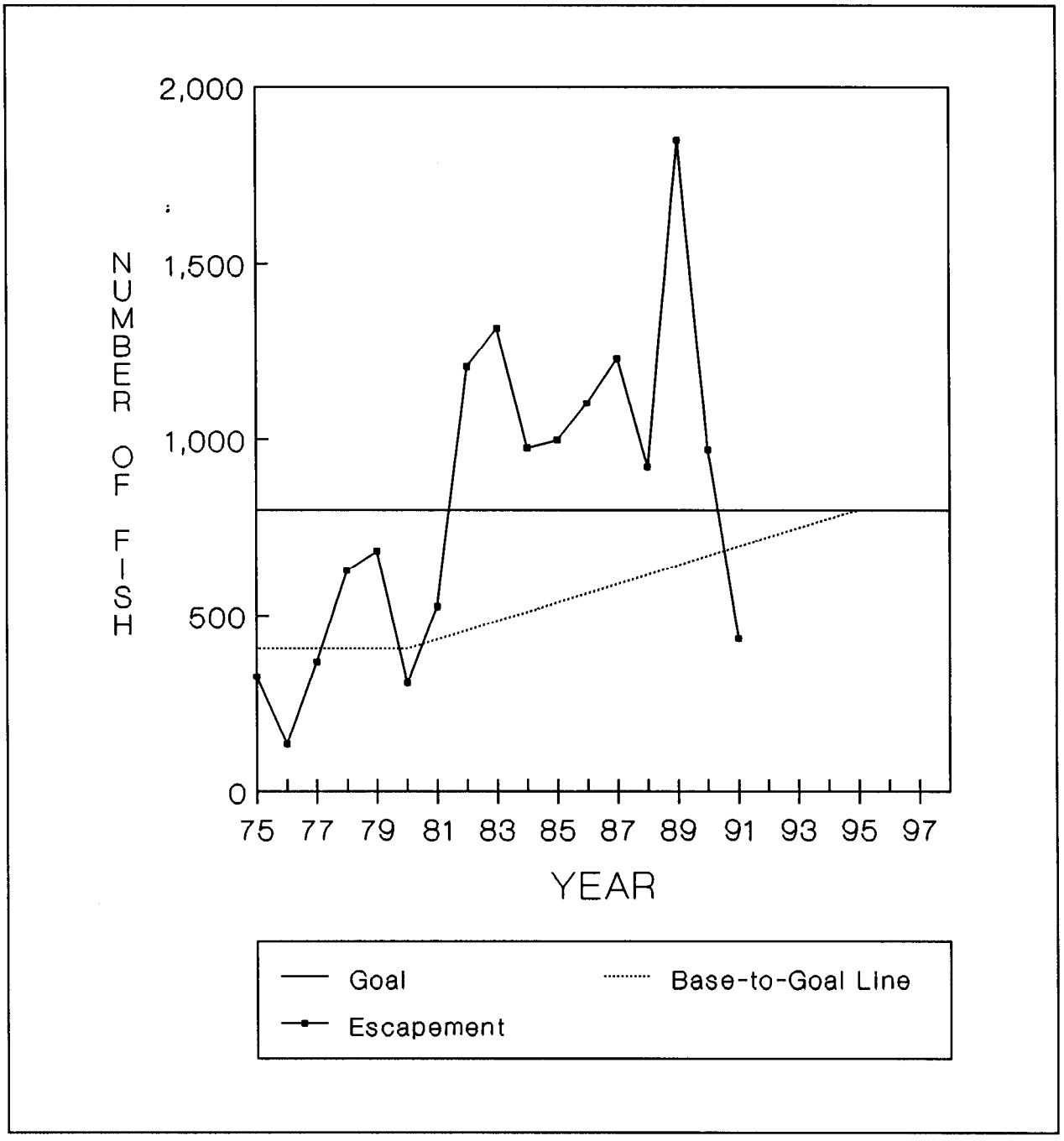

Figure 19. Estimated escapements of chinook salmon to the Keta River, 1975-1991. Base-to-goal line shows linear rebuilding trend, starting in 1981 at average escapement level during first cycle of rebuilding (1975-1980) and ending at management escapement goal of 800 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

Table 12. Peak escapements and weir counts of chinook salmon for the King Salmon River, 1957-1991.[a,b]

Year	Aerial count		Aerial count as percent of weir count[c]	Total Snettisham egg take	Total weir count (adults)[d]	Total weir count (jacks)[e]	Spawners below weir (foot count)	Total return[f]	Total natural spawning[g]
	Below weir	Above weir							
1957	-	200 (F)	-	-	-	-	-	200	200
1960	-	20 (F)[h]	-	-	-	-	-	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)	0.52[i]	37	231	54	12	243	206
1989	34	133 (H)	0.64	40[j]	249	71	29	278	238
1990	34	98 (H)	0.52	30	190	32	8	198	168
1991	6	91 (H)	0.68	20	146	89	8	154	134

[a] (F) = Escapement surveyed by walking stream.
(H) = Escapement surveyed from helicopter.
- = No survey conducted or data not comparable.

