PACIFIC SALMON COMMISSION
TRANSBOUNDARY TECHNICAL
COMMITTEE REPORT

REPORT TCTR (91)-4

ESCAPEMENT GOALS FOR CHINOOK SALMON IN THE ALSEK, TAKU, AND STIKINE RIVERS

Prepared by the
Transboundary Technical Committee
for the
Pacific Salmon Commission

November 27, 1991

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The Transboundary Technical Committee has developed single escapement goals for the transboundary Alsek, Taku, and Stikine Rivers that have been agreed to by both Parties. For the Alsek River, the escapement goal for the Klukshu River tributary, where the escapement is enumerated annually at a weir, is 4,700 chinook salmon. For the Taku River, the escapement goal for the combined six aerial-survey index systems is 13,200 chinook salmon. For the Stikine River, the escapement goal for the Little Tahltan tributary, where the escapement is enumerated annually at a weir, is 5,300 chinook salmon.

The chinook escapement goals presented here are based on refinements of the goals or methods developed by the two Parties in 1981. While the new joint escapement goals are not considered better estimates of optimal escapement than those originally used by either of the Parties, they do incorporate improvements, including both data correction and refinements in the old methods. Most important, they provide a single estimate for each river that can be used to assess rebuilding in 1995. Exploratory spawner-recruit analyses are currently being done based upon age-specific data from weir samples and it is hoped that by 1995 a sufficient number of years of data and range of escapements will be available to provide revised estimates that better reflect optimal escapement goals.

INTRODUCTION

A program was initiated by the Alaska Department of Fish and Game (ADF&G) in 1981 to help rebuild depressed chinook stocks in Southeast Alaska and transboundary river systems by 1995. The program was later adopted by the Pacific Salmon Commission. The initial rebuilding program lacked specific escapement goals, so the Parties were required to develop appropriate goals. Each Party provided their best estimates of escapement goals for each of the three major transboundary rivers. Although the aim was to have escapement goals that provided the optimal level of harvest, little data was available to produce such estimates. As a result, escapement goals were based on past observed levels of escapement in index tributaries multiplied by expansion factors to account for the proportion of spawners thought to be observed in surveys and the proportion of the entire system represented by the index tributary. The expansion factors were based largely upon professional judgement of the biologists familiar with the watersheds. Considering the limited data, it is not surprising the two Parties arrived at different escapement goals for each river. This report presents escapement goals for the Alsek, Stikine, and Taku Rivers that were developed at a meeting of the Transboundary Technical Committee (TBTC), October 15-18, 1991.

The February 1991 revision of Chapter 3, Annex IV, of the Pacific Salmon Treaty calls for the Parties to *"submit a report to the Commission by December 1991 which presents*

(a) joint recommendations for chinook salmon escapement goals in the transboundary rivers;

(b) given the goals recommended in 3(a), a jointly accepted assessment of progress toward rebuilding chinook stocks in these transboundary rivers based on escapement data available through 1991, and the likelihood of achievement of these goals by 1995; and,

(c) cooperatively developed management options to be identified by December 1991 and initiated in 1992 and following seasons to ensure rebuilding of chinook stocks in the transboundary rivers which are identified in 3(b) as requiring further management actions."

This report directly addresses item (a) and touches on items (b) and (c). The TBTC has developed joint recommendations for chinook escapement goal levels that are based on the goals previously developed by the two Parties. Escapement goals are developed for the index tributaries enumerated on each river rather than for the entire river systems. Expansion factors for converting index escapement levels to entire river

system levels are often based on very little hard data and do not improve assessment of reaching escapement goals. The Chinook Technical Committee (CTC) has used expansion factors on index tributaries such that terminal catches could be added to the expanded escapement allowing total return to the system to be examined. However, in these three transboundary systems, terminal catches in relation to the escapement levels are very small and do not add much information beyond what the escapement data tells us of rebuilding. Available information on expansion factors are reported here.

While the new joint escapement goals are not considered better estimates of optimal escapement than those originally used by either of the Parties, they do incorporate improvements, including both data correction and refinements in the old methods. Most important, they provide a single estimate for each river that can be used to assess rebuilding. Exploratory spawner-recruit analyses are currently being done based upon age-specific data from weir samples and it is hoped that by 1995 a sufficient number of years of data and range of escapements will be available to develop estimates of optimal escapement goals that have a better biological basis. The analysis is limited to years and catches/escapements where age-specific data was collected. In addition, the proposed analyses are limited by the lack of information on stock specific catches of chinook salmon in the marine mixed stock fisheries.

Chinook escapements are generally expressed as adult returns and do not include jacks, although jacks may be listed separately. In early surveys it is not always clear whether the counts include jacks or not; however, all escapements reported here are assumed to be adults and the escapement goals presented refer to adult returns. Male chinook salmon less than 2.3 kg (5 lbs) or less than 71 cm (28 inches) are considered jacks.

ALSEK RIVER

Escapement of chinook salmon to the Alsek River has been enumerated, using standardized methods, at a weir on the Klukshu River since 1976 (Table 1). The highest count recorded between 1976 and 1981 when the goals were originally set was 4,403 chinook, which occurred in 1979. The U.S. originally used this level, rounded to 4,400 fish, as the escapement goal while Canada considered this level to still represent a depressed stock level and set 5,000 as their goal. The TBTC recommends that 4,700 chinook, an average of the two numbers, be used as the escapement goal for the Klukshu River until a better goal is developed. Age specific terminal catch and Klukshu escapement data is available from 1982. By 1995

there will be 10 brood years of data available for spawner-recruit analysis which will, hopefully, lead to a more biologically based escapement goal.

Annual spawning escapements for the Klukshu River are determined by subtracting the Indian food fish catch above the weir from the weir count. Because of the interest by the CTC in looking at escapement to the entire Alsek River and because several different methods of expanding and accounting for inriver catches had been used, in 1989 the TBTC developed a recommended procedure. To estimate the spawning escapement to the entire system, both Parties agreed to double the weir count and then subtract all Canadian sport and Indian food catches. The escapement goals used in the CTC annual reports do not reflect this expansion procedure. The U.S. Alsek goal used by the CTC of 5,000 chinook salmon for the entire Alsek River used in the CTC annual reports was mistakenly derived from 3,200 fish as the highest escapement level between 1976 and 1980; a factor of 1.56 (1/0.64) was used to expand the number to represent the entire system. The Canadian goal of 12,500 chinook for the entire Alsek was derived from Canada's original Klukshu goal of 5,000 chinook and an expansion factor of 2.5. Unless terminal and inriver catches increase significantly, the TBTC recommends that expansion factors not be used and just the spawning escapements to the Klukshu River be used to assess rebuilding.

The chinook rebuilding assessment graphs for the Alsek River from the CTC 1990 annual report, using the original two escapement goals for the entire river, are presented in Figure 1 and a new graph based on the new joint escapement goal for the Klukshu River is presented in Figure 2. The base period (1976-1980) average escapement to Klukshu River is 2,696 large fish; this number is used to determine the base-to-goal line in Figure 2. The Klukshu chinook stock has not responded to the rebuilding program; the escapement levels since 1981 have varied less than between 1977 and 1981 and have shown no discernable increasing or decreasing trend. It is not known why this stock is not responding, particularly since inriver U.S. and Canadian catches have been relatively low compared to Klukshu escapement levels. It is hoped that results from a coded-wire-tag study available starting in 1992 will provide information on the distribution of this stock in marine catches and perhaps an indication as to whether high exploitation rates are limiting the escapement into the river.

Table 1. Index escapement counts of chinook salmon for tributaries of the Alsek River, 1976 to 1991.[a/]

Year	Klukshu Weir Count	Klukshu Escape-ment[b/]	Blanchard River	Takhanne River	Goat Creek	Total
1976	1,244	1,153	-	-	-	1,153
1977	3,144	2,894	-	-	-	2,894
1978	2,976	2,676	-	-	-	2,676
1979	4,403	4,274	-	-	-	4,274
1980	2,637	2,487	-	-	-	2,487
1981	2,113	1,963	35 (H)	11 (H)	-	2,009
1982	2,369	1,969	59 (H)	241 (H)	13 (H)	2,282
1983	2,537	2,237	108 (H)	185 (H)	-	2,530
1984	1,672	1,572	304 (H)	158 (H)	28 (H)	2,062[c/]
1985	1,458	1,283	232 (H)	184 (H)	-	1,699
1986	2,709	2,607	556 (H)	358 (H)	142 (H)	3,663
1987	2,615	2,491	624 (H)	395 (H)	85 (H)	3,595
1988	2,018	1,994	437 E(H)	169 E(H)	54 E(H)	2,654
1989	2,456	2,289	-	158 E(H)	34 E(H)	3,577
1990	1,915	1,742	-	325 E(H)	32 E(H)	2,099
1991	2,489	2,248	121 N(H)	86 E(H)	63 E(H)	2,770

KEY: (F) = Foot survey.
(A) = Fixed-wing aircraft survey.
(H) = Helicopter survey.
E = Excellent survey conditions.
- = No survey conducted or data not comparable.

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

b/ Klukshu River escapement = weir count minus subsistence fishery harvest.

c/ Surveys conducted by CDFO in 1984.