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

[c] (total aerial count above weir)/(total weir count excluding jacks - egg take).

[d] Includes adult spawners used for egg take.

[e] Minimum count as jacks could pass through weir.

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

[g] Natural spawning (adults) = (weir count - egg take & mortality) + spawners below weir (83-89).

[h] Accuracy of count questionable (minimal number of spawners).

[i] Four females and two males were held but not spawned for egg take.

[j] Includes holding mortality of 4 males and 6 females for egg take.

slightly below the management escapement goal of 250 large chinook salmon, but until 1990 were still ahead of the linear rebuilding schedule (Figure 20).

Escapements of chinook salmon to the Situk River in 1991 increased to 875 large chinook salmon (Table 13). The 1991 escapement was 25% higher than the 1990 escapement of 700 and 22% and 33% lower than the 1981-1985 and 1975-1980 average escapements of 995 and 1,299 fish, respectively. In 1991, the chinook salmon escapement goal to the Situk River was reduced to 600 large fish (ADF&G 1991) Escapements have exceeded the revised escapement goal since 1984 (Figure 21).

DISCUSSION

The index expansion method relies on the assumption that escapements to the index tributaries are a constant proportion of the total escapement and are, therefore, "indicative" of the total escapement to all systems. There is reason to question the validity of this assumption for at least the Taku and Chilkat Rivers. Mecum (1990) examined those years when all Taku River tributaries were surveyed and found that expansion of five or six index systems may give a more representative estimation of total escapement to the Taku River than the two systems then used. The Transboundary River Technical Committee of the PSC agreed in 1991 to a new escapement goal for the combined counts of all six index tributaries (TCTR 91-4). This goal incorporates no expansion factors and refers to chinook actually observed on the surveys. Since terminal catches at this time are insignificant compared to escapement levels, the TBTC recommends that only escapement counts for the six index tributaries be used in assessing rebuilding.

Any change in survey methods must also take into account the comparability of historical data with new data. Year to year consistency and repeatability of index counts may be more important than their absolute accuracy to agencies that compare escapement estimates between years. Therefore, the expanded estimates of total escapement to the Taku River and total Southeast Alaska escapement, were calculated using the same methods as used from 1981 to 1990 (Pahlke 1990).

The estimated total escapement of chinook salmon for all Southeast Alaska and transboundary rivers declined from 52,031 fish in 1990 to 47,193 fish in 1991. This was the third decline in a row after increasing escapements were observed over the previous six years. The total escapement of chinook salmon in 1991 was 8%, or 4,300 fish, less than in 1990 and only 75% of the 1991 escapement goal of 64,000 chinook salmon. The 1991 escapement represents an increase of approximately 74%, or 20,200 chinook salmon, over the 1975-1980 base period average of 27,500 chinook salmon and an increase of 15%, or 6,000 chinook salmon, over the 1981-1985 average of 41,700 chinook salmon (Appendix A.2).

Although total escapements of chinook salmon declined in 1991, increases were still observed in the Stikine (3%), Alsek (37%), Situk (25%), Unuk (29%) and Chilkat Rivers (>200%). Chinook salmon escapements declined in 6 of the 11 index systems. The largest declines occurred in the Taku River, where the 1991 escapement of 16,254 chinook salmon was 23% (4,854 fish) below the 1990 escapement of 21,278 fish, and in the Keta River, which declined 55% from 970 in 1990 to only 435 in 1991. Escapements of chinook salmon also declined in the Chickamin (down 14%), Blossom (down 7%), King Salmon (down 20%) Rivers and Andrew Creek (down 40%).