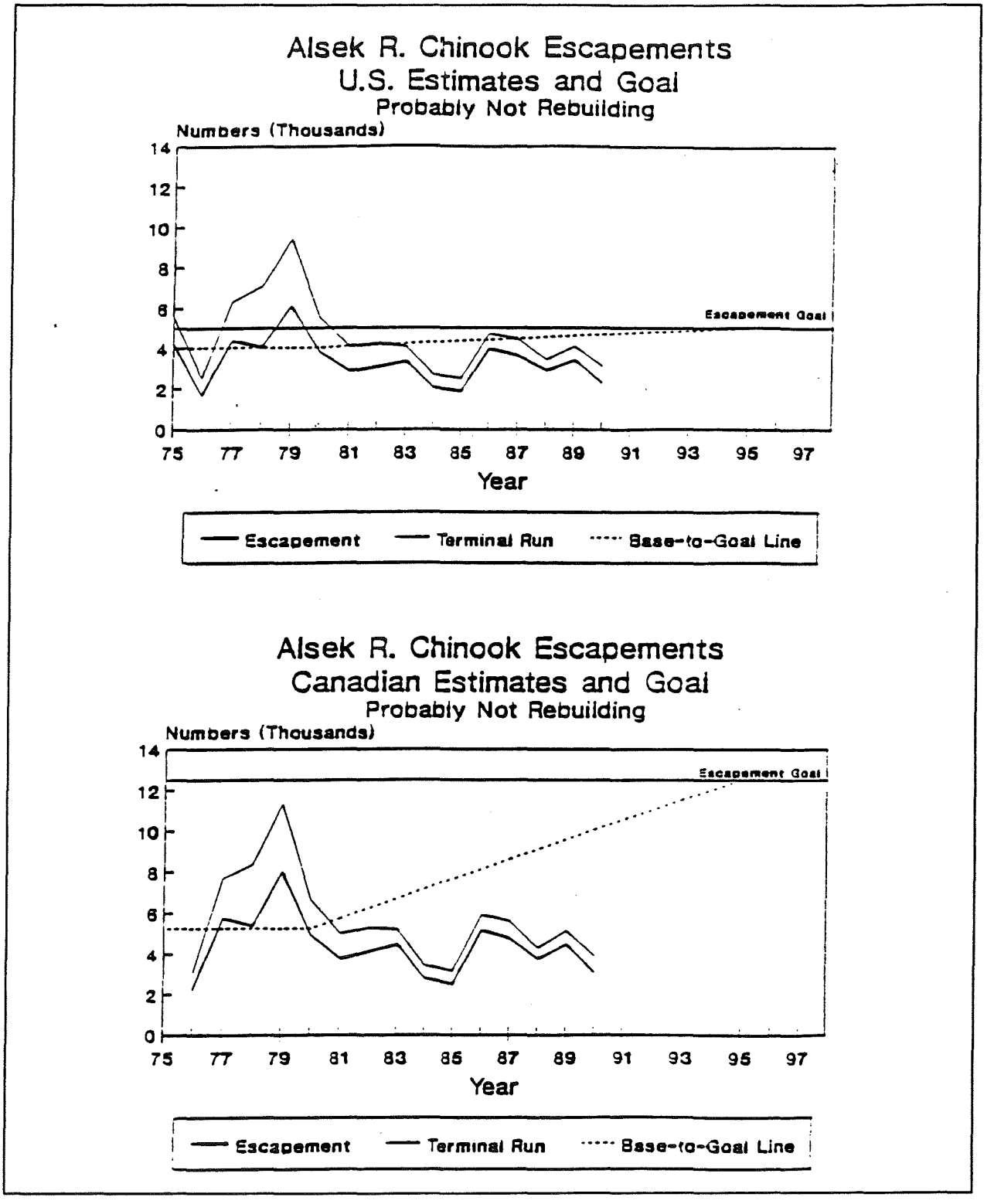

Figure 1. Chinook rebuilding for the Alsek River using the original goals by the two Parties. (from CHINOOKTC 91-4).