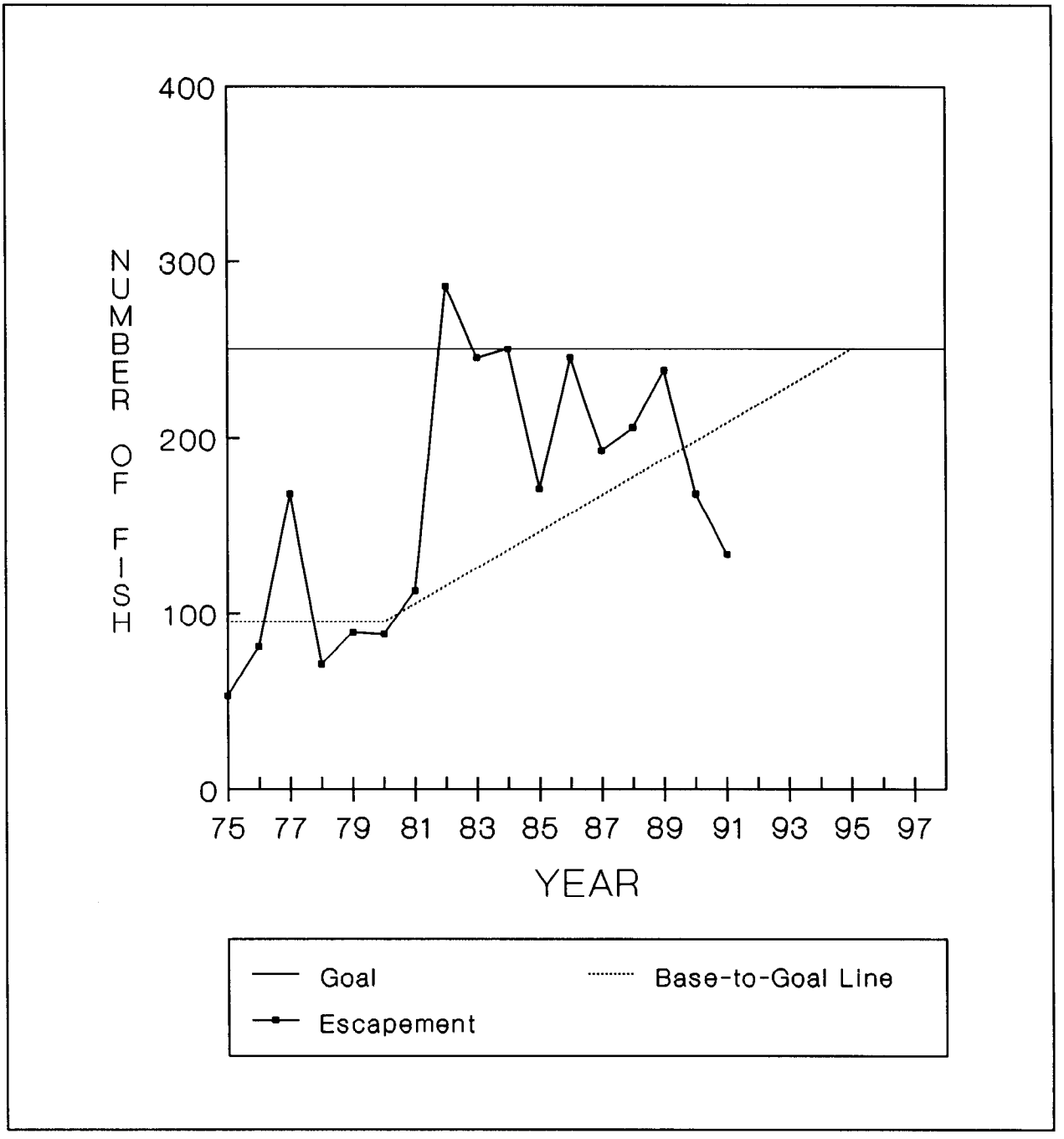

Figure 20. Estimated escapements of chinook salmon to the King Salmon River, 1975-1991. Base-to-goal line shows linear rebuilding trend, starting in 1981 at average escapement level during first cycle of rebuilding (1975-1980) and ending at management escapement goal of 250 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

Table 13. Harvest, escapement, and minimum total run of Situk River chinook salmon, 1915-1991.

Year	Commercial chinook harvests: Yakutat Bay	Situk River: Commercial	Situk River: Subsistence	Recreational: Large	Recreational: Small	Escapement: Large chinook	Escapement: Small chinook	Escapement: Total	Total run size[a]: Large only	Total run size[a]: All chinook
1915	–	836	–	–	–	–	–	–	–	836
1916	–	931	–	–	–	–	–	–	–	931
1917	–	2,499	–	–	–	–	–	–	–	2,499
1918	–	1,036	–	–	–	–	–	–	–	1,036
1919	–	316	–	–	–	–	–	–	–	316
1920	–	782	–	–	–	–	–	–	–	782
1921	–	1,952	–	–	–	–	–	–	–	1,952
1922	–	2,118	–	–	–	–	–	–	–	2,118
1923	–	1,761	–	–	–	–	–	–	–	1,761
1924	–	1,351	–	–	–	–	–	–	–	1,351
1925	–	1,087	–	–	–	–	–	–	–	1,087
1926	–	1,851	–	–	–	–	–	–	–	1,851
1927	–	1,687	–	–	–	–	–	–	–	1,687
1928	–	–	–	–	–	–	–	1,224	–	1,224
1929	–	–	–	–	–	–	–	3,559	–	3,559
1930	–	–	–	–	–	–	–	1,455	–	1,455
1931	–	–	–	–	–	–	–	2,967	–	2,967
1932	–	–	–	–	–	–	–	1,978	–	1,978
1933	–	267	–	–	–	–	–	–	–	267
1934	–	450	–	–	–	–	–	1,486	1,936	1,936
1935	–	558	–	–	–	–	–	638	1,196	1,196
1936	–	–	–	–	–	–	–	816	–	816
1937	–	–	–	–	–	–	–	1,290	–	1,290
1938	–	1,220	–	–	–	–	–	2,668	3,888	3,888
1939	–	495	–	–	–	–	–	2,117	2,612	2,612
1940	–	164	–	–	–	–	–	903	1,067	1,067
1941	–	390	–	–	–	–	–	2,594	2,984	2,984
1942	–	430	–	–	–	–	–	2,543	2,973	2,973
1943	–	947	–	–	–	–	–	3,546	4,493	4,493
1944	–	844	–	–	–	–	–	2,906	3,750	3,750
1945	–	692	–	–	–	–	–	1,458	2,150	2,150
1946	–	1,468	–	–	–	–	–	4,284	5,752	5,752
1947	–	885	–	–	–	–	–	5,077	5,962	5,962
1948	–	694	–	–	–	–	–	3,744	4,438	4,438
1949	–	410	–	–	–	–	–	1,978	2,388	2,388
1950	–	378	–	–	–	–	–	2,011	2,389	2,389
1951	–	948	–	–	–	–	–	2,780	3,728	3,728
1952	–	225	–	–	–	–	–	1,459	1,684	1,684
1953	–	378	–	–	–	–	–	1,040	1,418	1,418
1954	–	314	–	–	–	–	–	2,101	2,415	2,415
1955	–	740	–	–	–	–	–	1,571	2,311	2,311
1956	–	1,867	–	–	–	–	–	–	–	1,867
1957	–	1,796	–	–	–	–	–	1,500	–	3,296
1958	–	187	–	–	–	–	–	300	–	487
1959	–	426	–	–	–	–	–	–	–	426
1960	24	312	–	–	–	–	–	500	–	812
1961	28	367	–	–	–	–	–	400	–	767
1962	99	337	–	–	–	–	–	1,000	–	1,337
1963	141	466	–	–	–	–	–	–	–	466
1964	115	706	–	–	–	–	–	725	–	1,431
1965	86	442	–	–	–	–	–	1,500	–	1,942
1966	43	411	–	–	–	–	–	800	–	1,211
1967	241	203	–	–	–	–	–	200	–	403
1968	31	312	–	–	–	–	–	700	–	1,012
1969	29	1,089	–	–	–	–	–	2,500	–	3,589

-continued-

Table 13. (Page 2 of 2).

Year	Commercial chinook harvests: Yakutat Bay	Commercial chinook harvests: Situk River Commercial	Commercial chinook harvests: Situk River Subsistence	Recreational: Large	Recreational: Small	Escapement: Large chinook	Escapement: Small chinook	Escapement: Total	Total run size[a]: Large only	Total run size[a]: All chinook
1970	119	927	–	–	–	–	–	1,100	–	2,027
1971	106	473	–	–	–	–	–	964	–	1,437
1972	115	303	–	–	–	–	–	400	–	703
1973	79	752	–	–	–	–	–	510	–	1,262
1974	64	791	–	–	–	–	–	702	–	1,493
1975	41	562	27	–	–	–	–	1,180	–	1,769
1976	69	1,002	41	200	–	1,433	509	1,942	2,676	3,185
1977	53	833	24	244	–	1,732	148	1,880	2,833	2,981
1978	108	382	50	210	–	814	289	1,103	1,456	1,745
1979	51	1,028	25	282	–	1,400	367	1,767	2,735	3,102
1980	164	969	57	353	–	905	220	1,125	2,284	2,504
1981	151	858	62	130	–	702	105	807	1,752	1,857
1982	419	248	27	63	0	434	177	611	772	949
1983	371	349	50	42	10	592	257	849	1,033	1,300
1984	145	512	50	146	5	1,726	475	2,201	2,434	2,914
1985	240	484	81	294	217	1,521	461	1,982	2,380	3,058
1986	211	202	87	0	37	2,067	505	2,572	2,356	2,898
1987	329	891	22	76	319	1,884	494	1,884	2,873	3,192
1988	196	299	81	185	3	885	193	1,078	1,450	1,646
1989	297	1	29	0	0	652	1,217	1,869	682	1,899
1990	304	0[b]	na	0	0	700	631[c]	1,331	923	1,741
1991	na	786	na	na	na	875	716[d]	1,591	na	na

[a] Total run = chinook escapement + Situk commercial, sport, and subsistence harvests.

[b] Non-retention regulation in effect for commercial fisheries in 1989 and 1990; estimated harvest of 223 large chinook in 1990.

[c] Small chinook includes 486 medium fish (>450mm<660mm MEF).

[d] Small chinook 1991 includes 132 medium fish.