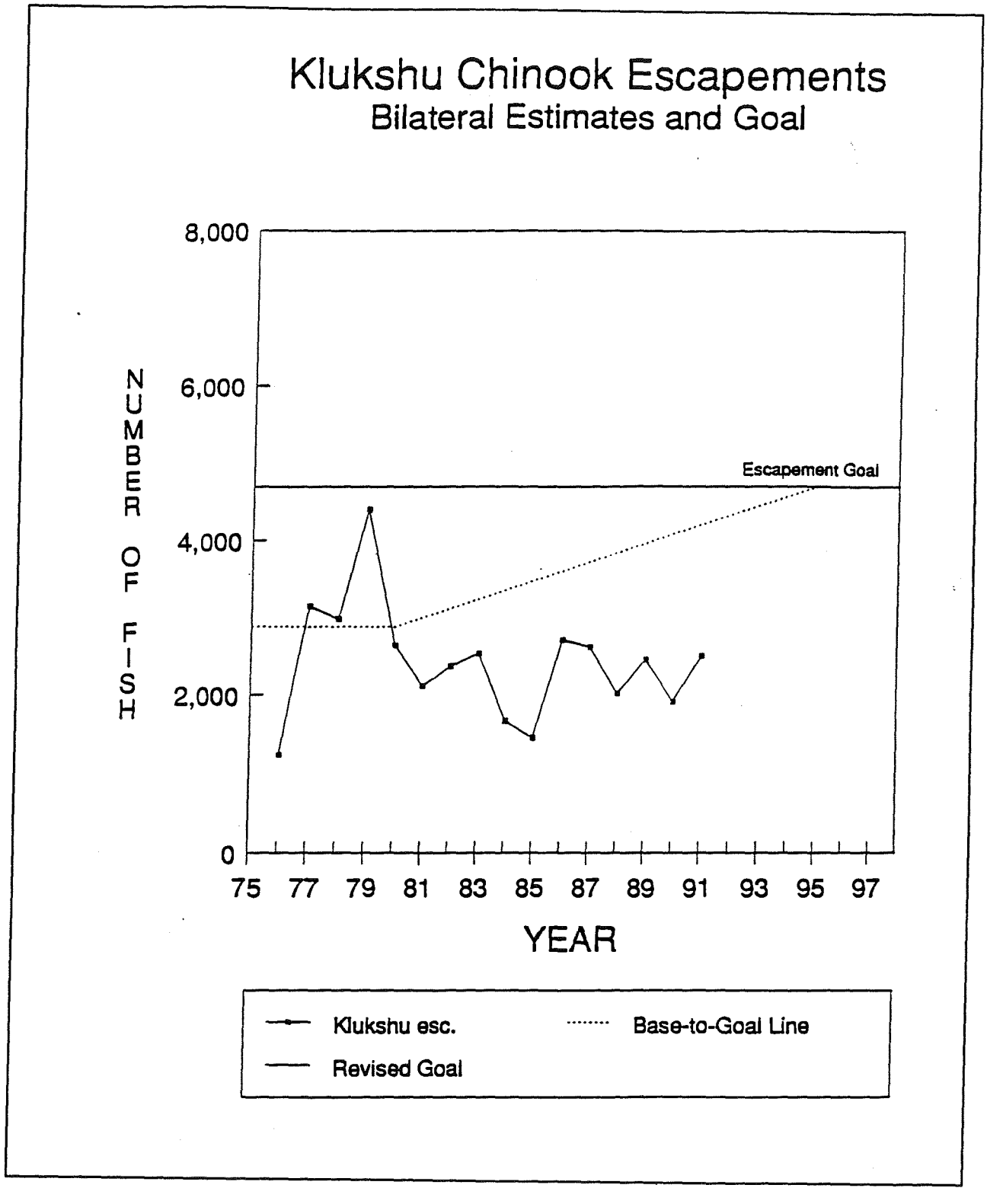

Figure 2. Chinook rebuilding for the Klukshu River using the joint escapement goal.

TAKU RIVER

Aerial surveys of escapement have been conducted fairly regularly on six index tributaries on the Taku River since 1965 (Table 2). Prior to 1991, the U.S. expanded counts from the Nakina and Nahlin River index areas to estimate the escapement to the entire Taku River, while Canada expanded counts from all six index tributaries. It has been agreed by both Parties to use counts from all six tributaries when they are available. Not all tributaries are equally easy to survey and poor conditions could limit surveys in some years. In such cases, it has been agreed that counts of the surveyed tributaries will be expanded to represent the six tributaries based on the historical average proportions.

A joint escapement goal for the combined counts of the six index tributaries was developed by summing each individual tributary's highest count between 1965 and 1981. This gave a goal of 13,200 chinook salmon. This goal incorporates no expansion factors and refers to chinook actually observed on the surveyed tributaries.

Previously used expansion factors were not based on any scientific studies and differed between the two countries. A study conducted by the National Marine Fisheries Service on the Taku River using radio tagging of chinook salmon shows that the contribution of these six index tributaries to the entire Taku system was 55% in 1989 and 44% in 1990 giving an average of about 50% (Table 3). Expanding survey counts to reflect total numbers of fish in the streams surveyed is not so easy. The proportion of the spawning escapement of each tributary surveyed will vary from year to year depending on weather and tributary conditions. While it is noted on the recording sheets whether survey conditions were excellent, normal, or hampered, no estimates of annual variation in proportions counted is attempted. If conditions are very poor, escapement counts are not recorded. ADF&G survey biologists, based on stream characteristics, consider that about 75% of the fish present in the Nakina and Nahlin are counted while only 62.5% of the fish present in the other surveyed tributaries are counted. Since terminal catches are insignificant compared to escapement levels (Figure 3), the TBTC recommends that only escapement counts for the six index tributaries be used in assessing rebuilding (Figure 4).

The chinook rebuilding assessment graphs for the Taku River from the CTC 1990 annual report, using the original two escapement goals for the entire river, are presented in Figure 3 and a new graph based on the new joint escapement goal for the index tributaries is presented in Figure 4. The base period (1975-1980) average escapement to the six index tributaries was 4,582 large fish; this number is used to determine the base-to-goal line in Figure 4. Taku River chinook from the index tributaries are showing a strong rebuilding trend under current management restrictions. The 1990 escapement was near the escapement goal.

Table 2. Index escapement counts of chinook salmon for tributaries of the Taku River, 1965 to 1991.[a/]

Year	Nakina River	Kowatua River	Tatsamenie River	Dudidontu River	Tseta Creek	Nahlin River	Total
1965	3,050 (H)	200 P(A)	50 P(A)	110 (A)	18 (A)	35 (A)	3,463
1966	3,700 P(A)	14 P(A)	100 P(A)	252 (A)	150 (A)	300 (A)	4,516
1967	700 (A)	250 P(A)	-	600 (A)	350 (A)	300 P(A)	2,200
1968	300 P(A)	1,100 (A)	800 E(A)	590 (A)	230 (A)	450 (A)	3,470
1969	3,500 (A)	3,300 (A)	800 E(A)	-	-	-	7,600
1970	-	1200 P(A)	530 E(A)	10 (A)	25 (A)	26 (A)	1,791
1971	500 (A)	1,400 E(A)	360 E(A)	165 (A)	- (A)	473 (A)	2,898
1972	1,000 (F)	170 (A)	132 (A)	102 (A)	80 P(A)	280 (A)	1,764
1973	2,000 N(H)	100 N(H)	200 E(H)	200 E(H)	4 (A)	300 E(H)	2,804
1974	1,800 E(H)	235 (A)	120 (A)	24 (A)	4 (A)	900 E(H)	3,083
1975	1,800 E(H)	-	-	15 N(H)	-	274 E(H)	2,089
1976	3,000 E(H)	341 P(A)	620 E(H)	40 (H)	-	725 E(H)	4,726
1977	3,850 E(H)	580 E(H)	573 E(H)	18 (H)	-	650 E(H)	5,671
1978	1,620 E(H)	490 N(H)	550 E(H)	- (H)	21 E(H)	624 E(H)	3,305
1979	2,110 E(A)	430 N(H)	750 E(H)	9 E(H)	-	857 E(H)	4,156
1980	4,500 E(H)	450 N(H)	905 E(H)	158 E(H)	-	1,531 E(H)	7,544
1981	5,110 E(H)	560 N(H)	839 E(H)	74 N(H)	258 N(H)	2,945 E(H)	9,786
1982	2,533 E(H)	289 N(H)	387 N(H)	130 N(H)	228 N(H)	1,246 E(H)	4,813
1983	968 E(H)	171 E(H)	236 E(H)	117 E(H)	179 N(H)	391 N(H)	2,062
1984	1,887 (H)	279 E(H)	616 E(H)	-	176 (H)	951 (H)	3,909[b/]
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 P(W)	1,228 E(H)	204 E(H)	494 E(H)	1,812 E(H)	9,480[c/]
1990	7,917 E(H)	614 (W)	1,068 N(H)	820 E(H)	172 N(H)	1,658 E(H)	12,249[c/]
1991	5,610 E(H)	570 N(H)	1,164 E(H)	804 E(H)	224 N(H)	1,781 E(H)	10,153
Maximum[d/]	5,110	3,300	905	600	350	2,945	13,210

KEY:
- (F) = Foot survey.
- (A) = Fixed-wing aircraft survey.
- (H) = Helicopter survey.
- P = Survey conditions hampered by glacial or turbid waters.
- N = Normal water flows and turbidities; average survey conditions.
- E = Survey conditions excellent.
- - = No survey conducted.

a/ Escapement counts before 1975 may not be comparable due to changes in survey dates and methods.
b/ Surveys in 1984 conducted by CDFO; partial survey of Tseta Creek and Nahlin.
c/ Carcass weir at Kowatua River used to partially enumerate escapement due to unfavorable water conditions.
d/ Maximum count observed between 1965 and 1981; used to determine escapement goal.

Table 3. Proportion of the chinook salmon spawning in index areas in the Taku River as determined by distribution of radio-tagged fish, 1989 and 1990. Standard deviations are in parenthesis. (from Eiler, J. *in prep.*)

Stock	Percent of Run 1989		1990		Annual Variation
Nakina River	40.9	(2.9)	33.6	(3.7)	11.3
Kowatua Creek	2.7	(0.8)	0.8	(0.3)	1.8
Tatsatua Creek	2.6	(0.9)	1.0	(0.5)	1.3
Nahlin River	8.0	(1.5)	5.7	(1.7)	3.4
Dudidontu River[a/]	0.1	(0.1)	2.1	(1.3)	1.7
Tseta Creek	1.1	(0.7)	0.4	(0.3)	0.3
Total	55.4		43.6		13.0

[a/] Telemetry data suggest that fish movements through the lower portion of the river may have been restricted in 1989.