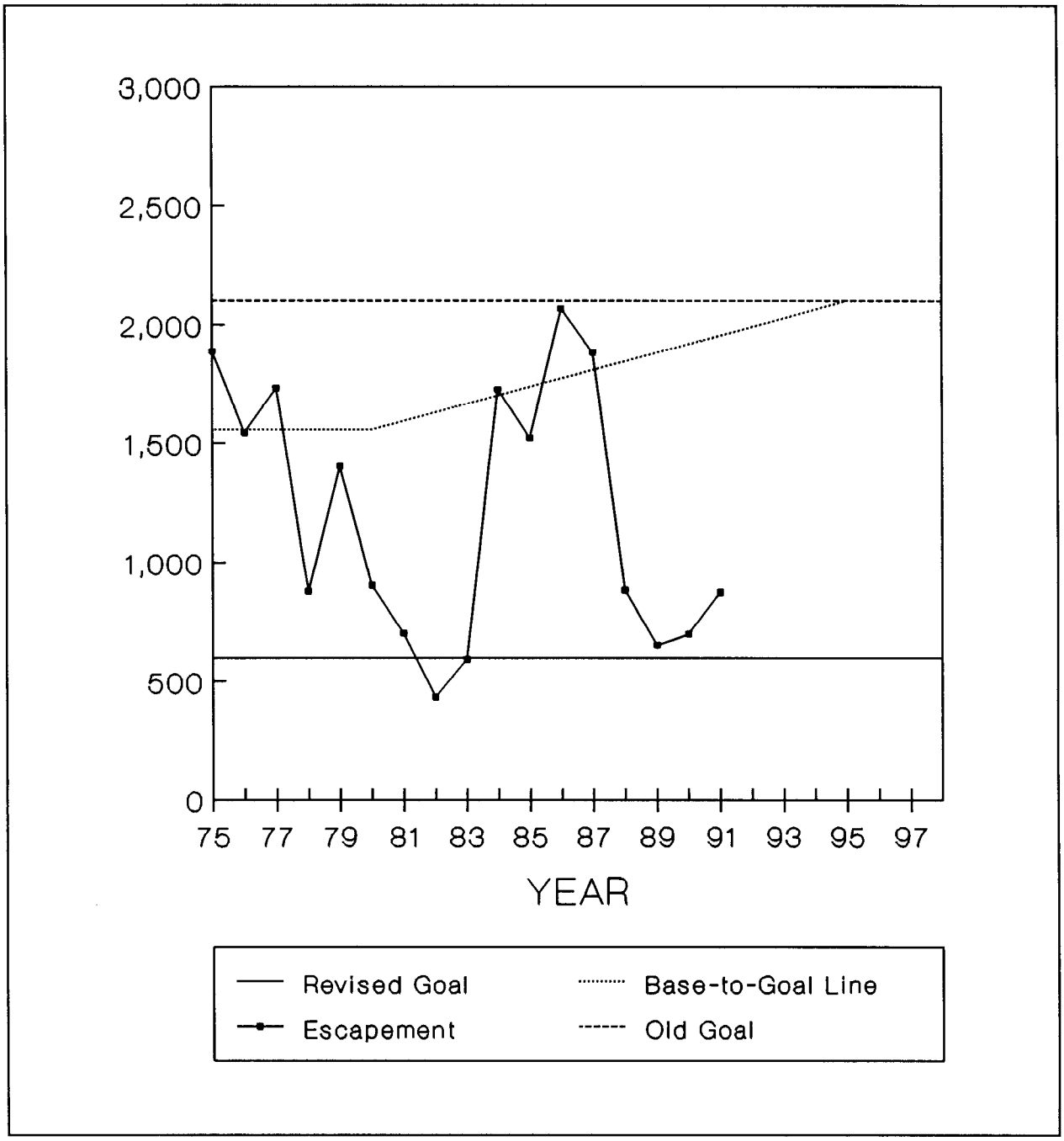

Figure 21. Estimated escapements of chinook salmon to the Situk River, 1975-1991. Base-to-goal line shows linear rebuilding trend, starting in 1981 at average escapement level during first cycle of rebuilding (1975-1980) and ending at management escapement goal of 2,100 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

Total escapements of chinook salmon in Southeast Alaska have exhibited a strong trend towards rebuilding since 1984 (Figure 22). This is due primarily to the Taku and Stikine rivers. These two rivers make up 61% of the total Southeast Alaska escapement goal and made up 72% of the total 1991 escapement. Three of the index systems (the Chilkat, Alsek, and Blossom rivers) have lagged behind the linear rebuilding schedule, and several others have slipped below the schedule in the last two years. Fluctuations in the annual escapement into an index area are expected. Water and weather conditions, pilot or observer experience and/or a change in the actual escapement can all affect the count. Multi-year trends are more significant than a given escapement count, and that is why the PSC concentrates on whether a stock's escapement trend is above or below the linear rebuilding trends as shown in Figures 11-22.

The observed decline in escapements to the Alsek River was not expected, particularly since harvests of this stock in terminal net and recreational fisheries has been greatly reduced in recent years. Gmelch (1982) hypothesized that increased siltation and subsequent changes in channel morphology in the lower Alsek River estuary in Dry Bay may be contributing to the slow rebuilding progress of this stock. Other possible factors include: (1) the management escapement goals for the Alsek River is higher than it should be to achieve optimum sustained production; (2) Alsek River chinook salmon may be harvested to a greater extent in mixed stock domestic or high seas foreign gill net fisheries than previously believed; or (3) some combination of all of the factors listed above (Mecum and Kissner 1989). Recently initiated coded-wire tagging studies on the Alsek (Mecum 1989) and Situk rivers will provide information on migratory patterns and harvest rates and may provide insight into the primary reasons for the decline of these stocks.

Based on spawner-recruit analysis, ADF&G in 1991 revised the management escapement goal for chinook salmon in the Situk River to 600 large fish, with a range of 450 to 900 (McPherson, in press). This revised goal has been adopted by the PSC and was therefore used for assessment of rebuilding. The Alaska Board of Fisheries, approved a Situk River management plan in 1991 that incorporated the revised escapement goal through the Situk River weir of 600 large chinook salmon. With this plan in operation, it is unlikely that the old escapement goal of 2,100 fish will ever be reached.

Chinook salmon escapements to the Unuk, Chickamin, and Blossom rivers have declined substantially since 1987. Before 1987, the three stocks had been rebuilding and were above the linear rebuilding schedules for each river. The cause of the recent decline in these stocks is unknown. The three rivers, along with the Keta River, make up the major wild stocks of chinook salmon in southern Southeast Alaska. Brood stocks from the Unuk and Chickamin rivers are used in several large hatchery programs near Ketchikan. These hatcheries provide significant returns of adult salmon which rear and migrate in similar areas to wild donor stocks (Mecum and Kissner 1989). It is possible that increasing effort to harvest hatchery stocks has impacted the wild stocks. Coded-wire tag recoveries of wild and hatchery stocks will help evaluate this hypothesis (Pahlke *In press*).

Information from recoveries of coded-wire tagged chinook salmon fingerlings released in the Chilkat River indicate that this stock is harvested primarily in the Lynn Canal drift gill net fishery, the Haines and Juneau area marine recreational fisheries and in the commercial troll fishery in Icy Straits (Pahlke, 1991).

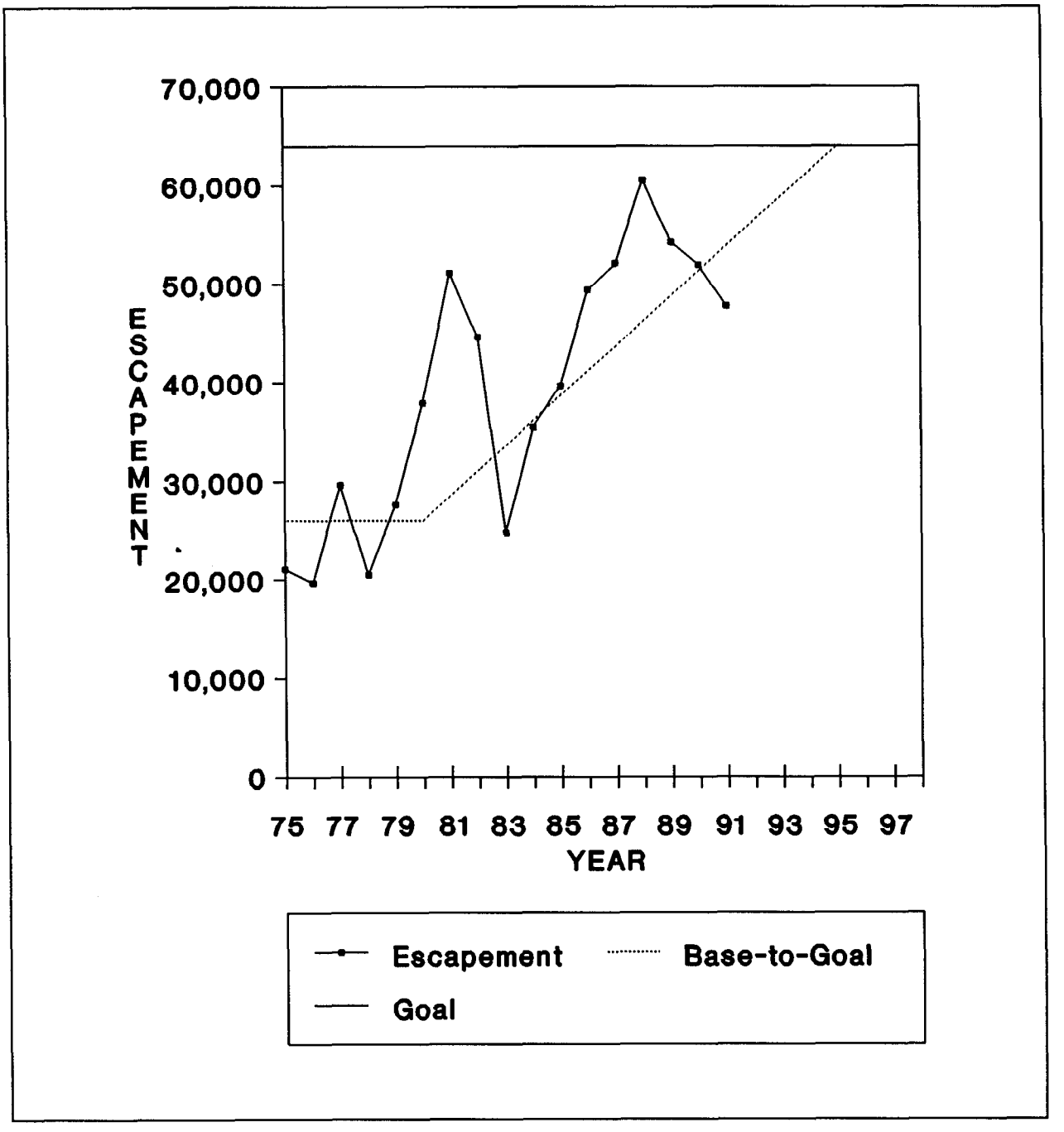

Figure 22. Estimated total escapement of chinook salmon to Southeast Alaska and transboundary river index systems, 1975-1991. Base-to-goal line shows linear rebuilding trend, starting in 1981 at average escapement level during first cycle of rebuilding (1975-1980) and ending at management escapement goal of 64,000 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