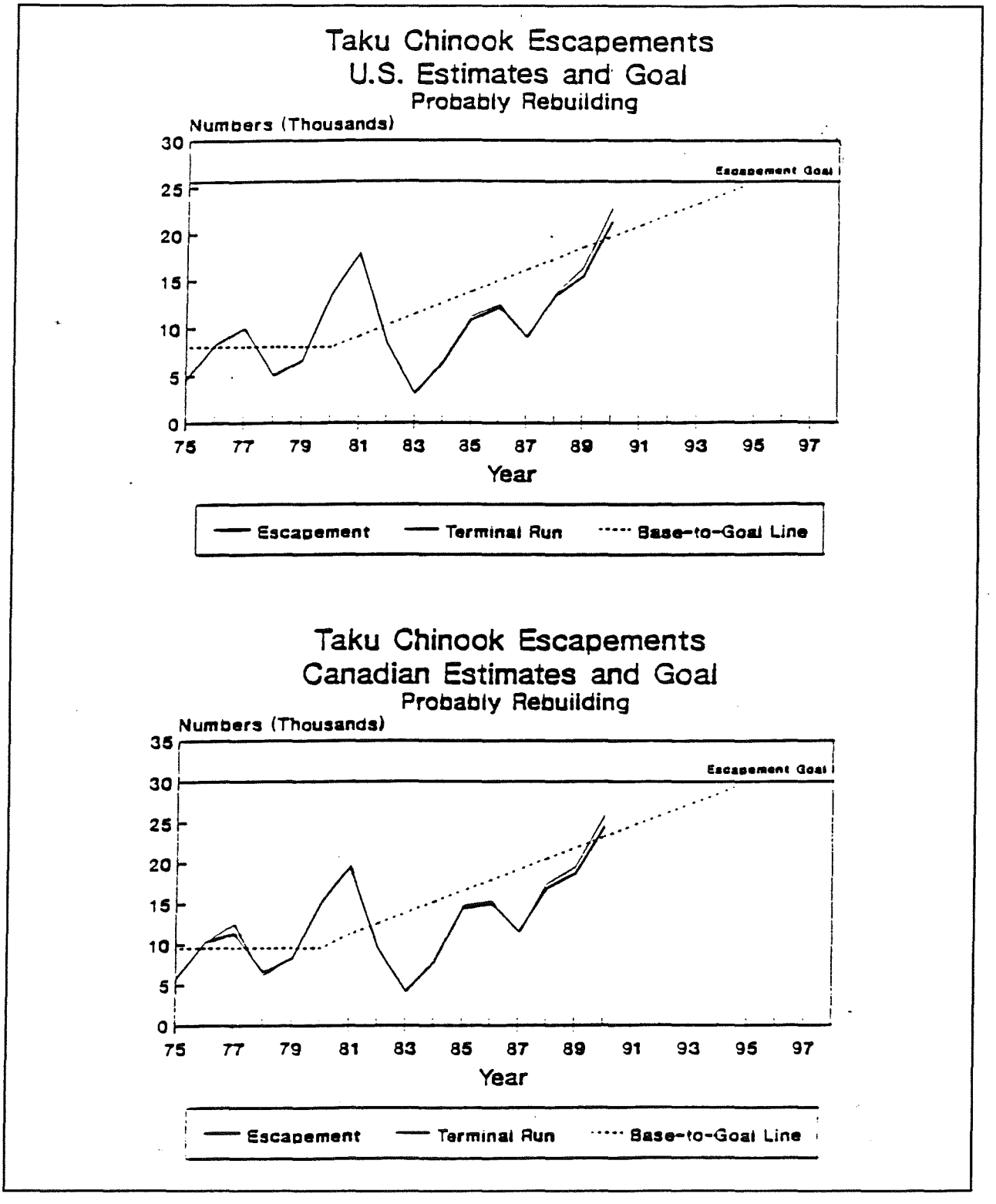

Figure 3. Chinook rebuilding for the Taku River using the original goals by the two Parties. (from CHINOOKTC 91-4).

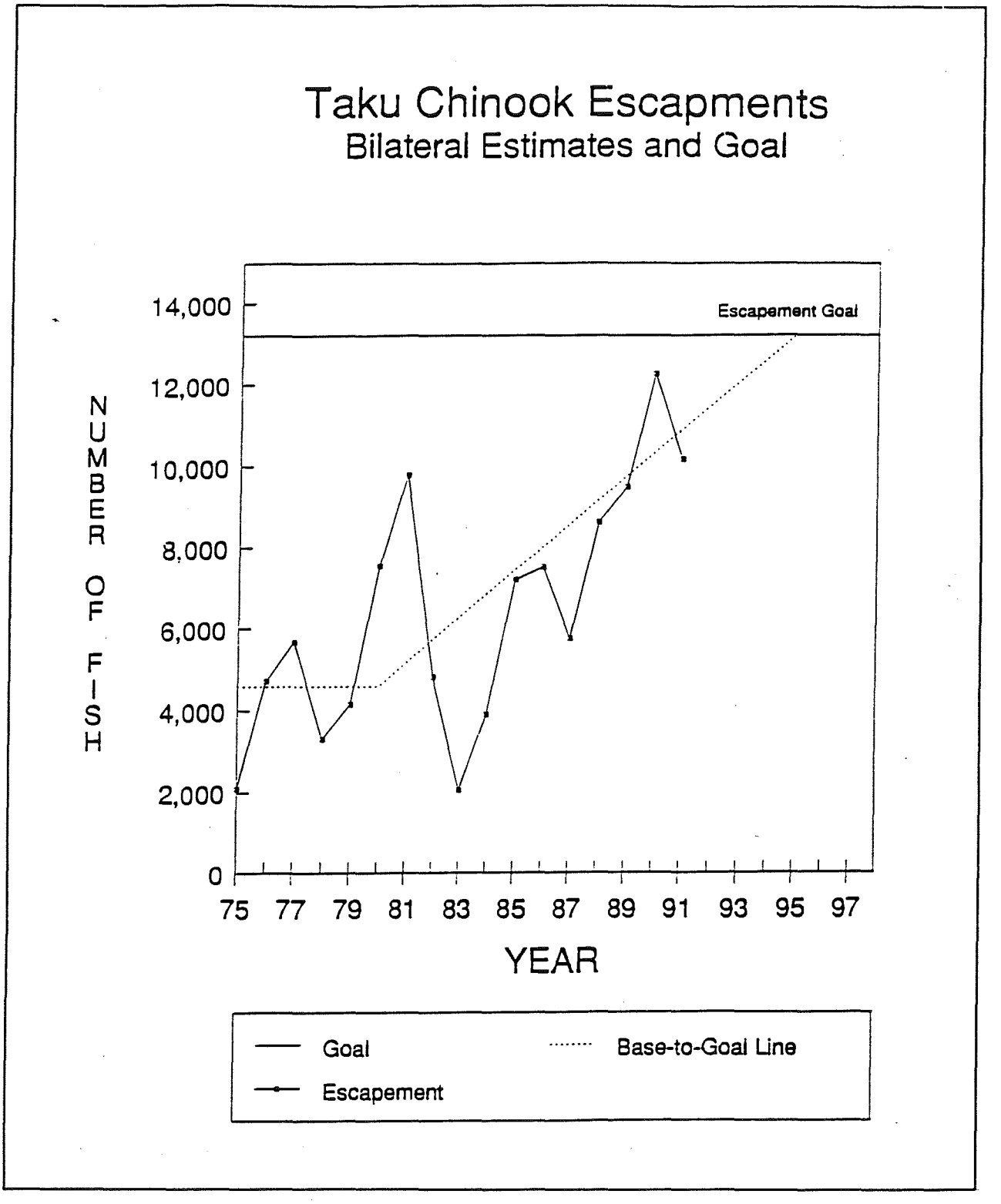

Figure 4. Chinook rebuilding for the six index stocks on the Taku River using the joint escapement goal.

STIKINE RIVER

Chinook escapement to the Little Tahltan River in the Stikine River system has been enumerated using aerial survey counts since 1975 and weir counts since 1985 (Table 4). Canada previously developed an escapement goal of 6,250 fish for Little Tahltan River based on previous levels of escapements and taking into consideration that those levels were considered depressed. The U.S. goal of 3,360 was based on a maximum helicopter count (prior to 1981) of 2,137 chinook rounded to 2,100 and expanded by 1/0.625 to equal a weir count. Both Parties, based on data available from 1985 to 1990 when both aerial surveys and weir counts were available, have agreed to use a factor of two to increase aerial counts to weir counts. This would make the U.S. goal for the Little Tahltan weir equal 4,300 chinook salmon. Taking the average of the Canadian and U.S. goals of 6,250 and 4,300, respectively, gives 5,300 chinook for the joint escapement goal.

Both Parties have used for several years an expansion factor of four to raise the weir count to a total Stikine system escapement estimate. This factor is not based on any scientific study and the TBTC recommends just using the Little Tahltan River escapements to assess rebuilding.

The chinook rebuilding assessment graphs for the Stikine River from the CTC 1990 annual report, using the original two escapement goals, are presented in Figure 5 and a new graph based on the new escapement goal is presented in Figure 6. A base period (1975-1980) average of 1,945 fish was calculated for use in Figure 6, using the aerial survey expansion factor of two for counts in those years. The Little Tahltan stock appears to be rebuilding under current management restrictions and is expected to be at goal levels by 1995 without additional management actions.

Table 4. Index escapement counts of chinook salmon for tributaries of the Stikine River, 1975 to 1991.[a/]

Year	Little Tahltan River		Mainstem Tahltan River	Beatty Creek	Andrew Creek	Total
	Aerial Count	Weir Count				
1975	700 E(H)	-	2,908 E(H)	-	260 (F)	3,868
1976	400 N(H)	-	120 (H)	-	468 (W)	988[b/]
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[c/]
1985	1,598 E(H)	3,114	1,490 N(H)	147 N(H)	319 E(F)	5,102[d/]
1986	1,201 E(H)	2,891	1,400 P(H)	183 N(H)	707 N(F)	5,183
1987	2,706 E(H)	4,783	1,390 P(H)	312 E(H)	651 E(H)	7,134
1988	3,796 E(H)	7,292	4,384 N(H)	593 E(H)	470 E(F)	12,739
1989	2,527 E(H)	4,715	-	362 E(H)	530 E(F)	5,607
1990	1,765 E(H)	4,392	2,134 N(H)	271 E(H)	664 E(H)	7,423
1991	1,768 E(H)	4,500	2,445 N(H)	193 N(H)	303 N(H)	7,744

KEY:
(F) = Foot survey.
(A) = Fixed-wing aircraft survey.
(H) = Helicopter survey.
(W) = Weir count.
(F/A) = Combined Foot and Aerial Survey
N = Normal survey conditions.
P = Survey conditions hampered by glacial or turbid waters.
E = Excellent survey conditions.
- = No survey conducted or data not comparable.

a/ Escapement counts prior to 1975 may not be comparable due to differences in survey dates and counting methods.
b/ Late count on mainstem Tahltan, minimal estimate.
c/ Surveys by CDFO in 1984.
d/ Total = Little Tahltan weir count plus aerial or weir counts on other systems.