In 1991, a mark/recapture study on the Chilkat River indicated an escapement of several thousand more chinook salmon than was estimated by the index area surveys (Johnson, in press). Many of the spawning areas in the Chilkat system are glacial and can not be surveyed. The large tributary expansion factor was developed to reflect those uncounted fish, but in 1991 it greatly underestimated the escapement. Continued research will be required to determine if the index area surveys accurately reflect trends in escapement or whether alternative methods should be developed.

The King Salmon River is unique in being the only island chinook system in Southeast Alaska and it may not be the best system to represent 21 other small mainland chinook systems. However, small systems are expensive to survey for very few fish and are fairly insignificant as far as the total escapement goal. Without additional funding it is unlikely that more small systems will be surveyed regularly.

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APPENDIX A

Appendix A1. Management escapement goals and survey and tributary expansion factors for Southeast Alaska and transboundary rivers. The category escapement goal equals the sum of the survey escapement goal times the survey and tributary expansion factors times the category expansion factor.

River system	Index tributaries surveyed	Survey escapement goal[a]	Survey expansion factor	Tributary expansion factor	System escapement goal	Category expansion factor	Category escapement goal
			Major Production Systems (Total = 3)				
Alsek	Klukshu	3,200 (W)	1/1	1/.64	5,000		
Taku	Nakina/Nahlin	11,500 (A)	1/0.75	1/.60	25,556		
Stikine	Little Tahltan	3,360 (W)	1/1	1/.25	13,440		
Major category subtotal		18,060			43,996	3/3	43,996
			Medium Production Systems (Total = 9)				
Situk	All	2,100 (W)	1/1	1/1	2,100		
Chilkat	Big Boulder/Stonehouse	450 (A)	1/0.80	1/0.28	2,009		
Andrew Cr.	All	470 (A)	1/0.625	1/1	750		
Unuk	All	1,800 (A)	1/0.625	1/1	2,880		
Chickamin	All	900 (A)	1/0.625	1/1	1,440		
Blossom	All	800 (A)	1/0.625	1/1	1,280		
Keta	All	500 (A)	1/0.625	1/1	800		
Medium category subtotal		7,020			11,259	9/7	14,476
			Minor Production Systems (Total = 22)				
King Salmon	All	250 (W)	1/1	1/1	250		
Minor category subtotal		250			250	22/1	5,500
All systems total		25,330			55,504		63,971

[a] (W) = weir count; (A) = aerial survey peak escapement estimate.
Survey escapement goal = number of fish actually counted on survey, or through weir.

Appendix A2. Estimates of total escapements of chinook salmon to escapement indicator systems and to Southeast Alaska and transboundary (T) rivers, 1975-1991. Index escapements are expanded for survey counting rates and unsurveyed tributaries, using 1990 expansions and escapement goals.