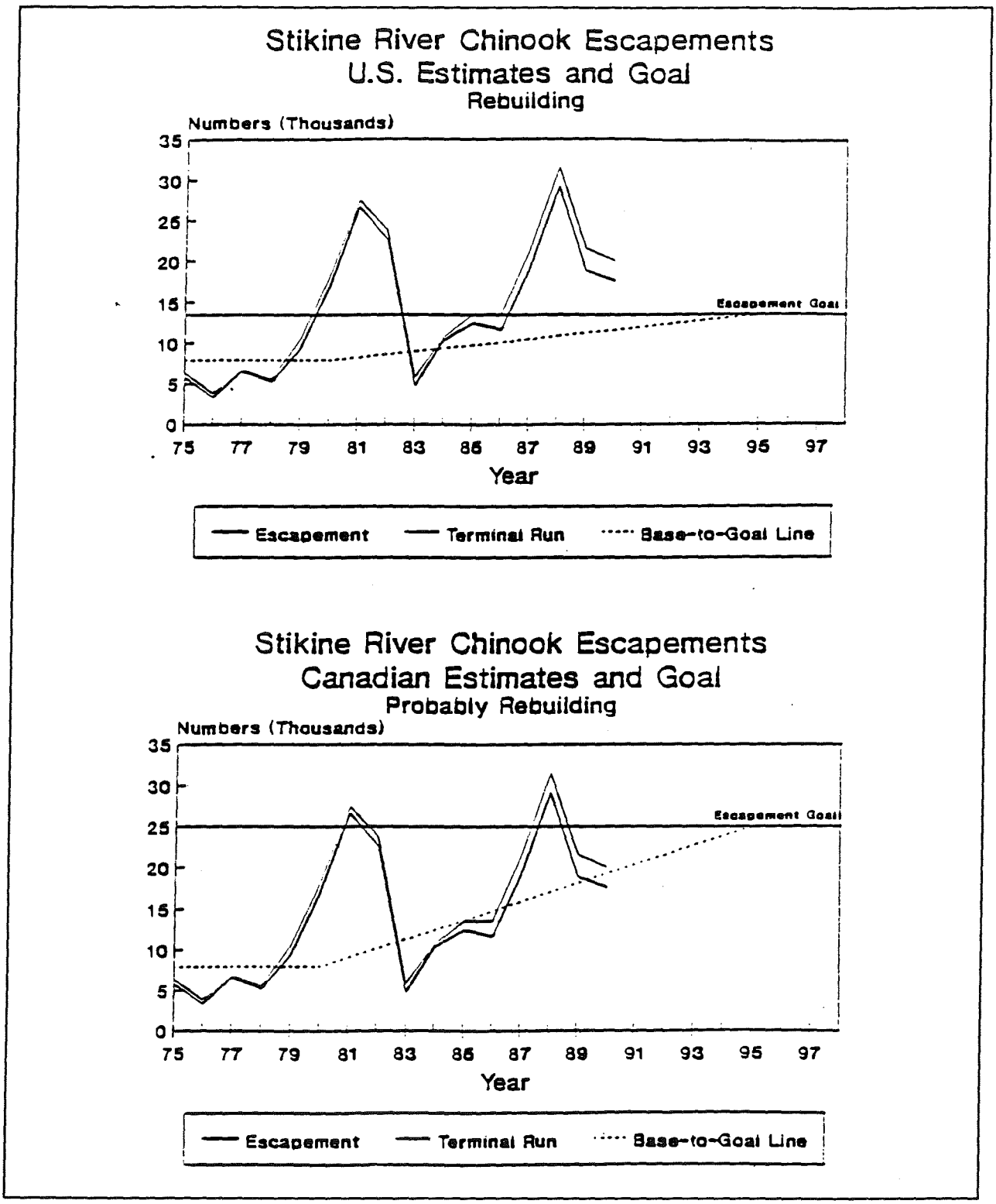

Figure 5. Chinook rebuilding for the Stikine River using the original goals by the two Parties. (from CHINOOKTC 91-4).

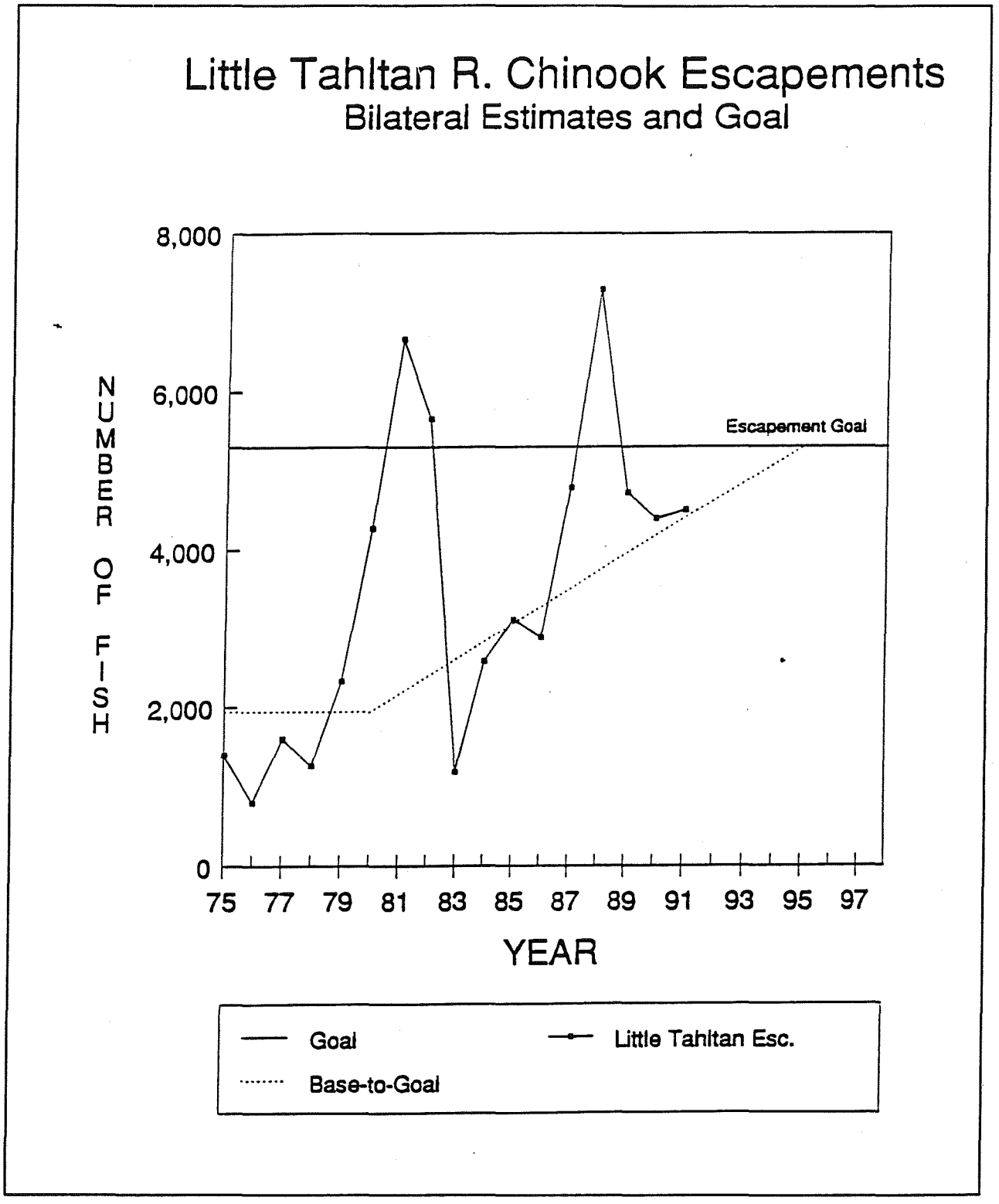

Figure 6. Chinook rebuilding for the Little Tahltan River using the joint escapement goal.