	MAJOR SYSTEMS				MEDIUM SYSTEMS										MINOR SYSTEMS			TOTAL
Year	Alsek (T)	Taku (T)	Stikine (T)	Major Subt.	Situk	Chilkat (T)	Andrew	Unuk (T)	Chick- amin(T)	Blossom	Keta	Behm Subt.	Medium Unsurv.	Medium Subt.	King Salm.	Minor Unsurv.	Minor Subt.	ALL SYSTEMS
1975	4,214	4,609	5,800	14,623	1,510	187	416	1,469	588	234	325	2,616	1,351	6,080	53	1,113	1,166	21,869
1976	1,672	8,278	3,300	13,250	1,433	223	404	1,469	147	109	134	1,859	1,120	5,039	81	1,701	1,782	20,071
1977	4,363	10,000	6,600	20,963	1,732	223	456	1,558	363	179	368	2,468	1,394	6,273	168	3,528	3,696	30,932
1978	4,050	4,987	5,200	14,237	814	214	388	1,770	290	229	627	2,916	1,238	5,570	71	1,491	1,562	21,369
1979	6,101	6,593	9,328	22,022	1,400	214	327	922	224	86	682	1,914	1,101	4,956	89	1,869	1,958	28,936
1980	3,770	13,402	17,096	34,268	905	214	282	1,626	418	142	307	2,493	1,113	5,007	88	1,848	1,936	41,211
Average	4,028	7,978	7,887	19,894	1,299	213	379	1,469	338	163	407	2,378	1,219	5,487	92	1,925	2,017	27,398
1981	2,837	17,900	26,672	47,409	702	1,143	536	1,170	614	254	526	2,564	1,413	6,358	113	2,373	2,486	56,253
1982	3,078	8,398	22,640	34,116	434	799	672	2,162	1,015	552	1,206	4,935	1,954	8,794	286	6,006	6,292	49,202
1983	3,352	3,020	4,752	11,124	592	1,103	366	1,800	922	942	1,315	4,979	2,011	9,051	245	5,145	5,390	25,565
1984	2,038	6,307	10,352	18,697	1,726	1,487	389	2,939	1,763	813	976	6,491	2,884	12,977	250	5,250	5,500	37,174
1985	1,853	10,851	12,456	25,160	1,521	536	510	1,894	1,530	1,134	998	5,556	2,321	10,444	171	3,591	3,762	39,366
Average	2,632	9,295	15,374	27,301	995	1,014	495	1,993	1,169	739	1,004	4,905	2,117	9,525	213	4,473	4,686	41,512
Goals	5,000	25,556	13,440	43,996	2,100	2,009	750	2,880	1,440	1,280	800	6,400	3,217	14,476	250	5,250	5,500	63,971
AVERAGE PERCENT OF GOAL																		
1975-80	81%	31%	59%	45%	62%	11%	51%	51%	23%	13%	51%	37%	38%	38%	37%	37%	37%	43%
1981-85	53%	36%	114%	62%	47%	50%	66%	69%	81%	58%	126%	77%	66%	66%	85%	85%	85%	65%
1986-90	66%	56%	143%	84%	59%	38%	135%	84%	110%	90%	152%	100%	83%	83%	84%	84%	84%	84%
1986	3,966	12,178	11,564	27,708	2,067	129	1,131	3,402	2,683	2,045	1,104	9,234	3,589	16,150	245	5,145	5,390	49,248
1987	3,598	8,951	19,132	31,681	1,884	1,286	1,261	3,157	1,560	2,158	1,229	8,104	3,581	16,116	193	4,053	4,246	52,043
1988	2,891	13,411	29,168	45,470	885	781	760	2,794	1,258	614	920	5,586	2,289	10,301	206	4,326	4,532	60,303
1989	3,399	15,451	18,860	37,710	652	1,362	848	1,838	1,494	550	1,848	5,730	2,455	11,047	238	4,998	5,236	53,993
1990	2,722	21,278	17,568	41,568	700	272	1,062	946	902	411	970	3,229	1,504	6,767	168	3,528	3,696	52,031
Average	3,315	14,254	19,258	36,827	1,238	766	1,012	2,427	1,579	1,156	1,214	6,377	2,684	12,076	210	4,410	4,620	53,524
1991	3,165	16,424	18,024	37,613	875	826	640	1,221	779	382	435	2,817	1,474	6,632	134	2,814	2,948	47,756
1991 CHANGE FROM 1990																		
Number	1,006	(4,854)	456	(3,392)	175	554	(422)	275	(123)	(29)	(535)	(412)	(30)	(135)	(34)	(714)	(748)	(4,275)
Percent	37%	-23%	3%	-8%	25%	204%	-40%	29%	-14%	-7%	-55%	-13%	-2%	-2%	-20%	-20%	-20%	-8%

1/ Prior to Little Tahltan weir in 1985, Stikine estimate is 8 times aerial survey.
2/ Using CTC calculations of Alsek Escapement: Escapement = (weir count/0.64)-sport and IFF harvest.
3/ Andrew Creek revised to include North Arm counts

Appendix A3. Survey dates for indexing escapements by helicopter (h) or foot (f) during 1991. Dates are selected to encompass the historical dates of peak spawning.[a]

Location	Survey dates	Survey type
TAKU RIVER		
Nakina River	29 July and 5 August	h
Nahlin River	19 and 29 July	h
Dudidontu River	30 July and 5 August	h
Tseta Creek	29 July and 5 August	h
Kowatua River	11 and 21 August	h
Tatsamenie River	21 and 26 August	h
STIKINE RIVER		
Little Tahltan River	30 July and 6 August	h
Tahltan River	6 August	h
Beatty Creek	30 July and 6 August	h
Andrew Creek	12 August	f
ALSEK RIVER		
Klukshu River	1 August	no survey
Blanchard River	1 August	h
Takhanne River	1 August	h
Goat Creek	1 August	h
BLOSSOM RIVER	19, and 28 August	h
KING SALMON RIVER	23 and 27 July	h
CHILKAT RIVER		
Big Boulder Creek	10 and 17 August	h/f
Stonehouse Creek	10 and 17 August	h
KETA RIVER	19, and 28 August	h
MARTIN RIVER	19 August	h
UNUK RIVER		
Cripple Creek	5 and 10 August	f
Eulachon Creek	21 and 28 August	h & f
Genes Lake Creek	21 August	f
Clear Creek	7 and 14 August	h & f
Lake Creek	7 and 14 August	h & f
Kerr Creek	7 and 14 August	h
CHICKAMIN RIVER		
South Fork	7 and 14 August	h
Barrier Creek	7 and 14 August	h
Butler Creek	7 and 14 August	h
Indian Creek	7 and 14 August	h
Humpy Creek	21 and 28 August	h
King Creek	21 and 28 August	h
Leduc Creek	7 and 14 August	h
Clear Falls Creek	7 and 14 August	h

[a] Kissner (1982).